PAPER

Effect of socioeconomic status on functional and motor recovery after stroke: a European multicentre study

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Background: Previous studies have shown an inverse gradient in socioeconomic status for disability after stroke. However, no distinction has been made between the period in the stroke rehabilitation unit (SRU) and the period after discharge. The purpose of this study was to examine the impact of education and equivalent income on motor and functional recovery for both periods.

Methods: 419 consecutive patients were recruited from six SRUs across Europe. The Barthel Index (BI) and Rivermead Motor Assessment (RMA) were measured on admission, at discharge and 6 months after stroke. Ordinal logistic regression models were used, adjusting for case mix. Cumulative odds ratios (OR) were calculated to measure differences in recovery between educational levels and income groups with adjustments for case mix.

Results: Patients with a low educational level were less likely to improve on the BI (OR 0.53; 95% CI 0.32 to 0.87) and the RMA arm during inpatient stay (OR 0.54; 95% CI 0.31 to 0.94). For this period, no differences in recovery were found between income groups. After discharge, patients with a low equivalent income were less likely to improve on all three sections of the RMA: gross function (OR 0.20; 95% CI 0.06 to 0.66), leg and trunk (OR 0.22; 95% CI 0.09 to 0.55) and arm (OR 0.30; 95% CI 0.10 to 0.87). No differences were found for education.

Conclusions: During inpatient rehabilitation, educational level was a determinant of recovery, while after discharge, equivalent income played an important role. This study suggests that it is important to develop a better understanding of how socioeconomic factors affect the recovery of stroke patients.

Socioeconomic health inequalities have been studied for a long time but the publication of the Black Report¹ in the UK provoked the attention of policy makers for the existence of important health inequalities² and resulted in an increased awareness of these issues in health care in general.³ At the end of the 20th century, some authors even considered socioeconomic health disparities as the most important public health issue.⁴

Stroke is no exception to the general findings on health inequalities. The incidence of fatal and non-fatal strokes shows an inverse gradient over socioeconomic groups. In an unselected population based sample, Thrift and colleagues⁵ found that the incidence rate of both stroke types was higher in disadvantaged areas. These disparities remain in the post-acute period. The proportion of patients who are dependent or dead at 6 months after stroke varies between groups of different socioeconomic status (SES). Patients with a lower SES are at greater risk for stroke morbidity and stroke mortality compared with higher SES groups.^{6–7} However, these associations were not confirmed by other studies.^{8–9} In a recent review by Cox and colleagues¹⁰ it was concluded that the association between SES and morbidity and mortality is well known but that the reasons behind this association are far from clear.

The socioeconomic gradient in disability after stroke is also observed in the chronic phase. Patients with lower SES experienced more disabilities up to 3 years post-stroke compared with the group of patients with a higher SES.¹¹ It remains unclear whether these differences are the result of differences in stroke severity at onset or whether they become more prominent over time.

Comparison of results between studies may be difficult because of the different methods used to define SES. Several

indicators are used to determine SES (eg, education, income). Various models are used explaining health inequalities, and education and income reflect different dimensions of socioeconomic inequalities in health.¹² The behavioural/cultural explanation is perhaps the most widely used.¹³ This model refers to the more systematic unhealthy behaviours and lifestyle in lower socioeconomic groups, in part related to differences in knowledge or awareness of risks. In this model, distinction between SES groups is often based on educational attainment.¹³ The materialist model tries to explain differences in health between SES groups by material factors (eg, housing, work conditions), and income is mainly used as an indicator for material stratification.¹⁴

Apart from the choice of SES indicator, differences in how the selected indicator is measured may hamper comparison between studies and make general conclusions more difficult. For example, the measurement of an indicator can be based on an individual level or at a more aggregated area level. Although individual based indicators are preferred,¹⁵ the availability of data is probably an underestimated factor in how indicators are measured.

