Thesis submitted in partial fulfilment of the degree of Doctor of Clinical Psychology (DClinPsych)



Margot Juliëtte Overman

St Cross College, University of Oxford

Oxford Doctoral Course in Clinical Psychology

May 2026

Word Count

Systematic Review of the Literature: 6,122 words

Service Improvement Project: 5,113 words

Theoretically-Driven Research Project: 5,147 words

Executive Summary: 715 words

Connecting Reflective Narrative: 946 words

Total Word Count: 18,043 words

Table of Contents

Abstracts **5**

Systematic Review of the Literature 5

Service Improvement Project 6

Theoretically-Driven Research Project 7

AI Statement **9**

Systematic Review of the Literature **10**

Abstract 11

Introduction 12

Methods 15

Results 18

Discussion 41

References 48

Service Improvement Project **61**

Abstract 62

Introduction 63

Methods 65

Results 67

Discussion 84

References 88

Theoretically-Driven Research Project **93**

Abstract 94

Introduction 95

Results 104

Discussion 112

References 119

Executive Summary 130

Connecting Reflective Narrative 133

Acknowledgements 136

Systematic Review of the Literature Appendices 137

Appendix A. European Journal of Ageing Instructions to Authors 137

Appendix B. PRISMA Checklist 150

Appendix C. Search Strategy 153

Appendix D. Additional Study Characteristics 154

Service Improvement Project Appendices 158

Appendix E. Neuropsychological Rehabilitation Instructions to Authors 158

Appendix F. Quality Improvement (QI) Approval 166

Appendix G. Qualtrics XM Survey 168

Appendix H. Semi-Structured Interview Topic Guide 171

Appendix I. Research Team and Qualitative Analysis Details 173

Appendix J. Braun and Clarke's (2006) 15-Point Checklist for Qualitative Research .. 174

Appendix K. Audit Results 175

Appendix L. Qualitative Responses to Clinical Practice Survey 176

Appendix M. Themes and Codes 177

Theoretically-Driven Research Project Appendices 178

Appendix N. Journal of Affective Disorders Instructions to Authors 178

Appendix O. Journal of Affective Disorders Publication 190

Appendix P. CUREC 1 Ethics Approval Letter 200

Appendix Q. Supplementary Analyses 201

Abstracts

Systematic Review of the Literature

Associations between older adults' attitudes to ageing, mental health, and quality of life: a systematic review

The stereotype embodiment theory posits that negative age stereotypes, which are not self-relevant in early life, are internalised at a young age. Cognitive models suggest that such internalised attitudes present a latent vulnerability which can be activated with increasing age and contribute to mental health difficulties. Attitudes to ageing are proposed to be multidimensional, with individual domains exerting differential effects on health outcomes. This review therefore aimed to assess the relationship of general and domain-specific attitudes to ageing with depression, anxiety, and quality of life (QoL) in older adults. The protocol was pre-registered on PROSPERO (CRD42024537940). PsycInfo, Embase, Medline, CINAHL, Scopus, and Web of Science databases were searched from inception to February 7, 2026. 22 articles including 41,882 participants were identified and synthesised using a narrative approach, with quality assessed using the AXIS tool. Papers investigated depression (n=11), QoL (n=10), and anxiety (n=7). General negative attitudes to ageing were associated with increased psychopathological symptoms and lower QoL. Across individual domains, negative attitudes to psychosocial loss were most reliably linked with poorer mental health. Conversely, positive attitudes to psychological growth may present a protective factor. These findings are consistent with the stereotype embodiment theory and suggest that attitudes to ageing may present a novel intervention target. Interpretations are limited by the observational nature of the studies. Therefore, a priority for future research is the use of experimental approaches to clarify the causality of observed associations and clinical application of attitudes to ageing as a treatment target for older adults' mental health.

Service Improvement Project

Beyond sharing test scores: what matters to patients and relatives in neuropsychological feedback

Providing feedback on neuropsychological assessments (FNA) can impact on patients' and their relatives' outcomes and service satisfaction. However, there is currently no consensus regarding optimal FNA approaches and little is known about service users' experiences of FNA. This project therefore aimed to map current FNA processes in an outpatient neuropsychology service and develop service user-informed recommendations. An audit of 153 referrals over a 6-month period and a survey for neuropsychologists in the service were conducted to describe the patient population and feedback methods. Semi-structured interviews were carried out with eight service users (four patient-relative dyads), with thematic analysis used to understand their experiences of feedback. FNA typically consisted of a 30-minute, on-the-day feedback session followed by a written report addressed to the referrer. Patients' clinical characteristics were heterogeneous, suggesting a need for personalising FNA. Interviews with service users presenting with a range of diagnoses enabled the construction of five themes applicable across neurological conditions. Themes described cognitive, emotional, and relational elements which influence FNA experiences. Resulting recommendations were elaborated and implemented collaboratively with the service's psychology team. This included strategies to support service users emotionally, scaffold understanding of technical results, and increase transparency about wider care processes.

Theoretically-Driven Research Project

Understanding the relationship between post-stroke cognitive impairments and depression: the role of loneliness

Background: Post-stroke cognitive impairments have been shown to increase the risk of depression, however the mechanisms underpinning this association are not well understood. The theory of social isolation in chronic illness proposes that the relationship between symptom severity in chronic conditions and mood disorders is mediated by social isolation. This study therefore aimed to explore the impact of social isolation on depression in stroke survivors with and without cognitive impairments.

Methods: Stroke survivors were recruited ≥6 months post-stroke from the Oxford Screening Programme and completed assessments of cognitive function, social isolation, and depression. Measures of social isolation evaluated both subjective feelings of loneliness and objective social disconnectedness. Multiple linear regressions examined associations of cognition and social isolation with depression symptoms, and serial mediation analyses assessed potential mediating effects of loneliness and social disconnectedness.

Results: Eighty-five participants completed the study measures. Chronic cognitive impairments predicted depressive symptoms in stroke survivors ($\beta = 1.11$, $p < 0.001$). This relationship was mediated by feelings of loneliness, which were associated with higher depression scores in participants with more severe cognitive impairments (indirect effect [IE] = 0.294, $p < 0.05$). Whilst significant direct effects were observed between all variables in the mediation analyses (all $p < 0.05$), there was no evidence for indirect effects of social disconnectedness.

Conclusions: Subjective experiences of loneliness, but not objective social disconnectedness, may increase the risk of depression in stroke survivors with cognitive

impairments. These findings suggest that feelings of loneliness may be a suitable target for intervention in post-stroke depression.

AI Statement

No artificial intelligence tools were used for any of the research projects presented in this thesis.

Systematic Review of the Literature

Associations between older adults' attitudes to ageing, mental health, and quality of life: a systematic review

Margot Juliëtte Overman

Student number: 842046

Contact details: margot.overman@stx.ox.ac.uk

Word count: 5,960 words

Date: May 2026

Internal supervisor: Dr Kathryn Evans, Course Tutor, The Oxford Institute of Clinical Psychology Training and Research, Warneford Hospital, Oxford OX3 7JX

Email: kathryn.evans@psy.ox.ac.uk

Proposed journal: This report has been submitted to the European Journal of Ageing and is currently under review (see Appendix A for Instructions to Authors). This journal was chosen because of its focus on social, behavioural, and population health aspects of ageing, which fits the review's overarching aim of identifying modifiable factors of mental health difficulties that can be addressed at both individual and societal levels.

Abstract

The stereotype embodiment theory posits that negative age stereotypes, which are not self-relevant in early life, are internalised at a young age. Cognitive models suggest that such internalised attitudes present a latent vulnerability which can be activated with increasing age and contribute to mental health difficulties. Attitudes to ageing are proposed to be multidimensional, with individual domains exerting differential effects on health outcomes. This review therefore aimed to assess the relationship of general and domain-specific attitudes to ageing with depression, anxiety, and quality of life (QoL) in older adults. The protocol was pre-registered on PROSPERO (CRD42024537940). PsycInfo, Embase, Medline, CINAHL, Scopus, and Web of Science databases were searched from inception to February 7, 2026. 22 articles including 41,882 participants were identified and synthesised using a narrative approach, with quality assessed using the AXIS tool. Papers investigated depression (n=11), QoL (n=10), and anxiety (n=7). General negative attitudes to ageing were associated with increased psychopathological symptoms and lower QoL. Across individual domains, negative attitudes to psychosocial loss were most reliably linked with poorer mental health. Conversely, positive attitudes to psychological growth may present a protective factor. These findings are consistent with the stereotype embodiment theory and suggest that attitudes to ageing may present a novel intervention target. Interpretations are limited by the observational nature of the studies. Therefore, a priority for future research is the use of experimental approaches to clarify the causality of observed associations and clinical application of attitudes to ageing as a treatment target for older adults' mental health.

Introduction

Global demographic trends suggest that the population of older adults is growing rapidly (Leeson 2018), with the number of people aged 60 years or over anticipated to be more than double the number of children by 2050 (United Nations 2009). This rise in population ageing has been paralleled by improved life expectancy and health, greater intergenerational contact, and legislation aiming to enhance older adults' social environments (Levy 2017; Diehl et al. 2021). However, societal changes have not been matched by more favourable attitudes to ageing over time (Wahl et al. 2022), with negative views remaining prevalent across age groups (Choi et al., 2022; North & Fiske, 2015). Attitudes to ageing are stable evaluations of ageing that integrate affective, cognitive, and behavioural components (i.e. feelings, beliefs, and behavioural responses; Hess 2006). Research on attitudes has historically been complicated by heterogeneous definitions (Bohner and Dickel 2011) and consequent difficulties in distinguishing this construct from other psychological concepts such as beliefs. As proposed by Eagly and Chaiken (2007), we consider attitudes to represent a broad construct characterised by its evaluative nature. Beliefs, by contrast, have typically been conceptualised as encompassing (Eagly and Chaiken 2007) or consisting of non-evaluative judgements (Granados Samayoa and Albarracín 2025). Crucially, theoretical frameworks suggest that evaluative attitudes to ageing play a central role in the development and maintenance of mental health disorders in older adults.

The stereotype embodiment theory (SET; Levy 2009) proposes that ageing stereotypes, which are socially shared beliefs about ageing and older people as a group (Wurm et al. 2017), present a risk factor for mental health difficulties in older age. Specifically, SET posits that exposure to age stereotypes in childhood and young adulthood leads to negative views being unquestionably accepted and internalised. Upon reaching old age, these internalised attitudes become self-relevant and may affect health through

psychological, behavioural, and physiological responses, namely: (1) self-fulfilling prophecies, in which individuals 'match' negative expectations regarding their abilities, (2) reduced engagement with health-promoting behaviours, and (3) heightened physiological stress responses which increase the risk of adverse health outcomes (e.g. cardiovascular events; Levy 2009; Levy and Leifheit-Limson 2009). Laidlaw (2010) suggested that SET can be integrated with cognitive models of psychopathology to explain specific relationships with mental health outcomes (see Figure 1). The cognitive model views internalised negative attitudes to ageing as a latent vulnerability, which can be triggered by relevant external and internal events (e.g. retirement or physical pain). Once activated, negative attitudes can give rise to cognitive, affective, and behavioural symptoms of mental health disorders. First, information processing is biased towards stimuli which are congruent with the underlying attitudes, with associated changes in attention, memory, and interpretation of events (Disner et al. 2011; Beck and Haigh 2014). For example, expectations of older age as a time of poor health may lead to increased attention to aversive physical sensations and attributing these specifically to the ageing process. This distorted information processing results in emotional distress and maladaptive behaviours (Beck and Haigh 2014). For instance, heightened attention to physical changes can increase feelings of anxiety or low mood, whilst interpreting these changes as a normative aspect of ageing may reduce engagement with health-promoting behaviours. These affective and behavioural responses can further worsen physical health and reinforce negative attitudes, resulting in a vicious cycle.

Importantly, worldwide estimates suggest that approximately a third of older adults are affected by mental health disorders such as depression and anxiety (Cai et al. 2023; Shafiee et al. 2025). There is thus a clear need for effective interventions to improve older people's mental wellbeing. The cognitive approach to the stereotype embodiment theory outlined above indicates that internalised attitudes to ageing may present a modifiable risk

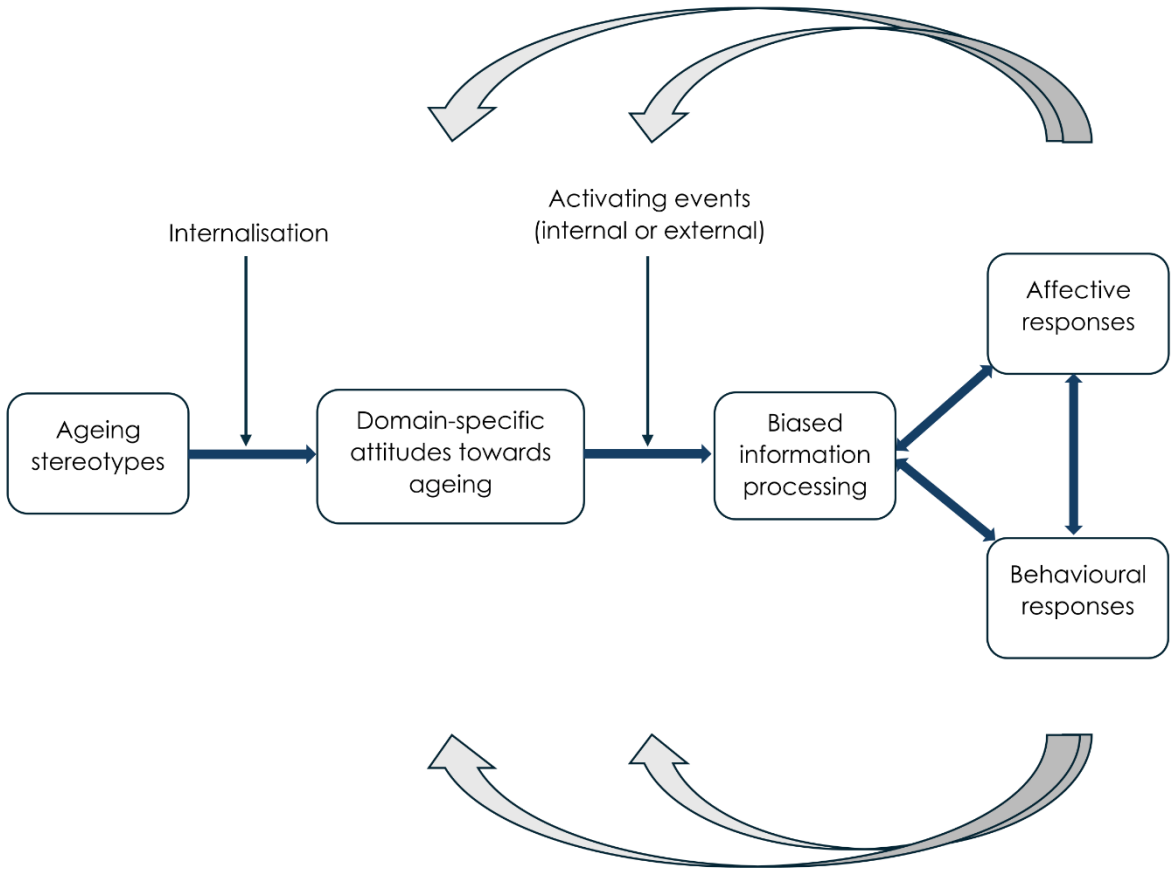
factor for mental health difficulties. We therefore aimed to evaluate the evidence for associations between attitudes to ageing and older adults' mental health, which could enhance understanding of the pathways outlined by the theoretical framework and clarify the potential of attitudes to ageing as an intervention target. Previous reviews (e.g. Westerhof et al. 2023) have typically aggregated results from studies on different elements of views on ageing. Here, views on ageing, also referred to as (self-)perceptions of ageing, is defined as an umbrella term which includes not only attitudes to ageing but also related constructs such as awareness of age-related changes (AARC) and subjective age (Wurm et al. 2017; Hausknecht et al. 2020). Although these concepts are interconnected, evidence suggests that they represent distinct, measurable aspects of views on ageing which may differentially affect health outcomes (Brothers et al. 2017; Spuling et al. 2020; Carbone et al. 2025). We hypothesise that these constructs may map onto different components of the cognitive model. For example, AARC could reflect an information processing bias, such that attention to specific experiences (e.g. memory lapses) is heightened and attributed to ageing. Given these theoretical distinctions, this review focused specifically on attitudes to ageing, which the cognitive model conceptualises as a core antecedent for mental health outcomes.

In addition, there is increasing evidence that attitudes to ageing are multidimensional. That is, attitudes can differ in valence (positive, negative, or neutral) and vary across life domains such as physical health and social networks (Laidlaw et al. 2007; Diehl et al. 2014; Faudzi et al. 2019). However, relationships between individual dimensions of attitudes to ageing and mental health have not been systematically evaluated. A second objective of this review was therefore to explore associations between domain-specific attitudes and older adults' mental health. Notably, the World Health Organization (WHO) and positive mental health approaches emphasise that mental health should be defined not only by the absence of psychopathological symptoms, but also the presence of positive

indicators of wellbeing (WHO 2004; Margraf et al. 2024). As well as reviewing the literature on symptoms of depression and anxiety, we therefore evaluated current research on wellbeing as indicated by older adults' quality of life (QoL).

Figure 1

Cognitive Model of the Stereotype Embodiment Theory for Mental Health Outcomes



Methods

This review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Page et al., 2021; see Appendix B). A pre-defined protocol was registered with PROSPERO (International Prospective Register of Systematic Reviews; CRD42024537940).

Search strategy

PsycInfo, Embase, Medline, CINAHL, Scopus, and Web of Science databases were initially

searched from inception to the 12th of July 2024, with searches re-run on the 7th of February 2026. The search strategy was developed in consultation with a librarian. Titles, abstracts, and topics were searched with Boolean operators using key terms and subject headings including 'attitudes to ageing', 'older adults', 'depression', 'anxiety', 'mental health', and 'quality of life' (see Appendix C for the full search strategy). Reference lists from selected papers and existing reviews were screened to identify additional relevant studies.

Inclusion and exclusion criteria

The study inclusion criteria were (1) peer-reviewed observational studies, (2) published in the English language, (3) measure of attitudes to ageing included as a predictor variable, (4) measure of depression, anxiety, and/or quality of life included as an outcome variable, and (5) results reporting the direct relationship between the predictor and outcome variables within the same individual. If multiple papers reported overlapping or highly related samples, studies were evaluated based on their overall alignment with the inclusion criteria and review aims. Where studies were considered highly comparable, only one paper was retained to avoid duplication and overrepresentation of specific cohorts. In these instances, the paper with the largest sample size was selected for review.

Articles which exclusively focused on young adults (aged 18-35) or included young adults without reporting results by age group were excluded from the review. Studies which only conducted simple correlations or mediation and moderation analyses without reporting direct associations between attitudes and mental health were not included. Mental health in older adults with particular physical health conditions or living in residential care can be affected by distinct illness-related psychological processes (Vilhjalmsson 1998; Hudson and Moss-Morris 2019) and environmental or institutional factors (Chao & Chen, 2019; Choi et al., 2008). Articles focusing on participants with a specific health condition (e.g. HIV, cancer, or dementia) or not living in the community were therefore excluded. Reviews, case reports,

book chapters, commentaries, dissertations, editorials, and conference abstracts were not considered for review.

Screening and data extraction

All titles, abstracts, and full texts were screened by the trainee, with data from each selected article being extracted using a pre-defined template. 30% of all results were independently screened and extracted by a second trainee, with any discrepancies resolved in consultation with the supervisor. Inter-rater reliability was calculated using Cohen's kappa statistic, with minimum acceptable agreement set at .80 (Altman 1990). Data extracted included author(s), publication year, study design, country, participant demographics, measure(s) of attitude to ageing, measure(s) of depression, anxiety, and/or quality of life, analysis methods, and main statistical results.

Quality assessment

The methodological quality of included articles was evaluated using the AXIS tool (Downes et al. 2016). Study quality was scored as the total number of items with a 'yes' response (max. 20). Studies with a score of >15 were rated as high quality, 10-15 as moderate quality, and <10 as low quality (Boos et al. 2019). All studies were appraised by the trainee, with 30% of selected studies rated independently by a second trainee. Any differences in ratings were resolved through discussion with the supervisor.

Data synthesis

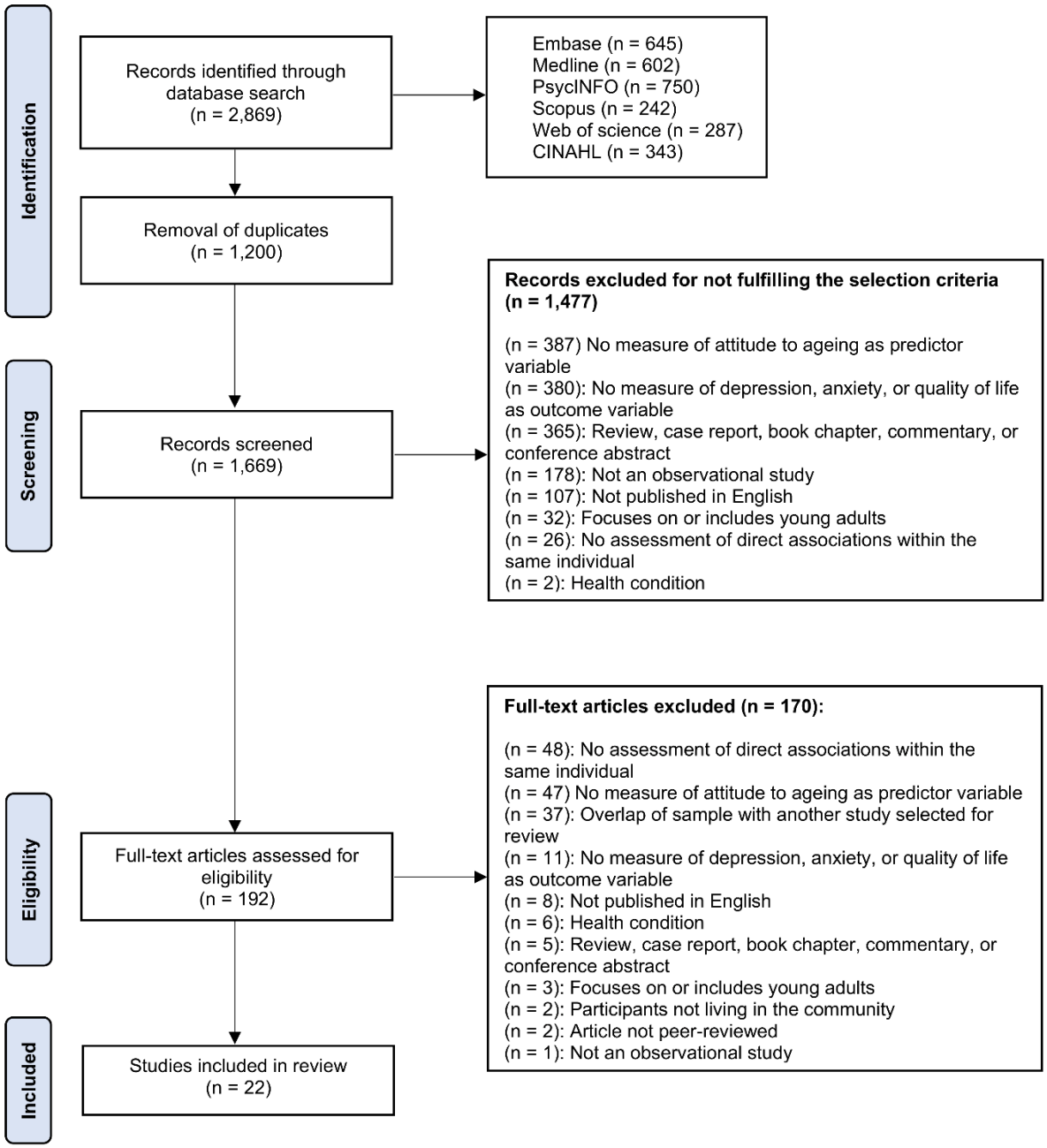
Due to the heterogeneity of instruments used to assess attitudes to ageing, mental health, and quality of life, a narrative approach was taken to synthesising the outcomes. Studies were grouped and thematically reported according to the outcome of interest (i.e. depression, anxiety, and quality of life) and attitude domains, with all results presented in tables.

Results

The PRISMA flow diagram for study selection is displayed in Figure 2. The initial search retrieved a total of 2,869 publications. Following the removal of duplicates, screening of the titles and abstracts for 1,669 articles was completed. The full texts of 192 papers were reviewed, with 22 studies meeting the inclusion criteria. High inter-rater agreement was reached between the two reviewers completing article selection (κ = 0.83). No additional papers were identified through screening reference lists of included studies and relevant reviews.

Figure 2

PRISMA Flowchart of Study Selection



Study characteristics

A summary of the included study characteristics is provided in Table 1 (see Appendix D for additional details). The 22 studies reported data from a total of 41,882 individuals, with sample sizes ranging from 40 to 7,229 participants. 18 studies employed a cross-sectional design and predominantly used regression-based analytical approaches. Four studies

reported longitudinal analyses using panel data from large cohorts, including the Irish Longitudinal Study on Ageing (Freeman et al. 2016), the Health and Retirement Study (Gum and Ayalon 2018), The National Health and Resilience in Veterans Study (Levy et al. 2019), and the German Ageing Survey (Wurm and Benyamini 2014). Longitudinal studies included between two and three measurement waves with follow-up ranging from approximately two to six years. All employed logistic or multiple regression analyses and accounted for baseline depression and/or anxiety symptoms. Studies were conducted in Asia (n = 9), Europe (n = 6), Australia (n = 2), and North America (n = 3), with two studies reporting data from countries spanning multiple continents (Lai 2009; Long et al. 2021).

Quality assessment

An item-by-item overview of the quality assessment of all included studies is provided in Table 2. Eight studies were classified as high quality and 14 as moderate quality. High inter-rater agreement was achieved for the assessment of study quality (κ = 0.80). Few studies justified the sample size (n = 5), undertook measures to address and categorise non-responders (n = 1), or provided demographic data about non-responders (n = 2).

Table 1

Summary of Study Characteristics

First author (year)	Design	Country	Max. sample size included in analyses	Age inclusion criterion	Mean age (SD)	Sex (% female)	Outcome(s) of interest
Bryant (2012)	Cross-sectional	Australia	421	≥65	71.7 (7.9)	61.5%	Depression Anxiety QoL
Chen (2021)	Cross-sectional	China	7,229	≥60	69.0 (7.4)	45.8%	Depression QoL
Choi (2022)	Cross-sectional	South Korea	253	≥55	74.0 (6.3)	57.3%	Depression
Chu (2022)	Cross-sectional	Australia	482	≥50	61.7 (6.9)	60.2%	Depression Anxiety
Freeman (2016)	Longitudinal (two-year follow-up)	Ireland	6,095	≥50	63.3 (9.0)	51.7%	Depression Anxiety
Gum (2018)	Longitudinal (four- and six-year follow-up)	United States	4,606	≥50	65.3 (0.2)	55.5%	Depression
Ingrand (2018)	Cross-sectional	France	258	≥55	66.9 (7.9)	46.9%	Quality of life
Kalfoss (2018)	Cross-sectional	Norway	434	≥60	75.0 (8.1)	55.8%	Depression
Korkmaz Aslan (2019)	Cross-sectional	Turkey	999	≥60	72.3 (23.6)	50.4%	Quality of life
Kornadt (2021)	Cross-sectional	Luxembourg	527	≥65	69.9 (7.0)	49.6%	Quality of life
Kulakçı Altıntaş (2025)	Cross-sectional	Turkey	400	≥65	Not reported	44.5%	Death anxiety
Lai (2009)	Cross-sectional	China, Hong Kong, Taiwan, Canada, and the United States	4,240	≥55	69.1 (8.7)	55.5%	Quality of life
Levy (2019)	Longitudinal (two- and four-year follow-up)	United States	2353	≥55	68.0 (7.9)	5.5%	Depression Anxiety

Table 1 (continued)

Summary of Study Characteristics

First author (year)	Design	Country	Sample size included in analyses	Age inclusion criterion	Mean age (SD)	Sex (% female)	Outcome(s) of interest
Long (2021)	Cross-sectional	20 countries across Europe, North America, South America, Asia, and Africa	4,616	≥60	72.5 (8.0)	58.5%	Quality of life
Mohammadpour (2018)	Cross-sectional	Iran	330	≥60	74.0 (7.7)	57.6%	Death anxiety
Pourghayoumi (2023)	Cross-sectional	Iran	419	60-90	66.9 (6.4)	29.1%	Depression
Sadeghi (2024)	Cross-sectional	Iran	300	≥60	68.3 (8.7)	60.7%	Death anxiety
Sindi (2012)	Cross-sectional	Canada	40	58-85	71.3 (1.4)	55.0%	Depression
Sun (2022)	Cross-sectional	China	764	≥60	71.8 (7.5)	54.2%	Quality of life
Top (2013)	Cross-sectional	Turkey	550	>60	68.0 (6.6)	49.1%	Quality of life
Wurm (2014)	Longitudinal (three-year follow-up)	Germany	6,205	40-85	61.5 (12.1)	49.5%	Depression
Yamada (2015)	Cross-sectional	Czech Republic	361	≥50-91	77.3 (14.0)[a]	66.0%	Quality of life

[a] Interquartile range (IQR)

Table 2

Quality Evaluation of Included Studies

Author (year)	Aims	Design	Sample size	Population	Sample frame	Selection process	Addressing non-response	Validity measures	Reliability measures	Statistical significance	Methods description	Basic data	Response rate	Description non-response	Internal consistency	Results description	Justified conclusions	Limitations	Funding	Ethical approval	Overall rating
Bryant (2012)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	High
Chen (2021)	Y	Y	N	Y	U	U	N	Y	Y	Y	Y	Y	U	N	Y	Y	Y	N	U	U	Moderate
Choi (2022)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	N	Y	Y	Y	Y	Y	Y	High
Chu (2022)	Y	Y	N	Y	Y	N	N	Y	Y	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Moderate
Freeman (2016)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	U	Y	High
Gum (2018)	Y	Y	N	Y	U	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Ingrand (2018)	N	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	U	Y	Moderate
Kalfoss (2018)	Y	Y	N	Y	U	U	N	N	Y	Y	Y	Y	N	N	Y	Y	N	N	Y	U	Moderate
Korkmaz Aslan (2019)	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	U	N	Y	Y	Y	Y	U	Y	High
Kornadt (2021)	Y	N	N	Y	N	U	N	Y	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Moderate
Kulakçı Altıntaş (2025)	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	High
Lai (2009)	Y	Y	N	Y	U	U	N	N	N	Y	Y	Y	U	Y	Y	Y	N	Y	U	U	Moderate
Levy (2019)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N	U	High
Long (2021)	Y	Y	N	Y	U	U	N	Y	Y	Y	N	Y	U	N	Y	Y	Y	N	Y	Y	Moderate
Mohammadpour (2018)	Y	Y	N	Y	Y	N	N	Y	Y	N	Y	Y	U	N	Y	Y	N	N	Y	Y	Moderate
Pourghayoumi (2023)	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y	Y	Moderate
Sadeghi (2024)	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	U	N	Y	Y	Y	Y	U	Y	Moderate
Sindi (2012)	Y	Y	N	Y	U	U	N	Y	U	Y	Y	N	U	N	Y	Y	Y	Y	Y	Y	Moderate
Sun (2022)	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	U	Y	High
Top (2013)	Y	Y	N	Y	Y	U	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Moderate
Wurm (2014)	Y	Y	N	Y	Y	U	N	Y	U	Y	N	Y	N	N	Y	U	Y	Y	Y	Y	Moderate
Yamada (2015)	Y	Y	N	Y	Y	U	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Moderate

N = no; U = unclear, Y = yes

Overview of measures

The most common measures used to assess attitudes to ageing were versions of the Attitudes to Ageing Questionnaire (AAQ; Laidlaw et al., 2007; n = 10) and the Ageing Perceptions Questionnaire (APQ; Barker et al., 2007; Sexton et al., 2014; n = 5). Other measures used were based on the Philadelphia Geriatric Center Morale Scale (PGCMS; Lawton, 1975) Attitudes Towards Own Ageing (ATOA) subscale (n = 2), the Ageing Cognition Scales (AgeCog; Steverink et al., 2001; n = 2), and the 12-item Expectations Regarding Ageing Survey (ERA-12; Sarkisian et al. 2005; n = 2). One article used questions specifically developed for the study (Lai 2009). The PGCMS ATOA subscale and the questionnaire used by Lai (2009) are unidimensional measures which assess attitudes to ageing on a single positive-negative continuum. In contrast, the AAQ, APQ, AgeCog, and ERA-12 contain subscales evaluating different domains of attitudes to ageing. The AAQ and AgeCog distinguish between (psycho)social loss, physical change or decline, and psychological or continuous growth. The ERA-12 assesses ageing-related attitudes towards physical health, mental health, and cognitive function. Finally, the APQ consists of seven subscales which explore individuals' perceptions of the consequences of ageing (positive versus negative), the consistency of awareness of ageing over time (chronic versus cyclical timeline), the extent of personal control over ageing processes (positive versus negative), and emotional responses to ageing (Barker et al. 2007). In the brief APQ (B-APQ; Sexton et al. 2014) the negative control and consequences subscales are combined into a single scale and the cyclical timeline subscale is removed. An overview of all attitudes to ageing measures is provided in Table 3.

Depression was predominantly assessed using versions of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977; n = 6) and the Geriatric Depression Scale (GDS; Brink et al., 1982; n = 3), with two studies using either the 9- or 4-

item Patient Health Questionnaire (PHQ-9; Löwe et al. 2004; PHQ-4; Kroenke et al. 2009). General anxiety was measured with the Geriatric Anxiety Scale (GAI; Segal et al., 2010; n = 2), the PHQ-4 (Kroenke et al. 2009, n = 1), and the Hospital Anxiety and Depression Scale – Anxiety subscale (HADS-A; Zigmond & Snaith, 1983; n = 1). Two studies explored symptoms of death anxiety using the Death Anxiety Scale (DAS; Templer, 1970) and one used the Collett-Lester Fear of Death Scale (CL-FODS; Lester, 1990). The majority of studies used continuous data for analysis of depression and anxiety, with one study applying clinical cut-offs for the CES-D (score ≥16) and the HADS-A (score ≥8) to determine the incidence of depression and anxiety, respectively (Freeman et al. 2016).

Quality of life is a broad concept which the World Health Organization (The WHOQOL Group 1998, p. 551) defines as "an individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations and standards and concerns". Validated instruments capture a range of different domains, including global QoL, health-related QoL, mental QoL, and life satisfaction (Halvorsrud and Kalfoss 2007). Measures used in the included studies were the World Health Organisation Quality of Life Module (WHOQOL-OLD; Power et al., 2005; n = 4) and abbreviated questionnaire (WHOQOL-BREF; The WHOQOL Group, 1998; n = 2), the Satisfaction With Life Scale (SWLS; Diener et al., 1985; n = 1), the Life Satisfaction Index A (LSI-A; Neugarten et al., 1961; n = 1), the CASP-12 (Wiggins et al., 2008; n = 1), the Medical Outcomes Study 36-item Short Form (SF-36; Patel et al., 2007; n = 1), and the 8-item (SF-8; Ware et al., 2001; n = 1) and 12-item Short Form Health Survey (SF-12; Ware et al. 1996; n = 1). Two studies used single-item Likert scales to measure quality of life and life satisfaction (Chen et al. 2021; Kornadt et al. 2021).

Table 3

Overview of Attitudes to Ageing Measures

Measure	Structure	Nr items	Subscales	Example items
Attitudes to Ageing Questionnaire (AAQ; Laidlaw et al. 2007)	Multidimensional	24	Psychosocial loss Psychological growth Physical change	'Old age is a time of loneliness' 'Wisdom comes with age' 'My health is better than I expected for my age'
Ageing Cognition Scales (AgeCog; Steverink et al. 2001)	Multidimensional	12	Social losses Continuous growth Physical decline	'Ageing means to me… that others don't need me so much anymore' 'Ageing means to me… becoming more and more competent' 'Ageing means to me… that I have less physical endurance'
Ageing Perceptions Questionnaire (APQ; Barker et al. 2007)	Multidimensional	32	Consequences positive Consequences negative Control positive Control negative Timeline chronic Timeline cyclical Emotional representations	'As I get older I get wiser' 'As I get older I can take part in fewer activities' 'The quality of my social life in later years depends on me' 'How mobile I am in later life is not up to me' 'I am conscious of getting older all the time' 'I go through phases of feeling old' 'I feel angry when I think about getting older'
12-item Expectations Regarding Ageing Survey (ERA-12; Sarkisian et al. 2005)	Multidimensional	12	Physical health Mental health Cognitive function	'Having more aches and pains is an accepted part of ageing' 'It's normal to be depressed when you are old' 'I expect that as I get older I will become more forgetful'
Philadelphia Geriatric Center Morale Scale (PGCMS; Lawton 1975) Attitudes Towards Own Ageing subscale	Unidimensional	5	None	'As you get older, you are less useful'
Lai (2009) attitudes to ageing scale	Unidimensional	6	None	'Life is all down-slope in old age, and there is not much hope'

Attitudes to ageing and depression

Relationships between attitudes to ageing and depression were explored in seven cross-sectional and four longitudinal studies (see Table 4). More negative total attitudes to ageing scores were associated with higher depression scores cross-sectionally (Sindi et al. 2012; Chu et al. 2022; Pourghayoumi et al. 2023) and at 4- and 6-year follow-up (Gum and Ayalon 2018). In addition, more negative attitudes to ageing at baseline predicted both incident (Freeman et al. 2016; Levy et al. 2019) and persistent depression (Freeman et al. 2016). Highlighting the importance of the self-relevance of attitudes, Sindi and colleagues (2012) found that negative attitudes towards one's *own* ageing process but not attitudes to ageing in general were related to more depressive symptoms.

For specific domains, higher psychosocial loss scores on the AAQ were consistently associated with more symptoms of depression (Bryant et al., 2012; Chen et al., 2021; Choi et al., 2022; Kalfoss et al., 2018). Three of these studies also found that higher scores on the psychological growth domain were linked with fewer depressive symptoms (Bryant et al. 2012; Kalfoss et al. 2018; Chen et al. 2021), with one study reporting no significant relationship (Choi et al., 2022). Results for attitudes to physical change were mixed. One cross-sectional (Kalfoss et al. 2018) and one longitudinal study (Wurm and Benyamini 2014) indicated that higher physical change and decline scores as measured with the AAQ and AgeCog scales, respectively, predicted more depressive symptoms. However, Bryant and colleagues (2012) found no significant association and Choi et al. (2022) reported variable outcomes by age group, with higher physical change scores predicting greater depressive symptomatology in older but not middle-aged participants. Only one study reported results from individual B-APQ domains, showing that stronger negative emotional responses and higher chronic awareness of ageing scores were linked with more depressive symptoms. In contrast, higher scores on both positive and negative beliefs about the impact of ageing as

well as control over positive and negative experiences were associated with lower depression scores (Pourghayoumi et al. 2023).

Attitudes to ageing and anxiety

Four studies assessed general anxiety and three studies focused on death anxiety (see Table 5). Two cross-sectional studies suggested that more negative attitudes to ageing, based on total AAQ and ERA-12 scores, were linked with higher levels of general anxiety (Bryant et al. 2012; Chu et al. 2022). In addition, a longitudinal study demonstrated that total B-APQ baseline scores predicted both incident and persistent anxiety at two-year follow-up (Freeman et al. 2016). Similarly, Levy and colleagues (2019) showed that more negative attitudes on the ERA-12 strongly increased the risk of developing generalised anxiety in a cohort of United States veterans. Specific attitude domains were only assessed by Bryant and colleagues (2012), who reported that higher psychosocial loss scores were linked with more symptoms of anxiety. In contrast, no significant associations were found for psychological growth and physical change scores.

Kulakçı Altıntaş and Ercan Şahin (2025) found that more negative total scores on the AAQ were associated with greater death anxiety. The other two studies on death anxiety explored associations with domain-specific attitudes on the APQ. Mohammadpour et al. (2018) reported that higher chronic awareness and positive consequences of ageing scores related to less anxiety, whereas higher scores on negative emotional responses to ageing and control over positive experiences predicted more anxiety symptoms. No significant associations between negative consequences or control over negative experiences and death anxiety were observed. In contrast, Sadeghi et al. (2024) indicated that only higher emotional representation scores were associated with greater death anxiety. No clear mechanisms were proposed for the differential impact of individual APQ domains within these studies.

Attitudes to ageing and quality of life

Ten cross-sectional studies investigated associations between attitudes to ageing and quality of life (see Table 6). More negative attitudes to ageing were associated with lower global (Yamada et al. 2015), health-related (Sun et al. 2022), and mental QoL (Lai 2009). Ingrand et al. (2018) combined APQ subdomains into positive (positive consequences and control) and negative (negative consequences and control, chronic and cyclical timeline, and emotional representations) dimensions. Higher scores on the positive dimension directly predicted quality of life, whereas the negative dimension exerted only indirect effects on QoL mediated by psychological distress.

Six studies investigated specific attitude domains measured with the AAQ and AgeCog scales. Higher psychosocial loss scores were associated with lower life satisfaction and poorer global, physical, and mental QoL (Bryant et al. 2012; Korkmaz Aslan et al. 2019; Long et al. 2021; Chen et al. 2021; Kornadt et al. 2021), with only one study reporting a non-significant relationship with global QoL (Top et al. 2013). Conversely, higher psychological and continuous growth scores consistently predicted better global QoL and life satisfaction (Korkmaz Aslan et al. 2019; Chen et al. 2021; Kornadt et al. 2021). However, Bryant et al. (2012) suggest that psychological growth scores may be differentially related to specific QoL components, with associations being positive for mental QoL and life satisfaction but negative for physical QoL. They hypothesise that a reverse causal relationship may explain the latter finding, such that individuals with more physical health difficulties may develop more effective coping skills which is reflected in psychological growth scores. Results for the physical change domain also varied across QoL measures. Several studies reported that higher AAQ physical change scores predicted lower global, mental, and physical quality of life on the WHOQOL-BREF and WHOQOL-OLD (Top et al. 2013; Korkmaz Aslan et al. 2019; Long et al. 2021), which assess a wide range of life

domains. However, there was no significant relationship between AAQ or AgeCog physical domain scores and unidimensional measures of life satisfaction (Bryant et al. 2012; Kornadt et al. 2021).

