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RESEARCH ARTICLE

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Understanding the role of illness perceptions in the relationship between cognitive and emotional difficulties after stroke

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ABSTRACT

Emotional difficulties are common after stroke and up to one third of stroke-survivors develop post-stroke depression. Psychological distress in this population remains poorly understood, despite high prevalence and secondary implications. One established predictor of depressive symptoms after stroke is cognitive impairment, however, the mechanism underlying this relationship is unclear. This research investigated the potential role of stroke-related illness appraisals as a mediating factor to this known association. Seventy-seven participants, aged 45–94, were consecutively recruited from inpatient stroke units in Oxfordshire over 15-months and completed assessments of mood, cognition and illness appraisals, which were analyzed cross-sectionally. As expected, cognitive impairment significantly predicted depressive symptoms. Importantly, this relationship was shown to be mediated by perceptions of threat and control. Higher levels of cognitive impairment were significantly associated with lower perceived control and higher perceived threat, which partially explained the relationship between cognitive impairment and depressive symptoms. Perceptions of illness coherence were predictive of depressive symptoms but not associated with degree of cognitive impairment. This research has implications for the management of cognitive impairment in the early stages after stroke and suggests that illness appraisals may be an important intervention target for reducing depressive symptoms in patients with post-stroke cognitive impairments.

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KEYWORDS
Stroke; cognitive impairment; post-stroke depression; illness perceptions; health beliefs

Introduction

Cognition, depression and anxiety after stroke

Stroke is the largest cause of disability in the United Kingdom, with approximately 130,000 cases estimated to occur per year (Bath & Lees, 2000). Cognitive

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and emotional difficulties are frequent sequalae. As many as 91% of acute stroke patients are thought to have cognitive difficulties to some degree (Demeyere et al., 2015; Jaillard et al., 2009); around one third of stroke survivors experience depression in the year after their stroke (Hackett et al., 2005); and around 10% are impacted by Post-Stroke Cognitive Impairment (PSCI) (Mitchell et al., 2017). Cognitive and emotional difficulties after stroke can significantly impact recovery and well-being. PSCI has been shown to negatively impact engagement with neurorehabilitation (Skidmore et al., 2010) and is associated with increased levels of disability, reduced social participation and poorer quality of life (Mellon et al., 2015; Mole & Demeyere, 2020). Similarly, mental health difficulties after stroke can impede functional recovery (Pohjasvaara et al., 2001) and are predictive of reduced independence (Lee et al., 2019). Understanding these changes is therefore a key research priority (Stroke Association, 2021).

PSCI tends to improve over time, particularly during the acute stage (Ballard et al., 2003; Milosevich et al., 2024), although cognitive impairment can persist or worsen over time and lead to a dementia diagnosis (del Ser et al., 2005; Demeyere et al., 2019; Pendlebury & Rothwell, 2019). Post-stroke depression also persists over time with around one quarter of stroke patients still experiencing depression long term after stroke (Hackett et al., 2005; Kusec et al., 2023). Anxiety after stroke has been less extensively researched and its prognosis over time is unclear. A recent study found prevalence of approximately 20% long term after stroke (Kusec et al., 2023). Anxiety symptoms are also known to be highly correlated with depressive symptoms (Wright et al., 2017).

PSCI as a predictor of mood

It is well established that PSCI impacts mood over and above any bidirectional effect of mood on cognition (Nys et al., 2006) and, in particular, associations between cognitive impairment and depressive symptoms are consistently identified across the literature (Barker-Collo et al., 2010; Hackett & Anderson, 2005; Williams & Demeyere, 2021). A relationship between cognition and anxiety has also been postulated (Barker-Collo, 2007), but is less well researched. There is some support for a lesion location hypothesis (Li et al., 2019), however, previous research has indicated that there may not be a relationship with anxiety (Castillo et al., 1995), or associations may only exist due to co-morbid post-stroke depression (Lee et al., 2019; Williams & Demeyere, 2021).