As most functional recovery is expected to take place in the first 5 months after stroke,¹⁶ stroke rehabilitation units (SRUs) may play an important role in minimising discrepancies

Abbreviations: BI, Barthel Index; ISCED, International Standard Classification of Education; OT, occupational therapy; PT, physiotherapy; RMA, Rivermead Motor Assessment; RMA-GF, gross motor function of the Rivermead Motor Assessment; RMA-LT, leg and trunk function of the Rivermead Motor Assessment; RMA-AR, arm function of the Rivermead Motor Assessment; SES, socioeconomic status; SRU, stroke rehabilitation unit

Table 1 Comparison of patient characteristics according to socioeconomic status on admission to the stroke rehabilitation unit

	Educational level				Equivalent income			
	Total group	Low	High	p Value	Low	Moderate	High	p Value
n	419	194	225		90	230	99	
Age								
Median	70.2	72.0	68.7	<0.001*	70	71	66	0.002†
Q1–Q3	62–76	65–76	58–74		64–75	63–76	57–74	
Presence of urinary incontinence								
n (%)	108 (25.8)	60 (30.9)	48 (21.4)	0.027‡	17 (18.9)	66 (28.7)	25 (25.5)	0.189†
Presence of swallowing problems								
n (%)	68 (16.3)	36 (18.6)	32 (14.3)	0.238‡	13 (14.4)	48 (20.9)	7 (7.1)	0.007†
Presence of comorbidities								
n (%)	366 (87.6)	165 (85.1)	201 (89.7)	0.148‡	82 (91.1)	198 (86.1)	86 (87.8)	0.524†
BI								
Median	60	50	65	<0.001*	52.5	50	75	<0.001†
Q1–Q3	30–85	25–80	35–85		30–80	25–80	50–90	
RMA-GF								
Median	5	4.5	5	0.022*	4	4	8	0.001†
Q1–Q3	1–9	1–9	2–9		1–8	1–8	3–10	
RMA-LT								
Median	6	5	6	0.008*	5.5	5	7	0.002†
Q1–Q3	2–8	2–8	3–8		2–7	2–8	4–9	
RMA-AR								
Median	4	4	6	0.108*	4	4	6	0.255†
Q1–Q3	1–11	1–11	1–11		1–10	1–11	1–11	
TSOA								
Median	16	17	16	0.690*	15.5	15	17	0.553†
Q1–Q3	10–24	10–24	11–23		9–24	10–24	13–24	
LOS								
Median	50	51.5	49.5	0.685*	55.5	51	49	0.956†
Q1–Q3	29–79	28–83	30–78		29–80	28–80	35–79	

BI, Barthel Index; LOS, length of stay at the stroke rehabilitation unit; Q1–Q3, first quartile–third quartile; RMA-AR, Rivermead Motor Assessment, section arm; RMA-GF, Rivermead Motor Assessment, section gross function; RMA-LT, Rivermead Motor Assessment, section leg and trunk; TSOA, time between stroke onset and admission to the stroke rehabilitation unit.

*Mann-Whitney U test; †Duncan's multiple range test; ‡Pearson's χ^2 test.

between socioeconomic groups. However, the influence of SES on recovery during inpatient stay has not been studied. Moreover, illness trajectories are not often considered in the comparison of functional recovery between socioeconomic groups.¹⁷ To the best of our knowledge, no distinction has been made between recovery during stay in an inpatient SRU and after discharge for different SES groups. Therefore, the aim of this study was to assess the association of education and equivalent income with functional and motor recovery for these two periods.

METHODS

Settings and subjects

This study was part of a European project, Collaborative Evaluation of Rehabilitation in Stroke across Europe (CERISE), comparing outcome after stroke between rehabilitation centres in four European countries. Data were collected from six SRUs: Queen's Medical Centre and City Hospital (considered one centre), Nottingham, UK; two SRUs at the University Hospital Pellenberg, Pellenberg, Belgium; the RehaClinic, Zurzach, Switzerland; and the Fachklinik, Herzogenaurach, Herzogenaurach, Germany.

Because of different admission policies between centres, it was expected that the case mix would vary considerably. Therefore, inclusion criteria were introduced to define a more uniform group of patients across centres. For example, as age is known to be associated with comorbidities, it was decided to use a lower and upper age limit. In the Swiss and German centres, patients with mainly cognitive deficits without a significant motor deficit were also admitted. These types of patients were not observed in the other centres. To maximise comparisons between centres it was decided to introduce upper limits on the Rivermead Motor Assessment (RMA). Inclusion

criteria were: (a) first ever stroke, as defined by WHO,¹⁸ (b) age 40–85 years, (c) score on the gross motor function of the RMA¹⁹ (RMA-GF) ≤ 11 , and/or a score on the leg and trunk function (RMA-LT) ≤ 8 and/or a score on arm function (RMA-AR) ≤ 12 on admission to the rehabilitation centre.

