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REVIEW

CURRENT STATUS OF REHABILITATION, ESPECIALLY IN PATIENTS WITH STROKE, IN JAPAN

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The current status of stroke rehabilitation in Japan was reviewed from the perspectives of epidemiology, structures, outcomes and research. Japan is the fastest aging society in the world, facing a rapid increase in its disabled population and ensuing healthcare costs. Although its mortality is decreasing, stroke is the most frequent cause of disability. Traditionally, stroke patients acutely admitted to general hospitals remained bed-ridden for months, hindering maximal functional gain. With more attention to the importance of rehabilitation, improved outcomes such as shorter length of stay, more functional gain and increased community discharge have resulted. Japan's healthcare system, characterized by universal coverage, equity and a mandatory fee schedule, has contributed to the world's longest life expectancy and the lowest infant mortality rate, but it has also lacked quality assurance. Under stringent economic conditions, drastic healthcare and welfare reform plans are being debated and pressure is mounting for more efficient stroke rehabilitation.

Key words: cerebrovascular disease, epidemiology, disability, healthcare, insurance, outcome.

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INTRODUCTION

Japan is the fastest aging country in the world. The proportion of population aged 65 years and over increased from 6% in 1960 to 15.7% in 1997, and is expected to reach 25% by 2020 (1). The aging of the society indicates a more disabled population and an increased burden to the society in the form of increasing healthcare demand and ensuing costs. The bed-ridden population has increased from 2 million in 1993 to 2.8 million in 2000, and is predicted to reach 5.2 million in 2025 (1). The annual cost for medical care increased from ¥16,015.9 billion (US$145.5 billion; $1 ≒ ¥110, or 6.15% of the gross domestic product: GDP) in 1985 to ¥29,065.1 billion ($261.8 billion or 7.45% of the GDP) in 1997, an annual increase of approximately 5% (2). A significant proportion is used by persons aged 65 years and older (35.1% in 1997).

As in other developed countries, stroke is a common cause of death as well as an important health and economic problem in Japan. Stroke ranks third as a cause of death, following cancer and heart disease (2). The annual medical expenses for stroke were estimated as approximately ¥1,920 billion ($17.46 billion) in 1997, or about 6.6% of the total medical expenses (2), and 78% of these expenses were used for patients aged 65 years and older. The situation holds true for the USA as well, where stroke ranks third as a cause of death after heart disease and cancer, and the annual economic consequences were estimated to exceed $15.6 billion in 1991 (3).

The number of persons left with stroke residuals was estimated as 1.7 million in 1996 (2) and stroke is presumed to be the cause in about 30% of the bed-ridden population (1). It is the most frequent cause of disability, accounting for 12.2% of all causes in 1996, followed by bone and joint disease (12.1%) and heart disease (10.0%) (4), and the most frequent reason for rehabilitation referrals. However, the actual circumstances of stroke rehabilitation in Japan are not well known to the rest of the world, partly because of the limited information available in the English literature.

The introduction of the nation-wide Public Long-Term Care Insurance Program (5) in April 2000 is hoped to pave the way for the forthcoming highly aged society. This program, together with health insurance reform plans currently in hot debate, will exert a major impact on medical rehabilitation. Under these circumstances, rehabilitation professionals are requested to create an efficient and effective stroke rehabilitation program to minimize its consequences. In this article, the current status of rehabilitation, especially of stroke, in Japan is reviewed from the perspectives of epidemiology, structures surrounding rehabilitation practices, outcomes and research, to provide a common ground for discussion for international readers.

EPIDEMIOLOGY OF STROKE

Mortality

In 1997, the number of deaths from stroke was 138,697 (111 per 100,000 population) or 15.2% of total deaths, and ranked third following malignancy (220 or 30.2%) and cardiac diseases (112 or 15.3%) (2). Stroke was the leading cause of death for three

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decades after 1951. Its mortality continued to increase until 1970, when it began to decrease and yielded the first place to cancer in 1981, and was outnumbered by heart disease in 1985. Among the 52 countries studied, the stroke mortality in Japan ranked 25th for men and 36th for women, ranking high by Western European and North American standards, but low compared with other countries (6). This contrasted sharply with its ranking as the highest in the early 1970s. Thus, Japan has experienced the world's most dramatic decrease (about 75%) in stroke mortality. When analysed by type (2), the mortality rate per 100,000 decreased drastically for cerebral hemorrhage, from 120 before 1950 to 25 in 1997. In contrast, the mortality rate for cerebral infarction increased from 10 in 1955 to 70 in 1997. For subarachnoid hemorrhage, the mortality rate gradually increased from 6 in 1955 to 12 in 1996.