Table 4

Attitudes to Ageing and Depression

Author (year)	Attitudes to ageing measure	Depression measure	Statistical results	Key findings
Bryant (2012)	Attitudes to Ageing Questionnaire (AAQ)	Center for Epidemiological Studies Depression Scale (CES-D)	Hierarchical multiple regression: Psychosocial loss and CES-D: β = 0.38, p <0.01 Psychological growth and CES-D: depression: β = 0.38, p <0.01 Physical change and CES-D: non-significant	Psychosocial loss ↑ depression Psychological growth ↓ depression Physical change Ø depression
Chen (2021)	Attitudes to Ageing Questionnaire (AAQ) – seven-item version with questions from the psychosocial loss and psychological growth domains	Center for Epidemiological Studies Depression Scale (CES-D) – nine-item version	Hierarchical multiple regression: Psychosocial loss and CES-D: β = 0.327, p <0.001 Psychological growth and CES-D: β = -0.258, p <0.001	Psychosocial loss ↑ depression Psychological growth ↓ depression
Choi (2022)	Attitudes to Ageing Questionnaire (AAQ)	Center for Epidemiological Studies Depression Scale (CES-D) – ten-item version	Multiple linear regression: Psychosocial loss and CES-D (age 55-64): β = -0.32, p <0.001 Physical change and CES-D (age 55-64): β = -0.04, p >0.05 Psychological growth and CES-D (age 55-64): β = -0.08, p >0.05 Psychosocial loss and CES-D (age ≥65): β = -0.27, p <0.001 Physical change and CES-D (age ≥65): β = -0.28, p <0.01 Psychological growth and CES-D (age ≥65): β = -0.08, p-value not clearly reported	*Middle-aged adults:* Psychosocial loss ↑ depression Physical change Ø depression Psychological growth Ø depression *Older adults:* Psychosocial loss ↑ depression Physical change ↑ depression Psychological growth Ø depression

Table 4 (continued)

Attitudes to Ageing and Depression

Author (year)	Attitudes to ageing measure	Depression measure	Statistical results	Key findings
Chu (2022)	12-item Expectations Regarding Ageing Survey (ERA-12)	Geriatric Depression Scale (GDS) with the original dichotomous responses adapted to a four-point Likert scale	Independent *t*-test: Total ERA-12 score and GDS: $t(480) = 7.31$, $p < 0.001$	Negative attitudes ↑ depression
Freeman (2016)	Brief Ageing Perceptions Questionnaire (B-APQ)	Center for Epidemiological Studies Depression Scale (CES-D)	Multivariate logistic regression: Baseline total B-APQ score and CES-D incident depression: OR = 1.09, $p < 0.001$ Baseline total B-APQ score and CES-D persistent depression: OR = 1.05, p <0.01	Negative attitudes ↑ incident and persistent depression
Gum (2018)	Philadelphia Geriatric Center Morale Scale (PGCMS) – Attitude Toward Own Ageing subscale combined with 3 additional questions designed for the study	Center for Epidemiological Studies Depression Scale (CES-D); eight-item version with yes-no response format	Linear regression: Baseline PGCMS subscale and 4-year follow-up CES-D: β = -0.30, $p < 0.001$ Baseline PGCMS subscale and 6-year follow-up CES-D: β = -0.41, $p < 0.001$	Negative attitudes ↑ depression
Kalfoss (2018)	Attitudes to Ageing Questionnaire (AAQ)	Short-form Geriatric Depression Scale (sf-GDS)	Multiple linear regression: Psychosocial loss and sf-GDS: $F(1,419) = 27.74$, $p < 0.001$ Physical change and sf-GDS: $F(1, 421) = 16.52$, $p < 0.001$ Psychological growth and sf-GDS: $F(1,419) = 8.97$, $p = 0.003$	Psychosocial loss ↑ depression Physical change ↑ depression Psychological growth ↓ depression scores

Table 4 (continued)

Attitudes to Ageing and Depression

Author (year)	Attitudes to ageing measure	Depression measure	Statistical results	Key findings
Levy (2019)	Three-item version of the 12-item Expectations Regarding Ageing Survey (ERA-12)	Patient Health Questionnaire (PHQ-4)	Logistic regression with category 0 as a referent for comparison with categories 1-3 (representing increasingly negative attitudes): Category 1 and PHQ-4: OR = 2.07, p <0.001 Category 2 and PHQ-4: OR = 2.40, p <0.01 Category 3 and PHQ-4: OR = 2.49, p <0.001	Negative attitudes ↑ incident depression
Pourghayoumi (2023)	Brief Ageing Perceptions Questionnaire (B-APQ)	Patient Health Questionnaire-9 (PHQ-9)	Hierarchical multiple regression: Total B-APQ score and PHQ-9: β = 0.12, p <0.001 Chronic timeline and PHQ-9: OR = 1.12, p <0.001 Emotional representations and PHQ-9: OR = 1.20, p <0.001 Positive consequences and PHQ-9: OR = 0.83, p <0.001 Negative consequences/control and PHQ-9: OR = 0.89, p <0.001	Negative attitudes ↑ depression Chronic timeline ↑ depression Emotional representations ↑ depression Positive consequences ↓depression Positive control ↓ depression Negative consequences and control ↓ depression
Sindi (2012)	8 items assessing general attitudes toward ageing and attitudes towards own ageing, based on the Philadelphia Geriatric Center Morale Scale (PGCMS) – Attitude Towards Own Ageing subscale	Geriatric Depression Scale (GDS)	Stepwise regression: PGCMS subscale self-perceptions and GDS: β = 0.691, p = 0.001 PGCMS subscale general perceptions and GDS: non-significant	Negative attitudes to own ageing ↑ depression General negative attitudes Ø depression

Table 4 (continued)

Attitudes to Ageing and Depression

Author (year)	Attitudes to ageing measure	Depression measure	Statistical results	Key findings
Wurm (2014)	Ageing Cognition Scales (AgeCog) physical decline subscale	Center for Epidemiological Studies Depression Scale (CES-D) – 15-item version	Multiple linear regression: AgeCog physical decline and CES-D: $\beta = 0.10$, $p < 0.01$	Physical decline ↑ depression

↑ Predictor associated with higher outcome scores; ↓ predictor associated with lower outcome scores; Ø no significant association between predictor and outcome variable

Table 5

Attitudes to Ageing and Anxiety

Author (year)	Attitudes to ageing measure	Anxiety measure	Statistical results	Key findings
Bryant (2012)	Attitudes to Ageing Questionnaire (AAQ)	Geriatric Anxiety Inventory (GAI)	Hierarchical multiple regression: Psychosocial loss and GAI: $\beta = 0.41$, $p < 0.01$ Psychological growth and GAI: non-significant Physical change and GAI: non-significant	Psychosocial loss ↑ anxiety Psychological growth Ø anxiety Physical change Ø anxiety
Chu (2022)	12-item Expectations Regarding Ageing Survey (ERA-12)	Geriatric Anxiety Inventory (GAI) with the original dichotomous responses adapted to a four-point Likert scale	Independent *t*-test: Total ERA-12 score and GAI: $t(480) = 6.47$, $p < 0.001$	Negative attitudes ↑ anxiety
Freeman (2016)	Brief Ageing Perceptions Questionnaire (B-APQ)	Hospital Anxiety and Depression Scale – Anxiety subscale (HADS-A)	Multivariate logistic regression: Baseline total B-APQ score and HADS-A incident anxiety: OR = 1.04, $p < 0.05$ Baseline total B-APQ score and HADS-A persistent anxiety: OR = 1.04, $p < 0.001$	Negative attitudes ↑ incident and persistent anxiety
Kulakçı Altıntaş (2025)	Attitudes to Ageing Questionnaire Turkish Version (AAQ-TR)	Death Anxiety Scale (DAS)	Linear regression: Total AAQ-TR score and DAS: $\beta = -0.154$, $p = 0.001$	Negative attitudes ↑ death anxiety
Levy (2019)	Three-item version of the 12-item Expectations Regarding Ageing Survey (ERA-12)	Patient Health Questionnaire (PHQ-4)	Logistic regression with category 0 as a referent for comparison with categories 1-3 (representing increasingly negative attitudes): Category 1 and PHQ-4: OR = 1.78, $p < 0.01$ Category 2 and PHQ-4: OR = 2.97, $p < 0.001$ Category 3 and PHQ-4: OR = 6.55, $p < 0.001$	Negative attitudes ↑ incident anxiety

Table 5 (continued)

Attitudes to Ageing and Anxiety

Author (year)	Attitudes to ageing measure	Anxiety measure	Statistical results	Key findings
Mohammadpour (2018)	Brief Ageing Perceptions Questionnaire (B-APQ)	Collett-Lester Fear of Death Scale (CL-FODS)	Linear regression: Timeline chronic and CL-FODS: β = -0.13, p = 0.01 Positive consequences and CL-FODS: β = -0.11, p = 0.04 Positive control and CL-FODS: β = 0.10, p = 0.04 Emotional representations and CL-FODS: β = 0.22, p <0.001 Negative consequences/control and CL-FODS: β = 0.10, p = 0.05	Timeline chronic ↓ anxiety Positive consequences ↓ anxiety Positive control ↑ anxiety Emotional representations ↑ death anxiety Negative consequences and control Ø anxiety
Sadeghi (2024)	Ageing Perceptions Questionnaire (APQ)	Death Anxiety Scale (DAS)	Multiple linear regression: Emotional representations and DAS: β = 0.07, p = 0.003 All remaining APQ subdomains and DAS: non-significant	Emotional representations ↑ death anxiety Negative control, negative consequences, positive control, positive consequences, chronic timeline, and cyclical timeline Ø DAS

↑ Predictor associated with higher outcome scores; ↓ predictor associated with lower outcome scores; Ø no significant association between predictor and outcome variable

Table 6

Attitudes to Ageing and Quality of Life

Author (year)	Attitudes to ageing measure	QoL measure	Statistical results	Key findings
Bryant (2012)	Attitudes to Ageing Questionnaire (AAQ)	Medical Outcomes 12-item Short Form Health Survey (SF-12); physical and mental subdomains Satisfaction With Life Scale (SWLS)	Hierarchical multiple regression: Psychosocial loss and physical SF-12: β = -0.15, p <0.01 Physical change and physical SF-12: β = 0.37, p <0.01 Psychological growth and physical SF-12: β = -0.15, p <0.01). Psychosocial loss and mental SF-12: β = -0.36, p <0.01 Physical change and mental SF-12: β = - 0.18, p < 0.01 Psychological growth and mental SF-12: β = 0.10, p <0.05 Psychosocial loss and SWLS: β = -0.13, p <0.01 Psychological growth and SWLS: β = 0.26, p <0.01 Physical change and SWLS: non-significant	Psychosocial loss ↓ physical QoL, mental QoL, and satisfaction with life Physical change ↓ physical and mental QoL Physical change Ø satisfaction with life Psychological growth ↓ physical QoL Psychological growth ↑ mental QoL and satisfaction with life
Chen (2021)	Attitudes to Ageing Questionnaire (AAQ) – seven-item version with questions from the psychosocial loss and psychological growth domains	5-point Likert Scale	Hierarchical multiple regression: Psychosocial loss and QoL: β = -0.036, p <0.001 Psychological growth and QoL: β =0.042, p <0.001	Psychosocial loss ↓ QoL Psychological growth ↑ QoL

Table 6 (continued)

Attitudes to Ageing and Quality of Life

Author (year)	Attitudes to ageing measure	QoL measure	Statistical results	Key findings
Ingrand (2018)	Ageing Perceptions Questionnaire (APQ)	CASP-12 Life Satisfaction Index A (LSI-A)	Structural equation model: Positive consequences and control and CASP-12/LSI-A: $\beta = 0.39$, $p < 0.001$ Negative consequences and control, chronic and cyclical timeline, and emotional representations and CASP-12/LSI-A: non-significant	Positive consequences and control ↑ global QoL
Korkmaz Aslan (2019)	Attitudes to Ageing Questionnaire (AAQ)	WHOQOL-OLD	Hierarchical multiple regression: Psychosocial loss and WHOQOL-OLD: $\beta = -0.289$, $p < 0.001$ Physical change and WHOQOL-OLD: $\beta = 0.296$, $p < 0.001$ Psychological growth and WHOQOL-OLD: $\beta = 0.279$, $p < 0.001$	Psychosocial loss ↓ older adult QoL Physical change ↓ older adult QoL Psychological growth ↑ older adult QoL
Kornadt (2021)	Ageing Cognition Scales (AgeCog)	4-point Likert Scale for life satisfaction	Hierarchical moderated regression: Social loss and life satisfaction: $\beta = -0.16$, $p < 0.001$ Continuous growth and life satisfaction: $\beta = 0.10$, $p = 0.006$ Physical decline and life satisfaction: $\beta = -0.06$, $p = 0.140$	Social loss ↓ life satisfaction Continuous growth ↑ life satisfaction Physical decline Ø life satisfaction
Lai (2009)	5 statements using a 5-point Likert scale developed for the study	Medical Outcomes Study 36-item Short Form (SF-36), mental health component	Hierarchical multiple regression: Total attitudes score and mental SF-36: $\beta = 0.22$, $p < 0.01$	Negative attitudes ↓ mental QoL

Table 6 (continued)

Attitudes to Ageing and Quality of Life

Author (year)	Attitudes to ageing measure	QoL measure	Statistical results	Key findings
Long (2021)	Attitudes to Ageing Questionnaire (AAQ)	WHOQOL-BREF WHOQOL-OLD	Hierarchical multiple regression: Psychosocial loss and WHOQOL-BREF: β = 0.242, p <0.001 Physical change and WHOQOL-BREF: β = 0.339, p <0.001) Psychological growth and WHOQOL-BREF: β = 0.032, p <0.01 Psychosocial loss and WHOQOL-OLD: β = 0.311, p <0.001 Physical change and WHOQOL-OLD: β = 0.207, p <0.001 Psychological growth and WHOQOL-OLD: β = 0.121, p <0.001	Psychosocial loss ↓ global and older adult QoL Physical change ↓ global and older adult QoL Psychological growth ↑ global and older adult QoL
Sun (2022)	Attitudes to Ageing Questionnaire (AAQ) – short version	8-item Short Form Health Survey (SF-8)	Multiple linear regression: Total AAQ score and health SF-8: β = -0.211, p <0.01	Negative attitudes ↓ health-related QoL
Top (2013)	Attitudes to Ageing Questionnaire (AAQ)	WHOQOL-OLD	Multiple linear regression: Physical change and WHOQOL-OLD: β = 0.185, p <0.001 Psychological growth and WHOQOL-OLD: β = 0.378, p <0.001) Psychosocial loss and WHOQOL-OLD: β = 0.062, p = 0.102	Physical change ↓ older adult QoL Psychological growth ↑ older adult QoL Psychosocial loss Ø older adult QoL

Table 6 (continued)

Attitudes to Ageing and Quality of Life

Author (year)	Attitudes to ageing measure	QoL measure	Statistical results	Key findings
Yamada (2015)	Attitudes to Ageing Questionnaire (AAQ)	WHOQOL-BREF WHOQOL-OLD	Generalised linear model: Total AAQ score and WHOQOL-BREF: $\beta = 0.8$, $p < 0.001$ Total AAQ score and WHOQOL-OLD: $\beta = 0.9$, $p < 0.001$	Negative attitudes ↓ global and older adult QoL

↑ Predictor associated with higher outcome scores; ↓ predictor associated with lower outcome scores; Ø no significant association between predictor and outcome variable

Discussion

Consistent with the cognitive model integrated with stereotype embodiment theory (Levy 2009; Laidlaw 2010), this systematic review found that attitudes to ageing were associated with older adults' mental health. Evidence was strongest for a relationship between negative attitudes to ageing and depressive symptoms, which was observed in large-scale cross-sectional and longitudinal studies. Although fewer studies investigated anxiety symptoms, results to date suggest that more negative attitudes predict higher generalised anxiety, with preliminary findings suggesting similar associations with death anxiety. Finally, whilst associations with quality of life were also consistently reported, the lack of longitudinal research limits inferences regarding the direction of this relationship.

Attitudes to ageing domains

A second objective of the review was to explore associations between specific attitude domains and older adults' mental health. The most frequently measured domains were social loss, psychological/continuous growth, and physical change on the AAQ and AgeCog scales. Although the APQ is similarly a multidimensional instrument, the small number of studies reporting results for its individual subscales limits robust conclusions about their relationship with mental wellbeing.

Social loss scores were consistently associated with all outcomes of interest. This extends research showing that the *experience* of social isolation predicts mental health in older people (Cornwell and Waite 2009; Domènech-Abella et al. 2019) and suggests that *evaluating* older age as a time of social isolation and exclusion could similarly result in poorer mental wellbeing. The cognitive model predicts that such attitudes may lead to biased processing of socially relevant events and information, such as heightened attention to signs of rejection. This could alter emotional and behavioural responses (e.g. withdrawal or hostility), which in turn may increase social loss and reinforce existing attitudes. In this

manner, ageing attitudes could act as a self-fulfilling prophecy in the social domain. In line with this hypothesis, evidence from longitudinal studies indicates that stereotypes and expectations of social changes with age predict subjective feelings of loneliness (Pikhartova et al. 2016) and objective outcomes such as making new friends (Menkin et al. 2017).

In contrast, results showed that viewing older age as a time of growth may serve as a protective factor. It has been proposed that this positive attitude to ageing could increase resilience through developing more adaptive coping strategies (Trică et al. 2024). In accordance with positive psychology and successful ageing perspectives (Ranzijn 2002; Bowling and Iliffe 2011), this highlights the potential of positive attitudes to ageing for increasing older adults' psychological resources. Of interest, one study in this review suggested that positive and negative attitudes may be differentially linked with mental wellbeing and psychopathological aspects of mental health, respectively (Ingrand et al. 2018). Additional research is needed to more firmly establish potentially independent effects of positive and negative attitudes to ageing.

Somewhat mixed findings were reported for the relationship between attitudes to physical change and mental health. Whilst some studies indicated that negative attitudes predicted depression and lower QoL, others found that associations were non-significant or varied by age group. Non-significant results were mainly reported by studies using unidimensional or binary outcome measures, which were likely less sensitive compared with multidimensional instruments and continuous outcomes. Overall, the findings may reflect a relatively weaker effect of attitudes to physical decline compared with psychological and social change on mental wellbeing. Levy and Leifheit-Limson (2009) propose a stereotype-matching effect, such that age stereotypes have the greatest impact on corresponding outcome domains. Attitudes to physical change may therefore be more strongly linked with physical (e.g. McLachlan et al. 2020; Diehl et al. 2021) than mental health. However, Boeder

and Tse (2021) reported domain-congruent effects for psychological growth but generalised effects of physical decline. There is thus a need to further explore domain-dependent effects across different health outcomes.

Limitations and future research directions

There were several limitations to the present review and existing evidence base. First, this review focused on observational research and most identified studies were cross-sectional, which limits conclusions about the causality of reported associations. The relationships are likely bidirectional, with negative attitudes leading to poorer mental health and vice versa. For physical health, it has been shown that the impact of negative attitudes to ageing on health is stronger than the reverse relationship (Wurm et al. 2007; Sargent-Cox et al. 2012). Whether this finding can be generalised to symptoms of mental health disorders and quality of life remains to be established and requires additional longitudinal and experimental research.

It should be noted that, whilst the AXIS tool was originally developed for the evaluation of cross-sectional studies, we used this instrument for all studies included in the review for comparability and ease of interpretation. The quality assessment highlighted that most of the included studies did not justify sample size or address non-responses. It is likely that the majority of included studies had sufficiently large sample sizes to achieve adequate statistical power, with only one study including fewer than 250 participants. However, response rates varied substantially, with reported rates ranging from 34.9% to 81.3% (see Appendix D) and most studies did not give details about non-responders' demographics. This limitation of the evidence base raises concerns about the potential for sampling biases, which could affect the generalisability of the findings. In addition, this review aimed to evaluate associations between attitudes to ageing and mental health in the general population. People living in care homes or presenting with specific health conditions were

therefore excluded from review and it is unclear whether the findings can be extrapolated to these groups of older people. These populations warrant investigation using tailored conceptual frameworks in future studies.

It has also been proposed that some measures of attitudes to ageing, which were predominantly developed in Western countries, may not be universally suitable as attitudes to ageing are shaped by cultural influences such as tradition, religion, and social beliefs (Yun and Lachman 2006; Laidlaw et al. 2010; North and Fiske 2015). For example, a Malay adaptation of an attitudes to ageing questionnaire highlighted the need for adding various items related to family and religion to fully capture ageing attitudes in this population (Faudzi et al. 2020). Although results appeared to be relatively consistent across countries and continents within the present review, it is possible that important components of attitudes to ageing are not sufficiently assessed across cultures with the measures that are currently available. In line with this idea, there is evidence that attitudes to ageing outcomes may vary across cultures depending on the specific domains included (Voss et al. 2018; Kornadt et al. 2022) and phrasing of individual questions (Peterson and Ralston 2017). It should also be noted that there is a current lack of research on attitudes to ageing and mental health in African and South American populations. It is crucial that potential cultural differences are explored further, as a thorough understanding of such variability is needed to develop culturally appropriate interventions for negative attitudes to ageing.

During the screening process we encountered high variability in definitions of attitudes to ageing, which reflects a wider challenge within the views-on-ageing literature. This review specifically focused on articles which used instruments that were consistent with the definition of attitudes to ageing specified in the Introduction, and was informed by a previous review of attitudes to ageing measures (Faudzi et al. 2019). However, we acknowledge that these instruments may measure overlapping constructs such as beliefs

about ageing, and vary in the extent to which they assess attitudes related to the self, others, and society (Klusmann et al. 2020). These differences could contribute to variability across findings and highlight the value of greater conceptual and terminological consistency within the literature. Furthermore, the inclusion of additional constructs, such as awareness of age-related changes, subjective age, and essentialist beliefs about ageing, could provide useful information about the contribution of different elements of views on ageing to older adults' mental health. However, whilst interrelated, these constructs can be conceptually and empirically distinguished from one another and may have different effects on health outcomes (Brothers et al. 2017; Spuling et al. 2020; Carbone et al. 2025). As the theoretical framework outlined in this review emphasises the centrality of attitudes to ageing, we aimed to provide a detailed overview of specific associations between attitudes and older adults' mental health. Going forward, however, it would be valuable to examine how attitudes may interact with other views on ageing constructs.

Finally, consistent with the World Health Organization's (2004) emphasis on conceptualising mental health in positive rather than negative terms, we included quality of life as an outcome measure of interest. However, we recognise that QoL instruments frequently assess multiple domains that extend beyond psychological functioning. Although quality of life provided a useful indicator of overall wellbeing, future studies would benefit from incorporating more specific measures of positive mental health to provide a more detailed understanding of the relationship between attitudes to ageing and psychological wellbeing.

Clinical implications

This review demonstrates that ageing attitudes are associated with psychopathology and wellbeing in older age, and may present a novel target for both public and individual interventions. From a societal perspective it has been proposed that policies should be

developed to challenge negative views of ageing, which could include public education on healthy ageing processes, presenting a balanced view of older age in the media, and providing positive examples of ageing (Lu et al. 2010; Kotter-Grühn 2015; World Health Organization 2015; Tully-Wilson et al. 2021). Such strategies may not only support older adults to adjust their attitudes to ageing, but also serve a preventative function by protecting younger adults from developing negative internalised attitudes before they become self-relevant (Levy 2009; Tully-Wilson et al. 2021).

In addition, specific interventions for addressing negative attitudes to ageing may be developed. Interventions to date have typically adopted group approaches which involve provision of counter-stereotypical information and behaviour change techniques (Knight et al. 2022). Preliminary evidence suggests that such programmes can be effective in reducing negative attitudes to ageing (Burnes et al. 2019; Knight et al. 2022). However, most of these studies were carried out in younger populations (Burnes et al. 2019) or focused on effects on physical rather than mental health (Knight et al. 2022). Only one study included depression as an outcome measure, reporting that a group involving exercise combined with an attitudes to ageing intervention reduced average depression scores (Beyer et al. 2019). Further work is needed to assess whether group interventions focused on changing negative attitudes to ageing can improve mental health and quality of life in older adults.

Finally, the results indicate that adjustments to standard therapeutic protocols may be beneficial for older adults presenting with mental health disorders. Laidlaw (2010) emphasised that, if not addressed by the therapist, negative attitudes to ageing could limit progress in therapy. In addition, as attitudes to ageing may directly affect older people's mental health, they could form a specific target for therapy. In this context, interventions could aim to both reduce negative attitudes and emphasise growth as a positive aspect of ageing (Laidlaw 2010). As such, it has been suggested that attitudes to ageing questionnaires

may be useful as a screening tool for identifying therapy goals and monitoring intervention outcomes (Tully-Wilson et al. 2021). Additional research is needed to determine whether incorporating strategies related to ageing attitudes can enhance standard therapeutic treatments for older adults.

Conclusion

This review demonstrates that there is a significant relationship between attitudes to ageing and depression, anxiety, and quality of life in older adults. The evidence suggests that negative attitudes to psychosocial loss are linked to poorer mental health, whereas positive attitudes to psychological or continuous growth may present a protective factor. Altogether, our findings are consistent with the stereotype embodiment theory and indicate that attitudes to ageing may present a suitable target for interventions aiming to improve older adults' mental wellbeing. We propose that a main priority for future research is the use of experimental and interventional approaches to more clearly establish the causality of the observed associations and clinical application of attitudes to ageing as a treatment target.

References

Altman DG (1990) Practical statistics for medical research. Chapman and Hall, New York

Barker M, O'Hanlon A, McGee HM, et al (2007) Cross-sectional validation of the Aging Perceptions Questionnaire: A multidimensional instrument for assessing self-perceptions of aging. BMC Geriatr 7:9. https://doi.org/10.1186/1471-2318-7-9

Beck AT, Haigh EAP (2014) Advances in cognitive theory and therapy: The generic cognitive model. Annu. Rev. Clin. Psychol. 10:1–24

Beyer AK, Wolff JK, Freiberger E, Wurm S (2019) Are self-perceptions of ageing modifiable? Examination of an exercise programme with vs. without a self-perceptions of ageing-intervention for older adults. Psychol Health 34:661–676. https://doi.org/10.1080/08870446.2018.1556273

Boeder J, Tse DCK (2021) Measuring Self-Perceptions of Aging: Differences between Measures When Predicting Health Outcomes. Journals of Gerontology - Series B Psychological Sciences and Social Sciences 76:825–835. https://doi.org/10.1093/geronb/gbaa064

Bohner G, Dickel N (2011) Attitudes and attitude change. Annu Rev Psychol 62:391–417. https://doi.org/10.1146/annurev.psych.121208.131609

Boos CJ, De Villiers N, Dyball D, et al (2019) The relationship between military combat and cardiovascular risk: a systematic review and meta-analysis. Int J Vasc Med 1:9849465. https://doi.org/10.1155/2019/9849465

Bowling A, Iliffe S (2011) Psychological approach to successful ageing predicts future quality of life in older adults. Health Qual Life Outcomes 9:. https://doi.org/10.1186/1477-7525-9-13

Brink TL, Yesavage JA, Lum O, et al (1982) Screening tests for geriatric depression. Clin Gerontol 1:37–44

Brothers A, Miche M, Wahl HW, Diehl M (2017) Examination of Associations among Three Distinct Subjective Aging Constructs and Their Relevance for Predicting Developmental Correlates. Journals of Gerontology - Series B Psychological Sciences and Social Sciences 72:547–560. https://doi.org/10.1093/geronb/gbv085

Bryant C, Bei B, Gilson K, et al (2012) The relationship between attitudes to aging and physical and mental health in older adults. Int Psychogeriatr 24:1674–1683. https://doi.org/10.1017/S1041610212000774

Burnes D, Sheppard C, Henderson CR, et al (2019) Interventions to reduce ageism against older adults: A systematic review and meta-analysis. Am J Public Health 109:E1–E9. https://doi.org/10.2105/AJPH.2019.305123

Cai H, Jin Y, Liu R, et al (2023) Global prevalence of depression in older adults: A systematic review and meta-analysis of epidemiological surveys. Asian J Psychiatr 80:103417. https://doi.org/10.1016/j.ajp.2022.103417

Carbone E, Paccagnella O, Borella E (2025) Gauging the link between different views of aging facets and their associations with cognitive and mood functioning in midlife and older age: a cross-sectional study. Front Psychol 16:1676575. https://doi.org/10.3389/fpsyg.2025.1676575

Chao SF, Chen YC (2019) Environment patterns and mental health of older adults in long-term care facilities: the role of activity profiles. Aging Ment Health 23:1307–1316. https://doi.org/10.1080/13607863.2018.1484889

Chen L, Guo W, Perez C (2021) The effect of aging attitudes on the quality of life of older adults in China. Res Aging 43:96–106. https://doi.org/10.1177/0164027520948192

Choi EY, Um S, Shin H, Kim YS (2022) Attitudes toward aging, active coping, and depressive symptoms among middle-aged and older Korean adults: How do they differ by age group? J Affect Disord 296:380–387. https://doi.org/10.1016/j.jad.2021.09.086

Choi NG, Ransom S, Wyllie RJ (2008) Depression in older nursing home residents: The influence of nursing home environmental stressors, coping, and acceptance of group and individual therapy. Aging Ment Health 12:536–547. https://doi.org/10.1080/13607860802343001

Chu L, Burton NW, Pachana NA (2022) Ageing attitudes and mental health in middle and later adulthood: The buffering effect of education. Australas J Ageing 41:e172–e180. https://doi.org/10.1111/ajag.13035

Cornwell EY, Waite LJ (2009) Social disconnectedness, perceived isolation, and health among older adult. J Health Soc Behav 1:31–48

Diehl M, Brothers AF, Wahl HW (2021) Self-perceptions and awareness of aging: Past, present, and future. In: Handbook of the Psychology of Aging. Elsevier, pp 155–179

Diehl M, Wahl HW, Barrett AE, et al (2014) Awareness of aging: Theoretical considerations on an emerging concept. Developmental Review 34:93–113

Diener E, Emmons RA, Larsen RJ, Griffin S (1985) The Satisfaction With Life Scale. J Pers Assess 49:71–75

Disner SG, Beevers CG, Haigh EAP, Beck AT (2011) Neural mechanisms of the cognitive model of depression. Nat Rev Neurosci 12:467–477. https://doi.org/10.1038/nrn3027

Domènech-Abella J, Mundó J, Haro JM, Rubio-Valera M (2019) Anxiety, depression, loneliness and social network in the elderly: Longitudinal associations from The Irish Longitudinal Study on Ageing (TILDA). J Affect Disord 246:82–88. https://doi.org/10.1016/j.jad.2018.12.043

Downes MJ, Brennan ML, Williams HC, Dean RS (2016) Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). BMJ Open 6:e011458. https://doi.org/10.1136/bmjopen-2016

Eagly AH, Chaiken S (2007) The advantages of an inclusive definition of attitude. Soc Cogn 25:582–602

Faudzi FNM, Armitage CJ, Bryant C, Brown LJE (2019) A systematic review of the psychometric properties of self-report measures of attitudes to aging. Res Aging 41:549–574. https://doi.org/10.1177/0164027518825117

Faudzi FNM, Armitage CJ, Bryant C, Brown LJE (2020) Cultural adaptations to the measurement of attitudes to ageing: psychometric assessment of the Malay Reactions to Ageing Questionnaire. Assessment 27:1272–1284. https://doi.org/10.1177/1073191118766400

Freeman AT, Santini ZI, Tyrovolas S, et al (2016) Negative perceptions of ageing predict the onset and persistence of depression and anxiety: Findings from a prospective analysis of the Irish Longitudinal Study on Ageing (TILDA). J Affect Disord 199:132–138. https://doi.org/10.1016/j.jad.2016.03.042

Granados Samayoa JA, Albarracín D (2025) Understanding belief-behavior correspondence: Beliefs and belief-to-behavior inferences. Psychol Inq 36:1–22. https://doi.org/10.1080/1047840X.2025.2482343

Gum AM, Ayalon L (2018) Self-perceptions of aging mediate the longitudinal relationship of hopelessness and depressive symptoms. Int J Geriatr Psychiatry 33:591–597. https://doi.org/10.1002/gps.4826

Halvorsrud L, Kalfoss M (2007) The conceptualization and measurement of quality of life in older adults: A review of empirical studies published during 1994-2006. Eur. J. Ageing 4:229–246

Hausknecht S, Low LF, O'loughlin K, et al (2020) Older adults' self-perceptions of aging and being older: A scoping review. Gerontologist 60:E524–E534. https://doi.org/10.1093/geront/gnz153

Hess TM (2006) Attitudes toward aging and their effects on behavior. In: Birren JE, Schaie KW (eds) Handbook of the psychology of aging, 6th edn. Academic Press, San Diego, CA, pp 379–406

Hudson JL, Moss-Morris R (2019) Treating Illness Distress in Chronic Illness: Integrating Mental Health Approaches with Illness Self-Management. Eur. Psychol. 24:26–37

Ingrand I, Paccalin M, Liuu E, et al (2018) Positive perception of aging is a key predictor of quality-of-life in aging people. PLoS One 13:e0204044. https://doi.org/10.1371/journal.pone.0204044

Kalfoss MH, Low G, Halvorsrud L (2018) Identity processes among older Norwegians living in urban and rural areas. West J Nurs Res 40:701–724. https://doi.org/10.1177/0193945916687514

Klusmann V, Notthoff N, Beyer AK, et al (2020) The assessment of views on ageing: a review of self-report measures and innovative extensions. Eur J Ageing 17:403–433. https://doi.org/10.1007/s10433-020-00556-9

Knight RL, Chalabaev A, McNarry MA, et al (2022) Do age stereotype-based interventions affect health-related outcomes in older adults? A systematic review and future directions. Br J Health Psychol 27:338–373. https://doi.org/10.1111/bjhp.12548

Korkmaz Aslan G, Kulakçi Altintaş H, Özen Çinar İ, Veren F (2019) Attitudes to ageing and their relationship with quality of life in older adults in Turkey. Psychogeriatrics 19:157–164. https://doi.org/10.1111/psyg.12378

Kornadt AE, Albert I, Hoffmann M, et al (2021) Ageism and older people's health and well-being during the Covid-19-pandemic: the moderating role of subjective aging. Eur J Ageing 18:173–184. https://doi.org/10.1007/s10433-021-00624-8

Kornadt AE, de Paula Couto C, Rothermund K (2022) Views on aging – current trends and future directions for cross-cultural research. Online Readings in Psychology and Culture 6:. https://doi.org/10.9707/2307-0919.1176

Kotter-Grühn D (2015) Changing negative views of aging: Implications for intervention and translational research. Annu Rev Gerontol Geriatr 35:167–186. https://doi.org/10.1891/0198-8794.35.167

Kroenke K, Spitzer RL, Janet BW, et al (2009) An ultra-brief screening scale for anxiety and depression: The PHQ-4. Psychosomatics 50:613–621

Kulakçı Altıntaş H, Ercan Şahin N (2025) Attitudes to aging, depression, and death anxiety among community-dwelling older adults: a cross-sectional correlational study. BMC Geriatr 25:. https://doi.org/10.1186/s12877-025-05839-3

Lai DWL (2009) Older Chinese' attitudes toward aging and the relationship to mental health: An international comparison. Soc Work Health Care 48:243–259. https://doi.org/10.1080/00981380802591957

Laidlaw K (2010) Are attitudes to ageing and wisdom enhancement legitimate targets for CBT for late life depression and anxiety? Nord Psychol 62:27–42. https://doi.org/10.1027/1901-2276/a000009

Laidlaw K, Power MJ, Schmidt S, et al (2007) The attitudes to ageing questionnaire (AAQ): Development and psychometric properties. Int J Geriatr Psychiatry 22:367–379. https://doi.org/10.1002/gps.1683

Laidlaw K, Wang D, Coelho C, Power M (2010) Attitudes to ageing and expectations for filial piety across Chinese and British cultures: A pilot exploratory evaluation. Aging Ment Health 14:283–292. https://doi.org/10.1080/13607860903483060

Lawton MP (1975) The Philadelphia Geriatric Center Morale Scale: A revision. J Gerontol 30:85–89

Leeson GW (2018) Global demographic change and grandparenthood. Contemp Soc Sci 13:145–158. https://doi.org/10.1080/21582041.2018.1433316

Lester D (1990) The collett-lester fear of death scale: The original version and a revision. Death Stud 14:451–468. https://doi.org/10.1080/07481189008252385

Levy BR (2017) Age-stereotype paradox: opportunity for social change. Gerontologist 57:S118–S126. https://doi.org/10.1093/geront/gnx059

Levy BR (2009) Stereotype embodiment: A psychosocial approach to aging. Curr Dir Psychol Sci 18:332–336

Levy BR, Chung PH, Slade MD, et al (2019) Active coping shields against negative aging self-stereotypes contributing to psychiatric conditions. Soc Sci Med 228:25–29. https://doi.org/10.1016/j.socscimed.2019.02.035

Levy BR, Leifheit-Limson E (2009) The stereotype-matching effect: greater influence on functioning when age stereotypes correspond to outcomes. Psychol Aging 24:230–233. https://doi.org/10.1037/a0014563

Long S, Laidlaw K, Lorimer A, Ferreira N (2021) Attitudes to ageing and quality of life in young and old older adults: an international cross-sectional analysis. Working with Older People 25:39–57. https://doi.org/10.1108/WWOP-06-2020-0032

Löwe B, Kroenke K, Herzog W, Gräfe K (2004) Measuring depression outcome with a brief self-report instrument: Sensitivity to change of the Patient Health Questionnaire (PHQ-9). J Affect Disord 81:61–66. https://doi.org/10.1016/S0165-0327(03)00198-8

Lu L, Kao SF, Hsieh YH (2010) Positive attitudes toward older people and well-being among Chinese community older adults. Journal of Applied Gerontology 29:622–639. https://doi.org/10.1177/0733464809343289

Margraf J, Teismann T, Brailovskaia J (2024) Predictive Power of Positive Mental Health: A Scoping Review. J. Happiness Stud. 25

McLachlan KJJ, Cole JH, Harris SE, et al (2020) Attitudes to ageing, biomarkers of ageing and mortality: The Lothian Birth Cohort 1936. J Epidemiol Community Health (1978) 74:377–383. https://doi.org/10.1136/jech-2019-213462

Menkin JA, Robles TF, Gruenewald TL, et al (2017) Positive expectations regarding aging linked to more new friends in later life. Journals of Gerontology - Series B Psychological Sciences and Social Sciences 72:771–781. https://doi.org/10.1093/geronb/gbv118

Mohammadpour A, Sadeghmoghadam L, Shareinia H, et al (2018) Investigating the role of perception of aging and associated factors in death anxiety among the elderly. Clin Interv Aging 13:405–410. https://doi.org/10.2147/CIA.S150697

Neugarten BL, Havighurst RJ, Tobin SS (1961) The measurement of life satisfaction. J Gerontol 16:134–143

North MS, Fiske ST (2015) Modern attitudes toward older adults in the aging world: A cross-cultural meta-analysis. Psychol Bull 141:993–1021. https://doi.org/10.1037/a0039469

Page MJ, McKenzie JE, Bossuyt PM, et al (2021) The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. International Journal of Surgery 88:105906. https://doi.org/10.1016/j.ijsu.2021.105906

Patel AA, Donegan D, Albert T (2007) The 36-item Short Form. Journal of the American Academy of Orthopaedic Surgeons 15:126–134

Peterson L, Ralston M (2017) Valued elders or societal burden: Cross-national attitudes toward older adults. International Sociology 32:731–754. https://doi.org/10.1177/0268580917726943

Pikhartova J, Bowling A, Victor C (2016) Is loneliness in later life a self-fulfilling prophecy? Aging Ment Health 20:543–549. https://doi.org/10.1080/13607863.2015.1023767

Pourghayoumi M, Marzban M, Farhadi A, et al (2023) The relationship of spiritual well-being and aging perceptions with depression in Iranian older adults: a cross-sectional study. Ment Health Relig Cult 26:261–275. https://doi.org/10.1080/13674676.2023.2180496

Power M, Quinn K, Schmidt S (2005) Development of the WHOQOL-Old module. Quality of Life Research 14:2197–2214. https://doi.org/10.1007/s11136-005-7380-9

Radloff LS (1977) A self-report depression scale for research in the general population. Applied Psychological Measurements 1:385–401

Ranzijn R (2002) Towards a positive psychology of ageing: Potentials and barriers. Aust Psychol 37:79–85. https://doi.org/10.1080/00050060210001706716

Sadeghi A, Mohamadzadeh M, Shoraka HR, et al (2024) The relationship between the perception of aging and death anxiety in the older adults of eastern Iran during COVID-19. Health Soc Care Community 1:3236251. https://doi.org/10.1155/2024/3236251

Sargent-Cox KA, Anstey KJ, Luszcz MA (2012) The relationship between change in self-perceptions of aging and physical functioning in older adults. Psychol Aging 27:750–760. https://doi.org/10.1037/a0027578

Sarkisian CA, Steers WN, Hays RD, Mangione CM (2005) Development of the 12-Item Expectations Regarding Aging Survey. Gerontologist 45:240–248

Segal DL, June A, Payne M, et al (2010) Development and initial validation of a self-report assessment tool for anxiety among older adults: The Geriatric Anxiety Scale. J Anxiety Disord 24:709–714. https://doi.org/10.1016/j.janxdis.2010.05.002

Sexton E, King-Kallimanis BL, Morgan K, McGee H (2014) Development of the Brief Ageing Perceptions Questionnaire (B-APQ): A confirmatory factor analysis approach to item reduction. BMC Geriatr 14:44. https://doi.org/10.1186/1471-2318-14-44

Shafiee A, Mohammadi I, Rajai S, et al (2025) Global prevalence of anxiety symptoms and its associated factors in older adults: A systematic review and meta-analysis. J Gen Fam Med 26:116–127. https://doi.org/10.1002/jgf2.750

Sindi S, Juster RP, Wan N, et al (2012) Depressive symptoms, cortisol, and cognition during human aging: The role of negative aging perceptions. Stress 15:130–137. https://doi.org/10.3109/10253890.2011.599047

Spuling SM, Klusmann V, Bowen CE, et al (2020) The uniqueness of subjective ageing: convergent and discriminant validity. Eur J Ageing 17:445–455. https://doi.org/10.1007/s10433-019-00529-7

Steverink N, Westerhof GJ, Bode C, Dittmann-Kohli F (2001) The personal experience of aging, individual resources, and subjective well-being. Journal of Gerontology: Psychological Sciences 56B:P364–P373

Sun T, Zhang SE, Yan MY, et al (2022) Association between self-perceived stigma and quality of life among urban Chinese older adults: The moderating role of attitude toward own aging and traditionality. Front Public Health 10:767255. https://doi.org/10.3389/fpubh.2022.767255

Templer DI (1970) The construction and validation of a death anxiety scale. J Gen Psychol 82:165–177

The WHOQOL Group (1998) WHOQOL-BREF. Psychol Med 28:551–558

Top M, Eriş H, Kabalcioğlu F (2013) Quality of life (QOL) and attitudes toward aging in older adults in Şanlıurfa, Turkey. Res Aging 35:533–562. https://doi.org/10.1177/0164027512447822

Trică A, Golu F, Sava NI, et al (2024) Resilience and successful aging: A systematic review and meta-analysis. Acta Psychol (Amst) 248:. https://doi.org/10.1016/j.actpsy.2024.104357

Tully-Wilson C, Bojack R, Millear PM, et al (2021) Self-perceptions of aging: a systematic review of longitudinal studies. Psychol Aging 36:773–789. https://doi.org/10.1037/pag0000638

United Nations (2009) World Population Prospects: The 2008 revision

Vilhjalmsson R DIRECT AND INDIRECT EFFECTS OF CHRONIC PHYSICAL CONDITIONS ON DEPRESSION: A PRELIMINARY INVESTIGATION

Voss P, Kornadt AE, Hess TM, et al (2018) A world of difference? Domain-specific views on aging in China, the US, and Germany. Psychol Aging 33:595–606. https://doi.org/10.1037/pag0000237

Wahl HW, Drewelies J, Duezel S, et al (2021) Subjective Age and Attitudes Toward Own Aging Across Two Decades of Historical Time. Psychol Aging 37:413–429. https://doi.org/10.1037/pag0000649

Ware JE, Kosinki M, Dewey J, Gandek B (2001) How to score and interpret single-item health status measures: a manual for users of the SF-8 Health Survey. QualityMetric Inc, Boston

Ware JE, Kosinski M, Keller SD (1996) A 12-item Short Form Health Survey: Construction of scales and preliminary tests of reliability and validity. Med Care 34:220–233

Westerhof GJ, Nehrkorn-Bailey AM, Tseng HY, et al (2023) Longitudinal Effects of Subjective Aging on Health and Longevity: An Updated Meta-Analysis. Psychol Aging 38:147–166. https://doi.org/10.1037/pag0000737

Wiggins RD, Netuveli G, Hyde M, et al (2008) The evaluation of a self-enumerated scale of quality of life (CASP-19) in the context of research on ageing: A combination of

exploratory and confirmatory approaches. Soc Indic Res 89:61–77. https://doi.org/10.1007/s11205-007-9220-5

World Health Organization (2004) Promoting mental health: summary report. World Health Organization

World Health Organization (2015) World report on ageing and health

Wurm S, Benyamini Y (2014) Optimism buffers the detrimental effect of negative self-perceptions of ageing on physical and mental health. Psychol Health 29:832–848. https://doi.org/10.1080/08870446.2014.891737

Wurm S, Diehl M, Kornadt AE, et al (2017) How do views on aging affect health outcomes in adulthood and late life? Explanations for an established connection. Developmental Review 46:27–43. https://doi.org/10.1016/j.dr.2017.08.002

Wurm S, Tesch-Römer C, Tomasik MJ (2007) Longitudinal findings on aging-related cognitions, control beliefs, and health in later life. Journal of Gerontology: Psychological Sciences 62B:P156–P164

Yamada Y, Merz L, Kisvetrova H (2015) Quality of life and comorbidity among older home care clients: role of positive attitudes toward aging. Quality of Life Research 24:1661–1667. https://doi.org/10.1007/s11136-014-0899-x

Yun RJ, Lachman ME (2006) Perceptions of aging in two cultures: Korean and American views on old age. J Cross Cult Gerontol 21:55–70. https://doi.org/10.1007/s10823-006-9018-y

Zigmond AS, Snaith RP (1983) The Hospital Anxiety and Depression Scale. Acta Psychiatr Scand 67:361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Service Improvement Project

Beyond sharing test scores: what matters to patients and relatives in neuropsychological feedback

Margot Juliëtte Overman

Student number: 842046

Contact details: margot.overman@stx.ox.ac.uk

Word count: 4,991

Date: May 2026

Internal supervisor: Dr Kathryn Evans, Course Tutor, The Oxford Institute of Clinical Psychology Training and Research, Warneford Hospital, Oxford OX3 7JX

Email: kathryn.evans@psy.ox.ac.uk

External supervisor: Dr Claire Isaac, Consultant Clinical Neuropsychologist, Adult Clinical Neuropsychology, John Radcliffe Hospital, Oxford OX3 9DU

Email: claire.isaac1@ouh.nhs.uk

Proposed journal: A manuscript focused on the qualitative data from this report has been submitted to Neuropsychological Rehabilitation (see Appendix E for Instructions to Authors). This journal has been selected because of its emphasis on clinically applicable research and interest in qualitative findings.

