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Original Contributions

A Prospective Community-Based Study of Stroke in Warsaw, Poland

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Background and Purpose Poland is a country with high morbidity and mortality rates from cardiovascular diseases. No recent studies have evaluated the contribution of cerebrovascular diseases to this morbidity and mortality. Our aim was to accurately determine stroke incidence rates in Warsaw, Poland.

Methods A 2-year prospective and population-based stroke registry was maintained for health care units 2 and 3 in Warsaw, Poland (population, 182 285). Case subjects were ascertained by surveying hospital admissions, outpatient visits, and death certificates.

Results During the 2 years of the study (1991 to 1992), 633 cases of first-event strokes were registered, 462 of which were first ever in a lifetime. Computed tomography or necropsy was performed in 72% of first-ever stroke cases. The crude annual incidence rate for first-ever stroke was 127/100 000 (95% confidence intervals, 111 to 145); the rate standardized to the

European population was 111 (95% confidence intervals, 96 to 128). Our incidence rates for first-event strokes were found to be in the middle of the range among other first-event studies. When comparing our first-ever stroke incidence rates with those of comparable studies performed throughout Europe, they were found to be similar for groups aged younger than 65 years but lower in the older age groups. The distribution of ischemic and hemorrhagic stroke subtypes was similar to that of other countries.

Conclusions This first population-based prospective stroke registry in Poland showed that incidence rates were not high compared with other studies throughout Europe and the world. These stroke incidence rates are not a large contributing factor to high cardiovascular morbidity rates in Poland. (*Stroke*. 1994;25:547-551.)

Key Words • cerebrovascular disorders • epidemiology • incidence

Cardiovascular diseases account for the majority of morbidity and mortality in Poland. Ischemic heart disease is a very important contributing factor, as incidence rates are among the highest in the world.¹ Because no reliable prospective data are available, the role played by stroke is unknown. Most epidemiologic studies done previously in Poland were hospital-based registries. Population-based studies included only retrospective analyses of medical records.^{2,3} Incidence and mortality rates from these studies are widely disparate, and trends are conflicting. A World Health Organization (WHO) study based on death certificates reported increasing stroke mortality rates with time,⁴ whereas a community-based registry using medical records found decreases in stroke incidence with time.² POLMONICA¹ was the only cohort study done in Poland, but it was limited to patients younger than 65 years of age and was directed primarily toward coronary heart disease. In 1976 to 1988 it revealed an increase in standardized death rates for cerebral stroke in men aged 45 to 64 years and in women aged 25 to 44 years; the overall death rates did not change in that time.

We designed a comprehensive study for the simultaneous observation of stroke incidence and mortality, risk factor levels, health behavior, and medical care. Here we report the incidence rates for strokes estimated according to the criteria proposed for an ideal study,⁵ which include use of the standard WHO definition, prospective ascertainment of case subjects from a well-defined and representative population, and comprehensive case-finding methods to identify nonfatal case subjects treated out of hospital and patients dying shortly after an acute stroke event. Incidence rates for strokes were given for first-ever-in-a-lifetime strokes (FEL), according to the criteria for an ideal study, and for first-event strokes (FES), as in the WHO Collaborative Study. Rates were given for all pathological types of stroke combined. Estimation of the distribution of a pathological type of stroke was also performed. Future reports will deal with case fatality rates, outcomes by pathological stroke subtypes, and risk factor levels.

Subjects and Methods

In Poland health care is rigidly allotted to certain regions termed health care units in which residents of each health care unit are assigned to predesignated doctors and health care centers. Even if patients suffer strokes in some other city, they are subsequently transferred, with very few exceptions, to the hospital serving the health care unit of their residence. In Poland stroke patients are routinely hospitalized in neurological centers and much less often in nonneurological centers.

Our study population included permanent residents from health care units 2 and 3 of the Mokotow region in Warsaw who suffered a stroke between January 1, 1991, and December 31, 1992. This region has 182 285 inhabitants (85 647 males

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TABLE 1. Annual Age- and Sex-Specific Incidence Rates per 1000 for First-Event Strokes in Warsaw, Poland (1991-1992)

Age, y	Men		Women		Total	
	Rate	n	Rate	n	Rate	n
<30	0.04	3	0.01	1	0.03	4
30-44	0.53	24	0.19	10	0.35	34
45-54	0.98	19	0.96	22	0.97	41
55-64	4.08	87	1.89	48	2.89	135
65-74	7.61	87	4.35	66	5.75	153
75-79	8.18	24	10.14	59	9.49	83
≥80	17.78	48	17.98	135	17.93	183
Total	1.70	292	1.76	341	1.74	633
Standardized*	4.48		3.30		3.90	

*Age standardized using the World Health Organization's pooled population of all centers truncated at 45 years of age.⁶

and 96 638 females) with an age distribution similar to that of Europe.

