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Cerebrovascular disease in the community: results of a WHO Collaborative Study*

K. AHO,[1] P. HARMSEN,[2] S. HATANO,[3] J. MARQUARDSEN,[4] V. E. SMIRNOV,[5] & T. STRASSER[6], on behalf of the participants in the WHO Collaborative Study on the Control of Stroke in the Community[7]

In a cooperative study coordinated by WHO, stroke was registered between 1971 and 1974 in 17 centres both in developing and developed countries. A common operating protocol was used to obtain comparable data. Age-adjusted incidence of stroke shows moderate geographical variations, cerebrovascular accidents being common in all the contrasting populations studied in various parts of the world. Data were also obtained on the types of management of stroke patients, their survival rates, and functional prognosis. Control of hypertension, although known to be effective in the prevention of stroke, seemed to be insufficient in most countries. It is concluded that stroke registers may be used as a source of information for the planning and implementation of stroke control programmes in the community.

Leading specialists in stroke participated in a WHO meeting on cerebrovascular diseases in Monaco in 1970 (*1*). They recommended that WHO should develop methods for collecting reliable information on the magnitude and nature of stroke in communities, as a basis for planning and implementing activities for the prevention of stroke, and care and rehabilitation of stroke patients.

Following up this recommendation, a group of interested investigators worked out the methodology for a community-based stroke register, by which comparable data could be gathered from all over the world.

The purpose of the stroke register was outlined and it was decided that more accurate information should be collected on:

(*a*) the magnitude of the problem of stroke in the community;

(*b*) the social and clinical profile of stroke patients;

(*c*) the preventive measures, diagnostic procedures, and rehabilitation applied to the patient; and

(*d*) the natural history of stroke.

After a pilot trial lasting several months, a study on stroke registration in the community was started in 1971. Seventeen centres joined the WHO-coordinated study and 15 continued to register new patients until December 1974, following up their progress for 1 year after the onset of stroke (*2*).

This is a concise report of the WHO stroke registration project. Its intention is to highlight the most important findings of the study, without going into too much detail.

METHODS

The basic operating protocol that was followed ensured that great care was given to uniform data collection according to pre-determined standards (*3*, *4*).[a]

Seventeen centres from 12 countries participated in the study. The World Health Organization acted as coordinating centre and collated and processed the data. Table 1 summarizes the characteristics of the studied populations at the outset.

Data obtained from the latest population census, and also previous censuses in some areas, were used for calculation of the incidence rates. In some centres, these data were not available and incidence rates were not calculated. The total background population

* Requests for reprints of this article should be addressed to: Dr T. Strasser, Cardiovascular Diseases, World Health Organization, 1211 Geneva 27, Switzerland.

[1] Department of Neurology, University of Helsinki, Finland.

[2] Department of Neurology, Sahlgren's Hospital, Gotëborg, Sweden.

[3] Department of Epidemiology, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan.

[4] Department of Neurology, Frederiksberg Hospital, Copenhagen, Denmark.

[5] Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR.

[6] Medical Officer, Cardiovascular Diseases, World Health Organization, Geneva, Switzerland.

[7] Listed on page 128.

[a] See also: *Community control of stroke and hypertension*. Report of a WHO meeting, Göteborg, 29 November—3 December 1971 (Unpublished WHO document CVD/72.1).

Table 1. Study areas and populations

Code	Centre	Country	Characteristics of study area and population	Total population (thousands)	Population structure: Men/ women	Population structure: Percentage ⩾65 years
01	Gothenburg	Sweden	Urban. Age up to 65 years at entry	450.9	0.98	13.1
05	Copenhagen[a]	Denmark	Mainly residential and commercial; + light industry	100.0	0.82	21.5
06	Dublin	Ireland	Mainly residential	133.7	0.91	8.4
21	Espoo[b]	Finland	Developing neighbouring town to Helsinki. Commerce, services, and industry	103.5	0.93	5.0
22	North Karelia	Finland	Mainly agricultural. Emigration continues	178.3	1.00	8.9
28	Moscow[c]	USSR	Urban		data not available	
29	Zagreb	Yugoslavia	Urban	87.9[d]	0.84[d]	12.8[d]
33	Zerifin[e]	Israel	Urban and rural: 50% Afro-Asian and 50% Euro-American origin	218.4	1.02	6.9
39	Ibadan	Nigeria	Urban	803.1	1.33	1.4
45	Akita	Japan	Rural. Agriculture and commerce	36.1	0.95	5.9
46	Saku	Japan	Rural. Mainly agriculture + commerce, light industry	105.2	0.92	10.5
47	Fukuoka	Japan	Urban. Part of Fukuoka City + 3 towns. Age below 65 years in part	36.8	0.94	7.2
48	Osaka	Japan	Semi-urban. Commuter area to Osaka. Services, agriculture, and commerce	40.4	0.93	4.7
49	Japan National Railways	Japan	Male employees of a company in the Tokyo region. Age up to 59 years	76.8	—	0
55	Ulan Bator	Mongolia	Urban	261.3	1.04	4.4
81	Rohtak	India	Urban	124.7	1.16	5.3
83	Colombo	Sri Lanka	Urban	562.4	1.29	3.6

[a] Area of study: Frederiksberg, Copenhagen.
[b] Area of study: Espoo and Kauniainen.
[c] Area of study: Tušino, Moscow.
[d] Population size is known up to age 74 years.
[e] Area of study: Ramle and Rehovot.

covered by all registers amounted to more than 2.6 million people, without counting two centres—Rohtak and Colombo—which joined later.

Criteria for inclusion

For the purpose of this study, stroke was defined as "rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin". This definition obviously includes most cases of subarachnoid haemorrhage, intracranial haemorrhage, and cerebral infarction, but *not* cases of transient ischaemic attacks. The term "global" disturbances of cerebral function refers only to patients with subarachnoid haemorrhage without focal neurological deficits.

Patients who were permanent residents of one of the study areas and who during the study period suffered a stroke as defined above were eligible for regis-

tration. In all but three centres stroke patients were registered irrespective of age and sex.

Patients who were initially registered as stroke cases but who were later proved to have nonvascular brain lesions were excluded from the final data.

Case finding

In each of the study areas, a stroke register was set up in a local hospital or a health centre, usually staffed by one or more doctors, a secretary, and an interviewer. Before the project was started, all hospital doctors, 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 report (*5*, *6*). In order to make registration as complete as possible, regularly repeated checks were made of local medical records, social insurance records and, in particular, all death certificates issued in the area. However, certified deaths from cerebrovascular accidents, even if confirmed by autopsy, were registered only if preceded by a clinical "stroke", according to the above definition. For each case of stroke, the relevant data were entered on a record form.[b]

Whenever possible, patients who were reported to the register were seen by a doctor or an interviewer sent by the registry, whether in hospital or at home.

Follow-up

All surviving patients were contacted 3 weeks, 3 months, and 1 year after the stroke and a follow-up record form was completed.[b] Information about new strokes in the follow-up period was entered on a special recurrence record form. However, new episodes occurring within the first 3 weeks were regarded as a progression of the original attack and were not recorded as a recurrence.

In all cases of death within 1 year of stroke, the causes of death were recorded according to death certificates or autopsy findings.

In order to obtain comparable data, the record forms were designed to include only information that could readily be obtained in all the participating centres, irrespective of the availability of advanced medical facilities.

Diagnostic methods

The use of diagnostic procedures varied widely, depending on local possibilities and routine in the centres. Nearly all patients were seen by a physician. In the total series, more than one-half were examined by a neurologist, the proportion ranging from 12–85%. In all but a few centres, lumbar puncture was performed in about one-third of the cases; cerebral angiography was made in less than 10%. At the time of the registration, computerized tomographic (CT) scanning was not available in any of the participating centres.

At the 3-week follow-up the diagnosis of the type of stroke (ICD, 1965 revision)[c] was recorded, based on clinical or laboratory examinations. If the diagnosis of the type of stroke had to be revised later, for example on the basis of autopsy findings, the final diagnosis was used in the analysis.

In order to assess the comparability of diagnoses made in different centres, a diagnostic reliability test was made, based on 60 cases selected from the various centres (*7*, *8*). The clinical diagnosis of stroke itself (versus non-stroke) was found to be valid, showing only small inter- and intraobserver variability, whereas diagnosis of the *type* of stroke varied considerably between centres and also was less consistent among the individual observers.

Autopsy diagnosis was used for analysis whenever available. Autopsy rates varied widely between centres (Fig. 1).