Incidence

Data from model areas show a general decrease in stroke incidence. In Hisayama (7), for example, where the demographic characteristics are close to the national statistics, the age and gender-adjusted incidences per 1,000 person-years for all strokes for the three periods (1962–1970, 1971–1979 and 1980–1988) were 3.71, 1.71 and 1.62 for males and 2.34, 1.33 and 1.44 for females. For cerebral hemorrhage, the incidence constantly decreased in males from the first to the third period (0.97, 0.54 and 0.36), but remained at a low level in females (0.25, 0.18 and 0.23). The incidence of cerebral infarction decreased remarkably from the first to the second period, but slightly increased thereafter in both genders (2.35, 1.13 and 1.17 for males and 1.63, 0.83 and 0.90 for females). For subarachnoid hemorrhage, the incidence markedly decreased from the first to the second period and then plateaued in males (0.32, 0.05 and 0.07), but remained at a relatively high level for females (0.40, 0.26 and 0.30). These changes in stroke incidence was brought about by rapid changes in diet and other lifestyles with economic growth between the 1960s and the 1980s and improved blood pressure control (8). It should be noted, however, that although the stroke incidence in general is decreasing, the decrease in cerebral infarction is less among the elderly, in whom the frequency of disability is high (9).

Compared with other countries, the age-standardized incidence of cerebral hemorrhage in people aged 25–74 years living in Akita (from 1984 to 1986) was twice as high as that in Finland (FINMONICA; from 1983 to 1985), while the reverse was true for the incidence of cerebral infarction (10). The incidences per 100,000 population per year were 118 for cerebral infarction, 69 for cerebral hemorrhage and 28 for subarachnoid hemorrhage in men for Akita, and 225, 26 and 33, respectively, for FINMONICA. The incidences were lower for women in both studies, but the general trend was the same as in men.

Survival and recurrence

The survival rates of all strokes range from 70 to 90% at 1 month, 50 to 80 at 1 year, 50 to 60% at 3 years and 30% at 10 years post-stroke (11, 12). The survival rate is influenced by age, type of stroke and gender. Sankai et al. (11), in a study of 297 first-ever strokes in three Japanese rural communities with a total population of 47,000, reported that the risk ratio for death was 2.07 in age 70–79 years and 3.80 in age 80 and older compared with age 60–69 years. The risk ratio was 3.46 for intracerebral hemorrhage with ventricular rupture, 3.38 for subarachnoid hemorrhage and 2.46 for cortical cerebral infarction compared with lacunar infarction. The survival rate was lower for females, who tended to be older at onset and were more prone to fatal strokes than males.

In a long-term follow-up of 171 episodes of cerebral infarction occurring among 1,621 residents aged 40 and over in Hisayama during 1961–1979, recurrence was observed in 20% of those surviving more than 1 month (12). Forty-eight per cent of the recurrence occurred within 2 years and 84% within 5 years (5.4% /year). Recurrence was more frequent for those with hypertension and atrial fibrillation in both genders and with diabetes mellitus in males.

STRUCTURE FOR MEDICAL REHABILITATION

Healthcare system

Japan's healthcare system, characterized by universal coverage, equity and a mandatory fee schedule that controls spending by manipulating prices, has played a major role in Japan achieving the world's longest life expectancy and the lowest infant mortality rate at an exceptionally low cost (7.45% of GDP in 1997) (2). Universal coverage was started in 1961, and currently, two-thirds of the population are covered by the insurance for employees and their dependants, and the remaining one-third by that for the self-employed, their dependants and pensioners managed by the municipalities. In addition, there is a pooling fund created by the Geriatric Health Act in 1983, which covers all healthcare costs incurred by the elderly aged 70 years and over and those bed-ridden between 65 and 69 years of age.

Despite the advantages of equity and low cost, the fee-for service system has resulted in an excessive usage of medication, a lack of control on the volume of treatment and a lack of quality assurance. In the face of rapidly aging society and decelerated economic growth, drastic reform plans, such as increasing patients' share of costs, creating an independent insurance plan for the elderly and introducing inclusive payments for acute inpatient care, are being proposed (13).

