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Title page

Reduced inequality in access to stroke unit care over time. A 15-year follow-up of socioeconomic disparities in Sweden.

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Abstract

Background

Despite the compelling scientific evidence on the superiority of stroke unit (SU) care, far from all acute stroke patients have access to SU care. In congruence with what has been observed when other new methods are introduced in health care, we hypothesized that there has been an inequality in the build-up phase of SUs, but that the gradients between patient groups have decreased as the total capacity of SU care has increased. The purpose of this study was to explore if patients in a national sample, who were socioeconomically disadvantaged (low education or low income) had reduced access to SU care and if differences varied over time.

Methods

All patients 18-74 years of age in 1995-2009 year cohorts in Riks-Stroke, the Swedish stroke register, were included. “The Stroke unit Trialists” definition of a stroke unit has been adopted by Riks-Stroke and hospitals participating in the registry. Basic patient characteristics, stroke risk factors, process and outcome variables are recorded in Riks-Stroke. Socioeconomic data was accessed from Statistics Sweden. Multiple logistic regression analyses were used to calculate odds ratios for stroke unit care between pre-specified patient subgroups.

Results

A total of 319240 stroke patients were included in Riks-Stroke during year 1995-2009 and 124173 were in ages between 18 and 74 years; they were included in final analyses. After adjustment for confounders in a multiple regression model, women were slightly less often treated in stroke units (OR 0,97. 95% CI 0.95-0.99). There were no statistically significant associations between stroke unit care and age or between stroke unit care and being cohabitant or living alone. Highest level of education predicted access to stroke unit care

(secondary vs. primary school (OR 1.04, 95% CI 1.01-1.07) and university vs. primary school (OR 1.06, 95% CI 1.01-1.10)). Differences by level of education diminished over time (p-value 0.001). Income was not independently associated with SU care and over time the proportion of patients treated in SUs increased at a similar rate in all income groups (p-value 0.12).

Conclusions

Even in a country with modest socioeconomic differences in the general population and public financing of all acute hospital care, socioeconomic inequalities in access to stroke unit care were evident during the early years but they diminished as the total capacity for SU care increased.

Introduction

Despite the compelling scientific evidence on the superiority of stroke unit (SU) care vs. stroke care in general wards as to death and disability, far from all acute stroke patients have access to SU care [1]. In Sweden, the first SUs were established in the 1970s. Since then, there has been a gradual increase in the access to SU care so that, by 2011, 85 % of all acute stroke patients were treated in a stroke unit, i.e., they spent at least part of the hospital stay in a SU [2].

The national stroke care guidelines in Sweden state that all acute stroke patients should be treated in a SU. This recommendation has rank 1 on a 10-level priority list [3]. Although the guidelines are explicit, it may be that resource limitations have resulted in disadvantages for certain patient groups.

In congruence with what has been observed when other new methods are introduced in health care, we hypothesized that there has been an inequality in the build-up phase of SUs, but that the gradients between patient groups have decreased as the total capacity of SU care has increased. We explored if patients who were socioeconomically disadvantaged (low education or low income) had reduced access to SU care and if possible differences varied with time.

Methods

This study is based on patients included in Riks-Stroke, the Swedish stroke register, between 1995 and 2009 [4,5]. The register, started in 1994, covers all hospitals that admit acute stroke patients in Sweden. Compared with epidemiological data and routine hospital statistics, approximately 75% of all stroke events in Sweden were included in Riks-Stroke in 1997 and increased to 85% in 2009. Most patients are identified for inclusion in Riks-Stroke on admission to hospital or later by routine hospital statistics or death certificates. Patients with acute stroke diagnosis according to ICD10 are included (ICD10; cerebral infarction I61, intracerebral hemorrhage I63, unspecified stroke I64) and deaths certificates. All patients included in Riks-Stroke and aged 75 years or younger were included in this study.