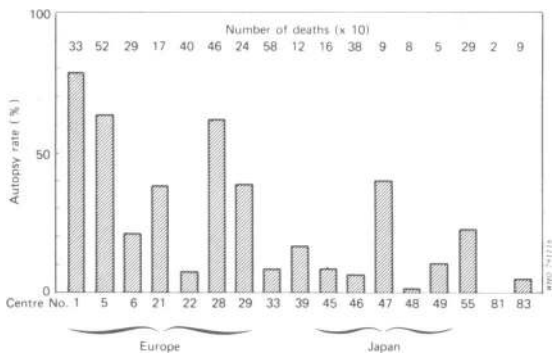

Fig. 1. Autopsy rates.

Subjects studied

After a pilot study undertaken during 1971, registration of stroke patients with a uniform record was carried out from May 1971 until December 1974. Most centres started in 1972. Two Asian centres that joined in June 1974 continued the registration for 1 year. The duration of registration thus varied from 1 to 4 years. Nine centres registered more than 500 cases and 12 centres more than 300 cases. Altogether, 9064 cases, including suspected ones, were registered by 17

[b] Specimens are available on request from Cardiovascular Diseases, WHO, 1211 Geneva 27, Switzerland.

[c] *Manual of the international statistical classification of diseases, injuries, and causes of death, Eighth Revision*, Geneva, World Health Organization, 1969.

centres, but 310 cases were eventually excluded from the analysis because stroke was not confirmed in the final diagnosis.

The numbers of registered stroke patients are shown in Table 2. There were more men in the younger and more women in the older age groups. The age-distribution of the patients varied widely among the centres, depending on the background populations.

Table 2. Numbers of registered patients with stroke by age group

Centre No.	Age groups (years)					
	< 45	45–54	55–64	65–74	⩾ 75	All ages
01	92	157	474	61	–	784
05	13	27	143	264	444	891
06	29	38	118	183	174	539
21	34	35	62	99	73	303
22	69	105	237	318	209	938
28	41	142	240	357	251	1031
29	23	71	126	235	176	631
33	12	47	206	343	308	916
39	93	71	71	51	14	300
45	29	57	96	142	58	382
46	27	63	144	244	230	708
47	10	14	43	50	17	134
48	5	9	36	57	51	158
49	35	100	7	–	–	141
55	59	126	217	186	65	653
81	9	9	30	18	16	82
83	17	30	37	53	26	163
Total	597	1098	2286	2661	2112	8754

INCIDENCE RATES

All strokes

For epidemiological purposes it is customary to base incidence rates only on first attacks. From the community point of view, however, subsequent attacks are also important, since they require medical services. In this report, incidence rates are therefore given both for first attacks and for all strokes, including recurrences.

The incidence of stroke, unlike that of myocardial infarction, showed only moderate variations between different parts of the world (Table 3). For first attacks, rates were about 5 per 1000 in males aged 65–74 years; the rates in females were about 30% lower than in males. Compared with the European incidence rates, those found in Mongolia and Nigeria were rather similar in the middle-aged population, but were lower in older age groups; this may reflect difficulties in the registration of cases in very old patients in some areas. Higher rates were found in Finland and Japan (*9*), particularly in Akita, where the incidence of stroke was apparently twice that of other Japanese areas (*10–13*). These differences are in accordance with the trends found in national mortality statistics.

The incidence rates for all attacks were about 20–30% higher than those for first attacks only and showed similar variations between centres to those described above (Table 3).

Age-adjusted incidence rates are shown in Table 4. The "standard population" was the pooled population of all centres truncated at age 45 years, since it was felt that while the number of cases of stroke below age 45 was relatively low, the majority of the pooled population were below this age, giving a relatively high weight to an age category with relatively low incidence. By truncating at age 45 years, the following weights for age standardizing were derived:

45–54 years	38%
55–64 years	32%
65–74 years	20%
⩾75 years	10%

Types of stroke

Differences in rates for various types of stroke are certainly influenced by variations in local diagnostic habits and the availability of diagnostic facilities, but may nevertheless reflect true differences.

Subarachnoid haemorrhage, which can usually be diagnosed with a high degree of reliability, occurred at higher rates in Finland and two rural areas in Japan, than in Copenhagen and Zerifin. Subarachnoid haemorrhage seems to be the only type of stroke of which the incidence rises only slightly with age. In some areas, rates were higher for females, in others for males.

The incidence of presumed intracerebral haemorrhage was found to rise markedly with age, being generally higher for males than for females. Finnish and Japanese centres, particularly Akita, reported especially high rates, mostly in males.

For cerebral infarction, incidence rates were found to rise steeply with age. In the younger age groups the rates were higher for males, in older age groups for females. Geographical differences were unremarkable.

The number of cases labelled "type unknown" varied considerably, but was highest in some European centres; the proportion of such cases may reflect the strictness of the diagnostic criteria for type diagnosis used in individual centres.

Table 3. Annual incidence rates for stroke per 1000 population (roman figures — all attacks; italic figures — first attacks only)

Centre No.	Sex	Age group (years) ⩽44		45–54		55–64		65–74		⩾75		All ages	
01	M	0.10	*0.09*	0.94	*0.91*	3.08	*2.71*	—	—	—	—	—	—
	F	0.07	*0.06*	0.56	*0.53*	1.65	*1.52*	—	—	—	—	—	—
	M+F	0.08	*0.08*	0.75	*0.72*	2.32	*2.08*	—	—	—	—	—	—
05	M	0.07	*0.06*	0.82	*0.72*	3.88	*3.40*	7.65	*6.37*	15.04	*13.12*	2.37	*2.04*
	F	0.07	*0.06*	0.48	*0.44*	1.76	*1.50*	4.65	*4.04*	15.35	*13.08*	2.70	*2.32*
	M+F	0.07	*0.06*	0.63	*0.56*	2.65	*2.30*	5.74	*4.89*	15.26	*13.09*	2.55	*2.19*
06	M	0.13	*0.13*	1.38	*1.32*	4.73	*4.39*	9.50	*8.92*	18.40	*17.71*	1.44	*1.36*
	F	0.06	*0.06*	0.83	*0.78*	2.60	*2.49*	8.01	*7.22*	20.56	*18.69*	1.58	*1.45*
	M+F	0.09	*0.09*	1.07	*1.02*	3.55	*3.04*	8.62	*7.91*	19.85	*18.37*	1.51	*1.41*
21	M	0.18	*0.16*	2.28	*1.97*	5.22	*4.37*	14.25	*11.98*	30.27	*25.42*	1.42	*1.14*
	F	0.20	*0.19*	1.53	*1.44*	2.87	*1.27*	11.58	*8.84*	27.06	*24.24*	1.50	*1.19*
	M+F	0.19	*0.17*	1.88	*1.69*	3.93	*3.23*	12.63	*10.08*	28.08	*24.62*	1.46	*1.17*
22	M	0.22	*0.20*	2.82	*2.51*	5.61	*4.66*	11.51	*9.30*	18.16	*16.97*	1.96	*1.69*
	F	0.17	*0.15*	1.29	*1.22*	3.89	*3.38*	9.35	*8.34*	18.18	*15.44*	1.98	*1.74*
	M+F	0.20	*0.18*	2.02	*1.83*	4.67	*3.98*	10.26	*8.75*	18.17	*16.00*	1.97	*1.71*
29	M	0.14	*0.11*	1.64	*1.30*	4.66	*3.93*	7.71	*4.76*	not available		2.23	*1.59*
	F	0.09	*0.06*	1.28	*0.99*	2.05	*1.46*	4.72	*3.18*	not available		1.90	*1.36*
	M+F	0.11	*0.08*	1.45	*1.14*	2.97	*2.34*	5.98	*3.85*	not available		2.05	*1.47*
33	M	0.10	*0.09*			4.08	*3.23*	13.42	*10.81*			1.32	*1.07*
	F	0.12	*0.11*			3.10	*2.72*	15.28	*12.47*			1.47	*1.23*
	M+F	0.11	*0.10*			3.58	*2.97*	14.37	*11.66*			1.40	*1.15*
45	M	0.38	*0.38*	7.15	*6.80*	12.75	*11.72*	28.98	*24.90*	28.57	*28.57*	3.61	*3.31*
	F	0.11	*0.09*	3.31	*3.02*	6.71	*6.12*	25.15	*21.96*	35.19	*30.56*	2.76	*2.44*
	M+F	0.24	*0.23*	5.04	*4.72*	9.67	*8.86*	26.93	*23.32*	32.58	*29.78*	3.17	*2.87*
46	M	0.47	*0.54*			6.51	*5.91*	14.18	*11.25*	27.97	*22.67*	2.78	*2.36*
	F	0.22	*0.20*			3.72	*2.89*	8.99	*7.52*	24.83	*20.23*	2.14	*1.76*
	M+F	0.39	*0.36*			5.00	*4.27*	11.38	*9.24*	26.04	*21.17*	2.45	*2.05*
47	M	0.07	*0.07*	1.51	*1.51*	6.06	*5.87*	9.11	*8.20*	6.60	*4.95*	1.19	*1.11*
	F	0.04	*0.02*	0.98	*0.98*	1.59	*1.12*	4.94	*4.69*	4.39	*3.91*	0.65	*0.57*
	M+F	0.05	*0.05*	1.21	*1.21*	3.67	*3.33*	6.81	*6.26*	5.21	*4.29*	0.91	*0.83*
48	M	0.04	*0.04*	0.82	*0.82*	4.93	*4.41*	15.84	*14.88*	40.59	*35.29*	1.25	*1.14*
	F	0.04	*0.04*	0.97	*0.65*	3.61	*3.61*	9.11	*7.60*	26.67	*26.67*	1.11	*1.02*
	M+F	0.04	*0.04*	0.90	*0.72*	4.21	*3.97*	12.08	*10.81*	31.55	*29.69*	1.17	*1.08*
49	M	0.22	*0.22*	1.39	*1.39*	31.96	*31.96*	—	—	—	—	0.61	*0.61*
	F	—	—	—	—	—	—	—	—	—	—	—	—
	M+F	0.22	*0.22*	1.39	*1.39*	31.96	*31.96*	—	—	—	—	0.61	*0.61*
55	M	0.04	*0.03*	1.66	*1.24*	4.71	*3.39*	6.37	*5.09*	5.22	*4.70*	0.71	*0.54*
	F	0.08	*0.05*	4.31	*2.71*	3.26	*2.31*	4.56	*3.26*	13.43	*10.36*	0.65	*0.45*
	M+F	0.06	*0.04*	2.43	*1.66*	3.96	*2.83*	5.47	*4.18*	7.79	*6.47*	0.68	*0.50*
83	M	0.03	*0.03*	0.79	*0.59*	1.52	*1.06*	4.26	*3.86*	5.79	*5.79*	0.32	*0.26*
	F	0.03	*0.03*	0.48	*0.43*	1.20	*1.03*	2.97	*2.68*	4.01	*2.68*	0.26	*0.22*
	M+F	0.03	*0.03*	0.67	*0.52*	1.38	*1.05*	3.63	*3.29*	4.81	*4.07*	0.29	*0.24*
39	M	0.03	*0.03*[a]	0.70	*0.60*[a]	1.95	*1.75*[a]	4.61	*3.75*[a]	3.02	*2.49*[a]	0.19	*0.17*
	F	0.04	*0.05*	0.58	*0.53*	1.35	*1.23*	1.24	*1.13*	0.85	*0.77*	0.14	*0.13*
	M+F	0.04	*0.04*	0.63	*0.57*	1.71	*1.55*	3.38	*3.07*	2.09	*1.90*	0.17	*0.15*
81	M	0.05	*0.04*[a]	0.33	*0.25*[a]	1.52	*1.17*[a]	5.04	*3.88*[a]			0.57	*0.34*
	F	0.03	*0.03*	0.45	*0.41*	1.17	*1.06*	1.95	*1.77*			0.21	*0.19*
	M+F	0.04	*0.03*	0.38	*0.32*	1.34	*1.12*	3.56	*2.97*			0.33	*0.27*

