Title page

Factors associated with participation in life situations for adults with stroke: a systematic review.

Authors

Leisle Ezekiel MRes, Johnny Collett PhD, Helen Dawes PhD, Nancy E. Mayo PhD, Lori Pang MSc, Leanne Field.

Leisle Ezekiel, Dr Johnny Collett and Professor Helen Dawes are affiliated with Oxford Institute for Nursing, Midwifery and Allied Health Research (OXiNMAHR), Faculty of Health & Life Sciences, Oxford Brookes University.

Professor Nancy Mayo Fellow of the Canadian Academy of Health Sciences, Department of Medicine, School of Physical and Occupational Therapy, McGill University.

Corresponding author:

Leisle Ezekiel, Movement Science Group, Faculty of Sport and Health Sciences, Oxford Brookes University, Gypsy Lane, Oxford, United Kingdom OX3 0BP.

Email: lezekiel@brookes.ac.uk

Tel: +44(0)1865 483272, Fax +44(0)1865 483242

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30 ***Review Article.***

31 **Factors associated with participation in life situations for adults with stroke: a systematic**
32 **review.**

33 **Keywords** stroke, community participation, social support, activities of daily living, depression,
34 cognitive dysfunctions, and chronic disease.

35 **Word count**

36 **Abstract**

37 **Objectives:** To identify biopsychosocial factors associated with participation outcomes for adults
38 with stroke and to investigate factors associated with participation at different time points post
39 stroke.

40 **Data sources:** Medline, CINAHL, AMED, PsychINFO and Web of science were systematically
41 searched using key words “stroke”, “participation” and “outcomes” and their synonyms on 15th
42 May 2017.

43 **Study selection:** observational studies reporting on biopsychosocial factors and participation
44 outcomes for community dwelling adults with stroke were selected. Studies were eligible for
45 inclusion if participation outcomes were measured using indices that mapped to the participation

domain of the ICF. Intervention studies were excluded. A second reviewer checked all studies against eligibility criteria at each stage.

Data extraction: Data were extracted on any statistically determined association between biopsychosocial factors and participation outcomes.

Data synthesis: The proportion of studies reporting significant associations with variables were classified according to the ICF. The exact binomial test was used to determine the probability that the proportion of studies reporting significant associations was due to chance alone. Qualitative descriptive summaries of each study allowed consideration of interactions between variables and changes in participation over time points.

Conclusions: Many biopsychosocial factors are associated with poor participation outcomes. Stroke severity, age, depression, cognitive functioning, mobility and activity limitations were most frequently and consistently associated. There is an urgent need for consensus on a core set of outcome measures to be used in the long-term evaluation of participation in life situations after stroke.

Keywords: stroke, participation

Abbreviations: International classification of functioning (ICF). Cumulative Index of Nursing and Allied Health Literature (CINAHL), Allied and Complimentary Medicine Database (AMED).

Introduction

Advances in the prevention and management of stroke mean that more people are surviving and living with the long-term consequences of stroke¹. Moreover, the number of people

67 experiencing stroke at a younger age is increasing^{2,3} resulting in a considerable lifetime impact of
68 stroke, particularly around productivity and work⁴. These changes have been described as
69 epidemiological shift towards stroke becoming a long-term health condition⁵.

70 There is considerable evidence that those surviving stroke experience difficulties retaining
71 previous levels of participation in social, community, work and leisure activities ³. Personal,
72 environmental and stroke related factors have been reported as potential barriers to resuming
73 participation in life roles one year after stroke⁶. The resulting restrictions in social and
74 community participation are strongly associated with lower quality of life ⁷.

75 Many overlapping terms are used to describe social and community participation ⁸. The
76 International Classification of Functioning (ICF) provides a taxonomy of activities and
77 participation: where activities reflect performance at an individual level and participation in life
78 situations reflects performance at a societal level ^{9 9-11}. For the purpose of this review,
79 participation was operationalised using the ICF chapters 6 (domestic life), 7 (interpersonal
80 interactions and relationships), 8 (major life areas) 9 (community social and civic life)^{12 13}.