Rehabilitation professionals

Physiatrists. In Japan, the specialties involved in stroke rehabilitation mostly consist of physiatry, neurology and neurosurgery, and involvement by geriatricians is rare. Among the specialties, physiatry is relatively new. Although the Japanese Association of Rehabilitation Medicine (JARM) was founded in 1963, a specialty certification board examination was started only in 1980 (14). Two types of specialist were created, one with sufficient knowledge and experience in all fields of rehabilitation medicine (physiatrists) and the other with profound knowledge and experience in a particular field of

rehabilitation while belonging to other specialties (subspecialists). In 1987, there were 122 physiatrists and 136 subspecialists. The certification system underwent a major reform in 1996, when a two-stage system was introduced. In the first stage, those who have completed at least 1 year of a residency during a 4-year postgraduate training and passed a written examination are certified as clinical specialists in rehabilitation medicine. In the second stage, those who have passed the first stage, finished a 3-year rehabilitation training program and passed an oral examination are certified as physiatrists. In 1996, the membership of the JARM amounted to 8,639, and while the number of clinical specialists reached 5,254, there were only 615 physiatrists practising primarily rehabilitation medicine. The number of physiatrists per 100,000 population is among the lowest in the world (0.51 for Japan compared with 4.11 for Belgium, 3.71 for Spain, 3.21 for France, 2.47 for the USA, 2.30 for Denmark, 1.88 for Sweden and 0.15 for the UK) (2, 15).

Until 1998, those who practised rehabilitation medicine could only use the term "physical medicine" or physical therapy" legally. In 1998, the Japanese Government adopted the term "rehabilitation medicine" to be used officially and legally as one of the clinical specialties. According to the 1996 statistics, the number of doctors totalled 240,908 or 191 per 100,000. The proportion by specialty was 31.6% for internal medicine, 10.8% for surgery, 7.1% for orthopedics, 6.0% for pediatrics and only 0.4% for physical medicine. The size of the increase, however, was among the highest (16.3%) (2).

Comedicals. The registration systems for physical therapists (PTs) and occupational therapists (OTs) were started in 1965. The respective numbers of PTs and OTs were only 1,849 and 558 in 1970 (16), but increased to 21,330 and 11,039 in 1996 (2). This was brought about by an increase in training schools (11 for PT and 5 for OT in 1975 to 104 for PT and 93 for OT in 1995). Traditionally, the schools were 3 year special schools after high-school graduation, but the number of colleges and universities is increasing. For other specialists, the licensing for clinical prosthetists and orthotists (CPOs) started in 1990 and the number of certified CPOs was 2,209 in 1996 (2). Certification for speech therapists (ST) started in 1999, when about 2,000 STs were given national licensure (2).

Rehabilitation facilities

The number of hospitals in Japan totalled 9,413 in 1997, with 1.66 million beds (1,000 per 100,000); 53.5% of these were privately owned (2). Of all hospitals, 5,491 (58.3%) had PT and 1,361 (14.5%) had OT rooms (2). The member hospitals of the Japanese Association of Rehabilitation Hospitals (JARH) amounted to 455 in 1998 (17), and they are likely to be providers of active rehabilitation. The 1996 JARH survey gives a rough picture of rehabilitation hospitals in Japan (18). The JARH sent a questionnaire to 399 member hospitals and received replies from 142 (35.8%). There were 29 hospitals (20.4%) with rehabilitation units only (group A), 32 hospitals (22.5%) with rehabilitation units as well as other units (group B) and 81 hospitals (57.1%) without specifically defined rehabilitation units (group C). Group A had the largest mean numbers of rehabilitation staffs (physiatrists: A 5.0, B 1.8, C 1.7; PTs: A 14.5, B 6.8, C 6.0; OTs: A 8.9, B 4.3, C 3.5; STs: A 4.1, B 2.1, C1.7; social workers: A 2.7, B 2.3, C 2.3), the longest mean length of stay (A: 132.5 days; B: 110.4 days; C: 88.2 days), and the largest mean earnings per patient per day by the rehabilitation department (A: $42.4; B: $39.0; C: $23.5). No data are available regarding the proportion of stroke patients among the rehabilitation patients for these facilities, but empirically, stroke patients comprise approximately 70–80% of patients in most rehabilitation facilities.

Since the early 1990s, there has been a nation-wide trend for private hospital owners to manage simultaneously health facilities for the elderly, nursing homes, visiting nurse stations, community care support centers, home help services, care houses, etc., to provide healthcare and welfare services. This "healthcare complex" is more prevalent among rehabilitation hospitals than among general hospitals. A recent JARH survey revealed that 231 of the 348 private member facilities (66.4%) had some kind of health and/or welfare facilities (17). The introduction of the Public Long-term Care Insurance is regarded as a fair wind to this trend, because rehabilitation hospitals, however highly functioning they may be, cannot survive alone and need to take advantage of the vertical integration of healthcare and welfare services.