Abstract

Providing feedback on neuropsychological assessments (FNA) can impact on patients' and their relatives' outcomes and service satisfaction. However, there is currently no consensus regarding optimal FNA approaches and little is known about service users' experiences of FNA. This project therefore aimed to map current FNA processes in an outpatient neuropsychology service and develop service user-informed recommendations. An audit of 153 referrals over a 6-month period and a survey for neuropsychologists in the service were conducted to describe the patient population and feedback methods. Semi-structured interviews were carried out with eight service users (four patient-relative dyads), with thematic analysis used to understand their experiences of feedback. FNA typically consisted of a 30-minute, on-the-day feedback session followed by a written report addressed to the referrer. Patients' clinical characteristics were heterogeneous, suggesting a need for personalising FNA. Interviews with service users presenting with a range of diagnoses enabled the construction of five themes applicable across neurological conditions. Themes described cognitive, emotional, and relational elements which influence FNA experiences. Resulting recommendations were elaborated and implemented collaboratively with the service's psychology team. This included strategies to support service users emotionally, scaffold understanding of technical results, and increase transparency about wider care processes.

Introduction

Advanced theoretical knowledge and skills in the application of cognitive assessments for patients with neurological conditions is a core competency of clinical neuropsychologists (Hessen et al., 2018). This includes communicating assessment results to service users verbally and in written format, which can serve multiple functions. First, feedback on neuropsychological assessments (FNA) helps service users to develop an understanding of their diagnosis, difficulties, and implications for everyday life (Gruters et al., 2022; Mountjoy et al., 2017). Second, FNA can inform interventions or act as an intervention in itself by providing specific recommendations (Gorske, 2008). It can be valuable to include family members or carers in the feedback process, particularly if cognitive impairments may hamper understanding of the results or implementation of recommendations (Gass & Brown, 1992; Varela et al., 2024). Moreover, sharing assessment results can enhance relatives' or carers' empathic understanding and better equip them to support the patient's needs (Belciug, 2006; Lanca et al., 2020; Longley et al., 2023; Rosado et al., 2018).

A cognitive model of health communication (Ley, 1982) suggests that effective communication hinges on the patient's understanding and memory of the information provided. This, in turn, affects service satisfaction and adherence to recommendations. Building on this model, Kessels (2003) posited that the service user's cognitive and emotional state, form of feedback, and perceived importance of the information influence both understanding and memory of feedback content (see Figure 1). This need to adapt the form and content of health information to the service user aligns with British Psychological Society (BPS) guidelines, which state that "people who use psychological tests are expected to […] provide the test taker and other authorised persons with any agreed feedback about the results in a form which makes clear the implications of the results, is clear and in a style appropriate to their level of understanding" (British Psychological Society, 2010, p.3).

Similarly, guidance from the London Dementia Clinical Network (Butler et al., 2021) highlights the importance of writing neuropsychological reports in a clear and concise manner, and considering the intended reader when presenting the results. They further indicate that it is best practice to offer an opportunity for in-person discussion of the results.

Several frameworks have been proposed which outline the structure and core topics of FNA. Typical elements include reviewing the purpose of testing, describing strengths and weaknesses, discussing the diagnosis, prognosis, and implications, and making recommendations (Butler et al., 2021; Gass & Brown, 1992; Gorske, 2008). Drawing on clinicians' experiences, Postal and Armstrong (2013) further suggest specific strategies to enhance feedback methods. Among others, they indicate that understanding and retention may be improved by presenting simple, novel, emotionally and cognitively stimulating, and concrete information. However, there is currently no consensus within the neuropsychological community regarding optimal methods for providing FNA and there is significant variability in approaches between individual neuropsychologists and services (Bennett-Levy et al., 1994; Meth et al., 2016). In addition, whilst neuropsychologists' views have been integrated in existing FNA frameworks and strategies, little is known about service users' perceptions of what and how information about neuropsychological assessment results should be communicated. Based on the cognitive model of health communication, a better understanding of their experiences is instrumental to ensuring optimal outcomes and service satisfaction.

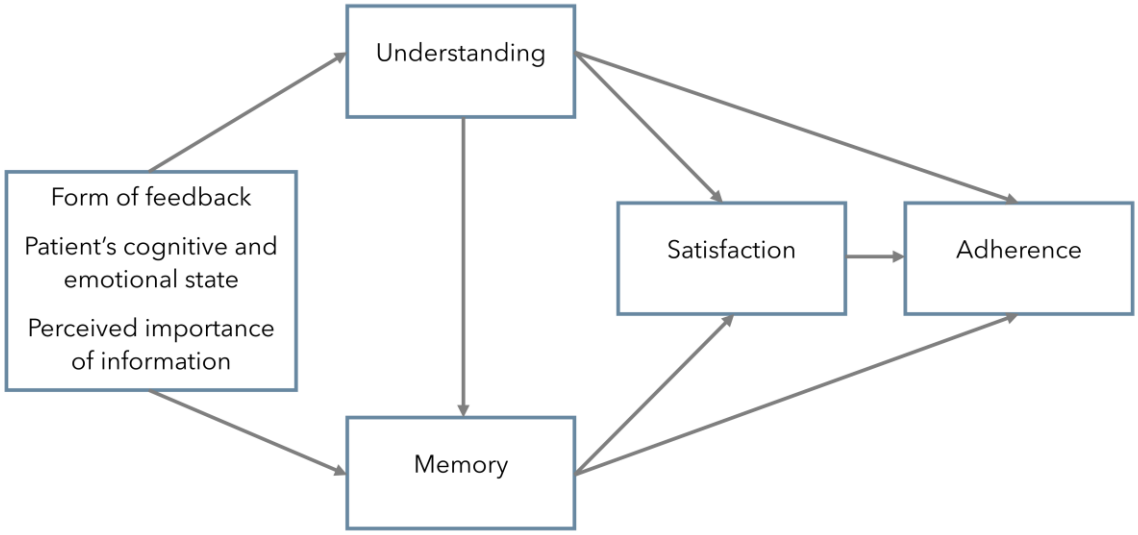
Service context and study aims

This project was developed in an adult neuropsychological outpatient service in an acute NHS Trust. The service provides neuropsychological assessments for patients with a neurological condition referred by any health or social care professional. Typical referral reasons include differential diagnosis, assessing cognitive function and/or mood, evaluating

suitability and effects of surgery, and questions regarding ability to work or drive. The team consists of four qualified clinical neuropsychologists and three assistant psychologists. In consultation with the service lead, a need was identified to obtain information about current FNA approaches and service user-informed recommendations for providing feedback. The present study therefore aimed to (1) describe current practice, (2) explore patients' and relatives' experiences of FNA, and (3) develop and implement recommendations to improve FNA procedures.

Figure 1

Schematic Representation of Ley's (1982) Cognitive Model of Health Communication Incorporating Predictive Factors Proposed by Kessels (2003).



Methods

PPI and ethics

Materials for the study were developed in collaboration with three experts by experience, including two patients with Parkinsonian disorders and one relative. All had previously attended a comprehensive neuropsychological assessment and had received both written and verbal feedback. The project was approved by the Directorate Management of the local NHS

Trust (registration number: 9592; see Appendix F). All eligible service users[1] provided informed consent and a written summary of the results was distributed to participants via email.

Stage 1: Current practice

The first stage aimed to describe the patient population and FNA approaches in the service. Referral data across six months (January – June 2025) were retrieved from the Electronic Patient Record (EPR). Information collected included patient demographics, neurological condition, whether FNA was provided, form of FNA (verbal and/or written), and who was present during FNA. All qualified neuropsychologists completed a survey on Qualtrics XM to gain further details about current FNA methods (see Appendix G).

Stage 2: Service users' experiences

The second stage explored patients' and relatives' experiences of FNA using semi-structured interviews. Inclusion criteria were (1) ≥18 years of age, (2) completed a cognitive assessment and received FNA, (3) able to provide written informed consent, (4) able to concentrate for a minimum of 20 minutes, (5) sufficient English language skills to understand and respond to interview questions, (6) no severe cognitive or communication impairment, and (7) no current severe psychiatric disorder. The interview topic guide encompassed questions about the FNA format and content based on relevant literature (Gass & Brown, 1992; Gorske, 2008; Postal & Armstrong, 2013; Wong et al., 2024), PPI consultations, and discussions with two clinical psychologists (see Appendix H). Patients and relatives were interviewed jointly to capture their shared experience, enhance support for the patient, and accommodate service users' preferences. Interviews were conducted via

[1] The term 'service users' is used to refer to both patients and relatives

videocall between June 2025 and February 2026 and recorded using Teams software. Interviews were completed within 3 weeks following FNA to facilitate recall.

Stage 3: FNA recommendations and implementation

Quantitative and qualitative data were integrated to develop initial service recommendations. Findings were presented to psychologists from adult and paediatric neuropsychology services in the Trust at a continuing professional development (CPD) meeting, where it was collaboratively discussed how recommendations could be further elaborated and implemented.

Data analysis

Quantitative data were summarised with descriptive statistics using R software (version 4.1.2). Transcriptions of semi-structured interviews were imported from Teams into NVivo (version 13.23.4), refined and anonymised manually, and analysed using Braun and Clarke's (2006) six-phase thematic analysis approach guided by their 15-point checklist criteria (see Appendices I-J). A tempered realist and post-positivist stance was adopted, which assumed that participants' accounts reflected their real experiences whilst acknowledging the researcher's active role in data collection and constructing meaning. The primary analytic approach was inductive, however analysis and resulting recommendations were secondarily informed by the existing FNA frameworks and communication theory outlined above.

Results

Stage 1A: Referrals audit

Over a 6-month period, 153 patients (96 male, 62.7%) were offered a neuropsychological assessment. Patients' mean age was 50.6 years (SD ± 17.4, range = 17.3-80.9). Recording of additional demographic details was variable, with substantial missing data (see Figure 2). Patients presented with a wide range of primary diagnoses (see Appendix K). The most

frequent conditions were cancer/brain tumours, epilepsy, neurodegenerative disorders, and cardiovascular disease. A total of 128 patients completed a cognitive assessment (see Appendix K). Of these, 59.4% attended the appointment with another person, most commonly a spouse/partner or parent (see Table 1). A written report was documented on EPR for all but one patient, and 41.4% of these reports explicitly stated that verbal feedback was offered and/or provided. Reports were addressed to referrers, with a copy sent to the patient.

Stage 1B: Neuropsychologists' survey

Survey results suggested consistency in the feedback process (see Figure 3). Typically, up to 30 minutes of in-person verbal feedback was provided on the day of the assessment. Timing of the report ranged from one to four weeks post-assessment. Feedback content differed more substantially between practitioners (see Figure 4). All respondents indicated they would discuss the diagnosis and results by domain, whereas less common elements were reviewing the purpose of the assessment, discussing the prognosis, and signposting. Frequently used strategies included summaries, simplifying language, and metaphors. In contrast, use of visual aids, interpreters, and technological aids were each endorsed by only one respondent. No consistent barriers to feedback were identified (see Appendix L).

Figure 2

Patients' Demographic Characteristics

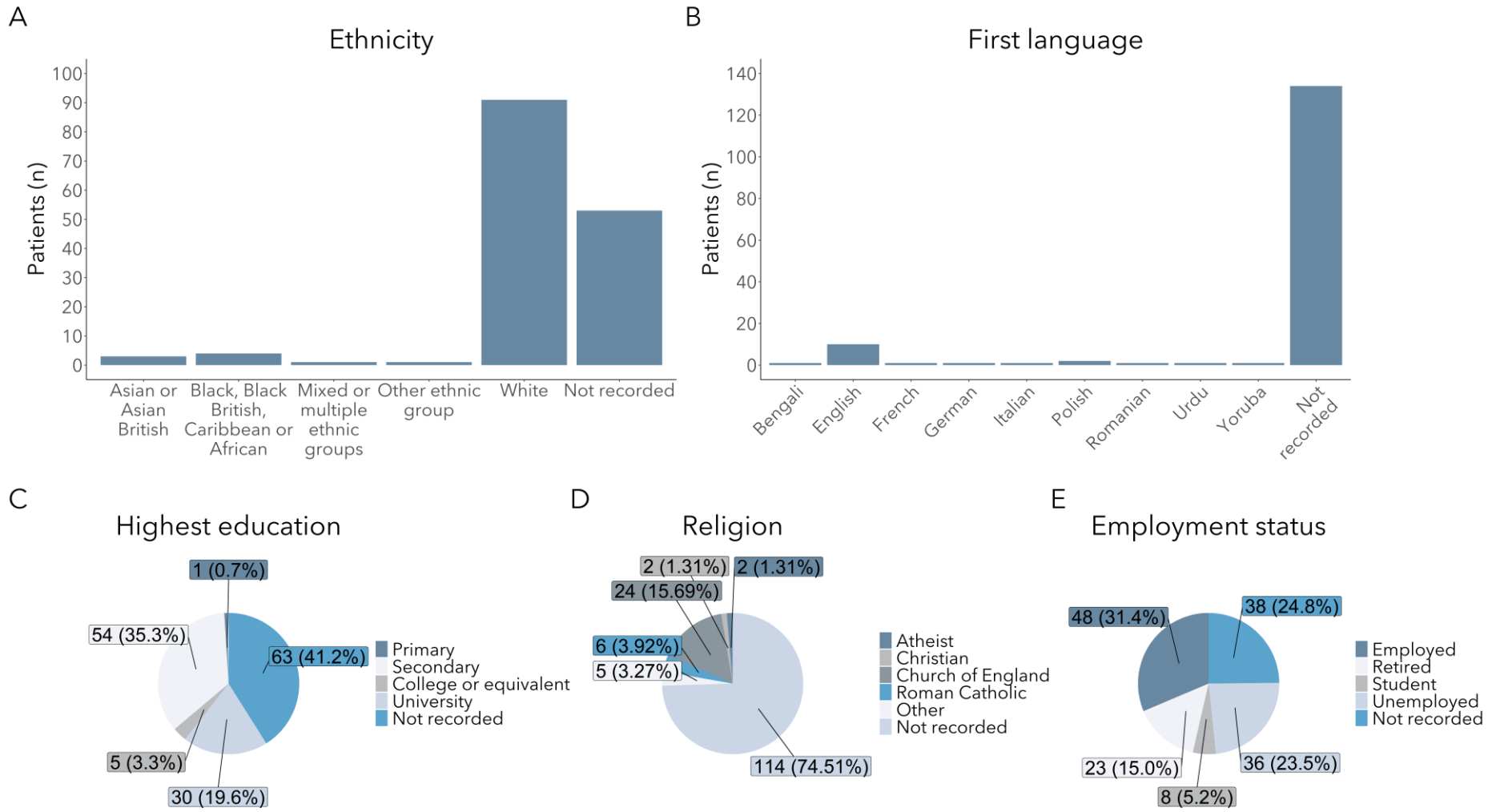


Table 1

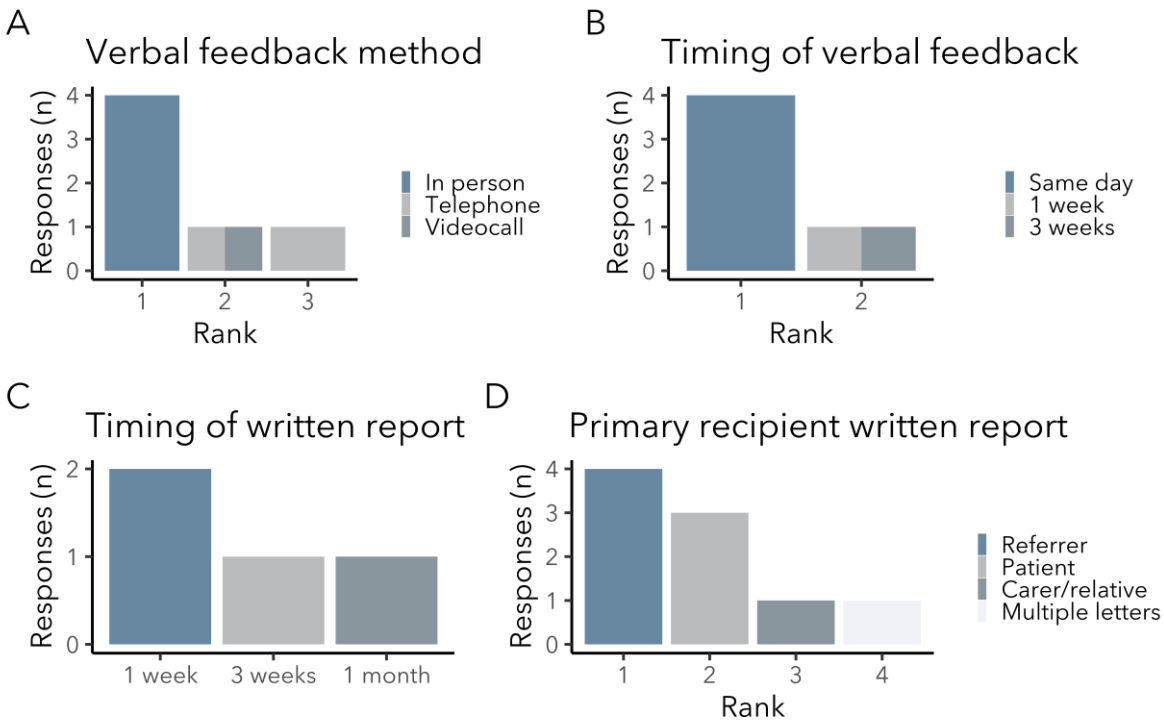
FNA Audit Details (N = 128)

	n (%)
Relative/carer present	
Yes	76 (59.4%)
No	50 (39.1%)
Not recorded	2 (1.6%)
Relative/carer relationship	
Spouse or partner	37 (28.9%)
Parent	19 (14.8%)
Sibling	6 (4.7%)
Child	4 (3.1%)
Friend	1 (0.8%)
Support worker	1 (0.8%)
Multiple relatives/carers present	8 (6.3%)
Verbal feedback	
Offered[a]	14 (10.9%)
Provided	39 (30.5%)
Not recorded	75 (58.6%)
Written report	
Provided	127 (99.2%)
Not recorded	1 (0.8%)
Primary intended recipient of report	
Referrer	127 (99.2%)
Not applicable	1 (0.8%)

[a] Not explicitly stated whether offer was taken up

Figure 3

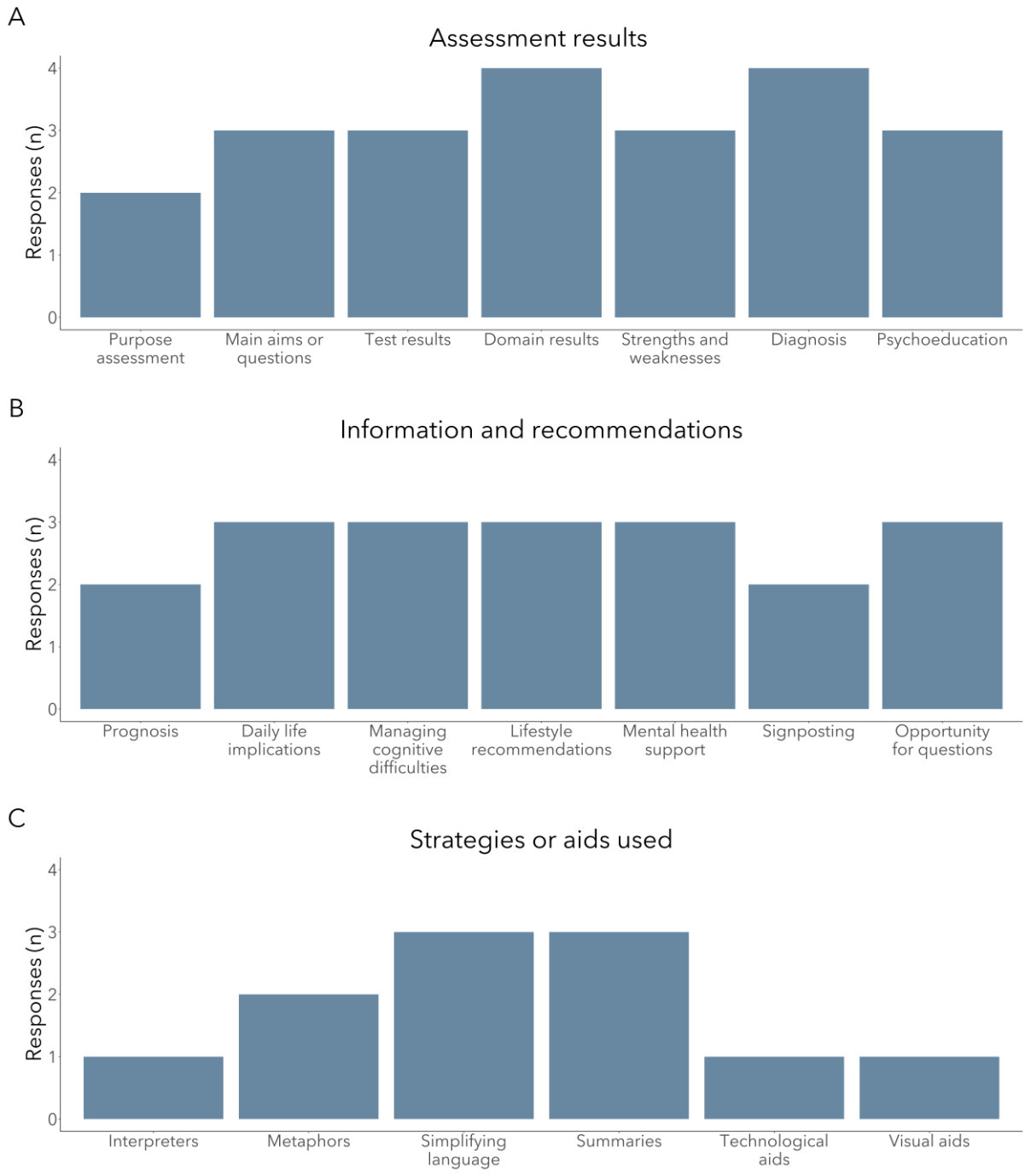
Feedback Format



Note. This figure shows ranking of the typical **(A)** method of providing verbal feedback, **(B)** time of verbal feedback relative to the assessment, **(C)** time of written report relative to the assessment, and **(D)** primary intended recipient of the written report.

Figure 4

Content of Feedback



Note. This figure shows **(A)** topics included in feedback related to the assessment and results, **(B)** information and recommendations provided, and **(C)** strategies or aids used to enhance understanding.

Stage 2: Service users' experiences

Participants

Eight participants, comprising four patients with a neurological condition (P1-4) and their relatives (R1-4), took part in joint interviews. Patients included one male and three female participants, with ages ranging from early 30s to early 70s. Patients' neurological conditions were epilepsy, traumatic brain injury, dystonia, and functional neurological disorder. Relatives included three spouses/partners (one male, two female) and one parent (female). Two of the patient-relative dyads received on-the-day verbal feedback followed by a written report (P2-R2 and P3-R3). One dyad received the report before verbal feedback (P4-R4) and one dyad received only written feedback (P1-R1). Median interview length was 60 minutes, with one interview completed across two sessions to ameliorate patient fatigue. Five interconnected themes encompassing 34 unique codes were constructed from the data (see Appendix M).

Theme 1: Emotional trajectory of the feedback process

This theme describes the strong emotions elicited across stages of the feedback process, with participants reporting changes in mood and self-perceptions before and after FNA. Prior to feedback, many service users felt anxious about potentially negative outcomes and their implications for the future. P1 highlighted the difficulty of uncertainty: *"I had all that anxiety […] it was that not knowing"*. Several participants described how on-the-day verbal feedback reduced uncertainty and worry whilst waiting for the report:

> "If we hadn't have had the [verbal feedback] I think […] that wait for the letter – regardless whether it was two days, two weeks, two months – would have been an increased anxiety. […] I think maybe you'd be waiting for the post, whereas we weren't really. We didn't have that anxiety." (R2)

Upon learning the results, service users noticed immediate emotional shifts. P2 shared: *"After I got out of the appointment I was making more jokes. […] I just maybe subconsciously felt happier"*. R2 noted how the impact of FNA extended to relatives, with feedback providing *"relief for us all as a family"*. Most participants experienced a positive change in mood and self-confidence, however P4 reported feeling low after receiving the report due to being deficit-focused. Codes linked with positive emotions included reassurance from the clinician, clarity about the prognosis, and a balanced view of strengths and weaknesses. Emotional responses and self-perceptions were therefore shaped not only by the results themselves, but also by how feedback was delivered.

Theme 2: Making sense of the results

This theme captures service users' efforts to interpret their results, showing how the volume, language, and format of feedback influenced their understanding. Several participants described the volume of information as "a lot" (P2, R3) or "overwhelming" (P3, P4, R4). Service users emphasised that a clear structure in verbal feedback (e.g. providing an outline at the beginning) and written reports (e.g. headings) helped them focus on key points and process information more effectively. It was repeatedly suggested that a summary of the main messages at the start of feedback would make information more accessible, particularly in the context of cognitive difficulties. Some indicated this could help reduce anxiety and allow service users to choose whether they wanted to learn any further details:

> "I would then relax and not had to read all the stuff and […] get totally confused and then read the most important sentence at the end." (P1)

Although areas of interest varied between dyads, common priorities included practical implications for everyday life and changes in functioning over time. Service users consistently appreciated verbal feedback, which they felt focused on their concerns. On the

other hand, the value of the written report varied and depended on whether this was preceded by verbal feedback. Dyads who received verbal feedback first described how the report enhanced their understanding and served as a reference document. Some indicated that having additional details and time to process information was helpful:

> "It's having the space to […] read something. You can read a paragraph and then think about it and go 'okay, fine' and then move on. It's all at your own pace." (R3)

In contrast, participants who did not receive on-the-day verbal feedback reported difficulties understanding the findings and ruminating about the results. For the written report, which was addressed to the referrer, service users noted that some information felt irrelevant and the language used was difficult to understand. As R1 indicated, *"there were a lot of sections that I hadn't a clue what they meant […] there was a lot of scientific stuff"*. Across dyads, the introduction and conclusion were found to be most helpful. When reading the assessment results, many noted that they lacked background knowledge to interpret technical information such as test names, scores, and performance labels (e.g. 'average'). Patients reported uncertainty about who their results were compared with in terms of age and education, while relatives had limited knowledge about specific tests as they had not observed the assessment. Some thought that test descriptions or visual aids might improve their understanding of both written and verbal feedback. Where interpretation of the results was felt to be unclear, service users attempted to make sense of this themselves. Reflecting on the report, P4 noted that *"even though it's quite black and white, you kind of like read between the lines and you start kind of extrapolating from that feedback"*. Their relative noted how this could lead to discrepancies between the service user's and neuropsychologist's interpretation:

> "[The clinician] seemed like… kind of surprised that that report […] was a source of worry because obviously [they've] got the broader context." (R4)

Overall, making sense of the results was an active but constrained process, which was influenced by the medium, sequence, and structure of feedback as well as participants' prior knowledge.

Theme 3: Knowledge is empowering

Beyond the immediate emotional impact of feedback, developing a clear understanding of neuropsychological difficulties gave service users a greater sense of control and practical confidence in managing the condition. Both patients and relatives emphasised the importance of clearly explaining the symptoms and prognosis. P4 highlighted the value of getting *"more insight, whether that be good or bad […] just get more transparency on what our situation might be"*. For many, the results provided an 'objective' account that helped them stop questioning their experiences. As one relative noted, *"we didn't feel [their] memory had been affected. But you don't know until that test has been done"* (R2). When feedback aligned with lived experience it was felt to be validating, irrespective of whether findings were positive or negative. For patients, increased understanding and validation facilitated self-acceptance and confidence:

> "It makes me okay with myself. […] Considering how much it's […] destroyed life it's helpful. It's actually sort of empowering, actually. It's sort of 'okay, actually, considering that, you're doing quite well' sort of feeling." (P3)

Feedback provided service users with more certainty and a language to explain difficulties to others, including friends, family, and employers. P2 reflected that *"it's not really words*

against words […] it's someone saying this is what the data shows". Involving relatives in feedback was felt to be helpful for supporting patients' understanding during FNA but also increasing their own knowledge. Some highlighted that a shared understanding affected how relatives positioned themselves in relation to the patient. R3 and P3 described this shift:

> "Sometimes there is a limit, obviously, to what I can fix. And […] okay, it's not a case of fixing, it's a case of supporting." (R3)

> "I feel supported differently. And it's just understanding, it's subtle, but it's meaningful." (P3)

As well as reframing difficulties, knowledge facilitated behavioural change. P2 noted becoming more active after feedback and said that *"I feel like I am able to do things"*. Several participants described adopting new coping strategies and implementing recommendations. One patient linked this directly to understanding: *"I know that I manage my symptoms better now than I did before and that's come from knowledge"* (P3). Overall, developing a better understanding of the neurological symptoms empowered patients and relatives, both emotionally and behaviourally.

Theme 4: Feedback is a relational process

This theme describes how relational connection with the clinician influenced service users' sense of safety and fostered open discussions. Verbal feedback was valued as an opportunity to raise questions and concerns. Service users stressed the importance of creating an environment in which they could voice their worries. One dyad suggested being explicitly invited to share anxieties could facilitate this openness:

> "Just the invitation to be, you know, 'what's keeping you awake at night? What other things you're worrying about that we could talk about now?'

> […] You're more likely to kind of be brave and ask those things because there's kind of the space made for it." (R4)

Participants also said that it made a difference when clinicians demonstrated interest, took time for the patient, and conveyed empathy through non-verbal cues. Several suggested that this connection was easier in person compared with phone calls:

> "I feel like if you had a silly question, you might be more able to ask it in person than over the phone […] because you can read people's expressions and things like that." (P2).

It was important to service users that they were seen and heard as a person rather than solely a clinical case. Many noted how this was reinforced by having an accurate written account:

> "An accurate review of what you've done makes you feel heard, I suppose, but also it's not just medicalised, it's about you. It's not just about the referrers. It's not just about the test. It's about just your experience." (P3)

As explored in previous themes, participants reflected on the emotional challenges of undergoing a neuropsychological assessment and receiving results. Several service users described wanting to be supported through this process by the neuropsychologist. One relative discussed the reassurance of having the clinician present during difficult feedback:

> "If […] it wasn't such good news and [P2] was upset than there's somebody with me to help [them] through it. Rather than just being at home receiving a letter and [P2] being upset and, you know then am I saying the right thing […], whereas if it was a face to face with the clinician […] they can be saying the right sort of thing then." (R2)

Overall, the experience of FNA was influenced not only by its content but also by the quality of the relational connection. Empathy, attention, and support from the clinician enabled service users to engage with the feedback process.

Theme 5: Accessing support across the care pathway

This theme captures how service users' experiences were shaped by the extent to which they felt included in and invited to access the care pathway beyond initial feedback. Although service users appreciated being informed that they could contact the clinician, invitations limited to written reports were sometimes experienced as ambiguous. Some participants questioned whether the offer was a genuine part of the pathway or merely a "nicety" (R4). In the context of perceived pressure on NHS services, they worried about being demanding or questions not being important enough to justify contact:

> "To be honest if […] they said 'ring us if you've got any problems or other questions' I don't think I would have done […] what's the point of ringing up you know, it's not a major problem." (P1)

One carer highlighted uncertainty about the typical pathway, as well as the cognitive and emotional burden having to initiate contact places on service users:

> "Is it like demanding to ask for more rather than it's like a natural part of the pathway […] that's like another step you've got to kind of get through when you're already feeling overwhelmed and maybe a bit scared to have that conversation." (R4)

In contrast, explicit reassurance that there was an 'open door' to the service if needed created a greater sense of being supported and held: *"I was glad, you know, [they said they] would see me again. So that feeling of not just being left"* (P3). Participants also wanted to feel included by receiving the same information as healthcare professionals. Learning that other

services had accessed information first sometimes generated anxiety. R4 described a situation in which professionals referred to a report they had not yet seen themselves: *"So that was quite like 'Oh, this is a big report about me. Haven't seen it. Maybe it's really bad', you know?"*. On the other hand, when they had access to the same information patients valued details being shared with other services, which reinforced a sense of joined-up care. Altogether, service users wanted to be actively invited, informed about, and included in their care, suggesting that perceived access to support influenced how feedback was experienced.

Stage 3: FNA recommendations

Based on the quantitative and qualitative results, service recommendations were developed and discussed with neuropsychology teams (see Table 2). Recommendations were linked to specific elements of the cognitive model of health communication (Kessels, 2003; Ley, 1982) as well as wider service and Trust processes. The findings and associated recommendations were well-received by stakeholders. Whilst some recommendations could be implemented immediately, it was noted that more extensive discussions would be valuable for deciding on detailed adjustments to written reports. It was agreed that time would be allocated for this in the subsequent CPD meeting. Following this meeting a finalised summary of the recommendations will be distributed to the teams and added to the service's SharePoint for future reference.

Table 2

Service Recommendations and Responses

Improvement aspect	Recommendations	Service response and implementation
Service users' cognitive and emotional state		
Minimising uncertainty and anxiety	Prioritise verbal feedback and, if on-the-day feedback is not feasible, discuss with service users when and how (e.g. in person, videocall, or telephone call) they would prefer to discuss the results.	Psychologists found it validating to hear the value of verbal feedback for service users. They noted that, when asking service users about their preferences, it is not uncommon for them to say that a written report is sufficient. It was therefore suggested that the psychologist can explicitly recommend arranging a verbal feedback session if it is not possible to provide this on the day.
Preventing deficit-focused interpretations	Provide a balanced discussion of the patient's strengths and weaknesses. Consider whether performance labels such as 'average' could be adjusted or if an explanation could be given to patients about the meaning of these words to reduce potentially negative emotional impact.	It was agreed that providing additional information about the technical meaning of performance labels may be helpful, for example by explaining how these relate to normal distributions.
Creating space for difficult emotions and conversations	Service users indicated that they highly valued clinicians demonstrating genuine interest and taking time for the patient. Prioritising verbal feedback can facilitate this. In addition, explicitly inviting service users to share their worries and concerns is recommended.	Psychologists found it helpful to have an increased awareness of the emotional impact of verbal feedback, and some indicated this encouraged them to focus more on its therapeutic potential.
Engaging relatives/carers in the feedback process	Family members can support patients' understanding and memory of the feedback. In addition, attending feedback impacted on relatives' emotional wellbeing and everyday support strategies. However, it was noted that appointment letters did not indicate that family members or carers should attend the appointment.	This aspect was identified during data collection and, in collaboration with the administrative team, letters were adjusted to explicitly encourage patients to ask a family member or carer to join the appointment.

Table 2 (continued)

Service Recommendations and Responses

Improvement aspect	Recommendations	Service response and implementation
2. Importance of information		
Focus on what matters to the service user	Explore and focus on service users' main questions. Start feedback with the most important information or give an outline of the feedback so that service users are reassured that their main concerns will be discussed.	Psychologists indicated this could be implemented within the feedback process.
Consider common areas of interest	Whilst specific questions will differ between service users, be aware that common topics of interest include factors contributing to symptoms, change over time and prognosis, and concrete recommendations.	This recommendation was linked to current practice, which suggested that prognosis and signposting are not consistently included in assessment feedback. Psychologists agreed this could be included more systematically.
3. Form of feedback		
Reducing the amount of information presented in the written report	Consider what information is essential for the referrer and how results can be presented to avoid overwhelming service users.	It was noted that specific test scores were included mainly for future reference for the psychologist. It was suggested that these could be placed in an appendix instead of the main text.
Guide service users towards relevant information in the report	Use clear headings to denote specific aspects within the report. It may be worth discussing the purpose of the letter with the service user in advance and provide explicit recommendations for how to read the report.	It was suggested that additional headings could be provided in the conclusion, for example having separate sections titled 'information for the referrer' and 'information for the patient'.
Scaffold understanding of the test results	Explore whether additional information can be provided to help the service user understand the more technical test results, for example by including task descriptions, details about comparison groups, and the meaning of test scores or ranges. Consider whether visual aids may be useful for clarifying this information.	Suggested adaptations included using an image of a normal distribution to contextualise the scores, a lay summary, or a glossary of technical terms. An overview of this information could be created by the assistant psychologists in the team and included as a standard component of the written report.

Table 2 (continued)

Service Recommendations and Responses

Improvement aspect	Recommendations	Service response and implementation
4. Care pathway and Trust processes		
Enhance service users' understanding of the care pathway	Clearly explain that verbal feedback is a standard part of the pathway and provide information about when and how service users will be able to contact the service after their initial appointment. It may be helpful to provide standard information about the service using a leaflet.	It was indicated that information about the pathway could be provided to patients during the verbal feedback session. The possibility of creating a leaflet will be discussed in the following CPD meeting.
Recording patients' demographic details	Quantitative data demonstrated that demographic details about patients is recorded inconsistently across the Trust. Ensuring that this information is obtained and recorded can be helpful for personalising assessments and feedback provided.	One of the psychologists noted that they have helpful recommendations for discussing service users' religion during assessments and offered to share this with the team via email.
Sharing information with the service user and relevant services	Explore whether the report could be sent to service users electronically, so that they have access to information at the same time as health professionals. With the service user's consent, consider copying relevant services into the written report to enhance sharing of information and joined-up working.	It was noted that the reports may already be accessible online, but little is known about this process. It was agreed that it would be clarified if and where this information could be accessed by patients at present.

Discussion

This project aimed to describe current practice and examine service users' experiences of assessment feedback in an outpatient neuropsychology service to enhance FNA. Audit results demonstrated that patients with a wide range of neurological conditions across the adult lifespan were seen for cognitive assessments. This suggested that a flexible rather than a 'one-size-fits-all' approach in terms of the content and format of feedback is most appropriate for the service (Gass & Brown, 1992). As semi-structured interviews included patients of different ages and a range of diagnoses it was possible to identify general factors which influence the experience of FNA. Informed by the cognitive model of health communication (Kessels, 2003; Ley, 1982), it was explored how the form of feedback, service users' cognitive and emotional state, and the perceived importance of information influenced understanding of and satisfaction with FNA.

A service user-informed FNA approach

Surveying neuropsychologists in the service showed that the typical FNA process is clearly established, consisting of a 30-minute verbal feedback session on the day of the assessment followed by a written report addressed to the referrer. A review of the current FNA literature suggests this service model is somewhat unusual, with most services reporting that verbal feedback is provided a few weeks post-assessment and takes approximately an hour (Gruters et al., 2022). There are several advantages and disadvantages to each of these approaches. On-the-day feedback means that clinicians typically have less time to interpret the results or to prepare and deliver feedback. In addition, service users may be fatigued by the assessment which could affect information processing. On the other hand, if clinicians provide feedback on a separate day, they may need to reestablish rapport and remind themselves about service users' specific circumstances.

Validating the current service model, a recurring topic in qualitative interviews was

the value of in-person, on-the-day feedback. Both patients and relatives emphasised that this approach alleviated anxiety and uncertainty. In addition, in-person contact facilitated feeling connected and supported by the neuropsychologist, as well as providing space to discuss questions and concerns openly. Crucially, qualitative results suggested that relational aspects of in-person feedback strongly contribute to service users' emotional state and satisfaction with FNA. This aligns with the wider literature on patient-centred communication, which indicates that the interpersonal relationship enhances overall satisfaction and adherence to recommendations (Bensing et al., 2011; Martin et al., 2005; Matusitz & Spear, 2014). The quality of the therapeutic relationship has also long been acknowledged to be a cornerstone of effective psychological interventions (Muran & Barber, 2010). Importantly, however, relational elements have received relatively little attention in neuropsychological assessment research and are not explicitly incorporated in existing FNA frameworks. The present results suggest this is a critical factor which encourages open and supportive conversations in FNA, which can be further enhanced by explicitly creating space for difficult emotions (e.g. by asking service users about their concerns).

