

Relationship between personality and poststroke functional outcomes: a systematic review

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ABSTRACT

Background Factors such as age and stroke severity are commonly used to predict poststroke functional outcomes and tailor stroke rehabilitation therapy. However, the role of personality in stroke rehabilitation and its influence on functional outcomes is unclear. This review aims to assess whether an association exists between personality and poststroke functional outcomes.

Methods We searched Medline, AMED, APA PsychINFO, CENTRAL, CINAHL and Scopus for studies published between database inception and 22 October 2024. Studies were included if they recruited adults with stroke, used a validated method to assess personality and poststroke functional outcomes and were published in a peer-reviewed journal.

Results Five studies were identified (n=424): four cohort and one cross-sectional. There were no major concerns regarding risk of bias. Methods of assessing personality and poststroke functional outcome both varied, with Eysenck's Personality Questionnaire and Barthel Index being the most frequently used. Extroversion, openness and lie-tendency were associated with improved poststroke functional outcomes, while type D personality was negatively associated with poststroke functional outcomes.

Conclusions There is some evidence for an association between personality and poststroke functional outcomes, but this is limited by the small number of relevant studies and small sample sizes. Further studies are needed to investigate this potential relationship.

PROSPERO registration number CRD42024592518.

INTRODUCTION

Rationale

Rehabilitation has been shown to improve the functional status of poststroke individuals, particularly for those who receive organised inpatient care in a stroke unit,¹ but there is often interindividual variability in the effectiveness of stroke rehabilitation.² There are several tools that can be used to predict functional outcomes following stroke, which can help inform stroke rehabilitation planning and allow more individualised therapy.³ These tools often use predictive factors such as age, stroke severity and baseline functional

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Personality has been associated with multiple post-stroke symptoms but its relationship with functional outcomes remains unclear.

WHAT THIS STUDY ADDS

⇒ We identified a small body of evidence supporting a relationship between personality and poststroke functional outcomes.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Further research investigating the relationship between personality and poststroke functional outcomes may facilitate better individualised stroke rehabilitation therapy.

level.^{4–6} However, there have been few studies assessing the role of personality in stroke rehabilitation and its influence on poststroke functional outcomes.

Personality refers to enduring thoughts, feelings and behaviours that characterise an individual.⁷ One of the most widely accepted models of conceptualising personality is the Five-Factor Model, also known as the Big Five.⁸ This model describes five broad categories of personality: neuroticism, extroversion, openness, agreeableness and conscientiousness. Several studies have identified associations between stroke and personality, particularly neuroticism: a recent meta-analysis found that neuroticism was a risk factor for post-stroke depression,⁹ and higher neuroticism has been associated with higher fatigue severity poststroke¹⁰ and a higher risk of incident stroke.¹¹ Despite this, the influence of personality on functional outcomes following stroke remains unclear.

Understanding the relationship between personality and poststroke functional outcomes may enable improved prediction of interindividual variability in poststroke functional outcomes and potentially help guide

tailored stroke rehabilitation programmes based on individual personality.

Objectives

This systematic review aims to assess the evidence regarding the relationship between personality and post-stroke functional outcomes in adults, specifically:

1. To investigate whether an association exists between personality and poststroke functional outcomes.
2. To explore whether certain personality traits are associated with better or worse poststroke functional outcomes.

METHODS

This systematic review has been reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement, and it is registered with the International Prospective Register of Systematic Reviews (PROSPERO) under the registration number: CRD42024592518.

Eligibility criteria

Studies were eligible if they:

1. Recruited adult (age ≥ 18 years) patients with stroke.
2. Assessed personality using a validated method of personality assessment.
3. Assessed poststroke functional outcomes using a validated score.
4. Quantitatively examined the relationship between personality and poststroke functional outcomes.
5. Were published in a peer-reviewed journal.

Studies were excluded if they recruited adults with other brain injuries (eg, traumatic brain injury), did not use a validated method of assessment of personality or poststroke functional outcomes, did not analyse the relationship between personality and poststroke functional outcomes or were non-peer-reviewed publications.

Search strategy

An extensive literature search was conducted in October 2024 to identify relevant publications that have assessed the relationship between personality and stroke outcomes. The search strategy was developed with a medical librarian in accordance with the PRISMA-Search checklist and peer-reviewed by another medical librarian using the Peer Review of Electronic Search Strategies checklist. The search included appropriately exploded Medical Subject Headings terms and Boolean operators properly adapted for each database, combining the following key terms: stroke, personality, functional outcomes and rehabilitation. Databases included Medline (1946 to October 2024), Embase (1974 to October 2024), AMED (1985 to October 2024), APA PsychINFO (1806 to October 2024), CENTRAL, CINAHL (1937 to October 2024) and Scopus (1974 to October 2024). Backward citation searching was conducted by manually inspecting the reference lists of all included studies. The citation database Scopus was used for forward citation searching and EndNote V.20

was used for deduplication. A full search strategy is found in online supplemental materials.

