Socioeconomic Deprivation and Survival after Stroke: ***Findings from the Prospective South London Stroke Register of 1995-2011***

Cover title: Socioeconomic Deprivation and Survival after Stroke

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Abstract

Background and Purpose Previous findings of the association of socioeconomic deprivation (SED) with survival after stroke are inconsistent. There is less investigation on long-term survival. We assessed the associations in a multi-ethnic population in England.

Methods We examined data from 4398 patients (3103 whites, 932 blacks, 253 Asians/others) with first-ever stroke, collected by a population-based stroke register in South London from 1995 to 2011. SED was measured using the Carstairs index score - the higher score, the more deprived. It was analysed in multivariate Cox regression models in relation to survival after stroke.

Results Over 17 years follow up 2754 patients died. The quartile data of Carstairs score showed no significant association of SED with survival in patients, except for Black Caribbeans and Africans. Black patients with the 4th quartile SED had a multivariate adjusted hazard ratio (HR) of 1.76 (95%CI 1.06-2.94) for 3-month mortality and 1.54 (1.00-2.37) for 1-year mortality. After adjustment for acute stroke care provisions, these were no longer significant. However, the sextile data of Carstairs score showed a consistent association of SED with survival after stroke; all patients with the 6th sextile had a fully-adjusted HR of 1.23 (1.05-1.44) for 3-months mortality and 1.13 (1.01-1.25) for 17-year mortality.

Conclusions There is a weak but significant association of SED with reduced survival after stroke in England. Compared with white patients, SED in blacks may have a stronger impact on short-term survival. Further efforts are required to achieve equality in survival among stroke patients of different socioeconomic groups.

Key words: Stroke, Survival; Socioeconomic deprivation; Minority Ethnic populations; Cohort study

Introduction

People from lower socioeconomic groups have a higher incidence of stroke.[1] The disparities in stroke risk across socioeconomic groups have been explained by differences in the prevalence of major risk factors. [1;2] Many studies, [3 4] but not all [5;6] have shown that stroke patients with socioeconomic deprivation (SED) have a significant increase in mortality. The reasons for the social gap in stroke survival are not yet fully understood. There is less investigation on the impact of SED on long-term survival. [1 4] Furthermore, few studies have examined whether and the extent to which SED affects survival among Black and Minority Ethnic (BME) stroke patients who live in western countries. In the West the number of BME populations have been increased over the last 2 decades,[7] and patients of BME groups are likely to experience socioeconomic disadvantage and health care inequality compared to their white counterparts.[8] Studying the impact of SED on survival among BME stroke patients will help understand stroke health care inequality. In this study we investigated the associations of SED with short and long term survivals in a multi-ethnic population study of stroke register in England. We compared data from patients of White, Black and Asian/other ethnic groups, and examined whether hospital stroke care played a significant mediating role in the impact of SED on mortality.

Methods

Data collection

The study population was derived from the South London Stroke Register (SLSR).[9;10] Its methodology has been fully described before.[9;11;12] In brief, the SLSR is an ongoing prospective population-based stroke register set up in January 1995, recording all first-ever strokes in patients of all ages living in 22 electoral wards in Lambeth and Southwark (total population at the 2001 census were 271,817), inner city South London. [10;13] Stroke case ascertainment and data collection have been described in detail elsewhere.[10;14] Data collected between 1995 and 2011 were used in this analysis.

Sociodemographic Characteristics

Ethnic origin (self-definition, census question) was stratified into White, Black Caribbean (BC), Black African (BA), South Asian (Indian, Pakistan, Bangladesh), Chinese, others and unknown. According to patients' postcode of residence at the time of stroke, we calculated the Carstairs deprivation index score [15] to measure baseline SED for each patient, as we previously did.[16] The Carstairs index is an area-based measure of socio-economic deprivation derived from decennial census data, using levels of male unemployment, overcrowding, car ownership and proportion in social classes IV and V (partly skilled and unskilled) in a small area. [17 15] The index was derived using 2001 census data for each lower layer super output area (SOA) covered by the register.[17 15] The higher score, the more deprived. [17 15] The Carstairs deprivation index has been validated and widely used in health-related studies in the UK. [15 16] In this study we used the Carstairs score, a comprehensive index for SED to examine the impact of low socioeconomic status on health outcome as we did previously.[16]

Risk Factors Before Stroke

Hypertension (general practice or hospital records of high blood pressure >140 mm Hg systolic or >90 mm Hg diastolic); myocardial infarction; atrial fibrillation; peripheral vascular disease; previous transient ischemic attack; diabetes mellitus; and current smoking status. Barthel index prior to stroke, collected from the hospital records or from our interview team using a standard questionnaire, were grouped to <15 (severe/ moderate disability), 15-19 (mild disability) and 20 (independent disability). Living conditions were recorded to measure social network and contact.