Information provided during FNA also had the potential to empower both patients and relatives. Increased knowledge helped patients feel more able to manage their symptoms and altered self-perceptions. Relatives appreciated having a better understanding of the patient's symptoms, which in turn could affect how they approached patient support. This highlights the value of including relatives in the feedback process. Service users found it particularly helpful to be given a clear explanation of factors causing their difficulties, changes over time and prognosis, and concrete recommendations. This highlighted that some elements (e.g. discussing prognosis and signposting) may need to be incorporated more consistently than is currently the case based on psychologists' survey responses. Moreover, adaptations to the form and focus of FNA may be needed to enhance service

users' understanding. It was repeatedly noted that technical information in reports was hard to digest and could be misinterpreted if read without support from the neuropsychologist. Methods for scaffolding service users' understanding, reducing the amount of information, and guiding readers towards relevant information are currently being explored with the psychology team. Written reports are intended for multiple audiences, and it can be challenging to balance language and level of detail for service users and referrers. Interestingly, there is evidence that referrers would prefer less jargon and do not tend to consume the entire report but rather focus on the psychologists' impression and recommendations (Baum et al., 2018; Mahoney et al., 2017; Postal et al., 2018). It would be worth exploring whether these findings extend to professionals referring to this service, as some adjustments to written reports may be helpful for professionals and service users alike.

Finally, the findings suggested that changes to care processes beyond FNA itself could improve service users' experiences. Specifically, having an 'open door' where service users were actively invited to contact clinicians and felt that follow-up appointments were possible if needed was appreciated. Furthermore, openly sharing information with both service users and external services provided a sense of inclusion and joined-up care.

Limitations and future directions

This project focused mainly on service users' subjective experiences within the cognitive model of health communication (Kessels, 2003; Ley, 1982). Future studies could explore whether the present recommendations also affect objective outcomes (e.g. memory and adherence). In addition, the qualitative findings should be interpreted within the context of the specific sample. The sample size for semi-structured interviews was relatively small, however it has been suggested that a total of 8-10 participants is appropriate for small projects (Braun & Clarke, 2013, p.48). Moreover, given the specific study aim, dialogue quality, and richness of collected data, the information power was sufficient to develop

informative themes (Malterud et al., 2016). It should be noted that all participants were white British, native English speakers, and had attended secondary education or higher. Furthermore, there was limited information about patients' demographic details on EPR. It has been proposed that factors such as ethnicity, first language, and educational attainment can affect service users' perceptions and understanding of FNA (Gruters et al., 2022). In addition, study criteria excluded patients with severe cognitive impairments or psychiatric disorders, and specific adjustments to FNA may be required to meet these service users' needs. It would be valuable for the service to collect demographic details more systematically and explore experiences of service users with diverse backgrounds and clinical characteristics to ensure inclusive FNA approaches. A further limitation is that recruitment details, such as participation rates and reasons for non-participation or exclusion, were not consistently recorded during recruitment. It was therefore not possible to evaluate potential recruitment bias in this study or determine whether participants systematically differed from service users who did not take part. Finally, patients and relatives were interviewed jointly to understand their shared experience and maximise patient support. However, this may have led to participants withholding sensitive information and greater agreement within dyads. In future, it may therefore be helpful to investigate patients' and relatives' individual experiences.

Conclusion

Consistent with previous studies, this project showed that FNA can significantly impact on service users' wellbeing and coping. The results provide novel information about factors contributing to understanding of and satisfaction with FNA, including creating a therapeutic environment and scaffolding neuropsychological information. Altogether, this project contributed to concrete adjustments and greater consistency in the service's FNA approach.

References

Baum, K. T., von Thomsen, C., Elam, M., Murphy, C., Gerstle, M., Austin, C. A., & Beebe, D. W. (2018). Communication is key: the utility of a revised neuropsychological report format. *Clinical Neuropsychologist*, *32*(3), 345–367. https://doi.org/10.1080/13854046.2017.1413208

Belciug, M. P. (2006). Concerns and anticipated challenges of family caregivers following participation in the neuropsychological feedback of stroke patients. *International Journal of Rehabilitation Research*, *29*, 77–80. http://journals.lww.com/intjrehabilres

Bennett-Levy, J., Klein-Boonschate, M. A., Batchelor, J., McCarter, R., & Walton, N. (1994). Encounters with Anna Thompson: The customer's experience of neuropsychological assessment. *Clinical Neuropsychologist*, *8*(2), 219–238. https://doi.org/10.1080/13854049408401559

Bensing, J. M., Deveugele, M., Moretti, F., Fletcher, I., van Vliet, L., Van Bogaert, M., & Rimondini, M. (2011). How to make the medical consultation more successful from a patient's perspective? Tips for doctors and patients from lay people in the United Kingdom, Italy, Belgium and the Netherlands. *Patient Education and Counseling*, *84*(3), 287–293. https://doi.org/10.1016/j.pec.2011.06.008

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. SAGE Publications.

Butler, C., Clatworthy, L., Clayton, M., & Souris, H. (2021). *Neuropsychological assessment in memory services: Guidance from the London Dementia Clinical Network*.

Gass, C. S., & Brown, M. C. (1992). Neuropsychological test feedback to patients with brain dysfunction. *Psychological Assessment*, *4*(3), 272–277. https://doi.org/10.1037/1040-3590.4.3.272

Gorske, T. T. (2008). Therapeutic neuropsychological assessment: a humanistic model and case example. *Journal of Humanistic Psychology*, *48*(3), 320–339. https://doi.org/10.1177/0022167807303735

Gruters, A. A. A., Ramakers, I. H. G. B., Verhey, F. R. J., Kessels, R. P. C., & de Vugt, M. E. (2022). A scoping review of communicating neuropsychological test results to patients and family members. *Neuropsychology Review*, *32*(2), 294–315. https://doi.org/10.1007/s11065-021-09507-2

Hessen, E., Hokkanen, L., Ponsford, J., van Zandvoort, M., Watts, A., Evans, J., & Haaland, K. Y. (2018). Core competencies in clinical neuropsychology training across the world. *Clinical Neuropsychologist*, *32*(4), 642–656. https://doi.org/10.1080/13854046.2017.1413210

Kessels, R. P. C. (2003). Patients' memory for medical information. *Journal of the Royal Society of Medicine*, *96*, 219–222.

Lanca, M., Giuliano, A. J., Sarapas, C., Potter, A. I., Kim, M. S., West, A. L., & Chow, C. M. (2020). Clinical outcomes and satisfaction following neuropsychological assessment for adults: a community hospital prospective quasi-experimental study. *Archives of Clinical Neuropsychology*, *35*(8), 1303–1311. https://doi.org/10.1093/arclin/acz059

Ley, P. (1982). Satisfaction, compliance and communication. *British Journal of Clinical Psychology*, *21*(4), 241–254. https://doi.org/10.1111/j.2044-8260.1982.tb00562.x

Longley, W. A., Tate, R. L., & Brown, R. F. (2023). The psychological benefits of neuropsychological assessment feedback as a psycho-educational therapeutic intervention: A randomized-controlled trial with cross-over in multiple sclerosis. *Neuropsychological Rehabilitation*, *33*(5), 764–793. https://doi.org/10.1080/09602011.2022.2047734

Mahoney, J. J., Bajo, S. D., De Marco, A. P., Arredondo, B. C., Hilsabeck, R. C., & Broshek, D. K. (2017). Referring providers' preferences and satisfaction with neuropsychological services. *Archives of Clinical Neuropsychology*, *32*(4), 427–436. https://doi.org/10.1093/arclin/acx007

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Qualitative Health Research*, *26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444

Martin, L. R., Williams, S. L., Haskard, K. B., & DiMatteo, M. R. (2005). The challenge of patient adherence. *Therapeutics and Clinical Risk Management*, *1*(3), 189–199. https://doi.org/10.2147/tcrm.s12160382

Matusitz, J., & Spear, J. (2014). Effective doctor-patient communication: An updated examination. *Social Work in Public Health*, *29*(3), 252–266. https://doi.org/10.1080/19371918.2013.776416

Meth, M., Calamia, M., & Tranel, D. (2016). Does a simple intervention enhance memory and adherence for neuropsychological recommendations? *Applied Neuropsychology: Adult*, *23*(1), 21–28. https://doi.org/10.1080/23279095.2014.996881

Mountjoy, T., Field, S., Stapleton, A., & Kemp, S. (2017). Experiences of attending neuropsychological assessment: a service evaluation. *Clinical Psychology Forum*, *292*, 24–30. https://doi.org/10.53841/bpscpf.2016.1.286.21

Muran, J. C., & Barber, J. P. (2010). *The therapeutic alliance: An evidence-based guide to practice*. Guilford Press.

Postal, K., & Armstrong, K. (2013). *Feedback that sticks: the art of effectively communicating neuropsychological assessment results*. Oxford University Press.

Postal, K., Chow, C., Jung, S., Erickson-Moreo, K., Geier, F., & Lanca, M. (2018). The stakeholders' project in neuropsychological report writing: a survey of neuropsychologists' and referral sources' views of neuropsychological reports. *Clinical Neuropsychologist*, *32*(3), 326–344. https://doi.org/10.1080/13854046.2017.1373859

Rosado, D. L., Buehler, S., Botbol-Berman, E., Feigon, M., León, A., Luu, H., Carrión, C., Gonzalez, M., Rao, J., Greif, T., Seidenberg, M., & Pliskin, N. H. (2018). Neuropsychological feedback services improve quality of life and social adjustment. *Clinical Neuropsychologist*, *32*(3), 422–435. https://doi.org/10.1080/13854046.2017.1400105

The British Psychological Society. (2010). *Code of good practice for psychological testing*. https://cms.bps.org.uk/sites/default/files/2022-07/ptc09_code_of_good_practice_amended.pdf

Varela, J. L., Sperling, S. A., Block, C., O'Leary, K., Hart, E. S., & Kiselica, A. M. (2024). A survey of neuropsychological assessment feedback practices among neuropsychologists. *Clinical Neuropsychologist*, *38*(3), 529–556. https://doi.org/10.1080/13854046.2023.2233738

Wong, D., Pinto, R., Price, S., Watson, L., & McKay, A. (2024). What does competently delivered neuropsychological assessment feedback look like? Development and

validation of a competency evaluation tool. *Clinical Neuropsychologist*, *38*(1), 116–134. https://doi.org/10.1080/13854046.2023.2200205

Theoretically-Driven Research Project

Understanding the relationship between post-stroke cognitive impairments and depression: the role of loneliness

Margot Juliëtte Overman

Student number: 842046

Contact details: margot.overman@stx.ox.ac.uk

Word count: 4,997

Date: May 2026

Internal supervisor: Dr Reena Vohora, Course Tutor, The Oxford Institute of Clinical Psychology Training and Research, Warneford Hospital, Oxford OX3 7JX

Email: reena.vohora@psy.ox.ac.uk

External supervisor: Professor Nele Demeyere, Nuffield Department of Clinical Neurosciences, University of Oxford, John Radcliffe Hospital, Oxford OX3 9DU

Email: nele.demeyere@ndcn.ox.ac.uk

Proposed journal: This project has been published in the Journal of Affective Disorders (see Appendix N for Instructions to Authors and Appendix O for the published manuscript). The choice for this journal was motivated by the interdisciplinary nature of their publications and consequent ability to reach a diverse audience, which is relevant to this work given the clinical implications for both health professionals and public health organisations.

Abstract

Background: Post-stroke cognitive impairments have been shown to increase the risk of depression, however the mechanisms underpinning this association are not well understood. The theory of social isolation in chronic illness proposes that the relationship between symptom severity in chronic conditions and mood disorders is mediated by social isolation. This study therefore aimed to explore the impact of social isolation on depression in stroke survivors with and without cognitive impairments.

Methods: Stroke survivors were recruited ≥6 months post-stroke from the Oxford Screening Programme and completed assessments of cognitive function, social isolation, and depression. Measures of social isolation evaluated both subjective feelings of loneliness and objective social disconnectedness. Multiple linear regressions examined associations of cognition and social isolation with depression symptoms, and serial mediation analyses assessed potential mediating effects of loneliness and social disconnectedness.

Results: Eighty-five participants completed the study measures. Chronic cognitive impairments predicted depressive symptoms in stroke survivors ($\beta = 1.11$, $p < 0.001$). This relationship was mediated by feelings of loneliness, which were associated with higher depression scores in participants with more severe cognitive impairments (indirect effect [IE] = 0.294, $p < 0.05$). Whilst significant direct effects were observed between all variables in the mediation analyses (all $p < 0.05$), there was no evidence for indirect effects of social disconnectedness.

Conclusions: Subjective experiences of loneliness, but not objective social disconnectedness, may increase the risk of depression in stroke survivors with cognitive impairments. These findings suggest that feelings of loneliness may be a suitable target for intervention in post-stroke depression.

Introduction

Stroke is one of the leading medical causes of disability worldwide, affecting physical, cognitive, and communicative functioning (Feigin et al., 2025; Goljar et al., 2010). Mental health is strongly affected in both acute and long-term recovery, with estimates suggesting 29% of stroke survivors present with depression and rates remaining stable up to 10 years after the event (Ayerbe et al., 2013). Post-stroke depressive symptoms negatively impact on survival, functional recovery, and quality of life (Dafer et al., 2008; Gbiri et al., 2010). In order to develop preventative strategies and effective interventions, it is crucial that factors contributing to post-stroke depression are identified. Importantly, post-stroke cognitive impairments have been shown to predict poorer mental health outcomes (Nys et al., 2006; Turunen et al., 2018; Williams and Demeyere, 2021). Chronic cognitive impairments affect between 20-85% of stroke survivors (Demeyere et al., 2016; Sexton et al., 2019) and encompass a wide range of domains, including executive functioning, memory, language, and visuospatial abilities (Jokinen et al., 2015). Most stroke survivors present with multi-domain impairments (Milosevich et al., 2024) which have additive effects on the risk of depression (Williams and Demeyere, 2021). However, the mechanisms by which cognitive impairments may lead to depression are not well understood.

Social isolation in chronic illness

The middle-range theory of social isolation in chronic illness (Iovino et al., 2023) posits that social isolation is a driving factor in the development of depression in persistent physical health conditions. It suggests that precipitating and predisposing factors, such as the frequency and severity of symptoms, increase the risk of social isolation which in turn affects health outcomes including depression. Social isolation is a complex construct, which consists of two interacting elements: social disconnectedness and loneliness. Social disconnectedness is defined as an *objective* measure of social isolation, which reflects a lack

of contact with other individuals (Cornwell and Waite, 2009a). In contrast, loneliness refers to the *subjective* experience of social isolation, resulting from a perception of a discrepancy between the relationships one expects and the actual relationships one has (Peplau and Perlman, 1982). Whilst they can co-occur, it has been demonstrated that social disconnectedness and loneliness are distinct concepts which are independently associated with different health outcomes (Cornwell and Waite, 2009b). The physical presence of others is not in itself sufficient to prevent feelings of loneliness (Cacioppo et al., 2015), and conversely it is possible to be socially disconnected without feeling lonely (Hawkley and Cacioppo, 2010). Congruently, the correlation between loneliness and disconnectedness has been found to be weak to moderate (Cornwell and Waite, 2009b; Golden et al., 2009). It has therefore been proposed that there are four categories of social isolation: neither disconnected nor lonely, disconnected but not lonely, lonely but not disconnected, and both disconnected and lonely (Andersson, 1986; Iovino et al., 2023; see Figure 1A). Evidence for the existence of these subgroups has been provided by Smith and Victor (2019) using latent class analysis. Both social disconnectedness and loneliness are associated with depression in healthy adults, although the underlying mechanisms may differ (Cornwell and Waite, 2009b) and loneliness typically has a stronger effect (Ge et al., 2017). Research on social isolation should therefore assess both social disconnectedness and loneliness to ascertain whether they exert independent and/or additive effects on mental health (Taylor et al., 2018).

The impact of social isolation on post-stroke depression

Iovino and colleagues (2023) emphasise that their theory remains to be tested empirically for specific illnesses. Applying their hypotheses to chronic symptoms of stroke, we predict that greater severity of cognitive impairments may increase social isolation, which consequently heightens the risk of depressive symptoms. There is emerging evidence that social isolation presents a risk factor for depression in stroke survivors (Goh et al., 2019;

Petitte et al., 2015). However, the contribution of cognitive impairments to this relationship remains to be explored. Qualitative studies suggest that there are different pathways by which cognitive impairments may lead to social isolation. First, cognitive impairments may produce practical barriers to social participation. For example, stroke survivors with cognitive impairments indicated that dependence on others restricts their engagement in social and leisure activities (Norlander et al., 2022). Moreover, difficulties with attention and memory interfered with stroke survivors' ability to participate meaningfully in social interactions, leading to a reduced number of social relationships (Bennett et al., 2024). Accordingly, Iovino and colleagues (2023) suggest a serial mediation process by which this social disconnectedness causes feelings of loneliness, which then result in depressive symptoms (see Figure 1B). A second pathway involves a direct effect of loneliness through changes in stroke survivors' perceptions of themselves and the quality of their relationships. Individuals with acquired brain injuries who have cognitive impairments report feeling psychologically distant from and misunderstood by others, and alone in their experience of brain injury (Dunne et al., 2023; Salter et al., 2008; Yang et al., 2022). In addition, they describe attempting or feeling pressure to conceal perceived deficits (Crowe et al., 2016; Lowe et al., 2021) which further reduces the quality of social relationships. Thus, there may be a simple mediation process in which cognitive impairments directly heighten experiences of loneliness and thereby depressive symptoms (Iovino et al., 2023; see Figure 1C) even when the individual objectively has a large social network or participates in social activities.

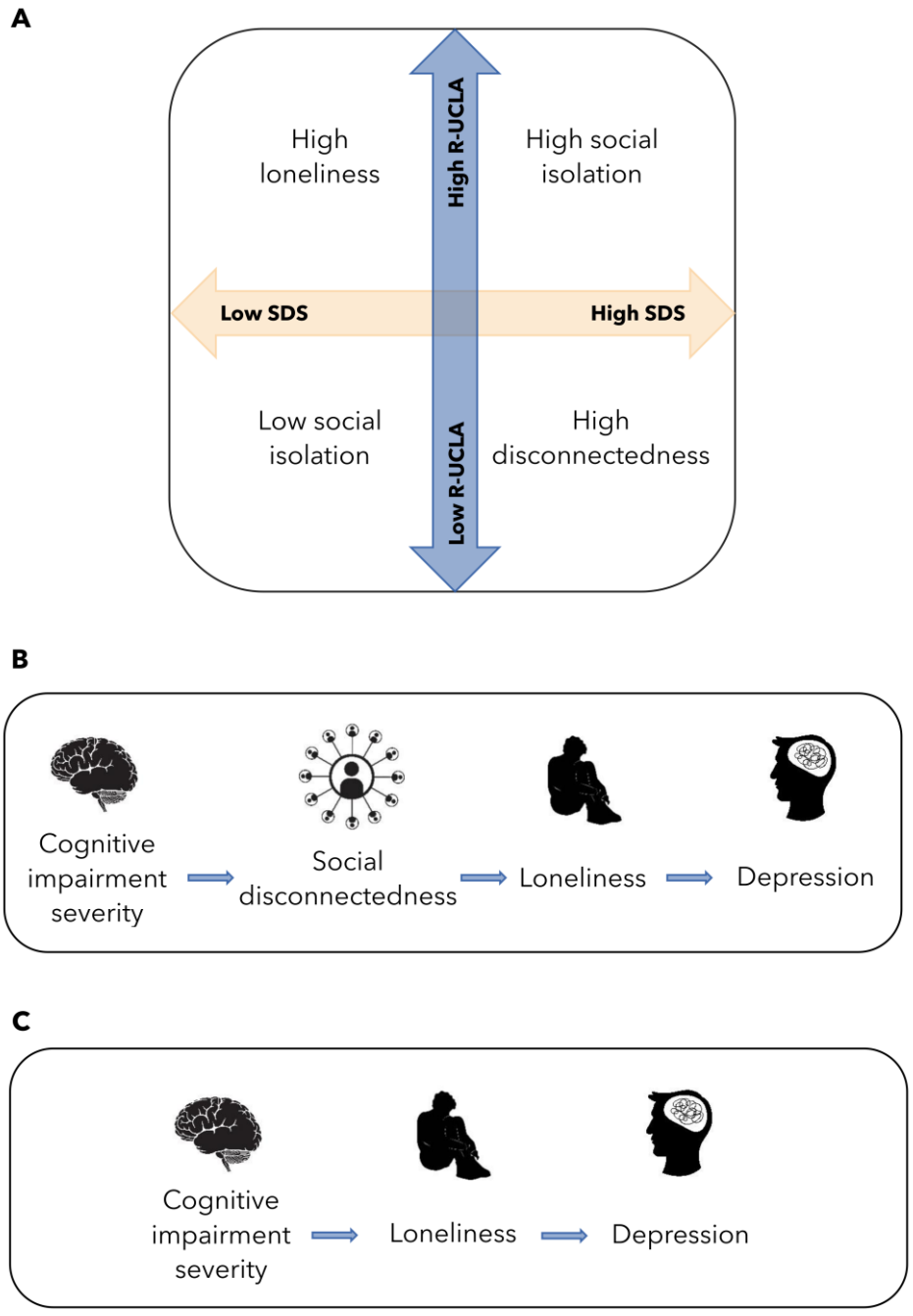
Study aims and hypotheses

From a clinical perspective, a better understanding of the effects of social isolation on depression in stroke survivors with chronic cognitive impairments could help identify new and more timely targets and strategies for interventions. This study therefore seeks to clarify the relationship between chronic post-stroke cognitive impairments, social isolation, and

depression. We hypothesise that (1) results will replicate and extend previous findings that the severity of cognitive impairments predicts symptoms of depression (Williams and Demeyere, 2021) in the chronic phase post-stroke, (2) social isolation will be associated with higher depression scores, with a stronger effect of loneliness compared with social disconnectedness as previously suggested (Ge et al., 2017), and (3) the relationship between cognitive impairments and depression will be mediated by social isolation.

Figure 1

Schematic Representations of the Theory of Social Isolation in Chronic Illness



Note. **(A)** Patterns of social isolation based on social disconnectedness (Social Disconnectedness Scale; SDS) and loneliness (Revised UCLA Loneliness Scale; R-UCLA) scores. **(B)** Serial mediation with cognitive impairment severity causing reduced social connectedness, which results in feelings of loneliness that lead to depression. **(C)** Simple mediation with cognitive impairments causing loneliness (independent of objective social connectedness) which increases the risk of depression.

Patient and public involvement (PPI)

Three stroke survivors were consulted regarding the main research question, participant information sheets, and measures of social isolation to ensure project relevance and accessibility. These experts by experience indicated that the main research questions were relevant for this population based on their personal experiences and contact with other stroke survivors. They emphasised the importance of clarifying the inclusion criteria, for example that individuals did not have to feel depressed or socially isolated to be eligible. In addition, they suggested providing different options for completing questionnaires on sensitive topics where possible (e.g. reading out the questions, filling out questionnaires independently, or asking a relative/carer to assist). Procedures were adjusted to incorporate the recommendations.

Recruitment and participants

Eighty-five participants were recruited from the Oxford Screening Programme (Milosevich et al., 2024). Stroke survivors were included if they were (1) 18 years or older, (2) admitted with a suspected or confirmed stroke ≥6 months previously, (3) able and willing to provide informed consent, (4) able to sufficiently understand English to complete the study questionnaires, and (5) able to concentrate for approximately 30 minutes consecutively.

Study procedure

Ethical approval for the study was obtained from the Central University Research Ethics Committee (CUREC; Ethics Ref: 94589/RE002; see Appendix P). Stroke survivors were contacted by phone or email, provided with information sheets, and given the opportunity to ask questions before deciding whether to take part. All participants provided informed consent in accordance with the 1964 Helsinki declaration and its later amendments. In-person sessions were arranged in which participants completed a cognitive screening tool along with questionnaires assessing social isolation and depression. Participants were

offered regular breaks throughout the session to minimise effects of fatigue. At the end of the session, participants were offered signposting information to mental health support services.

Demographics and stroke characteristics

Demographic details and stroke characteristics were obtained from participants' records in the Oxford Screening Programme. Information collected included participant age, sex, education (years), type of stroke, lesion hemisphere, time since stroke, acute stroke severity as measured with the National Institutes of Health Stroke Scale (NIHSS), and acute level of functional impairment as indicated by the Barthel Index (BI; Mahoney & Barthel, 1965).

Cognitive assessment

The Oxford Cognitive Screen (OCS; Demeyere et al., 2015) is a screening tool which was designed to evaluate common cognitive impairments associated with stroke. The OCS assesses six cognitive domains: visuospatial attention, executive function, language, memory, number processing, and praxis. It takes approximately 15-20 minutes to administer and has good content validity, specificity, and sensitivity for impairments across cognitive domains in stroke survivors (Demeyere et al., 2015). Subtest outcomes were binarized as impaired or unimpaired according to cut-off scores based on normative data. Domains were considered impaired if there was at least one subtest score outside the cut-off range.

Social isolation measures

Social disconnectedness was measured with the 8-item Social Disconnectedness Scale (SDS; Cornwell & Waite, 2009a) which evaluates social network size and range, frequency of interaction with members of the personal network, household size, number of friends, frequency of socialising with friends, family, and groups, and volunteering activities. The SDS has satisfactory internal consistency (Cronbach's $\alpha = 0.73$) and construct validity

(Cornwell and Waite, 2009a). SDS outcomes were converted into z-scores across the sample, with higher scores representing greater social disconnectedness. Loneliness was assessed with the 11-item Revised University of California, Los Angeles Loneliness Scale (R-UCLA; Lee and Cagle, 2017). The R-UCLA uses a three-point Likert scale, with higher scores suggesting greater levels of subjective loneliness. The 11-item R-UCLA has good internal consistency (Cronbach's $\alpha = 0.87$) and content validity (Lee & Cagle, 2017).

Mental health outcomes

The depression and anxiety subscales from the Hospital Anxiety and Depression Scale (HADS-D and HADS-A, respectively; Zigmond & Snaith, 1983) were used to assess mental health outcomes. The HADS is a 14-item questionnaire with scores ranging from 0 to 21 for each subscale. Higher scores represent greater symptomatology, with scores ≥8 indicating symptoms in the clinical range. This measure has good psychometric properties with sensitivity and specificity at the level of 0.80 (Bjelland et al., 2002) and is suitable for assessing symptoms of mood disorders specifically in stroke survivors (Aben et al., 2002; Ayis et al., 2018).

Sample size

A power analysis was carried out using the 'mc_power_med' package in R software (version 4.1.2). The required sample size was calculated for a mediation model with two serial mediators using standardised coefficients derived from the existing literature (Cacioppo et al., 2006; Franco-O'Byrne et al., 2023; Glymour et al., 2008; Taylor et al., 2018; Williams & Demeyere, 2021) with 10,000 replications and 20,000 Monte Carlo draws per replication. Results indicated that a minimum sample of 78 participants was needed to achieve 80% power to detect the main effects of interest, namely simple and serial mediation for the relationship between cognitive impairment severity, social isolation, and depression.

Statistical analyses

All statistical analyses were completed in R (version 4.1.2). Descriptive statistics were used to summarise sample demographics and clinical characteristics. Pairwise Pearson correlations were performed between HADS scores and age, education (years), time since stroke (years), and NIHSS scores, with a two-tailed independent *t*-test run to determine potential sex differences in depression scores. Imputation of missing NIHSS data was carried out using predictive mean matching (PMM) procedures with the 'mice' package. A data-driven approach was used to select covariates for analyses in order to increase predictive accuracy whilst minimising the risk of overfitting analysis models. Specifically, variables which were significantly (alpha <.05) correlated with the main outcome of interest (HADS depression scores) were included as covariates in all analyses.

Multiple linear regressions were used to assess whether previous findings of a significant relationship between cognitive impairments and depression at 6 months post-stroke (Williams and Demeyere, 2021) were replicated in this sample of chronic stroke survivors. To account for non-normal distributions of residuals, robust multivariate regression models were created using the '*lmrob*' function from the 'robustbase' package. Number of impaired cognitive domains was specified as the predictor and HADS-D score as the outcome variable. Secondary analyses explored the relationship between impairments on individual cognitive domains with depression scores. False discovery rate (FDR) corrections were applied to these analyses using the Benjamini-Hochberg procedure to reduce Type-I error inflation associated with performing multiple tests (Glickman et al., 2014).

Next, the association between social isolation and depression was examined. As discussed above, social isolation and loneliness are hypothesised to be related but distinct constructs. Exploratory analyses therefore evaluated the impact of specific patterns of social

isolation on post-stroke depression (see Figure 1A). Participants were categorised into four groups based on median splits of SDS and R-UCLA data to represent the subgroups proposed by Andersson (1986) and enhance clinical interpretability: (1) high social isolation (high SDS and R-UCLA scores), (2) high loneliness (high R-UCLA and low SDS scores), (3) high disconnectedness (high SDS and low R-UCLA scores), and low social isolation (low SDS and R-UCLA scores). The relationship between social isolation patterns and depression scores was examined with multiple linear regression analyses. Sensitivity analyses using continuous SDS and R-UCLA outcomes are reported in the Appendix Q.

The main analyses investigated potential mediation effects of social disconnectedness and loneliness in the relationship between post-stroke cognitive impairments and depression. Serial mediation models were generated using the 'lavaan' package, with number of impaired cognitive domains as the predictor, SDS and R-UCLA scores as causally ordered mediators, and HADS-D score as the outcome variable. All mediation models were fitted using non-parametric bootstrap resampling with 10,000 iterations.

Finally, exploratory multiple regression and mediation models were run to assess the impact of cognitive impairment severity and social isolation on anxiety symptoms as measured with the HADS-A. As depression was the main outcome of interest and depression and anxiety scores were highly correlated, results for HADS-A scores are reported in Appendix Q.

Results

Eighty-five participants completed the cognitive assessment and questionnaires. Descriptive statistics for demographic variables, clinical characteristics, and outcome measures are provided in Table 1. All participants were assessed in the chronic stroke phase, with assessments completed an average of 4.5 (*SD* ± 2.8) years post-stroke. Forty-eight (56.4%)

participants presented with one or more impaired cognitive domains upon assessment. Cognitive impairments assessed using the OCS were prevalent across domains except for executive dysfunction, which was observed in only four (4.8%) participants. A total of 27 (31.8%) participants scored in the clinical range on the HADS-D and 23 (27.1%) participants had scores in the clinical range on the HADS-A. Co-morbidity of depression and anxiety was high, with 15 (17.6%) participants presenting with clinical symptoms on both scales ($r(83) = 0.54$, $p < 0.001$). Significant correlations were observed for time since stroke ($r(83) = -0.14$, $p < 0.05$) and years of education ($r(83) = -0.227$, $p < 0.05$) with depression (see Appendix Q), which were therefore included as covariates in the analyses. Adding stroke severity as measured by the NIHSS as a covariate did not alter the results (see Appendix Q). HADS-D scores did not differ between male and female participants ($t(83) = 1.26$, $p = 0.210$).

Cognitive impairment and post-stroke depression

A multiple linear regression adjusted for covariates was conducted to determine effects of cognitive impairment severity on depression scores. A greater number of impaired cognitive domains predicted higher depression scores in chronic stroke ($\beta = 1.11$, $t = 3.63$, $p < 0.001$; see Figure 2A). Additional analyses by domain demonstrated that specific impairments in visuospatial attention ($\beta = 2.58$, $t = 3.81$, FDR-corrected $p < 0.05$) and language ($\beta = 4.83$, $t = 4.57$, FDR-corrected $p < 0.001$) were associated with greater depressive symptomatology (see Figures 2B-2G). No significant associations with depression were observed for any of the remaining cognitive domains following adjustment for covariates (all FDR-corrected $p > 0.05$, see Appendix Q).

Table 1

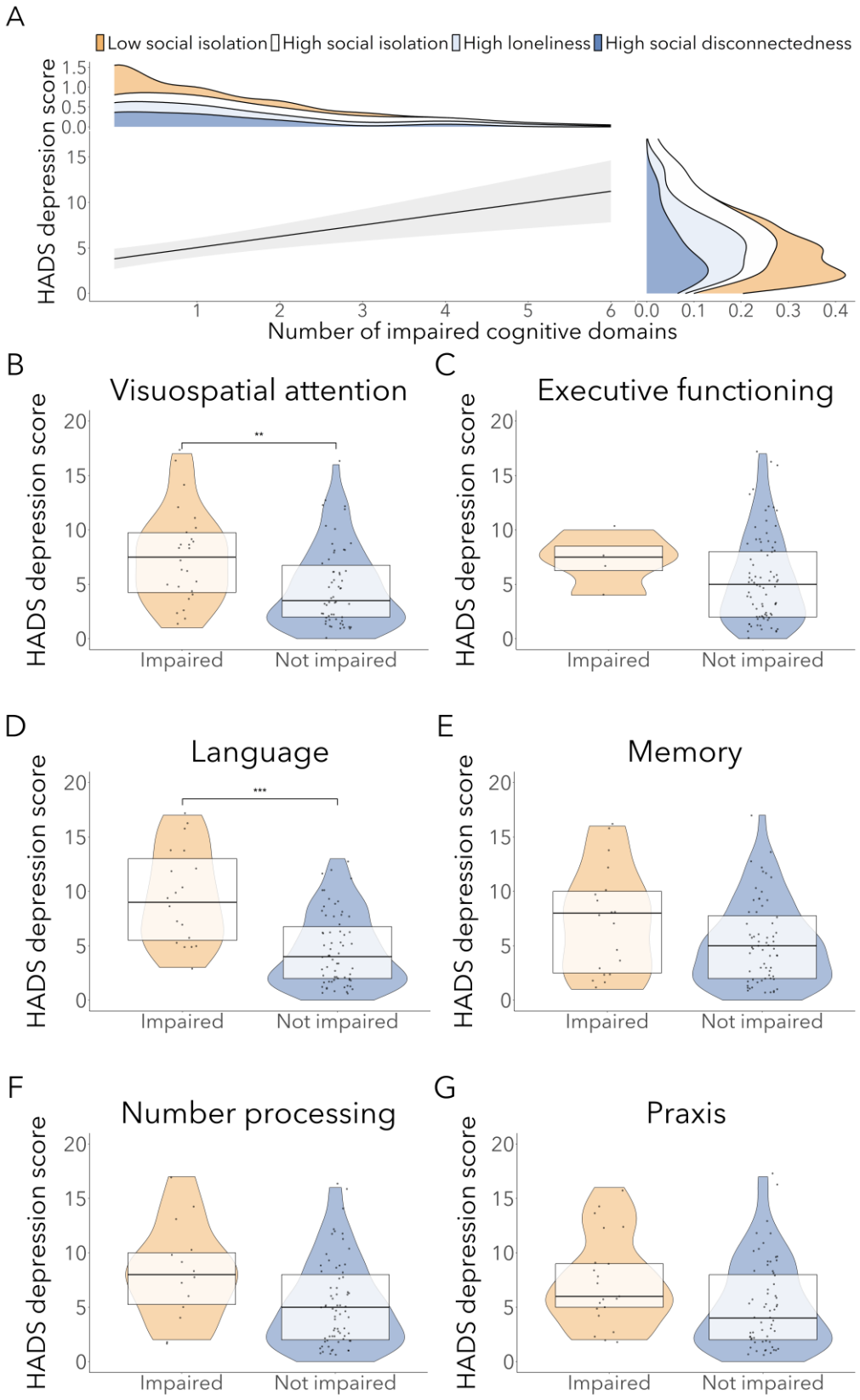
Participant Characteristics and Outcome Scores (N = 85)

		Median (IQR)	Range
Age - mean (*SD*)	72.8 (12.6)	75.6 (17.0)	32.6 – 98.0
Sex – *n female* (%)	31 (36.4%)		
Years of education – mean (*SD*)	13.6 (3.8)	12.0 (5.0)	9 – 23
Ethnicity - *n* (%)			
White British	80 (94.1%)		
Irish	1 (1.2%)		
White other	2 (2.4%)		
Black other	1 (1.2%)		
Indian	1 (1.2%)		
Stroke hemisphere – *n* (%)			
Left	38 (44.7%)		
Right	32 (37.7%)		
Bilateral	8 (9.4%)		
Unknown	7 (8.2%)		
Stroke subtype – *n* (%)			
Ischaemic	64 (75.3%)		
Haemorrhagic	18 (21.2%)		
Unknown	3 (3.5%)		
First or recurrent stroke – *n* (%)			
First	59 (69.4%)		
Recurrent	23 (27.1%)		
Unknown	3 (3.5%)		
Years post-stroke – mean (*SD*)	4.5 (2.8)	3.6 (3.8)	0.8 – 13.3
Acute NIHSS score[a] – mean (*SD*)	7.4 (5.2)	6.0 (8.0)	0 – 21
Acute BI score[b] – mean (*SD*)	10.63 (5.65)	9.00 (8.0)	0.0 – 20.0
OCS total – *n* (%)			
0 domains impaired	37 (43.5%)		
1 domain impaired	20 (23.5%)		
≥2 domains impaired	28 (32.9%)		
OCS subdomain impaired – *n* (%)			
Visuospatial attention	26 (30.1%)		
Executive functioning	4 (4.8%)		
Language	19 (22.4%)		
Memory	19 (22.4%)		
Number processing	14 (16.5%)		
Praxis	21 (24.7%)		
Social isolation scores – mean (*SD*)			
SDS	0.0 (0.4)	0.0 (0.6)	-1.1 – 1.4
R-UCLA	17.4 (5.3)	16.0 (6.0)	11.0 – 22.0
HADS total scores – mean (*SD*)			
Depression subscale	5.7 (4.2)	5.0 (6.0)	0.0 – 17.0
Anxiety subscale	5.5 (3.5)	5.0 (5.0)	0.0 – 15.0
HADS-D range – *n* (%)			
Normal	58 (68.2%)		
Clinical	27 (31.8%)		
HADS-A range – *n* (%)			
Normal	62 (72.9%)		
Clinical	23 (27.1%)		

[a] *n* assessed = 74; [b] *n* assessed = 49. Abbreviations: IQR = Interquartile range; *SD* = standard deviation; NIHSS = National Institutes of Health Stroke Scale; BI = Barthel Index; OCS = Oxford Cognitive Screen, SDS = Social Disconnectedness Scale; R-UCLA = Revised University of California, Los Angeles Loneliness Scale; HADS-D = HADS depression subscale; HADS-A = HADS anxiety subscale

Figure 2

Associations Between Cognitive Impairments and Depression



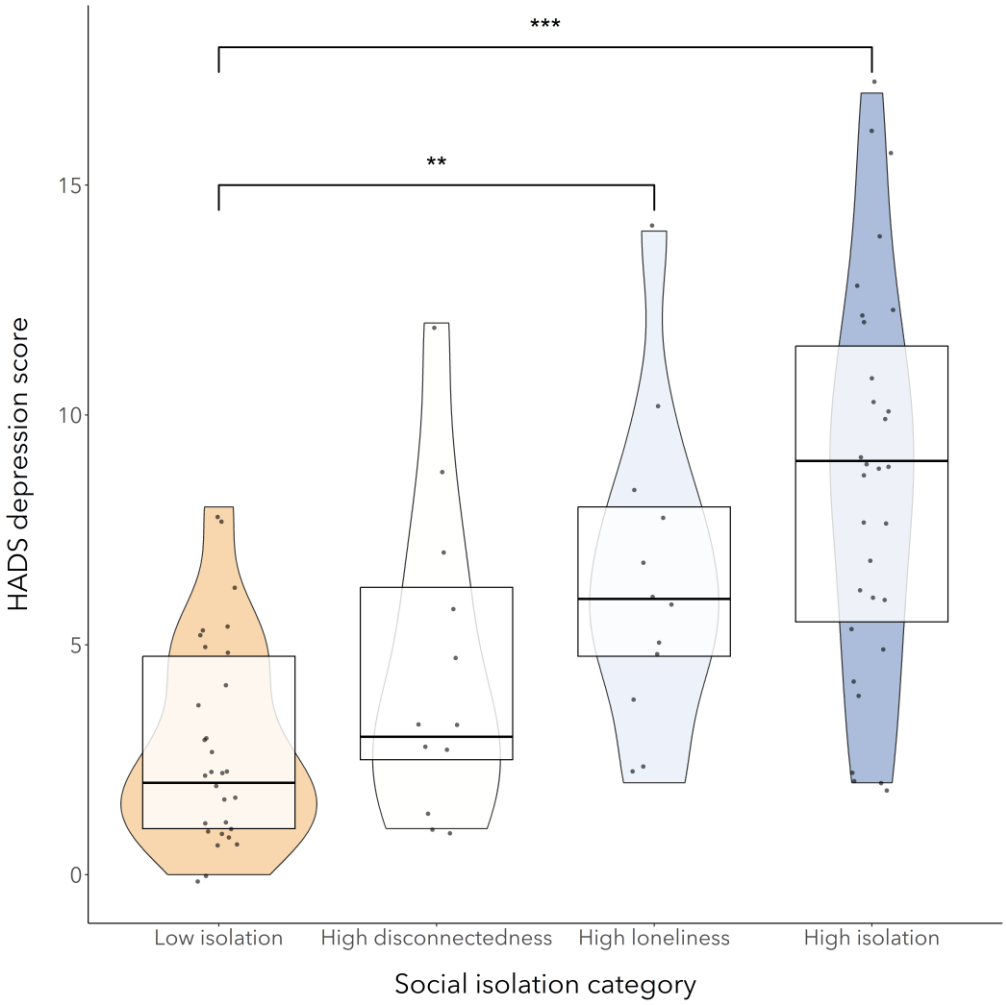
Note. **(A)** A greater number of impaired cognitive domains on the OCS predicts higher depression scores. The solid line represents the multiple linear regression formula, with the shaded area indicating standard errors. Density plots indicate the distribution of HADS-D scores and number of cognitively impaired domains across social isolation categories. **(B-G)** Violin plots demonstrating the distributions of depression scores by impairment across cognitive domains. Impairments in the visuospatial attention and language domains predicted higher depression scores (**p* <0.05, ***p* <0.01, ****p* <0.001 for FDR-corrected *p*-values).

Impact of social isolation on post-stroke depression

The impact of social isolation on post-stroke depression scores was assessed across social isolation categories (see Figure 3 and Appendix Q). Multiple linear regressions adjusted for covariates showed that participants with high overall social isolation ($\beta = 5.17$, $t = 5.68$, $p < 0.001$) or loneliness ($\beta = 3.02$, $t = 5.68$, $p < 0.01$) scores were more depressed than participants with low social isolation scores. In contrast, participants who were more socially disconnected (but had low loneliness scores) did not differ significantly from individuals who had low overall social isolation scores ($\beta = 1.35$, $t = 1.35$, $p = 0.18$). This suggests that the presence of subjective feelings of loneliness is critical in the relationship between social isolation and post-stroke depression.

Figure 3

Depression Scores by Social Isolation Category



Note. Violin plots showing the distributions of depression scores by social isolation category (*p <0.05, **p <0.01, ***p <0.001). Small dots represent raw data points, with box plots indicating median scores alongside the first and third quartiles of HADS-D scores.