81 Participation in life situations is potentially modifiable even when there is no further recovery in
82 body functions and is therefore an important concept to consider for those living with long term
83 health conditions ¹⁴. Considering that participation in life situations is an important outcome of
84 stroke rehabilitation,¹⁵ there is surprisingly limited evidence of effective interventions for
85 reducing participation restrictions in the longer term ^{3,16,17}. There is considerable literature
86 investigating factors associated with participation after stroke, but this hasn't sufficiently
87 informed the use of participation measures within intervention studies and participation
88 outcomes remain underutilised ^{18 19,20}. Synthesis of the available evidence could inform the

development of more comprehensive approaches to improve participation outcomes for stroke survivors. Therefore, the aims of this study are:

- to identify biopsychosocial factors associated with or determining participation outcomes for adults with stroke
- To investigate associations with participation at different time points post stroke.

Methods

Search strategy and Selection criteria. This systematic review was registered with PROSPERO²¹ and is reported following PRISMA guidelines²².

We searched for and included studies involving stroke patients that met the following criteria:

- Community dwelling stroke survivors (all strokes) aged 18 and over. Studies with mixed populations were included if 90% of participants had stroke.
- Observational studies
- Investigated biopsychosocial factors associated with participation outcomes
- Written in English.

Intervention studies were excluded

We searched Medline, CINAHL, AMED, Psych INFO and Web of Science on 1st January 2015 (updated on 17th May 2017). The literature search was not limited by date; results dated back to 1946. We used keywords ‘stroke’, ‘participation’, ‘measures’ and their associated synonyms and terms (please see supplementary appendix I). We hand searched three most cited journals from our eligible studies between May 2016 and May 2017. Additional studies were located through reference lists of eligible studies.

The primary outcome of interest was participation in life situations. An initial list of measures relevant to stroke was collated from literature that had evaluated psychometric properties and mapped participation instruments to the ICF²³⁻²⁶.

Two reviewers then independently mapped the content of each measure to chapters six to nine of the activity and participation domain of the ICF (domestic life, interpersonal interactions and relationships, major life areas, community social and civic life). Learning and applying knowledge, general tasks and demands, communication, self-care and mobility were not included²⁷. This was to ensure that participation was the primary focus of each measure. Participation outcomes were included if fifty percent or more of the questions in the measure mapped to chapters six to nine. Differences in reviewers' assessments were discussed until agreement was reached.

A total of 24 measures were reviewed and 14 were eligible for inclusion (see supplementary appendix II). Interrater agreement was very good (Kappa= 0.810, SE 0.13). All included measures were standardised questionnaires but it is beyond the scope of this review to report on psychometric properties.

Study selection process. Figure 1 summarises the selection process. A second reviewer (LF) independently reviewed all studies against eligibility criteria at each stage. Any disagreements were resolved through discussion with both reviewers. Agreement was assessed using Cohen's kappa. Inter-rater agreement of eligibility by abstracts was moderate (kappa 0.655, 95% CI, 0.580 to 0.729)²⁸. Inter-rater agreement of eligibility by full text was also moderate (kappa 0.583 95% CI 0.474 to 0.692).

Data extraction. Data were extracted on any statistically determined association between participation outcomes and biopsychosocial variables under study. Where studies were reported in more than one paper, data was extracted, pooled and treated as one study.

Risk of bias in individual studies. Risk of bias was assessed using the Quality Assessment Tool for Observational and Cross-sectional studies^{29 30}. The tool provides a rating for low, fair or high risk of bias. A second researcher reviewed (LP) ten per cent of the risk of bias assessments, interrater agreement of risk of bias was moderate (kappa 0.565, 95% CI 0.018-1). Risk of bias assessments informed the interpretation of our findings.

Analysis. Variables investigated were grouped (by LE) according to the ICF classification³¹: contextual factors (personal or environmental factors), health condition (type of stroke, time since stroke), stroke related impairments in body functions and structures (e.g. cognitive deficits, movement deficits) and activity limitations (i.e. limitations in mobility or in daily activities)⁹. For example, Fugl Meyer assessment of lower limb function was labelled as “control of voluntary movement” from the ICF chapter “neuromusculoskeletal and movement functions”, whereas the six-meter timed walk test was labelled as “walking and moving” from the ICF chapter “mobility”. As the presence of depressive symptoms was determined by depression scales, it was mapped to “emotional functions” within the ICF chapter “mental functions”, rather than assuming the presence of depression as a health condition³¹.