Case Mix

The diagnosis of stroke, using the World Health Organization clinical definition, was verified by a study clinician, and patients were examined within 48 hours of being notified to the South London Stroke Register where possible. We obtained the clinical details at the time of maximal impairment. Case severity variables included Glasgow Coma Scale, dichotomized to <13 (severe/moderate) and ≥13 (mild), and Barthel index at 7 days after stroke, grouped to <15 (severe/ moderate disability), 15-19 (mild disability) and 20 (independent disability), urinary incontinence, swallow impairment, speech deficit and motor deficit.

Stroke Subtype

Classification of the pathological subtype (cerebral infarction, primary intracerebral hemorrhage, and subarachnoid hemorrhage) was based on results from at least one of the following: brain imaging, cerebrospinal fluid analysis, or necropsy examination. Cases without pathological confirmation of stroke subtype were unclassified.

Acute Care After Stroke

Patients were classified as (1) not admitted to hospital; (2) admitted to stroke unit; (3) >50% of stay on stroke unit; (4) brain imaging; and (5) swallow test.[10;13]

Follow-up of the cohort

Follow-up data were collected by validated postal or face-to-face instruments with patients and/or their carers.[9] Patients were assessed at 3 months and annually after stroke. All follow-up assessments included in the present study were completed by 31 December 2011. We estimated rehabilitation therapy provision for those with recorded deficits and appropriate management of clinical risk factors. Outcome measures included activity of daily living using the Barthel Index (BI), health-related quality of life (HRQOL), cognitive impairment using the Mini-Mental State Exam (MMSE) or Abbreviated Metal Test, and anxiety and depression using the Hospital Anxiety and Depression Scale. All interviewers underwent regular standardised training in the use of the different scales. The vital status of the cohort members are on-going for monitoring via Office for National Statistics (ONS).

Statistical Analysis

Median score of Carstairs index was examined according to socio-demographics, risk factors, severity of stroke and processes of care, using a nonparametric Kruskal–Wallis test. To examine the association of SED with mortality, we divided patients into 4 groups according to the quartiles of the Carstairs score, and took patients with the 4th quartile of Carstairs score as the most deprived group for data analysis. In analysis stratified by ethnicity we divided patients into 4 groups according to the quartiles of the Carstairs score within each ethnicity. We employed multivariate adjusted Cox regression models to

compute hazards ratio (HR) and its 95% confidence intervals for mortality in relation to SED. In the Cox models, we adjusted for age, sex, ethnicity, year of stroke, admitted to hospital, living conditions before stroke, cardiovascular diseases and risk factors score (which was derived from smoking, hypertension, diabetes, peripheral vascular disease, transient ischemic attack (TIA), atrial fibrillation, and myocardial infarction), type of stroke, and severity of stroke. To examine whether acute care plays a role in the association of SED with survival after stroke, in other Cox models analysis we further adjusted for hospital acute stroke care and examined the HRs changed.

We also carried out a sensitivity analysis, using a higher cut-off point of Carstairs score to examine the association of SED with survival after stroke. We divided all patients into 6 groups according to the sextiles of Carstairs score. Mortality among patients with the 6^{th} sextitle SED, which included 16.7% of the cohort members and were most extremely deprived, was compared to other patients of the cohort. All analyses were performed in Stata, version 11 (StataCorp, College Station, Texas).

Ethics

Patients or their relatives gave written informed consent to participate in the study. Ethical approval was from the ethics committees of Guy's and St Thomas' Hospital Trust, King's College Hospital, Queens Square, and Westminster Hospital (London).

