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Epidemiological analysis of hospitalisations due to recurrent stroke in the Silesian Province, Poland, between 2009 and 2015

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ABSTRACT

Background and aim. There is a lack of recent epidemiological studies on recurrent stroke (RS) in Poland. The aim of this study was to analyse all hospitalisations related to RS in Silesia – an industrial region covering 12% of the Polish population.

Material and methods. We carried out statistical analysis of data contained in stroke questionnaires transferred to the Polish National Health Fund by hospitals in Silesia, Poland, between 2009 and 2015.

Results. In the analysed period, the number of RS hospitalisations in Silesia was 18,063 (22.2% of all acute strokes). The percentage of RS significantly decreased during the period under consideration ($p < 0.001$). The same observation concerned recurrent ischaemic stroke (RIS), but not recurrent haemorrhagic stroke (RHS). The median hospitalisation time was 14 days for RHS, and 11 days for RIS. Large-artery atherosclerosis and cardioembolisms were significantly more often recognised in RIS than in first-ever ischaemic stroke (FIS) (consecutively, 38.2% *vs* 36.0%, and 21% *vs* 18.1%; $p < 0.001$). The in-hospital mortality rate was significantly higher for RS than for first-ever stroke (18.4% *vs* 17.2%; $p < 0.001$). The same observation was done for RIS vs FIS (16.2% *vs* 13.9%; $p < 0.001$), and for RHS vs FHS (39.8% *vs* 36%; $p = 0.004$). The rtPA therapy was applied to 5.3% of FIS and 3.2% of RIS patients ($p < 0.001$).

Conclusions. This is the first such comprehensive and long-term analysis of recurrent stroke in Silesia, Poland. It could help in the implementation of appropriate educational programmes, and thus help to improve the health status of society.

Key words: stroke, epidemiology, ischaemic stroke, haemorrhagic stroke, recurrent stroke

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Introduction

Stroke constitutes the third highest cause of death and the main cause of permanent disability in adults in Europe. Due to its poor prognosis, and the high costs of treatment and of chronic care, stroke is not only a medical but also a social problem.

Recently conducted epidemiological studies have significantly improved our understanding of stroke epidemiology and treatment. But regular updates at local, national and global levels are needed. The first epidemiological data on cerebrovascular diseases in Poland comes from the years 1980–2010 [1–13]. The most recent studies, both national and regional, were conducted in the last decade [14–17]. Some

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of them have concerned the Silesian Province, an industrial region of Poland covering 12% of the nation's population (4.6 million people). In these studies, we have analysed the local incidence of first-ever-stroke (FS), the number of stroke hospitalisations, stroke aetiology, outcome, used methods of diagnostics, and treatment between 2009 and 2015 [15, 16].

However, there is still a lack of recent epidemiological data on recurrent stroke (RS) in Poland despite the fact that this is a known indicator of the effectiveness of secondary stroke prevention.

Therefore, the aim of this study was to assess the epidemiological characteristics of RS in the Silesian Province of Poland over the course of the last decade.

Materials and methods

Our study was based on data obtained from stroke questionnaires (n = 88,425) which were mandatorily reported to the National Health Fund (NHF; the only public health insurer in Poland) by all Silesian hospital departments for stroke patients (homogeneous patient groups: A48-A51). The analysed period was between 2009 and 2015. The study was carried out with the approval of the Silesian division of the NHF and the Consultant in Neurology for the Silesian Province.

The questionnaire was verified for incomplete or recurring data (e.g. recurring records of the same hospitalisation were excluded). Finally, 81,193 stroke questionnaires were enrolled for analysis. A diagnosis of stroke was made according to the International Classification of Diseases version 10 (ICD-10).

The following data from the stroke questionnaires were used in the present study: age, sex, admission date, date of the first occurrence of stroke symptoms, date of death or discharge, number of hospitalisation days, aetiology of ischaemic stroke (IS) (according to the Trial Org 10172 in Acute Stroke Treatment - TOAST), clinical symptoms (consciousness disorders, hemiparesis/hemiplegia, speech disorders, sensory disorders, posterior circle syndrome), secondary stroke prevention (antiplatelets, anticoagulants, antihypertensives), information on referral for vascular intervention due to artery stenosis, and application of recombinant tissue plasminogen activator (rtPA).

The questionnaires also included information as to whether the stroke was classified as first-ever-stroke (FS) or recurrent stroke (RS). FS was diagnosed when the response to the question "Was it your first stroke accident?" was "Yes", and RS when the response was "No".

According to the Bioethics Committee, the study was not a medical experiment. Therefore, no approval of the Committee was required.

Statistical analysis was done using SAS statistical package version 9.4 (SAS Institute Inc., Cary, NC, USA). The level of statistical significance was set at $p < 0.05$.

For nominal data, percentage values were used. The correlation between the nominal variables was verified using the $\chi 2$ test. Normally distributed quantitative data were characterised using the mean and the standard deviation, whereas the median and the interquartile range was used for non-normally distributed data. The verification of the distribution of the variables and the agreement with the normal distribution were made using the Shapiro-Wilk test. The mean difference significance was verified using the Student's t-test for two groups and the ANOVA test for three or more groups. The consistency of the distribution was verified using the Mann-Whitney U test for two groups and the Kruskal-Wallis test for three or more groups for skewed distributions. Multiple comparisons were made based on post-hoc test results for variance analysis (ANOVA) and the Kruskal-Wallis test and with the Holm-Bonferroni correction to assess significance of the percentage difference in cases of three or more groups. The test for trend was also calculated for consecutive years by means of Jonckheere-Terpstra and Cochran-Armitage tests for continuous and categorical variables, respectively.

Results

Based on analysis of the data obtained from the stroke questionnaires, the number of RS hospitalisations in the Silesian Province between 2009 and 2015 was 18,063 (9,229 women and 8,715 men; $P < 0.001$; in 119 cases sex was not recorded). In 4,763 subjects, the type of stroke (first or recurrent) could not be determined (Tab. 1).

RS constituted 22.2% of all acute stroke hospitalisations in the analysed period. The number of hospitalisations due to recurrent haemorrhagic stroke (RHS; I60, I61, I62) was 1,619 (15% of all hospitalisations with acute haemorrhagic stroke i.e. HS diagnosis), while the total number of hospitalisations due to recurrent ischaemic stroke (RIS; I63) was 16,256 (23.4% all hospitalisations with acute IS diagnosis) (Tab. 3, 4).

The percentage of RS significantly decreased during the period under consideration ($p < 0.001$). The same observation concerned RIS, but not RHS (Tab. 1, 3, 4).

The median age for patients with RS was 74 (range 66–81) years. The age of male patients (71 (range 63–78) years) was statistically significantly lower ($P < 0.001$) compared to female patients (78 (70–84) years).

The median age for patients with RIS was 75 (range 66–81) years. The age of male patients (71 (range 63–79) years) was statistically significantly lower ($P < 0.001$) compared to female patients (78 (range 70–84) years).

