Relationship between mobility, social participation, and quality of life after stroke

Relação entre mobilidade, participação social e qualidade de vida pós-acidente vascular cerebral

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Abstract

Introduction: Mobility limitations commonly occur in post-stroke patients, frequently associated with restricted social participation and reduced quality of life. However, the literature is yet to clearly define the relationship between these factors. **Objective:** To conduct a systematic review of observational studies to investigate the relationship between mobility, social participation, and quality of life in post-stroke patients. **Methods:** This systematic review was registered on PROSPERO (CRD42023368824). Pub Med, EMBASE, and LILACS were systematically searched following the PRISMA guidelines in December 2024. The selection, data extraction, and methodological quality assessment of the studies were conducted by two independent reviewers, with conflict resolution by a third reviewer. The ARHQ Methodology Checklist was used to assess the methodological quality of cross-sectional studies and the Newcastle-Ottawa scale for cohort studies. The Best Evidence Synthesis system was used to assess the quality of evidence in this review. **Results:** Of the 350 retrieved studies, eight met the eligibility criteria. Of these, two assessed the relationship between mobility and social participation, whereas six, the relationship between mobility and quality of life. The studies showed a limited level of evidence as all had moderate methodological quality (the scores of which ranged 50 from 80%). **Conclusion:** Despite evidence of a relationship between mobility, social participation, and quality of life, conclusions require careful interpretation due to the methodological limitations of the retrieved studies and the heterogeneity of the used scales.

Keywords: Stroke. Mobility limitation. Social participation. Quality of life. International Classification of Functioning, Disability and Health.

Resumo

Introdução: *Limitações na mobilidade são comuns em pacientes pós-acidente vascular cerebral (AVC), frequentemente associadas à restrição da participação social e à redução da qualidade de vida. No entanto, a relação entre esses fatores ainda não está claramente definida na literatura.* ***Objetivo:*** *Realizar uma revisão sistemática de estudos observacionais para investigar a relação entre mobilidade, participação social e qualidade de vida em pacientes pós-AVC.* ***Métodos:*** *Essa revisão sistemática foi registrada no PROSPERO (CRD42023368824). Buscas sistemáticas foram realizadas nas bases de dados PubMed, EMBASE e LILACS seguindo o* guideline *PRISMA, em dezembro de 2024. A seleção, extração de dados e avaliação da qualidade metodológica dos estudos foram conduzidas por dois revisores independentes, com resolução de conflitos por um terceiro revisor. A escala ARHQ Methodology Checklist foi utilizada para avaliar a qualidade metodológia dos estudos transversais e a escala Newscatle-Ottawa para os estudos de coorte. O sistema Best Evidence Synthesis (BES) foi utilizado para avaliar a qualidade da evidência dessa revisão.* ***Resultados:*** *Dos 350 estudos identificados, oito atenderam aos critérios de elegibilidade. Destes, dois avaliaram a relação entre mobilidade e participação social, enquanto seis investigaram a relação entre mobilidade e qualidade de vida. O nível de evidência foi considerado limitado, pois os oito estudos apresentaram qualidade metodológica moderada, com pontuações entre 50 e 80%.* ***Conclusão:*** *Embora existam evidências de uma relação entre mobilidade, participação social e qualidade de vida, as conclusões devem ser interpretadas com cautela devido às limitações metodológicas dos estudos e à heterogeneidade das escalas utilizadas.*

Palavras-chave: *Acidente vascular cerebral. Limitação de mobilidade. Participação social. Qualidade de vida. Classificação Internacional de Funcionalidade, Incapacidade e Saúde.*

Introduction

Recovering mobility constitutes a priority for stroke survivors.[1,2] It involves activities such as standing up, sitting down, climbing stairs, turning, transferring, using a wheelchair, walking at speed, and covering specific distances.[3] Post-stroke mobility recovery is closely linked to the ability to regain lower-limb function, sitting and standing balance, walking ability, and other skills.[1,2]

The International Classification of Functioning, Disability and Health defines mobility as (1) changing and maintaining body position, (2) carrying, moving, and handling objects, (3) walking and moving, and (4) moving around using transportation.[4] These activities determine independence in mobility.[2,5] Mobility can be understood as individuals' ability to move within the environment to participate in activities of daily living and to travel from one place to another, including actions such as standing up, bending, walking, and climbing steps.[6]

Participation is defined as involvement in a life situation, and participation restrictions are defined as problems an individual may experience during life situations.[4,7] Participation is considered an indicator of successful rehabilitation[8] and a crucial factor for post-stroke social reintegration,[9] representing a major public health concern.[10] Furthermore, participation is intrinsically related to environmental factors – physical, social, and attitudinal – which may act either as facilitators or barriers to individuals' engagement in life situations.[4]

Quality of life is defined as individuals' perception of their position in life within the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.[11] This concept encompasses personal, physical, and psychological characteristics and social aspects, providing a multidimensional indicator of individual well-being and health.[12]

Post-stroke patients experience limitations in mobility, a priority in rehabilitation.[1-3,13] Moreover, post-stroke social participation is frequently disrupted, restricted, and challenging, constituting a need that is often unmet in these patients.[3,14] Although individuals partially resume their pre-stroke activities, they maintain physically demanding and community-based activities less frequently than domestic and sedentary activities.[14] Stroke survivors often face permanent sequelae and dependence, with functional and psychological impairments that compromise their autonomy in daily activities and reduce their quality of life.[15-17]

Mobility rehabilitation facilitates the performance of physical activities in the home and community environments, promoting social participation and contributing to improvements in quality of life.[6] Given the impact of stroke on mobility, social participation, and quality of life in affected patients, this systematic review aims to analyze the relationship between mobility and social participation and quality of life in post-stroke patients.

Methods

This systematic review was registered on PROSPERO (CRD42023368824), and follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline.[18]

Search strategies

Systematic searches were initially conducted in September 2023 and updated in December 2024 on Pub Med, EMBASE, and LILACS. The following Medical Subject Headings (MeSH) and their synonyms were used: Stroke [MESH] AND Mobility limitation [MESH] AND (Social participation [MESH] OR Quality of life [MESH]). Emtree terms were also used on EMBASE. In LILACS, two strategies were used: the first included terms in Portuguese with all alternative terms from Health Science Descriptors (DeCS), whereas the second included only the four Portuguese DeCS terms. The search strategies on each database are detailed in the supplementary material.