Results

From 1 January 1995 to 31 December 2011, 4414 people with first-ever stroke were registered, of whom 4398 had the Carstairs index calculated for analysis. Table 1 shows characteristics and Carstairs scores among these patients. High Carstairs score was

significantly associated with younger age at the time of stroke, Asian/other ethnicities, the later period of years of stroke occurring, hypertension and having no atrial fibrillation, and having speech deficit. Patients who admitted to St George's Hospital were likely to be more deprived. Other factors listed in Table 1, and diabetes, peripheral vascular disease, TIA, BI prior to stroke, incontinence, swallow impairment and 5 indicators of stroke acute care were not significantly related to Carstairs score.

Over 17 years follow up, 2754 patients died; 1134 deaths occurred within 3 months after stroke. Table 2 shows number and adjusted HR of 3-month, 1-year and 2-year mortality among stroke patients across 4 groups of the quartiles of Carstairs score. For the total sample data analysis, we did not find any significant associations of SED with mortality either at 3 months, 1 year and 2 years (Table 2), or in longer term follow up to 17 years (multivariate adjusted HR 1.08, 0.97-1.21). Such patterns of non-significant HRs were similar in white patients (eg, 1.13, 0.93-1.36 at 3 months, and 1.08, 0.96-1.22 in 17 years). However, black patients with the 4^{th} versus 1^{st} quartile of Carstairs score had a significantly increased risk of mortality, which was limited to 1 year follow up (Table 2). Asian/other ethnic patients had similar patterns to those in blacks, but the increased HRs did not reach the conventional significant level (Table 2).

After further adjustment for acute stroke care, including hospital admission, stroke unit admission, >50% of stay on stroke unit, brain imaging and swallow test, the association between SED and mortality in black patients was attenuated to be non significant; fully adjusted HR for mortality at 3 months among patients with the 4^{th} quartile of Carstairs score was 1.62 (0.96-2.75), and in 1 year 0.99 (0.71-1.39). There were no significant associations between SED and survival in other ethnic groups of patients.

In the sensitivity analysis, we found that all patients with the 6th sextile SED had a significant increase in mortality in short-term follow up (Table 3). The impact of SED remained significant on long term survival; fully adjusted HR for mortality in 10 or 17 years follow up was 1.12 (1.01-1.25) and 1.13 (1.01-1.25) respectively. The patterns for increased HRs were similar among white, black and Asian/other ethnic groups of patients, but the association of SED with mortality in BME groups was not significant, probably due to the small numbers (Table 3).

Discussion

In a multi-ethnic population stroke register in England, we found that black patients with the 4th quartile of Carstairs score had an increased risk of 3-month or 1-year mortality, while in whites there were no such associations. After adjustment for acute stroke care variables, the significant association of SED with mortality were attenuated. In the analysis for the sextile of Carstairs score, however, we identified that all patients with the most deprived had a significant reduction in short and long term survival after stroke. The consistent impact of SED on increased mortality was not explained by acute stroke care.

Strengths and weaknesses of the study

The main contribution of this study lies in what it tells us about differences in the impact of SED on stroke survival between black and white patients, and the impact on long-term survival. We employed the Carstairs index, a comprehensive indicator of SED,[16] to analyse the association between SED and stroke survival. It may be more powerful to examine the associations of SED with survival after stroke than other socioeconomic indicators, eg, educational level, occupational class and income. It can be analysed in different cut-off point scores, helping identify the association of SED with increased

mortality. Our study has limitations. The numbers of BME stroke patients were small, giving a wide confidence interval in the impact of SED on survival of stroke. However, we observed a significant association of SED with increased mortality in black patients in the multivariate adjustment analysis without acute stroke care. We only used the Carstairs index which were measured during the patients had the first-ever stroke. We did not have data of the Carstairs index measured at an early time, eg, in patients' childhood for analysis, and either of the Carstairs scores changed in the pre-and post-stroke neighbourhoods of the stroke survivors. However their effects would make our findings towards the null hypothesis. Like other studies,[18] we did not adjust for processes of care variables, recurrent stroke and incident co-morbidities which occurred during the follow up because they were related to length of survival and baseline acute stroke care, and including them for adjustment may cause collinearity problems. But we did adjust for the severity of stroke and stroke care at baseline, and thus the residuals of the confounding effects from these factors would be minimized. Future work is required to include these and Carstairs scores changed over time for analysis.