There is a lack of understanding with regards to the mechanism underlying the relationship between cognitive impairment and depressive symptoms. Historically, research has focused on understanding neurobiological predictors of post-stroke depression, such as neurotransmitter disturbances (Robinson et al., 1975), hormonal dysfunction (Terroni et al., 2015) and neuroanatomical changes to frontal-subcortical circuitry (Terroni et al., 2011; Zhang et al., 2012). Fewer studies have considered the psychological process, or social and

emotional predictors of depression after stroke, such as pre-existing psychological difficulties (Mitchell et al., 2017).

The role of illness appraisals

There are many known contributors to psychological outcomes after stroke including social and structural support (Sarre et al., 2014) and participation (Hoyle et al., 2023). Perceptions of recovery and discrepancies in sense of self have been shown to be crucial to the adjustment process (Gracey et al., 2009; Gracey & Ownsworth, 2012; Hoyle et al., 2023). How a person appraises their stroke and recovery, such as their perception of loss and locus of control, has been considered to be particularly important to the relationship between PSCI and depression. Previous studies have found that the cognitive deficits most associated with depression are those that are likely to be immediately apparent and disabling, such as aphasia, amnesia and perceptual distortions (Nys et al., 2005). This is supported by wider research demonstrating a relationship between depression and aphasia (Kauhanen et al., 2000) and is in line with the Common Sense Model (CSM) which emphasizes the role of beliefs in coping with health difficulties (Leventhal et al., 1980). Cognitive and emotional representations are proposed to guide the selection of coping strategies, which influence important outcomes, such as engagement in rehabilitation and psychological adjustment. Those with greater perceptions of threat, who consider their illness to be highly symptomatic, chronic and having serious consequences, are more likely to demonstrate avoidance and high emotional expression, whereas those with a strong perception of controllability, who see their illness as coherent and manageable, are less likely to experience psychological distress (Hagger & Orbell, 2003; Hagger & Orbell, 2021). A strong relationship between illness appraisals and psychological adjustment has been demonstrated across health conditions (Hagger & Orbell, 2003), and this process has been shown to be a broadly universal phenomenon (Chesla et al., 2000), although with differences in the specific nature of perceptions across cultures (Capstick et al., 2009). This relationship has also been shown in the stroke population, with several studies demonstrating an association between appraisal style and psychological outcomes after stroke (e.g., (Aujla et al., 2020; Pai et al., 2019)). However, the possible impact of cognitive changes on stroke-related appraisals is yet to be explored. Whilst stroke survivors wish to understand more about post-stroke cognitive impairments (Hobden et al., 2023), discussions around declining trajectories and post-stroke dementia can be experienced as anxiety provoking and depressing (Hobden et al., 2024). Indeed, clinicians may therefore avoid discussions about risk of dementia after stroke (Ball et al., 2022). Likewise, cognitive rehabilitation is often a lower priority in acute stroke care (Tang et al., 2017), which could contribute to negative perceptions about recovery. In line with the Common Sense

Model, individuals with more significant cognitive impairment may therefore consider their stroke to be more threatening and less easily controlled, in turn mediating the relationship between cognition and depressive symptoms. Identifying a role of illness appraisals would present an avenue for intervention, and perhaps prevention, of psychological distress in those with PSCI.

Aims of this research

The objective of this research was to better understand whether and how illness appraisals moderate the relationship between cognitive impairments and depressive symptoms. It was hypothesized that there would be a relationship between cognition and depressive symptoms which would be at least partially mediated by illness appraisals (perceived threat and control). We also explored the relationship between cognition and anxiety symptoms, predicting that this would be accounted for by comorbid symptoms of depression, as has been shown to be the case in previous research (Williams & Demeyere, 2021). Finally, if indeed illness appraisals mediate the cognition/mood relationship, we aimed to further explore the direct relationships between level of cognitive impairment and aspects of illness appraisals.

Method

Design

This study used a cross-sectional design and reporting is in line with the STROBE checklist (von Elm et al., 2007).

Participants

Participants were consecutively recruited from the John Radcliffe Acute Stroke Unit and the Oxfordshire Stroke Rehabilitation Unit over a 15-month period (June 2021 to August 2022). The majority were assessed while in the hospital, typically at bedside, but a proportion were assessed at home due to having been quickly discharged. Patients were invited to participate if they were (i) over 18 years old and had suffered a stroke in the last six months; (ii) willing and able to give informed consent to participate; (iii) well enough to concentrate for a 30–60-minute assessment. Patients were excluded if they (i) had a prior intellectual disability; (ii) had insufficient English language skills to comprehend the initial orienting questions on the measure of cognition; (iii) were judged by the care team to be too unwell to participate (e.g., delirium, fatigue or medical complications).