The median age for patients with RHS was 72 (range 62–80) years. The age of male patients (69 (range 61–77) years) was statistically significantly lower ($P < 0.001$) compared to female patients (76 (range 66–82) years) (Tab. 5).

Large-artery atherosclerosis and cardioembolisms were significantly more often recognised in RIS than in first-ever ischaemic stroke (FIS) (consecutively, 38.2% *vs* 36.0%, and 21% *vs* 18.1%; $p < 0.001$). On the other hand, lacunar stroke was less

Table 1. Number of acute (first and recurrent) stroke-related hospitalisations in the Silesian Province between 2009 and 2015 (no data on sex in 487 patients in 2012)

Year		Number of hospitalisations due to acute stroke N (%)	Number of hospitalisations in women N (%)	Number of hospitalisations in men N (%)
2009	All	11,083 (100)	5,697 (100)	5,386 (100)
	FS	7,987 (72.1)	4,061 (71.3)	3,926 (72.9)
	RS	**2,559 (23.1)**	**1,338 (23.5)**	**1,221 (22.7)**
	ND	537 (4.9)	298 (5.2)	239 (4.4)
2010	All	11,751 (100)	6,126 (100)	5,625 (100)
	FS	8,598 (73.2)	4,465 (72.9)	4,133 (73.5)
	RS	**2,681 (22.8)**	**1,391 (22.7)**	**1,290 (22.9)**
	ND	472 (4)	270 (4.4)	202 (3.6)
2011	All	11,921 (100)	6,139 (100)	5,782 (100)
	FS	8,618 (72.3)	4,409 (71.8)	4,209 (72.8)
	RS	**2,789 (23.4)**	**1,443 (23.5)**	**1,346 (23.3)**
	ND	514 (4.3)	287 (4.7)	227 (3.9)
2012	All	11,912 (100)	5,905 (100)	5,520 (100)
	FS	8,690 (72.9)	4,282 (72.5)	4,052 (73.4)
	RS	**2,725 (22.9)**	**1,350 (22.9)**	**1,256 (22.8)**
	ND	497 (4.2)	273 (4.6)	212 (3.8)
2013	All	11,926 (100)	6,202 (100)	5,724 (100)
	FS	8,605 (72.2)	4,486 (72.3)	4,119 (72.0)
	RS	**2,668 (22.4)**	**1,368 (22.1)**	**1,300 (22.7)**
	ND	653 (5.5)	348 (5.6)	305 (5.3)
2014	All	11,505 (100)	5,956 (100)	5,549 (100)
	FS	8,143 (70.8)	4,261 (71.5)	3,882 (70.0)
	RS	**2,413 (21.0)**	**1,210 (20.3)**	**1,203 (21.7)**
	ND	949 (8.3)	485 (8.1)	464 (8.4)
2015	All	11,095 (100)	5,671 (100)	5,424 (100)
	FS	7,726 (69.6)	3,924 (69.2)	3,802 (70.1)
	RS	**2,228 (20.1)**	**1,129 (19.9)**	**1,099 (20.3)**
	ND	1,141 (10.3)	618 (10.9)	523 (9.6)
All	All	81,193 (100)	39,010 (100)	41,696 (100)
	FS	58,367 (71.9)	28,123 (72.1)	29,888 (71.7)
	RS	**18,063 (22.2)**	**8,715 (22.3)**	**9,229 (22.1)**
	ND	4,763 (5.9)	2,172 (5.6)	2,579 (6.2)
P[a] for trend		< 0.001	< 0.001	0.173

All – all stroke types (I60-I64); FS – first-ever-stroke; RS – recurrent stroke; ND – no data on type of stroke; [a] – Cochran–Armitage test for trend with Holm-Bonferroni correction

often diagnosed in RIS than in FIS (8.8% *vs* 10.0%; p < 0.001). The aetiology of stroke was undetermined in 30.4% of subjects of RIS compared to 34.1% of subjects of FIS (p < 0.001) (Tab. 6). The clinical manifestation of stroke was significantly more expressed in RIS than in FIS (p < 0.001) (Tab. 7).

During the analysed period, the in-hospital mortality rate for RS was 18.4%, and it was significantly higher compared to FS (17.2%) (p < 0.001). The same observation was done for RIS vs FIS (16.2% *vs* 13.9%; p < 0.001), and for RHS vs first-ever haemorrhagic stroke (FHS) (39.8% *vs* 36%; p = 0.004). The same trend was seen in women and in men (Tab. 8–10).

The median hospitalisation time was 14 (range 5–24) days for RHS, and 11 (range 9–15) days for RIS (Tab. 11). 77.2% of patients with FS and 78.9% of patients with RS were admitted to hospital on the day when stroke symptoms appeared (p < 0.001).

The rtPA therapy was applied to 2,598 patients with FIS (5.3%) and to 525 patients with RIS (3.2%) treated in hospitals

Table 2. Rt-PA therapy in patients hospitalised due to first-ever and recurrent ischaemic stroke (I63) in the Silesian Province between 2009 and 2015

Year	Number of all hospitalisations due to FIS N	Number of all hospitalisations due to RIS N	Number of all patients treated with rt-PA[a] /percentage of treated patients to all patients with I63 diagnosis /	Number of patients with FIS treated with rt-PA /percentage of treated patients to all patients with FIS diagnosis /	Number of patients with RIS treated with rt-PA /percentage of treated patients to all patients with RIS diagnosis /	P[b] FIS *vs* RIS treated with rt-PA
2009	6,584	2,277	107 /1.2%/	88 (1.3%)	17 (0.7%)	0.025
2010	7,298	2,397	196 /1.9%/	164 (2.2%)	27 (1.1%)	0.002
2011	7,314	2,517	296 /2.9%/	242 (3.3%)	50 (2%)	0.002
2012	7,339	2,469	453 /4.4%/	366 (5%)	82 (3.3%)	0.002
2013	7,353	2,422	537 /5.2%/	439 (6%)	84 (3.5%)	< 0.001
2014	6,937	2,169	806 /8.2%/	620 (8.9%)	131 (6%)	< 0.001
2015	6,600	2,005	887 (9.3%)	679 (10.3%)	134 (6.7%)	< 0.001
P[a] for trend	-	-	< 0.001	< 0.001	< 0.001	-
All	49,425	16,256	3,282 (4.7%)	2,598 (5.3%)	525 (3.2%)	< 0.001

[a] – Cochran–Armitage test for trend with Holm-Bonferroni correction
[b] – Chi^2 test with Holm-Bonferroni correction

of the Silesian Province between 2009 and 2015 ($p < 0.001$) (Tab. 2). The percentage changed between 2009 and 2015 from 1.3% (FIS) and 0.7% (RIS) to 10.3% (FIS) and 6.7% (RIS).