Previous studies report inconsistent findings related to the association between socioeconomic deprivation and mortality after stroke. In the US, Brown et al[3] examined the data of 806 stroke patients $\geqslant$65 years in the Cardiovascular Health Study, suggesting that living in a socioeconomically disadvantaged neighborhood is associated with higher mortality hazard at 1 year following an incident stroke. In Canada, Kapral et al[18] conducted a cohort study on a population-based sample of 7,816 patients with stroke or TIA, seen at 153 acute care hospitals in the province of Ontario. They measured socioeconomic status for each patient using income quintiles imputed from median neighborhood income, and found that 1-year mortality rates were higher in those from the lowest income group compared to those from the highest income group, even after

adjustment for age, sex, stroke type and severity, comorbid conditions, hospital and physician characteristics, and processes of care (adjusted HR 1.18, 1.03 to 1.29). In Austria, Arrich and colleagues[19] found that occupation and income have an independent effect on risk of death, which is sustained after adjusting for stroke severity. Analysing the Anhui cohort data[20] and systematically reviewing literature of Chinese studies (the results are orally presented with the current SLSR study together in *Asia Pacific Stroke Conference, Hong Kong, September 2013*; the full paper is submitted for journal publication), we have demonstrated that survival time in Chinese stroke patients is inversely associated with socioeconomic deprivation. Yet other studies report either a weak or no association. [21-23] Swedish data[24] showed that decreasing income was associated with an increased 28-day and one-year case fatality in men but not women. In the same study by Arrich et al[19] there was no association of educational level with survival. Studies from Australia and New Zealand using area-level socioeconomic status [6] showed no association of SED with 30-day or 12-month case fatality. There is no evidence of socioeconomic disparities in such mortality after a first stroke in an Italian study.[5] The inconsistencies may be due to the studied sample variations, different systems of health service, and the methodology used. In the current study, we did not find the significant association of SED with mortality in patients using the quartiles of Carstairs score. However, using the sextiles of Carstairs score, which included the smaller proportion of patients but who were more extremely deprived, we identified a significant association of SED with reduced survival after stroke. Although policies in England have sought to tackle health inequalities for some years[25] reasons for on-going inequality in stroke survival are unclear.

In conclusion, our study reported the impact of SED on survival among the black and minority ethnic stroke patients who live in high income countries. Compared to white

patients, the impact seems to be stronger in blacks. Among these 16.6% patients who were most extremely deprived in the 6th sextile Carstairs score, there were significant associations of SED with short and long term survival after stroke. The associations were independent of stroke risk factors, severity, and acute care. The findings have shown evidence that inequalities in stroke survival exist in England. Innovative acute and long-term stroke care strategies targeting people with SED are required, particularly in BME populations. Reducing socioeconomic deprivation and tackling health inequality will improve short and long term survival after stroke.

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Disclosures

None.

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Table 1. Characteristics of patients and median score of Carstairs index: SLSR of 1995-2011

Variable	*Patients*		Carstairs score		P value†
	n	*%*	Median	Interquartile range (IQR)	
Socio-demography					
Age (years)					
0-64	*1413*	*32.1*	10.2	6.8-12.5	0.009
65-74	*1102*	*25.1*	10.1	6.7-12.2	
75-84	*1227*	*27.9*	10.2	7.2-12.1	
85+	*656*	*14.9*	9.7	6.6-11.7	
Sex					
Men	*2230*	*50.6*	10.2	6.8-12.2	0.749
Women	*2168*	*49.4*	10.1	6.7-12.2	
Ethnicity					
White	*3103*	*70.6*	10.1	6.8-11.9	0.005
Black‡	*932*	*21.2*	10.0	6.6-12.6	
Asian/other‡	*253*	*5.8*	10.8	7.5-13.1	
Unknown	*110*	*2.5*	9.8	7.5-12.1	
Living conditions before stroke					
Alone in private accommodation	*1347*	*30.6*	10.2	7.1-12.1	0.071
With others in private accommodation	*2103*	*47.8*	10.2	6.7-12.5	
Nursing home or Other	*862*	*19.6*	9.8	6.7-11.7	
Unknown	*86*	*2.0*	9.8	7.7-11.7	
Year of stroke					