All participants were recruited within a wider study (OCS-Recovery) and gave informed consent under NHS ethics (Ethics Ref: 18/SC/ 05501). In some cases,

assessments were completed in one testing session but typically, assessment batteries were staggered with breaks. Recruitment was terminated when 77 participants had completed the relevant measures, based on a priori power analyses for the primary mediation analysis, ensuring at least 80% power (conducted using G*Power (Faul et al., 2009)).

Measures

Cognition

Cognition was assessed using the OCS-Plus (Demeyere et al., 2015), a computerized, tablet-based stroke-specific screening tool comprised of 10 subtests (Demeyere et al., 2021), which takes around 15–20 minutes to complete in the subacute population (Webb et al., 2022). Impairment is scored over 18 criteria in comparison to typically aging adults of a similar age, across a number of tasks including, naming, semantics, memory and visuospatial skills, but with a particular focus on memory and executive functioning. This measure has been validated for use in the stroke population, including a task-by-task validation (Webb et al., 2022). This tool was chosen due to its capacity to detect more subtle PSCI, with particular sensitivity to deficits in memory and executive function (Demeyere et al., 2021). An overall impairment score on this measure was used, defined as the proportion of impairment on the tasks completed (e.g., if a person was impaired on 9 of the 18 criteria, this was scored as 0.5), with higher scores thus denoting more severe cognitive impairment.

Mood

Mood was assessed using the Patient Health Questionnaire (PHQ-9), a 9 item valid and reliable measure of depression (Kroenke et al., 2001), and the Generalized Anxiety Disorder Assessment (GAD-7), a seven item valid and reliable measure of anxiety (Spitzer et al., 2006). These measures were chosen due to their high sensitivity and specificity, short administration time and use in Stroke Rehabilitation services (Tyson et al., 2013). Both measures have a cut off score of 10 for identifying cases of depression or anxiety.

Illness appraisals

Illness appraisals were measured using a stroke-specific version of the Revised Illness Perception Questionnaire (Stroke IPQ-R). The IPQ-R (Moss-Morris et al., 2002) is a validated and reliable measure of nine domains of illness appraisals which has been adapted for use in stroke survivors with good internal consistency (Aujla et al., 2020). Scores on the identity, emotional, timeline, consequences and cyclical subscales can be summed to give an overall measure of perceived threat. Likewise, scores on the personal control, treatment control and illness coherence (i.e., the degree to which a person holds a coherent understanding of their illness) subscales can be summed to give an overall

measure of perceived control (Hagger & Orbell, 2003; Hagger & Orbell, 2021). Questions assessing causality were not administered as this domain can only be analyzed using factor analysis.

Stroke severity and impact

The Barthel Index for Activities of Daily Living (Loewen & Anderson, 1988) was used as an approximation of physical disability after stroke. Scores across 10 items range from 0 to 20, with lower scores reliably indicating increased disability. This was either completed by a clinician or the researcher. The NIH Stroke Scale (NIHSS) was also collected from patient records. This is an 11-item scale used to assess the severity of a stroke with high reliability and validity (Meyer et al., 2002).

Data analysis

The number of impairments on the OCS-Plus were compared to scores on the PHQ-9 and GAD-7 using multivariate linear regression, controlling for physical impairment and self-reported history of mental health difficulties. Given past literature, we anticipated that severity of PSCI would significantly predict the degree of symptoms of depression and anxiety, with at least a medium effect ($f^2 = 0.15$). PHQ-9 score was controlled for when assessing the relationship between PSCI and anxious symptoms to determine if the relationship existed aside from the impact of depression. A large effect was hypothesized for this analysis ($f^2 = 0.35$). If cognition was found to be predictive of depressive symptoms as hypothesized, we planned to conduct mediation analyses to determine the impact of appraisals on this relationship. We proposed to use a well-established method of mediation analysis (Baron & Kenny, 1986) which is dependent on demonstrating significant relationships between the independent variable (cognitive impairment) and the mediator (illness appraisals), between the mediator and the dependent variable (depressive symptoms), and between the independent variable and the dependent variable. To demonstrate mediation, the relationship between the independent variable and the dependent variable needs to be greatly reduced when the mediator is included in the model. It was therefore predicted that illness appraisals (perceived threat and perceived control) would significantly account for the variability in depressive symptoms, with a large effect ($f^2 = 0.35$), and that the effect of cognitive impairment on depressive symptoms would decrease substantially when perceived threat and perceived control were entered into the model (Baron & Kenny, 1986). If this were the case, we planned perform a bootstrapping analysis and predicted that this would also show a significant indirect effect of cognition on depressive symptoms, via illness appraisals. A sample of 77 participants was considered sufficient to ensure each of these analyses had at least 80% power.