[a] The age groups for centres 39 and 81 were slightly different: from right to left they were — < 40 years, 40–49 years, 50–59 years, 60–69 years (⩾ 60 years for centre 81), and ⩾ 70 years.

Table 4. Age-adjusted annual incidence rates for stroke per 1000 population (all cases)

Centre No.	Sex		Total	M/F
	Male	Female		
01	0.53[a]	0.32[a]	0.43[a]	1.7
05	5.55	3.73	4.44	1.5
06	5.71	4.77	5.20	1.2
21	8.34	6.45	7.23	1.3
22	7.18	5.55	6.30	1.3
29	3.92	2.21	2.88	1.8
33	2.70	2.66	2.58	1.0
45	15.12	11.84	13.44	1.3
46	7.60	5.32	6.26	1.4
47	8.73	4.35	6.35	2.0
48	9.04	6.01	7.21	1.5
49	0.61[a]	–	–	–
55	4.13	3.28	3.69	1.3
83	2.19	1.56	1.89	1.4

[a] Crude incidence rates. Age-adjusted rates could not be computed, since in centres 01 and 49 subjects were registered only up to 65 years of age (in centre 49 only males).

Geographical differences in the incidence of cerebral haemorrhage

The higher incidence of cerebral haemorrhage in Japan than elsewhere, having been reported also by several earlier workers, has given rise to many comments, one of these being that there is only a difference in diagnostic habits, but not in the true incidence rate. On the basis of a closer analysis of the present series (and assuming that light cases of stroke were indeed registered to the same extent in the Japanese centres as elsewhere) the following three pieces of evidence can be presented:

(*a*) Cerebral haemorrhage is known to be the commonest cause of coma in stroke patients. Both the relative frequency and the incidence of comatose patients were higher in Japan than in other countries (Table 5), particularly in males. Particularly high rates were found in Akita, for both sexes and most ages.

(*b*) In cerebral haemorrhage, blood pressure is often elevated as a sign of serious and extended cerebral damage. The mean blood pressures of Japanese stroke patients significantly exceeded those of Europeans (Table 6) ($P<0.001$ for systolic and $P<0.01$ for diastolic pressures, ages and sexes combined).

(*c*) In the relatively small group of autopsy-verified cases, cerebral haemorrhage was more frequent in Japan than in European countries.

On the basis of these three arguments it seems likely that the reported high incidence of cerebral haemorrhage in Japan is real (*14*).

PAST MEDICAL HISTORY

Previous stroke

Earlier stroke had been experienced by 14% of the patients under 65 years and by 18% of those over that age (Table 7). Sex differences were negligible except in a few centres where the calculations were based on small numbers of patients. Rates found in different centres varied considerably, the highest values being reported from Moscow, Ulan Bator and Zagreb; among the Western European centres, only small variations were found.

Myocardial infarction

About 7% of all registered patients had a history of myocardial infarction, men much more frequently than women, particularly at younger ages (Table 7). The figures were high in Israel and Europe, especially in the Finnish centres and Moscow, negligible in the Japanese centres, and zero in Nigeria.

Other heart disease

About 20% of the younger and about 35% of the older patients had a history of some heart disease other than myocardial infarction (Table 7); in general, prevalence was somewhat higher in women. The variation between individual centres was very wide. Highest values were observed in Moscow and in the Finnish centres, and lowest ones in Rohtak, Ulan Bator, Colombo, and Ibadan.

Hypertension

A history of hypertension was obtained in about half of the patients (Table 7), with a higher prevalence in women. In the Japanese centres the prevalence was about 75%, in Moscow and in Ulan Bator even higher. In the Western European centres it was less than 50% with the exception of only one centre. About one-third of the patients were under treatment for hypertension at the time of stroke. More than one-third of the patients with a history of hypertension were not receiving treatment when they suffered the stroke.

Diabetes mellitus

About 8% of the younger and 11% of the older patients were known diabetics (Table 7). The prevalence was a little higher in women than in men. The values were highest in the Finnish centres, and in Zagreb, and Zerifin, clearly lower in the Japanese centres, and lowest in Ulan Bator.

Table 5. Annual incidence rate for stroke patients with coma within 24 hours of onset of first stroke