Before the project was started, all hospital physicians, general practitioners, nursing institutions, and health authorities in the area were contacted, informed of the study, and asked to report every suspected case of stroke coming to their attention.

In the study area there are two acute-care hospitals (Institute of Psychiatry and Neurology [IPN] and Mokotowski Hospital), five outpatient clinics, and one nursing home. Our study subjects included patients from five possible sources: (1) the IPN, the study center for this project; (2) the Mokotowski Hospital; (3) military, police, and railway hospitals; (4) outpatient clinics; and (5) death certificates.

The IPN receives the vast majority of stroke patients requiring hospitalization in our district, with the exception of a small number of personnel and their dependents who are admitted to their own military, police, or railway hospitals. Admission records from the neurology division of these institutions were reviewed weekly for a tentative diagnosis of stroke. Epidemiologic data from these patients were collected by a project neurologist. Patients with serious concomitant illnesses are routinely admitted to the Mokotowski Hospital, where a collaborating neurologist is involved as a consultant. If

and when these patients are stabilized, they are transferred to the IPN.

Physicians from outpatient clinics serving health care units 2 and 3 were notified of our study and asked to send patients with suspected stroke to the IPN. Patients with mild stroke who declined admission and were subsequently managed at home were included in the study at the time the primary care physicians consulted collaborating neurologists at these centers. In addition, outpatient registers were checked monthly to ensure that we were notified of all strokes.

Patients with acute neurological complications from the nursing home are routinely admitted to the IPN. Physicians from the nursing home were required to send even the patients with mild stroke to the IPN and to inform study neurologists of patients who died because of stroke. Additionally, the nursing home was checked monthly to ensure that we were notified of all strokes.

Certificates of death from cerebrovascular accidents, even if confirmed by autopsy, were registered only if death was preceded by a clinical stroke, according to the study definition. We verified that patients listed on death certificates were not previously registered. Death certificates were analyzed by a project neurologist twice each month. If possible, the clinical records of those patients were reviewed.

TABLE 2. Annual Age- and Sex-Specific Incidence Rates per 100 000 for First-Ever-in-a-Lifetime Strokes in Warsaw, Poland (1991-1992)

Age, y	Men		Women		Total	
	Rate	n	Rate	n	Rate	n
<30	4	3	2	1	3	4
30-44	44	20	19	10	31	30
45-54	88	17	71	18	83	35
55-64	324	69	134	34	221	103
65-74	533	61	323	49	413	110
75-79	647	19	774	45	731	64
≥80	1259	34	1092	82	1137	116
Total	130	223	124	239	127	462
Standardized*	134		91		111	

*Age standardized to the European population⁶ by the direct method.

TABLE 3. First-Ever-in-a-Lifetime, Recurrent, and First-Ever Strokes by Pathological Subtype

	Ischemic										UNK		PICH		All No.
	ATH		EMB		Lacune		Other		Total		No.	%	No.	%	
	No.	%	No.	%	No.	%	No.	%	No.	%					
FEL	112	24	67	15	73	16	14	3	266	58	142	31	54	12	462
REC	35	20	19	11	16	9	3	2	73	43	93	55	5	3	171
FES	147	23	86	14	89	14	17	3	339	54	235	37	59	9	633

UNK indicates infarction, cause unknown; PICH, parenchymatous intracerebral hemorrhage; ATH, infarction due to atherosclerosis; EMB, embolism from cardiac source; FEL, first-ever-in-a-lifetime stroke; REC, recurrent stroke; and FES, first-event stroke in the study period.

We used the WHO definition of stroke as a rapid onset of clinical signs of a focal or global disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent nonvascular cause.⁶ Patients with transient ischemic attacks and subarachnoid hemorrhages were excluded from our study. Patient information was gathered prospectively and comprehensively using a format developed by the Stroke Data Bank in the United States,⁷ which involved collecting detailed information on each patient, including outcome at 30 days and 1 year. The diagnosis of stroke was further subdivided into one of six categories based on the Stroke Data Bank definitions: (1) infarction due to atherosclerosis, (2) embolism from cardiac source, (3) lacune, (4) miscellaneous ischemic infarction subtypes (other), (5) ischemic infarction of uncertain pathological subtype, and (6) parenchymatous intracerebral hemorrhage. This determination was usually made on the basis of noncontrast brain computed tomographic (CT) scans, using a Picker 1200SX 256×256 matrix scanner and at times a magnetic resonance imaging scan (Resonex 0.38T), particularly when the CT scan was normal. Autopsies were performed in a high proportion of patients with fatal outcomes. To ensure uniform diagnostic standards, the study team met at least weekly to discuss each new case subject.