Results

Analyses were carried out in R Studio (R version 4.2.1) and are reported below.

Demographics

Seventy-seven participants completed all measures used in the present study.[1] Eleven participants did not complete all subtasks of the OCS-Plus due to ward-based interruptions (e.g., therapy and family visits) or severity of pre-existing visual impairment (e.g., macular degeneration). These participants were included due to having completed the majority of subtasks (74% on average) and this was accounted for by scoring impairment as a proportion of tasks completed. The demographics of the sample are presented in Table 1 and stroke-specific information in Table 2. No participants had a prior diagnosis of dementia, although three were reported to have Mild Cognitive Impairment (MCI)[2] and 23 had at least one previous stroke.

Analysis

Cognition and mood. Multivariate linear regression was used to investigate the impact of cognitive impairment on anxious and depressive symptoms, controlling for physical impairment and history of mental health difficulties.[3] A significant regression model was found for the relationship between PSCI and depressive symptoms (Table 3; $F(3, 73) = 5.78$, $p < 0.01$, $f^2 = 0.24$), with cognitive impairment significantly predicting depressive symptoms. A significant regression model was also found for the relationship between PSCI and anxious symptoms, with cognitive impairment significantly predicting anxious symptoms (Table 4 – Model 1; $F(3, 73) = 6.78$, $p < 0.01$, $f^2 = 0.28$). However, when depressive symptoms were included in the model, cognitive impairment was no longer a significant predictor of anxiety (Table 4 – Model 2; $F(4, 72) = 19.99$, $p < 0.01$, $f^2 = 1.11$). The relationships between cognitive impairment and psychological distress are shown graphically in Figure 1.

Impact of illness appraisals. Causal mediation analysis was carried out to consider the possible impact of appraisals (perceived threat and control) on the relationship between cognition and depressive symptoms. When calculating overall scores for perceived threat and perceived control using the Stroke

Table 1. Demographic information.

Characteristic	Mean (SD)	Percentage
Age (years)	73.45 (12.64)	<60: 13.0%; 60–70: 27.3%: >70: 59.7%
Education (years)	13.62 (3.43)	≤12 years: 42.9%, >12 years: 57.1%
Sex	–	F: 45.5%; M: 54.5%
Handedness	–	L: 11.7%; R: 87.0%; A: 1.3%
Ethnicity	–	White British: 95%; Asian British: 2.6%; White Other: 1.3% Black British: 1.3%

Table 2. Stroke specific information.

	n	Mean (SD)	Percentage
Time since stroke (days)	77	36.08 (23.18)	–
Stroke type	–	–	Ischemic: 88.3%; Hemorrhagic: 10.4%; Other/ Unspecified: 1.3%
Stroke side	77	–	L: 39.0%, R: 50.6%, B:10.4%
Stroke severity (NIHSS Score)	71	8.09 (5.55)	–
Degree of physical difficulty (Barthel)	77	10.71 (6.51)	–
Past history of stroke	77	–	None: 68.9% One: 21.3%, Multiple: 5.0%, Unknown: 5.0%
Reported History of Mood Difficulties	77	–	24.7% (Depression: 16.9%; Anxiety: 7.8% Other: 5.2%)
Current Depression (PHQ-9)	77	7.40 (6.4)	Scored above clinical threshold: 27.5%
Current Anxiety (GAD-7)	77	4.75 (5.69)	Scored above clinical threshold: 21.3%
Cognitive Impairment (Proportion of impaired tasks on OCS-Plus)	77	0.31 (0.22)	Impaired on at least one task: 98.7%

Note: *n* is lower for NIHSS as this was not always available from patient records.