Centre No.	Sex	Age group (years) < 45	46–54	55–64	65–74	⩾ 75	All ages
01	M	0.04	0.17	0.33	–	–	–
	F	0.03	0.17	0.27	–	–	–
	M + F	0.03	0.17	0.30	–	–	–
05	M	0.02	0.00	0.26	0.30	0.84	0.12
	F	0.01	0.04	0.16	0.46	1.64	0.28
	M + F	0.01	0.02	0.20	0.40	1.42	0.21
06	M	0.04	0.30	0.40	0.88	1.17	0.16
	F	0.02	0.20	0.41	0.87	3.30	0.24
	M + F	0.03	0.25	0.41	0.88	2.60	0.20
21	M	0.08	0.52	0.71	3.87	4.84	0.32
	F	0.09	0.27	0.69	2.32	7.89	0.38
	M + F	0.08	0.39	0.70	2.93	6.92	0.35
22	M	0.02	0.24	0.47	0.77	2.41	0.17
	F	0.02	0.14	0.28	0.87	2.65	0.21
	M + F	0.02	0.19	0.37	0.80	2.56	0.19
29	M	–	0.07	0.27	0.30	not available	0.10
	F	–	0.03	0.06	0.22	not available	0.08
	M + F	–	0.05	0.14	0.25	not available	0.11
33	M	0.01		0.10	0.40		0.04
	F	0.00		0.24	1.39		0.13
	M + F	0.01		0.17	0.91		0.08
45	M	0.16	1.22	2.55	4.74	3.32	0.69
	F	0.05	0.56	1.68	4.39	9.33	0.60
	M + F	0.10	0.85	2.11	4.56	6.97	0.64
46	M	0.12		1.35	2.04	4.28	0.50
	F	0.06		0.89	1.71	4.08	0.46
	M + F	0.09		1.10	1.86	4.15	0.48
47	M	0.08	0.14	2.69	2.23	0.00	0.35
	F	0.00	0.65	0.53	1.08	1.75	0.16
	M + F	0.04	0.42	1.53	1.59	1.14	0.25
48	M	0.05	–	0.81	3.35	12.31	0.29
	F	0.02	0.25	0.66	1.47	8.11	0.26
	M + F	0.03	0.14	0.72	2.30	9.59	0.28
49	M	0.07	0.37	1.79	–	–	0.17
	F	–	–	–	–	–	–
	M + F	–	–	–	–	–	–
55	M	0.00	0.00	0.08	0.34	0.37	0.02
	F	0.00	0.06	0.09	0.04	0.00	0.01
	M + F	0.00	0.03	0.09	0.19	0.16	0.01
83	M	0.01	0.10	0.13	0.93	2.07	0.06
	F	0.01	0.11	0.34	0.99	1.67	0.09
	M + F	0.01	0.10	0.22	0.96	1.85	0.07
39	M	0.01[a]	0.19[a]	0.32[a]	1.44[a]	0.97[a]	0.06
	F	0.02	0.08	0.21	0.57	0.31	0.03
	M + F	0.01	0.14	0.27	1.04	0.66	0.05
81	M	0.00[a]	0.00[a]	0.00[a]	0.14[a]		0.01
	F	0.00	0.10	0.00	0.00		0.01
	M + F	0.00	0.05	0.00	0.07		0.01

[a] The age groups for centres 39 and 81 were slightly different – see footnote to Table 3.

Table 6. Mean blood pressure in kPa (mmHg) after onset of stroke

		Europe and Israel		Japan		Mongolia		Nigeria		India		Sri Lanka	
		<65 years (n = 2383)	⩾65 years (n = 3273)	<65 years (n = 650)	⩾65 years (n = 829)	<65 years (n = 234)	⩾65 years (n = 65)	<65 years (n = 402)	⩾65 years (n = 251)	<65 years (n = 45)	⩾65 years (n = 31)	<65 years (n = 83)	⩾65 years (n = 78)
males	systolic	23.4 (176.1)	22.9 (172.2)	24.2 (182.0)	24.1 (181.4)	23.3 (174.9)	23.4 (176.3)	23.7 (178.0)	26.1 (196.3)	21.1 (158.6)	22.2 (166.7)	22.9 (172.0)	22.6 (169.9)
	diastolic	13.7 (102.9)	13.0 (97.7)	14.0 (105.1)	13.3 (100.3)	14.4 (108.5)	14.1 (105.7)	14.6 (109.9)	16.6 (124.5)	13.4 (100.9)	13.2 (99.5)	13.5 (101.6)	13.0 (98.0)
females	systolic	23.9 (179.8)	23.8 (179.1)	24.8 (186.6)	24.2 (182.0)	21.7 (163.4)	22.2 (167.0)	25.2 (189.8)	25.8 (194.2)	19.2 (144.3)	20.6 (154.7)	22.5 (168.8)	22.6 (170.2)
	diastolic	13.8 (103.5)	13.2 (98.9)	13.9 (104.8)	13.2 (99.3)	13.4 (100.7)	13.1 (98.5)	15.5 (116.4)	15.6 (117.5)	11.6 (87.3)	12.5 (94.3)	12.7 (95.5)	12.3 (92.2)

Negative medical history

Only about 36% of the younger and 26% of the older patients were reported to be free from all the above-mentioned diseases (Table 7). Negative histories were particularly rare in elderly women. The highest number of previously "healthy" subjects was found in Rohtak, the lowest in Moscow and Ulan Bator.

Comment

Although the patients' awareness of their previous diseases was probably influenced by local factors, such as availability of health services and screening procedures for cardiovascular diseases, some of the differences undoubtedly reflect genuine geographical variations in the prevalence of certain diseases. An example is the remarkable difference between the prevalence of myocardial infarction in the Finnish and the Japanese centres.

In the present community-based study, the prevalence of the above-mentioned diseases was of the same magnitude as, or somewhat lower than, those given in earlier reports based on hospitalized stroke patients

Table 7. Frequency (%) of past medical history of stroke patients, by age, sex and geographical area

History		Europe and Israel		Japan		Nigeria		Mongolia		India		Sri Lanka		All centres	
		Age group (years)		Age group (years)		Age group (years)		Age group (years)		Age group (years)		Age group (years)		Age group (years)	
		<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65
Stroke	M	14.3	19.5	4.3	16.0	6.2	13.3	27.4	18.0	21.9	23.1	24.1	6.5	13.2	18.3
	F	13.6	18.3	14.7	14.5	7.9	15.0	33.5	26.8	6.3	12.5	13.3	18.2	15.8	18.0
Myocardial infarction	M	14.3	12.7	0.4	1.4	0.0	0.0	1.0	1.4	6.3	7.7	11.1	2.2	9.3	9.2
	F	5.6	7.2	1.0	1.6	0.0	0.0	0.0	0.9	0.0	12.5	10.0	6.1	4.1	6.0
Other heart disease	M	25.3	37.1	9.1	14.8	7.5	6.7	3.4	5.0	6.3	0.0	3.7	0.0	18.3	28.6
	F	28.5	46.6	19.9	19.3	10.1	5.0	3.6	2.7	6.3	0.0	20.0	3.0	23.0	39.3
Hypertension	M	43.2	40.4	53.2	78.3	26.7	22.2	76.4	94.2	15.6	26.9	44.4	37.0	46.8	50.9
	F	49.1	50.3	75.4	79.0	14.6	35.0	88.1	93.8	0.0	37.5	23.3	45.5	54.1	56.5
Treated hypertension	M	25.7	23.9	18.8	36.9	19.2	13.3	74.5	92.1	3.1	15.4	22.2	15.2	27.8	30.4
	F	31.0	29.7	39.3	41.0	12.4	30.0	85.6	90.2	0.0	12.5	10.0	6.1	36.9	33.7
Diabetes	M	10.3	12.7	2.5	4.8	6.2	6.7	0.5	1.4	6.3	7.7	7.4	15.2	7.5	10.3
	F	12.3	14.5	3.1	3.7	2.2	15.0	0.5	2.7	6.3	12.5	23.3	15.2	9.4	12.3
None of diseases listed above	M	38.9	33.2	44.3	16.9	64.4	68.9	12.5	3.6	45.6	53.8	31.5	52.2	39.5	29.4
	F	37.3	24.9	16.8	17.2	76.4	65.0	5.2	1.8	81.3	50.0	40.0	39.4	33.6	23.3
Total numbers of patients (= 100%)	M	1466	1438	483	420	146	45	208	139	32	26	54	46	2389	2114
	F	1072	2057	191	429	89	20	194	112	16	8	30	33	1592	2659

(*15–17*). Comparisons between the stroke patients and the corresponding general populations were made in some centres (*5, 18–20*). Most of the diseases under study were significantly more frequent in stroke patients than in the population at large.

The fact that nearly three-quarters of all stroke patients had associated diseases, mostly in the cardiovascular system, supports the view that in most cases stroke is merely an incident in the slowly progressive course of a generalized vascular disease. From the preventive point of view it is particularly important that over one-third of the patients with known hypertension were not receiving antihypertensive treatment at the time of the stroke.

CLINICAL MANIFESTATIONS IN THE ACUTE PHASE

Clinical signs observed in the acute phase of stroke were analysed in order to assess the severity of stroke in different parts of the world and to obtain a baseline for the evaluation of the effects of rehabilitation. A detailed analysis of the neurological signs was neither intended nor feasible, since many of the registered patients were not hospitalized.

About one-half of the registered patients were fully conscious at the time of registration, one-fifth were comatose—i.e., unresponsive to painful stimuli—the remaining patients being either somnolent or semicomatose. The state of consciousness was not appreciably influenced by the age and sex of the patients (Table 8).

The predominant neurological deficit was hemiplegia, observed in over two-thirds of the patients; it was probably present also in many cases in which motor function could not be assessed because of coma. A small group of patients were recorded as having "no neurological deficit", which means no impairment of consciousness, speech, or muscle power in the limbs (Table 8). Such cases were particularly frequent below the age of 55, one of the reasons undoubtedly being the relatively higher incidence of subarachnoid haemorrhage in young people; otherwise no significant correlation was found between age of the patient and neurological deficit.