The overall in-hospital mortality in patients with FIS treated with rtPA (n = 396; 15.2%) was not statistically significantly higher compared to the in-hospital mortality of patients with FIS untreated with rtPA (n = 6,489; 13.9%) (P = 0.142). Also, the overall in-hospital mortality in patients with RIS treated with rtPA (n = 87; 16.6%) was not statistically significantly higher compared to the in-hospital mortality of patients with RIS untreated with rtPA (n = 2,548; 16.2%) (P = 0.885). No difference was found between the in-hospital mortality of FIS patients and the in-hospital mortality of RIS patients treated with rtPA ($p = 0.885$). Gender did not influence the in-hospital mortality in patients treated with rtPA (Tab. 12–13).

The in-hospital mortality in patients either with RIS or FIS was significantly higher in cardiogenic stroke compared to atherogenic stroke (Tab. 14–15).

The in-hospital mortality in patients either with FIS or RIS treated with rtPA was not associated with aetiology of stroke (Tab. 16–17).

Data obtained from the stroke questionnaires allowed us to determine the secondary stroke prevention therapy; 81.7% of RIS patients and 84.3% of FIS patients ($p < 0.001$) were administered antiplatelet drugs, 26.2% of RIS subjects and 23% of FIS subjects – oral anticoagulants ($p < 0.001$), and subsequently, 84.4% and 79.9% - antihypertensive drugs ($p < 0.001$) (Tab. 18). Furthermore, 3.4% of patients with FIS and 3.1% of patients with RIS were referred for vascular intervention due to artery stenosis.

In patients with cardioembolic stroke aetiology, 37.5% of subjects with FIS and 40.6% of subjects with RIS were administered anticoagulants. The percentage of patients with RIS and cardioembolic stroke treated with anticoagulants gradually increased over the subsequent years ($p = 0.033$) while a negative trend was observed for antiplatelet drugs ($p = 0.004$) (Tab. 19).

Discussion

As we described in our previous paper, the number of hospitalisations due to stroke and the incidence of first-ever-stroke in the Silesian Province were high (from 169/100,000 in 2009 to 187/100,000 in 2015), and seemed to be more akin to Eastern rather than to Western European countries [15, 18, 19]. This suggests that primary prevention of stroke may be imperfectly implemented in our country, and that the awareness of cerebrovascular risk factors is insufficient.

On the other hand, the number of recurrent strokes is the indictor of the efficiency of secondary prevention. Our study shows that hospitalisations due to recurrent stroke constituted a little more than one fifth of all hospitalisations due to acute stroke. The recurrence is higher in IS than in HS. The selected epidemiological studies show that the risk of recurrence after a first-ever stroke reaches 4% at 1 month, 13% at 1 year, and almost 40% at 10 years [20–24]. Readmission to hospital has a negative effect on the quality of a patient's life and increases socioeconomic costs [25].

We have found that the number of RS has significantly decreased during the last decade (RS constituted 23.1% of all stroke hospitalisations in 2009 but 20.1% in 2015; $p < 0.001$). In the Warsaw Stroke Registry (conducted in 1991–1992), recurrent strokes constituted 27% of all acute stroke events observed during the study [2, 3]. In our study, a decreasing number concerned RIS, but not RHS. This is consistent with other studies [20, 26]. The decreasing number of recurrent strokes could be associated

Table 3. Number of acute (first and recurrent) ischaemic stroke–related hospitalisations in the Silesian Province between 2009 and 2015

Year		Number of hospitalisations due to acute stroke N (%)	Number of hospitalisations in women N (%)	Number of hospitalisations in men N (%)
2009	All	9,275 (100)	4,789 (100)	4,486 (100)
	FIS	6,584 (71.0)	3,346 (69.9)	3,238 (72.2)
	RIS	2,277 (24.5)	1,208 (25.2)	1,069 (23.8)
	ND	414 (4.5)	235 (4.9)	179 (4.0)
2010	All	10,058 (100)	5,284 (100)	4,774 (100)
	FIS	7,298 (72.6)	3,816 (72.2)	3,482 (72.9)
	RIS	2,397 (23.8)	1,262 (23.9)	1,135 (23.8)
	ND	363 (3.6)	206 (3.9)	157 (3.3)
2011	All	10,223 (100)	5,303 (100)	4,920 (100)
	FIS	7,314 (71.5)	3,764 (71.0)	3,550 (72.2)
	RIS	2,517 (24.6)	1,318 (24.9)	1,199 (24.4)
	ND	392 (3.8)	221 (4.2)	171 (3.5)
2012	All	10,187 (100)	5,078 (100)	4,693 (100)
	FIS	7,339 (72.0)	3,632 (71.5)	3,407 (72.6)
	RIS	2,469 (24.2)	1,232 (24.3)	1,129 (24.1)
	ND	379 (3.7)	214 (4.2)	157 (3.4)
2013	All	10,289 (100)	5,393 (100)	4,896 (100)
	FIS	7,353 (71.5)	3,853 (71.4)	3,500 (71.5)
	RIS	2,422 (23.5)	1,258 (23.3)	1,164 (23.8)
	ND	514 (5)	282 (5.2)	232 (4.7)
2014	All	9,850 (100)	5,143 (100)	4,707 (100)
	FIS	6,937 (70.4)	3,653 (71.0)	3,284 (69.8)
	RIS	2,169 (22.0)	1,104 (21.5)	1,065 (22.6)
	ND	744 (7.6)	386 (7.5)	358 (7.6)
2015	All	9,521 (100)	4,890 (100)	4,631 (100)
	FIS	6,600 (69.3)	3,368 (68.9)	3,232 (69.8)
	RIS	2,005 (21.1)	1,012 (20.7)	993 (21.4)
	ND	916 (9.6)	5,10 (10.4)	406 (8.8)
All	All	69,403 (100)	35,880 (100)	33,107 (100)
	FIS	49,425 (71.2)	25,432 (70.9)	23,693 (71.6)
	RIS	16,256 (23.4)	8,394 (23.4)	7,754 (23.4)
	ND	3,722 (5.4)	2,054 (5.7)	1,660 (5.0)
P[a] for trend		< 0.001	< 0.001	0.209

FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63); ND – no data;
[a] – Cochran–Armitage test for trend with Holm–Bonferroni correction

with a better stroke care network and improvements in secondary stroke prevention.

This is also consistent with the observation that the number of stroke survivals with atrial fibrillation on anticoagulants increased from 40% in 2009 to 44% in 2015.

As regards the aetiology of RIS, this was undetermined in less than one third of patients (for comparison, in 1991–1992 this figure was more than half) [2, 3]. Such a decrease in unknown aetiology might be the result of a greater availability of diagnostic methods (such as ultrasonography, magnetic resonance, angiography, and broader cardiologic diagnostic possibilities). It is worth emphasising that undetermined RIS was rarer than undetermined FIS (30% *vs* 34%). The most common reason for RIS was large-artery atherosclerosis. Cardioembolisms were responsible for 21% of RIS (18% in FIS).