Payment system

It was not until 1974, when rehabilitation services became appreciated in the health insurance system through the listing of PT and OT fees in the fee list (19). Since then, PT and OT fees have been constantly raised. In 1992, a new fee system for rehabilitation services was started, in which rehabilitation facilities are classified into four ranks according to the criteria that regulate the number of professionals, the gym areas and therapy equipment. As of 1999, 349 facilities were approved as the highest ranking comprehensive rehabilitation facilities (staffed with $\geq$2 physicians, $\geq$5 PTs, $\geq$3 OTs and gym areas $\geq$300 m^2 for PT and $\geq$100 m^2 for OT), and 3,395 and 1,077 facilities approved as rank 2 PT and OT facilities (staffed with $\geq$1 physician, $\geq$1 PT or OT and gym areas $\geq$100 m^2 for PT or OT), respectively (20). Currently, the fee system is more complex, and the fees are determined according to the rank of facilities, patients' age and days from onset (21). The fee for speech therapy is rather low, about one-third of the PT or OT fees, mainly because the certification of STs only started in 1999.

Traditionally, hospital administrators regarded rehabilitation departments as "red-ink" departments. According to a 1978 survey (19), the mean cost price per 100 benefit was 180.1 (meaning a deficit of 80.1%) for PT. Since the doubling of PT and OT fees in 1981, the situation seems to have improved. In 1986, the JARM surveyed the cost price of rehabilitation services in 57 facilities (22). The mean numbers of PTs, OTs and STs were 11.5, 6.1 and 3.3, respectively. The mean cost prices per 100 benefit were 100.8 for PT, 95.9 for OT and 312.2

for ST service, with a total cost price of 107.9 for the rehabilitation department as a whole. These data are rather old, and newer cost–benefit data are needed so that appropriate fee system can be proposed.

In recent years, new fee items supposed to promote earlier discharge, such as comprehensive rehabilitation planning, home visits before discharge, and recovery phase rehabilitation unit are increasing (21). Particularly noteworthy and expected to have a major impact on medical rehabilitation is the recovery phase rehabilitation unit fee, newly created in April 2000. The payment is inclusive except for rehabilitation services that are paid on the fee-for service basis. The candidate patients are stroke patients, post-fracture patients or those with other acute conditions within 3 months from the onset. Although the approval criteria for the unit are rigorous, there is a strong economic incentive to become certified as a unit for well-staffed and well-equipped facilities. Its impact on stroke rehabilitation awaits future analysis.

THE FLOW OF STROKE REHABILITATION

Historically, stroke rehabilitation in Japan developed in rehabilitation hospitals located in remote spa areas, partly because of the Japanese liking of hot springs, attaching some mystical healing power to them. Although this system had the advantage of efficient use of limited rehabilitation resources, it led to the misunderstanding among medical professionals, administrators and consumers that rehabilitation was something different from ordinary medical care. It was a common practice in these hospitals to admit stroke patients long after the onset, often complicated by immobilization syndrome, and to train them for as long as 6 months or more.

After the 1970s, a notion that stroke rehabilitation should be started as early as possible became recognized by some foresighted professionals, and pioneering efforts were made to establish stroke rehabilitation units in urban general hospitals where stroke patients were acutely admitted and provided with multidisciplinary, coordinated and protocol-based care. This resulted in the prevention of immobilization, better functional gain, increased community discharge, shortened length of stay and cost savings compared with historical control data (23). Over the years, it has become common sense among rehabilitation professionals that stroke rehabilitation should be started as early as possible, but unfortunately, this concept is not widely shared among other specialists. Because of the lack of facilities capable of providing sufficient acute rehabilitation and a long waiting list for rehabilitation hospital beds, stroke patients acutely admitted to general hospitals tend to remain bed-ridden or inactive for several months, developing immobilization syndrome when they are transferred to rehabilitation. These patients constitute a significant proportion of referrals, who, with appropriate early phase rehabilitation, should have become independent in activities of daily living (ADL) much earlier. Younger patients with a possibility of returning to work, and patients with special rehabilitation needs, such as dysphagia, cognitive problems and multiple disabling conditions other than stroke, are also referred.

In rehabilitation hospitals, a 3-month program has been popular, but recently, it is becoming shorter owing to the pressure for earlier discharge and increased availability of community rehabilitation services, including daycare rehabilitation, outpatient rehabilitation and home rehabilitation following the introduction of the Public Long-Term Care Insurance Program. After discharge, about 85% of the patients go home, 12% to long-term care facilities, 2% to vocational rehabilitation and 1% to acute care (24). Because of the diminishing care capacity of the families and insufficient community resources, the percentage of bed-ridden patients cared for at home is decreasing (from 69.1% in 1978 to 55.9% in 1984) (23). Coupled with a lack of good-quality long-term care facilities, there has been a problem of the "hospitalization for social reasons" in rehabilitation hospitals. For the smooth and efficient flow of stroke patients, it is necessary to develop a good network of acute rehabilitation units, specialized rehabilitation hospitals, long-term care facilities and community services.