Incidence rates were calculated in two ways: (1) using the WHO Collaborative Study method of including all strokes occurring for the first time in the study period (FES) and (2) using only FEL.

Results

We registered a total of 633 patients in upper Mokotow with FES between January 1, 1991, and December 31, 1992 (316 in the first year and 317 in the second).

The majority (68%) were admitted to the IPN, 10% were admitted to outside hospitals, and 7% with mild stroke were managed as outpatients. Data regarding 15% of patients were first obtained from death certificates. In 62% of these cases, mainly those with recurrent stroke, case records were also available. Autopsy was performed in 36% of patients who died. The diagnosis of stroke was confirmed by CT or autopsy in 68%. Patient age ranged from 18 to 97 years (mean±SD age, 69±13.9 years).

The crude annual incidence rate for FES was 1.74 per 1000 (95% confidence intervals [CI], 1.56 to 1.95). Fifty-four percent (341/633) were women, and 46% (292/633) were men. The age-standardized rate to the truncated WHO population⁶ by the direct method for FES was 3.90 per 1000 (CI, 3.57 to 4.15). Incidence rates rose steeply with age in both sexes and were higher in men than in women in the population aged younger than 75 years (Table 1).

Of the 633 FES, 462 were FEL (the remaining 171 were recurrent strokes). The majority of patients with FEL (76%) had been admitted to the IPN, 11% were treated at other hospitals, 5% were managed as outpatients, and 8% were ascertained by death certificate. Our CT or necropsy rate was 72% for FEL. Age ranged from 18 to 96 years (mean±SD age, 68.4±14.2 years).

Our crude annual incidence rate for FEL was 127 per 100 000 (CI, 111 to 145). Age standardized to the European population⁸ by the direct method, the incidence rates were as follows: men, 134 per 100 000;

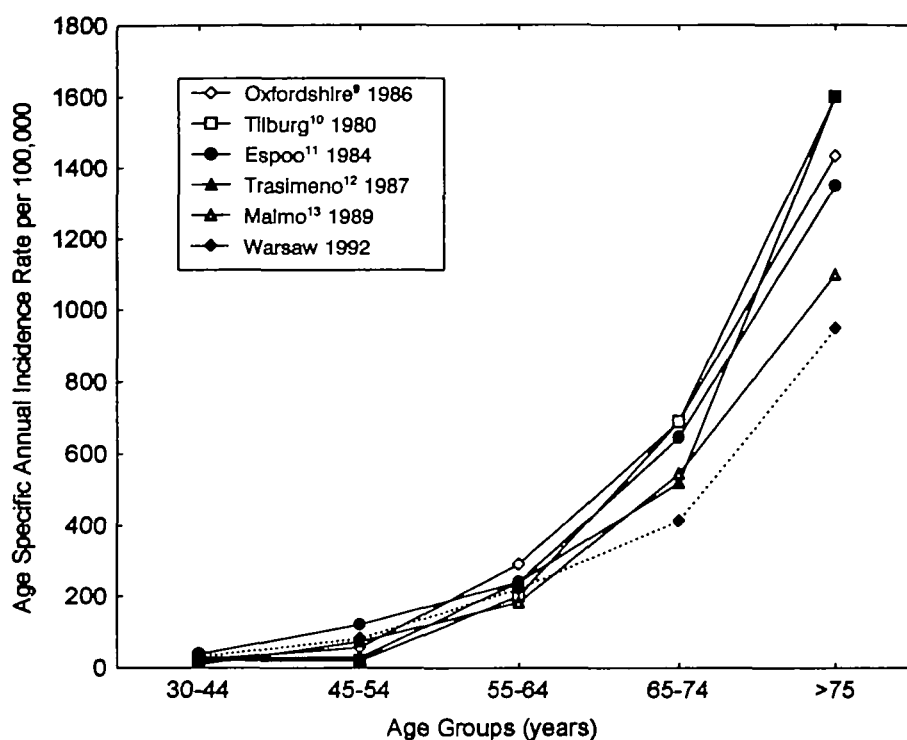
TABLE 4. Annual Age-Specific Incidence Rates for First-Event Strokes (per 1000)