In our study we could not establish the recurrence rates for different subtypes of ischaemic stroke because the findings were anonymous. From the literature, we can see that

Table 4. Number of acute (first and recurrent) haemorrhagic stroke–related hospitalisations in the Silesian Province between 2009 and 2015

Year		Number of hospitalisations due to acute stroke N (%)	Number of hospitalisations in women N (%)	Number of hospitalisations in men N (%)
2009	All	1,604 (100)	798 (100)	806 (100)
	FHS	1,251 (78.0)	629 (78.8)	622 (77.2)
	RHS	246 (15.3)	115 (14.4)	131 (16.3)
	ND	107 (6.7)	54 (6.8)	53 (6.6)
2010	All	1,578 (100)	783 (100)	795 (100)
	FHS	1,219 (77.3)	608 (77.7)	611 (76.9)
	RHS	255 (16.2)	113 (14.4)	142 (17.9)
	ND	104 (6.6)	62 (7.9)	42 (5.3)
2011	All	1,562 (100)	747 (100)	815 (100)
	FHS	1,211 (77.5)	583 (78.1)	628 (77.1)
	RHS	245 (15.7)	108 (14.5)	137 (16.8)
	ND	106 (6.8)	56 (7.5)	50 (6.1)
2012	All	1,596 (100)	761 (100)	771 (100)
	FHS	1,260 (79.0)	604 (79.4)	605 (78.5)
	RHS	233 (14.6)	104 (13.7)	119 (15.4)
	Na's	103 (6.5)	53 (7.0)	47 (6.1)
2013	All	1,518 (100)	740 (100)	778 (100)
	FHS	1,169 (77.0)	584 (78.9)	585 (75.2)
	RHS	220 (14.5)	97 (13.1)	123 (15.8)
	Na's	129 (8.5)	59 (8.0)	70 (9.0)
2014	All	1,531 (100)	740 (100)	791 (100)
	FHS	1,125 (73.5)	557 (75.3)	568 (71.8)
	RHS	219 (14.3)	94 (12.7)	125 (15.8)
	Na's	187 (12.2)	89 (12.0)	98 (12.4)
2015	All	1,439 (100)	711 (100)	728 (100)
	FHS	1,038 (72.1)	511 (71.9)	527 (72.4)
	RHS	201 (14.0)	105 (14.8)	96 (13.2)
	Na's	200 (13.9)	95 (13.4)	105 (14.4)
All	All	10,828 (100)	5,280 (100)	5,484 (100)
	FHS	8,273 (76.4)	4,076 (77.2)	4,146 (75.6)
	RHS	1,619 (15.0)	736 (13.9)	873 (15.9)
	Na's	936 (8.6)	468 (8.9)	465 (8.5)
P[a] for trend		0.476	0.957	0.305

FHS – first–ever haemorrhagic stroke (I60–I62); RHS – recurrent haemorrhagic stroke (I60–I62); ND – no data; [a] – Cochran–Armitage test for trend with Holm–Bonferroni correction

the 3-month recurrence rates are higher for stroke caused by large artery atherosclerosis (14.3%) than for cardioembolic stroke (7.7%), lacunar stroke (2%) and ischaemic stroke due to undetermined causes (5.6%) [27]. A 23-year longitudinal population-based study showed that the implementation of a stroke care network and good primary prevention are defined areas associated with a decrease in the number of recurrent strokes [26].

The clinical symptoms were significantly more expressed in RIS than in FIS. Similarly to other authors, we found that hemiparesis/hemiplegia and speech disorders were the most common presenting symptoms [28].

The median length of hospital stay was 11 (range 9–15) days for RIS and 14 (range 5–24) days for RHS, both shorter than previously described [29]. Hospitalisation time was similar for RIS and FIS, but longer for RHS than for FHS.

Table 5. Median (Q1–Q3) age of patients with stroke in the analysed period

Year	FS	RS	P[a]	FIS	RIS	P[a]	FHS	RHS	P[a]
2009	72 (62–80)	74 (66–81)	< 0.001	73 (63–80)	75 (66–81)	< 0.001	70 (56–78)	73 (63–80)	< 0.001
2010	72 (62–80)	74 (65–81)	< 0.001	73 (62–80)	74 (65–81)	< 0.001	68 (56–79)	72 (62–79)	0.009
2011	73 (62–81)	74 (65–81)	< 0.001	73 (63–81)	74 (65–81)	< 0.001	68 (57–79)	71 (62–80)	0.012
2012	73 (62–81)	74 (65–81)	< 0.001	73 (63–81)	75 (65–81)	< 0.001	67 (56–78)	70 (61–78)	0.004
2013	73 (63–81)	74 (65.5–81)	< 0.001	73 (63–81)	74 (66–82)	< 0.001	70 (59–79)	72 (61–79)	0.139
2014	73 (63–81)	75 (66–82)	< 0.001	73 (64–82)	75 (66–82)	< 0.001	70 (59–79)	73 (64–80)	0.003
2015	73 (63–81)	75 (66–82)	< 0.001	73 (64–81)	75 (67–83)	< 0.001	70 (59–80)	74 (65–80)	0.001
P[b] for trend	< 0.001	< 0.001	–	< 0.001	< 0.001	–	0.001	0.206	–
All	73 (62–81)	74 (66–81)	< 0.001	73 (63–81)	75 (66–81)	< 0.001	69 (57–79)	72 (62–80)	< 0.001

[a] – U Mann–Whitney test;
[b] – Jonckheere–Terpstra test for trend with Holm–Bonferroni correction;
FS – first–ever stroke; RS – recurrent stroke;
FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63);
FHS – first–ever haemorrhagic stroke (I60–I62); RHS – recurrent haemorrhagic stroke (I60–I62)

Table 6. Aetiology of ischaemic stroke in the Silesian Province between 2009 and 2015, according to the TOAST classification