THE PUBLIC LONG-TERM CARE INSURANCE PROGRAM

In April 2000, a new system for long-term care was started in Japan. Although it is too early to judge, it is expected to have a major impact on medical rehabilitation.

Background

In Japan, the care of elderly people, when they became disabled, has been traditionally regarded as the responsibility of family members, particularly the spouses and the daughters-in-law. In recent years, however, elderly people have begun to live longer and remain in need of care for an extended period, while the caregivers themselves grow older as well. In addition, the support capacity of the families is weakening owing to the decreasing proportion of three-generation families, increasing number of women working outside the home and an efflux of the younger generation from rural areas (5). It has therefore become necessary for the society as a whole to sustain the care burden. Under these circumstances, the Public Long-Term Care (LTC) Insurance Act was enforced in 1997, with the aims of: (i) clarifying the relationship between benefits and shares by introducing a social insurance system; (ii) reorganizing the traditional sectionalistic service delivery systems so that unified healthcare and welfare services are provided; (iii) providing individualized services based on users' selection; and (iv) cutting medical expenses by eliminating hospital stays for social reasons (1). The LTC insurance program is a kind of social insurance system that asks Japanese people aged 40 years and older to pay premium contributions. When the insured become disabled, benefits are provided by municipalities either as institutional or home-care services based on the care need levels (Table I). The program was started in 2000, and Japan became the third country to introduce it after The Netherlands and Germany (5).

Table I. *Level of care and the upper limits of benefits in the Public Long-Term Care Insurance Program*

Level of care	Expected care (minutes/day)	State	Upper limits of benefits/ month for home care
0 Social support	<30	Partial support for nail care, bathing, taking medications, management of money, etc.	¥61,500 ($559)
1 Partial care	30–65	Indirect care for toileting/partial or total care for bathing/partial support for nail care and dressing/partial or total care for room cleaning, taking medications, management of money, etc.	¥165,800 ($1,507)
2 Moderate care	65–100	Indirect or direct care for toileting/partial or total care for bathing/partial or total care for dressing, room cleaning, taking medications, management of money, etc.	¥194,800 ($1,771)
3 Heavy care	100–135	Total care for bathing, dressing, room cleaning, taking medications, management of money, etc./increase in forgetfulness, violent words or behaviour	¥267,500 ($2,482)
4 Heaviest care	135–170	Total care for dressing/frequent forgetfulness, violent words or behaviour, problematic behaviour	¥306,000 ($2,782)
5 Severe care	≥170	Total care for all aspects of daily living/almost or totally uncommunicative	¥358,300 ($3,257)

Data Source: announcement by the Ministry of Health, March 2000.

Funding

Half of the funding comes from mandatory premium contributions paid by everyone aged 40 years and older (Fig. 1) (1, 5). The premiums include payroll deductions for the employed with the employer contributing half, health-insurance premiums for the self-employed, and deductions or waivers for very low-income groups. The other half is supported by general taxation, half paid by the central government and the remaining half evenly divided by the prefectures and municipalities. The insurers are the municipalities that also carry the health-insurance programs for the self-employed and pensioners. To reduce inequity among municipalities with different proportions