Eligibility criteria

Characterized according to the PEOT framework, the eligibility criteria to select articles were: "P" (population), individuals who had experienced a stroke with no restrictions regarding age, sex, or time since stroke; "E" (exposure), mobility; "O" (outcome), social participation and/or quality of life; and "T" (type of study), unrestricted, with only review and experimental studies being excluded.

The following were used as inclusion criteria: observational studies that assessed the relationship between mobility and social participation and/or quality of life in post-stroke patients in the acute and chronic phases of the disease. Experimental studies and review studies were excluded.

Study selection and data extraction

After the search, the titles and abstracts of eligible studies were screened by two blinded reviewers based on previously established eligibility criteria. Studies with unavailable in full were excluded. Disagreements between reviewers were resolved by consensus and, when necessary, with a third reviewer. Study management was performed on Rayyan – Intelligent Systematic Review.[19]

To extract the data from the selected studies, a document was created on Microsoft Word with a data extraction table for each article. This was also conducted by two blinded reviewers from December 2023 to December 2024. The extracted data included authors' names, year of publication, country, study design (cohort or cross-sectional), number of participants, age, sex, type of stroke (ischemic or hemorrhagic), TOAST classification (Trial of Org 10172 in Acute Stroke Treatment), stroke severity according to the National Institutes of Health Stroke Scale, performance of thrombectomy/thrombolysis, time since stroke, mobility assessment instrument and parameter, measures of social participation and quality of life, type of inferential analysis, and the main result regarding the relationship between the variables of interest. Discrepancies between evaluators were discussed, a third reviewer was consulted in case of disagreements.

Methodological quality assessment

The methodological quality of each chosen study was assessed by two blinded reviewers. Scales were used according to study design: the ARHQ Methodology Checklist for cross-sectional studies[20] and the Newcastle–Ottawa Scale for cohort studies.[21] Disagreements between reviewers' judgments were resolved between them and, when disagreement persisted, together with a third reviewer. The scores for each study were classified according to a percentage-based categorization method.[22] Studies with a score above 80% were considered high quality; those with scores from 50 to 80%, as moderate quality; and studies scoring below 50%, as low quality.

Statistical analysis

This review first aimed to perform a meta-analysis to establish relationships between mobility limitations and social participation and quality of life in post-stroke patients. However, the wide variety of analyses in the included studies (descriptive, association, and prediction studies), research designs (five cohort and three cross-sectional studies), and assessment instruments used prevented such meta-analysis.

Therefore, the chosen studies were organized into two subgroups by a qualitative analysis: (1) mobility and social participation and (2) mobility and quality of life. The findings of each study were individually evaluated

and synthesized, highlighting the types of observed associations, the direction and magnitude of the reported relationships, and the used instruments. This approach allowed for a structured comparison of the results despite the methodological differences among the studies.

Analysis of level of evidence

The Best Evidence Synthesis system (supplementary material) was used to assess the quality of the evidence in this review. It can be applied under substantial heterogeneity between the included studies if the researchers rejected a meta-analysis.[23]

Results

The initial database search in this review retrieved 350 studies, of which 141 were duplicates. This review screened the remaining 209 articles based their titles and abstracts, considering 24 articles as eligible and choosing them for full-text reading. This review extracted the data and analyzed the methodological quality of eight articles. Figure 1 describes the flowchart of the study selection process, whereas Table 1 shows the main characteristics of the eight included studies.[24-31] Regarding the analyzed variables, six studies assessed mobility and quality of life (Table 2), whereas two, mobility and participation (Table 3).