The following exclusion criteria were used. A high pre-stroke functional dependency highly affects potential functional recovery. In the case of differences in functional recovery between SES groups, distinguishing between the influence of pre-morbid conditions and processes of care is difficult. A cut-off point of 50 on the Barthel Index (BI)²⁰ for pre-stroke functional ability was defined. This was based on the interpretation of the BI, as no cut-off points were found in the literature for pre-stroke conditions. Other exclusion criteria were: (a) other neurological impairments with permanent damage (eg, previous head injury, multiple sclerosis); (b) stroke-like symptoms caused by subdural haematoma, tumour, encephalitis or trauma; and (c) admitted to the rehabilitation centre more than 6 weeks after the stroke. In each centre, a researcher was assigned to screen the medical records of all admissions to the SRU. The study was explained to eligible patients. At least 1 day was given to consider participation. After agreement, they were asked to sign an informed consent and the patient was included in the study. If no informed consent was given, the patient was not included in the study.

Study design

Patients were recruited consecutively on admission to the SRU. The prognostic factors (pre-stroke BI, urinary incontinence, swallowing problems and the time between stroke onset and admission to the SRU) as well as comorbidities (hyperlipidaemia, history of high blood pressure, myocardial infarction, smoking, diabetes mellitus, atrial fibrillation and coronary heart disease) were documented.

Figure 1 Functional and motor outcome for educational level. RMA-AR, Rivermead Motor Assessment, section arm; RMA-GF, Rivermead Motor Assessment, section gross function; RMA-LT, Rivermead Motor Assessment, section leg and trunk. Interquartile ranges are indicated by vertical lines.

Educational level, household composition and monthly household income were determined using a structured interview at discharge. In addition, duration of stay in the SRU was recorded. Motor and functional outcome were assessed using the RMA and BI on admission, at discharge and 6 months after the stroke. The study was approved by the ethics committee of each centre.

Data analysis

To enable valid comparison between countries, the patient's educational level was converted to the International Standard Classification of Education (ISCED).²¹ Low education was defined as an ISCED classification of 0–2 (below or equal to lower secondary level) and high education as an ISCED classification of 3 or higher (upper secondary level or higher).

Equivalent income was based on the monthly household income and household composition, and calculated according to the modified Organisation for Economic Co-operation and Development (OECD) scale.²² Each patient was assigned to one of three categories (low, moderate or high), based on the respective median national equivalent income for Belgium,²³ the UK,²³ Switzerland²⁴ or Germany.²⁵ The upper limit of low income was specified by the at-risk-of-poverty threshold²⁶ and equalled 60% of the median national equivalent income. Equivalent incomes between 60% and 120% of the median national equivalent income were considered as moderate incomes. High equivalent income was defined by the 120% threshold or higher.

Data were analysed in three phases. Firstly, descriptive statistics were used to document patient characteristics on admission to the SRU, and univariate comparisons between SES groups were calculated using the Mann–Whitney U, Duncan's multiple range and Pearson's χ^2 tests, as appropriate. Secondly, functional and motor outcome were compared between SES subgroups at three time points (admission, discharge and 6 months after stroke) using the Mann–Whitney U and Duncan's multiple range test for educational

level and equivalent income, respectively. Thirdly, the association between SES and motor and functional recovery was explored, using multivariate ordinal logistic regression models. Recovery was defined as the probability of improving on the BI or RMA. Two time periods were considered: (1) the period of inpatient rehabilitation and (2) the period between discharge and 6 months post-stroke. Independent variables were functional or motor outcome scores at the beginning of the period, time between stroke onset and admission to the SRU, length of stay at the SRU, centre, age, sex, educational level, equivalent income, prognostic factors and comorbidities (dichotomised as 0 = none and 1 = at least one). Dependent variables were BI and RMA measured at the end of the time period. BI was categorised into five groups (0–20; 25–40; 45–60; 65–80; 85–100). Each section of the RMA was divided into three groups: RMA-GF (0–3; 4–6; 7–13), RMA-LT (0–3; 4–7; 8–10) and RMA-AR (0–5; 6–10; 11–15). All independent variables were entered stepwise into the model, with an entry threshold of 0.15. The models used fitted the following criteria: (1) non-significance of the Score test for the proportional odds assumption, (2) non-significance of the residual χ^2 and (3) an association between predicted probabilities and observed responses above 85%. The effect sizes of education and equivalent income were expressed as cumulative odds ratios (ORs). These ORs indicated the probability of one subgroup reaching a higher category on the outcome assessment in comparison with another subgroup for the same SES indicator, controlled for other independent variables. Significance levels were set at 0.05. For the statistical analyses, SPSS 12.0 and SAS 8.2 were used.