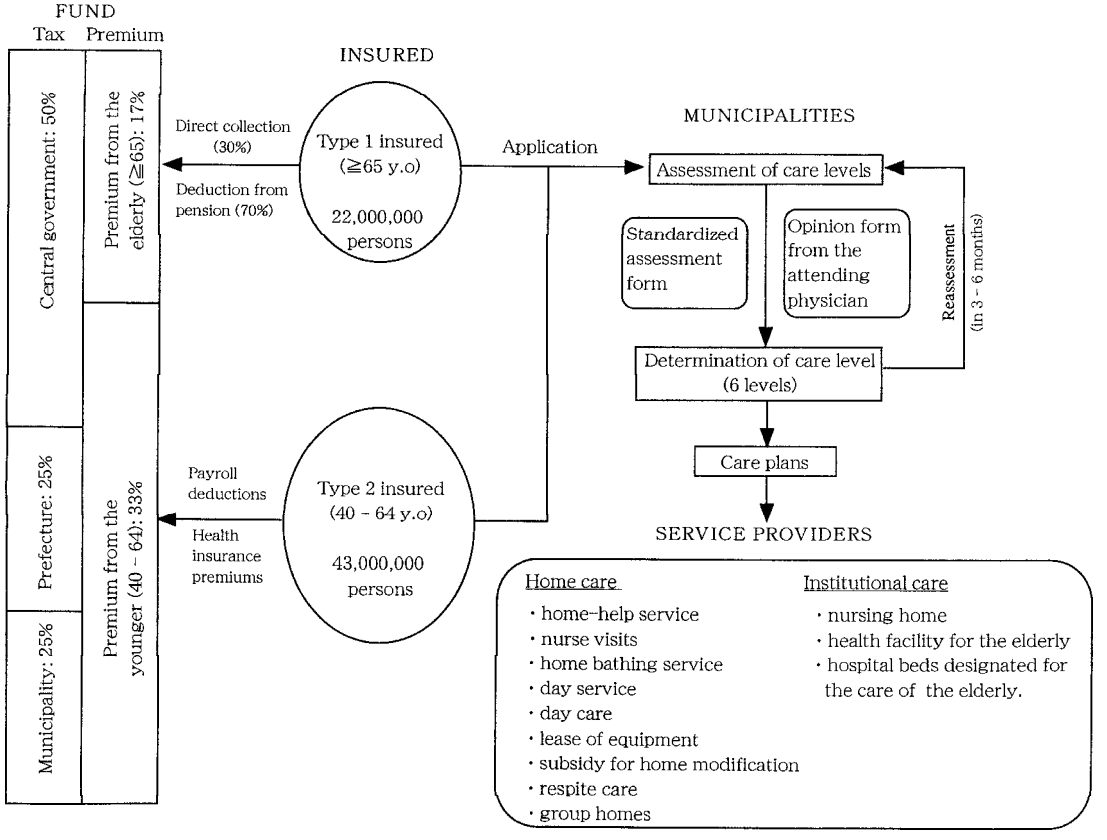

Fig. 1. The Public Long-Term Care Insurance Program. Half of the funding comes from mandatory premium contributions paid by everyone 40 years and older, and the other half is supported by general taxation. Persons aged 65 years and over are automatically eligible, and those between 40 and 64 years are eligible if they have one of the 15 age-related diseases. The benefits include home care and institutional care services. Upon application by the insured, the municipality office assesses and determines the care level, and the six-level classification dictates the maximum amount paid by the insurance for services.

of age groups, a pooling mechanism is available at the national level to allocate resources equally.

Benefits and eligibility

The benefits include home-care services such as home help, nurse visits, day services, lease of equipment, subsidy for home modification and respite care, and institutional care including nursing homes, health facilities for the elderly and hospital beds for the care of the elderly (1, 5). Physicians' fees are included in the inclusive payment made for institutional care or a monthly medical management fee is paid to the attending physician. Ambulatory care in physicians' offices and hospitals, physicians' extra home visits and acute care continue to be covered by the health insurance.

Persons aged 65 years and over are automatically eligible, but those between 40 and 64 years are only eligible if they have one of the following 15 "age-related diseases": presenile dementia, stroke, amyotrophic lateral sclerosis, Parkinson's disease, spinocerebellar degeneration, Shy–Drager syndrome, diabetic triopathy (retinopathy, neuropathy and nephropathy), atherosclerosis obliterans, chronic obstructive lung disease, osteoarthropathy, rheumatoid arthritis, ossification of the posterior longitudinal ligament, spinal canal stenosis, osteoporosis with fracture and Welner syndrome.

Upon application by the insured, the municipality office sends a certified examiner for assessment of eligibility. The examiner assesses the insured according to a standardized assessment form consisting of 85 items. The first 73 items measure direct care (bathing, toileting, feeding, etc.), indirect care (cleaning, laundry, etc.), problematic behavior, and care related to functional training (swallowing, gait, etc.). The remaining 12 items measure the degree of medical supervision such as tube feeding, drip infusion, decubitus care and respiratory care. The extent of informal care available is not considered in determining the eligibility status, to avoid the traditionally prevalent overdependence on informal support. The assessment forms are processed by computers that will automatically classify individuals into six levels (Table I), which were derived from a nationwide time study performed on 3,403 institutionalized elderly persons (1). Using a classification and regression tree analysis, the elderly were classified into six groups according to the total care time based on their attributes. The municipal committee, made up of health and welfare professionals, decides on the appropriateness of the computer-generated initial classification after obtaining further information from the qualitative part of the assessment and the opinion form from the attending physician (5). The six-level classification dictates the maximum amount paid by the insurance for services. To select services within the financial limits, care managers, certified by each prefecture, advise the users in planning their care. The users can make the care plans themselves, and they can also ask for additional services that exceed the limits set by their entitlement level by paying by themselves. Reassessment of the eligibility status is periodically performed every 3–6 months.