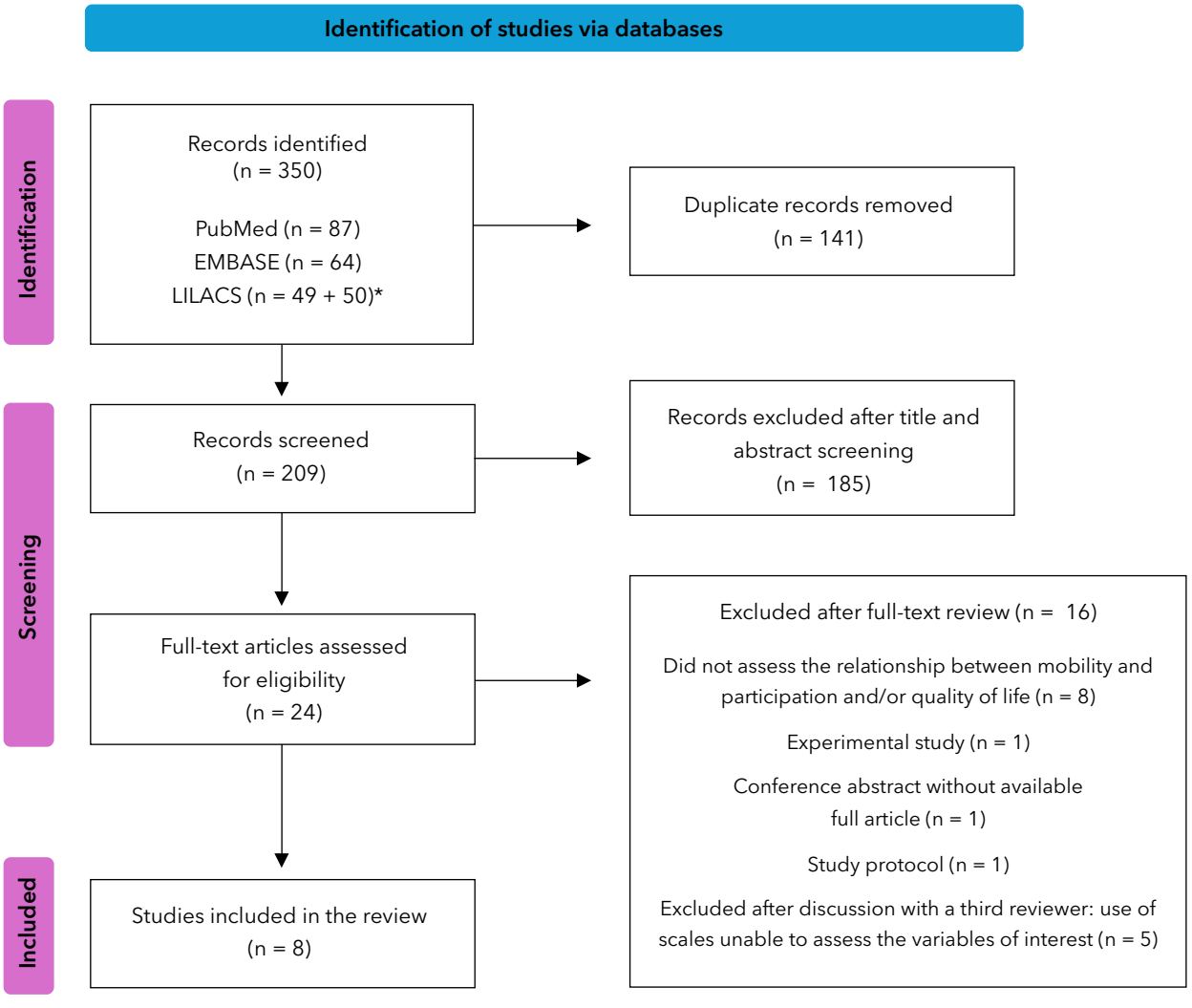

Figure 1 - Study selection process according to the PRISMA flow diagram.

Note: *Two strategies were used (Tables 3 and 4 of the supplementary material).

Table 1 - Characteristics of the eight included studies

Studies	Sample	Type of stroke	NIHSS	Time post-stroke	Instruments
Chang et al. (2023), Taiwan[24] Design: cohort Type: descriptive and predictive	n = 570 (228F/342M) Age: 52.61 (±8.3)	392 IQ 178 HM	Mean (SD): 8.80 (±2.26)	1, 3, 6, and 12 months (acute to chronic)	1. AM-PAC 2. PM-3D4D 3. NA*
Chavda and Prakash (2023), India[25] Design: cross-sectional Type: descriptive and comparative	n = 77 (25F/52M) Age: 58 (±10)	NR*	NR*	Mean (SD): 24 (±34) months (chronic)	1. Transportation use questionnaire 2. SIS 3. NA*
Franceschini et al. (2010), Italy[26] Design: cohort Type: descriptive and association	n = 528 (241F/287M) Age: 68 (±11.9)	396 IQ 132 HM	NR*	12 months (chronic)	1. TCT 2. NA* 3. EQ5D (EQ-index)
Fonseca et al. (2021), Brazil[27] Design: cohort Type: descriptive	n = 68 (68F/0M) Age: 56 (±13.7)	40 IQ 28 HM	Median (IQR): 2 (1-5)	Median (IQR): 10 (4–29) months (chronic)	1. TUG 2. NA* 3. EQ5D (EQ-index)
Im et al. (2020), Republic of Korea[28] Design: cohort Type: descriptive and association	n = 181 (83F/98M) Age: 67.3 (±13)	132 IQ 47 HM 2 CM	Median (IQR): 5 (2-8)	3, 6, and 12 months (acute to chronic)	1. PSC, FAC 2. NA* 3. EQ5D (EQ-index)
Rouillard et al. (2012), South Africa[29] Design: cross-sectional Type: descriptive	n = 46 (26F/20M) Age: 51.9 (±14.3)	16 IQ 9 HM 21 UD	NR*	Six months (chronic)	1. NEADL 2. NA* 3. EQ5D (QoL-VAS)
Ryan et al. (2024), Switzerland[30] Design: cohort Type: descriptive and association	n = 51 (18F/38M) Age: 71.1 (±10.3)	51 IQ	Median (IQR): 2 (1-0)	Three and 12 months (acute to chronic)	1. TUG 2. NA* 3. SS-QOL
Vahlberg et al. (2013), Sweden[31] Design: cross-sectional Type: descriptive and association	n = 195 (57F/138M) Age: 74 (±5.2)	172 IQ 23 HM	NR*	12 to 36 months (chronic)	1. SPPB 2. NA* 3. EQ5D (EQ-index and Qol-VAS)

Note: Age: mean (SD); SD = standard deviation; F = female; M = male. Stroke type: CM = combined; HM = hemorrhagic; UD = undetermined; IQ = ischemic; NR = not reported. NIHSS = National Institutes of Health Stroke Scale. Instruments: 1. Mobility assessment: AM-PAC = Activity Measure for Post Acute Care (mobility domain of the scale);[44] Transportation use questionnaire;[25] TCT = Trunk Control Test;[41] TUG = Timed Up and Go;[38] PSC = Post-Stroke Checklist (mobility domain of the scale);[35] FAC = Functional Ambulation Categories;[34] NEADL = Nottingham Extended Activities of Daily Living (mobility domain of the scale);[40] SPPB = Short Physical Performance Battery;[37] 2. Social participation assessment: PM-3D4D = Participation Measure – 3 Domains 4 Dimensions;[45] SIS = Stroke Impact Scale (participation domain of the scale);[46] 3. Quality of life assessment: EQ5D = EuroQol 5 Dimensions; EQ-index = index derived from the EQ5D questionnaire; QoL-VAS = Quality of Life Visual Analogue Scale (the visual analogue scale of the EQ5D);[36] SS-QoL = Stroke-Specific Quality of Life Scale;[39] NA = not applicable.