A comparison between different centres revealed that severe impairment of consciousness was twice as frequent in the Japanese as in the European patients; conversely, cases with only mild neurological deficits were seen more often in Europe (Table 8).

The neurological findings in various types of stroke were not compared, since the diagnosis of type of stroke often remained unverified and the types of stroke were often classified on the basis of neurological findings.

In the total series, the average systolic blood pressure, as recorded in the acute phase of the stroke, was 23.5 kPa (176 mmHg) in men and 23.9 kPa (179 mmHg) in women, the diastolic values being 13.5 kPa (101 mmHg) for both sexes. As shown in Table 6, age had only a slight influence on blood pressure.

Blood pressure levels were much higher in comatose patients than in those who were alert, probably

Table 8. Proportion (%) of patients with consciousness or neurological deficits (within 24 hours of onset)

Deficit	Europe and Israel		Japan		Nigeria		Mongolia		India		Sri Lanka	
	Age group (years)		Age group (years)		Age group (years)		Age group (years)		Age group (years)		Age group (years)	
	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65	<65	⩾65
Consciousness												
Fully conscious	57.9	49.2	40.4	39.3	11.2	11.6	47.7	47.7	47.9	44.1	31.0	26.4
Somnolent	16.2	20.6	15.4	16.7	60.7	54.6	11.1	6.2	22.9	23.5	21.4	20.3
Semicomatose or comatose	23.1	29.0	43.4	43.3	28.1	33.9	40.0	44.6	29.2	32.3	46.4	53.2
Consciousness not assessed	2.8	1.1	0.7	0.6	0.0	0.0	1.3	1.5	0.0	0.0	1.2	0.0
Neurological deficit												
None	10.0	2.8	8.3	3.2	1.3	1.5	0.0	0.0	2.1	0.0	0.0	0.0
Speech only	4.4	5.7	3.1	1.4	2.1	1.5	7.7	2.4	2.1	5.9	0.0	2.5
Monoplegia	5.7	5.6	3.3	1.5	5.1	3.1	0.0	0.4	2.1	14.7	0.0	0.0
Hemiplegia	64.0	70.4	68.8	79.4	73.2	70.8	84.6	88.8	83.3	73.5	84.5	79.8
Paraplegia or multiple paralysis	3.6	2.7	3.7	5.2	5.5	7.7	4.0	4.8	2.1	0.0	7.2	3.8
Not assessed	12.4	12.7	13.2	9.3	12.8	15.4	3.5	3.6	8.3	5.9	8.3	13.9
Total numbers of patients (=100%)	2538	3495	674	849	235	65	402	251	48	34	84	79

because most of the comatose patients had cerebral haemorrhage.

The comparison between centres showed that systolic blood pressures in every age group were considerably higher in Japanese than in European patients, whereas the diastolic values differed only slightly.

In summary, in the acute phase of stroke, impairment of consciousness was observed in about one-half and hemiplegia in over two-thirds of the patients. Coma and hemiplegia were more frequent in the Japanese than in Europeans. Also blood pressure levels were higher in the Japanese.

TYPE OF MANAGEMENT

The management of stroke patients is an important aspect of the public health problem posed by cerebrovascular disease (*21–22*). One of the objectives of the study was to analyse how stroke was being managed in various parts of the world. Information was collected on hospital admission rates, bed usage, rehabilitation procedures, utilization of nursing institutions, etc., in order to assess the quality of care and the burden that stroke imposed on the health services. These data are also of great importance for the planning of health services (*23*).

Hospital admissions

In the European centres and Israel about three-quarters of the patients were admitted to hospital, whereas in Japan more than half the patients were treated at home (Fig. 2). In some of the centres the admission rates reported may be low, owing to lack of medical facilities. The admission rates in Japan were influenced by factors such as age and sex of the patient; they were much lower for elderly stroke patients than for younger ones and much lower for females than for males. In Europe and Israel such trends were negligible. Hospital admission was apparently independent of whether the patients were living alone or with relatives, but less than half the patients who were living in nursing institutions were transferred to hospital—even in centres with high overall admission rates.

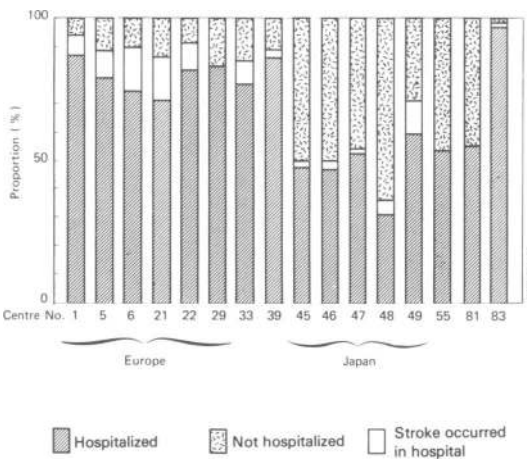

Fig. 2. Admission to hospital.

As regards the influence of the clinical state, most non-hospitalized patients either had mild strokes that were treated at home or had particularly severe strokes that became fatal before admission could be arranged. However, in the Japanese centres hospital admission seemed to be independent of the severity of the stroke.

An important aspect of acute stroke care is the length of the interval between onset and hospitalization. For all centres combined, 80% of the patients who were referred to hospital were admitted on the day of onset, and only 11% were admitted later than the third day after onset. In this respect, differences between the centres were small.

In centres with high admission rates and aged populations, a substantial proportion of the strokes (10–16%) occurred in patients who were already in hospital for other reasons. These patients were characterized by a high cardiovascular morbidity; about 80% of them gave a history of at least one previous cardiovascular disease or of diabetes. In some of these patients, the pre-existing disease (e.g., myocardial infarction) or the treatment given in hospital (e.g., dehydration, blood transfusion, surgical procedures) might have been the direct cause of the recent stroke, but the number of such instances cannot be assessed on the basis of the available data.

About one-fifth of all the patients who left the hospital alive were discharged within 2 weeks of the stroke, but about 54% stayed for more than 4 weeks. Of those who died in hospital, 59% died within 2 weeks and 29% after more than 4 weeks (Table 9). After 3 months, 17% of the patients still remained in hospital. There were wide variations not only between different parts of the world, but also between "neighbouring" centres. For example, the proportion of survivors who stayed in hospital longer than 4 weeks in the whole series, ranged from 16% to 94%, and was 65% in one Scandinavian centre but only 46% in another. Long stays were frequent in Japan, but rare in Ibadan. The date of discharge from hospital was not always recorded; hence the mean duration of stay could not be calculated.

Table 9. Duration of stay in hospital

Centres	Discharge status	Number of hospitalized patients (= 100%)	Percentages of patients whose length of stay in hospital were:				
			1–7 days	8–14 days	15–21 days	22–28 days	⩾29 days
Europe and Israel	Patients discharged alive	2638	10.5	12.7	16.3	10.5	50.0
	Patients discharged dead	2417	43.0	14.7	8.1	5.5	28.6
Japan	Patients discharged alive	525	1.3	3.0	4.6	4.4	86.7
	Patients discharged dead	329	45.9	10.3	6.1	4.6	33.1
Nigeria	Patients discharged alive	150	28.0	7.3	18.0	12.7	34.0
	Patients discharged dead	119	52.9	13.4	4.2	5.9	23.5
Mongolia	Patients discharged alive	249	10.4	6.4	38.6	3.2	41.4
	Patients discharged dead	101	53.5	5.0	2.0	1.0	38.6
India	Patients discharged alive	32	31.3	25.0	18.8	9.4	15.6
	Patients discharged dead	14	50.0	14.3	7.1	0.0	28.6
Sri Lanka	Patients discharged alive	73	4.1	4.1	16.4	17.8	57.5
	Patients discharged dead	87	67.8	6.9	4.6	9.2	11.5
All centres	Patients discharged alive	3667	9.9	10.6	16.2	9.4	53.9
	Patients discharged dead	3067	44.8	13.7	7.4	5.4	28.8

Rehabilitation

Rehabilitation policies were the same in age groups under and over 65 years. Rehabilitation was started before 3 weeks in two-thirds or more of the patients in most of the European centres. Early start and termination of rehabilitation was common in Israel, but very infrequent in the Japanese centres (except centre 46). More than 40% of the whole series of patients were given rehabilitative treatment up to 3 months or even longer. About one-third did not receive any such treatment at all. As expected, the proportion of those without rehabilitation was higher when the disability was either slight or extremely severe; rehabilitation was obviously considered unnecessary in the former category and hopeless in the latter.