Loneliness mediates effects of cognitive impairment on depression

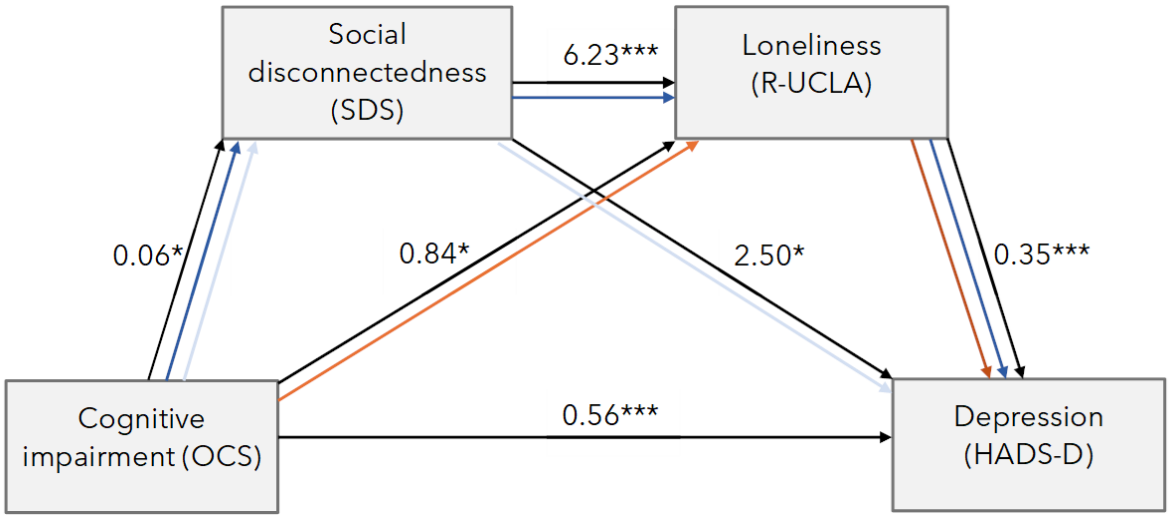
The relationship between cognitive impairments, social isolation, and depression was evaluated with serial mediation models. All pathways showed significant direct effects (see Figure 4), such that greater cognitive impairment severity predicted higher social disconnectedness, loneliness, and depression scores. In addition, social disconnectedness and loneliness had significant direct effects on depression outcomes.

Participants with a greater number of impaired cognitive domains reported stronger

feelings of loneliness, which predicted higher depression scores (see Table 2). This indirect effect was maintained following adjustment for significant covariates. In non-adjusted models a serial mediation effect was observed, with the effects of cognitive impairment on depression being sequentially mediated by social disconnectedness and loneliness. However, this effect was not significant after adjusting for years of education and time since stroke. Consistent with the analyses of social isolation categories reported above, there was no evidence that social disconnectedness independently mediated the relationship between cognitive impairment severity and depression.

Figure 4

Graphical Representation of the Serial Mediation Analysis



Note. Analysis was adjusted for covariates, with coefficients for direct effects (*p <0.05, **p <0.01, ***p <0.001) indicated by black arrows. Loneliness was a significant mediator in the relationship between cognitive impairment and depression (p <0.05; orange arrows). A serial mediation pathway via social disconnectedness and loneliness was not significant following adjustment for covariates (p = .0.08; dark blue arrows). Finally, there was no evidence that social disconnectedness mediated associations between cognitive impairment and depression (p = 0.125; light blue arrows).

Table 2

Indirect Effects of the Serial Mediation Model of the Relationship Between Cognitive Impairment, Social Isolation, and Depression After Stroke

	Model 1[a]				Model 2[b]			
	Estimate (*SE*)	**z-score**	***p*-value**	***CI***	**Estimate (*SE*)**	**z-score**	***p*-value**	***CI***
Indirect effect 1: Cog → Disc → Dep	0.182 (0.109)	1.665	0.096	0.040 – 0.481	0.155 (0.101)	1.535	0.125	0.022 – 0.427
Indirect effect 2: Cog → Lon → Dep	0.361 (0.152)	2.374	<0.05	0.123 – 0.743	0.294 (0.144)	2.044	<0.05	0.071 – 0.656
Indirect effect 3: Cog → Disc → Lon → Dep	0.197 (0.090)	2.197	<0.05	0.076 – 0.452	0.135 (0.077)	1.757	0.079	0.030 – 0.362
Total effect	1.331 (0.294)	4.533	<0.001	0.811 – 1.960	1.140 (0.292)	3.909	<0.001	0.625 – 1.762

[a] Unadjusted model; [b] Adjusted for education and time since stroke

Abbreviations: Cog = number of impaired cognitive domains on the OCS; Disc = social disconnectedness (SDS) score; Dep = depression (HADS-D) score; Lon = loneliness (R-UCLA) score; *SE* = standard error; *CI* = confidence interval

Discussion

This study explored the role of chronic cognitive impairments and social isolation in post-stroke depression. More severe cognitive difficulties predicted higher depression scores in stroke survivors. Consistent with the theory of social isolation in chronic illness (Iovino et al., 2023), this relationship was mediated by feelings of loneliness. However, there was no evidence that social disconnectedness significantly altered the association between cognitive impairments and depression. Taken together, these findings suggest that loneliness presents a possible mechanism by which cognitive impairments increase the risk of post-stroke depression.

Cognitive impairment severity predicts depression in chronic stroke

Stroke survivors with more severe, multi-domain cognitive impairments have been reported to be at higher risk of depression at 6 months post-stroke (Williams and Demeyere, 2021). The present study, in which assessments were completed an average of 4.5 years post-stroke, shows that this relationship is maintained throughout the chronic stroke phase. Cognitive impairment severity is therefore a consistent predictor of mental health after stroke.

Analyses by cognitive domain suggested that language and visuospatial attention impairments most strongly influenced post-stroke depression. This corresponds with longitudinal research by Nys and colleagues (2006), which showed that acute visuospatial and language difficulties increased risk of depression at 6 months post-stroke. In contrast, previous studies using the OCS found that language, memory, number processing, visuospatial attention, and praxis impairments predicted depression symptoms (Kelleher et al., 2025; Williams and Demeyere, 2021). These divergent results may be due to the larger sample sizes and consequently greater power of previous studies to detect smaller effects. It should be noted that sample size for the present study was calculated based on overall cognitive impairment severity, and analyses for individual domains were therefore

exploratory by nature. It is possible that a larger-scale study would have revealed effects of additional cognitive domains on depression.

Evidence for the impact of executive dysfunction as measured by the OCS has been mixed. Whilst significant effects on depression were reported by Williams and Demeyere (2021), this finding was not replicated by Kelleher and colleagues (2025).The low number of participants presenting with executive dysfunction in the current study limited our ability to test associations between this domain and depressive symptoms. Additional research is needed to clarify potential associations between executive function and depression after stroke.

Differential effects of social disconnectedness and loneliness

As well as cognitive impairment severity, social isolation was a significant predictor of higher depression scores after stroke. When investigating specific patterns of social isolation, participants with stronger feelings of loneliness presented with more depressive symptoms. Importantly, whilst concurrent social disconnectedness numerically increased predicted depression scores, this additive effect was not significant. Moreover, stroke survivors who were objectively socially disconnected but had low subjective loneliness scores did not differ in mood ratings from participants who were not socially isolated. Consistent with research in healthy populations (Lee et al., 2021), this suggests that the experience of loneliness is an important predictor of post-stroke depression independent of individuals' social network and/or extent of social participation.

Crucially, mediation analyses showed that loneliness mediates the previously observed relationship between cognitive impairment severity and depression. A greater number of impaired cognitive domains was associated with higher loneliness scores, which in turn predicted increased depressive symptoms. In contrast, serial mediation effects in which social disconnectedness preceded loneliness were not significant after adjusting for

demographic and clinical covariates. Altogether, these findings suggest that the impact of cognitive impairments on stroke survivors' perception of and/or satisfaction with their relationships, rather than social connectedness, contributes to poorer mental health outcomes. There was thus evidence for the simple, but not the serial mediation pathway proposed by Iovino et al.'s (2023) theory of social isolation in chronic illness in this population.

Clinical implications

These findings have clear implications for the treatment of post-stroke depression. First, they demonstrate that effects of cognitive impairments on depression do not dissipate over time. It is therefore crucial that effective strategies are developed to support the mental health of stroke survivors with cognitive difficulties. Whilst cognitive rehabilitation may improve neuropsychological functioning to some extent (Gillespie et al., 2015), pervasive cognitive impairments are common even in stroke survivors who have made a successful clinical recovery (Jokinen et al., 2015; Planton et al., 2012). For individuals with chronic cognitive impairments, social isolation may present a modifiable factor which could improve mental health outcomes. When designing suitable interventions for this population, it is important to consider that loneliness but not disconnectedness significantly mediated the relationship between cognition and depression. This suggests that strategies aiming to increase stroke survivors' social networks and participation may not be sufficient to ameliorate depressive symptoms, and interventions may be more effective when targeting feelings of loneliness and the cognitions associated with these.

In clinical practice, this could be implemented by using measures to assess for the presence of feelings of loneliness and testing effects of targeted interventions for loneliness. A meta-analysis of loneliness interventions indicated that approaches based on cognitive behavioural therapy (CBT) models are most effective in reducing the experience of

loneliness (Masi et al., 2011). According to the social cognition model of loneliness, subjective perceptions of being socially isolated lead to negative cognitive biases towards social threats as well as behaviours which confirm maladaptive thoughts and beliefs (Cacioppo et al., 2015). Qualitative research suggests that, in adults with cognitive impairments following an acquired brain injury, common cognitions and behaviours may include a reluctance to share distressing thoughts and feelings with others (Crowe et al., 2016; Yang et al., 2022), a perceived lack of understanding of their experience by other people (Lowe et al., 2021; Salter et al., 2008), a heightened awareness of differences between oneself and other people (Yang et al., 2022), and attempts to conceal cognitive impairments (Lowe et al., 2021). CBT approaches aim to address maladaptive cognitions and behaviours which inadvertently maintain feelings of loneliness. To date, the application of CBT for loneliness has predominantly been assessed in cognitively unimpaired older adults (Cohen-Mansfield and Parpura-Gill, 2007; Dworschak et al., 2024; Theeke et al., 2016) and young people (Käll et al., 2020). Further research is needed to determine the effectiveness of and potential adaptations (e.g. Ponsford et al., 2020) to this intervention for loneliness and associated symptoms of depression in stroke survivors with cognitive impairments.

Strengths and limitations

The participant sample recruited in this study presented with similar rates of depression and cognitive impairments reported in previous studies (Ayerbe et al., 2013; Demeyere et al., 2016; Sexton et al., 2019), indicating that clinical characteristics were representative of this population. However, there was a lack of ethnic diversity and acute stroke severity was predominantly in the minor to moderate range. Moreover, a substantial proportion of participants had multiple strokes, which has been associated with an increased risk of depression (Medeiros et al., 2020) and may influence relevant psychological processes such as coping responses and illness beliefs (Lin et al., 2021).

Additional work is needed to explore the generalisability of our findings across demographic characteristics and individuals with different stroke characteristics, including those who have experienced severe or multiple strokes.

Whilst grounded in a clear theoretical framework, it was not possible to determine causality of the associations observed in the present study. Previously, it has been shown that cognition, loneliness, and depression have reciprocal influences (Cacioppo et al., 2006; Liang et al., 2023; Sbarra et al., 2023), complicating investigations of the relationship between these three constructs. However, longitudinal studies have consistently demonstrated that baseline cognitive impairments can precede both depression (Nys et al., 2006) and social isolation (Duan et al., 2023), as well as loneliness scores predicting the onset of depression (Kraav et al., 2021; Mann et al., 2022; Martín-María et al., 2021; Van Winkel et al., 2017). Moreover, analyses using cross-lagged analytical models indicated that loneliness predicted changes in depressive symptoms, whereas the reverse relationship was not significant (Cacioppo et al., 2010). The current evidence base therefore suggests that loneliness is a causal factor in the development of depression. In the present study, a stroke-specific screening tool was used to assess common cognitive sequelae associated with stroke, such as hemispatial neglect, apraxia, and aphasia, in addition to more general impairments in memory and executive functioning. Whilst depression has been linked with changes in a range of domains, including memory, attention, and executive functioning (Rock et al., 2014), it is unlikely that low mood caused more stroke-specific impairments as measured with the OCS. Going forward, longitudinal studies and clinical trials will be instrumental for establishing the directional effects of domain-general cognitive impairments and loneliness on post-stroke depressive symptoms.

In addition, there are several limitations to the measures used in this study that should be considered when interpreting the findings. First, consistent with the present definition of

social isolation, the selected instruments assessed both objective disconnectedness and subjective feelings of loneliness. However, they do not explicitly capture the *quality* of specific relationships, which may have a stronger impact on depressive symptoms compared with the quantity of social interactions (Elmer et al., 2025). Second, although the HADS has been validated as a suitable measure for assessing depressive symptoms in stroke survivors, it has been noted that some items (e.g. 'I feel I am slowed down') may reflect physical rather than emotional consequences (Karlsson et al., 2024). Third, the measures did not assess for comorbid difficulties in stroke such as fatigue, which can occur alongside and may interact with cognitive impairments and depressive symptoms (Delbridge et al., 2024; Galligan et al., 2016; Lagogianni et al., 2018) as well as being associated with reduced social support and activities (Ablewhite et al., 2022; Michael et al., 2006). It was therefore not possible to assess the relative impact of cognitive difficulties and fatigue, and it would be useful to explore this in future studies.

Finally, due to a high proportion of missing data on the Barthel Index it was not possible to impute missing values for this measure and determine the potential impact of functional abilities on social isolation or depression. However, as BI scores are strongly associated with NIHSS scores (Kwakkel et al., 2010), it was attempted to account for possible confounding effects of functional impairments by including stroke severity as a covariate. The addition of NIHSS scores did not alter the main results, suggesting that the effects of cognitive impairments and loneliness on depression were independent of stroke severity. This is consistent with previous findings that the inclusion of NIHSS and Barthel Index scores did not affect the observed relationship between post-stroke cognition and depression (Williams and Demeyere, 2021). Given the high prevalence of physical disability after stroke, however, it would be of interest to explore potentially independent contributions of physical dysfunction to social isolation and depression in future studies.

Conclusions

This study showed that the extent of stroke survivors' cognitive impairments consistently predicts symptoms of depression. Feelings of loneliness mediated this relationship and may therefore present a modifiable target for interventions aiming to improve depression in this population. Priorities for further research include establishing causality of these relationships and examining the potential for interventions targeting loneliness in depressed stroke survivors with cognitive impairments.

References

Aben, I., Verhey, F., Lousberg, R., Lodder, J., Honig, A., 2002. Validity of the Beck Depression Inventory, Hospital Anxiety and Depression Scale, SCL-90, and Hamilton Depression Rating Scale as screening instruments for depression in stroke patients. Psychosomatics 43, 386–393.

Ablewhite, J., Nouri, F., Whisker, A., Thomas, S., Jones, F., das Nair, R., Condon, L., Jones, A., Sprigg, N., Drummond, A., 2022. How do stroke survivors and their caregivers manage post-stroke fatigue? A qualitative study. Clin. Rehabil. 36, 1400–1410. https://doi.org/10.1177/02692155221107738

Andersson, L., 1986. A model of estrangement - including a theoretical understanding of loneliness. Psychol. Rep. 58, 683–695.

Ayerbe, L., Ayis, S., Wolfe, C.D.A., Rudd, A.G., 2013. Natural history, predictors and outcomes of depression after stroke: Systematic review and meta-analysis. British Journal of Psychiatry 202, 14–21. https://doi.org/10.1192/bjp.bp.111.107664

Ayis, S.A., Ayerbe, L., Ashworth, M., DA Wolfe, C., 2018. Evaluation of the Hospital Anxiety and Depression Scale (HADS) in screening stroke patients for symptoms: Item Response Theory (IRT) analysis. J. Affect. Disord. 228, 33–40. https://doi.org/10.1016/j.jad.2017.11.037

Bennett, K.J., Leese, J., Davis, J.C., Eng, J.J., Liu-Ambrose, T., 2024. Exploring the experience of cognitive changes among community-dwelling stroke survivors: a qualitative study. Disabil. Rehabil. 9, 1870–1877. https://doi.org/10.1080/09638288.2023.2210309

Bjelland, I., Dahl, A.A., Haug, T., Neckelmann, D., 2002. The validity of the Hospital Anxiety and Depression Scale: An updated literature review. J. Psychosom. Res. 52, 69–77.

Cacioppo, J.T., Hawkley, L.C., Thisted, R.A., 2010. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the chicago health, aging, and social relations study. Psychol. Aging 25, 453–463. https://doi.org/10.1037/a0017216

Cacioppo, J.T., Hughes, M.E., Waite, L.J., Hawkley, L.C., Thisted, R.A., 2006. Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses. Psychol. Aging 21, 140–151. https://doi.org/10.1037/0882-7974.21.1.140

Cacioppo, S., Grippo, A.J., London, S., Goossens, L., Cacioppo, J.T., 2015. Loneliness: clinical import and interventions. Perspectives on Psychological Science 10, 238–249. https://doi.org/10.1177/1745691615570616

Cohen-Mansfield, J., Parpura-Gill, A., 2007. Loneliness in older persons: A theoretical model and empirical findings. Int. Psychogeriatr. 19, 279–294. https://doi.org/10.1017/S1041610206004200

Cornwell, E.Y., Waite, L.J., 2009a. Measuring social isolation among older adults using multiple indicators from the NSHAP study. Journals of Gerontology - Series B Psychological Sciences and Social Sciences 64, i38–i46. https://doi.org/10.1093/geronb/gbp037

Cornwell, E.Y., Waite, L.J., 2009b. Social disconnectedness, perceived isolation, and health among older adults. J. Health Soc. Behav. 50, 31–48.

Crowe, C., Coen, R.F., Kidd, N., Hevey, D., Cooney, J., Harbison, J., 2016. A qualitative study of the experience of psychological distress post-stroke. J. Health Psychol. 21, 2572–2579. https://doi.org/10.1177/1359105315581067

Dafer, R.M., Rao, M., Shareef, A., Sharma, A., 2008. Poststroke depression. Top. Stroke Rehabil. 15, 13–21. https://doi.org/10.1310/tsr1501-13

Delbridge, A., Davey, J., Galloway, M., Drummond, A., Lanyon, L., Olley, N., Mason, G., English, C., Simpson, D.B., 2024. Exploring post-stroke fatigue from the perspective of stroke survivors: what strategies help? A qualitative study. Disabil. Rehabil. 46, 4187–4193. https://doi.org/10.1080/09638288.2023.2266363

Demeyere, N., Riddoch, M.J., Slavkova, E.D., Bickerton, W.L., Humphreys, G.W., 2015. The Oxford Cognitive Screen (OCS): Validation of a stroke-specific short cognitive screening tool. Psychol. Assess. 27, 883–894. https://doi.org/10.1037/pas0000082

Demeyere, N., Riddoch, M.J., Slavkova, E.D., Jones, K., Reckless, I., Mathieson, P., Humphreys, G.W., 2016. Domain-specific versus generalized cognitive screening in acute stroke. J. Neurol. 263, 306–315. https://doi.org/10.1007/s00415-015-7964-4

Duan, Y., Jiang, S., Yin, Z., Wang, S., Gao, J., Yang, M., Chen, C., Fu, H., Wang, C., 2023. Association of social isolation and cognitive performance: a longitudinal study using a four-wave nationwide survey. BMC Public Health 23. https://doi.org/10.1186/s12889-023-16274-7

Dunne, S., Williams, G.P., Bradbury, C., Keyes, T., Lane, A.R., Yang, K., Ellison, A., 2023. Uncovering the social determinants of brain injury rehabilitation. J. Health Psychol. 28, 956–969. https://doi.org/10.1177/13591053231166263

Dworschak, C., Heim, E., Kuhn, N., Schwager, J., Tröster, A., Maercker, A., 2024. User-centered development of an internet-based CBT intervention for the treatment of loneliness in older individuals. Internet Interv. 35, 100720. https://doi.org/10.1016/j.invent.2024.100720

Elmer, T., Ram, N., Gloster, A.T., Bringmann, L.F., 2025. Studying daily social interaction quantity and quality in relation to depression change: A multi-phase experience sampling study. Pers. Soc. Psychol. Bull. 51, 1294–1309. https://doi.org/10.1177/01461672231211469

Feigin, V.L., Brainin, M., Norrving, B., Martins, S.O., Pandian, J., Lindsay, P., F Grupper, M., Rautalin, I., 2025. World Stroke Organization: Global stroke fact sheet 2025. International Journal of Stroke 20, 132–144. https://doi.org/10.1177/17474930241308142

Franco-O'Byrne, D., Sepúlveda, J.P.M., Gonzalez-Gomez, R., Ibáñez, A., Huepe-Artigas, D., Matus, C., Manen, R., Ayala, J., Fittipaldi, S., Huepe, D., 2023. The neurocognitive impact of loneliness and social networks on social adaptation. Sci. Rep. 13, 12048. https://doi.org/10.1038/s41598-023-38244-0

Galligan, N.G., Hevey, D., Coen, R.F., Harbison, J.A., 2016. Clarifying the associations between anxiety, depression and fatigue following stroke. J. Health Psychol. 21, 2863–2871. https://doi.org/10.1177/1359105315587140

Gbiri, C.A., Akinpelu, A.O., Odole, A.C., 2010. Prevalence, pattern and impact of depression on quality of life of stroke survivors. Int. J. Psychiatry Clin. Pract. 14, 198–203. https://doi.org/10.3109/13651501003797633

Ge, L., Yap, C.W., Ong, R., Heng, B.H., 2017. Social isolation, loneliness and their relationships with depressive symptoms: A population-based study. PLoS One 12, e0182145. https://doi.org/10.1371/journal.pone.0182145

Gillespie, D.C., Bowen, A., Chung, C.S., Cockburn, J., Knapp, P., Pollock, A., 2015. Rehabilitation for post-stroke cognitive impairment: An overview of recommendations arising from systematic reviews of current evidence. Clin. Rehabil. 29, 120–128. https://doi.org/10.1177/0269215514538982

Glickman, M.E., Rao, S.R., Schultz, M.R., 2014. False discovery rate control is a recommended alternative to Bonferroni-type adjustments in health studies. J. Clin. Epidemiol. 67, 850–857. https://doi.org/10.1016/j.jclinepi.2014.03.012

Glymour, M.M., Weuve, J., Fay, M.E., Glass, T., Berkman, L.F., 2008. Social ties and cognitive recovery after stroke: Does social integration promote cognitive resilience? Neuroepidemiology 31, 10–20. https://doi.org/10.1159/000136646

Goh, H.T., Tan, M.P., Mazlan, M., Abdul-Latif, L., Subramaniam, P., 2019. Social participation determines quality of life among urban-dwelling older adults with stroke in a developing country. Journal of Geriatric Physical Therapy 42, E77–E84. https://doi.org/10.1519/JPT.0000000000000196

Golden, J., Conroy, R.M., Bruce, I., Denihan, A., Greene, E., Kirby, M., Lawlor, B.A., 2009. Loneliness, social support networks, mood and wellbeing in community-dwelling elderly. Int. J. Geriatr. Psychiatry 24, 694–700. https://doi.org/10.1002/gps.2181

Goljar, N., Burger, H., Vidmar, G., Marincek, C., Krizaj, J., Chatterji, S., Raggi, A., Leonardi, M., Bickenbach, J.E., 2010. Functioning and disability in stroke. Disabil. Rehabil. 32, S50–S58. https://doi.org/10.3109/09638288.2010.517598

Hawkley, L.C., Cacioppo, J.T., 2010. Loneliness matters: A theoretical and empirical review of consequences and mechanisms. Annals of Behavioral Medicine 40, 218–227. https://doi.org/10.1007/s12160-010-9210-8

Iovino, P., Vellone, E., Cedrone, N., Riegel, B., 2023. A middle-range theory of social isolation in chronic illness. Int. J. Environ. Res. Public Health 20, 4940. https://doi.org/10.3390/ijerph20064940

Jokinen, H., Melkas, S., Ylikoski, R., Pohjasvaara, T., Kaste, M., Erkinjuntti, T., Hietanen, M., 2015. Post-stroke cognitive impairment is common even after successful clinical recovery. Eur. J. Neurol. 22, 1288–1294. https://doi.org/10.1111/ene.12743

Käll, A., Shafran, R., Lindegaard, T., Bennett, S., Cooper, Z., Coughtrey, A., Andersson, G., 2020. A common elements approach to the development of a modular cognitive behavioral theory for chronic loneliness. J. Consult. Clin. Psychol. 88, 269–282. https://doi.org/10.1037/ccp0000454

Karlsson, J., Hammarström, E., Fogelkvist, M., Lundqvist, L.O., 2024. Psychometric characteristics of the Hospital Anxiety and Depression Scale in stroke survivors of working age before and after inpatient rehabilitation. PLoS One 19, e0306754. https://doi.org/10.1371/journal.pone.0306754

Kelleher, K., Demeyere, N., Kusec, A., 2025. Specific within-domain cognitive impairments predict depression severity six-months after stroke. Top. Stroke Rehabil. 1–11. https://doi.org/10.1080/10749357.2025.2557317

Kraav, S.L., Lehto, S.M., Junttila, N., Ruusunen, A., Kauhanen, J., Hantunen, S., Tolmunen, T., 2021. Depression and loneliness may have a direct connection without mediating factors. Nord. J. Psychiatry 75, 553–557. https://doi.org/10.1080/08039488.2021.1894231

Kwakkel, G., Veerbeek, J.M., van Wegen, E.E.H., Nijland, R., Harmeling-van der Wel, B.C., Dippel, D.W.J., 2010. Predictive value of the NIHSS for ADL outcome after ischemic hemispheric stroke: Does timing of early assessment matter? J. Neurol. Sci. 294, 57–61. https://doi.org/10.1016/j.jns.2010.04.004

Lagogianni, C., Thomas, S., Lincoln, N., 2018. Examining the relationship between fatigue and cognition after stroke: A systematic review. Neuropsychol. Rehabil. 28, 57–116. https://doi.org/10.1080/09602011.2015.1127820

Lee, J., Cagle, J.G., 2017. Validating the 11-Item Revised University of California Los Angeles Scale to assess loneliness among older adults: an evaluation of factor structure and other measurement properties. American Journal of Geriatric Psychiatry 25, 1173–1183. https://doi.org/10.1016/j.jagp.2017.06.004

Lee, S.L., Pearce, E., Ajnakina, O., Johnson, S., Lewis, Glyn, Mann, F., Pitman, A., Solmi, F., Sommerlad, A., Steptoe, A., Tymoszuk, U., Lewis, Gemma, 2021. The association between loneliness and depressive symptoms among adults aged 50 years and older: a 12-year population-based cohort study. Lancet Psychiatry 8, 48–57. https://doi.org/10.1016/S2215-0366(20)30383-7

Liang, W., Miao, J., Wang, Y., Sun, W., Pan, C., Chen, M., Li, G., Lan, Y., Qiu, X., Zhao, X., Jing, P., Chen, G., Mei, J., Zhu, Z., 2023. Longitudinal relationships between depressive symptoms and cognitive function after stroke: A cross-lagged panel design. J. Psychosom. Res. https://doi.org/10.1016/j.jpsychores.2023.111486

Lin, B., Zhang, Z., Guo, Y., Wang, W., Mei, Y., Wang, S., Tong, Y., Shuaib, N., Cheung, D., 2021. Perceptions of recurrence risk and behavioural changes among first-ever and recurrent stroke survivors: A qualitative analysis. Health Expectations 24, 1962–1970. https://doi.org/10.1111/hex.13335

Lowe, N., Crawley, L., Wilson, C., Waldron, B., 2021. 'Lonely in my head': The experiences of loneliness in individuals with brain injury. Br. J. Health Psychol. 26, 444–463. https://doi.org/10.1111/bjhp.12481

Mahoney, F.I., Barthel, D.W., 1965. Functional evaluation: the Barthel Index. Md. State Med. J. 14, 61–65.

Mann, F., Wang, J., Pearce, E., Ma, R., Schlief, M., Lloyd-Evans, B., Ikhtabi, S., Johnson, S., 2022. Loneliness and the onset of new mental health problems in the general population. Soc. Psychiatry Psychiatr. Epidemiol. 57, 2161–2178. https://doi.org/10.1007/s00127-022-02261-7

Martín-María, N., Caballero, F.F., Lara, E., Domènech-Abella, J., Haro, J.M., Olaya, B., Ayuso-Mateos, J.L., Miret, M., 2021. Effects of transient and chronic loneliness on major depression in older adults: A longitudinal study. Int. J. Geriatr. Psychiatry 36, 76–85. https://doi.org/10.1002/gps.5397

Masi, C.M., Chen, H.Y., Hawkley, L.C., Cacioppo, J.T., 2011. A meta-analysis of interventions to reduce loneliness. Personality and Social Psychology Review 15, 219–266. https://doi.org/10.1177/1088868310377394

Medeiros, G.C., Roy, D., Kontos, N., Beach, S.R., 2020. Post-stroke depression: A 2020 updated review. Gen. Hosp. Psychiatry. https://doi.org/10.1016/j.genhosppsych.2020.06.011

Michael, K.M., Allen, J.K., Macko, R.F., 2006. Fatigue after stroke: Relationship to mobility, fitness, ambulatory activity, social support, and falls efficacy. Rehabilitation Nursing 31, 210–217. https://doi.org/10.1002/j.2048-7940.2006.tb00137.x

Milosevich, E.T., Moore, M.J., Pendlebury, S.T., Demeyere, N., 2024. Domain-specific cognitive impairment 6 months after stroke: The value of early cognitive screening. International Journal of Stroke 19, 331–341. https://doi.org/10.1177/17474930231205787

Norlander, A., Iwarsson, S., Jönsson, A.C., Lindgren, A., Månsson Lexell, E., 2022. Participation in social and leisure activities while re-constructing the self: understanding strategies used by stroke survivors from a long-term perspective. Disabil. Rehabil. 44, 4284–4292. https://doi.org/10.1080/09638288.2021.1900418

Nys, G.M.S., van Zandvoort, M.J.E., van der Worp, H.B., de Haan, E.H.F., de Kort, P.L.M., Jansen, B.P.W., Kappelle, L.J., 2006. Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. J. Neurol. Sci. 247, 149–156. https://doi.org/10.1016/j.jns.2006.04.005

Peplau, L., Perlman, D., 1982. Perspectives on loneliness, in: Peplau, L., Perlman, D. (Eds.), Loneliness: A Sourcebook of Current Theory, Research, and Therapy. Wiley, New York.

Petitte, T., Mallow, J., Barnes, E., Petrone, A., Barr, T., Theeke, L., 2015. A systematic review of loneliness and common chronic physical conditions in adults. Open Psychol. J. 8, 113–132. https://doi.org/10.2174/1874350101508010113

Planton, M., Peiffer, S., Albucher, J.F., Barbeau, E.J., Tardy, J., Pastor, J., Januel, A.C., Bezy, C., Lemesle, B., Puel, M., Demonet, J.F., Chollet, F., Pariente, J., 2012. Neuropsychological outcome after a first symptomatic ischaemic stroke with “good recovery.” Eur. J. Neurol. 19, 212–219. https://doi.org/10.1111/j.1468-1331.2011.03450.x

Ponsford, J., Lee, N.K., Wong, D., Mckay, A., Haines, K., Downing, M., Alway, Y., Furtado, C., O'donnell, M.L., 2020. Factors associated with response to adapted cognitive behavioral therapy for anxiety and depression following traumatic brain injury. Journal of Head Trauma Rehabilitation 35, 117–126. https://doi.org/10.1097/HTR.0000000000000510

Rock, P.L., Roiser, J.P., Riedel, W.J., Blackwell, A.D., 2014. Cognitive impairment in depression: A systematic review and meta-analysis. Psychol. Med. 44, 2029–2040. https://doi.org/10.1017/S0033291713002535

Salter, K., Hellings, C., Foley, N., Teasell, R., 2008. The experience of living with stroke: A qualitative meta-synthesis. J. Rehabil. Med. 40, 595–602. https://doi.org/10.2340/16501977-0238

Sbarra, D.A., Ramadan, F.A., Choi, K.W., Treur, J.L., Levey, D.F., Wootton, R.E., Stein, M.B., Gelernter, J., Klimentidis, Y.C., 2023. Loneliness and depression: bidirectional mendelian randomization analyses using data from three large genome-wide association studies. Mol. Psychiatry 28, 4594–4601. https://doi.org/10.1038/s41380-023-02259-w

Sexton, E., McLoughlin, A., Williams, D.J., Merriman, N.A., Donnelly, N., Rohde, D., Hickey, A., Wren, M.A., Bennett, K., 2019. Systematic review and meta-analysis of the prevalence of cognitive impairment no dementia in the first year post-stroke. Eur. Stroke J. 4, 160–171. https://doi.org/10.1177/2396987318825484

Smith, K.J., Victor, C., 2019. Typologies of loneliness, living alone and social isolation, and their associations with physical and mental health. Ageing Soc. 39, 1709–1730. https://doi.org/10.1017/S0144686X18000132

Taylor, H.O., Taylor, R.J., Nguyen, A.W., Chatters, L., 2018. Social isolation, depression, and psychological distress among older adults. J. Aging Health 30, 229–246. https://doi.org/10.1177/0898264316673511

Theeke, L.A., Mallow, J.A., Moore, J., McBurney, A., Rellick, S., VanGilder, R., 2016. Effectiveness of LISTEN on loneliness, neuroimmunological stress response, psychosocial functioning, quality of life, and physical health measures of chronic illness. Int. J. Nurs. Sci. 3, 242–251. https://doi.org/10.1016/j.ijnss.2016.08.004

Turunen, K.E.A., Laari, S.P.K., Kauranen, T. V., Uimonen, J., Mustanoja, S., Tatlisumak, T., Poutiainen, E., 2018. Domain-specific cognitive recovery after first-ever stroke: a 2-year follow-up. Journal of the International Neuropsychological Society 24, 117–127. https://doi.org/10.1017/S1355617717000728

Van Winkel, M., Wichers, M., Collip, D., Jacobs, N., Derom, C., Thiery, E., Myin-Germeys, I., Peeters, F., 2017. Unraveling the role of loneliness in depression: The relationship between daily life experience and behavior. Psychiatry 80, 104–117. https://doi.org/10.1080/00332747.2016.1256143

Williams, O.A., Demeyere, N., 2021. Association of depression and anxiety with cognitive impairment 6 months after stroke. Neurology 96, e1966–e1974. https://doi.org/10.1212/WNL.0000000000011748

Yang, K., Armstrong, N., Diamond, C., Lane, A.R., Dunne, S., 2022. The meaning of loneliness to stroke survivors: A qualitative study in Northeast England. J. Health Psychol. 27, 2539–2548. https://doi.org/10.1177/13591053211017198

Zigmond, A.S., Snaith, R.P., 1983. The Hospital Anxiety and Depression Scale. Acta Psychiatr. Scand. 67, 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Executive Summary

Understanding the relationship between post-stroke cognitive impairments and depression: the role of loneliness

Why did we do this study?

Chronic cognitive impairments are highly common after stroke and have been associated with an increased risk of depression at 6 months post-stroke. However, the mechanisms by which cognitive impairments may lead to depression are not well understood. A better understanding of factors which contribute to depression after stroke could help to identify new and more timely targets and strategies for interventions.

It has been proposed that social isolation may mediate the relationship between symptoms of chronic health conditions and mental health outcomes. Social isolation is a complex construct which consists of two interacting elements: social disconnectedness and loneliness. Social disconnectedness refers to an objective lack of contact with other people, whereas loneliness reflects the subjective experience of social isolation.

Although these aspects of social isolation can occur simultaneously, it has been shown that being in the presence of other people is not sufficient to prevent feelings of loneliness, and conversely it is possible to be socially disconnected without feeling lonely. It is therefore important to assess the specific contributions of social disconnectedness and loneliness to mental health outcomes.

What were the aims of this study?

The main aim of this study was to clarify the impact of social disconnectedness on depression in stroke survivors with cognitive impairments. The key research questions were:

1) Can previous findings that the severity of cognitive impairments predicts depression be replicated in the chronic phase of stroke recovery?

2) Do social disconnectedness and/or loneliness mediate the relationship between cognitive impairments and depression in chronic stroke?

How was the study carried out?

Three experts by experience helped to develop the project by reviewing the study aims and materials. This helped to ensure that the project was relevant and accessible to stroke survivors. A total of 85 participants were recruited from the Oxford Screening Programme, which comprised a large cohort of stroke survivors who had attended an acute stroke unit. All participants were at least 18 years old (mean = 72.8 years) and had been admitted with a suspected or confirmed stroke a minimum of 6 months (mean = 4.5 years) before taking part in the study. All participants completed a cognitive screening tool and questionnaires which assessed social disconnectedness, loneliness, and symptoms of depression.

What did we learn?

The results showed that stroke survivors with more severe cognitive impairments had higher depression scores. This confirms that the previously observed relationship between post-stroke cognition and depression persists in the chronic phase of stroke. Cognitive impairment severity is therefore a consistent predictor of mental health after stroke.

Importantly, we found that feelings of loneliness mediated this relationship. In other words, participants with more severe cognitive impairments reported stronger feelings of loneliness, which in turn was linked with increased depressive symptoms. Social disconnectedness, on the other hand, was not a significant mediator. These findings suggest that the impact of cognitive impairments on post-stroke depression is influenced by stroke services' perceptions of or satisfaction with their relationships, rather than objective contact with other people.

What does this mean for future research and clinical practice?

This study demonstrated that effects of cognitive impairments on depression do not dissipate over time, and it is therefore crucial that effective strategies are developed to better support the mental health of stroke survivors with cognitive difficulties. Our results indicate that social isolation may present a modifiable factor which could improve health outcomes in this population. When designing interventions, it is important to consider that loneliness but not disconnectedness significantly influenced the relationship between cognition and depression. This suggests that strategies aiming to increase stroke survivors' social networks and participation may not be sufficient to reduce depressive symptoms, and that interventions may be more effective when targeting feelings of loneliness and associated cognitions.

In both clinical practice and research, this could be implemented by using loneliness questionnaires as outcome measures and exploring the impact of targeted interventions for loneliness. Previously, cognitive behavioural therapy (CBT) protocols have been developed which focused on reducing loneliness in young people and older adults. Additional research is needed to determine the efficacy and potential adaptations to such interventions for stroke survivors with cognitive impairments. Given the cross-sectional nature of the present study, longitudinal and interventional studies will also be valuable for clearly establishing the causality of the relationships observed here.

Connecting Reflective Narrative

Before starting clinical training, I had a long-standing interest in working with older people and adults with neurological conditions. Due to my background in clinical neuroscience, I had previously conducted research which focused on more objective outcomes in these populations such as functional brain activity and task performance. However, one of the most rewarding aspects of this work was the conversations I had with participants between research tasks, which helped me gain some insight into their subjective experiences. This led me to pursue clinical roles, and working as an assistant psychologist in neurorehabilitation and memory assessment services strengthened my aspirations to improve support for these individuals. The research component of the course gave me the opportunity to explore some of the themes I encountered in clinical settings and try to develop a better understanding of people's personal experiences of ageing and neurological conditions.

Systematic Review of the Literature (SRL)

For the SRL I was keen to focus on predictors of older adults' mental health difficulties and/or associated interventions. An early challenge within this project was that this population appears to be relatively understudied, with the evidence base being too limited for a systematic review on many relevant topics. I found this surprising given the global changes in ageing, and it made me wonder whether there are assumptions about older age that limit academics' interest in or funding for this research. Having noticed some of the language used when talking about older people, both clinically and in society more generally, I decided to focus on the impact of attitudes to ageing. The resulting paper is currently under peer review, and I have found this process helpful for strengthening the narrative synthesis. Importantly, this project not only enabled me to gain a better understanding of the content of attitudes to ageing and theories linking them to mental

health, but also increased awareness of my own beliefs about ageing and how these might influence my work with older adults.

Service Improvement Project (SIP)

The service improvement project was motivated by my previous experiences in a neurorehabilitation hospital and memory assessment service, where one of my main tasks was carrying out cognitive assessments. As I thought the resulting reports seemed quite complex, I was curious about how accessible and useful these assessments were to the service users themselves. Being able to carry out in-depth interviews with service users was a particularly valuable experience, as it is rarely possible to have these kinds of conversations in fast-paced assessment settings. This project also highlighted the importance of working collaboratively with experts by experience, as the findings led to some recommendations that had not clearly emerged from the extant literature which was predominantly based on clinicians' expertise. As I had not previously been involved in qualitative research, I felt more uncertain throughout this project than was the case for my other research studies. I found the analysis stage particularly challenging, as I wanted to do justice to the participants' stories and initially struggled to reduce the number of codes and quotes used in the report. Being on placement in the service, I also felt hesitant to suggest adjustments to feedback processes to the wider team. However, their positive responses to the project and seeing how this led to real change was very rewarding and has motivated me to continue engaging in service improvement projects going forward. In future roles, I hope to be part of teams with the same level of openness and enthusiasm for continuously improving clinical practice.

Theoretically-Driven Research Project (TDRP)

Finally, my TDRP was driven by anecdotal reports from stroke survivors I had worked with, who indicated how difficult it was for them to participate in social activities and the impact

it had on their relationships. PPI was very useful for developing this project as it gave initial validation of the relevance of the research questions and helped to refine the measures used. Data collection was enjoyable but logistically challenging, as power analyses indicated a large sample size was needed and the project involved home visits across Oxfordshire. As I had some prior familiarity with the ethics process it was possible to gain early approval of the project and complete data collection within the expected timeframe. However, the time-consuming nature of this study made me wonder about the feasibility of combining clinical and research responsibilities in qualified posts. In my final year I had the opportunity to present this work at the British Neuropsychological Society conference, which enabled me to connect with both researchers and clinicians in this field. I found it highly encouraging and motivating to see so many examples of how research and clinical work can be practically integrated in different settings.

Impact on clinical practice and future research

Although the individual research topics differed, a key theme that emerged across the projects was the importance of relationships: how we are seen by others, how connected we feel, and the value of the therapeutic relationship. This has shaped my thinking and approach to both therapy sessions and neuropsychological assessments. I would be keen to continue doing research after qualification, although I am aware that many services are under pressure and it can be difficult to allocate time to research projects. However, in the past three years I have seen several examples of how research can be built into clinical settings and support from Trusts for improving clinical practice. I particularly enjoyed my SIP, as this showed me how an evidence-based approach can have an immediate impact on clinical work. Going forward, I hope to be able to be part of similar service-based projects and thereby contribute to ongoing development of services as well as improving my own practice.

Acknowledgements

In one way or another, each project in this thesis showed me how much the people around us matter – something that proved equally true throughout my experience of the doctorate. I am very grateful to the many people who contributed to this research and supported me over the past three years.

First of all, a huge thank you to all the volunteers who so generously gave their time to develop and participate in these studies. It has been such a pleasure to meet each of you and to learn from your insights, resilience, and commitment to improving how we help others in the future.

I would like to thank my research supervisors Reena Vohora, Kathryn Evans, Nele Demeyere, and Claire Isaac for all their advice and thoughtful feedback. As my course tutor, I also particularly want to thank Reena for her practical support, encouragement, and kindness, all of which made a real difference during training.