Year		Aetiology of ischaemic stroke					P[a]
		Large–artery atherosclerosis	Cardio––embolism	Small–vessel occlusion (lacune)	Other determined aetiology	Undetermined aetiology	
2009	FIS	2,502 (38.0%)	1,026 (15.6%)	683 (10.4%)	141 (2.1%)	2,232 (33.9%)	< 0.001
	RIS	875 (38.4%)	455 (20.0%)	215 (9.4%)	34 (1.5%)	698 (30.7%)	
2010	FIS	2,672 (36.6%)	1,093 (15.0%)	642 (8.8%)	111 (1.5%)	2,780 (38.1%)	< 0.001
	RIS	912 (38.1%)	463 (19.3%)	177 (7.4%)	35 (1.5%)	810 (33.8%)	
2011	FIS	2,579 (35.3%)	1,348 (18.4%)	699 (9.6%)	110 (1.5%)	2,578 (35.3%)	< 0.001
	RIS	988 (39.3%)	512 (20.3%)	230 (9.1%)	24 (1.0%)	763 (30.3%)	
2012	FIS	2,720 (37.1%)	1,473 (20.1%)	713 (9.7%)	135 (1.8%)	2,298 (31.3%)	0.004
	RIS	943 (38.2%)	555 (22.5%)	187 (7.6%)	49 (2.0%)	735 (29.8%)	
2013	FIS	2,540 (34.5%)	1,395 (19.0%)	778 (10.6%)	126 (1.7%)	2,514 (34.2%)	< 0.001
	RIS	919 (37.9%)	539 (22.3%)	220 (9.1%)	33 (1.4%)	711 (29.4%)	
2014	FIS	2,407 (34.7%)	1,312 (18.9%)	738 (10.6%)	166 (2.4%)	2,314 (33.4%)	0.001
	RIS	824 (38.0%)	454 (20.9%)	211 (9.7%)	35 (1.6%)	645 (29.7%)	
2015	FIS	2,388 (36.2%)	1,276 (19.3%)	675 (10.2%)	125 (1.9%)	2,136 (32.4%)	0.010
	RIS	751 (37.5%)	442 (22.0%)	191 (9.5%)	42 (2.1%)	579 (28.9%)	
P[b] for trend		0.289	< 0.001	0.626	0.751	0.082	–
Total	FIS	17,808 (36.0%)	8,923 (18.1%)	4,928 (10.0%)	914 (1.9%)	16,852 (34.1%)	< 0.001
	RIS	6,212 (38.2%)	3,420 (21.0%)	1,431 (8.8%)	252 (1.6%)	4,941 (30.4%)	

[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction
FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63)

Table 7. Clinical symptoms of acute stroke in the Silesian Province between 2009 and 2015

	ALL STROKES (I60–I64)	FS (I60–I64)	RS (I60–I64)	P
Consciousness disorders	26,302 (34.4%)	19,301 (33.1%)	7,001 (38.8%)	< 0.001
Hemiparesis/ hemiplegia	61,984 (81.1%)	46,670 (80.0%)	15,314 (84.8%)	< 0.001
Speech disorders	45,117 (59.0%)	33,221 (56.9%)	11,896 (65.9%)	< 0.001
Sensation disorders	25,026 (32.7%)	18,735 (32.1%)	6,291 (34.8%)	< 0.001
Posterior circle syndrome	17,180 (22.5%)	12,943 (22.2%)	4,237 (23.5%)	< 0.001

Table 8. In–hospital mortality in acute first–ever and recurrent stroke in the Silesian Province between 2009 and 2015. Data presented as the number and percentage of deaths, n (%)

Year	Overall hospital mortality in FS	Overall hospital mortality in RS	P FS *vs* RS	Mortality in FIS	Mortality in RIS	P FIS *vs* RIS	Mortality in FHS	Mortality in RHS	P FHS *vs* RHS
2009	1,440 (18.0%)	510 (19.9%)	0.187	954 (14.5%)	396 (17.4%)	0.005	410 (32.8%)	99 (40.2%)	0.166
2010	1,460 (17.0%)	519 (19.4%)	0.033	1,010 (13.8%)	405 (16.9%)	0.002	435 (35.7%)	110 (43.1%)	0.166
2011	1,523 (17.7%)	521 (18.7%)	0.696	1,074 (14.7%)	420 (16.7%)	0.047	422 (34.8%)	93 (38.0%)	1.000
2012	1,468 (16.9%)	491 (18.0%)	0.696	1,004 (13.7%)	395 (16.0%)	0.018	454 (36.0%)	94 (40.3%)	1.000
2013	1,459 (17.0%)	459 (17.2%)	1.000	994 (13.5%)	363 (15.0%)	0.139	452 (38.7%)	87 (39.5%)	1.000
2014	1,342 (16.5%)	432 (17.9%)	0.504	910 (13.1%)	338 (15.6%)	0.018	419 (37.2%)	91 (41.6%)	1.000
2015	1,340 (17.3%)	394 (17.7%)	1.000	939 (14.2%)	318 (15.9%)	0.139	384 (37.0%)	70 (34.8%)	1.000
P[b] for trend	0.261	0.035	–	0.261	0.105	–	0.035	0.0321	–
All	10,032 (17.2%)	3,326 (18.4%)	< 0.001	6,885 (13.9%)	2,635 (16.2%)	< 0.001	2,976 (36.0%)	644 (39.8%)	0.004

FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63);
FHS – first–ever haemorrhagic stroke (I60–I62); RHS – recurrent haemorrhagic stroke (I60–I62)
Data presented as N (%)
[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction (level of significance for trend in in–hospital mortality between 2009 and 2015)

Table 9. In–hospital mortality in acute first–ever and recurrent stroke in women in the Silesian Province between 2009 and 2015. Data presented as the number and percentage of deaths, n (%)

Year	Overall female hospital mortality in FS	Overall female hospital mortality in RS	P FS *vs* RS	Mortality in FIS	Mortality in RIS	P FIS *vs* RIS	Mortality in FHS	Mortality in RHS	P FHS *vs* RHS
2009	804 (19.8%)	271 (20.3%)	1.000	539 (16.1%)	226 (18.7%)	0.172	220 (35.0%)	42 (36.5%)	1.000
2010	812 (18.2%)	283 (20.3%)	0.499	590 (15.5%)	229 (18.1%)	0.172	215 (35.4%)	52 (46.0%)	0.219
2011	849 (19.3%)	294 (20.4%)	1.000	607 (16.1%)	248 (18.8%)	0.172	219 (37.6%)	41 (38.0%)	1.000
2012	782 (18.3%)	256 (19.0%)	1.000	558 (15.4%)	222 (18.0%)	0.172	218 (36.1%)	34 (32.7%)	1.000
2013	822 (18.3%)	253 (18.5%)	1.000	589 (15.3%)	201 (16.0%)	1.000	226 (38.7%)	47 (48.5%)	0.36
2014	757 (17.8%)	227 (18.8%)	1.000	543 (14.9%)	181 (16.4%)	0.644	204 (36.6%)	44 (46.8%)	0.36
2015	760 (19.4%)	212 (18.8%)	1.000	549 (16.3%)	169 (16.7%)	1.000	202 (39.5%)	40 (38.1%)	1.000
P[b] for trend	0.977	0.492	–	1.000	0.202	–	0.492	1.000	–
All	5,586 (18.7%)	1,796 (19.5%)	0.098	3,975 (15.6%)	1,476 (17.6%)	< 0.001	1,504 (36.9%)	300 (40.8%)	0.046

FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63);
FHS – first–ever haemorrhagic stroke (I60–I62); RHS – recurrent haemorrhagic stroke (I60–I62)
Data presented as N (%)
[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction (level of significance for trend in in–hospital mortality between 2009 and 2015)

Table 10. In–hospital mortality in acute first–ever and reccurent stroke in men in the Silesian Province between 2009 and 2015. Data presented as the number and percentage of deaths, n (%)