Table 2 - Main results of studies evaluating mobility and quality of life (QoL) in post-stroke patients

Studies	Mobility descriptive data	QoL descriptive data	Inferential statistics	Conclusion
Franceschini et al. (2010)[26]	TCT (0–100, higher scores indicate better trunk control) mean (SD): 84.4 (±23.2) median (IQR): 100 (74–100)	EQ index (0–1, higher scores indicate better QoL; < 0.78 indicates impaired QoL) mean (SD): 0.48 (NR)	Association: MLR	No statistically significant association between TCT and quality of life indices (EQ-5D and QoL-VAS).
Fonseca et al. (2021)[27]	TUG (> 14 seconds indicates impaired mobility) median (IQR): 15 (11–42)	EQ index (0–1, higher scores indicate better QoL; < 0.78 indicates impaired QoL) median (IQR): 0.60 (0.18-0.76)	Not performed	The sample showed impaired mobility and reduced quality of life.
Im et al. (2020)[28]	FAC (0–5, higher scores indicate better independence in ambulation) three months: median (IQR): 3 (1.75–4) 6 months: median (IQR): 4 (1.5–5) 12 months: median (IQR): 4 (1–5) PSC (most prevalent problems) At 3 months: reduced mobility and mood disturbances At 6 months: prevalence of worsened mobility increased by 16% At 12 months: reduced mobility and communication difficulties	EQ index (0–1, higher scores indicate better QoL; < 0.78 indicates impaired QoL) 3 months mean (SD): 0.68 (±0.31) 6 months mean (SD): 0.65 (±0.32) 12 months mean (SD): 0.69 (±0.33)	Association: SC at 6 months: FAC × EQ index *Respondent group: r = 0.484, p = 0.01 *Proxy group: r = 0.671, p < 0.001 MLR (at 3 months): FAC × EQ index: b = 0.095, p < 0.001 PSC × EQ index: b = -0.582, p = 0.014 MLR (at 6 months): FAC × EQ index: b = 0.118, p < 0.01 PSC × EQ index: b = -0.17, p = 0.014	Mobility (FAC) showed a positive correlation and was a predictor of quality of life at 3 and 6 months post-stroke, whereas PSC (mobility domain) showed a negative association. These findings indicate that higher mobility (reflected by a higher FAC score and a lower PSC score) is associated with better quality of life (higher EQ-index score).
Rouillard et al. (2012)[29]	NEADL (mobility domain) – Independence in activities Walking outdoors: 32 (69.6%) Getting in/out of a car: 32 (69.6%) Walking on uneven terrain: 27 (58.7%) Crossing streets: 25 (54.3%) Climbing stairs: 18 (39.1%) Using public transportation: 16 (34.8%)	QoL-VAS (0–100, higher scores indicate better QoL) median (IQR): 70 (57–85)	Not performed	Out of the 46 patients, few were independent in more complex mobility activities, such as climbing stairs and using public transportation. Similarly, this sample showed impaired QoL.
Ryan et al. (2024)[30]	TUG (> 14 seconds indicates impaired mobility) 3 months mean (SD) = 10.1 (±4.4) seconds 12 months mean (SD) = 8.7 (±2.9) seconds	SS-QoL (49–245, higher scores indicate better QoL) 3 months mean (SD) = 201.5 (±20.5) 12 months mean (SD) = 204.2 (±17.4)	Association: LMER TUG at 3 months × SS-QoL b = -13.923, p = 0.048 R^2 = 0.658, Cohen's f^2 = 1.93	The TUG time at 3 months post-stroke and SS-QoL showed a negative association, suggesting that a longer TUG time (lower mobility) is related to a decline in QoL R^2 = 0.658 indicates that mobility explains 65.8% of the variation in QoL.
Vahlberg et al. (2013)[31]	*SPPB (0 to 12, higher is better) median (IQR) = 10 (4) mean (SD) = 8.7 (±2.9)	*EQ index (0 to 1, higher is better) mean (SD): 0.73 (±0.36) *QoL VAS (0 to 1, higher is better) mean (SD): 0.70 (±0.20)	Association SLR SPPB X EQ index: b = 0.48 (p < .001) (95% CI: 4 to 6.8) MLR SPPB x EQ Index: b = 0.18 (p = 0.02) (95% CI: 0.35 to 3.56)	Mobility showed a positive predictive relationship with QoL. The regression model explained 42% of the variance in mobility, highlighting the importance of this variable as a predictor of QoL. The results indicate that mobility has a significant impact on QoL.

Note: QoL = quality of life. Mobility assessment instruments: TCT = Trunk Control Test (0–100; higher scores indicate better trunk control);[41] TUG = Timed Up and Go (time >14 seconds indicates impaired mobility);[38,47] FAC = Functional Ambulation Categories (0–5; higher scores indicate greater walking independence);[34] PSC = Post-Stroke Checklist – mobility domain (tool to identify difficulties after stroke; higher scores indicate lower mobility);[35] NEADL = Nottingham Extended Activities of Daily Living – mobility domain (assesses instrumental activities of daily living in four domains; including mobility);[40] SPPB = Short Physical Performance Battery (0–12; higher scores indicate better mobility);[37] Quality of life assessment instruments: EQ-index = index derived from the EQ5D questionnaire (0–1; higher scores indicate better quality of life;[36] scores below 0.78 indicate impaired quality of life in post-stroke patients);[56] QoL-VAS = Quality of Life Visual Analogue Scale – EQ5D visual analogue scale[36] (0–1 in the study by Vahlberg et al.;[31] and 0–100 in the study by Rouillard et al.;[29] higher scores indicate better quality of life); SS-QoL = Stroke-Specific Quality of Life Scale (49–245; higher scores indicate better quality of life).[39] Inferential statistics: SLR = simple linear regression; MLR = multiple linear regression; SC = Spearman correlation; ITT = independent t-test; LMER = linear mixed-effects regression. SD = standard deviation; IQR = interquartile range; CI = confidence interval; r = Spearman correlation coefficient; β = regression coefficient; R^2 = coefficient of determination; p = significance value.