IPQ-R, only the former had acceptable internal consistency ($\alpha = .82$). A perceived control score was therefore generated by summing the personal and treatment control subscales ($\alpha = .74$) only, with illness coherence considered separately.

Perceived threat. A significant regression model was found for the relationship between degree of PSCI and perceived threat ($R^2 = .06$, $F(1, 75) = 4.75$, $p = .03$), with higher levels of PSCI predicting greater perceived threat ($b = 30.53$). A significant regression model was also found for the relationship between perceived threat and depressive symptoms ($R^2 = .65$, $F(4, 72) = 32.76$, $p < 0.01$), with greater perceived threat significantly predicting increased depressive symptoms ($b = 0.18$).[4] The association between cognitive impairment and depressive symptoms decreased when perceived threat was included in the model ($b = 6.67$) and a bootstrapping procedure with 1000 resamples indicated a significant indirect effect of cognition on depressive symptoms through perceived threat ($p < .01$), as shown in Figure 2.

Perceived control. A significant regression model was found for the relationship between PSCI and perceived control ($R^2 = .07$, $F(1, 75) = 5.86$, $p = .02$), with higher levels of PSCI predicting lower perceived control ($b = -9.08$). A significant regression model was also found for the relationship between perceived control and depressive symptoms ($R^2 = .31$, $F(4, 72) = 7.95$, $p < 0.01$), with greater perceived control significantly predicting lower depressive symptoms ($b = -0.32$). The association between cognitive impairment and depressive symptoms

Table 3. Regression analysis showing the relationship between cognitive impairment (OCS-Plus) and depressive symptoms (PHQ-9).

	b	SE (b)	*t*
Constant	1.83	2.05	0.90
OCS-Plus Impairments	10.20	3.35	3.05**
Mental Health History	4.33	1.62	2.66**
Barthel Score	0.11	0.11	1.03

Notes: $R^2 = .19$ for Regression 1 (n = 77).
*$p < .05$, **$p < .01$.

Table 4. Regression analyses showing the relationship between cognitive impairment (OCS-Plus) and anxious symptoms (GAD-7), with and without controlling for depressive symptoms (PHQ-9).

	Model 1			Model 2		
	b	SE ()	*t*	b	SE (b)	*t*
Constant	−0.76	1.73	−0.44	−1.72	1.36	−1.27
OCS-plus impairments	9.94	2.83	3.51**	4.53	2.35	1.93
Mental health history	3.63	1.37	2.65**	1.34	1.12	1.19
Barthel score	0.14	0.10	1.40	0.07	0.08	0.96
PHQ-9 score	–	–	–	0.53	0.08	6.85**

Notes: $R^2 = .22$ ($n = 77$).
*$p < .05$, **$p < .01$.

decreased when perceived controllability was included in the model (*b = 7.27*) and a bootstrapping procedure with 1000 resamples indicated a significant indirect effect of cognition on depressive symptoms through perceived controllability ($p < .05$), as shown in Figure 3.

Perceived coherence. A significant regression model was also found for the relationship between PSCI and illness coherence ($R^2 = .12$, $F(1, 75) = 10.58$, $p < .01$), with higher levels of PSCI predicting reduced illness coherence (*b = −8.44*). A significant regression model was also found for the relationship between illness coherence and depressive symptoms ($R^2 = .24$, $F(4, 72) = 5.77$, $p < 0.01$), with greater illness coherence significantly predicting lower depressive symptoms (*b = −0.30*). The association between cognitive impairment and depressive symptoms decreased when illness coherence was included in the model (*b = 7.79*), but the indirect effect was not significant ($p = .06$).