For each study, we determined which factors had a significant association ($p < 0.05$) with participation outcomes. In longitudinal studies with multiple data time points, we counted each

association once. We then used an exact binomial test to calculate the probability that the observed proportion of studies reporting associations deviated from the expected proportion by chance alone (assuming that there was no association and no publication bias)^{32,33}. The expected proportion of studies finding an association with $p < 0.05$, would be 0.05³⁴. We also determined whether studies were adequately powered to detect a weak association (correlation of 0.2), alpha at 0.05 (two tailed), and power of 0.8

Descriptive summaries of the results of each study were coded and analysed for evidence of interactions between biopsychosocial factors within each study³⁵. Findings from cohort studies were summarised by time points to provide a descriptive summary of how factors associated with participation outcomes changed over time.

Results

In total, 92 papers (reporting on 81 studies) were eligible for inclusion (figure 1).

Study Characteristics. Thirty-three of the studies in the review were cross-sectional and collect data from participants who were from three months to 31 years post stroke. Forty-two were prospective cohort studies and seven were retrospective cohort studies. Of the cohort studies, 11 studies assessed participants' outcomes at multiple time points, ranging from three one month³⁶ to six years post stroke³⁷. The total number of study participants was 11,815. Studies included people from 18 to 99 years old and stroke severity from minor to severe, residing at home or in a care facility (please see supplementary appendix IV). Fourteen participation measures assessed aspects of participation in life situations (table 1). Studies employed a range of statistical analyses including correlation, univariate and regression analysis

Table 1: Outcomes measures mapped to Activity Participation domain of ICF.

Figure 1: PRISMA 2009 Flow Diagram ²²

Analysis of factors associated with participation outcomes. Participation outcomes were associated with sociodemographic factors, health conditions, body function impairments and activity limitations (table 2). Type of stroke was the only factor where the proportion of studies finding associations with participation was likely to be a chance occurrence. The direction of the associations was mostly consistent across the studies with sex being the only exception. Poorer participation outcomes were associated with older age, increased stroke severity, more comorbidity, greater degree of stroke related impairment and more activity limitations.

Table 2: Results of exact binomial test

Contextual Factors. Older age was associated with worse participation outcomes. Whilst there was inconsistency in study results, we found a small effect size for associations between age and participation in sufficiently powered studies with a fair to low risk of bias.

Associations between sex and participation outcomes were also inconsistent. Ten studies reported significant associations, with women being at greater risk of poor participation outcomes than men. However, the correlations were weak ($r = 0.1 - 0.27$)^{38,39} and two adequately powered studies found no association between the persons sex and participation^{40,41}. One study

reported better participation outcomes for women⁴² and one study reported a differential effect of marriage on participation according to sex⁴³ .

Four studies found positive associations between social support and participation. These studies were underpowered to find a small effect size but nevertheless reported weak to moderate correlations ($r = 0.21 - 0.41$)^{44,45}.

Stroke factors. Stroke severity and increased number of comorbidities were consistently, and moderately associated with worse participation outcomes. The type of stroke (ischemic or hemorrhagic) was not found to be associated.

Stroke related impairments. Cognitive functioning and presence of depressive symptoms were the factors most frequently investigated. Most studies investigating depressive symptoms found significant associations with participation outcomes; the effect size range from small to large. One sufficiently powered study did not find an association with depressive symptoms (as measured by the Centre for Epidemiological studies depression scale⁴⁶) but did find a significant association between positive affect and better participation outcomes⁴⁷. Depressive symptoms were determined through the administration of depression scales (for example Geriatric Depression scale^{46,48}); mean scores on the depression scales reflected the presence of mild depressive symptoms with only two studies reporting mean scores indicating moderate to severe depression^{49,50}.

Cognitive functioning was determined through cognitive screening tools and assessment of specific cognitive functions. Most studies found significant relationships of impaired cognitive functions with participation, with effect sizes ranging from small to large.