Selection process

Two authors (DA-Y, SM) independently screened titles and abstracts of all articles retrieved. Following exclusion of irrelevant studies, two authors (DA-Y, SM) independently screened full-text articles for inclusion. In case of disagreement at any stage, consensus was resolved through discussion and if necessary, consultation with the other authors (BJ, JH).

Data extraction

One author (DA-Y) extracted all data manually using a purpose-built template. Extracted data included country of origin, study design, sample size, participant demographics, personality and outcome assessment tools and time of assessment. Any measure of poststroke functional outcome was eligible for inclusion. However, any measure of quality of life was not included as this was deemed to not be a strictly functional outcome due to the incorporation of psychosocial domains and the subjectivity of self-administered questionnaires. No restrictions were placed on length of follow-up or number of measurement points.

Data synthesis

Meta-analyses could not be undertaken due to the heterogeneity of outcome measures and methods of personality assessment. Instead, a narrative synthesis of the findings was conducted, focusing on the relationship between personality and poststroke functional outcomes.

Quality and risk of bias assessment

We assessed risk of bias in the included studies using the Joanna Briggs Institute (JBI) critical appraisal checklists appropriate to each study type.¹² One author (DA-Y) independently assessed each included study across between 8 and 11 domains, depending on the study design.

RESULTS

Study selection

We identified 2710 records through database searching. After duplicates removal, we screened 2090 records, from which we sought to retrieve 10 full-text documents. We were unable to retrieve one record despite contacting the corresponding author. From the search, nine full-text documents were reviewed, and three papers were included in this review. We also searched documents that cited any of the included studies (forward citation searching) as well as the references of the initially included studies (backward citation searching), which identified an additional two papers fulfilling the inclusion criteria. In total, five studies were included in this review. [Figure 1](#) displays the PRISMA flowchart of the systematic search.