Year	Overall male hospital mortality in FS	Overall male hospital mortality in RS	P[a] FS *vs* RS	Mortality in FIS	Mortality in RIS	P FIS *vs* RIS	Mortality in FHS	Mortality in RHS	P FHS *vs* RHS
2009	636 (16.2%)	239 (19.6%)	0.043	415 (12.8%)	170 (15.9%)	0.053	190 (30.5%)	57 (43.5%)	0.029
2010	648 (15.7%)	236 (18.3%)	0.158	420 (12.1%)	176 (15.5%)	0.016	220 (36.0%)	58 (40.8%)	1.000
2011	674 (16.0%)	227 (16.9%)	0.921	467 (13.2%)	172 (14.3%)	0.296	203 (32.3%)	52 (38.0%)	1.000
2012	629 (15.5%)	217 (17.3%)	0.552	410 (12.0%)	159 (14.1%)	0.143	216 (35.7%)	56 (47.1%)	0.116
2013	637 (15.5%)	206 (15.8%)	0.921	405 (11.6%)	162 (13.9%)	0.102	226 (38.6%)	40 (32.5%)	1.000
2014	585 (15.1%)	205 (17.0%)	0.496	367 (11.2%)	157 (14.7%)	0.013	215 (37.9%)	47 (37.6%)	1.000
2015	580 (15.3%)	182 (16.6%)	0.879	390 (12.1%)	149 (15.0%)	0.061	182 (34.5%)	30 (31.3%)	1.000
P[b] for trend	0.267	0.165	–	0.198	0.400	–	0.165	0.198	–
All	4,389 (15.6%)	1,512 (17.4%)	< 0.001	2,874 (12.1%)	1,145 (14.8%)	< 0.001	1,452 (35.0%)	340 (39.0%)	0.028

FIS – first–ever ischaemic stroke (I63); RIS – recurrent ischaemic stroke (I63);
FHS – first–ever haemorrhagic stroke (I60–I62); RHS – recurrent haemorrhagic stroke (I60–I62)
Data presented as N (%)
[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction (level of significance for trend in in–hospital mortality between 2009 and 2015)

Table 11. Hospitalisation time of patients with first–ever and recurrent stroke in the Silesian Province between 2009 and 2015. Data presented as median (Q1–Q3) in days

Year	FS	RS	p[a]	FIS	RIS	p[a]	FHS	RHS	p[a]
2009	11 (9–17)	11 (9–17)	0.463	11 (9–16)	11 (9–16)	0.692	13 (3–25)	14 (6–27)	0.047
2010	11 (9–17)	11 (9–16)	0.347	11 (9–16)	11 (9–16)	0.564	14 (3–25)	13 (4–22)	0.453
2011	11 (9–16)	11 (9–17)	0.161	11 (9–15)	11 (9–16)	0.374	13 (3–24)	15 (5–24)	0.134
2012	11 (9–16)	11 (9–15)	0.934	10 (9–15)	11 (9–15)	0.935	12 (3–23)	12 (5–23)	0.366
2013	11 (9–15)	11 (9–15)	0.439	10 (9–15)	11 (9–15)	0.482	13 (3–23)	13 (4–24)	0.197
2014	11 (9–16)	11 (9–16)	0.112	11 (9–15)	11 (9–15)	0.255	14 (4–24)	15 (8–24)	0.073
2015	10 (9–15)	11 (9–15)	0.252	10 (9–14)	10 (9–15)	0.724	12 (3–22)	15 (5–22)	0.151
P[b]	< 0.001	0.116	–	< 0.001	0.015	–	0.946	0.946	–
All	11 (9–16)	11 (9–16)	0.073	11 (9–15)	11 (9–15)	0.437	13 (3–24)	14 (5–24)	0.002

[a] – U Mann–Whitney test
[b] – Jonckheere–Terpstra test for trend with Holm–Bonferroni correction

Table 12. In–hospital mortality in patients treated with intravenous thrombolytic therapy (rt–PA) compared to in–hospital mortality in patients untreated with rt–PA in the Silesian Province between 2009 and 2015

Year	Mortality in FIS treated with rt–PA	Mortality in FIS untreated with rt–PA	P Treated *vs* untreated FIS	Mortality in RIS treated with rt–PA	Mortality in RIS untreated with rt–PA	P Treated *vs* untreated RIS	P Treated FIS *vs* treated RIS
2009	21 (23.9%)	933 (14.4%)	0.071	3 (17.6%)	393 (17.4%)	1.000	1.000
2010	23 (14.0%)	987 (13.8%)	1.000	4 (14.8%)	401 (16.9%)	1.000	1.000
2011	33 (13.6%)	1,041 (14.7%)	1.000	7 (14.0%)	413 (16.7%)	1.000	1.000
2012	53 (14.5%)	951 (13.6%)	1.000	13 (15.9%)	382 (16.0%)	1.000	1.000
2013	56 (12.8%)	938 (13.6%)	1.000	12 (14.3%)	351 (15.0%)	1.000	1.000
2014	104 (16.8%)	806 (12.8%)	0.033	21 (16.0%)	317 (15.6%)	1.000	1.000
2015	106 (15.6%)	833 (14.1%)	1.000	27 (20.1%)	291 (15.6%)	1.000	1.000
P[a] for trend	0.982	0.173	–	0.739	0.060	–	–
All	396 (15.2%)	6,489 (13.9%)	0.142	87 (16.6%)	2,548 (16.2%)	0.885	0.885

[a] – Chi^2 test with Holm–Bonferroni correction

Table 13. Comparison of in–hospital mortality in men treated with intravenous thrombolytic therapy (rt–PA) to in–hospital mortality in women treated with rt–PA in the Silesian Province between 2009 and 2015

Year	Mortality in men in FIS treated with rt–PA	Mortality in women in FIS treated with rt–PA	P F *vs* M	Mortality in men in RIS treated with rt–PA	Mortality in women in RIS treated with rt–PA	P F *vs* M
2009	9 (22.0%)	12 (25.5%)	1.000	3 (30.0%)	0 (0%)	0.772
2010	13 (14.3%)	10 (13.7%)	1.000	1 (10.0%)	3 (17.6%)	1.000
2011	22 (15.8%)	11 (10.7%)	1.000	3 (12.5%)	4 (15.4%)	1.000
2012	26 (13.9%)	24 (15.2%)	1.000	8 (17.8%)	5 (16.1%)	1.000
2013	24 (10.5%)	32 (15.2%)	0.949	4 (9.8%)	8 (18.6%)	1.000
2014	55 (16.9%)	49 (16.6%)	1.000	9 (13.6%)	12 (18.5%)	1.000
2015	52 (15.3%)	54 (15.9%)	1.000	18 (24.7%)	9 (14.8%)	0.928
P[a] for trend	1.000	1.000	–	1.000	1.000	–
All	201 (14.9%)	192 (15.7%)	0.570	46 (17.1%)	41 (16.4%)	0.831

[a] – Chi^2 test with Holm–Bonferroni correction

Table 14. In–hospital mortality (n, %) in association with the aetiology of FIS in the Silesian Province between 2009 and 2015