SURVIVAL OF STROKE PATIENTS

The magnitude of the stroke problem is strongly reflected in the case-fatality or survival rates (*18, 23–25*). For all centres combined, survival rates at various points in time after stroke onset are shown in Fig. 3. It appears that most deaths occurred within the first 1 or 2 weeks, and stabilization of the survival rates was characteristic after 3 weeks. Arbitrarily, therefore, deaths within the first 3 weeks after stroke can be termed "initial mortality".

Influence of age

Also in Fig. 3, survival of patients of 55–64 years of age at stroke onset is compared with that of patients of 65 years and over. During the first few days, survival was almost identical for the two age groups (it may even have been poorer for the younger group), but, thereafter, survival rates decreased more rapidly with

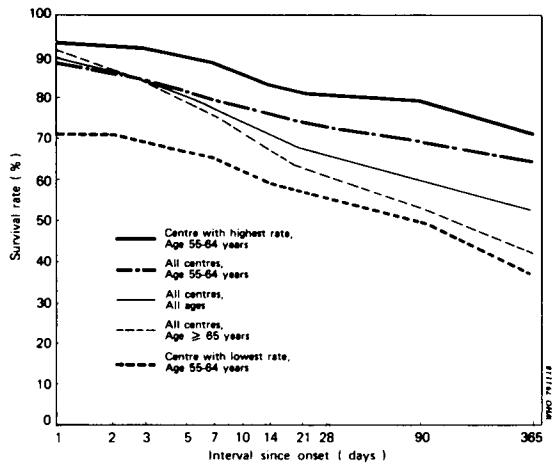

Fig. 3. Mean survival rates for all centres and centres with highest and lowest rates.

time in the older group. These differences may reflect the fact that in the younger age group the proportion suffering stroke of the subarachnoid or intracerebral haemorrhage type was larger than in the older group, with a correspondingly large early fatality. The older group had an increased risk over the young for all kinds of fatal disease and may have suffered from more advanced underlying disease.

Survival rates in males and females did not differ substantially.

Disturbance of consciousness at onset

The lowest level of consciousness noted during the first 24 hours after stroke onset was recorded in 4 categories. The survival rates for each of these are shown in Fig. 4. With decreasing levels of consciousness, survival markedly decreased, and this decrease occurred almost exclusively within the first week after onset.

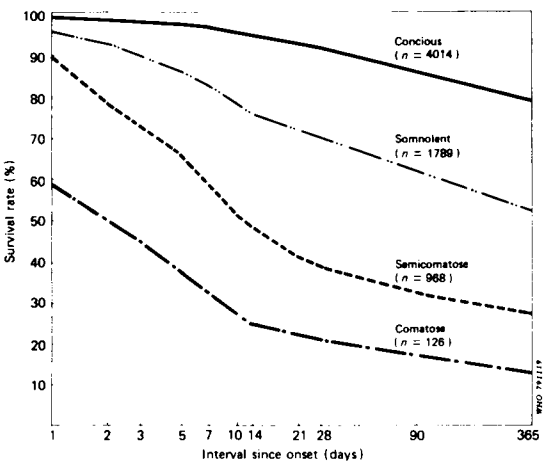

Fig. 4. Survival rates by level of consciousness within 24 hours of onset.

Hypertension

No substantial differences were found in early or late mortality between stroke patients with treated and untreated hypertension.

Analysis of the results of the first measurement of blood pressure after stroke onset showed that systolic blood pressure of 26.9 kPa (200 mmHg) and over was related to poor survival. The differences in survival were less pronounced at lower initial blood pressure levels. Systolic blood pressures of less than 21.3 kPa (160 mmHg) shortly after stroke onset seemed to be related to poorer survival than pressures of 21–24 kPa (160–179 mmHg). The decrease in survival was almost exclusively during the first few days after onset. It thus seems that, though high blood pressure at the onset of stroke may reflect the pre-existence of hypertension, it may also indicate the severity of the cerebral lesion caused by the stroke. In both cases poorer survival could be expected.

Recurrent stroke

Initial survival of stroke patients was little influenced by the presence of a history of previous stroke. However, one year after the attack those with a history of previous stroke had 20–25% lower survival rates than those who had a first attack. The pattern was similar for both the younger and older age groups.

Registered patients with recurring stroke during the study period had slightly poorer survival rates than the average survival for the whole series. Survival was poorer for female than for male patients.

Dependence and self-care before stroke

In 1134 patients (13% of the whole series) assistance by others in daily self-care was needed prior to stroke onset. This group had poorer survival rates compared with the group of non-dependent patients. At one year, survival was 27% in dependent and 57% in the non-dependent patients.

Variation with place of study

For comparison of survival rates between centres, only the age group 55–64 years from each centre was considered. In Fig. 3 is shown the range of survival rates at various points in time after stroke onset together with the mean for all centres. Even though the remaining centres produced curves with some variations, most were close to the mean curve.

There were differences between centres regarding both survival rates during the initial few days after stroke onset and later survival (between 21 days and 12 months), and the two were not always related. A good initial survival was not followed by a good late survival in some centres and vice versa.

In order to evaluate the statistical significance of the differences between centres, survival rates at 21 days were considered. When the maximum survival rate (centre 05) was compared with the minimum value (centre 47), it was found that the difference did not reach statistical significance at the 5% level. This does not, however, preclude the existence of true differences that were not detectable with the number of registered patients available in each centre.

Functional prognosis

For patients who have survived the acute phase of a stroke, the most important questions are to what extent they will recover physically and mentally, and

whether they will eventually be able to return home and take up former activities. The attending clinician can often give fairly reliable answers to such questions, based on assessment of the clinical picture. Numerous follow-up studies have established the unfavourable influence on the prognosis of such factors as: age over 70, severe motor deficit, impairment of consciousness, and conceptual disorders.

It was not an aim of the study to find further prognostic factors that might be useful in individual cases, but rather to study the recovery and social readaptation in large groups of stroke patients in different parts of the world.

Clinical state

As stated earlier, a total of 6217 patients, or 71% of the whole series, had hemiplegia or paraplegia at the initial examination, whereas the remaining patients had monoplegia, multiple paralysis, or merely speech disturbances; only 441 patients (5%) did not exhibit any of these types of deficit (but might have had cranial nerve pareses, sensory impairment, etc.). Three weeks after onset the number of patients with hemiplegia had been reduced to 3731, or 67% of those surviving at that time; after one year, hemiplegia or hemiparesis was still present in 1744 patients (46%). In contrast, the number of patients with "no deficit" rose steeply to 857 at 3 weeks, and subsequently to 1370 at 1 year, the latter figure representing over one-third of the 1-year survivors. Similar trends are observed when the diagnostic subgroups are considered separately, but some differences exist: at 1 year, neurological impairment (in the above sense) was absent in 74% of the patients with subarachnoid haemorrhage, in 24–34% of those with cerebral infarction or unspecified stroke, and in only 22% of those with cerebral haemorrhage. A comparison of selected European and Japanese centres shows that, at each follow-up term, neurological deficits were less severe in Europe than in Japan. The proportion of 1-year survivors without neurological impairment was 39% in Europe and 28% in Japan (Table 10).

Disability grade

At the time of the first follow-up, only 29% of patients were fully independent in self-care; 39% were partially dependent, and the remaining 32% were completely incapacitated. Over the following months, this pattern gradually changed, so that after 1 year 62% were independent in self-care, and only 9% were still totally dependent on other people.

A comparison between European and Japanese centres shows the following trend: before the stroke, nearly all Japanese patients were fully independent in self-care, whereas 10–20% of the European (and Israeli) patients were more or less disabled; 3 weeks after the stroke only a quarter of the Japanese stroke survivors had regained independence, as against over 30% of the European patients; the difference disappeared at 3 months (Table 11).

At each follow-up term, the proportion of patients with disturbance of bladder function was similar to that of patients who were totally dependent in self-care.