Table 3 - Main results of studies evaluating mobility and social participation in post-stroke patients

Studies	Mobility descriptive data	SP descriptive data	Inferential statistics	Conclusion
Chang et al. (2023)[24]	*AMPAC (mob) (0–100, higher scores indicate better mobility) mean (SD): 58.20 (±8.54)	*PM-3D4D (changes over time) -Participation frequency: slight improvements in all domains, especially during the first 3 months. - Perceived difficulty: difficulty in activities slightly decreased. - Slight improvement in social, community, and productive participation over one year after hospital discharge. Most of the improvement occurred within the first 3 months.	Prediction (LMER): (AMPAC × PM-3D4D domains) AMPAC × social participation frequency: b = 0.29 AMPAC × community participation frequency: b = 0.46 AMPAC × productive participation frequency: b = 0.42 AMPAC × social participation difficulty: b = 0.24 AMPAC × community participation difficulty: b = 0.47 AMPAC × productive participation difficulty: b = 0.42	Mobility (AMPAC) was the strongest predictor for all categories and dimensions of participation (PM-3D4D) over time, with b values ranging from 0.29 to 0.47. This predictive relationship shows that mobility limitations negatively impact social participation after stroke.
Chavda and Prakash (2023)[25]	*Transportation use questionnaire (independent/ dependent): Walking > 15 min: n = 56/n = 20 Bus: n = 32/n = 44 Automatic car: n = 45/n = 1 Train: n = 24/n = 52 Car passenger: n = 35/n = 41	*SIS (8–40, higher scores indicate better participation) (SIS score for independent/dependent in transportation use): mean (SD) Walking > 15 min: 27 (±9)/16 (±8) Bus: 28 (±10)/21 (±8) Automatic car: 26 (±9)/20 (±9) Train: 30 (±9)/21 (±8) Car passenger: 30 (±9)/19 (±8)	Comparison (ITT): (mean difference in SIS score for independent vs. dependent) Walking > 15 min: 11/6 to 14 (95% CI)/p < 0.01 Bus: 7/2 to 11 (95% CI)/p < 0.01 Automatic car: 6/2 to 11 (95% CI)/p < 0.01 Train: 9/4 to 13 (95% CI)/p < 0.01 Car passenger: 11/7 to 14 (95% CI)/p < 0.01	Patients who were independent in all assessed modes of transportation had significantly higher social participation scores than dependent patients.

Note: SP = social participation. Mobility assessment instruments: AMPAC (mob) = Activity Measure for Post Acute Care – mobility domain (0–100; higher scores indicate better mobility);[44] Transportation use questionnaire25 – the authors report the number of patients dependent and independent in using different types of transportation (total sample = 77). Social participation assessment instruments: PM-3D4D = Participation Measure – 3 Domains 4 Dimensions – assesses social participation in three domains (productivity; social; and community) and four dimensions (frequency; diversity; satisfaction; and perceived difficulty);[45] SIS = Stroke Impact Scale – participation domain (assesses the impact of stroke on various aspects of life; including social participation; score ranges from 0 to 100; higher scores indicate better social participation.[46] Chavda and Prakash[25] used a score range of 8–40). Inferential statistics: SLR = simple linear regression; MLR = multiple linear regression; SC = Spearman correlation; ITT = independent t-test; LMER = linear mixed-effects regression. SD = standard deviation; IQR = interquartile range; CI = confidence interval; r = Spearman correlation coefficient; b = regression coefficient; R^2 = coefficient of determination; p = significance value.

Methodological quality of the included studies

This review has a limited level of evidence according to the Best Evidence Synthesis system[23] as it includes eight studies of moderate methodological quality, the scores of which ranged from 50 to 80% (Table 4).

Cohort studies showed scores ranging from 55 to 78%. The main points this review deducted were related to potential sources of bias: (item 1) the sample poorly represented the average community, (item 2) case representativeness, (item 3) exposure evaluation was neither based on secure records nor on structured interviews with masking, (item 6) exposure determination was neither based on blinded or independent assessment nor secure records, and (item 8) adequacy of cohort follow-up, as most studies failed to describe sample loss.

Cross-sectional studies showed scores ranging from 50 to 70%. The main points deducted were related to sources of bias: (item 3) lack of indication of the time period used for identification, (item 5) no masking of the subjective components of the study to other aspects of participants' status, (item 6) absence of description of any assessments for quality assurance (test–retest of primary outcome measurements), (item 7) no explanation of any patient exclusions from the analysis, (item 8) lack of description of how confounding was assessed and/or controlled, (item 10) absence of description of patient response rates and data collection completeness, and (item 11) lack of clarification regarding the expected follow-up and the percentage of patients for whom data were obtained or who had incomplete follow-up.

Table 4 - Methodological quality assessment of the included cohort and cross-sectional studies

Studies	Study design/ Assessment scale	Items scored in the article	Total score/ Maximum possible score	Percentage (%)	Methodological quality
Chang et al.[24]	CO/NOS	1,2,4,5*,7,8	7/9	78	Moderate
Chavda and Prakash[25]	CS/AHRQ	1,2,4,7,8	5/10	50	Moderate
Franceschini et al.[26]	CO/NOS	2,4,5*,7	5/9	55	Moderate
Fonseca et al.[27]	CO/NOS	1,2,4,6,7	5/9	55	Moderate
Im et al.[28]	CO/NOS	2,4,5*,7	5/9	55	Moderate
Rouillard et al.[29]	CS/AHRQ	1,2,3,4,6,7,8	7/10	70	Moderate
Ryan et al.[30]	CO/NOS	1,2,4,5*,7,8	7/9	78	Moderate
Vahlberg et al.[31]	CS/AHRQ	1,2,3,4,9,10,11	7/11	64	Moderate

Note: CO = cohort; CS = cross-sectional; NOS = Newcastle-Ottawa Scale[21] (for cohort studies); AHRQ = AHRQ Methodology Checklist[20] (for cross-sectional studies). AHRQ checklist items: 1) Define source of information (survey; record review); 2) List inclusion and exclusion criteria for exposed and unexposed subjects (cases and controls) or refer to previous publications; 3) Indicate the time period used for identifying patients; 4) Indicate whether subjects were consecutive or not if not population-based; 5) Indicate if evaluators of subjective components of study were masked to other aspects of the status of the participants; 6) Describe any assessments undertaken for quality assurance purposes (e.g.; test/retest of primary outcome measurements); 7) Explain any patient exclusions from analysis; 8) Describe how confounding was assessed and/or controlled; 9) If applicable; explain how missing data were handled in the analysis; 10) Summarize patient response rates and completeness of data collection; 11) Clarify what follow-up; if any; was expected and the percentage of patients for which incomplete data or follow-up was obtained.[20] NOS checklist items: 1) Representativeness of the exposed cohort; 2) Selection of the non-exposed cohort; 3) Ascertainment of exposure; 4) Demonstration that outcome of interest was not present at study start; 5) Comparability of cohorts based on design or analysis controlled for confounders; 6) Assessment of outcome; 7) Was follow-up long enough for outcomes to occur; 8) Adequacy of follow-up of cohorts.[21] Maximum possible score: total scale. For the cross-sectional studies by Rouillard et al.[29] and Chavda and Prakash;[25] item 9 was "not applicable" (maximum = 10 points); whereas for Vahlberg et al.[31] it was applicable (maximum = 11 points). In cohort studies; item 5 could be scored twice; these cases are marked with an asterisk (*). Methodological quality: studies scoring >80% = high quality; 50–80% = moderate; <50% = low quality.