Year	Atiology of ischaemic stroke					P[a]
	Large–artery atherosclerosis	Cardio–embolism	Small–vessel occlusion (lacune)	Other determined aetiology	Undetermined aetiology	
2009	344 (13.8%)	196 (19.1%)	15 (2.2%)	18 (12.8%)	381 (17.1%)	< 0.001
2010	359 (13.4%)	194 (17.8%)	22 (3.4%)	13 (11.7%)	422 (15.2%)	< 0.001
2011	327 (12.7%)	299 (22.2%)	32 (4.6%)	15 (13.6%)	401 (15.6%)	< 0.001
2012	375 (13.8%)	262 (17.8%)	31 (4.4%)	13 (9.6%)	323 (14.1%)	< 0.001
2013	338 (13.3%)	262 (18.8%)	47 (6%)	6 (4.8%)	341 (13.6%)	< 0.001
2014	287 (11.9%)	233 (17.8%)	36 (4.9%)	14 (8.4%)	340 (14.7%)	< 0.001
2015	330 (13.8%)	226 (17.7%)	48 (7.1%)	20 (16.0%)	315 (14.8%)	< 0.001
P[b] for trend	1.000	0.468	< 0.001	1.000	0.045	–
Total	2.360 (13.3%)	1.672 (18.7%)	231 (4.7%)	99 (10.8%)	2.523 (15%)	< 0.001

[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction

Table 15. In–hospital mortality (n, %) in association with the aetiology of RIS in the Silesian Province between 2009 and 2015

Year	Aetiology of ischaemic stroke					P[a]
	Large–artery atherosclerosis	Cardio–embolism	Small–vessel occlusion (lacune)	Other determined aetiology	Undetermined aetiology	
2009	159 (18.2%)	88 (19.3%)	13 (6.1%)	2 (5.9%)	134 (19.2%)	< 0.001
2010	148 (16.2%)	100 (21.6%)	15 (8.5%)	4 (11.4%)	138 (17.0%)	0.004
2011	159 (16.1%)	112 (21.9%)	16 (7.0%)	3 (12.5%)	130 (17.0%)	< 0.001
2012	145 (15.4%)	114 (20.5%)	12 (6.4%)	7 (14.3%)	117 (15.9%)	0.001
2013	131 (14.3%)	98 (18.2%)	15 (6.8%)	3 (9.1%)	116 (16.3%)	0.004
2014	148 (18.0%)	85 (18.7%)	15 (7.1%)	7 (20.0%)	83 (12.9%)	0.001
2015	119 (15.9%)	83 (18.8%)	18 (9.4%)	9 (21.4%)	89 (15.4%)	0.043
P[b] for trend	0.795	0.720	0.795	0.168	0.031	–
Total	1009 (16.2%)	680 (19.9%)	104 (7.3%)	35 (13.9%)	807 (16.3%)	< 0.001

[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction

Table 16. In–hospital mortality in patients treated with rt–PA (n, %) in association with the aetiology of first–ever ischaemic stroke (I63; n=49,452) in the Silesian Province between 2009 and 2015

Year	Aetiology of ischaemic stroke					Pa
	Large–artery atherosclerosis	Cardio–embolism	Small–vessel occlusion (lacune)	Other determined aetiology	Undetermined aetiology	
2009	11 (36.7%)	2 (11.1%)	0 (0%)	0 (0%)	8 (22.2%)	0.657
2010	8 (11.6%)	5 (15.2%)	0 (0%)	0 (0%)	10 (20.4%)	1.000
2011	12 (15.6%)	11 (17.5%)	1 (4.8%)	0 (0%)	9 (11.4%)	1.000
2012	18 (16.5%)	18 (16.2%)	2 (7.7%)	0 (0%)	15 (13.3%)	1.000
2013	15 (11.1%)	18 (13.5%)	2 (7.1%)	0 (0%)	21 (15.1%)	1.000
2014	32 (15.3%)	41 (23.6%)	6 (12.5%)	1 (14.3%)	24 (13.2%)	0.545
2015	32 (13.5%)	26 (14.1%)	4 (8.3%)	2 (28.6%)	42 (20.9%)	0.545
P[b] for trend	0.505	1.000	0.681	0.290	1.000	–
Total	128 (14.8%)	121 (16.9%)	15 (8.2%)	3 (9.7%)	129 (16.2%)	0.040

[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction

Table 17. In–hospital mortality in patients treated with rt–PA (n, %) in association with the aetiology of RIS in the Silesian Province between 2009 and 2015

Year	Aetiology of ischaemic stroke					P[a]
	Large–artery atherosclerosis	Cardio–embolism	Small–vessel occlusion (lacune)	Other determined aetiology	Undetermined aetiology	
2009	1 (14.3%)	1 (50%)	0 (0%)	0 (0%)	1 (14.3%)	1.000
2010	3 (25%)	0 (0%)	0 (0%)	0 (0%)	1 (11.1%)	1.000
2011	3 (15.8%)	2 (12.5%)	0 (0%)	0 (0%)	2 (22.2%)	1.000
2012	6 (19.4%)	3 (17.7%)	0 (0%)	0 (0%)	4 (13.3%)	1.000
2013	5 (13.5%)	5 (25%)	0 (0%)	0 (0%)	2 (8%)	1.000
2014	10 (18.9%)	8 (19.5%)	0 (0%)	1 (50%)	2 (7.1%)	1.000
2015	9 (17.7%)	4 (13.8%)	4 (28.6%)	0 (0%)	10 (26.3%)	1.000
P[b] for trend	1.000	1.000	0.419	1.000	1.000	–
Total	37 (17.6%)	23 (17.7%)	4 (13.3%)	1 (11.1%)	22 (15.1%)	0.918

[a] – Chi^2 test with Holm–Bonferroni correction
[b] – Cochran–Armitage test for trend with Holm–Bonferroni correction

Table 18. Secondary stroke prevention in patients with ischaemic stroke (I63) in the Silesian Province between 2009 and 2015. Data presented as N (%)