RESULTS

Patient characteristics

There were 532 patients enrolled in the study; 113 patients were excluded from the analyses because of death ($n = 21$), missing data on SES indicators ($n = 59$) and missing data on BI and/or RMA for at least one of the measurements ($n = 33$).

Figure 2 Functional and motor outcome for equivalent income. RMA-AR, Rivermead Motor Assessment, section arm; RMA-GF, Rivermead Motor Assessment, section gross function; RMA-LT, Rivermead Motor Assessment, section leg and trunk. Interquartile ranges are indicated by vertical lines.

The median age of the total patient group ($n = 419$) was 70.2 years (interquartile range 14 years) (table 1). Age differed significantly between SES groups, both for educational level and equivalent income. The presence of urinary incontinence was significantly higher in the low education group ($p = 0.027$). Swallowing problems occurred significantly more often in the moderate than in the high income group (20.9% vs 7.1%; $p = 0.007$). No significant differences were found for the presence of comorbidities between SES subgroups.

On admission, the BI, RMA-GF and RMA-LT were significantly higher in the high education and high income groups compared with the other subgroups. No significant differences were found between the low and moderate income groups on the three assessments. RMA-AR, time between stroke onset and admission, and length of stay did not differ between the SES groups.

SES differences in functional and motor outcome

The BI scores were significantly different between educational levels and income groups at each time point ($p < 0.01$) (fig 1A, 2A). The high income group had consistently significantly higher scores compared with the moderate and low income groups. There were no significant differences between the low and moderate income groups on admission, at discharge or 6 months after stroke.

Similar results were found for the RMA. On the RMA-GF, significant higher outcome scores were found for both the high educational group and the high income group compared with the other subgroups at all three assessment points (fig 1B, 2B). For equivalent income, no significant differences were found between the low and moderate income groups on admission, at discharge or 6 months after stroke. Findings on the RMA-LT were analogous. The high educational group and high income group scored significantly higher at all time points compared with the corresponding subgroups (fig 1C, 2C). No significant differences were found between the moderate and low income

groups at each time point. For RMA-AR, there were no significant differences between educational groups and equivalent income groups on admission (fig 1D, 2D). On discharge and at 6 months, the RMA-AR differed significantly between the SES groups, for both education and income. The highest educational group and highest income group had significantly higher scores compared with the respective lowest subgroups ($p < 0.005$). No significant differences were found between the high and moderate equivalent income groups and between the moderate and low equivalent income groups.

Functional and motor recovery and SES

To analyse recovery between the SES groups, BI and RMA scores were compared, taking into account the other independent variables. During inpatient rehabilitation, education had a significant effect on the BI and RMA-AR (table 2). Patients with a low education were significantly less likely to reach a higher category of the BI (OR 0.53; 95% CI 0.32 to 0.87) and RMA-AR (OR 0.54; 95% CI 0.31 to 0.94) at discharge compared with patients with a high education. Equivalent income did not have a significant effect on motor and functional recovery during inpatient rehabilitation.

Between discharge and 6 months after stroke, neither equivalent income nor education had a significant effect on the BI but significant differences were found on all three sections of the RMA for equivalent income. The low income group was associated with a significant lower probability for a RMA score improvement compared with the high income group. Also, the low income group was significantly less likely to reach a higher score on the RMA-GF compared with the moderate income group (OR 0.39; 95% CI 0.17 to 0.89). In addition, significant differences were found between the moderate versus the high income group for RMA-LT (OR 0.42; 95% CI 0.19 to 0.93) and RMA-AR (OR 0.37; 95% CI 0.15 to 0.90). Education did not have a significant effect on motor or functional recovery from discharge until 6 months after stroke.