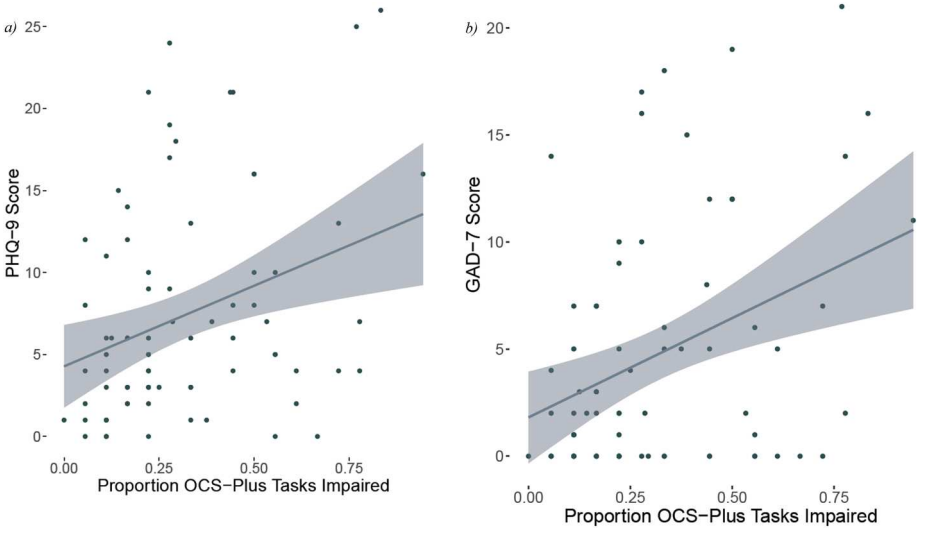

Figure 1. Graphs to show the relationship between proportion of impairments on the OCS-plus and PHQ-9 score (a) and GAD-7 score (b), with regression line and confidence interval (shaded area).

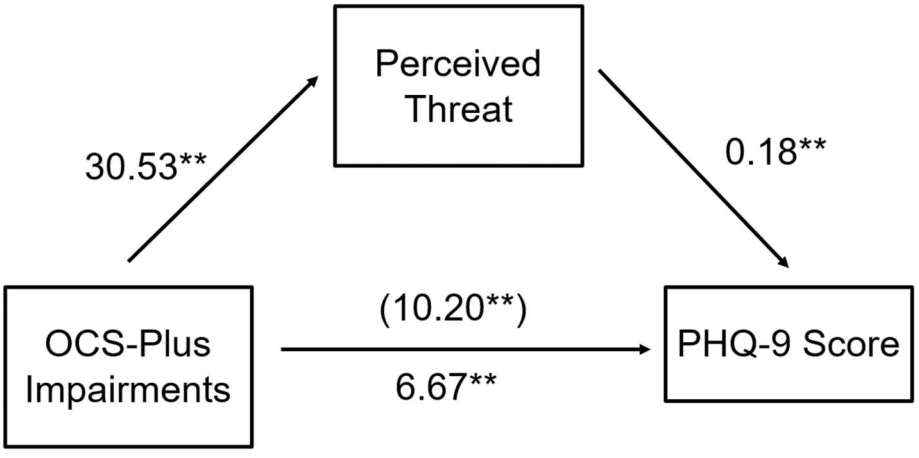

Figure 2. Graphical representation of the mediation analysis between OCS-plus impairments (independent variable), PHQ-9 score (dependent variable) and perceived threat (mediator). Co-efficients for direct and indirect effects are stated, with brackets indicating an indirect effect. $n = 77$. *$p < .05$, **$p < .01$.

Additional analysis

Due to a proportion of our sample having experienced a prior stroke, a post-hoc analysis was conducted to identify whether there were differences in the distributions of key outcome variables, between those with and without a history of previous stroke. Independent samples t-tests comparing these two groups showed no significant differences between their scores on the PHQ-9, perceptions of threat and perceptions of control (Table 5).