Basic patient characteristics, stroke risk factors, process and outcome variables are recorded in Riks-Stroke during acute care and at a 3-months follow up. More information on Riks-stroke is available at the Riks-Stroke website (www.riks-stroke.org). Data on income and education was accessed from Statistics Sweden, Longitudinal Integration Database for Health and Insurance and Labour Market (LISA) [6]. The project was approved by the Ethical Review Board at Umeå University (D-Nr 07-118M).

In 2011, Sweden had a population of 9.5 million inhabitants. There were 74 hospitals that admitted acute stroke patients and all of them had a stroke unit. The SU Trialists have defined a SU as “organized specialist in-patients stroke care” and have provided a set of criteria that should be fulfilled (1). This definition has been adopted by Riks-Stroke and the hospitals participating in the registry. In a detailed inventory performed in 2007, >90% of the SUs fulfilled all criteria [7].

Proportions of patients that were treated in a stroke unit are presented for pre-specified groups, including highest obtained level of education (primary, secondary, university), income (categorized by tertiles) and stroke subtype (ICD10 codes: cerebral infarction I61, intracerebral hemorrhage I63, unspecified stroke I64).

All statistical analyses were pre-specified. Multiple logistic regressions were used to adjust for possible confounders and simultaneously test the effect of predictors on the probability to be treated in a stroke unit care. Parameters were estimated using generalized estimation equations with an exchangeable correlation structure for patients within the same hospital. The two-way interaction terms (year*sex, year*age, year*income, year*education level) were added to the model to test if differences between subgroups in access to stroke unit care varied over the years. Parameters that did not improve the model were removed. The statistic software IBM SPSS statistics 20 was used to perform the analysis.

Results

A total of 319 240 stroke patients were included in Riks-Stroke during year 1995-2009 and 124173 were in ages between 18 and 74 years; they were included in final analyses.

After adjustment for confounders in a multiple regression model, there were no statistically significant associations between stroke unit care and age or between stroke unit care and being cohabitant or living alone (Table 1). Women were slightly less often treated in stroke units.

Between 1995 and 2009, there was a statistically significant increase in the proportion treated in stroke units from 57.2% to 87.6% (OR 4.961; 95% CI 3.47-7.09). In the beginning of the study period, patients with lower education had less access to stroke unit care (Figure 1).

Over time, these patients had a more rapid implementation rate and the differences in stroke unit care between educational groups diminished over time (p-value 0.001). In multivariable GEE analyses, higher level of education was independently associated with increased access to stroke unit care (Table 1). Ignoring the dependency between patients within the same hospital and instead adding a fixed hospital effect to the multiple logistic regression model did not change these results (OR 1.050; 95% CI 1.014-1,087 for secondary, and OR 1.068; 95% CI 1.017-1.112 for university education, compared to primary school education).

Over time the proportion of patients treated in stroke units increased at a similar rate in all income groups (p-value 0.12)(Figure 1). Income was not independently associated with stroke unit care after adjustments for other factors (Table 1).

Discussion

In the present study, we show that inequality by socioeconomic status existed in Sweden when overall access to stroke unit care was limited. The socioeconomic gradients have gradually diminished as stroke services have expanded. In 2009, 86.5% of all stroke patients in Sweden received stroke unit treatment. It is likely that a similar development with diminishing socioeconomic inequalities is to be expected in any country with increased overall access to stroke unit care.

As reviewed by Addo et al., socioeconomic status has been associated with inequalities in the delivery of care across the stroke pathway [8]. From Denmark, Canada and the US, low-income patients have been reported to be less likely to receive evidence-based care and being treated in university-hospitals [9-11]. However, in a single center study performed in the UK, no significant differences in stroke management by socioeconomic status were observed [12]. What is new with our study is the analyses of the relationships between socioeconomic status and access to SU care over time.

One of the potential problems in analyses of disparity of care may be the influence of the patients' geographical location. Therefore multiple regression analyses were performed using generalized estimation equations with an exchangeable correlation structure for patients within the same hospital. An additional analysis included hospital as a fixed effect in the logistic regression model. This way, the potential effect of relationship between socioeconomic differences and geographical location of the treating hospital was adjusted for.