In Europe, almost two-thirds of the 3-week survivors were staying in an institution (nursing-home or hospital), and after 1 year about 16% were still institutionalized. In Japan, the respective figures were

Table 10. Proportion (%) of patients with certain clinical conditions at different intervals after stroke

	Europe and Israel			Japan			Nigeria			Mongolia			India			Sri Lanka		
Time	3 wks	3 mths	1 year	3 wks	3 mths	1 year	3 wks	3 mths	1 year	3 wks	3 mths	1 year	3 wks	3 mths	1 year	3 wks	3 mths	1 year
No deficit	18.0	30.0	39.0	11.1	18.0	28.0	14.0	9.7	25.6	2.0	6.0	44.3	7.0	22.2	41.4	0.0	0.0	0.0
Speech only	7.0	6.0	5.0	2.0	3.0	3.0	2.0	0.0	0.0	3.0	3.0	0.0	2.0	2.2	0.0	0.0	0.0	0.0
Monoplegia	9.0	10.0	11.0	5.0	7.0	6.0	4.0	5.6	0.0	0.3	0.0	0.0	11.0	15.6	17.0	2.0	19.0	30.7
Hemiplegia or paraplegia	61.0	50.0	42.0	78.0	68.0	59.0	70.8	77.8	74.4	92.0	54.3	47.0	79.0	60.0	38.0	80.0	58.6	69.2
Multiple paralysis	2.0	1.0	1.0	3.0	2.0	2.0	2.0	4.2	0.0	1.5	2.9	0.0	1.6	0.0	0.0	2.0	1.7	0.0
Not assessed	2.0	2.0	1.0	2.0	1.0	1.0	7.0	2.8	0.0	2.2	28.6	8.9	0.0	0.0	3.5	15.0	20.7	0.0
Total number (= 100%)	3945	3308	2830	989	884	770	161	72	39	324	35	79	61	45	29	87	58	13

slightly lower, and in Ibadan, Ulan Bator, Rohtak, and Colombo, few patients were living in institutions after 1 year. It is striking that in Asia and Africa nearly all the patients who were staying in private homes were living with relatives, whereas a considerable proportion of the European patients were living alone.

Return to work

In all centres together, only 10% of the survivors at 3 months were back in gainful work (5.4% working full-time, 4.5% only part-time); at 1 year the number of patients who had resumed work had almost doubled. Similarly, domestic activities had been resumed by 23% at 3 months, and by 26% at 1 year. Comparison between centres disclosed only moderate variations, but it is noted that the highest percentage of patients going back to work was seen in one Japanese centre, where all patients were members of a large occupational group, and nearly all of whom were under the age of 55.

Table 11. Patients' conditions before and after stroke[a]

Centre	Time	Self-care				Control of bladder			Living conditions				Working conditions						
		1 %	2 %	3 %	U %	1 %	2 %	U %	1 %	2 %	3 %	U %	1 %	2 %	3 %	4 %	5 %	6 %	U %
Europe and Israel (*n* = 6033)	Before attack	81	14	3	2	89	8	3	15	79	5	2	24	44	20	9	1	0	3
	3 weeks after	32	38	30	0	74	25	1	3	32	65	0	1	1	35	4	7	41	12
	3 months after	51	35	14	0	86	14	1	8	67	25	0	5	3	29	10	18	30	6
	1 year after	60	30	9	1	90	10	1	9	74	16	1	10	4	27	14	18	26	2
Japan (*n* = 1523)	Before attack	94	5	1	0	97	2	0	3	96	1	0	49	19	8	11	14	0	0
	3 weeks after	24	35	41	0	76	24	0	1	45	54	0	1	2	60	0	2	35	1
	3 months after	52	31	17	1	86	14	1	1	65	33	1	6	9	51	2	6	25	1
	1 year after	68	22	11	0	90	10	0	1	85	14	1	14	17	40	4	7	17	1
Nigeria (*n* = 300)	Before attack	83	4	1	13	73	5	22	2	95	0	3	65	4	8	14	1	0	7
	3 weeks after	20	37	37	6	61	30	9	0	36	63	1	2	4	89	0	0	2	3
	3 months after	28	40	18	14	76	10	14	0	75	25	3	1	11	82	1	0	0	4
	1 year after	69	26	0	5	95	0	5	0	95	5	0	26	28	33	5	0	0	8
Mongolia (*n* = 653)	Before attack	99	1	0	0	90	8	2	5	95	0	1	23	52	23	1	0	0	1
	3 weeks after	15	61	23	2	39	61	0	1	44	55	0	1	0	99	0	0	0	0
	3 months after	20	26	26	29	57	14	29	0	89	9	3	0	0	97	0	0	0	3
	1 year after	67	22	3	9	86	5	9	5	91	4	0	6	0	94	0	0	0	0
India (*n* = 82)	Before attack	88	7	4	1	96	2	1	1	99	0	0	31	67	0	0	0	0	2
	3 weeks after	69	15	16	0	92	7	2	0	93	5	2	12	12	20	18	21	16	2
	3 months after	84	11	4	0	98	2	0	0	98	0	2	18	16	9	18	20	20	0
	1 year after	83	14	3	0	100	0	0	0	100	0	0	38	0	10	28	7	14	3
Sri Lanka (*n* = 163)	Before attack	70	22	1	2	88	4	8	13	82	3	3	29	62	0	0	0	0	10
	3 weeks after	1	59	31	9	55	35	10	1	15	76	8	0	0	33	0	0	59	8
	3 months after	40	41	0	19	71	10	19	0	76	0	24	0	28	17	0	26	10	19
	1 year after	46	54	0	0	92	8	0	0	92	0	8	8	0	46	8	0	39	0

[a] Keys to classification:

Self-care:
1 = independent
2 = partially dependent
3 = totally dependent
U = unknown

Control of bladder:
1 = not disturbed
2 = disturbed
U = unknown

Living conditions:
1 = in private household, alone
2 = in private household, not alone
3 = permanently living in institution
U = unknown

Working conditions (before attack):
1 = in gainful work
2 = retired because of ill health
3 = retired because of age
4 = housewife
5 = other
U = unknown

Working conditions (after attack):
1 = working as much as before
2 = working less than before
3 = not working
4 = domestic activities as before
5 = domestic activities less than before
6 = no domestic activities
U = unknown

Comments

The results confirm the clinical experience (*24-26*) that many stroke patients make partial recoveries, but very few are definitely "cured": 1 year after the stroke two-thirds of the survivors still had hemiplegia, monoplegia, or speech disturbances, more in the Japanese than in the European centres. One reason for this difference might be that the number of severe strokes —most of which were probably cerebral haemorrhages—appeared to be higher in Japan than elsewhere. As expected, disability roughly paralleled the motor deficit; the proportion of patients who had regained full independence in self-care rose from 29% at 3 weeks to 62% at 1 year. During the first few months of the follow-up period the Japanese patients, in accordance with their more severe neurological deficits, were more often disabled than their European counterparts, but at 1 year the difference was no longer present. It is tempting to associate the delayed improvement of the Japanese stroke victims with the fact that—as stated above—early start of rehabilitation was less frequent in Japan than in Europe. However, since several other factors may account for the above difference, the final assessment of the effects of stroke rehabilitation will still have to await the results of controlled studies.

The social readaptation of survivors from stroke depends not only on the grade of physical disability, but to a considerable extent also on the structure of the community in which the patients live, and on prevailing patterns of family life. Thus, in the Western European centres about 25% of the 1-year survivors were staying in institutions, whereas in the Asian and African communities nearly all survivors, no matter how disabled, were cared for by their relatives at home. The community problems created by cerebrovascular disease are therefore different in various parts of the world.

Finally, the results have shown the extent (and limits) of occupational resettlement as a goal of stroke rehabilitation. One year after the stroke, only some 20% of the survivors were in gainful work.

GENERAL DISCUSSION

The present study has clearly demonstrated the magnitude of the stroke problem in many parts of the world. In the populations studied, stroke incidence rates ranged from 0.2 to 2.5 per 1000 population per year, the variations being mainly due to differences in the age structure of the populations involved. Assuming that these incidence rates can be applied to larger population groups, it can be estimated that in the European countries the annual number of strokes may amount to nearly one million and in Japan to 200 000. As in most previous studies, the incidence rates were found to rise steeply with advancing age. From the point of view of community medicine, however, it is important that most of the stroke victims under 65 years of age had been active members of their communities up to the time of the stroke.

In spite of all modern therapeutic possibilities, stroke is still a severe threat to life. Of the total series of patients, 23% died within 1 week, 31% within 3 weeks and 48% within 1 year. As in other studies, unfavourable prognostic factors were old age, impairment of consciousness, and high blood pressure. Differences between fatality rates in various centres were only moderate.

For those who survive a stroke, the consequences are often, though not invariably, grave. One year after the stroke, two-thirds of the survivors still had some neurological deficit, nearly 40% had not regained independence in self-care, while some 20% were back in gainful work. Further, the importance of the structure of the local community in which the patient lives is clearly shown by the fact that in the Asian and the African centres, nearly all the survivors, irrespective of their disability grade, were cared for by their relatives at home, whereas in the European centres (except Moscow and Zagreb) 25% of the 1-year survivors had remained inpatients.