Problems and implications

Although the scheme has only just started, many problems have already been pointed out. They include the validity of the classification logic, the integrity and objectivity of the assessment, lack of services, lack of experienced care managers, limitation of eligibility to age-related diseases for those aged 40–64 years, and the gray zone between the existing health insurance system and the LTC insurance (5). The Ministry of Health and Welfare is to review and analyse these problems to make necessary revisions in the near future. One of the greatest concerns for rehabilitation professionals is the lack of sufficient resources to provide appropriate and sufficient medical rehabilitation services to those in need before sending them to the LTC insurance program. This could result in unnecessarily high care loads and elevate the cost for the program. Furthermore, the impact on medical rehabilitation of the LTC insurance together with the health insurance reform needs to be closely watched and analysed. It is argued that rehabilitation hospitals are forced to select their roles as either acute to recovery phase rehabilitation providers covered by the health insurance or chronic phase rehabilitation providers covered by the LTC insurance. They are also forced to cooperate with other facilities in the medical and welfare fields to form healthcare complexes to obtain the maximum benefit from the LTC insurance.

OUTCOMES OF STROKE REHABILITATION

Available data on the outcomes of stroke rehabilitation in Japan will be reviewed for acute, recovery and chronic phases.

Acute phase rehabilitation

Niki (23) reported that about 70% of the 404 stroke patients admitted within 1 month after the onset to an acute rehabilitation unit at a metropolitan community hospital could be discharged home after a length of stay of 2–3 months. Those who were expected to make further recovery with longer, more specialized rehabilitation were referred to rehabilitation hospitals. With intensive acute rehabilitation, however, the referral rate was less than 10%. Furthermore, another 20% remained highly dependent in ADL and needed to be transferred to long-term care facilities. The home discharge rate for fully dependent patients was only 54.3%, compared with 83.9% for all strokes.

Ishigami (25) reported the outcome of a well-defined acute stroke rehabilitation protocol consisting of immediate referral, intensive sitting and standing exercise, gait training initially with knee ankle foot orthosis, and ADL training under close supervision by physiatrists. Unlike global standards, referral to the rehabilitation service is often unnecessarily delayed in Japan owing to the unsupported notion that early sitting impairs cerebral circulation and is harmful, and also due to the lack of well-trained acute rehabilitation teams. With their protocol, however, 67% of the referrals occurred within 2 days and 92% within 5 days from the onset. For those with good sitting balance at the initial evaluation ($n = 14$), the mean rehabilitation stay was

Table II. *Distribution of ADL level at admission and at discharge*

		Age (years)		Type of admission	
ADL level	All patients	≤64	≥65	Direct	Transferred
Admission ADL	(*n* = 1013)	(*n* = 445)	(*n* = 558)	(*n* = 679)	(*n* = 317)
Complete independence (%)	4.0	5.2	3.2	3.2	6.0
Supervision (%)	14.1	16.2	12.4	13.5	15.1
Minimal assistance (%)	17.8	20.0	15.6	16.3	20.5
Moderate dependence (%)	24.7	25.4	24.4	23.4	28.1
Complete dependence (%)	39.4	33.2	44.4	43.6	30.3
Discharge ADL	(*n* = 999)	(*n* = 441)	(*n* = 548)	(*n* = 670)	(*n* = 312)
Complete independence (%)	29.7	38.1	22.8	29.9	29.8
Supervision (%)	33.3	38.3	29.2	27.6	44.9
Minimal assistance (%)	12.3	9.1	14.8	13.7	9.3
Moderate dependence (%)	11.9	8.4	15.0	14.2	7.0
Complete dependence (%)	12.8	6.1	18.2	14.6	9.0

Data source: A Survey of Subacute Phase Rehabilitation for Stroke in Japan, 1998 (27).

19.5 ± 13.3 days and the mean discharge Barthel Index (BI) (26) was 84.0 ± 27.5. Eleven patients (78.6%) became independent ambulators, 2 (14.3%) became ambulators under supervision and 1 (7.1%) died. For those with poor sitting balance initially (*n* = 19), the mean rehabilitation stay was 40.1 ± 3.0 days and the mean discharge BI was 52.0 ± 34.0. Six of them (31.6%) became independent ambulators, 2 (10.5%) became ambulators under supervision, 2 (10.5%) became ambulators with assistance and 9 (47.4%) died. They proposed a practical rule to predict ambulatory status and required rehabilitation days based on the ability to maintain sitting at the initial examination.

The above mentioned are examples of well-organized acute stroke rehabilitation programs, but unfortunately, they are still exceptional. To study the current status of acute to subacute stroke rehabilitation, Chino et al. (27) performed a nation-wide survey. The subjects were first-time stroke patients admitted and discharged in 1997 in whom rehabilitation was started within 30 days after the onset at hospitals where at least one physician specializing in rehabilitation medicine was present, and PT and OT were provided at least five times a week. Sixty-eight facilities scattered across Japan were enrolled, and information was retrospectively gathered about demographics, primary diagnosis, comorbidities, impairment, disability and discharge disposition. Patients with multiple, brainstem or cerebellar lesions were excluded.