Country	Age Groups, y				ASR
	45-54	55-64	65-74	≥75	
Japan*	0.7	4.0	10.8	29.7	6.7
Finland*	1.7	3.2	10.1	24.6	6.2
Ireland*	1.0	3.0	7.9	18.4	4.8
Poland†	1.0	2.9	5.7	14.0	3.9
Denmark*	0.6	2.3	5.7	13.1	3.4
Mongolia*	1.7	1.1	4.2	6.5	2.5
Sri Lanka*	0.5	1.1	3.3	4.1	1.6
Nigeria*	0.6	1.6	3.1	1.9	1.6

ASR indicates age-standardized rate, using the World Health Organization's pooled population of all centers truncated at 45 years of age.⁶

*Includes subarachnoid hemorrhages.

†Excludes subarachnoid hemorrhages.



Line graph shows age-specific annual incidence rates for first-ever-in-a-lifetime stroke per 100 000.

women, 91 per 100 000; and total, 111 per 100 000 (CI, 96 to 128) (Table 2). Incidence rates were higher in men than in women in all age groups except one and increased sharply with age in both sexes.

Table 3 shows the distribution of pathological stroke subtypes for FES, FEL, and recurrent strokes. Proportions were similar in all three groups with the exception of parenchymatous intracerebral hemorrhages, which were significantly more common for FEL than for recurrent strokes.

Discussion

This study represents the first prospective community-based epidemiologic study of stroke in Poland and perhaps in Eastern Europe. We are confident of nearly complete case ascertainment because of the rigid and highly centralized system of health care delivery in Poland. This high level of ascertainment is supported by the almost identical number of patients registered in 1991 and 1992. Because of the high number of CT scans and autopsies performed, we were also able to determine pathological stroke subtypes with a high degree of accuracy.

We compared our incidence rates with those of other studies using the WHO format, using FES (first stroke in the study period regardless of a past history of recurrent strokes) and age standardizing to the same truncated world population,⁶ and found that Poland was in the middle of the range, between Ireland and Denmark (Table 4).

We compared our results with studies judged to be ideal (Figure) based on proposed standards,⁹⁻¹³ such as including statistics on FEL and attempting to ensure complete case ascertainment by reviewing death certificates and outpatient visits.⁵ Our age-specific rates for those aged younger than 65 years were quite comparable to other studies done in Europe, but they were lower

in those aged older than 65 years. The exclusion of subarachnoid hemorrhage from our study may have contributed to this lower incidence rate, because subarachnoid hemorrhages account for 3% to 7% of all FEL in other studies.^{9,11,13-17} Timing should also be taken into account because FEL incidence is generally declining worldwide,^{4,11,14} and our study was completed 3 to 12 years later than those in the other countries. Finally, there is supporting evidence for a low incidence of stroke in Poland. Other Polish registries, albeit retrospective, also showed low incidence rates.^{2,3} Autopsy studies performed throughout Europe, the United States, and Japan revealed that Poland had a low rate of cerebral atherosclerosis.^{18,19}

One possible factor contributing to low stroke incidence rates in Poland is a phenomenon described by Haberman et al.²⁰ He proposed that stroke-prone persons could be "eliminated by ischemic heart disease before they reach the age at which they would have suffered a stroke." This explanation is supported by the fact that it was only among our older patients (aged older than 64 years) that comparatively low incidence rates were observed. Also, in contrast to studies done in Western Europe, North America, and Australia,^{9,11,13-17} FEL rates for men were lower than those for women in the group aged 75 to 79 years, and rates were comparable in the group aged 80 years and older. This suggests premature deaths in stroke-prone men.

Parenchymatous intracerebral hemorrhage was observed in 9% of our patients with FES, which is at the midpoint of percentages reported in other FES registries.^{7,21-23} Ischemic stroke subtypes were also observed in similar proportions. However, embolic strokes were observed in 15% of patients with FEL strokes and in 14% of those with FES, which is less than the percentage at Lausanne (17.5%)²² or Framingham (28.6%).²³

This may be due to the fact that patients in Poland undergo echocardiography less frequently.

In conclusion, the first population-based prospective stroke registry in Poland revealed that incidence rates were not high compared with other studies throughout Europe and the world. These stroke incidence rates do not seem to be a large contributing factor to high cardiovascular morbidity rates in Poland. Stroke may still be important for cardiovascular mortality, however, if high case fatality rates outweigh a low incidence. We address this issue in subsequent reports.

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