Thank you to my fellow trainees for the shared lunches, perspectives, and laughs that helped carry me through the ups and downs of the course. A special thank you to Lucy for the many hours spent reading abstracts and papers for the SRL. Thanks also to Paula and Karen for their help with recruitment for the TDRP.

To my family and friends on the other side of the Channel, who I don't get to see as often as I'd like but who have continued to support me from afar: thank you for always being there despite the distance.

Finally, to Owen – thank you for your patience, for keeping me grounded, and for reminding me what matters most. I could not have asked for a better husband and friend to have by my side, and I'm excited for everything that comes next for us.

Systematic Review of the Literature Appendices

Appendix A. European Journal of Ageing Instructions to Authors

Types of papers

Review Articles or Theoretical Articles*:* These usually invited submissions may have a maximum of 8000 words.

For all types of papers, abstracts should have 150 to 250 words and should be unstructured. The abstract should not contain any undefined abbreviations or unspecified references. For Original Investigations and Qualitative research articles, abstracts should state concisely the research objective, the methods used, and the results and conclusions of the research. For an Editorial no abstract is needed.

Manuscript Submission

Title Page

Please make sure your title page contains the following information.

Title

The title should be concise and informative.

Author information

- The name(s) of the author(s)
- The affiliation(s) of the author(s), i.e. institution, (department), city, (state), country
- A clear indication and an active e-mail address of the corresponding author
- If available, the 16-digit ORCID of the author(s)

If address information is provided with the affiliation(s) it will also be published.

For authors that are (temporarily) unaffiliated we will only capture their city and country of residence, not their e-mail address unless specifically requested.

Abstract

Please provide an abstract of 150 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references.

Keywords

Please provide 4 to 6 keywords which can be used for indexing purposes.

Statements and Declarations

The following statements should be included under the heading "Statements and Declarations" for inclusion in the published paper. Please note that submissions that do not include relevant declarations will be returned as incomplete.

- **Competing Interests:** Authors are required to disclose financial or non-financial interests that are directly or indirectly related to the work submitted for publication. Please refer to “Competing Interests and Funding” below for more information on how to complete this section.

Please see the relevant sections in the submission guidelines for further information as well as various examples of wording. Please revise/customize the sample statements according to your own needs.

Text

Text Formatting

Manuscripts should be submitted in Word.

- Use a normal, plain font (e.g., 10-point Times Roman) for text.

- Use italics for emphasis.
- Use the automatic page numbering function to number the pages.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.
- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Headings

Please use no more than three levels of displayed headings.

Abbreviations

Abbreviations should be defined at first mention and used consistently thereafter.

Footnotes

Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes.

Acknowledgments

Acknowledgments of people, grants, funds, etc. should be placed in a separate section on the title page. The names of funding organizations should be written in full.

References

Citation

Cite references in the text by name and year in parentheses. Some examples:

- Negotiation research spans many disciplines (Thompson 1990).
- This result was later contradicted by Becker and Seligman (1996).
- This effect has been widely studied (Abbott 1991; Barakat et al. 1995a, b; Kelso and Smith 1998; Medvec et al. 1999, 2000).

Reference list

The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text.

Reference list entries should be alphabetized by the last names of the first author of each work. Please alphabetize according to the following rules: 1) For one author, by name of author, then chronologically; 2) For two authors, by name of author, then name of coauthor, then chronologically; 3) For more than two authors, by name of first author, then chronologically.

If available, please always include DOIs as full DOI links in your reference list (e.g. “https://doi.org/abc”).

- Journal article

Gamelin FX, Baquet G, Berthoin S, Thevenet D, Nourry C, Nottin S, Bosquet L (2009) Effect of high intensity intermittent training on heart rate variability in prepubescent children. Eur J Appl Physiol 105:731-738. https://doi.org/10.1007/s00421-008-0955-8

Ideally, the names of all authors should be provided, but the usage of “et al” in long author lists will also be accepted:

Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. N Engl J Med 965:325–329

- Article by DOI

Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. J Mol Med. https://doi.org/10.1007/s001090000086

- Book

South J, Blass B (2001) The future of modern genomics. Blackwell, London

- Book chapter

Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York, pp 230-257

- Online document

Cartwright J (2007) Big stars have weather too. IOP Publishing PhysicsWeb. http://physicsweb.org/articles/news/11/6/16/1. Accessed 26 June 2007

- Dissertation

Trent JW (1975) Experimental acute renal failure. Dissertation, University of California

Always use the standard abbreviation of a journal’s name according to the ISSN List of Title Word Abbreviations, see

ISSN LTWA

If you are unsure, please use the full journal title.

Tables

- All tables are to be numbered using Arabic numerals.
- Tables should always be cited in text in consecutive numerical order.
- For each table, please supply a table caption (title) explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table caption.
- Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.

Artwork and Illustrations Guidelines

Electronic Figure Submission

- Supply all figures electronically.
- Indicate what graphics program was used to create the artwork.
- For vector graphics, the preferred format is EPS; for halftones, please use TIFF format. MSOffice files are also acceptable.
- Vector graphics containing fonts must have the fonts embedded in the files.
- Name your figure files with "Fig" and the figure number, e.g., Fig1.eps.

Line Art

- Definition: Black and white graphic with no shading.

- Do not use faint lines and/or lettering and check that all lines and lettering within the figures are legible at final size.
- All lines should be at least 0.1 mm (0.3 pt) wide.
- Scanned line drawings and line drawings in bitmap format should have a minimum resolution of 1200 dpi.
- Vector graphics containing fonts must have the fonts embedded in the files.

Halftone Art

- Definition: Photographs, drawings, or paintings with fine shading, etc.
- If any magnification is used in the photographs, indicate this by using scale bars within the figures themselves.
- Halftones should have a minimum resolution of 300 dpi.

Combination Art

- Definition: a combination of halftone and line art, e.g., halftones containing line drawing, extensive lettering, color diagrams, etc.
- Combination artwork should have a minimum resolution of 600 dpi.

Figure Lettering

- To add lettering, it is best to use Helvetica or Arial (sans serif fonts).
- Keep lettering consistently sized throughout your final-sized artwork, usually about 2–3 mm (8–12 pt).
- Variance of type size within an illustration should be minimal, e.g., do not use 8-pt type on an axis and 20-pt type for the axis label.

- Avoid effects such as shading, outline letters, etc.
- Do not include titles or captions within your illustrations.

Figure Numbering

- All figures are to be numbered using Arabic numerals.
- Figures should always be cited in text in consecutive numerical order.
- Figure parts should be denoted by lowercase letters (a, b, c, etc.).
- If an appendix appears in your article and it contains one or more figures, continue the consecutive numbering of the main text. Do not number the appendix figures,"A1, A2, A3, etc." Figures in online appendices [Supplementary Information (SI)] should, however, be numbered separately.

Figure Captions

- Each figure should have a concise caption describing accurately what the figure depicts. Include the captions in the text file of the manuscript, not in the figure file.
- Figure captions begin with the term Fig. in bold type, followed by the figure number, also in bold type.
- No punctuation is to be included after the number, nor is any punctuation to be placed at the end of the caption.
- Identify all elements found in the figure in the figure caption; and use boxes, circles, etc., as coordinate points in graphs.
- Identify previously published material by giving the original source in the form of a reference citation at the end of the figure caption.

Figure Placement and Size

- Figures should be submitted within the body of the text. Only if the file size of the manuscript causes problems in uploading it, the large figures should be submitted separately from the text.
- When preparing your figures, size figures to fit in the column width.
- For large-sized journals the figures should be 84 mm (for double-column text areas), or 174 mm (for single-column text areas) wide and not higher than 234 mm.
- For small-sized journals, the figures should be 119 mm wide and not higher than 195 mm.

Accessibility

In order to give people of all abilities and disabilities access to the content of your figures, please make sure that

- All figures have descriptive captions (blind users could then use a text-to-speech software or a text-to-Braille hardware)
- Patterns are used instead of or in addition to colors for conveying information (colorblind users would then be able to distinguish the visual elements)
- Any figure lettering has a contrast ratio of at least 4.5:1

Disclosures and declarations

All authors are requested to include information regarding sources of funding, financial or non-financial interests, study-specific approval by the appropriate ethics committee for research involving humans and/or animals, informed consent if the research involved human participants, and a statement on welfare of animals if the research involved animals (as appropriate).

The decision whether such information should be included is not only dependent on the scope of the journal, but also the scope of the article. Work submitted for publication may have implications for public health or general welfare and in those cases it is the responsibility of all authors to include the appropriate disclosures and declarations.

Author contributions

In absence of specific instructions and in research fields where it is possible to describe discrete efforts, the Publisher recommends authors to include contribution statements in the work that specifies the contribution of every author in order to promote transparency. These contributions should be listed at the separate title page.

Competing Interests

Authors are requested to disclose interests that are directly or indirectly related to the work submitted for publication. Interests within the last 3 years of beginning the work (conducting the research and preparing the work for submission) should be reported. Interests outside the 3-year time frame must be disclosed if they could reasonably be perceived as influencing the submitted work. Disclosure of interests provides a complete and transparent process and helps readers form their own judgments of potential bias. This is not meant to imply that a financial relationship with an organization that sponsored the research or compensation received for consultancy work is inappropriate.

Interests that should be considered and disclosed but are not limited to the following:

Funding: Research grants from funding agencies (please give the research funder and the grant number) and/or research support (including salaries, equipment, supplies, reimbursement for attending symposia, and other expenses) by organizations that may gain or lose financially through publication of this manuscript.

Employment: Recent (while engaged in the research project), present or anticipated employment by any organization that may gain or lose financially through publication of this manuscript. This includes multiple affiliations (if applicable).

Financial interests: Stocks or shares in companies (including holdings of spouse and/or children) that may gain or lose financially through publication of this manuscript; consultation fees or other forms of remuneration from organizations that may gain or lose financially; patents or patent applications whose value may be affected by publication of this manuscript.

It is difficult to specify a threshold at which a financial interest becomes significant, any such figure is necessarily arbitrary, so one possible practical guideline is the following: "Any undeclared financial interest that could embarrass the author were it to become publicly known after the work was published."

Non-financial interests: In addition, authors are requested to disclose interests that go beyond financial interests that could impart bias on the work submitted for publication such as professional interests, personal relationships or personal beliefs (amongst others). Examples include, but are not limited to: position on editorial board, advisory board or board of directors or other type of management relationships; writing and/or consulting for educational purposes; expert witness; mentoring relations; and so forth.

Primary research articles require a disclosure statement. Review articles present an expert synthesis of evidence and may be treated as an authoritative work on a subject. Review articles therefore require a disclosure statement. Other article types such as editorials, book reviews, comments (amongst others) may, dependent on their content, require a disclosure statement. If you are unclear whether your article type requires a disclosure statement, please contact the Editor-in-Chief.

Please note that, in addition to the above requirements, funding information (given that funding is a potential competing interest (as mentioned above)) needs to be disclosed upon submission of the manuscript in the peer review system. This information will automatically be added to the Record of CrossMark, however it is **not added** to the manuscript itself. Under 'summary of requirements' (see below) funding information should be included in the '**Declarations**' section.

Research Data Policy and Data Availability Statements

This journal follows Springer Nature research data policy. Sharing of all relevant research data is strongly encouraged and authors must add a Data Availability Statement to original research articles.

Research data includes a wide range of types, including spreadsheets, images, textual extracts, archival documents, video or audio, interview notes or any specialist formats generated during research.

Data availability statements

All original research must include a data availability statement. This statement should explain how to access data supporting the results and analysis in the article, including links/citations to publicly archived datasets analysed or generated during the study. Please see our full policy here.

If it is not possible to share research data publicly, for instance when individual privacy could be compromised, this statement should describe how data can be accessed and any conditions for reuse. Participant consent should be obtained and documented prior to data collection. See our guidance on sensitive data for more information.

When creating a data availability statement, authors are encouraged to consider the minimal dataset that would be necessary to interpret, replicate and build upon the findings reported in the article.

Further guidance on writing a data availability statement, including examples, is available at:

Data availability statements

Appendix B. PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	p. 10
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	p. 11
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	p. 12-14
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p. 13-14
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	p. 16-17
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.	p. 15-16
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	p. 15-16 and Appendix C
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.	p. 16-17
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.	p. 16-17
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.	p. 16-17
	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.	p. 17
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.	p. 17
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.	N/A
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)).	p. 17
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of	p. 17

Section and Topic	Item #	Checklist item	Location where item is reported
		individual studies and syntheses.	
	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.	p. 17
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	p. 17
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
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.	p. 17-18 and Figure 2
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	p. 19, p. 23-24, Table 1, and Appendix D
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	p. 19 and Table 2
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Tables 4-6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	p. 26-29 and Table 2
	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.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	p. 40-42
	23b	Discuss any limitations of the evidence included in the review.	p. 42-44
	23c	Discuss any limitations of the review processes used.	p. 42-44

Section and Topic	Item #	Checklist item	Location where item is reported
	23d	Discuss implications of the results for practice, policy, and future research.	p. 44-45
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.	p. 15
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p. 15
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	N/A
Competing interests	26	Declare any competing interests of review authors.	N/A
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.	N/A

Appendix C. Search Strategy

The following keyword search was applied across databases:

attitude to* ag?ing OR attitude* to* aged OR attitude* to* own ag?ing OR ag?ing attitude* OR perception* of ag?ing OR ag?ing perception* OR ag?ing self?perception* OR self*perception* of ag?ing OR perception* of older adult* OR belief* about ag?ing OR ag?ing belief**

AND

depress OR low mood OR mood disorder* OR affective disorder* OR anxiety OR anxious OR mental health OR mental well?being OR psychological well?being OR subjective well?being or mental well?being OR quality of life OR life satisfaction*

AND

old adult* OR old* age OR old* people OR elderly OR ag?ing adult* OR late adulthood OR late life OR aged*

Where possible, search results were then combined with the following MeSH term searches:

Attitudes to ageing	**Mental health and quality of life**	**Older adults**
Attitude to ageing Aged (attitudes toward) Aging (attitudes toward) Attitude Aging	Depression Major depression Affective disorders Anxiety disorders Anxiety Mixed anxiety and depression Mood disorder Mental health Quality of life Life satisfaction Subjective wellbeing Psychological wellbeing Emotional wellbeing	Older adulthood Aged

Appendix D. Additional Study Characteristics

Table D1

Response Rates, Inclusion Criteria, and Additional Demographics of Studies Selected for Review

First author (year)	Response rate	Inclusion criteria	Education
Bryant (2012)	34.9%	Age ≥60 years	Not reported
Chen (2021)	62.8%	Age ≥60 years Score ≥3 on 5 questions from MMSE	M = 6.87 years SD = 4.43 years
Choi (2022)	Not reported	Age ≥55 years	Scale of 1-5: M = 3.28 SD = 1.09
Chu (2022)	Not reported	Age ≥50 years	Without post-secondary education: 55.8%
Freeman (2016)	62.0%	Age ≥50 years Not living in an institution No dementia diagnosis	Primary: 1,604 participants Secondary: 2,517 participants Tertiary: 1,966 participants
Gum (2017)	Not reported	Age ≥50 years	M = 13.1 years SE = 0.09 years
Ingrand (2018)	70%	Age ≥55 years Not living in nursing home No evidence of cognitive impairment (MMSE score ≥24)	Less than baccalaureat: 66.5%
Kalfoss (2018)	53.1%	Age ≥60 years Able to speak Norwegian No illness likely to cause death within 6 months No significant cognitive impairment	Less than post-secondary: 62.0%
Korkmaz Aslan (2019)	Not reported	Age ≥65 years Literate in Turkish No communication or cognitive impairment	Illiterate: 12.9% Literate: 28.0% Primary school: 30.0% Secondary school: 15.6% High school: 10.1% University: 3.3%

Table D1 (continued)

Response Rates, Inclusion Criteria, and Additional Demographics of Studies Selected for Review

First author (year)	Response rate	Inclusion criteria	Education
Kornadt (2021)	27.% via random digit dialling 40% via online surveys	Age ≥60 years	Tertiary or more: 29.5%
Kulakçı Altıntaş (2025)	90.9%	Age ≥65 years Living in the community No verbal communication disabilities Not dependent on others for daily living activities	Illiterate: 17.7% Literate: 21.5% Elementary school: 28.0% Secondary school: 10.5% High school: 17.7% College/faculty: 4.3% Postgraduate: 0.3%
Lai (2009)	Mainland China: 68.7% Hong Kong: 21.7% Taiwan: 63.6% Canada: 77% USA: not reported	Age ≥55 years Chinese ethnicity	No formal education: 14.5% Primary: 28.2% Secondary: 36.8% Post-secondary and above: 20.5%
Levy (2019)	94%	Age ≥55 years Served on active duty in the United Staes Armed Forces, Military Reserves, or National Guard Negative screen for PTSD, suicidal ideation, generalised anxiety, and major depressive disorder at baseline	Attended college: 84.4%
Long (2021)	Not reported	Age ≥60 years	Illiterate: 141 School/trade: 3,627 College or higher: 1,536 Other: 115

Table D1 (continued)

Response Rates, Inclusion Criteria, and Additional Demographics of Studies Selected for Review

First author (year)	Response rate	Inclusion criteria	Education
Mohammadpour (2018)	Not reported	Age ≥60 years No recorded history of drug abuse No consumption of psychiatric drugs No existing diagnosis of terminal illness No cognitive impairment that would result in failure to understand questions and answers	Illiterate: 54.2% Reading and writing: 25.5% Elementary school certificate: 21.1% Middle school certificate: 3.9% High school diploma: 3.3% College/seminary degree: 0.9%
Pourghayoumi (2023)	Not reported	Age 60-90 years Permanent residence in the city of Bushehr Able to communicate verbally Living in the community No cognitive impairment	Illiterate: 33.7% Primary school: 26.3% Secondary school: 31.7% Academic education: 8.4%
Sadeghi (2024)	Not reported	Age ≥60 Not using psychiatric medication Not suffering from a terminal disease No cognitive disorder preventing understanding of questions	Illiterate: 43.3% Primary school: 31.3% Secondary/middle school: 11.3% High school diploma or pre-university: 10.0% Academic: 4.0%
Sindi (2012)	Not reported	No history of head injury, trauma, or cerebral vascular incident No alcohol abuse No medications that have a potential impact on cortisol secretion or cognitive performance No self-report of any general anesthesia in the previous year No signs of dementia or MMSE score <24	M = 14.8 years SD = 0.6 years
Sun (2022)	81.3%	Age ≥60 City resident for more than 6 months Able to communicate in Chinese No diagnosis of dementia No serious hearing impairments	Less than primary: 23.0% Primary: 35.7% Middle school: 20.6% High school: 13.0% Higher education: 7.3%

Table D1 (continued)

Response Rates, Inclusion Criteria, and Additional Demographics of Studies Selected for Review

First author (year)	Response rate	Inclusion criteria	Education
Top (2013)	49.1%	Age ≥65 years Living at home without community health care No illness that was likely to cause death within the next year No significant cognitive impairment	Illiterate: 242 participants Primary school: 217 participants Secondary school: 50 participants College: 28 participants Pre-bachelor: 7 participants Bachelor: 6 participants
Wurm (2014)	Baseline: 35.7% Follow-up: 64.4%	Not reported	Divided into categories of low (1), medium (2), and high (3): M = 2.2 SD = 0.6
Yamada (2015)	Not reported	Age ≥50 years Client of a home care agency No cognitive impairment	Primary: 31% Vocational: 30% Secondary: 30% University: 9%

Appendix E. Neuropsychological Rehabilitation Instructions to Authors

Preparing Your Paper

All authors submitting to medicine, biomedicine, health sciences, allied and public health journals should conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, prepared by the International Committee of Medical Journal Editors (ICMJE).

Clinical trials: must conform to the Consort guidelines http://www.consort-statement.org. Submitted papers should include a checklist confirming that all of the Consort requirements have been met, together with the corresponding page number of the manuscript where the information is located. In addition, trials must be pre-registered on a site such as clinicaltrials.gov or equivalent, and the manuscript should include the reference number to the relevant pre-registration.

Systematic reviews: submitted papers should follow PRISMA http://www.prisma-statement.org/ guidelines and submission should also be accompanied by a completed PRISMA checklist, together with the corresponding page number of the manuscript where the information is located.

Single-case studies: submitted papers should follow SCRIBE guidelines (http://psycnet.apa.org/fulltext/2016-17384-001.html) and include a completed SCRIBE checklist together with the corresponding page number of the manuscript where the information is located.

Observational studies: submitted papers should follow the STROBE guidelines (https://www.strobe-statement.org/index.php?id=strobe-home) and also include a

completed checklist of compliance, together with the corresponding page number of the manuscript where the information is located.

Qualitative studies: should follow the COREQ guidelines (http://www.equator-network.org/reporting-guidelines/coreq/) and be accompanied by a completed COREQ checklist of compliance, together with the corresponding page number of the manuscript where the information is located.

The EQUATOR Network (Enhancing the Quality and Transparency of Health Research) website provides further information on available guidelines.

Structure

Your paper should be compiled in the following order: title page; abstract; keywords; main text introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figures; figure captions (as a list).

Word Limits

Please include a word count for your paper. There are no word limits for papers in this journal.

Style Guidelines

Please refer to these quick style guidelines when preparing your paper, rather than any published articles or a sample copy.

Please use American spelling style consistently throughout your manuscript. Please use single quotation marks, except where ‘a quotation is “within” a quotation’. Please note that long quotations should be indented without quotation marks.

Image Descriptions

This journal now adds image descriptions (alternative text, alt text), to all images conveying information necessary for an understanding of your work. Image descriptions are typically used by systems such as pronouncing screen readers to make images accessible to people that cannot read or see the object due to a visual disability. Image descriptions can also provide better image context/descriptions to search engines, helping them to index an image properly and improve the discoverability of your research.

Taylor & Francis uses advanced Artificial Intelligence (AI) technologies to produce image descriptions and include them in your published content. You will have the opportunity to review image descriptions during the proofing process.

Authors have the option to include image descriptions as part of your submitted manuscript. If you choose to provide image descriptions, please follow our guidelines.

Format-Free Submission

Authors may submit their paper in any scholarly format or layout. Manuscripts may be supplied as single or multiple files. These can be Word, rich text format (rtf), open document format (odt), or PDF files. Figures and tables can be placed within the text or submitted as separate documents. Figures should be of sufficient resolution to enable refereeing.

- There are no strict formatting requirements, but all manuscripts must contain the essential elements needed to evaluate a manuscript: abstract, author affiliation, figures, tables, funder information, and references. Further details may be requested upon acceptance.
- References can be in any style or format, so long as a consistent scholarly citation format is applied. Author name(s), journal or book title, article or chapter title, year

of publication, volume and issue (where appropriate) and page numbers are essential. All bibliographic entries must contain a corresponding in-text citation. The addition of DOI (Digital Object Identifier) numbers is recommended but not essential.

- The journal reference style will be applied to the paper post-acceptance by Taylor & Francis.
- Spelling can be US or UK English so long as usage is consistent.

Note that, regardless of the file format of the original submission, an editable version of the article must be supplied at the revision stage.

Taylor & Francis Editing Services

To help you improve your manuscript and prepare it for submission, Taylor & Francis provides a range of editing services. Choose from options such as English Language Editing, which will ensure that your article is free of spelling and grammar errors, Translation, and Artwork Preparation. For more information, including pricing, visit this website.

Checklist: What to Include

1. **Author details.** Please ensure everyone meeting the International Committee of Medical Journal Editors (ICMJE) requirements for authorship is included as an author of your paper. All authors of a manuscript should include their full name and affiliation on the cover page of the manuscript. Where available, please also include ORCiDs and social media handles (Facebook, Twitter or LinkedIn). One author will need to be identified as the corresponding author, with their email address normally displayed in the article PDF (depending on the journal) and the online article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new

affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted. Read more on authorship.

2. Should contain an unstructured abstract of 200 words.

3. You can opt to include a **video abstract** with your article. Find out how these can help your work reach a wider audience, and what to think about when filming.Taylor & Francis Editing Services provides a video abstract creation service for a fee.

4. **Funding details.** Please supply all details required by your funding and grant-awarding bodies as follows:

   For single agency grants

   This work was supported by the [Funding Agency] under Grant [number xxxx].

   For multiple agency grants

   This work was supported by the [Funding Agency #1] under Grant [number xxxx]; [Funding Agency #2] under Grant [number xxxx]; and [Funding Agency #3] under Grant [number xxxx].

5. **Disclosure statement.** This is to acknowledge any financial interest or benefit that has arisen from the direct applications of your research. Further guidance on what is a conflict of interest and how to disclose it.

6. **Data availability statement.** If there is a data set associated with the paper, please provide information about where the data supporting the results or analyses presented in the paper can be found. Where applicable, this should include the hyperlink, DOI or other persistent identifier associated with the data set(s). Templates are also available to support authors.

7. **Data deposition.** If you choose to share or make the data underlying the study open, please deposit your data in a recognized data repository prior to or at the time of

submission. You will be asked to provide the DOI, pre-reserved DOI, or other persistent identifier for the data set.

8. **Supplemental online material.** Supplemental material can be a video, fileset, audio file or anything which supports (and is pertinent to) your paper. Articles with extenders, such as infographics or video summaries, are up to 108% more likely to be downloaded (based on data in May 2024 fromPlain Language Summary of Publication and Clinical Trial Protocol articles published in *Future Oncology* in 2023). We publish supplemental material online via Figshare. Find out more about supplemental material and how to submit it with your article. Taylor & Francis Editing Services can help you create research promotion materials, including infographics, video abstracts, lay summaries and graphical abstracts, to support your article's impact. For more information, including pricing, visit this website.

9. **Figures.** Figures should be high quality (1200 dpi for line art, 600 dpi for grayscale and 300 dpi for colour, at the correct size). Figures should be supplied in one of our preferred file formats: PS, JPEG, TIFF, or Microsoft Word (DOC or DOCX) files are acceptable for figures that have been drawn in Word. For information relating to other file types, please consult our Submission of electronic artwork document.

10. **Tables.** Tables should present new information rather than duplicating what is in the text. Readers should be able to interpret the table without reference to the text. Please supply editable files.

11. **Equations.** If you are submitting your manuscript as a Word document, please ensure that equations are editable. More information about mathematical symbols and equations.

12. **Units.** Please use SI units (non-italicized).

Disclosure Statement

Please include a disclosure statement, using the subheading "Disclosure of interest." If you have no interests to declare, please state this (suggested wording: *The authors report no conflict of interest*). For all NIH/Wellcome-funded papers, the grant number(s) must be included in the declaration of interest statement. Read more on declaring conflicts of interest.

Complying With Ethics of Experimentation

Please ensure that all research reported in submitted papers has been conducted in an ethical and responsible manner, and is in full compliance with all relevant codes of experimentation and legislation. All papers which report in vivo experiments or clinical trials on humans or animals must include a written statement in the Methods section. This should explain that all work was conducted with the formal approval of the local human subject or animal care committees (institutional and national), and that clinical trials have been registered as legislation requires. Authors who do not have formal ethics review committees should include a statement that their study follows the principles of the Declaration of Helsinki.

Consent

All authors are required to follow the ICMJE requirements on privacy and informed consent from patients and study participants. Please confirm that any patient, service user, or participant (or that person's parent or legal guardian) in any research, experiment, or clinical trial described in your paper has given written consent to the inclusion of material pertaining to themselves, that they acknowledge that they cannot be identified via the paper; and that you have fully anonymized them. Where someone is deceased, please ensure you have written consent from the family or estate. Authors may use this Patient Consent Form, which should be completed, saved, and sent to the journal if requested.

Data Sharing Policy

This journal applies the Taylor & Francis Basic Data Sharing Policy. Authors are encouraged to share or make open the data supporting the results or analyses presented in their paper where this does not violate the protection of human subjects or other valid privacy or security concerns.

Authors are encouraged to deposit the dataset(s) in a recognized data repository that can mint a persistent digital identifier, preferably a digital object identifier (DOI) and recognizes a long-term preservation plan. If you are uncertain about where to deposit your data, please see this information regarding repositories.

Authors are further encouraged to cite any data sets referenced in the article and provide a Data Availability Statement.

At the point of submission, you will be asked if there is a data set associated with the paper. If you reply yes, you will be asked to provide the DOI, pre-registered DOI, hyperlink, or other persistent identifier associated with the data set(s). If you have selected to provide a pre-registered DOI, please be prepared to share the reviewer URL associated with your data deposit, upon request by reviewers.

Where one or multiple data sets are associated with a manuscript, these are not formally peer reviewed as a part of the journal submission process. It is the author's responsibility to ensure the soundness of data. Any errors in the data rest solely with the producers of the data set(s).

Appendix F. Quality Improvement (QI) Approval

Oxford University Hospitals NHS
NHS Foundation Trust

Clinical Audit Details					
Audit ID	9592	**Version**	1	**Audit Type**	Service Evaluation
Audit Priority	Non Mandatory			**Audit Source**	Internal - Linked To Clinical Training
Status	03 - Approved Local Audit				
Division	**Directorate**	**Department**		**Specialty**	
CSS	Psychological Medicine, Pain Management And Outpatients	Psychology		Psychological Medicine	
Project Supervisor			Simon Prangnell		
Clinical Audit (Lead responsible for completion of project)			Simon Prangnell		

Audit Title
Experiences of patients and family members/carers of assessment feedback in an outpatient neuropsychology service

Audit Description
This is a Service Improvement Project undertaken by a Trainee Clinical Psychologist and supervised by a Consultant Clinical Neuropsychologist. 1. The project is seeking to understand, and improve the experience of, receiving feedback following a neuropsychological assessment in acute outpatient adult neuropsychology service. 2. There are no criteria against which to measure performance. Best practice guidance and a limited amount of literature suggests that feedback is an important part of a neuropsychological assessment, that it has therapeutic benefits and can be delivered in a range for formats. 3. As outlined above there are no established standards. A minimum standard that could be derived from the existing literature is for feedback to have been delivered in some format (e.g report).

Methodology
Part 1. Current practice Baseline data The trainee will collect the following information from service records over the past 6 months: -Demographic information (e.g. age, sex, ethnicity, first language, years of education, and SES) -Number of referrals and assessments -How many clients opted in to verbal/written feedback -Methods used to provide feedback -Frequency of family members/carers attending feedback sessions Participants There are five qualified clinical psychologists working in the service, who are all willing to provide information on their feedback methods. Measures An online questionnaire will be used to collect information on practical aspects (e.g. timing, duration, modality) and the content of typical feedback provided to patients and families/carers. Questions will be developed based on input from the external supervisor, existing frameworks for neuropsychological feedback (Gass & Brown, 1992; Gorske, 2008; Postal & Armstrong, 2013), and Ley's (1982) cognitive model of communication. Analysis Questionnaire data will be summarised using descriptive statistics with R software. Where possible, opt-in rates to feedback will be compared across demographic characteristics using ANOVAs, t-tests, and/or ?2 tests. Part 2. Service user experiences Participants Patients and family members/carers will be asked whether they are interested in participating in research during their assessment. Individuals who provide consent will be contacted by the trainee via phone or email. Four couples of participants (4 patients and 4 carers/family members) will be recruited for a semi-structured interview on their feedback experience, which will take place within 3 weeks after receiving feedback. Purposive sampling will be used to include patients presenting with different diagnoses and domains/severity of cognitive impairments, who were assessed by different psychologists, and who have different relationships to the family member/carer (e.g. partner/parent). Inclusion criteria: -=18 years -Able to provide written informed consent -Able to concentrate for min. 20 minutes

-Sufficient English to understand and respond to interview questions
Exclusion criteria:
-Severe cognitive or communication impairment
-Assessment did not include neuropsychological testing
-Patient opted out of feedback session
-Below-average performance on effort test
-Severe psychiatric disorders
Measures
An interview topic guide will be developed collaboratively with the supervisors and experts by experience. Interviews will take place in hospital or via videocall, which will be recorded on Teams and transcribed using Otter.ai software. Key topics include the format of feedback (verbal/written, timing, duration, adjustments), understanding and relevance of information, and suggested changes.
Analysis
All interview data will be explored using thematic analysis (Braun & Clarke, 2006).
Potential problems and alternatives
Participants may experience unanticipated barriers; should this occur, we will make further adjustments if feasible (e.g. visual support materials, home visits following lone working policies) to ensure accessibility.
Data management
Questionnaire data will be collected using MS Forms following Trust policy. Semi-structured interviews will be voice-recorded only using Teams and deleted following transcription. Relevant clinical information will be extracted from patient's medical notes. All data will be pseudonymised, with a separate password-protected file containing names and corresponding participant IDs. Data will be uploaded to an encrypted server and removed after 5 years.
Governance issues
The NHS Health Research Authority decision tool indicates that this project does not require NHS ethics (Appendix A). The project will be submitted for approval to the PPO Directorate Management Executive who has authority to approve improvement projects. Participants may find discussing their experience or cognitive difficulties distressing. Clear information about the study will be provided to minimise this possibility, and signposting to relevant support services (e.g. GP, Mind, Headway) will be provided. If there are participant safety concerns the trainee will contact Dr Prangnell or inform the local crisis team if there is immediate risk.
Dissemination and implementation
Results will be presented to the service in a neuropsychology CPD and/or referral meeting. Written reports will be distributed to the service and associated local organisations, and a manuscript will be submitted to a relevant professional journal (e.g. The Clinical Neuropsychologist).
Budget
Four hours of PPI participation (£15 per hour) are needed and reasonable travel costs will be reimbursed (Appendix B). Reimbursement for PPI and travel costs will be provided by the Oxford Doctorate in Clinical Psychology.

Requested	12/08/2024	**Target start**	02/09/2024	**Target completion**	16/10/2025	**Approved**	21/08/2024

Appendix G. Qualtrics XM Survey

Survey questions were informed by existing frameworks for providing feedback on neuropsychological assessments (Gass & Brown, 1992; Gorske, 2008), the cognitive model of health communication (Kessels, 2003; Ley, 1982), and a consultation with two clinical psychologists.

1) Which of the following forms of feedback do you typically offer to patients and their relatives/carers? Tick all that apply.
    - ☐ Verbal feedback (1 session)
    - ☐ Verbal feedback (multiple sessions)
    - ☐ Written report
    - ☐ Other *(allow free text for details)*
    - ☐ None (*allow free text for details*)

Branching:

- *If 'none' is selected, go to Q.2*
- *If any of the 'verbal feedback' AND the written report options are selected, go to Q.3*
- *If 'verbal feedback' is selected but 'written report' is not, present Q.3-5 and Q.8-10.*
- *If 'written report' is selected but 'verbal feedback' is not, present Q.6-8 and Q.10*

2) What are the main reasons for not offering feedback to patients or relatives/carers? *Allow free text for details*.

3) How do you tend to provide verbal feedback? Please select all that apply, and rank these from highest to lowest frequency.
    - ☐ In person
    - ☐ Via telephone
    - ☐ Via videocall
    - ☐ Other *(allow free text for details)*
    - ☐ Additional comments: (*allow free text for details)*

4) When would you usually offer verbal feedback? Please select all that apply, and rank these from highest to lowest frequency.

- ☐ On the same day as the assessment
- ☐ Within 1 week after the assessment
- ☐ Within 2 weeks after the assessment
- ☐ Within 3 weeks after the assessment
- ☐ Within 1 month after the assessment
- ☐ More than 1 month after the assessment
- ☐ Additional comments: (*allow free text for details)*

5) What is the typical duration of a verbal feedback session?
   - ☐ Up to 15 minutes
   - ☐ Up to 30 minutes
   - ☐ Up to 45 minutes
   - ☐ Up to 1 hour
   - ☐ Up to 1 ½ hours
   - ☐ More than 1 ½ hours
   - ☐ Additional comments: (*allow free text for details)*

6) When would the patient typically receive the neuropsychological report?
   - ☐ On the same day as the assessment
   - ☐ Within 1 week after the assessment
   - ☐ Within 2 weeks after the assessment
   - ☐ Within 3 weeks after the assessment
   - ☐ Within 1 month after the assessment
   - ☐ More than 1 month after the assessment
   - ☐ Additional comments: (*allow free text for details)*

7) Who is normally the primary intended recipient of your neuropsychological assessment/feedback reports? Select all that apply and rank in order of frequency.
   - ☐ The referrer
   - ☐ The patient
   - ☐ The carer/relative
   - ☐ Separate letters to patients and referrer
   - ☐ Other (*allow free text for details)*
   - ☐ Additional comments: (*allow free text for details)*

8) Which of the following elements do you typically include in your feedback sessions and/or reports? Please select all that apply and rank in order of priority.

- ☐ Reviewing the purpose of the assessment
- ☐ Reviewing the patient's main goals and/or questions
- ☐ Discussion of the results from each test
- ☐ Discussion of the results from each domain
- ☐ Psychoeducation (*allow free text for details on type of psychoeducation)*
- ☐ Overview of the patient's strengths and weaknesses
- ☐ Discussing (differential) diagnosis
- ☐ Implications for daily life
- ☐ Discussion of prognosis
- ☐ Strategies and/or recommendations for cognitive difficulties
- ☐ Strategies and/or recommendations for lifestyle factors
- ☐ Advice regarding mental health support
- ☐ Signposting to other services
- ☐ Opportunity for the patient/carer/relative to ask questions
- ☐ Other (*allow free text for details)*
- ☐ Additional comments: (*allow free text for details)*

9) Which of the following strategies do you use regularly in feedback sessions, if any? Please select all that apply and rank in order of frequency.

- ☐ Visual aids (*allow text for further details*)
- ☐ Simplifying language (*allow text for further details*)
- ☐ Use of metaphors (*allow text for further details*)
- ☐ Use of summaries (*allow text for further details*)
- ☐ Involvement of interpreters (*allow text for further details*)
- ☐ Technological aids (*allow text for further details*)
- ☐ Other (*allow text for further details)*
- ☐ None (*allow text for further details*)

10) What are the main barriers you experience in providing effective feedback to patients and/or carers? *Allow free text*.

Appendix H. Semi-Structured Interview Topic Guide

1) ***Context information:*** **What was the reason for your referral/assessment?**
    i. What was your understanding of why the neuropsychological assessment was done?
    ii. Did you have a single or multiple assessments?

2) **What was your experience of receiving the feedback?**
    i. Did you have an in-person feedback session? What happened in that session?
    ii. Did you go on your own, or did someone go with you?
    iii. Did you receive a report? What was in the report?
    iv. What did you most want to know about your assessment results?

3) **What aspects of the feedback were useful/informative, and what aspects were less useful/informative?**
    i. Probe: was there anything else you would have liked to know/discuss?
    ii. Probe (more about emotional aspects): how did you feel about the way the feedback was delivered?
    iii. Probe: how much did the feedback focus on strengths vs. weaknesses? What did you think about this?
    iv. Probe: how important was it for you to receive this information?

4) **How understandable was the information that was given to you?**
    i. Probe: were there any adjustments that were/could have been made to help you understand it better?
    ii. Probe: which parts of the report or verbal feedback were most difficult/easiest to understand?
    iii. Probe: how able did you feel to ask questions about the results of the assessment? How much time did you have to ask questions?
    iv. Probe: would you have found it helpful to have a simplified version of the report?

5) **What did you think about the format of the feedback?**
    i. Probe: did the language used make sense to you?

ii. Probe: roughly how long after the assessment did you get the feedback? What are your thoughts on this timing?
iii. Probe: what did you think about the level of detail of information given?
iv. Probe: what did you think about the structure of the report/feedback session?
v. Probe: how did you feel about the length of the verbal feedback session?
vi. Probe: who was the report written for?
vii. Probe: do you have a preference for an in-person session, phone call, and/or written report?

6) **If feedback included both verbal feedback and a letter/written report:**
   i. Probe: How much does what you told me relate to the verbal feedback and/or the report?
   ii. Probe: did you get more from one or the other?
   iii. Probe: was it useful to have both?

7) **What did you take away from the feedback?**
   i. Probe: what impact do you feel the feedback has had on you, if any?
   ii. Probe: is there anything you do differently now because of the feedback given?

8) **Is there anything else you would like to say about the feedback process that I haven't asked you about?**

Appendix I. Research Team and Qualitative Analysis Details

The research team consisted of the trainee clinical psychologist, a consultant clinical neuropsychologist, and a systemic family psychotherapist and consultant clinical psychologist. The trainee had previously completed a PhD in Clinical Neurosciences and 7 years of post-doctoral experience in neuropsychological research and clinical settings. The trainee's professional values and interests (e.g. taking a person-centred approach and interest in psychoeducation), experiences of working in neuropsychological services, and familiarity with cognitive neuropsychological theory shaped their interpretation of the data and theme development. Reflexive thematic analysis involved (1) data familiarisation through reading and re-reading the transcripts, (2) iteratively generating codes across the entire dataset, which were initially hand-written with subsequent labelling and organisation of the codes in NVivo software, (3) collating codes into initial themes and gathering relevant data, (4) reviewing themes and codes, ensuring that the overall dataset and coded extracts fit the themes, (5) refining and naming the themes in consultation with the internal and external research supervisors, and (6) producing a report of the analysis including selection of relevant extracts.

Appendix J. Braun and Clarke's (2006) 15-Point Checklist for Qualitative Research

Process	No.	Criteria
Transcription	1	The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'.
Coding	2	Each data item has been given equal attention in the coding process.
	3	Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive.
	4	All relevant extracts for each theme have been collated.
	5	Themes have been checked against each other and back to the original data set.
	6	Themes are internally coherent, consistent, and distinctive.
Analysis	7	Data have been analysed – interpreted, made sense of – rather than just paraphrased or described.
	8	Analysis and data match each other – the extracts illustrate the analytic claims.
	9	Analysis tells a convincing and well-organised story about the data and topic.
	10	A good balance between analytic narrative and illustrative extracts is provided.
Overall	11	Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly.
Written report	12	The assumptions about, and specific approach to, thematic analysis are clearly explicated.
	13	There is a good fit between what you claim you do, and what you show you have done – i.e. described method and reported analysis are consistent.
	14	The language and concepts used in the report are consistent with the epistemological position of the analysis.