Discussion

Most articles in this systematic review focused on the relationship between functional capacity, participation, and quality of life, whereas the impact of mobility on these outcomes remains underexplored. It is important to highlight that the concept of functional capacity is often confused with mobility. Functional capacity can be defined as a broad and multidimensional concept that encompasses activities of daily living, instrumental activities of daily living, and mobility activities.[32] Mobility is correlated with functional capacity, indicating that the longer individuals require to perform the mobility test Timed Up and Go (TUG), the lower their functional capacity.[27] These findings point to the need to explain the distinctions between these concepts, which, although complementary, are not synonymous.

Most studies in this review had samples consisting of post-stroke patients with mobility limitations.[24,25,27-29,31] Moreover, all studies that assessed quality of life[26-31] indicated impairment in the quality of life of post-stroke patients. Similarly, studies that evaluated social participation also showed that these patients had restricted social participation.[24,25] These findings corroborate previous studies reporting that post-stroke patients frequently endure mobility limitations,[1,2] considerable impairments in quality of life,[15,33] and restrictions in social participation.[3,14]

Of the eight included studies, six investigated the relationship between mobility and quality of life – two only showed the descriptive data of their sample[27,29] and four[26,28,30,31] examined the relationship between variables by statistical methods. Of these, three found an association between their variables.[28,30,31] The only two included studies that evaluated the relationship between mobility and social participation[24,25] found some association between their variables via different statistical methods.

Does post-stroke mobility affect quality of life?

Im et al.[28] conducted an association analysis using functional ambulation categories (FAC)[34] and the Post-Stroke Checklist (PSC)[35] to assess mobility and the EuroQol 5 Dimensions (EQ-5D)[36] to assess quality of life. Using Spearman's correlation, the authors found a positive correlation between mobility (FAC) and quality of life (EQ-5D) six months after stroke in the respondent group ($r = 0.484$; $p = 0.01$) and in the group whose responses were provided by caregivers ($r = 0.671$; $p < 0.001$). In their multiple linear regression three months after the stroke, FAC positively predicted quality of life ($b = 0.095$; $p < 0.001$), whereas PSC (mobility domain) showed a negative relationship ($b = -0.582$; $p = 0.014$). At 6 post-stroke months, FAC remained a positive predictor ($b = 0.118$; $p < 0.01$), and PSC again showed a negative relationship ($b = -0.17$; $p = 0.014$). These findings highlight that greater mobility (a higher FAC score and a lower PSC score) is associated with better quality of life, showing the relationship between these variables. The authors reinforce the importance of mobility as a crucial determinant of quality of life in post-stroke patients.

Vahlberg et al.[31] conducted a prediction analysis using the Short Physical Performance Battery (SPPB)[37] to assess mobility and the EQ5D[36] to assess quality of life using simple and multiple linear regression. Mobility showed a positive predictive relationship with quality of life (regression coefficient $b = 0.18$; $p = 0.02$). The regression model explained 42% of the variance in mobility, highlighting the relevance of this variable as a predictor of quality of life. The results indicate that mobility significantly impacts quality of life. The authors suggest that interventions aimed at improving quality of life in individuals 1–3 years after stroke should prioritize mobility.

Ryan et al.[30] conducted a prediction analysis using mobility, assessed by TUG,[38] as a predictor variable of quality of life, measured by the Stroke Specific Quality of Life Scale.[39] Their mixed-effects linear regression model showed a significant negative association between TUG time at 3 post-stroke months and SS-QoL development (regression coefficient = −13.923; $p = 0.048$), suggesting that longer TUG time at 3 months, indicating lower mobility, is associated with a decline in quality of life. Their R^2 value of 0.658 (Cohen's $f^2 = 1.93$) indicates that mobility explains 65.8% of the variance in quality of life. This result suggests that the longer patients take to complete the mobility test, the greater their perceived decline in quality of life. This association may reflect how mobility limitations interfere with essential aspects of daily life, directly affecting patients' overall well-being.

Rouillard et al.[29] conducted a descriptive study using the mobility domain of the Nottingham Extended Activities of Daily Living[40] to assess mobility and the EQ5D[36] to assess quality of life. Among the 46 patients in the sample, most were independent in gait-related activities,

such as walking outdoors (69.6%), getting in and out of a car (69.6%), walking on uneven ground (58.7%), and crossing streets (54.3%). However, fewer individuals were independent in more complex mobility activities, such as climbing stairs (39.1%) and using public transportation (34.8%), evincing the impaired quality of life in this sample (median 70, IQR: 57–85). Fonseca et al.[27] used TUG[38] to assess mobility and the EQ5D[36] to evaluate quality of life. Taher descriptive results showed parallel impairments in mobility and quality of life in post-stroke patients, with a mean TUG time of 15 seconds, indicating reduced mobility, and an EQ5D score below 0.78, reflecting impaired quality of life. Although Fonseca et al.[27] and Rouillard et al.[29] ignored correlation or prediction analyses, their descriptive findings suggest that post-stroke patients with reduced mobility also present show quality of life, in line with the other studies in this review that evince a relationship between mobility and quality of life.