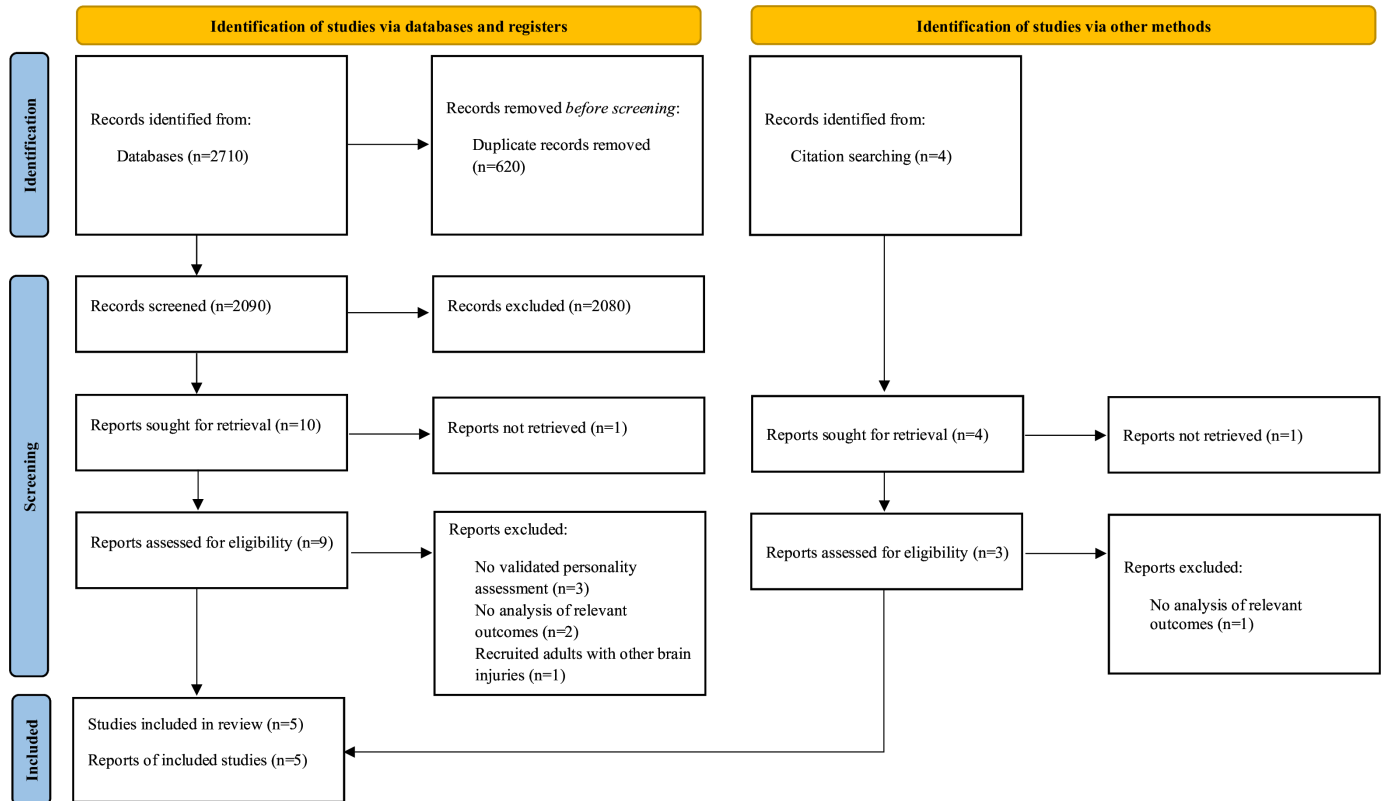


Figure 1 PRISMA flowchart of the systematic search process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

We excluded seven studies from our review. [Table 1](#) shows the characteristics of the excluded studies and the reasons for exclusion. Reasons for exclusion included reports not using a validated method of personality

assessment (n=3), lack of analysis of the association between personality and poststroke functional outcome (n=3), or recruitment of a heterogeneous

Table 1 Characteristics of excluded studies and reasons for exclusion			
Author (country)	Personality assessment method	Poststroke functional outcome assessment method	Reason for exclusion
Espernerberger <i>et al</i> (Australia) ²⁸	Semistructured interviews	Frenchay Activities Index Barthel Index	No validated personality assessment method
Karaahmet <i>et al</i> (Turkey) ²⁹	Self-reported personality traits	Functional Independence Measure	
Stone <i>et al</i> (UK) ³⁰	Questionnaire completed by carers	Barthel Index Nottingham Extended Activities of Daily Living scale	
Lau <i>et al</i> (Hong Kong) ¹⁰	NEO Five-Factor Inventory	Barthel Index	No analysis of relationship between personality and post-stroke functional outcome
Greenop <i>et al</i> (Australia) ³¹	NEO Personality Inventory-Revised	Instrumental Activities of Daily Living scale	
Storor <i>et al</i> (Australia) ²¹	NEO Personality Inventory-Revised	Modified Barthel Index Instrumental Activities of Daily Living scale	
Beck <i>et al</i> , 2010 (USA) ³²	Milon Behavioural Medicine Diagnostic	Mayo-Portland Adaptability Inventory	Recruitment of heterogeneous sample of adults with non-stroke brain injuries
NEO, Neuroticism, Extroversion, Openness to Experience.			

Table 2 Summary of the characteristics of the included studies

Author (country)	Study design	Sample size	Age, mean	Time of assessment	Personality assessment method	Poststroke functional outcome assessment method
Kim <i>et al</i> (South Korea) ¹³	Cross-sectional	n=170	64.9	3 months poststroke	Korean version of the Type D Personality Scale-14	Modified Rankin Scale score
Bragoni <i>et al</i> (Italy) ¹⁷	Prospective cohort	n=42	Control group: 66.0 Robot trained group: 58.6 Robot dropout group: 64.7	Baseline assessment within 3 months of stroke, then after 2 months of rehabilitation therapy	Eysenck Personality Questionnaire Revised	Barthel Index Functional Ambulation Category (walking ability)
Kim <i>et al</i> (South Korea) ¹⁵	Prospective cohort	n=151	64.1	2 weeks and 3 months poststroke	Big Five Inventory	Barthel Index
Hamzat <i>et al</i> (Nigeria) ¹⁴	Prospective cohort	n=27	57.0	Not reported	Eysenck Personality Questionnaire	Mean time of commencement of independent walking
Elmståhl <i>et al</i> (Sweden) ¹⁶	Prospective cohort	n=34	Men: 75.6 Women: 81.1	6 days, 1 year and 3 years poststroke	Eysenck Personality Inventory	Hamrin and Wohlin's Activity Index ¹⁸

sample of adults with other non-stroke brain injuries (n=1).

Study characteristics

Table 2 shows a summary of all the included studies' characteristics. Included studies comprised one cross-sectional study¹³ and four prospective cohort studies.^{14–17} Studies were conducted across four countries, with two studies in South Korea, one in Italy, one in Nigeria and one in Sweden. The total combined sample size of included studies was n=424, with the sample size of individual studies ranging from n=27 to n=170.