	15	The researcher is positioned as *active* in the research process; themes do not just 'emerge'.

Appendix K. Audit Results

Table K1

Primary Diagnoses of Patients Referred for a Neuropsychological Assessment (N = 128)

Primary diagnosis	n (%)
Cancer/brain tumour	34 (26.6%)
Epilepsy/seizures	26 (20.3%)
Neurodegenerative disorder	23 (18.0%)
Cardiovascular disease	18 (14.1%)
Diagnosis not specified	13 (10.2%)
Autoimmune/systemic conditions	9 (7.0%)
Traumatic brain injury	9 (7.0%)
Other	7 (5.5%)
Functional neurological disorder	5 (3.9%)
Movement disorder	5 (3.9%)
Alcohol-related dementia	2 (1.6%)
Viral or bacterial infection	2 (1.6%)

Table K2

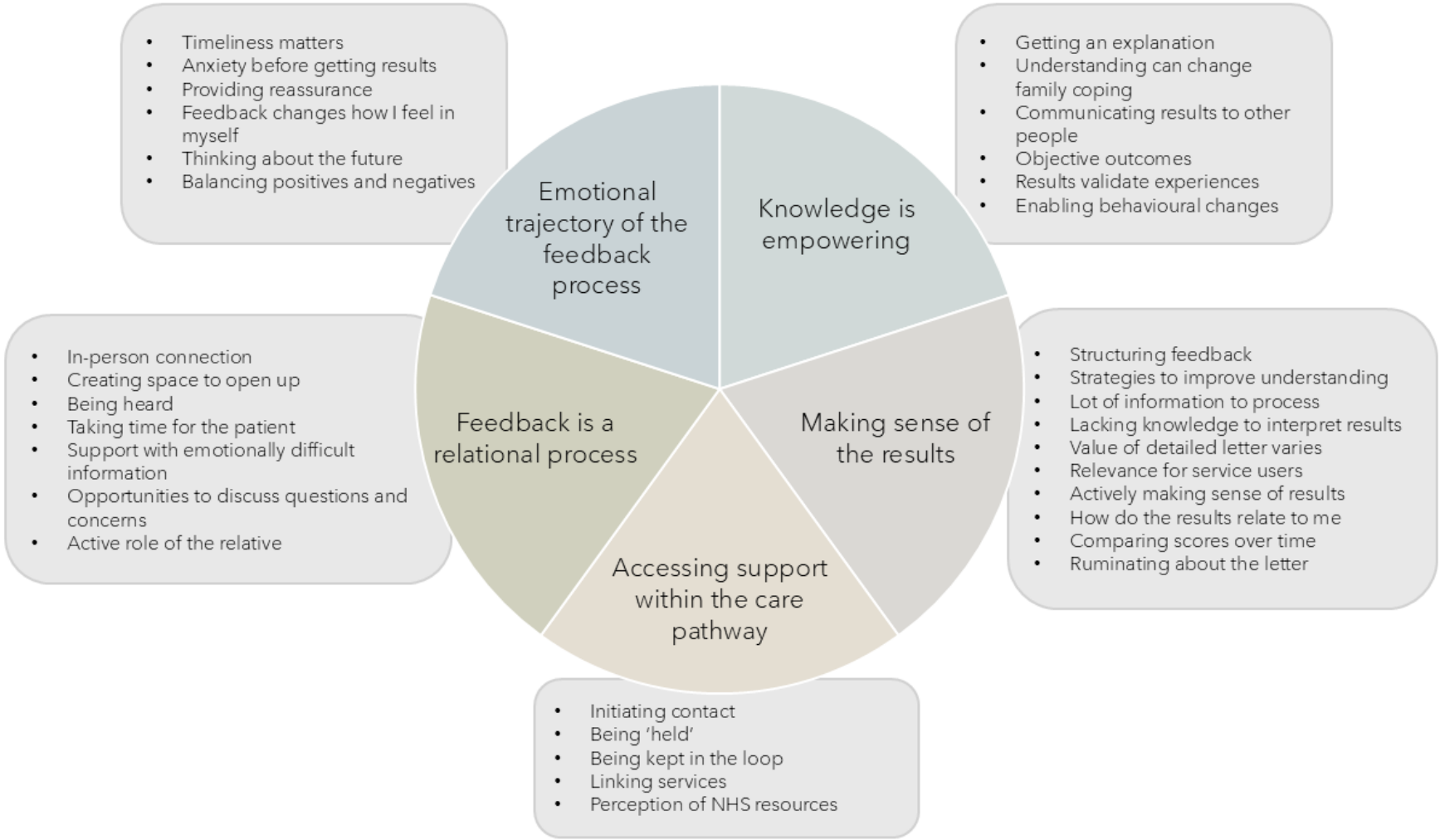
Reasons for Not Conducting a Cognitive Assessment (N = 25)

Reason provided	n (%)
Referral reason not for cognitive assessment	9 (36.0%)
Not indicated	7 (28.0%)
Physical barriers (e.g. speech, hearing, fatigue)	3 (12.0%)
Mental health difficulties	2 (8.0%)
Assessment previously completed	2 (8.0%)
Difficulties engaging	1 (4.0%)
Did not attend	1 (4.0%)

Appendix L. Qualitative Responses to Clinical Practice Survey

Question	Summary of responses
When would you usually offer feedback?	For the written report, one respondent indicated that this is dependent on how much time is available to write the report.
Who is the intended recipient of the written report?	One respondent stated that it is typically most important to provide information to the referrer due to specific referral reasons. However, they also noted they would keep in mind that the patient would read the letter as well.
Which elements do you include in your feedback sessions and/or reports?	One respondent indicated that all elements listed were important, but that it would be rare to include all of them in one feedback session. In terms of psychoeducation, three respondents said that topics might include executive functioning, the interaction of psychological and neurological processes, and 'normal' cognitive functioning. Signposting to specific services mentioned by three respondents included mental health services, neurorehabilitation, physiotherapy, and vocational rehabilitation.
What are the main barriers to providing effective feedback?	All respondents suggested there were typically no barriers. Examples of exceptions listed by three respondents included fatigue, conflict with family members, or the patient's lack of insight into their difficulties.

Appendix M. Themes and Codes



Appendix N. Journal of Affective Disorders Instructions to Authors

Article types

The Journal primarily publishes:

Full-Length Research Papers

(up to 5000 words, excluding references and up to 6 tables/figures)

Review Articles and Meta-analyses

(up to 8000 words, excluding references and up to 10 tables/figures)

Short Communications

(up to 2000 words, 20 references, 2 tables/figures)

Correspondence

(up to 1000 words, 10 references, 1 table/figure).

At the discretion of the accepting Editor-in-Chief, and/or based on reviewer feedback, authors may be allowed fewer or more than these guidelines.

Declaration of competing interests

All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence or bias their work. Examples of potential competing interests include:

- Employment
- Consultancies
- Stock ownership

- Honoraria
- Paid expert testimony
- Patent applications or registrations
- Grants or any other funding
- Affiliation with the journal as an Editor or Advisory Board Member

The declarations tool should always be completed.

Authors with a journal affiliation to declare should enter the following text under “Other Activities” within the declarations tool and should inform the journal and publisher prior to completing the submission process:
Given their role as [insert journal role title], [insert your name] had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to another journal editor.

Editorial disclosure statements will be included as a footnote and/or in the declaration of competing interest section of the article.

Authors with no competing interests to declare should select the option "I have nothing to declare".

The resulting Word document containing your declaration should be uploaded at the "attach/upload files" step in the submission process. It is important that the Word document is saved in the .doc/.docx file format. Author signatures are not required.

Funding sources

Authors must disclose any funding sources who provided financial support for the conduct of the research and/or preparation of the article. The role of sponsors, if any, should be declared in relation to the study design, collection, analysis and interpretation of data, writing of the report and decision to submit the article for publication. If funding sources had no such involvement this should be stated in your submission.

List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants, scholarships and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, it is recommended to include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Writing and formatting

File format

We ask you to provide editable source files for your entire submission (including figures, tables and text graphics). Some guidelines:

- Save files in an editable format, using the extension .doc/.docx for Word files and .tex for LaTeX files. A PDF is not an acceptable source file.

- Format Word files in a single-column layout. Double-column formatting is only permitted for LaTeX submissions.
- Remove any strikethrough and underlined text from your manuscript, unless it has scientific significance related to your article.
- Use spell-check and grammar-check functions to avoid errors.

We advise you to read our Step-by-step guide to publishing with Elsevier.

Title page

You are required to include the following details in the title page information:

- Article title. Article titles should be concise and informative. Please avoid abbreviations and formulae, where possible, unless they are established and widely understood, e.g. DNA.
- Author names. Provide the given name(s) and family name(s) of each author. The order of authors should match the order in the submission system. Carefully check that all names are accurately spelled. If needed, you can add your name between parentheses in your own script after the English transliteration.
- Affiliations. Add affiliation addresses, referring to where the work was carried out, below the author names. Indicate affiliations using a lower-case superscript letter immediately after the author's name and in front of the corresponding address. Ensure that you provide the full postal address of each affiliation, including the country name and, if available, the email address of each author.
- Corresponding author. Clearly indicate who will handle correspondence for your article at all stages of the refereeing and publication process and also post-publication. This responsibility includes answering any future queries about your

results, data, methodology and materials. It is important that the email address and contact details of your corresponding author are kept up to date during the submission and publication process.

- Present/permanent address. If an author has moved since the work described in your article was carried out, or the author was visiting during that time, a "present address" (or "permanent address") can be indicated by a footnote to the author's name. The address where the author carried out the work must be retained as their main affiliation address. Use superscript Arabic numerals for such footnotes.

Abstract

You are required to provide a concise and factual abstract which does not exceed 250 words. The abstract should briefly state the purpose of your research, principal results and major conclusions. Some guidelines:

- Abstracts must be able to stand alone as abstracts are often presented separately from the article.
- Avoid references. If any are essential to include, ensure that you cite the author(s) and year(s).
- Avoid non-standard or uncommon abbreviations. If any are essential to include, ensure they are defined within your abstract at first mention.

Keywords

You are required to provide 1 to 7 keywords for indexing purposes. Keywords should be written in English. Please try to avoid keywords consisting of multiple words (using "and" or "of").

We recommend that you only use abbreviations in keywords if they are firmly established in the field.

Highlights

You are required to provide article highlights at submission.

Highlights are a short collection of bullet points that should capture the novel results of your research as well as any new methods used during your study. Highlights will help increase the discoverability of your article via search engines. Some guidelines:

- Submit highlights as a separate editable file in the online submission system with the word "highlights" included in the file name.
- Highlights should consist of 3 to 5 bullet points, each a maximum of 85 characters, including spaces.

We encourage you to view example article highlights and read about the benefits of their inclusion.

Tables

Tables must be submitted as editable text, not as images. Some guidelines:

- Place tables next to the relevant text or on a separate page(s) at the end of your article.
- Cite all tables in the manuscript text.
- Number tables consecutively according to their appearance in the text.
- Please provide captions along with the tables.
- Place any table notes below the table body.
- Avoid vertical rules and shading within table cells.

We recommend that you use tables sparingly, ensuring that any data presented in tables is not duplicating results described elsewhere in the article.

Figures, images and artwork

Figures, images, artwork, diagrams and other graphical media must be supplied as separate files along with the manuscript. We recommend that you read our detailed artwork and media instructions. Some excerpts:

When submitting artwork:

- Cite all images in the manuscript text.
- Number images according to the sequence they appear within your article.
- Submit each image as a separate file using a logical naming convention for your files (for example, Figure_1, Figure_2 etc).
- Text graphics may be embedded in the text at the appropriate position. If you are working with LaTeX, text graphics may also be embedded in the file.

Figure captions

All images must have a caption. A caption should consist of a brief title (not displayed on the figure itself) and a description of the image. We advise you to keep the amount of text in any image to a minimum, though any symbols and abbreviations used should be explained.

Read how to add captions to your submission here.

Supplementary material

We encourage the use of supplementary materials such as applications, images and sound clips to enhance research. Some guidelines:

- Supplementary material should be accurate and relevant to the research.

- Cite all supplementary files in the manuscript text.
- Submit all supplementary materials at the same time as your manuscript.
- Include a concise, descriptive caption for each supplementary file, describing its content.
- After submission supplementary files can only be added or replaced in the revision stage of the editorial process.
- Be aware that all supplementary materials provided will appear online in the exact same way as received. These files will not be checked, formatted or typeset by the production team.

Data statement

To foster transparency, you are encouraged to state the availability of any data at submission.

Ensuring data is available may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you can state the reason why (e.g., your research data includes sensitive or confidential information such as patient data) during the submission process. This statement will appear with your published article on ScienceDirect.

Read more about the importance and benefits of providing a data statement.

Article structure

Article sections

Divide your manuscript into clearly defined sections covering all essential elements using headings.

Footnotes

We advise you to use footnotes sparingly. If you include footnotes in your article, ensure that they are numbered consecutively.

You may use system features that automatically build footnotes into text. Alternatively, you can indicate the position of footnotes within the text and present them in a separate section at the end of your article.

Acknowledgements

Include any individuals who provided you with help during your research, such as help with language, writing or proof reading, in the acknowledgements section.

Acknowledgements should be placed in a separate section which appears directly before the reference list. Do not include acknowledgements on your title page, as a footnote to your title, or anywhere else in your article other than in the separate acknowledgements section.

Author contributions: CRediT

Corresponding authors are required to acknowledge co-author contributions using CRediT (Contributor Roles Taxonomy) roles:

- Conceptualization
- Data curation
- Formal analysis
- Funding acquisition
- Investigation
- Methodology
- Project administration

- Resources
- Software
- Supervision
- Validation
- Visualization
- Writing – original draft
- Writing – review and editing

Not all CRediT roles will apply to every manuscript and some authors may contribute through multiple roles.

We advise you to read more about CRediT and view an example of a CRediT author statement.

Appendices

We ask you to use the following format for appendices:

- Identify individual appendices within your article using the format: A, B, etc.
- Give separate numbering to formulae and equations within appendices using formats such as Eq. (A.1), Eq. (A.2), etc. and in subsequent appendices, Eq. (B.1), Eq. (B. 2) etc. In a similar way, give separate numbering to tables and figures using formats such as Table A.1; Fig. A.1, etc.

References

References within text

Any references cited within your article should also be present in your reference list and vice versa. Some guidelines:

- References cited in your abstract must be given in full.
- We recommend that you do not include unpublished results and personal communications in your reference list, though you may mention them in the text of your article.
- Any unpublished results and personal communications included in your reference list must follow the standard reference style of the journal. In substitution of the publication date add "unpublished results" or "personal communication."
- References cited as "in press" imply that the item has been accepted for publication.

Linking to cited sources will increase the discoverability of your research. We encourage the use of Digital Object Identifiers (DOIs) as reference links, as they provide a permanent link to the electronic article referenced.

Before submission, check that all data provided in your reference list are correct, including any references which have been copied. Providing correct reference data allows us to link to abstracting and indexing services such as Scopus, Crossref and PubMed. Any incorrect surnames, journal or book titles, publication years or pagination within your references may prevent link creation.

Reference style

All citations in the text should refer to:

- Single author: the author's name (without initials, unless there is ambiguity) and the year of publication.

- Two authors: both authors' names and the year of publication.
- Three or more authors: first author's name followed by 'et al.' and the year of publication.

Citations can be made directly (or parenthetically). Groups of references can be listed either first alphabetically, then chronologically, or vice versa. Examples: "as demonstrated (Allan, 2020a, 2020b; Allan and Jones, 2019)" or "as demonstrated (Jones, 2019; Allan, 2020). Kramer et al. (2023) have recently shown".

The list of references should be arranged alphabetically and then chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication.

Abbreviate journal names according to the List of Title Word Abbreviations (LTWA).

Appendix O. Journal of Affective Disorders Publication

Journal of Affective Disorders 403 (2026) 121305

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Understanding the relationship between post-stroke cognitive impairments and depression: The role of loneliness

Margot Juliëtte Overman [a], Reena Vohora [a], Nele Demeyere [b,*]

[a] The Oxford Institute of Clinical Psychology Training and Research, University of Oxford, Warneford Hospital, Oxford, OX3 7JX, United Kingdom
[b] Nuffield Department of Clinical Neurosciences, University of Oxford, John Radcliffe Hospital, Oxford, OX3 9DU, United Kingdom

ARTICLE INFO

Keywords:
Stroke
Cognition
Depression
Loneliness
Social isolation
Social disconnectedness

ABSTRACT

Background: Post-stroke cognitive impairments have been shown to increase the risk of depression, however the mechanisms underpinning this association are not well understood. The theory of social isolation in chronic illness proposes that the relationship between symptom severity in chronic conditions and mood disorders is mediated by social isolation. This study therefore aimed to explore the impact of social isolation on depression in stroke survivors with and without cognitive impairments.

Methods: Stroke survivors were recruited ≥6 months post-stroke from the Oxford Screening Programme and completed assessments of cognitive function, social isolation, and depression. Measures of social isolation evaluated both subjective feelings of loneliness and objective social disconnectedness. Multiple linear regressions examined associations of cognition and social isolation with depression symptoms, and serial mediation analyses assessed potential mediating effects of loneliness and social disconnectedness.

Results: Eighty-five participants completed the study measures. Chronic cognitive impairments predicted depressive symptoms in stroke survivors ($\beta = 1.11$, $p < 0.001$). This relationship was mediated by feelings of loneliness, which were associated with higher depression scores in participants with more severe cognitive impairments (indirect effect [IE] = 0.294, $p < 0.05$). Whilst significant direct effects were observed between all variables in the mediation analyses (all $p < 0.05$), there was no evidence for indirect effects of social disconnectedness.

Conclusions: Subjective experiences of loneliness, but not objective social disconnectedness, may increase the risk of depression in stroke survivors with cognitive deficits. These findings suggest that feelings of loneliness may be a suitable target for intervention in post-stroke depression.

1. Introduction

Stroke is one of the leading medical causes of disability worldwide, influencing physical, cognitive, and communicative functioning (Feigin et al., 2025; Goljar et al., 2010). Mental health is strongly affected in both acute and long-term recovery, with estimates suggesting 29% of stroke survivors present with depression and rates remaining stable up to 10 years after the event (Ayerbe et al., 2013). Post-stroke depressive symptoms negatively impact on survival, functional recovery, and quality of life (Dafer et al., 2008; Gbiri et al., 2010). In order to develop preventative strategies and effective interventions, it is crucial that factors contributing to post-stroke depression are identified. Importantly, post-stroke cognitive impairments have been shown to predict poorer mental health outcomes (Nys et al., 2006; Turunen et al., 2018; Williams and Demeyere, 2021). Chronic cognitive impairments affect 20%to 85% of stroke survivors (Demeyere et al., 2016; Sexton et al., 2019) and encompass a wide range of domains, including executive functioning, memory, language, and visuospatial abilities (Jokinen et al., 2015). Most stroke survivors present with multi-domain deficits (Milosevich et al., 2024) which have additive effects on the risk of depression (Williams and Demeyere, 2021). However, the mechanisms by which cognitive impairments may lead to depression are not well understood.

1.1. Social isolation in chronic illness

The middle-range theory of social isolation in chronic illness (Iovino et al., 2023) posits that social isolation is a driving factor in the

* Corresponding author.
E-mail addresses: margot.overman@psy.ox.ac.uk (M.J. Overman), reena.vohora@psy.ox.ac.uk (R. Vohora), nele.demeyere@ndcn.ox.ac.uk (N. Demeyere).

https://doi.org/10.1016/j.jad.2026.121305
Received 20 October 2025; Received in revised form 11 January 2026; Accepted 28 January 2026
Available online 30 January 2026
0165-0327/© 2026 Published by Elsevier B.V.

development of depression in persistent physical health conditions. It suggests that precipitating and predisposing factors, such as the frequency and severity of symptoms, increase the risk of social isolation which in turn affects health outcomes including depression. Social isolation is a complex construct, which consists of two interacting elements: social disconnectedness and loneliness. Social disconnectedness is defined as an *objective* measure of social isolation, which reflects a lack of contact with other individuals (Cornwell and Waite, 2009a). In contrast, loneliness refers to the *subjective* experience of social isolation, resulting from a perception of a discrepancy between the relationships one expects and the actual relationships one has (Peplau and Perlman, 1982). Whilst they can co-occur, it has been demonstrated that social disconnectedness and loneliness are distinct concepts which are independently associated with different health outcomes (Cornwell and Waite, 2009b). The physical presence of others is not in itself sufficient to prevent feelings of loneliness (Cacioppo et al., 2015), and conversely it is possible to be socially disconnected without feeling lonely (Hawkley and Cacioppo, 2010). Congruently, the correlation between loneliness and disconnectedness has been found to be weak to moderate (Cornwell and Waite, 2009b; Golden et al., 2009). It has therefore been proposed that there are four categories of social isolation: neither disconnected nor lonely, disconnected but not lonely, lonely but not disconnected, and both disconnected and lonely (Andersson, 1986; Iovino et al., 2023; see Fig. 1A). Evidence for the existence of these subgroups has been provided by Smith and Victor (2019) using latent class analysis. Both social disconnectedness and loneliness are associated with depression in healthy adults, although the underlying mechanisms may differ (Cornwell and Waite, 2009b) and loneliness typically has a stronger effect (Ge et al., 2017). Research on social isolation should therefore assess both social disconnectedness and loneliness to ascertain whether they exert independent and/or additive effects on mental health (Taylor et al., 2018).

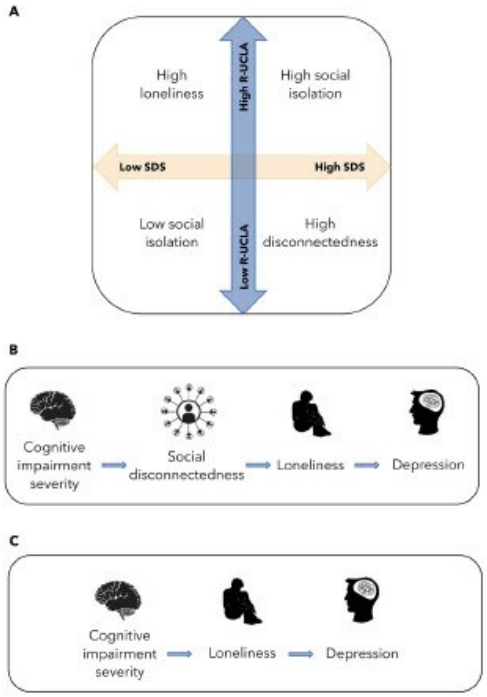


Fig. 1. (A) Patterns of social isolation based on social disconnectedness (Social Disconnectedness Scale; SDS) and loneliness (Revised UCLA Loneliness Scale; R-UCLA) scores. (B) Serial mediation with cognitive impairment severity causing reduced social connectedness, which results in feelings of loneliness that lead to depression. (C) Simple mediation with cognitive impairments causing loneliness (independent of objective social connectedness) which increases the risk of depression.

1.2. The impact of social isolation on post-stroke depression

Iovino et al. (2023) emphasise that their theory remains to be tested empirically for specific illnesses. Applying their hypotheses to chronic symptoms of stroke, we predict that greater severity of cognitive impairments may increase social isolation, which consequently heightens the risk of depressive symptoms. There is emerging evidence that social isolation presents a risk factor for depression in stroke survivors (Goh et al., 2019; Petitte et al., 2015). However, the contribution of cognitive impairments to this relationship remains to be explored. Qualitative studies suggest that there are different pathways by which cognitive impairments may lead to social isolation. First, cognitive impairments may produce practical barriers to social participation. For example, stroke survivors with cognitive impairments indicated that dependence on others restricts their engagement in social and leisure activities (Norlander et al., 2022). Moreover, difficulties with attention and memory interfered with stroke survivors' ability to participate meaningfully in social interactions, leading to a reduced number of social relationships (Bennett et al., 2024). Accordingly, Iovino et al. (2023) suggest a serial mediation process by which this social disconnectedness causes feelings of loneliness, which then result in depressive symptoms (see Fig. 1B). A second pathway involves a direct effect of loneliness through changes in stroke survivors' perceptions of themselves and the quality of their relationships. Individuals with acquired brain injuries who have cognitive impairments report feeling psychologically distant from and misunderstood by others, and alone in their experience of brain injury (Dunne et al., 2023; Salter et al., 2008; Yang et al., 2022). In addition, they describe attempting or feeling pressure to conceal perceived deficits (Crowe et al., 2016; Lowe et al., 2021) which further reduces the quality of social relationships. Thus, there may be a simple mediation process in which cognitive impairments directly heighten experiences of loneliness and thereby depressive symptoms (Iovino et al., 2023; see Fig. 1C) even when the individual objectively has a large social network or participates in social activities.

1.3. Study aims and hypotheses

From a clinical perspective, a better understanding of the effects of social isolation on depression in stroke survivors with chronic cognitive impairments could help identify new and more timely targets and strategies for interventions. This study therefore seeks to clarify the relationship between chronic post-stroke cognitive impairments, social isolation, and depression. We hypothesise that (1) results will replicate and extend previous findings that the severity of cognitive impairments predicts symptoms of depression (Williams and Demeyere, 2021) in the chronic phase post-stroke, (2) social isolation will be associated with higher depression scores, with a stronger effect of loneliness compared with social disconnectedness as previously suggested (Ge et al., 2017), and (3) the relationship between cognitive impairments and depression will be mediated by social isolation.

2. Methods

2.1. Patient and public involvement

Three stroke survivors were consulted regarding the main research question, participant information sheets, and measures of social

isolation to ensure project relevance and accessibility. These experts by experience indicated that the main research questions were relevant for this population based on their personal experiences and contact with other stroke survivors. They emphasised the importance of clarifying the inclusion criteria, for example that individuals did not have to feel depressed or socially isolated to be eligible. In addition, they suggested providing different options for completing questionnaires on sensitive topics where possible (e.g. reading out the questions, filling out questionnaires independently, or asking a relative/carer to assist). Procedures were adjusted to incorporate the recommendations.

2.2. Recruitment and participants

Eighty-five participants were recruited from the Oxford Screening Programme (Milosevich et al., 2024). Stroke survivors were included if they were (1) 18 years or older, (2) admitted with a suspected or confirmed stroke ≥6 months previously, (3) able and willing to provide informed consent, (4) able to sufficiently understand English to complete the study questionnaires, and (5) able to concentrate for approximately 30 min consecutively.

2.3. Study procedure

Ethical approval for the study was obtained from the Central University Research Ethics Committee (CUREC; Ethics Ref: 94589/RE002). Stroke survivors were contacted by phone or email, provided with information sheets, and given the opportunity to ask questions before deciding whether to take part. All participants provided informed consent in accordance with the 1964 Helsinki declaration and its later amendments. In-person sessions were arranged in which participants completed a cognitive screening tool along with questionnaires assessing social isolation and depression. Participants were offered regular breaks throughout the session to minimise effects of fatigue. At the end of the session participants were offered signposting information to mental health support services.

2.4. Demographics and stroke characteristics

Demographic details and stroke characteristics were obtained from participants' records in the Oxford Screening Programme. Information collected included participant age, sex, education (years), type of stroke, lesion hemisphere, time since stroke, acute stroke severity as measured with the National Institutes of Health Stroke Scale (NIHSS), and acute level of functional impairment as indicated by the Barthel Index (BI; Mahoney and Barthel, 1965).

2.5. Cognitive assessment

The Oxford Cognitive Screen (OCS; Demeyere et al., 2015) is a screening tool which was designed to evaluate common cognitive impairments associated with stroke. The OCS assesses six cognitive domains: visuospatial attention, executive function, language, memory, number processing, and praxis. It takes approximately 15–20 min to administer and has good content validity, specificity, and sensitivity for impairments across cognitive domains in stroke survivors (Demeyere et al., 2015). Subtest outcomes were binarized as impaired or unimpaired according to cut-off scores based on normative data. Domains were considered impaired if there was at least one subtest score outside the cut-off range.

2.6. Social isolation measures

Social disconnectedness was measured with the 8-item Social Disconnectedness Scale (SDS; Cornwell and Waite, 2009a) which evaluates social network size and range, frequency of interaction with members of the personal network, household size, number of friends, frequency of socialising with friends, family, and groups, and volunteering activities. The SDS has satisfactory internal consistency (Cronbach's $\alpha = 0.73$) and construct validity (Cornwell and Waite, 2009a). SDS outcomes were converted into z-scores across the sample, with higher scores representing greater social disconnectedness. Loneliness was assessed with the 11-item Revised University of California, Los Angeles Loneliness Scale (R-UCLA; Lee and Cagle, 2017). The R-UCLA uses a three-point Likert scale, with higher scores suggesting greater levels of subjective loneliness. The 11-item R-UCLA has good internal consistency (Cronbach's $\alpha = 0.87$) and content validity (Lee and Cagle, 2017).

2.7. Mental health outcomes

The depression and anxiety subscales from the Hospital Anxiety and Depression Scale (HADS-D and HADS-A, respectively; Zigmond and Snaith, 1983) were used to assess mental health outcomes. The HADS is a 14-item questionnaire with scores ranging from 0 to 21 for each subscale. Higher scores represent greater symptomatology, with scores ≥8 indicating symptoms in the clinical range. This measure has good psychometric properties with sensitivity and specificity at the level of 0.80 (Bjelland et al., 2002) and is suitable for assessing symptoms of mood disorders specifically in stroke survivors (Aben et al., 2002; Ayis et al., 2018).

2.8. Sample size

A power analysis was carried out using the 'mc_power_med' package in R software (version 4.1.2). The required sample size was calculated for a mediation model with two serial mediators using standardised coefficients derived from the existing literature (Cacioppo et al., 2006; Franco-O'Byrne et al., 2023; Glymour et al., 2008; Taylor et al., 2018; Williams and Demeyere, 2021) with 10,000 replications and 20,000 Monte Carlo draws per replication. Results indicated that a minimum sample of 78 participants was needed to achieve 80% power to detect the main effects of interest, namely simple and serial mediation for the relationship between cognitive impairment severity, social isolation, and depression.

2.9. Statistical analyses

All statistical analyses were completed in R (version 4.1.2). Descriptive statistics were used to summarise sample demographics and clinical characteristics. Pairwise Pearson correlations were performed between HADS scores and age, education (years), time since stroke (years), and NIHSS scores, with a two-tailed independent *t*-test run to determine potential sex differences in depression scores. Imputation of missing NIHSS data was carried out using predictive mean matching (PMM) procedures with the 'mice' package. A data-driven approach was used to select covariates for analyses in order to increase predictive accuracy whilst minimising the risk of overfitting analysis models. Specifically, variables which were significantly (alpha < 0.05) correlated with the main outcome of interest (HADS depression scores) were included as covariates in all analyses.

Multiple linear regressions were used to assess whether previous findings of a significant relationship between cognitive impairments and depression at 6 months post-stroke (Williams and Demeyere, 2021) were replicated in this sample of chronic stroke survivors. To account for non-normal distributions of residuals, robust multivariate regression models were created using the '*lmrob*' function from the 'robustbase' package. Number of impaired cognitive domains was specified as the predictor and HADS-D score as the outcome variable. Secondary analyses explored the relationship between impairments on individual cognitive domains with depression scores. False discovery rate (FDR) corrections were applied to these analyses using the Benjamini-Hochberg procedure to reduce Type-I error inflation associated with performing multiple tests

(Glickman et al., 2014).

Next, the association between social isolation and depression was examined. As discussed above, social isolation and loneliness are hypothesised to be related but distinct constructs. Exploratory analyses therefore evaluated the impact of specific patterns of social isolation on post-stroke depression (see Fig. 1A). Participants were categorised into four groups based on median splits of SDS and R-UCLA data to represent the subgroups proposed by Andersson (1986) and enhance clinical interpretability: (1) high social isolation (high SDS and R-UCLA scores), (2) high loneliness (high R-UCLA and low SDS scores), (3) high disconnectedness (high SDS and low R-UCLA scores), and low social isolation (low SDS and R-UCLA scores). The relationship between social isolation patterns and depression scores was examined with multiple linear regression analyses. Sensitivity analyses using continuous SDS and R-UCLA outcomes are reported in the Supplementary Materials (see Appendix A). The main analyses investigated potential mediation effects of social disconnectedness and loneliness in the relationship between post-stroke cognitive impairments and depression. Serial mediation models were generated using the 'lavaan' package, with number of impaired cognitive domains as the predictor, SDS and R-UCLA scores as causally ordered mediators, and HADS-D score as the outcome variable. All mediation models were fitted using non-parametric bootstrap resampling with 10,000 iterations. Finally, exploratory multiple regression and mediation models were run to assess the impact of cognitive impairment severity and social isolation on anxiety symptoms as measured with the HADS-A. As depression was the main outcome of interest and depression and anxiety scores were highly correlated, results for HADS-A scores are reported in the Supplementary Materials (see Appendix B).

3. Results

Eighty-five participants completed the cognitive assessment and questionnaires. Descriptive statistics for demographic variables, clinical characteristics, and outcome measures are provided in Table 1. All participants were assessed in the chronic stroke phase, with assessments completed an average of 4.5 ($SD \pm 2.8$) years post-stroke. Forty-eight (56.4%) participants presented with one or more impaired cognitive domains upon assessment. Cognitive impairments assessed using the OCS were prevalent across domains except for executive dysfunction, which was observed in only four (4.8%) participants. A total of 27 (31.8%) participants scored in the clinical range on the HADS-D and 23 (27.1%) participants had scores in the clinical range on the HADS-A. Comorbidity of depression and anxiety was high, with 15 (17.6%) participants presenting with clinical symptoms on both scales ($r(83) = 0.54$, $p < 0.001$). Significant correlations were observed for time since stroke ($r(83) = -0.14$, $p < 0.05$) and years of education ($r(83) = -0.227$, $p < 0.05$) with depression (see Appendix C), which were therefore included as covariates in the analyses. Adding stroke severity as measured by the NIHSS as a covariate did not alter the results (see Appendices C-F). HADS-D scores did not differ between male and female participants ($t(83) = 1.26$, $p = 0.210$).

3.1. Cognitive impairment and post-stroke depression

A multiple linear regression adjusted for covariates was conducted to determine effects of cognitive impairment severity on depression scores. A greater number of impaired cognitive domains predicted higher depression scores in chronic stroke ($\beta = 1.11$, $t = 3.63$, $p < 0.001$; see Fig. 2A). Additional analyses by domain demonstrated that specific impairments in visuospatial attention ($\beta = 2.58$, $t = 3.81$, FDR-corrected $p < 0.05$) and language ($\beta = 4.83$, $t = 4.57$, FDR-corrected $p < 0.001$) were associated with greater depressive symptomatology (see Figs. 2B-2G). No significant associations with depression were observed for any of the remaining cognitive domains following adjustment for covariates (all FDR-corrected $p > 0.05$, see Appendix D).

Table 1
Participant characteristics and outcome scores ($N = 85$).

		Median (IQR)	Range
Age – mean (*SD*)	72.8 (12.6)	75.6 (17.0)	32.6–98.0
Sex – *n* (%)			
Male	54 (63.5%)		
Female	31 (36.5%)		
Years of education – mean (*SD*)	13.6 (3.8)	12.0 (5.0)	9–23
Ethnicity – *n* (%)			
White British	80 (94.1%)		
White Irish	1 (1.2%)		
White other	2 (2.4%)		
Black other	1 (1.2%)		
Indian	1 (1.2%)		
Stroke hemisphere – *n* (%)			
Left	38 (44.7%)		
Right	32 (37.7%)		
Bilateral	8 (9.4%)		
Unknown	7 (8.2%)		
Stroke subtype – *n* (%)			
Ischaemic	64 (75.3%)		
Haemorrhagic	18 (21.2%)		
Unknown	3 (3.5%)		
First or recurrent stroke – *n* (%)			
First	59 (69.4%)		
Recurrent	23 (27.1%)		
Unknown	3 (3.5%)		
Years post-stroke – mean (*SD*)	4.5 (2.8)	3.6 (3.8)	0.8–13.3
Acute NIHSS score[a] – mean (*SD*)	7.4 (5.2)	6.0 (8.0)	0–21
Acute BI score[b] – mean (*SD*)	10.63 (5.65)	9.00 (8.0)	0.0–20.0
OCS total – *n* (%)			
0 domains impaired	37 (43.5%)		
1 domain impaired	20 (23.5%)		
≥2 domains impaired	28 (32.9%)		
OCS subdomain impaired – *n* (%)			
Visuospatial attention	26 (30.1%)		
Executive functioning	4 (4.8%)		
Language	19 (22.4%)		
Memory	19 (22.4%)		
Number processing	14 (16.5%)		
Praxis	21 (24.7%)		
Social isolation scores – mean (*SD*)			
SDS	0.0 (0.4)	0.0 (0.6)	−1.1–1.4
R-UCLA	17.4 (5.3)	16.0 (6.0)	11.0–22.0
HADS total scores – mean (*SD*)			
Depression subscale	5.7 (4.2)	5.0 (6.0)	0.0–17.0
Anxiety subscale	5.5 (3.5)	5.0 (5.0)	0.0–15.0
HADS-D range – *n* (%)			
Normal	58 (68.2%)		
Clinical	27 (31.8%)		
HADS-A range – *n* (%)			
Normal	62 (72.9%)		
Clinical	23 (27.1%)		

IQR = Interquartile range; *SD* = standard deviation; NIHSS = National Institutes of Health Stroke Scale; BI = Barthel Index; OCS = Oxford Cognitive Screen, SDS = Social Disconnectedness Scale; R-UCLA = Revised University of California, Los Angeles Loneliness Scale; HADS-D = HADS depression subscale; HADS-A = HADS anxiety subscale.

[a] *n* assessed = 74; [b] *n* assessed = 49.

3.2. Impact of social isolation on post-stroke depression

The impact of social isolation on post-stroke depression scores was assessed across social isolation categories (see Fig. 3 and Appendix E). Multiple linear regressions adjusted for covariates showed that participants with high overall social isolation ($\beta = 5.17$, $t = 5.68$, $p < 0.001$) or loneliness ($\beta = 3.02$, $t = 5.68$, $p < 0.01$) scores were more depressed than participants with low social isolation scores. In contrast, participants who were more socially disconnected (but had low loneliness scores) did not differ significantly from individuals who had low overall social isolation scores ($\beta = 1.35$, $t = 1.35$, $p = 0.18$). This suggests that the presence of subjective feelings of loneliness is critical in the relationship between social isolation and post-stroke depression.

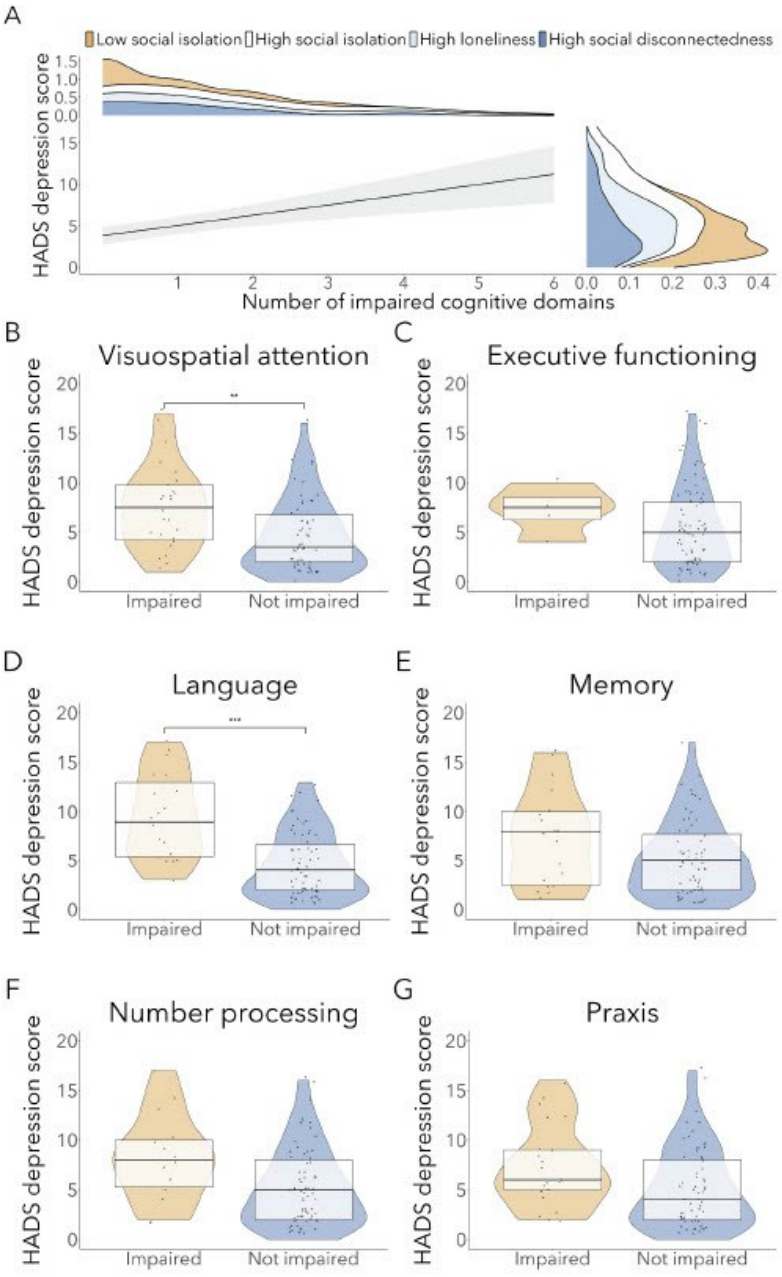


Fig. 2. (A) A greater number of impaired cognitive domains on the OCS predicts higher depression scores. The solid line represents the multiple linear regression formula, with the shaded area indicating standard errors. Density plots indicate the distribution of HADS-D scores and number of cognitively impaired domains across social isolation categories. (B-G) Violin plots demonstrating the distributions of depression scores by impairment across cognitive domains. Impairments in the visuospatial attention and language domains predicted higher depression scores (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ for FDR-corrected p-values).

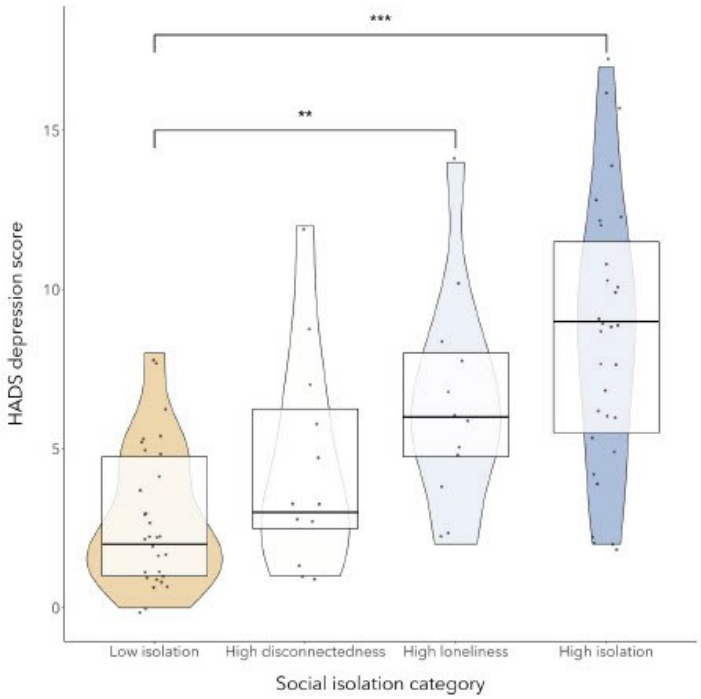


Fig. 3. Violin plots showing the distributions of depression scores by social isolation category (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$). Small dots represent raw data points, with box plots indicating median scores alongside the first and third quartiles of HADS-D scores.

3.3. Loneliness mediates effects of cognitive impairment on depression

The relationship between cognitive impairments, social isolation, and depression was evaluated with serial mediation models. All pathways showed significant direct effects (see Fig. 4), such that greater cognitive impairment severity predicted higher social disconnectedness, loneliness, and depression scores. In addition, social disconnectedness and loneliness had significant direct effects on depression outcomes.

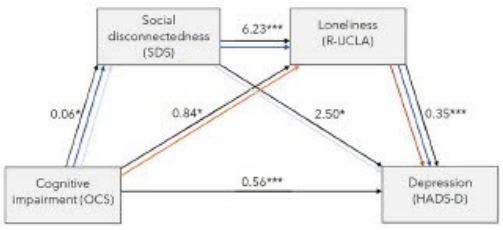


Fig. 4. Graphical representation of the serial mediation analysis adjusted for covariates, with coefficients for direct effects (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$) indicated by black arrows. Loneliness was a significant mediator in the relationship between cognitive impairment and depression ($p < 0.05$; orange arrows). A serial mediation pathway via social disconnectedness and loneliness was not significant following adjustment for covariates ($p = .0.08$; dark purple arrows). Finally, there was no evidence that social disconnectedness mediated associations between cognitive impairment and depression ($p = 0.125$; light purple arrows).