1995-1997	*964*	*21.9*	9.8	6.6-11.8	0.026
1998-2000	*850*	*19.3*	10.1	6.8-12.2	
2001-2003	*815*	*18.5*	10.2	7.2-12.2	
2004-2007	*969*	*22.0*	10.2	6.7-12.2	
2008-2011	*800*	*18.2*	10.3	6.8-12.3	
Admitted to hospital					
St Thomas' hospital	*2326*	*52.9*	9.8	6.8-11.9	<0.001
King's College hospital	*1108*	*25.2*	10.2	6.1-13.0	
St George's hospital	*409*	*9.3*	10.9	8.9-12.5	
Other hospitals in UK or abroad	*124*	*2.8*	9.7	6.7-12.5	
Unknown	*431*	*9.8*	9.8	6.8-11.8	
Risk factors prior to stroke					
Smoking status					
Never-	*1504*	*34.3*	9.9	6.6-12.2	0.277
Former-	*1157*	*26.3*	10.2	6.8-12.2	
Current-	*1365*	*31.1*	10.2	7.2-12.2	
Unknown	*372*	*8.5*	9.8	7.3-12.1	
Hypertension					
Yes	*2674*	*60.8*	10.2	6.8-12.2	0.031
No	*1501*	*34.1*	9.8	6.8-12.1	
Unknown	*223*	*5.1*	10.3	7.3-12.2	
Myocardial infarction					
Yes	*449*	*10.2*	10.4	7.7-12.2	0.097
No	*3727*	*84.7*	10.0	6.7-12.2	
Unknown	*222*	*5.1*	10.3	6.9-12.2	

Atrial fibrillation					
Yes	*689*	*15.7*	9.7	6.7-11.8	0.025
No	*3489*	*79.3*	10.2	6.8-12.2	
Unknown	*220*	*5.0*	10.2	7.0-12.2	
BI prior to stroke					
<15, severe/moderate disability	*295*	*6.7*	9.8	6.7-11.9	0.382
15-19, mild disability	*608*	*13.8*	10.2	6.8-12.2	
20, independent	*3266*	*74.3*	10.2	6.8-12.2	
Unknown	*229*	*5.2*	9.8	6.8-12.1	
Stroke subtype					
Infarction	*3248*	*73.8*	10.1	6.7-12.1	0.891
Primary intracerebral haemorrhage	*562*	*12.8*	9.8	6.8-12.2	
Subarachnoid haemorrhage (SAH)	*220*	*5.0*	10.2	7.1-12.2	
Unclassified	*190*	*4.3*	10.1	7.5-12.2	
Unknown	*178*	*4.1*	10.3	7.3-12.2	
Stroke severity (Case mix)					
Glasgow coma scale score					
<13 (impaired consciousness)	*1183*	*26.9*	10.2	7.2-12.1	0.909
≥13	*3039*	*69.1*	10.1	6.8-12.2	
Unknown	*176*	*4.0*	9.5	6.2-12.1	
Speech deficit					
Yes	*2293*	*52.1*	9.9	6.7-12.1	0.002
None	*1350*	*30.7*	10.3	7.3-12.5	
Unknown	*755*	*17.2*	9.8	6.8-12.1	
Motor deficit					

Present	*3431*	*78.0*	10.2	6.8-12.2	0.264
None	*761*	*17.3*	9.9	6.7-12.1	
Unknown	*206*	*4.7*	10.2	6.8-12.1	

† p value was for patients who had available data for characteristic variables.
‡ in 932 Blacks, 61.0% were Caribbean, 35.80% African, 3.2% other Blacks, and in 253 other ethnicities, 46.8% were south Asians, 18.2% Chinese, 3.7% Asians, and 34.0% other ethnicities, which we categorised as an Asian.

Table 2. Number* and adjusted HR† of mortality among stroke patients across 4 groups of the Carstairs score: SLSR of 1995-2011