215 Movement related functions and balance were consistently associated with poorer participation
216 outcomes. Associations between hand and arm function and participation tended to be weaker
217 than associations with impaired lower limb function or balance.

218 Nine out of ten studies reported significant associations between aphasia and participation
219 outcomes. Associations ranged from weak to strong.

220 Fatigue and pain were less frequently investigated but were consistently significantly associated
221 with poorer participation outcomes.

222 ***Activity limitations.*** Limitations in activities of daily living and mobility were strongly
223 associated with poor participation with studies reporting medium to large effect sizes. Only one
224 investigated frequency of falls and found a moderate association between participation outcomes
225 and the number of falls or fear of falling⁵¹.

226 .

228 ***Factors associated with participation at different time points post stroke.***

229 Participation scores for most stroke survivors were stable at one year or more post stroke ^{52 53 54}.
230 There seems to be improvement in participation outcomes when comparing mean participation
231 scores at three months to six months ⁵⁵ but little variation in participation scores overall from 1
232 year on ^{56 57 58 59,60}. However, this does not reflect changes in participation at an individual level.
233 Jansen et al⁵⁹ found that participation deteriorated in 11% and increased for 12 % of participants.
234 Lo et al ⁴⁰ found that 17.8% of participant's participation scores deteriorated from three months
235 to one-year post stroke. Egan found improvement in participation scores over time but only for

participants with higher incomes⁴². Older age was associated with deterioration in participation⁴⁰
³⁷. Nevertheless, participation outcomes remained significantly different from matched controls⁶¹
⁶² and poor participation outcomes at one year were strongly associated with poor outcomes three
years post stroke ⁵⁹ .

Table 3: Biopsychosocial factors associated with participation outcomes at different time points
in longitudinal studies.

Eleven studies investigated biopsychosocial factors associated at different time points after
stroke (time points from three months to three years). No single factor was consistently
associated with participation at all time points.

Descriptive analysis findings. From the narrative descriptive analysis, the presence of cognitive
impairments was reported as an independent predictor of participation but was also found to
predict depression and were associated with limitations in activities of daily living ^{57,63,64}.

Four studies reported associations with subdomains of participation and found depression to be
strongly associated with social functioning domains^{62,65}. One study found that participation
outcomes at six months post stroke predicted emotional wellbeing up to two years post stroke⁶⁶.

Risk of Bias within studies. Forty-six studies were assessed as being low to fair for risk of bias,
35 as high risk of bias and 11 studies where risk of bias was unclear. The main sources of bias
were selection bias and attrition bias (figure 2). Death and deterioration in health were the main
causes of attrition in longitudinal studies with 57 % of studies losing 20% or more participants³⁰

Figure 2: Percentage of studies with risk of bias for each domain. Attrition bias relates to longitudinal studies only.

Discussion

To our knowledge, this is the first comprehensive synthesis of research exploring factors associated with participation outcomes after stroke. We found that participation in life situations was associated with a wide range of biopsychosocial factors and remained limited in the longer term after stroke with most improvement occurring in the first six months. Furthermore, this review exposes that associations between participation outcomes and factors other than body functions are rarely considered.

The initial gains in participation after stroke maybe explained by the recovery of body functions but we found that participation outcomes stabilised for most stroke survivors after six months post stroke^{56 57 58 59,60}, This finding is explained by qualitative literature on life after stroke. Wood et al⁶⁷ reveals how stroke survivors adjust their lives to match changes in their abilities once their recovery from stroke has slowed. Furthermore, Salter⁶⁸ describes a process of relinquishing roles and meaningful activities because of a loss of ability and this is likely to be reflected in participation outcomes. However, the relative stability of participation from one-year post stroke could also be affected by long term stroke survivors being younger with less severe stroke⁵⁶. Over half of the cohort studies in this review were at risk of attrition bias, with death and worsening health being cited as the main reasons for high attrition rates.

The ICF framework explains participation as arising from the dynamic, non-linear and multiple interactions between health conditions, the person and their given context⁶⁹. Hence the wide

range of biopsychosocial associated with changes in participation after stroke found in this review are illustrative of the ICF framework and suggest the need for an interactionist perspective to intervention studies⁷⁰. Further research is needed to investigate how participation outcomes are influenced by the interrelationships of factors, rather than by any one single factor.