Vast numbers of hospital beds are occupied by stroke patients: in the total series, nearly three-quarters of the patients were hospitalized because of the stroke and about half of the survivors spent more than 4 weeks in hospital. However, the proportion of stroke patients admitted to hospital varied widely, ranging from less than half (Japan and India) to about three-quarters (Europe, Israel and Nigeria). It is a crucial question whether, from the point of view of benefits to the patients, the former admission rates are too low or the latter unnecessarily high.

Since specific diagnostic procedures, except lumbar puncture, were used only sparingly, the majority of patients must have been admitted mainly for reasons of better care, such as nursing or rehabilitation. Unfortunately, since the criteria on which patients were hospitalized in individual centres cannot be defined, it is impossible to assess the influence of hospital treatment and rehabilitation measures on the outcome of the disease.

From the point of view of prevention of stroke, it is important to stress that three-quarters of all the registered stroke patients gave a history of previous cerebrovascular or cardiovascular diseases, or of diabetes. In particular, over half of the patients had arterial hypertension in their history, and only one-third of these were under treatment.

CONCLUSIONS

1. Cerebrovascular accidents are common in the contrasting populations of the various countries studied all over the world. Age-adjusted incidence of stroke, unlike that of myocardial infarction, shows only moderate geographical variation. Intracerebral haemorrhage seems to be more frequent in countries where hypertension has been reported to be common, particularly in Japan.

2. The impact of stroke on the community depends on such factors as the age structure of the population, the sociocultural pattern, and the availability of medical facilities. Particularly in the developed countries, large numbers of hospital beds are occupied by stroke patients; half of the hospitalized patients stay longer than 1 month.

3. Both in developed and developing countries nearly one-third of stroke patients die within 3 weeks, and only a few recover completely. It is still uncertain to what extent the patients' chances of survival and recovery are influenced by the type of management, in particular hospitalization.

4. Control of hypertension, although known to be effective in the prevention of stroke, is insufficient in most countries.

5. Stroke registers may be used as a source of information needed for the implementation of stroke control programmes in the community.

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K. Aho, Department of Neurology, University of Helsinki, Finland
O. O. Akinkugbe, Faculty of Medicine, University of Ibadan, Nigeria
B. C. Bansal, Medical College Hospital, Rohtak, India
N. Dondog, Department of Cardiovascular Diseases, Medical Research Institute, Ulan Bator, Mongolia
M. L. Gander, International Classification of Diseases, World Health Organization, Geneva, Switzerland
L. Geltner, Asaf Harofe Government Hospital, Tel Aviv University Medical School, Zerifin, Israel
P. Harmsen, Department of Neurology, Sahlgren's Hospital, Gotëborg, Sweden
S. Hatano, Department of Epidemiology, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan
K. Isomura, Saku Central Hospital, Nagano, Japan
S. Kojima, Central Institute of Health, Akita, Japan
Y. Komachi, Centre for Adult Diseases, Osaka, Japan
K. Kondo, Central Health Institute, Japan National Railways, Tokyo, Japan
T. A. Makinskij, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR
J. Marquardsen, Department of Neurology, Frederiksberg Hospital, Copenhagen, Denmark
T. Omae, Faculty of Medicine, Kyushu University, Fukuoka, Japan
B. O. Osuntokun, Faculty of Medicine, University of Ibadan, Nigeria
J. B. Peiris, General Hospital, Colombo, Sri Lanka
Z. Poljaković, Centre for Cerebrovascular Diseases, Zagreb, Yugoslavia
P. Puska, North Karelia Project, University of Kuopio, Finland
A. Radić, Medico-Social Research Board, Dublin, Ireland
K. Salmi, North Karelia Central Hospital, Joensuu, Finland
E. E. Shmidt, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR
V. E. Smirnov, Institute of Neurology, Academy of Medical Sciences of the USSR, Moscow, USSR
K. Uemura, Division of Health Statistics, World Health Organization, Geneva, Switzerland

RÉSUMÉ

MALADIES CÉRÉBROVASCULAIRES DANS LA COLLECTIVITÉ: RÉSULTATS D'UNE ENQUÊTE COLLECTIVE DE L'OMS

Des spécialistes éminents de l'"attaque" cérébrale se sont rencontrés en 1970 à la faveur d'une réunion sur les maladies cérébrovasculaires organisée par l'OMS à Monaco. Ils ont recommandé que l'Organisation mette au point une méthodologie pour l'établissement de registres de l'apoplexie dans des collectivités déterminées, afin de pouvoir disposer de données fiables sur la prévalence et les caractéristiques des attaques et d'être ainsi en mesure d'engager des actions planifiées pour prévenir celles-ci ou en soigner et réadapter les victimes.

L'enquête définitive sur l'enregistrement des épisodes apoplectiques dans une collectivité, qui a été précédée d'une étude pilote de plusieurs mois, a débuté en 1971 avec la participation de 17 centres dans 12 pays. L'Organisation mondiale de la Santé, agissant comme centre de coordination, s'est chargée du collationnement et du traitement des données. La population de référence totale pour l'ensemble des registres était de plus de 2,6 millions de personnes, auxquelles sont venus s'ajouter les groupes couverts par les deux centres—Rohtak et Colombo—dont la participation a commencé plus tard.

Dans chacune des régions concernées, un registre de l'apoplexie a été ouvert dans un hôpital ou centre de soins local, et tous les médecins hospitaliers ou généralistes, institutions dispensant des soins et autorités sanitaires ont été informés de l'exécution de l'enquête et priés d'y collaborer en signalant tous les épisodes pouvant être considérés comme apoplectiques survenus dans leur secteur et en fournissant aux fins du rapport d'enquête les détails disponibles pour chaque cas.

Tous les sujets ayant survécu à une attaque ont été suivis pendant 12 mois et les cas de nouvelle attaque survenue pendant cette période ont été enregistrés sur un formulaire conçu spécialement à cet effet. Cependant, tout nouvel épisode se produisant au cours des trois premières semaines a été considéré comme une aggravation du premier et ne constituant pas une nouvelle attaque. En cas de décès survenu dans l'année suivant l'attaque, les causes de la mort indiquées dans le rapport d'enquête étaient celles figurant sur le certificat de décès ou sur le rapport d'autopsie.

L'enquête a mis clairement en lumière l'étendue du problème que posent les cas d'apoplexie dans de nombreuses parties du monde. Au sein des populations étudiées, les taux d'incidence allaient de 0,2 à 2,5 pour 1000 par année, la variation de ce pourcentage étant liée principalement à la structure par âge de la population concernée. Si l'on considère un taux d'incidence de cet ordre comme étant valable pour de plus vastes groupes de population, le nombre annuel de cas d'apoplexie dans les pays européens pourrait être estimé à près d'un million et au Japon à 200 000. En ce qui concerne la variation de l'incidence selon la structure par âge, on a constaté que les taux augmentaient très fortement avec l'âge.

Le pourcentage de décès pour l'ensemble des sujets suivis a été de 23% au cours de la première semaine après l'attaque, 31% dans les 3 semaines et 48% dans le délai d'une année. Parmi les facteurs justifiant un pronostic défavorable, on notait l'âge avancé, l'affaiblissement des sens et une pression artérielle élevée. Peu de différences ont été constatées entre les divers centres en ce qui concerne les taux de mortalité enregistrés.

Un an après avoir été frappées, près des deux tiers des victimes d'attaque souffraient encore d'une déficience neurologique ou l'autre, et près de 40% n'étaient pas capables de prendre soin d'elles-mêmes, alors que 20% avaient pu reprendre un travail rémunéré. Dans les centres participants d'Asie et d'Afrique, presque tous les survivants, quel que soit leur taux d'invalidité, étaient soignés à domicile par les membres de leur famille, alors que dans les centres européens (sauf ceux de Moscou et de Zagreb) 25% des survivants se trouvaient encore à l'hôpital un an après l'épisode apoplectique.

En moyenne, près des trois quarts des victimes d'une attaque ont été hospitalisées et près de la moitié des survivants ont passé plus de 4 semaines à l'hôpital. Mais, à l'intérieur de cette moyenne, la proportion d'admissions à l'hôpital était très variable selon la région, allant de moins de la moitié des sujets frappés au Japon et en Inde aux trois quarts environ en Europe, en Israël et au Nigéria.

Plus de la moitié des victimes d'attaque avaient souffert d'hypertension artérielle à un moment ou l'autre de leur vie, mais le tiers seulement d'entre elles avaient été ou étaient soignées pour cette cause. On peut donc considérer que l'hypertension, dont le traitement est un moyen efficace de prévention de l'apoplexie, fait l'objet d'une attention insuffisante dans la plupart des pays.

L'enquête a bien montré l'utilité des registres de l'apoplexie en tant que source de renseignements en vue de l'exécution de programmes de lutte contre les accidents cérébrovasculaires au sein des collectivités.

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