Franceschini et al.[26] used the Trunk Control Test (TCT)[14] to assess bed mobility as a predictor variable of quality of life, evaluated by the EQ5D[36] using multiple linear regression. They found no significant association between TCT and quality of life indices. In their descriptive analysis, participants showed good trunk control (median score of 100) but impaired quality of life (mean score of 0.48). These results suggest that, although the preservation of trunk function is an essential component for mobility activities such as locomotion and sitting,[42] it may fail to significantly improve perceived quality of life. The lack of association between the variables in Franceschini et al.[26] suggests that more restricted instruments, such as the TCT, may fail to capture the dimensions of mobility that are more directly related to quality of life since it exclusively assesses bed mobility, focusing on trunk function[43] without encompassing broader aspects of mobility, such as standing up and walking. In contrast, the other studies used more comprehensive scales, such as FAC, PSC, SPPB, and TUG, which consider multiple components of mobility that may influence patients' quality of life.

Does post-stroke mobility affect participation?

Chang et al.[24] conducted a prediction analysis between mobility, measured by the Activity Measure for Post Acute Care,[44] and participation, measured by the Participation Measure – 3 Domains 4 Dimensions,[45] using mixed-effects linear regression models. Physical function was the strongest predictor for all participation categories and dimensions over time, with regression coefficients ranging from 0.29 to 0.47. This predictive relationship indicates that mobility limitations objectively and subjectively impact post-stroke social participation, including socializing with friends and engagement in intimate activities. The authors highlighted the importance of early improvement in mobility after stroke, indicating it as essential to sustain social participation across areas of life over time.

Chavda and Prakash[25] compared patients who were dependent and independent across modes of transportation in relation to their social participation, measured by the participation domain of the Stroke Impact Scale.[46] The questionnaire they developed aimed to find dependence on various modes of transportation, such as walking, using an automatic car, bus, train, and being a passenger in a car. Patients who were independent in all evaluated modes of transportation had significantly higher social participation scores than dependent patients. These results suggest that patients with greater mobility independence achieve higher levels of social participation. Thus, both studies that evaluated the relationship between mobility and social participation found an association between the variables: Chang et al.[24] evinced a predictive relationship, whereas Chavda and Prakash[25] showed that patients with no dependence in modes of transportation enjoy greater social participation.

The instruments the studies used to assess mobility in this review, with established validity and reliability in the post-stroke population, include the Timed Up and Go,[38,47-49] Nottingham Extended Activities of Daily Living,[40,50] Trunk Control Test,[41,51] Functional Ambulation Categories,[34] Post-Stroke Checklist,[35,52,53] and Activity Measure for Post Acute Care.[44,54] The Short Physical Performance Battery has shown validity and reliability in institutionalized older adults, but lacks validation in post-stroke patients.[37,55] The transportation use questionnaire also is yet to be tested for its validity and reliability in this population. The quality-of-life instruments EQ-5D and the Stroke Specific Quality of Life Scale[39,58-61] have established validity and reliability in the post-stroke population as do the social participation instruments Participation Measure – 3 Domains 4 Dimensions[45,62,63] and Stroke Impact Scale,[46,64-66] which shown validity and reliability in this population.

The heterogeneity of the used mobility scales represents an important limitation for comparing the studies and for interpreting the results of this review since each scale captures different aspects of mobility. This diversity reflects the breadth of the concept of mobility, defined by International Classification of Functioning, Disability and Health as: (1) changing and maintaining body position, (2) carrying, moving, and handling objects, (3) walking and moving, and (4) moving around using transportation. In this review, seven studies[24,26-31] investigated mobility related to changing and maintaining body position, whereas one[25] assessed independence in the use of transportation, broadening the definition of mobility of the aforementioned classification by incorporating aspects of mobility that were less explored in the other studies.

Most cases in the eight included studies referred to ischemic strokes, in agreement with the literature, which indicates that this subtype accounts for 70–80% of cases.[67] Only four studies characterized their sample regarding stroke severity using the National Institutes of Health Stroke Scale, classified as mild in three studies[27,28,30] and moderate in one study.[24] Post-stroke severity corresponds to the degree of neurological deficit caused by the event.[68] Similarly, only four studies characterized their sample regarding functional capacity using the Barthel Index,[69] which assesses independence in activities of daily living. In two studies,[27,29] participants showed moderate dependence, whereas in two other studies[24,28] dependence was mild. The fact that not all included articles characterized the sample in terms of severity and functional capacity may influence the interpretation of their results due to the lack of information regarding participants' characteristics. Moreover, among the studies that performed this assessment, there was no homogeneity in severity and functional capacity, which makes comparability across studies difficult. These factors may represent limitations of this review.

The inclusion of studies with patients in the acute and chronic phases of stroke may represent a limitation of this review. The post-stroke period can be divided into phases: hyperacute (0–24 hours), acute (1–7 days), early subacute (up to three months), late subacute (up to six months), and chronic (after six months), and these phases influence individuals' functional recovery.[70] Of the included studies, three[24,28,30] followed patients over time from the acute phase to the chronic phase, whereas the remaining studies[25-27,29,31] only assessed patients in the chronic phase. This discrepancy in post-stroke phases may affect the comparability of the results in this review. Therefore, future studies that consider the phases of post-stroke recovery could help explain how the time elapsed since the event impacts the relationship between mobility, social participation, and quality of life.

Of the eight included studies, six investigated the relationship between mobility and quality of life,[26-31] whereas two evaluated mobility and social participation.[24,25] This predominance reflects the interest of the literature in understanding how mobility directly impacts quality of life and highlights a gap in the study of social participation. Therefore, future studies could more greatly detail the relationship between mobility and social participation. The heterogeneity of assessment scales also points to the need for greater standardization of evaluation tools in future research, which would more accurately compare results and better understand the impact of mobility on social participation and quality of life.

The included studies indicated a relationship between mobility, quality of life, and social participation by varying statistical methods. These findings reinforce the relevance of physiotherapeutic interventions to reduce mobility limitations in post-stroke individuals to improve their quality of life and minimize social participation restrictions.