The studies included in the review tended to reflect a biomedical focus with relatively few studies investigating environmental factors. Nevertheless, we found social support to be positively associated with participation after stroke. Other studies have found satisfactory social support to be protective of well-being and health related quality of life ⁷¹ and may enable successful return to social and community activities⁶. We propose that knowledge of social support, along with considering the presence of other factors such older age and comorbidities helps to identify those at greater risk of poor participation outcomes.

There was insufficient evidence to draw conclusions about associations between other environmental factors and participation considered in the review: for example, type of residence, whether the person lives alone, quality of physical and social environments and societal attitudes. This may reflect a historical focus on recovery of body functions and personal care activities within stroke research, as well as the difficulties encountered in developing meaningful and reliable measures of environmental factors^{3 72}. Further research utilising validated environmental measures is needed to develop our understanding of how the environment enables or restricts stroke survivors' participation.

Of the other contextual factors investigated, we found age and sex most likely to be associated with participation. In line with others findings^{73,74}, we found that participation outcomes for older stroke survivors were worse than those for sociodemographic and comorbidity matched

peers ⁶¹The relationship between age and participation is complex, with older people experiencing more comorbidities and activity limitations prior to their stroke, as well increased likelihood of severe stroke ⁷⁵. Whilst, gender was less consistently associated with participation amongst studies, there was a small effect size for women to experience worse participation outcomes than men. However, Dehelendorf⁷⁶ found that women experience more severe stroke and have better survival rates than men, thus explaining this finding.

All the investigated impairments in body functions were associated with participation, with depressive symptoms and cognitive impairment being most frequently investigated and consistently associated. It is probable that there are confounding relationships between different body function impairments, however the narrow focus of studies in the review and the statistical methods employed meant it was not possible for us to explore confounding relationships between different stroke related impairments. Indeed, the studies within the review tended to reflect a split between more physically focused factors and those related to cognition and mood. Only four studies within the review considered problems with movement functions as well as depression and cognitive functioning ^{44,65,77,78}.

Limitations in mobility, self-care and activity were consistently associated with poor participation outcomes. This may be due in part to overlapping constructs within activity and participation measures. We minimised this by including only participation measures with a focus on domestic, social and community life. However, the strong associations between mobility, activity limitations and participation outcomes may also indicate a potential area amenable to interventions focused on adaptation and modifications of environmental factors and activities. Participation is theoretically modifiable and achievable even in the presence of disability ⁷⁹.

323 The review also identified factors that are likely influential but underrepresented in the literature.
324 For example, fatigue is highly prevalent after stroke (incidence of fatigue has been reported as
325 between 35% and 92% ⁸⁰), yet was investigated by only six studies within this review.

326 In summary, our findings suggest that there are multiple factors impacting on participation
327 outcomes and underscore that even those with mild stroke may experience participation
328 restrictions long term, particularly when they have impairments across a range of body functions.
329 As such, interventions to improve participation outcomes should be person centred, deliver gains
330 across a range of body functions and focus on the resolution of community participation
331 restrictions ¹⁷.

332 ***Measuring participation outcomes.***

333 Defining and measuring participation continues to be problematic with a lack of consensus as to
334 the operationalisation of participation ¹⁵ and blurring of participation and activity within the ICF
335 ⁸¹. Older participation measures frequently include constructs outside of the activity and
336 participation domain as they are not underpinned by the ICF framework ²⁴. Furthermore,
337 measures included in this review captured different aspects of participation such as participation
338 restriction, frequency or satisfaction ⁸². The included measures all relied on self- report which
339 compounds issues of unreliability ¹⁵ and is particularly problematic for this group because of the
340 frequency of language, vision and cognitive deficits.

341 Furthermore, the most frequently occurring participations measures (LHS, FAI and RNLI
342 accounted for almost half of the included studies) have limited psychometric properties ²⁴ and
343 require further independent evaluation ⁸³.