Strengths of this study included (a) register coverage of all hospitals admitting acute stroke patients, (b) prospective data collection, (c) use of linkage to socioeconomic data using the unique personal identification numbers available in Sweden (and in other Scandinavian countries), (d) sufficient statistical power to detect even modest socioeconomic differences, and (e) the study has been performed in a country where all acute stroke care is publicly funded, eliminating selection of study patients by socioeconomic characteristics.

A possible limitation of the present is that coverage of the Riks-Stroke register has changed over time. An increased access to stroke unit care in Sweden has been paralleled by an increase in coverage in the register from approximately 50 % in the early years to the proportion increasing to well above 85 % in 2009. Patients treated in general wards are overrepresented among stroke patients not recorded in Riks-Stroke (A3). Had missing patients been included in early years, the socioeconomic gradients would most probably have been greater, strengthen our hypothesis that more stroke unit beds reduce social inequalities in access to stroke units.

Another limitation is that our study included patients up to the age of 75 years, i.e. only half of all stroke patients (2), because socioeconomic data were not available for older age groups. Although we did not find that access to stroke unit was age-dependent, it is possible that it is so in patients above 75 years.

Summary/conclusion

Even in a country with modest socioeconomic differences in the general population and public financing of all acute hospital care, socioeconomic inequalities in access to stroke unit care were evident during the early years but they diminished as the total capacity for SU care increased.

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Conflicts of interest/Disclosures

None

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Table and Figure legend

Table 1. Frequencies and proportions with stroke unit treatment in subgroups of stroke patients*.

Figure 1. Proportion of stroke patients treated in a stroke unit over time. Separate lines for different education groups and income groups.

Table 1.

		Treatment in stroke unit			Multiple logistic regression		
		Valid cases N	Frequency n	Proportion %	Odds Ratio	95% Confidence Interval	
Sex							
	Women	46638	36036	77.3	0.966	0.945	0.988
	Men	77535	60788	78.4	Ref	Ref	Ref
Age groups							
	18-54	16491	12859	78.0	1.020	0.888	1.172
	55-64	35423	28237	79.7	1.053	0.988	1.123
	65-74	72259	55728	77.1	Ref	Ref	Ref
Education							
	University	18208	14694	80.7	1.060	1.018	1.104
	Secondary	45928	36452	79.4	1.043	1.013	1.074
	Primary	57155	43557	76.2	Ref	Ref	Ref
	Missing	2882					
Income							
	High	41088	33544	81.6	1.025	0.987	1.064
	Middle	41076	31655	77.1	0.983	0.954	1.013
	Low	41089	30933	75.3	Ref	Ref	Ref
	Missing	920					
Previous Stroke							
	Yes	27866	21762	78.1	1.076	1.035	1.119
	No	92354	72299	78.3	Ref	Ref	Ref
	Missing	3953					
ADL-dependent							
	Yes	6434	4604	71.6	0.863	0.798	0.933
	No	116463	91583	78.6	Ref	Ref	Ref
	Missing	1276					
Institutional living							

	Yes	3973	2751	69.2	0.788	0.701	0.885
	No	119390	93616	78.4	Ref	Ref	Ref
	Missing	810					
Living alone							
	Yes	41013	31782	77.5	0.975	0.944	1.007
	No	81693	64192	78.6	Ref	Ref	Ref
	Missing	1467					
Fully conscious							
	No	17253	11744	68.1	0.651	0.612	0.693
	Yes	104941	83889	79.9	Ref	Ref	Ref
	Missing	1979					
Stroke subtype							
	I64	4990	2647	53.0	0.388	0.319	0.471
	I61	17549	12618	71.9	0.741	0.684	0.803
	I63	101537	81521	80.3	Ref	Ref	Ref
	Missing	97					

* Year for stroke onset was included in the multiple logistic regression model.