Participants with a greater number of impaired cognitive domains reported stronger feelings of loneliness, which predicted higher depression scores (see Table 2). This indirect effect was maintained following adjustment for significant covariates. In non-adjusted models a serial mediation effect was observed, with the effects of cognitive impairment on depression being sequentially mediated by social disconnectedness and loneliness. However, this effect was not significant after adjusting for years of education and time since stroke. Consistent with the analyses of social isolation categories reported above, there was no evidence that social disconnectedness independently mediated the relationship between cognitive impairment severity and depression.

4. Discussion

This study explored the role of chronic cognitive impairments and social isolation in post-stroke depression. More severe cognitive deficits predicted higher depression scores in stroke survivors. Consistent with the theory of social isolation in chronic illness (Iovino et al., 2023), this relationship was mediated by feelings of loneliness. However, there was no evidence that social disconnectedness significantly altered the association between cognitive impairments and depression after stroke. Taken together, these findings suggest that loneliness presents a possible mechanism by which cognitive impairments increase the risk of post-stroke depression.

4.1. Cognitive impairment severity predicts depression in chronic stroke

Stroke survivors with more severe, multi-domain cognitive deficits

Table 2
Indirect effects of the serial mediation model of the relationship between cognitive impairment, social isolation, and depression after stroke.

	Model 1[a]				Model 2[b]			
	Estimate (*SE*)	z-score	*p*-value	*CI*	Estimate (*SE*)	z-score	*p*-value	*CI*
Indirect effect 1: Cog → Disc → Dep	0.182 (0.109)	1.665	0.096	0.040–0.481	0.155 (0.101)	1.535	0.125	0.022–0.427
Indirect effect 2: Cog → Lon → Dep	0.361 (0.152)	2.374	<0.05	0.123–0.743	0.294 (0.144)	2.044	<0.05	0.071–0.656
Indirect effect 3: Cog → Disc → Lon → Dep	0.197 (0.090)	2.197	<0.05	0.076–0.452	0.135 (0.077)	1.757	0.079	0.030–0.362
Total effect	1.331 (0.294)	4.533	<0.001	0.811–1.960	1.140 (0.292)	3.909	<0.001	0.625–1.762

Abbreviations: Cog = number of impaired cognitive domains on the OCS; Disc = social disconnectedness (SDS) score; Dep = depression (HADS-D) score; Lon = loneliness (R-UCLA) score; *SE* = standard error; *CI* = confidence interval
[a] Unadjusted model; [b] Adjusted for education and time since stroke.

have been reported to be at higher risk of depression at 6 months post-stroke (Williams and Demeyere, 2021). The present study, in which assessments were completed an average of 4.5 years post-stroke, shows that this relationship is maintained throughout the chronic stroke phase. Cognitive impairment severity is therefore a consistent predictor of mental health after stroke.

Analyses by cognitive domain suggested that language and visuospatial attention deficits most strongly influenced post-stroke depression. This corresponds with a longitudinal study by Nys et al. (2006), which showed that acute visuospatial and language deficits increased risk of depression at 6 months post-stroke. In contrast, previous studies using the OCS found that language, memory, number processing, visuospatial attention, and praxis impairments predicted depression symptoms (Kelleher et al., 2025; Williams and Demeyere, 2021). These divergent results may be due to the larger sample sizes and consequently greater power of previous studies to detect smaller effects. It should be noted that sample size for the present study was calculated based on overall cognitive impairment severity, and analyses for individual domains were therefore exploratory by nature. It is possible that a larger-scale study would have revealed effects of other cognitive domains on depression in addition to language and visuospatial attention deficits.

Evidence for the impact of executive dysfunction as measured by the OCS has been mixed. Whilst significant effects on depression were reported by Williams and Demeyere (2021), this finding was not replicated by Kelleher et al. (2025). The low number of participants presenting with executive dysfunction in the current study limited our ability to test associations between this domain and depressive symptoms. Additional research is needed to clarify potential associations between executive function and depression after stroke.

4.2. Differential effects of social disconnectedness and loneliness

As well as cognitive impairment severity, social isolation was a significant predictor of higher depression scores after stroke. When investigating specific patterns of social isolation, participants with stronger feelings of loneliness presented with more depressive symptoms. Importantly, whilst concurrent social disconnectedness numerically increased predicted depression scores, this additive effect was not significant. Moreover, stroke survivors who were objectively socially disconnected but had low subjective loneliness scores did not differ in mood ratings from participants who were not socially isolated. Consistent with research in healthy populations (Lee et al., 2021), this suggests that the experience of loneliness is an important predictor of post-stroke depression independent of individuals' social network and/or extent of social participation.

Crucially, mediation analyses showed that loneliness mediates the previously observed relationship between cognitive impairment severity and depression. A higher number of impaired cognitive domains was associated with stronger feelings of loneliness, which in turn predicted increased depressive symptoms. In contrast, serial mediation effects in which social disconnectedness preceded loneliness were not significant after adjusting for demographic and clinical covariates. Altogether, these findings suggest that the impact of cognitive impairments on stroke survivors' perception of and/or satisfaction with their relationships, rather than on their social connectedness, contributes to poorer mental health outcomes. There was thus evidence for the simple, but not the serial mediation pathway proposed by Iovino et al.'s (2023) theory of social isolation in chronic illness in this population.

4.3. Clinical implications

These findings have clear implications for the treatment of post-stroke depression. First, they demonstrate that effects of cognitive impairments on depression do not dissipate over time. It is therefore crucial that effective strategies are developed to support the mental health of stroke survivors with cognitive deficits. Whilst cognitive rehabilitation may improve neuropsychological functioning to some extent (Gillespie et al., 2015), pervasive cognitive impairments are common even in stroke survivors who have made a successful clinical recovery (Jokinen et al., 2015; Planton et al., 2012). For individuals with chronic cognitive impairments, social isolation may present a modifiable factor which could improve mental health outcomes. When designing suitable interventions for this population, it is important to consider that loneliness but not disconnectedness significantly mediated the relationship between cognition and depression. This suggests that strategies aiming to increase stroke survivors' social networks and participation may not be sufficient to ameliorate depressive symptoms, and interventions may be more effective when targeting feelings of loneliness and the cognitions associated with these.

In clinical practice, this could be implemented by using measures to assess for the presence of feelings of loneliness and testing effects of targeted interventions for loneliness. A meta-analysis of loneliness interventions indicated that approaches based on cognitive behavioural therapy (CBT) models are most effective in reducing the experience of loneliness (Masi et al., 2011). According to the social cognition model of loneliness, subjective perceptions of being socially isolated lead to negative cognitive biases towards social threats as well as behaviours which confirm maladaptive thoughts and beliefs (Cacioppo et al., 2015). Qualitative research suggests that, in adults with cognitive impairments following an acquired brain injury, common cognitions and behaviours may include a reluctance to share distressing thoughts and feelings with others (Crowe et al., 2016; Yang et al., 2022), a perceived lack of understanding of their experience by other people (Lowe et al., 2021; Salter et al., 2008), a heightened awareness of differences between oneself and other people (Yang et al., 2022), and attempts to conceal cognitive deficits (Lowe et al., 2021). CBT approaches aim to address maladaptive cognitions and behaviours which inadvertently maintain feelings of loneliness. To date, the application of CBT for loneliness has predominantly been assessed in cognitively unimpaired older adults (Cohen-Mansfield and Parpura-Gill, 2007; Dworschak et al., 2024; Theeke et al., 2016) and young people (Käll et al., 2020). Further research is needed to determine the effectiveness of and potential

adaptations (e.g. Ponsford et al., 2020) to this intervention for loneliness and associated symptoms of depression in stroke survivors with cognitive impairments.

4.4. Strengths and limitations

The participant sample recruited in this study presented with similar rates of depression and cognitive impairments reported in previous large-scale studies (Ayerbe et al., 2013; Demeyere et al., 2016; Sexton et al., 2019), indicating that clinical characteristics were representative of this population. However, there was a lack of ethnic diversity and acute stroke severity was predominantly in the minor to moderate range. Additional work is needed to explore the generalisability of our findings across demographic characteristics and individuals with more severe stroke.

Whilst grounded in a clear theoretical framework, it was not possible to determine causality of the associations observed in the present study. Previously, it has been shown that cognition, loneliness, and depression have reciprocal influences (Cacioppo et al., 2006; Liang et al., 2023; Sbarra et al., 2023), complicating investigations of the relationship between these three constructs. However, longitudinal studies have consistently demonstrated that baseline cognitive impairments can precede both depression (Nys et al., 2006) and social isolation (Duan et al., 2023), as well as loneliness scores predicting the onset of depression (Kraav et al., 2021; Mann et al., 2022; Martín-María et al., 2021; Van Winkel et al., 2017). Moreover, analyses using cross-lagged analytical models indicated that loneliness predicted changes in depressive symptoms, whereas the reverse relationship was not significant (Cacioppo et al., 2010). The current evidence base therefore suggests that loneliness is a causal factor in the development of depression. In the present study, a stroke-specific screening tool was used to assess common cognitive sequelae associated with stroke, such as hemispatial neglect, apraxia, and aphasia, in addition to more general impairments in memory and executive functioning. Whilst depression has been linked with changes in a range of domains, including memory, attention, and executive functioning (Rock et al., 2014), it is unlikely that low mood caused more stroke-specific impairments as measured with the OCS. Going forward, longitudinal studies and clinical trials will be instrumental for establishing the directional effects of domain-general cognitive impairments and loneliness on post-stroke depressive symptoms.

Finally, all analyses were adjusted for relevant clinical and demographic characteristics. Although beyond the scope of the present study, more in-depth explorations would be valuable for understanding the impact of specific variables. First, whilst the data-driven approach to covariate selection did not include sex as a potential confounding variable, there is emerging evidence that relationships between cognition, social isolation, and depression may differ between men and women (Chi et al., 2024; Wan et al., 2025). It would therefore be worth investigating whether the pathways outlined here are similar or vary by sex or gender. In addition, due to a high proportion of missing data on the Barthel Index it was not possible to impute missing values for this measure and determine the potential impact of functional abilities on social isolation or depression. However, as Barthel Index scores are strongly associated with NIHSS scores (Kwakkel et al., 2010), it was attempted to account for possible confounding effects of functional impairments by including stroke severity as a covariate. The addition of NIHSS scores did not alter the main results, suggesting that the effects of cognitive impairments and loneliness on depression were independent of stroke severity. This is consistent with our previous finding that the inclusion of NIHSS and Barthel Index scores did not affect the observed relationship between post-stroke cognition and depression (Williams and Demeyere, 2021). Given the high prevalence of physical disability after stroke, however, it would be of interest to explore potentially independent contributions of physical dysfunction to social isolation and depression in future studies.

5. Conclusions

This study showed that the extent of stroke survivors' cognitive impairments consistently predicts symptoms of depression. Feelings of loneliness mediated this relationship and may therefore present a modifiable target for interventions aiming to improve depression in this population. Priorities for further research include establishing causality of these relationships and examining the potential for interventions targeting loneliness in depressed stroke survivors with cognitive impairments.

CRediT authorship contribution statement

Margot Juliëtte Overman: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Reena Vohora:** Writing – review & editing, Supervision. **Nele Demeyere:** Writing – review & editing, Supervision.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

ND is a developer of the Oxford Cognitive Screen.

Acknowledgements

We would like to thank our participants for their time, as well as Paula Grammatikos and Karen Veri for their contributions to participant recruitment. Vector images used in Fig. 1 were obtained from Vecteezy.com and Freepik.com platforms.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2026.121305.

Data availability

Raw data and analysis scripts can be accessed on https://osf.io/gu4f5.

References

Aben, I., Verhey, F., Lousberg, R., Lodder, J., Honig, A., 2002. Validity of the Beck depression inventory, hospital anxiety and depression scale, SCL-90, and Hamilton depression rating scale as screening instruments for depression in stroke patients. Psychosomatics 43, 386–393.

Andersson, L., 1986. A model of estrangement - including a theoretical understanding of loneliness. Psychol. Rep. 58, 683–695.

Ayerbe, L., Ayis, S., Wolfe, C.D.A., Rudd, A.G., 2013. Natural history, predictors and outcomes of depression after stroke: systematic review and meta-analysis. Br. J. Psychiatry 202, 14–21. https://doi.org/10.1192/bjp.bp.111.107664.

Ayis, S.A., Ayerbe, L., Ashworth, M., DA Wolfe, C., 2018. Evaluation of the hospital anxiety and depression scale (HADS) in screening stroke patients for symptoms: item response theory (IRT) analysis. J. Affect. Disord. 228, 33–40. https://doi.org/10.1016/j.jad.2017.11.037.

Bennett, K.J., Leese, J., Davis, J.C., Eng, J.J., Liu-Ambrose, T., 2024. Exploring the experience of cognitive changes among community-dwelling stroke survivors: a qualitative study. Disabil. Rehabil. 9, 1870–1877. https://doi.org/10.1080/09638288.2023.2210309.

Bjelland, I., Dahl, A.A., Haug, T., Neckelmann, D., 2002. The validity of the hospital anxiety and depression scale: an updated literature review. J. Psychosom. Res. 52, 69–77.

Cacioppo, J.T., Hughes, M.E., Waite, L.J., Hawkley, L.C., Thisted, R.A., 2006. Loneliness as a specific risk factor for depressive symptoms: cross-sectional and longitudinal analyses. Psychol. Aging 21, 140–151. https://doi.org/10.1037/0882-7974.21.1.140.

Cacioppo, J.T., Hawkley, L.C., Thisted, R.A., 2010. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago health, aging, and social relations study. Psychol. Aging 25, 453–463. https://doi.org/10.1037/a0017216.

Cacioppo, S., Grippo, A.J., London, S., Goossens, L., Cacioppo, J.T., 2015. Loneliness: clinical import and interventions. Perspect. Psychol. Sci. 10, 238–249. https://doi.org/10.1177/1745691615570616.

Chi, J., Liu, N., Tian, T., Jiang, Q., Lu, C., Li, Y., Zhang, X., Ma, Y., Wang, L., Li, S., 2024. Sex differences in loneliness, social isolation, and their impact on psychiatric symptoms and cognitive functioning in schizophrenia. BMC Psychiatry 24. https://doi.org/10.1186/s12888-024-06333-7.

Cohen-Mansfield, J., Parpura-Gill, A., 2007. Loneliness in older persons: a theoretical model and empirical findings. Int. Psychogeriatr. 19, 279–294. https://doi.org/10.1017/S1041610206004200.

Cornwell, E.Y., Waite, L.J., 2009a. Measuring social isolation among older adults using multiple indicators from the NSHAP study. J. Gerontol. B Psychol. Sci. Soc. Sci. 64, i38–i46. https://doi.org/10.1093/geronb/gbp037.

Cornwell, E.Y., Waite, L.J., 2009b. Social disconnectedness, perceived isolation, and health among older adults. J. Health Soc. Behav. 50, 31–48.

Crowe, C., Coen, R.F., Kidd, N., Hevey, D., Cooney, J., Harbison, J., 2016. A qualitative study of the experience of psychological distress post-stroke. J. Health Psychol. 21, 2572–2579. https://doi.org/10.1177/1359105315581067.

Dafer, R.M., Rao, M., Shareef, A., Sharma, A., 2008. Poststroke depression. Top. Stroke Rehabil. 15, 13–21. https://doi.org/10.1310/tsr1501-13.

Demeyere, N., Riddoch, M.J., Slavkova, E.D., Bickerton, W.L., Humphreys, G.W., 2015. The Oxford cognitive screen (OCS): validation of a stroke-specific short cognitive screening tool. Psychol. Assess. 27, 883–894. https://doi.org/10.1037/pas0000082.

Demeyere, N., Riddoch, M.J., Slavkova, E.D., Jones, K., Reckless, I., Mathieson, P., Humphreys, G.W., 2016. Domain-specific versus generalized cognitive screening in acute stroke. J. Neurol. 263, 306–315. https://doi.org/10.1007/s00415-015-7964-4.

Duan, Y., Jiang, S., Yin, Z., Wang, S., Gao, J., Yang, M., Chen, C., Fu, H., Wang, C., 2023. Association of social isolation and cognitive performance: a longitudinal study using a four-wave nationwide survey. BMC Public Health 23. https://doi.org/10.1186/s12889-023-16274-7.

Dunne, S., Williams, G.P., Bradbury, C., Keyes, T., Lane, A.R., Yang, K., Ellison, A., 2023. Uncovering the social determinants of brain injury rehabilitation. J. Health Psychol. 28, 956–969. https://doi.org/10.1177/13591053231166263.

Dworschak, C., Heim, E., Kuhn, N., Schwager, J., Tröster, A., Maercker, A., 2024. User-centered development of an internet-based CBT intervention for the treatment of loneliness in older individuals. Internet Interv. 35, 100720. https://doi.org/10.1016/j.invent.2024.100720.

Feigin, V.L., Brainin, M., Norrving, B., Martins, S.O., Pandian, J., Lindsay, P., F Grupper, M., Rautalin, I., 2025. World stroke organization: global stroke fact sheet 2025. Int. J. Stroke 20, 132–144. https://doi.org/10.1177/17474930241308142.

Franco-O'Byrne, D., Sepúlveda, J.P.M., Gonzalez-Gomez, R., Ibáñez, A., Huepe-Artigas, D., Matus, C., Manen, R., Ayala, J., Fittipaldi, S., Huepe, D., 2023. The neurocognitive impact of loneliness and social networks on social adaptation. Sci. Rep. 13, 12048. https://doi.org/10.1038/s41598-023-38244-0.

Gbiri, C.A., Akinpelu, A.O., Odole, A.C., 2010. Prevalence, pattern and impact of depression on quality of life of stroke survivors. Int. J. Psychiatry Clin. Pract. 14, 198–203. https://doi.org/10.3109/13651501003797633.

Ge, L., Yap, C.W., Ong, R., Heng, B.H., 2017. Social isolation, loneliness and their relationships with depressive symptoms: a population-based study. PLoS One 12, e0182145. https://doi.org/10.1371/journal.pone.0182145.

Gillespie, D.C., Bowen, A., Chung, C.S., Cockburn, J., Knapp, P., Pollock, A., 2015. Rehabilitation for post-stroke cognitive impairment: an overview of recommendations arising from systematic reviews of current evidence. Clin. Rehabil. 29, 120–128. https://doi.org/10.1177/0269215514538982.

Glickman, M.E., Rao, S.R., Schultz, M.R., 2014. False discovery rate control is a recommended alternative to Bonferroni-type adjustments in health studies. J. Clin. Epidemiol. 67, 850–857. https://doi.org/10.1016/j.jclinepi.2014.03.012.

Glymour, M.M., Weuve, J., Fay, M.E., Glass, T., Berkman, L.F., 2008. Social ties and cognitive recovery after stroke: does social integration promote cognitive resilience? Neuroepidemiology 31, 10–20. https://doi.org/10.1159/000136646.

Goh, H.T., Tan, M.P., Mazlan, M., Abdul-Latif, L., Subramaniam, P., 2019. Social participation determines quality of life among urban-dwelling older adults with stroke in a developing country. J. Geriatr. Phys. Ther. 42, E77–E84. https://doi.org/10.1519/JPT.0000000000000196.

Golden, J., Conroy, R.M., Bruce, I., Denihan, A., Greene, E., Kirby, M., Lawlor, B.A., 2009. Loneliness, social support networks, mood and wellbeing in community-dwelling elderly. Int. J. Geriatr. Psychiatry 24, 694–700. https://doi.org/10.1002/gps.2181.

Goljar, N., Burger, H., Vidmar, G., Marincek, C., Krizaj, J., Chatterji, S., Raggi, A., Leonardi, M., Bickenbach, J.E., 2010. Functioning and disability in stroke. Disabil. Rehabil. 32, S50–S58. https://doi.org/10.3109/09638288.2010.517598.

Hawkley, L.C., Cacioppo, J.T., 2010. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. Ann. Behav. Med. 40, 218–227. https://doi.org/10.1007/s12160-010-9210-8.

Iovino, P., Vellone, E., Cedrone, N., Riegel, B., 2023. A middle-range theory of social isolation in chronic illness. Int. J. Environ. Res. Public Health 20, 4940. https://doi.org/10.3390/ijerph20064940.

Jokinen, H., Melkas, S., Ylikoski, R., Pohjasvaara, T., Kaste, M., Erkinjuntti, T., Hietanen, M., 2015. Post-stroke cognitive impairment is common even after successful clinical recovery. Eur. J. Neurol. 22, 1288–1294. https://doi.org/10.1111/ene.12743.

Käll, A., Shafran, R., Lindegaard, T., Bennett, S., Cooper, Z., Coughtrey, A., Andersson, G., 2020. A common elements approach to the development of a modular cognitive behavioral theory for chronic loneliness. J. Consult. Clin. Psychol. 88, 269–282. https://doi.org/10.1037/ccp0000454.

Kelleher, K., Demeyere, N., Kusec, A., 2025. Specific within-domain cognitive impairments predict depression severity six-months after stroke. Top. Stroke Rehabil. 1–11. https://doi.org/10.1080/10749357.2025.2557317.

Kraav, S.L., Lehto, S.M., Junttila, N., Ruusunen, A., Kauhanen, J., Hantunen, S., Tolmunen, T., 2021. Depression and loneliness may have a direct connection without mediating factors. Nord. J. Psychiatry 75, 553–557. https://doi.org/10.1080/08039488.2021.1894231.

Kwakkel, G., Veerbeek, J.M., van Wegen, E.E.H., Nijland, R., Harmeling-van der Wel, B. C., Dippel, D.W.J., 2010. Predictive value of the NIHSS for ADL outcome after ischemic hemispheric stroke: does timing of early assessment matter? J. Neurol. Sci. 294, 57–61. https://doi.org/10.1016/j.jns.2010.04.004.

Lee, J., Cagle, J.G., 2017. Validating the 11-item revised University of California Los Angeles Scale to assess loneliness among older adults: an evaluation of factor structure and other measurement properties. Am. J. Geriatr. Psychiatr. 25, 1173–1183. https://doi.org/10.1016/j.jagp.2017.06.004.

Lee, S.L., Pearce, E., Ajnakina, O., Johnson, S., Lewis, Glyn, Mann, F., Pitman, A., Solmi, F., Sommerlad, A., Steptoe, A., Tymoszuk, U., Lewis, Gemma, 2021. The association between loneliness and depressive symptoms among adults aged 50 years and older: a 12-year population-based cohort study. Lancet Psychiatry 8, 48–57. https://doi.org/10.1016/S2215-0366(20)30383-7.

Liang, W., Miao, J., Wang, Y., Sun, W., Pan, C., Chen, M., Li, G., Lan, Y., Qiu, X., Zhao, X., Jing, P., Chen, G., Mei, J., Zhu, Z., 2023. Longitudinal relationships between depressive symptoms and cognitive function after stroke: a cross-lagged panel design. J. Psychosom. Res. https://doi.org/10.1016/j.jpsychores.2023.111486.

Lowe, N., Crawley, L., Wilson, C., Waldron, B., 2021. 'Lonely in my head': the experiences of loneliness in individuals with brain injury. Br. J. Health Psychol. 26, 444–463. https://doi.org/10.1111/bjhp.12481.

Mahoney, F.I., Barthel, D.W., 1965. Functional evaluation: the Barthel index. Md. State Med. J. 14, 61–65.

Mann, F., Wang, J., Pearce, E., Ma, R., Schlief, M., Lloyd-Evans, B., Ikhtabi, S., Johnson, S., 2022. Loneliness and the onset of new mental health problems in the general population. Soc. Psychiatry Psychiatr. Epidemiol. 57, 2161–2178. https://doi.org/10.1007/s00127-022-02261-7.

Martín-María, N., Caballero, F.F., Lara, E., Domènech-Abella, J., Haro, J.M., Olaya, B., Ayuso-Mateos, J.L., Miret, M., 2021. Effects of transient and chronic loneliness on major depression in older adults: a longitudinal study. Int. J. Geriatr. Psychiatry 36, 76–85. https://doi.org/10.1002/gps.5397.

Masi, C.M., Chen, H.Y., Hawkley, L.C., Cacioppo, J.T., 2011. A meta-analysis of interventions to reduce loneliness. Personal. Soc. Psychol. Rev. 15, 219–266. https://doi.org/10.1177/1088868310377394.

Milosevich, E.T., Moore, M.J., Pendlebury, S.T., Demeyere, N., 2024. Domain-specific cognitive impairment 6 months after stroke: the value of early cognitive screening. Int. J. Stroke 19, 331–341. https://doi.org/10.1177/17474930231205787.

Norlander, A., Iwarsson, S., Jönsson, A.C., Lindgren, A., Månsson Lexell, E., 2022. Participation in social and leisure activities while re-constructing the self: understanding strategies used by stroke survivors from a long-term perspective. Disabil. Rehabil. 44, 4284–4292. https://doi.org/10.1080/09638288.2021.1900418.

Nys, G.M.S., van Zandvoort, M.J.E., van der Worp, H.B., de Haan, E.H.F., de Kort, P.L.M., Jansen, B.P.W., Kappelle, L.J., 2006. Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. J. Neurol. Sci. 247, 149–156. https://doi.org/10.1016/j.jns.2006.04.005.

Peplau, L., Perlman, D., 1982. Perspectives on loneliness. In: Peplau, L., Perlman, D. (Eds.), Loneliness: A Sourcebook of Current Theory, Research, and Therapy. Wiley, New York.

Petitte, T., Mallow, J., Barnes, E., Petrone, A., Barr, T., Theeke, L., 2015. A systematic review of loneliness and common chronic physical conditions in adults. Open Psychol J 8, 113–132. https://doi.org/10.2174/1874350101508010113.

Planton, M., Peiffer, S., Albucher, J.F., Barbeau, E.J., Tardy, J., Pastor, J., Januel, A.C., Bezy, C., Lemesle, B., Puel, M., Demonet, J.F., Chollet, F., Pariente, J., 2012. Neuropsychological outcome after a first symptomatic ischaemic stroke with "good recovery.". Eur. J. Neurol. 19, 212–219. https://doi.org/10.1111/j.1468-1331.2011.03450.x.

Ponsford, J., Lee, N.K., Wong, D., Mckay, A., Haines, K., Downing, M., Alway, Y., Furtado, C., O'donnell, M.L., 2020. Factors associated with response to adapted cognitive behavioral therapy for anxiety and depression following traumatic brain injury. J. Head Trauma Rehabil. 35, 117–126. https://doi.org/10.1097/HTR.0000000000000510.

Rock, P.L., Roiser, J.P., Riedel, W.J., Blackwell, A.D., 2014. Cognitive impairment in depression: a systematic review and meta-analysis. Psychol. Med. 44, 2029–2040. https://doi.org/10.1017/S0033291713002535.

Salter, K., Hellings, C., Foley, N., Teasell, R., 2008. The experience of living with stroke: a qualitative meta-synthesis. J. Rehabil. Med. 40, 595–602. https://doi.org/10.2340/16501977-0238.

Sbarra, D.A., Ramadan, F.A., Choi, K.W., Treur, J.L., Levey, D.F., Wootton, R.E., Stein, M. B., Gelernter, J., Klimentidis, Y.C., 2023. Loneliness and depression: bidirectional mendelian randomization analyses using data from three large genome-wide association studies. Mol. Psychiatry 28, 4594–4601. https://doi.org/10.1038/s41380-023-02259-w.

Sexton, E., McLoughlin, A., Williams, D.J., Merriman, N.A., Donnelly, N., Rohde, D., Hickey, A., Wren, M.A., Bennett, K., 2019. Systematic review and meta-analysis of

the prevalence of cognitive impairment no dementia in the first year post-stroke. Eur. Stroke J. 4, 160–171. https://doi.org/10.1177/2396987318825484.
Smith, K.J., Victor, C., 2019. Typologies of loneliness, living alone and social isolation, and their associations with physical and mental health. Ageing Soc. 39, 1709–1730. https://doi.org/10.1017/S0144686X18000132.
Taylor, H.O., Taylor, R.J., Nguyen, A.W., Chatters, L., 2018. Social isolation, depression, and psychological distress among older adults. J. Aging Health 30, 229–246. https://doi.org/10.1177/0898264316673511.
Theeke, L.A., Mallow, J.A., Moore, J., McBurney, A., Rellick, S., VanGilder, R., 2016. Effectiveness of LISTEN on loneliness, neuroimmunological stress response, psychosocial functioning, quality of life, and physical health measures of chronic illness. Int J Nurs Sci 3, 242–251. https://doi.org/10.1016/j.ijnss.2016.08.004.
Turunen, K.E.A., Laari, S.P.K., Kauranen, T.V., Uimonen, J., Mustanoja, S., Tatlisumak, T., Poutiainen, E., 2018. Domain-specific cognitive recovery after first-ever stroke: a 2-year follow-up. J. Int. Neuropsychol. Soc. 24, 117–127. https://doi.org/10.1017/S1355617717000728.
Van Winkel, M., Wichers, M., Collip, D., Jacobs, N., Derom, C., Thiery, E., Myin-Germeys, I., Peeters, F., 2017. Unraveling the role of loneliness in depression: the relationship between daily life experience and behavior. Psychiatry 80, 104–117. https://doi.org/10.1080/00332747.2016.1256143.
Wan, L.P., Zhao, Z.Y., Liu, B.P., Zhu, J.H., Jia, C.X., Wang, X.T., 2025. Association between loneliness, social isolation and incident depression: a prospective study based on UK biobank. Gen. Hosp. Psychiatry 96, 171–177. https://doi.org/10.1016/j.genhosppsych.2025.07.007.
Williams, O.A., Demeyere, N., 2021. Association of depression and anxiety with cognitive impairment 6 months after stroke. Neurology 96, e1966–e1974. https://doi.org/10.1212/WNL.0000000000011748.
Yang, K., Armstrong, N., Diamond, C., Lane, A.R., Dunne, S., 2022. The meaning of loneliness to stroke survivors: a qualitative study in Northeast England. J. Health Psychol. 27, 2539–2548. https://doi.org/10.1177/13591053211017198.
Zigmond, A.S., Snaith, R.P., 1983. The hospital anxiety and depression scale. Acta Psychiatr. Scand. 67, 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x.

Appendix P. CUREC 1 Ethics Approval Letter

MEDICAL SCIENCES INTERDIVISIONAL RESEARCH ETHICS COMMITTEE
Research Services, Boundary Brook House, Churchill Drive, Headington, Oxford, OX3 7GB
Tel: +44(0)1865 616575
ethics@medsci.ox.ac.uk

CONFIDENTIAL

Margot Overman
Oxford Institute for Clinical Psychology Training
(OXICPTR),
Isis Education Centre,
Warneford Hospital
Oxford
OX3 7JX

9 August 2024

Dear Margot,

Research Ethics Approval - CUREC 1

Ethics Approval Reference: R94589/RE001

Study title: The impact of social isolation on depression in stroke survivors with cognitive impairments

The above application has been considered on behalf of the Medical Sciences Interdivisional Research Ethics Committee (MS IDREC) in accordance with the University's procedures for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to the IDREC, the proposed research has been judged as meeting appropriate ethical standards, and approval has been granted from **6th August 2024 until 31st December 2026.**

Insurance-provided indemnity arrangements are in place for the duration of the approval stated above. It is your responsibility to ensure that you request an extension to the end date for indemnity to remain in place should you continue the research beyond the dates covered.

Amendments

Should there be any subsequent changes to the study, you should submit details to the MS IDREC for consideration and approval. Details of changes must be listed on an amendment form.

Yours Sincerely

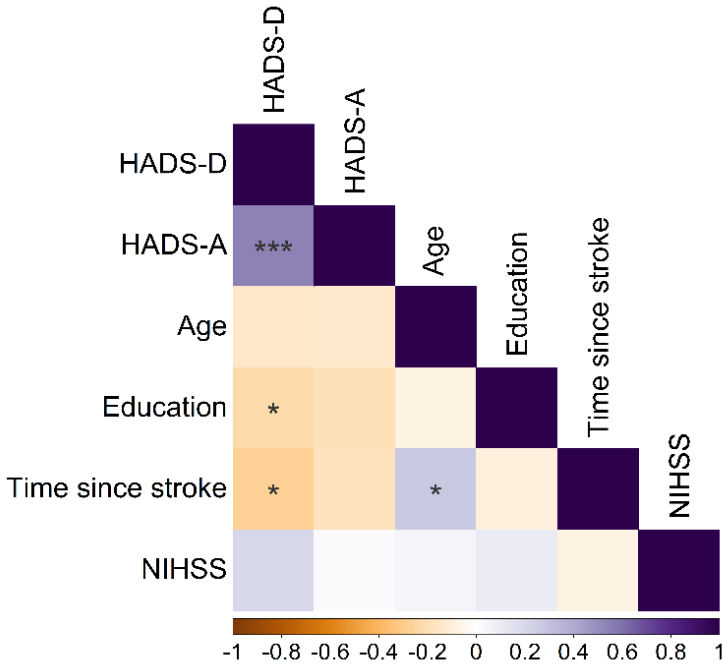
DocuSigned by:
Yolande Monger
552388586383436...

Mrs Yolande Monger
Research Ethics Administrator

for
Dr Helen Barnby-Porritt
Research Ethics Manager

Appendix Q. Supplementary Analyses

Pearson's correlations between demographic and clinical variables with HADS scores (*p <0.05, **p <0.01, ***p <0.001) are shown in the figure below.



In addition to the logistic regressions presented in the Results section, multiple linear regressions were carried out as sensitivity analyses to explore the relationship between continuous R-UCLA and/or SDS scores and HADS depression outcomes.

Table Q1

Multiple Linear Regressions of the Relationship Between Continuous Social Isolation Scores and Depression

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
SDS score	2.40 (1.75)	1.37	0.174	3.09 (1.91)	1.62	0.109	2.96 (1.93)	1.53	0.130
R-UCLA score	0.50 (0.10)	5.09	<0.001	0.46 (0.10)	4.70	<0.001	0.44 (1.93)	4.46	<0.001
SDS x R-UCLA interaction	-0.03 (0.08)	-0.38	0.704	-0.05 (0.08)	-0.64	0.526	-0.04 (0.09)	-0.48	0.637

[a] Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

Multiple linear regressions and mediation analyses were carried out to assess associations between cognitive impairments, social isolation, and anxiety symptoms.

Table Q2

Multiple Linear Regressions of Effects of Cognitive Impairments on Anxiety Symptoms

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
OCS domains impaired	1.00 (0.28)	3.52	<0.001	0.85 (0.30)	2.87	<0.01	0.85 (0.30)	2.87	<0.01
Attention impairment[†]	2.17 (0.97)	2.23	<0.05	1.76 (0.95)	1.85	0.135	1.75 (0.95)	1.84	0.140
Executive impairment[†]	0.95 (1.08)	0.88	0.421	0.36 (1.33)	0.28	0.783	0.32 (1.35)	0.24	0.810
Language impairment[†]	3.91 (1.09)	3.58	<0.01	3.56 (1.15)	3.11	<0.05	3.56 (1.18)	3.02	<0.05
Memory impairment[†]	0.96 (1.19)	0.81	0.421	0.71 (1.08)	0.66	0.612	0.74 (1.08)	0.68	0.598
Numeracy impairment[†]	2.30 (0.94)	2.44	<0.05	1.67 (1.02)	1.64	0.157	1.68 (1.03)	1.64	0.159
Praxis impairment[†]	2.51 (0.84)	3.00	<0.05	2.08 (0.95)	2.19	0.095	2.10 (0.95)	2.21	0.091

[a] Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

[†] FDR-corrected *p*-values

Table Q3

Multiple Linear Regressions of Effects of Social Isolation Category on Anxiety Symptoms with Low Social Isolation as the Reference Group

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
High disconnectedness	1.56 (1.17)	1.34	0.184	1.38 (1.13)	1.23	0.224	1.34 (1.14)	1.18	0.242
High loneliness	3.40 (0.84)	4.07	<0.001	3.19 (0.94)	3.39	<0.01	3.30 (1.06)	3.13	<0.01
High social isolation	3.68 (0.89)	4.13	<0.001	3.21 (0.97)	3.30	<0.01	3.19 (0.97)	3.28	<0.01

Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

Table Q4

Multiple Linear Regressions of the Relationship Between Continuous Social Isolation Scores and Anxiety

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
SDS score	1.21 (2.67)	0.46	0.650	1.06 (2.79)	0.38	0.704	1.12 (2.83)	0.40	0.694
R-UCLA score	0.37 (0.10)	3.69	<0.001	0.35 (0.10)	3.39	<0.01	0.36 (0.10)	3.44	<0.001
SDS x R-UCLA interaction	-0.07 (0.11)	-0.60	0.552	-0.07 (0.12)	-0.62	0.539	-0.08 (0.12)	-0.64	0.527

[a] Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

Table Q5

Serial Mediation Model of the Relationship Between Cognitive Impairment, Social Isolation, and Anxiety After Stroke

	Model 1[a]				Model 2[b]				Model 3[c]			
	Estimate (*SE*)	**z-score**	***p*-value**	***CI***	**Estimate (*SE*)**	**z-score**	***p*-value**	***CI***	**Estimate (*SE*)**	**z-score**	***p*-value**	***CI***
Direct effects												
Cog → Dep	0.51 (0.25)	2.00	<0.05	0.021 – 1.030	0.48 (0.26)	1.90	0.057	-0.013 – 0.991	0.49 (0.26)	1.87	0.062	-0.004 – 1.016
Cog → Disc	0.08 (0.03)	2.81	<0.01	0.033 – 0.149	0.06 (0.03)	2.12	<0.05	0.012 – 0.126	0.06 (0.03)	2.03	<0.05	0.009 – 0.128
Cog → Lon	0.95 (0.33)	2.91	<0.01	0.339 – 1.625	0.84 (0.34)	2.45	<0.05	0.192 – 1.546	0.82 (0.34)	2.44	<0.05	0.182 – 1.529
Disc → Lon	6.22 (1.18)	5.41	<0.001	3.886 – 8.508	6.23 (1.28)	4.89	<0.001	3.604 – 8.666	6.21 (1.29)	4.83	<0.001	3.575 – 8.680
Disc → Dep	-0.10 (1.08)	-0.09	0.929	-2.243 – 1.955	-0.24 (1.20)	-0.20	0.843	-2.591 – 2.118	-0.24 (1.21)	-0.20	0.841	-2.632 – 2.119
Lon → Dep	0.30 (0.08)	3.62	<0.001	0.145 – 0.471	0.29 (0.09)	3.24	<0.01	0.127 – 0.479	0.29 (0.09)	3.31	<0.01	0.135 – 0.480
Indirect effects												
Cog → Disc → Dep	-0.01 (0.10)	-0.08	0.934	-0.224 – 0.169	-0.02 (0.09)	-0.17	0.863	-0.236 – 0.116	-0.02 (0.09)	-0.18	0.861	-0.245 – 0.114
Cog → Lon → Dep	0.29 (0.12)	2.31	<0.05	0.101 – 0.608	0.24 (0.12)	1.98	<0.05	0.062 – 0.570	0.24 (0.12)	2.01	<0.05	0.066 – 0.564
Cog → Disc → Lon → Dep	0.16 (0.09)	1.83	0.067	0.047 – 0.395	0.11 (0.07)	1.50	0.133	0.021 – 0.337	0.11 (0.08)	1.45	0.148	0.021 – 0.356
Total effect	0.94 (0.26)	3.58	<0.001	0.449 – 1.491	0.83 (0.27)	3.01	<0.01	0.312 – 1.392	0.82 (0.28)	2.94	<0.01	0.316 – 1.435

Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

Results for multiple linear regressions and mediation analyses of associations between cognitive impairments, social isolation, and depression symptoms adjusted for NIHSS scores are presented below.

Table Q6

Multiple Linear Regressions of Effects of Total Cognitive Impairment and Impairment by Domain on Depression as Measured by the HADS-D

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
OCS domains impaired	1.23 (0.31)	6.86	<0.001	1.11 (0.30)	3.63	<0.001	1.09 (0.30)	3.65	<0.001
Visuospatial attention impairment[†]	2.92 (0.98)	2.98	<0.05	2.58 (0.92)	2.81	<0.05	2.53 (0.93)	2.73	<0.05
Executive impairment[†]	2.25 (1.27)	1.76	0.098	1.29 (1.67)	0.77	0.445	1.08 (1.81)	0.60	0.553
Language impairment[†]	5.05 (1.27)	3.98	<0.001	4.83 (1.06)	4.57	<0.001	4.83 (1.06)	4.57	<0.001
Memory impairment[†]	2.11 (1.35)	1.56	0.121	1.77 (1.25)	1.42	0.190	1.82 (1.21)	1.51	0.168
Number processing impairment[†]	3.23 (1.33)	3.42	<0.05	2.23 (1.35)	1.65	0.154	2.10 (1.41)	1.49	0.168
Praxis impairment[†]	2.39 (1.10)	2.18	<0.05	1.92 (1.06)	1.82	0.146	2.06 (1.05)	1.96	0.106

[a] Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores
OCS = Oxford Cognitive Screen
[†] FDR-corrected *p*-values

Table Q7

Multiple Linear Regressions of Effects of Social Isolation Category on Depressive Symptoms with Low Social Isolation as the Reference Group

	Model 1[a]			**Model 2[b]**			**Model 3[c]**		
	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value	β (*SE*)	*t*-value	*p*-value
High disconnectedness	1.34 (1.05)	1.28	0.21	1.56 (1.16)	1.35	0.18	1.42 (1.18)	1.21	0.23
High loneliness	3.37 (0.98)	3.25	<0.001	3.02 (0.94)	5.68	<0.01	3.37 (1.02)	3.30	<0.01
High social isolation	5.62 (0.96)	5.83	<0.001	5.17 (0.91)	5.68	<0.001	5.11 (0.93)	5.51	<0.001

[a] Unadjusted model; [b] Adjusted for education and time since stroke; [c] Adjusted for education, time since stroke, and NIHSS scores

Table Q8

Indirect Effects of the Serial Mediation Model of the Relationship Between Cognitive Impairment, Social Isolation, and Depression After Stroke, Adjusted for Years of Education, Time Since Stroke, and NIHSS Scores

	Estimate (*SE*)	**z-score**	***p*-value**	***CI***
Indirect effect 1: Cog → Disc → Dep	0.155 (0.104)	1.498	0.134	0.022 – 0.453
Indirect effect 2: Cog → Lon → Dep	0.280 (0.137)	2.053	<0.05	0.063 – 0.619
Indirect effect 3: Cog → Disc → Lon → Dep	0.130 (0.075)	1.729	0.084	0.027 – 0.350
Total effect	1.109 (0.287)	3.865	<0.001	0.595 – 1.712

Abbreviations: Cog = number of impaired cognitive domains on the OCS; Disc = social disconnectedness (SDS) score; Dep = depression (HADS-D) score; Lon = loneliness (R-UCLA) score; SE = standard error; CI = confidence interval