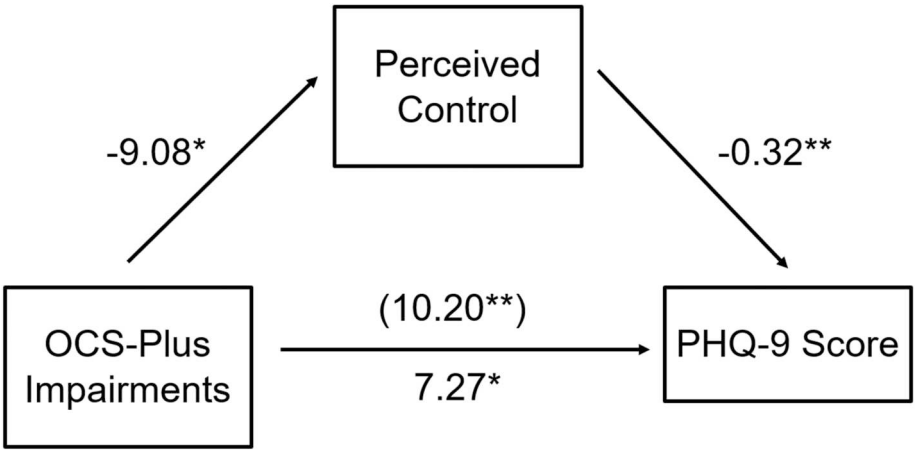

Figure 3. Graphical representation of the mediation analysis between OCS-plus impairments (independent Variable), PHQ-9 score (dependent variable) and perceived controllability (mediator). Co-efficients for direct and indirect effects are stated, with brackets indicating an indirect effect. $n = 77$. *$p < .05$, **$p < .01$.

Discussion

In line with initial hypotheses and previous research (Barker-Collo, 2007; Nys et al., 2005 Nys et al., 2006; Williams & Demeyere, 2021), this research demonstrated that degree of PSCI was associated with depressive symptoms, even when controlling for physical impairment and previous psychological difficulties. A similar relationship with anxiety did not exist when considering the impact of comorbid depression. This supports previous suggestions that the apparent association between anxiety and cognition is driven by a high of comorbidity with depression (Lee et al., 2019; Williams & Demeyere, 2021). A mediation analysis was then undertaken to better understand why a relationship between cognitive impairment and depressive symptoms exists. Consistent with cognitive theory and previous research (Aujla et al., 2020; Leventhal et al., 1980; Pai et al., 2019), we demonstrated that stroke-related illness appraisals (namely, total threat, controllability and illness coherence) are related to levels of depressive symptoms. Of these, threat perceptions explained more of the variance in depressive symptoms. Furthermore, this study presents new evidence for a relationship between cognitive impairment and illness perceptions (perceived threat and controllability), which mediated the relationship between cognition and depressive symptoms in this sample. This suggests that this relationship can be, at least partially, understood with respect to the immediate sense of disability caused by post-stroke changes in cognition (Nys et al., 2005). It may be that the perception of changes in cognition as threatening, difficult to personally manage and resistant to intervention, is responsible for increased depressive symptoms.

The importance of perceptions is perhaps not surprising given findings across a range of health conditions demonstrating the role of beliefs on symptoms of depression and adjustment (Pai et al., 2019; Thuné-Boyle et al., 2006; Vaughan et al., 2003). However, the impact of cognitive impairment on this process is less well researched. Illness beliefs have previously been shown to be relevant in other populations experiencing cognitive impairment. For example, in dementia, threat beliefs and locus of control have been shown to be key predictors of depressive symptoms (Guzmán et al., 2021; Halse et al., 2021). The observed relationship between cognition and illness beliefs is also consistent with lay perceptions of cognitive impairment, such as negative

Table 5. Independent samples *t*-tests showing the relationship between prior history of stroke and key variables (depressive symptoms, perceived threat and perceived control), tested at the 5% level.

	Prior stroke		No prior stroke				
	Mean	SD	Mean	SD	t	df	*p*
PHQ-9	8.13	6.66	7.09	6.66	−0.63	75	0.53
Perceived threat	97.96	24.25	96.70	29.21	−0.18	75	0.86
Perceived control	52.30	8.81	52.81	6.88	0.27	75	0.78

beliefs about control in carers of those with dementia (Quinn et al., 2017), and with reports by stroke-survivors of receiving limited support with memory problems after stroke (Stroke Association, 2017).