As a result of these issues, we have been cautious in our interpretation of the reviews results, particularly where findings are less consistent across the studies or where factors have been infrequently investigated. However, we suggest that factors such as depressive symptoms, cognitive functioning and limitations in mobility (which were frequently investigated and found to have strong associations with participation outcomes) are likely to be associated with poor participation outcomes. Further research is needed to explore potential causative relationships between these factors and participation.

Participation in life situations is widely recognised as an important outcome of stroke rehabilitation yet participation outcomes remain underutilised in intervention studies^{18 19,20}. Whilst the measurement of participation outcomes remains limited, we would urge more routine and judicious use of participation outcome measures in intervention studies and suggest wider use of the ICF to develop causative explanatory models, thereby enabling a better fit between research aims, concepts of participation and measurement of outcomes.

Limitations. The broad scope of this review is both strength and a limitation. Whilst primary research has focused on selected key areas, this review enabled examination of a wide range of factors to explore associations and potential risks for poor participation after stroke.

Interrater agreements for eligibility and risk of bias judgements were moderate and reflect the diversity of methodologies and participation outcome measures used by studies included in the review. However, differences between two reviewers were resolved through discussion without need for recourse.

Nevertheless, the heterogeneity of participation measures meant that meta-analysis was not viable and we determined proportions of studies with significant associations³². This approach is limited as it gives higher relative weighting to small studies and does not account for publication bias³². Consequently we reported the number of insufficiently powered studies to aid interpretation.

Selection and attrition bias means that the studies in this review reflects outcomes for those with mild to moderate stroke. Further targeted research is needed to establish participation outcomes and restrictions for those living with more severe stroke and disability.

Problems with defining and operationalising participation in life situations are well-documented^{15,84} and the lack of a clear delineation between activity and participation has already been discussed. Furthermore, the psychometric properties of commonly used participation measures within stroke research are limited (Salter et al 2016) thereby introducing measurement bias in our findings.

We examined associations between biopsychosocial factors and participation outcomes with the participation measures reflecting different aspects of participation. Hence, we viewed participation outcomes in the broadest terms and did not delineate between satisfaction with participation or restrictions in participation.

Conclusion

This review identified a wide range of biopsychosocial factors associated with participation in meaningful life roles after stroke. Those most at risk of poor participation are older people with more severe stroke and stroke related impairments There is little change in participation

outcomes from one-year post stroke and variability in which factors are associated with participation at different time points after stroke. The presence of depressive symptoms, problems in cognitive functioning, mobility and activity limitations were most frequently and consistently associated with poor participation outcome but how these factors impact on participation remains unclear and is inconsistent over time since stroke.

With this in mind, a consensus is needed on defining and measuring participation outcomes relevant to stroke survivors, along with wider use of participation outcomes in research to build a body of evidence for effective interventions.

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Tables & Figures

Table 1: Outcomes measures mapped to the Activity Participation domains of ICF.

Outcome measures	Activity and Participation chapters ICF								
	Learning & knowledge	General tasks	Communication	Mobility	Self-care	Domestic life	Interpersonal relationships	Major life areas	Community, social and civic life
Activity Card Sort (ACS) ^{*1}	✓		✓	✓	✓	✓	✓	✓	✓
Community Integration questionnaire ²		✓		✓		✓	✓	✓	✓
Frenchay Activities Index ³				✓		✓		✓	✓
IMPACT-S (participation subscale) ⁴					✓	✓	✓	✓	✓
Impact on Participation & Autonomy Questionnaire (IPAQ) ⁵					✓	✓	✓	✓	✓
LIFE-H (assessment of life habits) ⁶			✓	✓	✓	✓	✓	✓	✓
London Handicap Scale ⁷			✓	✓	✓	✓	✓	✓	✓
PAR- Pro ⁸				✓		✓	✓	✓	✓
Re-integration to normal living index ⁹							✓	✓	✓
Short Form 36 (social role functioning subscale only) ¹⁰									✓

Sickness Impact Profile (psychosocial subscale only) ¹¹			✓	✓	✓				
Stroke Impact Scale (social subscale) ¹²						✓	✓	✓	✓
Sydney psychosocial scale reintegration¹³			✓	✓	✓		✓	✓	
Utrecht scale for the evaluation of rehabilitation – participation (USER-P)¹⁴			✓	✓		✓	✓	✓	✓

* Includes constructs outside of activity and participation

Table 2: Results of exact binomial test.