Quartile SED	Duration of follow up								
	3 months			1 year			2 years		
	Death (%)	HR† (95%CI)		Death (%)	HR† (95%CI)		Death (%)	HR† (95%CI)	
All patients§									
Q-1	271 (24.2)	1.00		371 (34.0)	1.00		436 (41.4)	1.00	
Q-2	277 (25.9)	1.04	(0.88-1.24)	363 (34.5)	0.99	(0.86-1.15)	414 (40.3)	0.96	(0.84-1.10)
Q-3	301 (27.1)	1.11	(0.94-1.31)	377 (34.7)	1.03	(0.89-1.20)	432 (41.5)	1.01	(0.89-1.16)
Q-4	285 (26.8)	1.15	(0.97-1.37)	356 (34.5)	1.07	(0.93-1.24)	410 (41.3)	1.06	(0.63-1.22)
Black patients#									
Q-1	31 (13.2)	1.00		45 (19.7)	1.00		64 (29.5)	1.00	
Q-2	35 (15.6)	1.19	(0.69-2.06)	46 (21.1)	1.16	(0.74-1.83)	57 (27.1)	1.01	(0.68-1.49)
Q-3	39 (17.0)	1.40	(0.84-2.32)	51 (23.3)	1.39	(0.91-2.13)	53 (25.5)	1.04	(0.71-1.53)
Q-4	41 (18.1)	1.76	(1.06-2.94) @1	50 (24.2)	1.54	(1.00-2.37) @1	54 (28.6)	1.20	(0.81-1.76)
Asian/other ethic patients#									
Q-1	14 (21.9)	1.00		17 (26.6)	1.00		19 (30.2)	1.00	

Q-2	8 (12.3)	0.93	(0.31-2.81)	11 (17.7)	0.91	(0.35-2.31)	14 (23.3)	0.94	(0.41-2.20)
Q-3	13 (21.3)	1.75	(0.65-4.76)	15 (24.6)	1.50	(0.63-3.58)	17 (29.8)	1.37	(0.62-3.02)
Q-4	10 (16.1)	1.33	(0.43-4.09)	15 (24.6)	1.80	(0.72-4.48)	18 (31.0)	1.90	(0.84-4.28)

* the number of patients at the follow up time were derived from those who were actually followed up to the time, including deaths.
[§] within the whole cohort, interaction analysis for SED and ethnicity showed no significant effect on mortality at any time follow up.
[#] In analysis stratified by ethnicity we divided patients into 4 groups according to the quartiles of the Carstairs score within each ethnicity.
[†] adjusted for age, sex, ethnicity, years of stroke occurring, living conditions before stroke, admitted to hospital, cardiovascular risk factors score, type of stroke, Glasgow coma, speech deficit and motor deficit.
[@1] $p<0.05$

Table 3. Number* and adjusted HR[‡] of mortality among stroke patients with the 6th sextitle of the Carstairs score: SLSR of 1995-2011

Sextile SED	Duration of follow up								
	3 months			1 year			2 years		
	Death (%)	HR[†] (95%CI)		Death (%)	HR[†] (95%CI)		Death (%)	HR[†] (95%CI)	
All patients§									
S-1/5	936 (25.6)	1.00		1226 (34.3)	1.00		1416 (41.0)	1.00	
S-6	198 (27.8)	1.23	(1.05-1.44)[@1]	241 (35.0)	1.15	(1.00-1.33)[@1]	276 (41.8)	1.15	(1.00-1.33)[@1]
White patients[#]									
S-1/5	726 (28.1)	1.00		962 (38.0)	1.00		1105 (45.0)	1.00	
S-6	163 (32.2)	1.28	(1.07-1.52)[@2]	194 (38.7)	1.15	(0.98-1.35)	226 (46.2)	1.17	(1.01-1.35)[@1]
Black patients[#]									
S-1/5	121 (15.8)	1.00		160 (21.8)	1.00		195 (27.9)	1.00	
S-6	25 (16.6)	1.35	(0.84-2.17)	32 (23.4)	1.27	(0.84-1.91)	33 (26.6)	1.20	(0.73-1.59)
Asian/Other ethic patients[#]									
S-1/5	38 (17.9)	1.00		48 (23.1)	1.00		57 (28.5)	1.00	

S-6	7 (17.5)	1.36	(0.39-4.75)	10 (25.0)	1.69	(0.61-4.64)	11 (29.0)	1.57	(0.66-3.75)

* the number of patients at the follow up time were derived from those who were actually followed up to the time, including deaths.
§ within the whole cohort, interaction analysis for SED and ethnicity showed no significant effect on mortality at any time follow up.
# In analysis stratified by ethnicity we divided patients into 6 groups according to the sextitles of the Carstairs score within each ethnicity.
ǂ adjusted for age, sex, ethnicity, years of stroke occurring, living conditions before stroke, admitted to hospitals, cardiovascular risk factors score, type of stroke, Glasgow coma, speech deficit, motor deficit, hospital admission, stroke unit admission, >50% of stay on stroke unit, brain imaging and swallow test.
@1 $p<0.05$, @2 $p<0.01$