PSCI explained only a small amount of the variance in illness perceptions, which is in line with previous suggestions that illness characteristics are not always the most important predictor of how a person perceives their illness (Moss-Morris, 2013; Tansey et al., 2017). It is likely that perceptions of threat and controllability form just one part of the relationship between PSCI and depressive symptoms, with other contributing factors. For example, impairments may increase maladaptive coping strategies such as wishful thinking, catastrophizing or helplessness (Moss-Morris, 2013), due to rigidity of thinking. PSCI may also impact sense of self and personhood, which would in turn impact adjustment (Ellis-Hill & Horn, 2000). The sense of discrepancy between a person's preinjury identity and post injury sense of self is well documented as an important aspect of long term adjustment (Cantor et al., 2005). As well as increasing this sense of discrepancy, PSCI may make it more difficult for a person to resolve these differences and engage with activities that are meaningful to them, both of which are important contributors to positive psychological outcomes after brain injury (Gracey et al., 2009 Gracey & Ownsworth, 2012). However, there may be differences in this relationship at higher and lower levels of impairment. For example, those with greater PSCI, who may not have had the capacity to participate in this research, may have lower levels of insight, meaning the change in their identity is less apparent, in turn bringing about more positive coping (Naylor & Clare, 2008; Wheeler et al., 2022). The findings of this research suggest that even in the very early stages after stroke, individuals may have beliefs about their stroke which impact upon coping and adjustment. Interventions which support people to reappraise assumptions of threat and uncontrollability may be effective in reducing initial psychological distress, which may prevent later symptoms of depression. Likewise, psycho-education for those struggling to understand their stroke and its impact may also be important. Investigating the impact of interventions seeking to alter negative illness perceptions in those with PSCI would be an important step in establishing the clinical importance of this mediating relationship. Future research could also investigate how deficits in specific domains impact depressive symptoms and illness appraisals, as well as the extent to which perceptions of threat and control also contribute to anxiety after stroke.

Strengths and limitations

The recruited sample is largely representative of the clinical population due to consecutive sampling from clinical settings, and so the findings of this research are likely to be directly relevant to the subacute stroke population, despite the inevitable heterogeneity in this group (e.g., lesion location and severity). A

notable proportion of our recruited sample had had a previous stroke which, although expected within this population, may have had an impact on illness appraisals. No data were available on the extent of recovery from previous strokes. Additional analyses indicated no signs of different distributions between those with and without a prior stroke history.

Sampling in Oxfordshire meant that the recruited sample was not representative of the wider UK in terms of ethnicity and education and the impact of demographic and social factors, which may well have impacted illness beliefs and coping style (Saltapidas & Ponsford, 2008), were not explored in this study. Limits to cross-sectional methodology mean that further, longitudinal research is needed to truly understand the causal role of cognitive impairment and illness appraisals in symptoms of depression and anxiety. In particular, future research should seek to better understand the possible role of wider factors, such as stroke history, as well as the impact of specific aspects of cognition on illness appraisals. For example, impairments such as aphasia may be considered to be more threatening than other aspects of cognitive change. Likewise, an individual's appraisal of their stroke sequalae may be different for first-ever stroke compared with recurrent stroke, and direct research comparing these groups may help to tailor future interventions. Furthermore, we did not explore the reciprocal relations between depressive symptoms, illness appraisals and cognition but note the possibility that those with lower mood are in turn likely to have more negative illness appraisals and perhaps increased sensitivity to subjective cognitive impairment (Maor et al., 2001).

Conclusions

This research demonstrated a clear impact of perceptions of threat, controllability and illness coherence on depressive symptoms, indicating illness appraisals play an important role in emotional outcomes in the early stages after stroke. Cognitive impairment was shown to significantly impact perceptions, with threat and control beliefs mediating the relationship between cognition and depressive symptoms. It may therefore be particularly important to understand the specific beliefs associated with cognitive impairment in the post-stroke population, and targeting these appraisals via therapeutic intervention and increased education in the acute stroke setting, could be an effective means by which to improve longer term outcomes in those with PSCI. Establishing a causal role of illness perceptions on this relationship through longitudinal research will be an important next step in furthering the findings of this research.

Notes

1. Some participants also completed additional measures as part of co-occurring research studies.

2. MCI is defined as cognitive decline greater than expected for a person's age and education that does not significantly impact activities of daily living (Gauthier et al., 2006).
3. Assumptions of linearity, absence of multicollinearity and non-autocorrelation met. Normality assumed based on sample size and regression analysis considered robust to slight heteroskedasticity in the data.
4. For all analyses where depressive symptoms was the outcome variable, physical impairment and history of mental health difficulties were controlled for.

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