Multiple tools were used by researchers to assess personality, namely: Type D Personality Scale-14¹³, Eysenck Personality Questionnaire^{14 17} (EPQ), Eysenck Personality Inventory¹⁶ and the Big Five Inventory¹⁵. Three studies^{13 15 16} specifically assessed personality, whereas two studies^{14 17} assessed personality as a component of patients' broader psychological profiles.

A variety of measures of poststroke functional outcome were also used, including modified Rankin Scale (mRS) score, Barthel Index (BI), Functional Ambulation Category (FAC), mean time of commencement of independent walking and Hamrin and Wohlin's Activity Index¹⁸ (AI). BI was used as a measure of poststroke functional outcome in two studies,^{15 17} but none of the other measures was used in more than one study.

Risk of bias in studies

We used the JBI critical appraisal checklists appropriate to each study type to assess risk of bias for each of the included studies. Figure 2 displays a summary of these

assessments. There were no major concerns about risk of bias for the three studies, which fulfilled all the relevant criteria according to the critical appraisal checklist.^{15–17}

Two studies failed to state whether any strategies were used to mitigate the effects of potential confounding factors,^{13 14} which limits the interpretation of the conclusions made by the studies' authors.

Results of individual studies

Table 3 shows a summary of the main findings of each study. Four out of the five included studies identified an association between personality and a poststroke functional outcome.

Kim *et al*¹³ found that mRS scores 3 months after stroke were significantly higher in the type D group than in the non-type D group. In the study conducted by Bragoni *et al*,¹⁷ patients were selected for robotic or conventional rehabilitation by rehabilitative staff. In the robot-trained group, a significant correlation was identified between improved FAC score at discharge and EPQ lie-tendency score ($r=0.68$, $p=0.004$). In the conventional therapy group, personality was not associated with any differences in poststroke functional outcomes. There was no significant correlation between personality and BI score at discharge in either group. In contrast, Kim *et al*¹⁵ found that high openness was associated with a higher BI score ($p=0.047$). Elmståhl *et al*¹⁶ found that extroversion was significantly associated with higher improvement in AI during the first year after stroke. This relationship was also seen in the third year after stroke but was not statistically significant.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Kim et al. ¹⁹ , 2021 (South Korea)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
JBICritical Appraisal Checklist for Analytical Cross Sectional Studies: Q1: Were the criteria for inclusion in the sample clearly defined? Q2: Were the study subjects and the setting described in detail? Q3: Was the exposure measured in a valid and reliable way? Q4: Were objective, standard criteria used for measurement of the condition? Q5: Were confounding factors identified? Q6: Were strategies to deal with confounding factors stated? Q7: Were the outcomes measured in a valid and reliable way? Q8: Was appropriate statistical analysis used?								

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Bragoni et al. ²³ , 2013 (Italy)	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	N/A	Yes
Kim et al. ²¹ , 2013 (South Korea)	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	N/A	Yes
Hamzat et al. ²⁰ , 2006 (Nigeria)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes
Elmståhl et al. ²² , 1996 (Sweden)	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	N/A	Yes
JBICritical Appraisal Checklist for Cohort Studies: Q1: Were the two groups similar and recruited from the same population? Q2: Were the exposures measured similarly to assign people to both exposed and unexposed groups? Q3: Was the exposure measured in a valid and reliable way? Q4: Were confounding factors identified? Q5: Were strategies to deal with confounding factors stated? Q6: Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure?) Q7: Were the outcomes measured in a valid and reliable way? Q8: Was the follow up time reported and sufficient to be long enough for outcomes to occur? Q9: Was follow up complete, and if not, were the reasons to loss to follow up described and explored? Q10: Were strategies to address incomplete follow up utilised? Q11: Was appropriate statistical analysis used?											

Figure 2 Critical appraisal of the included studies. JBI, Joanna Briggs Institute.

DISCUSSION

This is the first systematic review to assess the relationship between personality and poststroke functional outcomes. Type D personality, openness, lie-tendency score and extroversion were each associated with differences in post-stroke outcomes.

Five studies were included in this review, all of which were well conducted based on our risk of bias assessment. However, studies in which personality is the exposure of interest are always limited by the fact that personality is an innate combination of characteristics and qualities that form an individual's character. Study participants cannot be made free of the exposure of interest; thus, it is impossible to confidently identify any causal relationships involving personality. As such, studies were limited

to identifying associations between personality and outcomes of interest. However, this can still be a powerful prognostic tool which can inform therapies, and the evidence presented in this review would support that.