Year		Oral antiplatelet drugs	Oral anticoagulant drugs	Antihypertensive drugs	Direction for vascular intervention due to artery stenosis[b]
2009	All	7,303 (78.7%)	2,194 (23.7%)	7,095 (76.5%)	202 (2.2%)
	FIS	5,267 (80.0%)	1,511 (22.9%)	4,924 (74.8%)	162 (2.5%)
	RIS	1,760 (77.3%)	605 (26.6%)	1,869 (82.1%)	38 (1.7%)
2010	All	8,383 (83.3%)	2,650 (26.3%)	7,939 (78.9%)	350 (3.5%)
	FIS	6,177 (84.6%)	1,879 (25.7%)	5,678 (77.8%)	272 (3.7%)
	RIS	1,939 (80.9%)	722 (30.1%)	1,994 (83.2%)	71 (3.0%)
2011	All	8,535 (83.5%)	2,608 (25.5%)	8,233 (80.5%)	315 (3.1%)
	FIS	6,191 (84.6%)	1,846 (25.2%)	5,862 (80.1%)	230 (3.1%)
	RIS	2,054 (81.6%)	694 (27.6%)	2,086 (82.9%)	80 (3.2%)
2012	All	8,655 (85.0%)	2,593 (25.5%)	8,193 (80.4%)	379 (3.7%)
	FIS	6,272 (85.5%)	1,805 (24.6%)	5,816 (79.2%)	278 (3.8%)
	RIS	2,087 (84.5%)	719 (29.1%)	2,079 (84.2%)	95 (3.8%)
2013	All	8,682 (84.4%)	2,301 (22.4%)	8,331 (81.0%)	344 (3.3%)
	FIS	6,245 (84.9%)	1,588 (21.6%)	5,912 (80.4%)	264 (3.6%)
	RIS	2,020 (83.4%)	579 (23.9%)	2,031 (83.9%)	68 (2.8%)
2014	All	8,248 (83.7%)	1,965 (19.9%)	8,187 (83.1%)	344 (3.5%)
	FIS	5,909 (85.2%)	1,380 (19.9%)	5,820 (83.9%)	249 (3.6%)
	RIS	1,794 (82.7%)	480 (22.1%)	1,890 (87.1%)	86 (4.0%)
2015	All	7,830 (82.2%)	1,888 (19.8%)	7,993 (84.0%)	326 (3.4%)
	FIS	5,605 (84.9%)	1,335 (20.2%)	5,483 (83.1%)	241 (3.7%)
	RIS	1,631 (81.3%)	459 (22.9%)	1,773 (88.4%)	72 (3.6%)
P[a] for trend	All	< 0.001	< 0.001	< 0.001	< 0.001
	FIS	< 0.001	< 0.001	< 0.001	0.002
	RIS	< 0.001	< 0.001	< 0.001	< 0.001
ALL	All	57,636 (83.0%)	16,199 (23.3%)	55,971 (80.6%)	2,260 (3.2%)
	FIS	41,666 (84.3%)	11,344 (23.0%)	39,495 (79.9%)	1,696 (3.4%)
	RIS	13,285 (81.7%)	4,258 (26.2%)	13,722 (84.4%)	510 (3.1%)

[a] – Trend test Cochran–Armitage with Holm–Bonferroni correction
[b] – endarterectomy or angioplasty of cervical artery

Table 19. Secondary stroke prevention in patients with ischaemic stroke (I63) with cardioembolic aetiology in the Silesian Province between 2009 and 2015. Data presented as N (%)

Year		Oral antiplatelet drugs	Oral anticoagulant drugs
2009	All	1,081 (68.9%)	589 (37.6%)
	FIS	734 (71.5%)	385 (37.5%)
	RIS	296 (65.1%)	183 (40.2%)
2010	All	1,203 (74.2%)	604 (37.2%)
	FIS	819 (74.9%)	415 (38.0%)
	RIS	340 (73.4%)	180 (38.9%)
2011	All	1,402 (72.5%)	697 (36.1%)
	FIS	982 (72.8%)	503 (37.3%)
	RIS	373 (72.9%)	180 (35.2%)
2012	All	1,545 (73.9%)	766 (36.7%)
	FIS	1091 (74.1%)	519 (35.2%)
	RIS	404 (72.8%)	234 (42.2%)
2013	All	1,445 (71.4%)	739 (36.5%)
	FIS	989 (70.9%)	488 (35.0%)
	RIS	389 (72.2%)	211 (39.1%)
2014	All	1,240 (65.7%)	774 (41.0%)
	FIS	875 (66.7%)	536 (40.9%)
	RIS	284 (62.6%)	207 (45.6%)
2015	All	1,155 (62.5%)	734 (39.7%)
	FIS	821 (64.3%)	497 (38.9%)
	RIS	271 (61.3%)	195 (44.1%)
P[a] for trend	All	< 0.001	< 0.001
	FIS	< 0.001	0.253
	RIS	0.004	0.033
ALL	All	9,071 (69.9%)	4,903 (37.8%)
	FIS	6,311 (70.7%)	3,343 (37.5%)
	RIS	2357 (68.9%)	1,390 (40.6%)

[a] — Trend test Cochran–Armitage with Holm–Bonferroni correction

Lekoubou et al. observed that stroke survivors had a 43% higher risk of dying after a RS compared to those with FS, because of unfavourable stroke risk profile [30]. In our study, the in-hospital mortality rate was also significantly higher for RS than for FS (18.4% *vs* 17.2%; p < 0.001). The same finding concerned RIS *vs* FIS (16.2% *vs* 13.9%; p < 0.001), and RHS *vs* FHS (39.8% *vs* 36%; p = 0.004). This might be also associated with older age and more expressed clinical symptoms in patients with RS.

We found that the rtPA therapy was applied to a smaller percentage of RIS patients (in 2009 – 0.7%; in 2015 – 6.7%) than FIS patients (in 2009 – 1.3%; in 2015 – 10.3%).

In some Western European countries, the percentage of patients with IS treated with rtPA was higher than in the Silesian Province e.g. up to 35% in the German state of Hesse (2007–2008) [31–33]. Silesia has a dense urban infrastructure and the densest hospital network in Poland, so transportation seems not to be a problem. In our opinion, the main reason for the low percentage of patients treated with rtPA in the Silesian Province remains insufficient knowledge and social awareness of stroke symptoms and the possibilities of treatment [34, 35]. Educational programmes should be regularly conducted among people using all forms of modern media.

Conclusions

1. Recurrent strokes constituted about one fifth of all stroke hospitalisations. However, the recurrence rate of ischaemic stroke has systematically decreased over the last decade. This is evidence of better secondary stroke prevention.
2. Large-artery atherosclerosis and cardioembolisms were significantly more often recognised in RIS than in FIS, but the main reason for RIS was large artery atherosclerosis.
3. The in-hospital mortality rate was significantly higher for RS than for FS.
4. Patients with RIS were almost two times less often treated with rtPA than patients with FIS.
5. This was the first such comprehensive analysis of RS in the Silesian Province, Poland. This study could help in the implementation of appropriate educational programmes, and thus help to improve the health status of society.

Limitations of the study

There were a few limitations to this research, as described in previous studies [15, 16]. Firstly, in our paper we analysed only stroke-related hospitalisations, but in Poland almost all patients with AS are admitted to hospital. Secondly, it is possible that in the case of some ASs the questionnaires might not have been sent to the NHF. Thirdly, we could not estimate the number of stroke-related deaths that had occurred prior to the patient's arrival at hospital, and therefore the true hospitalised incidence of stroke might be underestimated. Fourthly, we only analysed the questionnaire data and the information those questionnaires contained. As a result, human error could have occurred. Fifthly, the data was anonymous so we could not analyse the trends for strokes.

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