Relationship between deprivation and outcome for stroke patients: data from the UK national Stroke Registry

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Background:
Previous studies have identified that social deprivation is associated with the onset of stroke, with people from areas of higher deprivation being more likely to have a stroke at a younger age.

Method:
Data for 66,798 stroke patients treated in 266 stroke services between April 2013 and March 2014 were extracted from the Sentinel Stroke National Audit Programme (SSNAP) - the national register of stroke care in England and Wales. The data were linked with an index of multiple deprivation using the patient's zip code. Multivariable multilevel logistic regression models with hospital-level random intercepts were used to estimate 30 day mortality for the full data set using level of consciousness as a measure of stroke severity. Sensitivity analysis was additionally conducted using full NIHSS as the measure of stroke severity for those where it is fully completed.

Results:
- Of the 66,798 adults with acute stroke discharged from 266 hospitals, deprivation data was available for 63,007 patients (94.3%) and NIHSS was fully completed for 45,149 patients (71.7%). For the most deprived patients, NIHSS was fully completed for 73.6% and the corresponding percentages were 70.5% for the second most deprived, 70.2% for the second least deprived and 72.5% for the least deprived.
- The median age at stroke onset for the most deprived quartile was 5 years lower than for the least deprived group (74, 77, 79 and 79 years respectively, Kruskal–Wallis test $p<0.001$). [Figure 1]
- The most deprived group had different comorbidities compared to less deprived groups with a higher rate of diabetes (22.7%, 20.6%, 17.9% and 15.8%, chi^2 $p<0.001$) and a lower rate of atrial fibrillation (17.6%, 19.8%, 22.9% and 22.6%, chi^2 $p<0.001$).
- For patients in the most deprived quartile compared to the least deprived, the rate of primary intracerebral hemorrhage was lower (9.9%, 10.5%, 10.7% and 11.7% respectively, chi^2 $p<0.001$).
- Patients living in more deprived areas were less likely to have been independent before stroke (modified Rankin score (mRS) less than 3) compared to patients living in the least deprived areas and when controlling for age this relationship is even stronger. [Table 1]
- Unadjusted mortality at 30 days was higher for less deprived patients both when looking at all patients and when looking at only patients with fully completed NIHSS. After controlling for patient characteristics there was no evidence of an association when using the entire data set but when looking at the patients with a fully completed NIHSS there seems to be an association with the most deprived group being less likely to have died within 30 days compared to the second least deprived patients. [Table 1]

Figure 1: Age distribution for different levels of deprivation
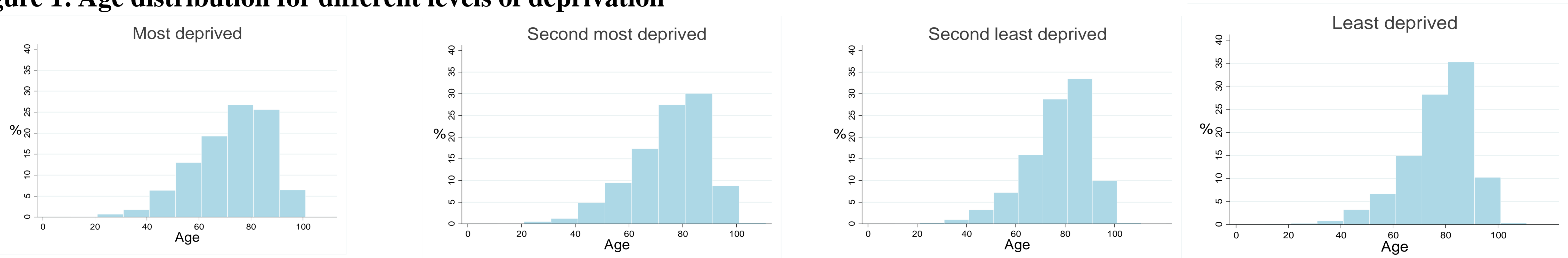
Table 1: Odds ratio and 95% confidence interval

	Unadjusted independent before stroke	Adjusted independent before stroke †	Unadjusted 30 day mortality (All patients)	Adjusted 30 day mortality § (All patients)	Unadjusted 30 day mortality (Only patients with fully completed NIHSS)	Adjusted 30 day mortality § (Only patients with fully completed NIHSS)
Most deprived	1.00	1.00	1.00	1.00	1.00	1.00
Second most deprived	1.04 (p=0.187) CI [0.98-1.10]	1.20 (p<0.001) CI [1.24-1.41]	1.10 (p=0.003) CI [1.03-1.18]	1.04 (p=0.373) CI [0.95-1.12]	1.09 (p=0.055) CI [1.00-1.20]	1.06 (p=0.266) CI [0.95-1.18]
Second least deprived	1.05 (p=0.093) CI [0.99-1.12]	1.33 (p<0.001) CI [1.24-1.41]	1.18 (p<0.001) CI [1.10-1.26]	1.06 (p=0.112) CI [0.98-1.16]	1.21 (p<0.001) CI [1.10-1.32]	1.14 (p=0.015) CI [1.03-1.27]
Least deprived	1.19 (p<0.001) CI [1.12-1.27]	1.57 (p<0.001) CI [1.46-1.68]	1.16 (p<0.001) CI [1.08-1.24]	1.05 (p=0.301) CI [0.96-1.14]	1.14 (p=0.006) CI [1.04-1.26]	1.08 (p=0.208) CI [0.96-1.20]

† Adjusted for age and clustered by admitting hospital.
‡ Adjusted for stroke type, age, sex, congestive heart failure, diabetes, atrial fibrillation, hypertension, previous stroke/TIA, mRS before stroke, and level of consciousness and clustered by admitting hospital.
§ Adjusted for stroke type, age, sex, congestive heart failure, diabetes, atrial fibrillation, hypertension, previous stroke/TIA, mRS before stroke, and stroke severity (NIHSS) and clustered by admitting hospital.

Conclusion:
Stroke patients living in more deprived areas are different from stroke patients living in less deprived areas. Despite having strokes at a younger age (median difference 5 years), patients living in deprived areas are less likely to have been independent before their stroke. They are also more likely to have a prior history of diabetes mellitus and less likely to been diagnosed with atrial fibrillation.

Even though patient characteristics vary depending on level of deprivation, there is no strong evidence that 30 day mortality is linked with deprivation despite the use of a large register of unselected patients. Healthcare is free at the point of use in England and Wales and everyone should have equal access to care. The lack of an association between deprivation and 30 day mortality supports this idea but the link between deprivation and other outcomes after stroke should be investigated.

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