Although Kim *et al*¹⁵ identified an association between high openness and BI score, high openness was also associated with younger age. The authors did not analyse the relationship between age and BI score, which may have provided insight as to whether age may have been a confounding factor: younger age may have been associated with higher BI scores independent of openness, and regression analysis may have revealed that openness was not in fact significantly associated with BI score.

Bragoni *et al*¹⁷ identified a correlation between EPQ lie-tendency score and improved FAC score at

Table 3 Findings of the included studies

Author (country)	Findings				
	Modified Rankin Scale score (mRS)	Barthel Index (BI)	Functional Ambulation Category (FAC)	Mean time of commencement of independent walking	Activity Index (AI)
Kim <i>et al</i> (South Korea) ¹³	Type D personality was associated with significantly higher mRS scores at 3 months post-stroke (p=0.001).	Not measured.	Not measured.	Not measured.	Not measured.
Bragoni <i>et al</i> (Italy) ¹⁷	Not measured.	Not significant.	Robot-trained group: higher lie-tendency scores were significantly correlated with higher FAC scores at discharge (r=0.68, p=0.004). Control group: not significant.	Not measured.	Not measured.
Kim <i>et al</i> (South Korea) ¹⁵	Not measured.	Openness was associated with a higher BI score (p=0.047).	Not measured.	Not measured.	Not measured.
Hamzat <i>et al</i> (Nigeria) ¹⁴	Not measured.	Not measured.	Not measured.	Not significant.	Not measured.
Elmståhl <i>et al</i> (Sweden) ¹⁶	Not measured.	Not measured.	Not measured.	Not measured.	Extroversion was significantly correlated with higher improvement of AI during the first year after stroke.

discharge—it may be that participants with a higher lie-tendency score want to be more socially desirable and would better engage with and adhere to a rehabilitation programme. They suggest that robotic therapy may be better tolerated and more effective in specific patient groups, and potentially those with specific personalities. Extroversion was significantly higher in patients who refused or abandoned robotic therapy, and this group had lower FAC scores compared with the robot-trained group.

There are several potential explanations for the associations identified between personality and post-stroke functional outcomes in the included studies. Personality is linked to coping,¹⁹ which has been found to be an important determinant of quality of life following stroke.²⁰ Elmståhl *et al*¹⁶ found that extroversion was associated with active coping strategies, which predicted improved ADL functions. The link between personality and coping may play a role in engagement with stroke rehabilitation therapies. For example, active coping might lead to higher motivation and awareness of rehabilitative goals.

Neuroticism is a predictor of poststroke depression,²¹ which is significantly associated with poor

functional outcomes.²² Similarly, studies have identified associations between neuroticism and poststroke fatigue,²³ which is also associated with poor long-term functional outcomes.²⁴ Interestingly, none of our included studies identified a relationship between neuroticism and poststroke functional outcomes.

Kim *et al*¹³ found an association between type D personality and higher mRS scores at 3 months after stroke, which is consistent with the existing literature reporting an association between type D personality and poor long-term prognosis in cardiovascular populations.²⁵ Though type D personality has independent associations with adverse cardiac events,²⁶ it is also associated with a significantly increased prevalence of depression.²⁷ The authors did not assess levels of depression in this study, so it is unclear whether the association identified between type D personality and higher mRS scores is independent of its association with depression.

The study conducted by Hamzat *et al*¹⁴ did not identify any association between personality and functional outcomes after stroke. They measured mean time of commencement of independent walking and found that this did not significantly differ with

personality. However, this may be due to the way they classified participants' personalities: they utilised the EPQ, but instead of providing separate scores for each domain, they attributed one of four personality types to each patient based on which domain they had scored highest in. This switch from a dimensional personality approach to a categorical one converted continuous data into discrete data, which limited the statistical analysis that could be performed.

The included studies were limited by their small sample sizes, single-centre approach and three quarters of the included participants being Korean, all of which reduce the generalisability and statistical power of the studies. Several studies also did not address potentially confounding factors, which may alter the strength of the associations between personality and poststroke functional outcomes. Use of different personality assessments and the variety of measures of functional outcomes meant that meta-analysis could not be conducted due to methodological heterogeneity.

CONCLUSION

Research on personality and stroke rehabilitation is sparse, but findings from this review suggest that personality may play an important role in prediction of poststroke functional outcomes. Early assessment of personality may enable us to identify patients who may be at risk of having poorer functional outcomes, which could facilitate earlier and more intensive rehabilitation to try to improve poststroke functional outcomes.

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