Conclusion

This review deems that its chosen studies show a limited level of evidence as it includes eight studies of moderate methodological quality. Despite the heterogeneity of the included studies, the results suggest that mobility shows a moderate to strong positive association with quality of life and a consistent (although still underexplored) relationship with social participation. Thus, greater mobility tends to be associated with higher social participation and better quality of life in post-stroke patients. Nevertheless, these conclusions require careful interpretation due to the heterogeneity and methodological limitations of the chosen studies.

Authors' contributions

All authors contributed to the conceptualization of the study. IMPV was responsible for project administration, visualization, and writing of the original draft. IMPV and

PAGG contributed to data curation, formal analysis, and investigation. CTG and LPR were responsible for the methodology, supervision, validation, and writing – review and editing. All authors approved the final version of this manuscript.

Data availability statement

The supplementary material in this article is available at the bottom of this article. The remaining research data are available from the corresponding author upon reasonable request.

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Supplementary material

Table 1 - Search strategies on the PubMed database

	Descriptors
#1	Stroke [MESH] OR Stroke OR Strokes OR "Cerebrovascular Accident" OR "Cerebrovascular Accidents" OR "CVA (Cerebrovascular Accident)" OR "CVAs Cerebrovascular Accident" OR "Brain Vascular Accident" OR "Brain Vascular Accidents" OR "Cerebrovascular Stroke" OR "Cerebrovascular Strokes" OR "Cerebral Stroke" OR "Cerebral Strokes" OR "Acute Stroke" OR "Acute Strokes" OR "Acute Cerebrovascular Accident" OR "Acute Cerebrovascular Accidents"
#2	"Mobility limitation" [MESH] OR "Mobility limitation" OR "Mobility Limitations" OR "Ambulation Difficulty" OR "Ambulation Difficulties" OR "Difficulty Ambulation" OR "Ambulatory Difficulty" OR "Ambulatory Difficulties" OR "Difficulty Walking"
#3	"Social Participation" [MESH] OR "Social Participation" OR "Social Engagement" OR "Social Citizenship" OR "Quality Of Life" [MESH] OR "Quality Of Life" OR "Life Quality" OR "Health Relater Quality Of Life" OR "HRQOL"

Table 2 - Search strategies on the EMBASE database

	Descriptors
	('cerebrovascular accident'/exp OR 'cva' OR 'accident, cerebrovascular' OR 'acute cerebrovascular lesion' OR 'acute focal cerebral vasculopathy' OR 'acute stroke' OR 'apoplectic stroke' OR 'apoplexia' OR 'apoplexy' OR 'blood flow disturbance, brain' OR 'brain accident' OR 'brain attack' OR 'brain blood flow disturbance' OR 'brain insult' OR 'brain insultus' OR 'brain vascular accident' OR 'cerebral apoplexia' OR 'cerebral insult' OR 'cerebral stroke' OR 'cerebral vascular accident' OR 'cerebral vascular insufficiency' OR 'cerebro vascular accident' OR 'cerebrovascular accident' OR 'cerebrovascular arrest' OR 'cerebrovascular failure' OR 'cerebrovascular injury' OR 'cerebrovascular insufficiency' OR 'cerebrovascular insult' OR 'cerebrum vascular accident' OR 'cryptogenic stroke' OR 'insultus cerebralis' OR 'ischaemic seizure' OR 'ischemic seizure' OR 'stroke' OR 'thrombotic stroke')
AND	('walking difficulty'/exp OR 'ambulation difficulties' OR 'ambulation difficulty' OR 'ambulatory difficulties' OR 'ambulatory difficulty' OR 'dependent ambulation' OR 'difficulty walking' OR 'mobility disabilities' OR 'mobility disability' OR 'mobility limitation' OR 'mobility limitations' OR 'walking difficulties' OR 'walking difficulty')
AND	('social participation'/exp OR 'social participation' OR 'quality of life'/exp OR 'hrql' OR 'health related quality of life' OR 'life quality' OR 'quality of life')

Table 3 - Search strategy in the LILACS database: Portuguese terms, including all alternative Health Science Descriptors (DeCS) terms

	Descriptors
	"Acidente Vascular Cerebral" OR "Acidente Cerebral Vascular" OR "Acidente Cerebrovascular" OR "Acidente Vascular Cerebral (AVC)" OR "Acidente Vascular Cerebral Agudo" OR "Acidente Vascular do Cérebro" OR "Acidente Vascular Encefálico" OR "Acidentes Cerebrais Vasculares" OR "Acidentes Cerebrovasculares" OR "Acidentes Vasculares Cerebrais" OR Apoplexia OR "Apoplexia Cerebral" OR "Apoplexia Cerebrovascular" OR "AVC" OR "AVC Agudo" OR "AVE" OR "Icto Cerebral" OR "Ictus Cerebral"
AND	"Limitação da Mobilidade" OR "Dificuldade da Ambulação" OR "Dificuldade da Deambulação" OR "Dificuldade de Ambulação" OR "Dificuldade de Deambulação" OR "Limitação de Mobilidade"
AND	"Participação Social" OR "Cidadania Social" OR "Compromisso Social" OR "Qualidade de Vida" OR "HRQOL" OR "Qualidade de Vida Relacionada à Saúde" OR "QVRS"

Table 4 - Search strategy on the LILACS database: the only four Portuguese Health Science Descriptors (DeCS) terms

	Descriptors
	"Acidente Vascular Cerebral"
AND	"Limitação de Mobilidade"
AND	"Participação Social" OR "Qualidade de Vida"

Table 5 - Quality of evidence in the studies in this systematic review according to the Best Evidence Synthesis system

Level of evidence	Minimum quality	Minimum quantity	Consistency
Strong	High (> 80%)	Three	Three high-quality studies agree with each other. If there are more than three studies, 3/4 of the medium- and high-quality studies agree with each other.
Moderate	Medium (50 - 80%)	Two high-quality studies	Two high-quality studies agree OR two medium--quality studies and one high-quality study agree with each other. If there are more than three studies, more than 2/3 of the medium- and high-quality studies agree with each other.
Limited	Medium (50 - 80%)	One high-quality study OR two medium-quality studies OR one medium-quality and one high--quality study	If two studies (medium and/or high quality) agree with each other OR if there are more than two studies, more than half of the medium- and high-quality studies agree with each other.