Table 2 Multivariate comparison between socioeconomic groups during inpatient stroke rehabilitation and between discharge and 6 months after stroke

	OR (95% CI)	p Value
Inpatient stroke rehabilitation		
Barthel Index		
Education low vs high	0.53 (0.32–0.87)	0.011
Income low vs moderate	1.34 (0.74–2.42)	0.335
Income low vs high	1.85 (0.87–3.92)	0.108
Income moderate vs high	1.38 (0.74–2.58)	0.307
RMA-GF		
Education low vs high	0.58 (0.32–1.03)	0.063
Income low vs moderate	0.98 (0.50–1.92)	0.955
Income low vs high	0.83 (0.32–2.18)	0.709
Income moderate vs high	0.85 (0.37–1.95)	0.700
RMA-LT		
Education low vs high	0.73 (0.45–1.18)	0.207
Income low vs moderate	1.01 (0.57–1.82)	0.954
Income low vs high	1.20 (0.58–2.51)	0.610
Income moderate vs high	1.19 (0.64–2.20)	0.582
RMA-AR		
Education low vs high	0.54 (0.31–0.94)	0.030
Income low vs moderate	0.71 (0.36–1.40)	0.321
Income low vs high	0.89 (0.39–2.02)	0.781
Income moderate vs high	1.26 (0.63–2.50)	0.511
Between discharge and 6 months post-stroke		
Barthel Index		
Education low vs high	0.81 (0.49–1.34)	0.412
Income low vs moderate	0.63 (0.34–1.17)	0.146
Income low vs high	0.55 (0.25–1.19)	0.127
Income moderate vs high	0.86 (0.45–1.66)	0.662
RMA-GF		
Education low vs high	0.88 (0.43–1.80)	0.733
Income low vs moderate	0.39 (0.17–0.89)	0.025
Income low vs high	0.20 (0.06–0.66)	0.008
Income moderate vs high	0.52 (0.18–1.48)	
RMA-LT		0.222
Education low vs high	0.68 (0.37–1.26)	0.223
Income low vs moderate	0.52 (0.26–1.04)	0.065
Income low vs high	0.22 (0.09–0.55)	0.001
Income moderate vs high	0.42 (0.19–0.93)	
RMA-AR		0.031
Education low vs high	0.90 (0.43–1.88)	0.775
Income low vs moderate	0.81 (0.33–1.99)	0.643
Income low vs high	0.30 (0.10–0.87)	0.027
Income moderate vs high	0.37 (0.15–0.90)	0.029

RMA-AR, Rivermead Motor Assessment, section arm; RMA-GF, Rivermead Motor Assessment, section gross function; RMA-LT, Rivermead Motor Assessment, section leg and trunk.

DISCUSSION

In this study, the effect of SES on functional and motor recovery was analysed, taking into account factors such as initial motor and functional deficit, prognostic factors, comorbidities, centre and age. During the inpatient rehabilitation period, a higher educational level was significantly associated with better motor and functional recovery. Equivalent income did not have a significant effect. Inpatient stroke rehabilitation within each centre took place in comparable environments for the patients in that centre. Differences in service delivery between centres may be hypothesised as having an intermediate effect on outcome at discharge. However, the variable “centre” was not retained in any of the statistical models. Consequently, differences in recovery between educational levels are not likely to be related to institutional differences between centres.

It may be hypothesised that discrepancies in recovery were attributed to more personal characteristics, such as differences in coping strategies. In a study by Tomberg and colleagues,²⁷ patients with a high education suffering from subarachnoid haemorrhage, tended to use more task and problem oriented strategies. Problem oriented coping strategies are characterised by proactive behaviour in which the patient counteracts his experience of uncertainty.²⁸ This may be reflected in a higher

participation in therapy sessions. Higher participation in physical and occupational therapy sessions is linked with an improved outcome at discharge.²⁹ Differences in coping strategies between educational levels and the link with outcome were shown in other domains of rehabilitation.^{30–31} This is less clear for stroke rehabilitation and further clarification is needed concerning the effect of coping on outcome after inpatient care.

Other explanations for the differences in recovery between educational levels may be the differences in interpersonal processes of care, such as intermediate factors in optimising service delivery. In the conceptual framework outlined by Stewart and colleagues,³² interpersonal processes were defined as the social-psychological aspects of the patient–physician interaction. Communication is one of the dimensions in this interaction. General clarity, elicitation of and responsiveness to the patient’s problems and expectations, and explanations of progress and prognosis are described as essential components for improved communication. Communication styles were found to be different depending on the SES of the patient.³³ Less information was given in communications with patients with a lower SES. Hence we suggest increasing the awareness of the communicative differences between socioeconomic groups in order to empower patients to express their concerns and preferences.

If patients with lower education are encouraged more to express their concerns and preferences, service delivery will improve by adaptations of therapeutic interventions to personal needs. This could lead to a better outcome³⁴ as these adaptations may facilitate the patient's motivation to participate more actively in the rehabilitation process and to comply better with therapeutic interventions.