*Underpowered studies where $n < 194$, for a correlation size of 0.2.

	Total number of studies.	No. of studies with a significant association	Binomial test, significance at $p < 0.05$	Association found in (n) studies with sufficient power*.	Effect size	No association found in (n) studies with sufficient power*	Effect size
Contextual Factors							
Age	58	33	$p < 0.001$	9	Small – medium.	3	small
Sex ⁱ	35	10	$p < 0.001$	2	small	2	NR
years of education	22	8	$p < 0.001$	3	small	3	Small
Employment	9	3	$p = 0.001$	2	small	0	
Social support	7	4	$p < 0.001$	0		0	
Health condition							

	Total number of studies.	No. of studies with a significant association	Binomial test, significance at $p < 0.05$	Association found in (n) studies with sufficient power*.	Effect size	No association found in (n) studies with sufficient power*	Effect size
comorbidities	11	7	$p < 0.001$	2	small	2	small
Type of stroke (haemorrhagic or ischemic)	14	2	$p = 0.12$	2	small	2	NR
Stroke severity	22	21	$p < 0.001$	7	Medium-large	2	NR
Number of strokes	5	3	$p = 0.001$	3	Small-large	1	NR
Time since stroke	13	4	$p = 0.003$	0		1	NR
Body functions.							
Impairment in movement related functions	14	14	$p < 0.001$	3	Small-medium	0	
Involuntary movement reaction functions: balance	6	6	$p < 0.001$	0		0	
Impairment in movement related functions: arm	7	5	$p < 0.001$	1	NR	1	NR
Impairment in specific mental functions (cognition)	30	24	$p < 0.001$	6	Medium-large	2	NR
Mental functions of	10	9	$p < 0.001$	2	Small - medium	1	NR

	Total number of studies.	No. of studies with a significant association	Binomial test, significance at $p < 0.05$	Association found in (n) studies with sufficient power*.	Effect size	No association found in (n) studies with sufficient power*	Effect size
language (aphasia)							
pain	7	6	$p < 0.001$	2	small	0	
Depressive symptoms	47	41	$p < 0.001$	11	Small-large.	1	Small
Anxiety	6	4	$p < 0.001$	1	NR	0	
Impairment in / energy or drive functions	6	5	$p < 0.001$	1	= medium	0	
Dispositions and intrapersonal functions.	3	2	$p = 0.007$	0		0	
Urinary continence	5	4	$p < 0.001$	1	Large	1	
Activity limitations							
Driving	3	2	$p = 0.007$	0		0	
Limitations in activities of daily living	44	36	$p < 0.001$	13	Medium-large	1	small
Mobility	21	21	$p < 0.001$	3	large	0	

Effect sizes categorised by Cohens rule of thumb – r , Odds ratios, where reported, Cohens f^2 for R^2 .

Table 3: Biopsychosocial factors associated with participation outcomes at different time points in longitudinal studies.

Study	Factors associated with participation at time points post stroke					
	<3 months	4-6months	7-11 months	12-23 months	>24 months	
Clarke & Black 1999	Stroke severity, depressive symptoms, cognition, limitations in adls			Stroke severity, depressive symptoms, cognition, limitations in adls, sex		
Harwood & Gompertz 1997				Depressive symptoms, stroke severity, limitations in adls, age, sex	Depressive symptoms, stroke severity, limitations in adls,	
Mercer & Freburger	Motor function	Not significant				
Patel & Tilling				Depressive symptoms, mobility, pain	Depressive symptoms, mobility, energy functions	
Sturm & Dewey 2002	Limitations in adls			Limitations in adls		
Tse et al 2017b	Limitations in adls, cognition, depressions, mobility	Limitations in adls.				
Egan2015		Mobility, female, low income	Mobility, female, low income, emotional well being	Mobility, female, emotional well being	Female, emotional well being	

Figure 1: PRISMA 2009 Flow Diagram²¹

Figure 2: Risk of bias summary

ⁱ Not all in same direction.