In conclusion, our findings call for specific support during inpatient rehabilitation for stroke patients with a lower educational level. It is likely that motivational aspects differ between SES groups because standard educational efforts may not be sufficient for the less favourable group. Without stigmatising this particular group, they need a more adequate learning environment, and staff should be more aware of providing information and encouragement on a more individual basis.

Between discharge and 6 months post-stroke, the "material indicator" of SES seemed to play an important role. Patients with low equivalent income had a significantly lower probability of reaching a higher outcome on all three sections of the RMA. In contrast with inpatient rehabilitation, contextual elements of rehabilitation after discharge were most likely to be different between SES groups. This may have accounted for differences in motor recovery.

Income related inequalities in the utilisation of rehabilitation services are expected. However, a Dutch study found no significant association between SES and health care utilisation after discharge.¹¹ In a study by McKevitt and colleagues,³⁵ it was shown that the provision of rehabilitation services varied for specific sociodemographic categories but there was no systematic pattern of inequality. Significant differences were found between manual and non-manual workers for speech and language therapy but not for physiotherapy (PT) or occupational therapy (OT) services in the time period between stroke onset and 90 days after stroke. However, there are some methodological issues that need to be addressed. Firstly, no distinction was made between inpatient stay and time after discharge. Therefore, it remains unclear if the non-significant differences in the utilisation of PT/OT services are valid for both distinct periods. Secondly, the service delivery for PT/OT was binary coded in the analysis. Patients had or had not received at least one therapy session. Aggregation of data to binary coding may mask differences in the total amount of therapy and prevent more detailed analysis on differences in the amount of therapy between socioeconomic groups.

Differences between SES groups in attendance at rehabilitation sessions after discharge could also affect recovery. It has been demonstrated that non-attendance at cardiac rehabilitation services occurred more frequently in the lower income groups.³⁶ One could expect a similar effect in stroke rehabilitation, explaining in part differences in motor recovery.

As the intensity of therapy in the first 6 months after stroke has a significant effect on functional recovery,³⁷ more detailed analyses are needed to draw a more firm conclusion concerning socioeconomic differences in provision of services after discharge and its relationship with motor recovery.

No significant SES indicator for functional recovery was identified between discharge and 6 months after stroke. This may be due in part to the ceiling effect of the BI.³⁸ At discharge, more than 50% of patients were classified in the highest of the five categories (BI scores ≥ 85). Consequently, upward shifts in BI categories between discharge and 6 months were limited. BI is an appropriate instrument to measure the basic activities of daily living in the early rehabilitation phase. Other assessments, such as the Nottingham Extended Activities of Daily Living, are more appropriate for measuring more complex activities of daily living at a later stage in the recovery process.³⁹ Because of consistency of assessments, however, it was decided to use the BI on each time point.

The study had some limitations. Firstly, the number of excluded patients was considerable. We opted for a complete case analysis in order to compare recovery for both periods. For education and equivalent income, there were no significant differences between the different subgroups in the proportions of patients who died (χ^2 test, $p = 0.93$ and $p = 0.42$, respectively). Comparing the independent variables on admission, no significant differences were found for comorbidity, time between stroke onset and admission to the SRU, length of stay, sex, age, educational level, equivalent income, pre-stroke BI and RMA-LT between patients that were excluded and those who were included. Subjects that were excluded had significantly lower scores compared with the included patients for BI ($p = 0.003$), RMA-GF ($p = 0.007$) and RMA-AR ($p = 0.042$). This means that the scores on these parameters are, to some extent, an overestimation of the total sample of stroke patients.

Secondly, education as an indicator for SES may have been influenced by the age distribution in our sample. Older stroke patients have lower educational attainment than younger stroke patients. Grundy and Holt¹² suggested pairing educational level with an indicator of deprivation to study socioeconomic inequalities in health, especially for older patients. In our study, interaction effects between educational level and equivalent income were entered into the model but no significant effects were found.

Although there were limitations, this study opens the debate on the challenging issue of taking into account socioeconomic differences in stroke rehabilitation. Our study indicates the need to develop a better understanding of how educational and income related factors affect the recovery of stroke patients. If further evidence is found of the effect of socioeconomic status on recovery after rehabilitation, needs-based rehabilitation approaches will have to be developed to guarantee equity in health care provision.

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