In total, 1,018 patients were enrolled (585 males, 424 females), with a mean age of 66.5 ± 12.3 years. There were 584 patients with cerebral infarction and 420 with cerebral hemorrhage (data unavailable in 14). The side of brain lesion was right in 491 and left in 480. The days from onset to the start of rehabilitation (DOR) and length of stay (LOS) were 11 and 70, respectively. When analysed by stroke type, mean DOR was similar (10 for infarction and 11 for hemorrhage), but mean LOS was longer for hemorrhage (64 vs 81). They were shorter for those admitted directly to the enrolled hospitals than for those transferred from other acute hospitals.

The distribution of ADL levels at admission and discharge is shown in Table II. At admission, 39.4% were completely dependent and 4.0% were completely independent. At discharge, the figures changed to 12.8% and 29.7%, respectively. The improvement was greater in younger (≤64 years) patients, and also in patients in whom rehabilitation was started within 10 days. In total, 62.4% were discharged home, 19% were transferred to another hospital for further rehabilitation, 2% for treatment of complications, 11.8% for social reasons, and 2.7% died. Discharge destination was related to discharge ADL level (Table III). This is the first nation-wide study on acute stroke rehabilitation in Japan, and although it is not comprehensive and prospective, it provides a good picture of its current status.

Recovery phase rehabilitation

Table IV shows multicenter outcome data from Japan (24) and the USA (28). Compared with the US data, the percentage of male patients was greater, the mean age was younger, duration from onset to admission and LOS were longer, admission and discharge Functional Independence Measure (FIM) (29) scores were higher, and the percentage of patients returning home was higher for the Japanese. When FIM scores were compared at approximately the same time interval from onset, however, admission FIM scores in Japan (about 60 days from onset) were approximately the same as the discharge FIM scores in the US data (about 50 days from onset). This indicated that physiatrists in the two countries are managing same kind of stroke patients with regard to the severity of disability, but American physiatrists are more responsible for the earlier phase of rehabilitation.

A nation-wide survey of the recovery phase of stroke rehabilitation is presently under way, and as of January 2000, data on 2,700 patients from 100 enrolled facilities had been collected. In this survey, information about the characteristics of the participating facilities, patients' demographics, stroke type, side of lesion, comorbidities, impairment, disability, higher cortical functions and discharge destination are being collected. The results of this study are eagerly awaited.

Chronic phase rehabilitation

Disability. Isagoda (30) studied the functional status of 206 stroke patients discharged from a rehabilitation hospital during

1989–1991 with a self-report BI. They received 167 responses, and excluding 9 who had died, the means of the LOS, the duration from onset to inquiry and the duration from discharge to inquiry were 3.0, 25.3 and 19.4 months, respectively. The mean discharge BI was 90.3 ± 16.5, and the BI decreased in 39 (24.0%) and was unchanged in 119 patients (76.0%). The time-course of the percentage of patients with unchanged BI was estimated using a Kaplan–Meier method. It decreased to 75% at 26 months and 50% at 33 months after discharge. During the first 2 years, the percentage of those maintaining ADL was high, but it decreased thereafter. This is in accordance with previous reports (31, 32). With a multiple regression analysis, the variables selected to explain the decline of BI were premorbid social adaptation, presence of a spouse, female gender, low discharge BI, more family members and stroke recurrence, and the coefficient of determination was 0.300. They stressed the importance of premorbid social adaptation in addition to biological factors such as discharge ADL and stroke recurrence in determining postdischarge functional decline.

The above study is based on a sample discharged from a rehabilitation hospital. To examine functional prognosis in the community, Okamura (33) followed 405 of the 490 stroke patients aged 40 years and older registered from 1969 to 1988 in a community-based stroke prevention program in a south-west rural town with a population of 13,965. The percentage of patients requiring assistance in ADL was 69.4% at 1 week, 57.5% at 1 month, 32.6% at 6 months, 26.4% at 1 year and 19.2% at 3 years after onset. With a multiple logistic regression analysis, factors related to dependence were male gender, higher age, cerebral hemorrhage, disturbance of consciousness and higher systolic blood pressure before stroke.

Sankai et al. (11), in a community-based study of 297 first-ever strokes, noted that after 1 year, 15% of the 206 survivors were totally dependent, 8% were independent only in bedside activities, 15% were household ambulators and 63% were community ambulators. After 3 years, among the 182 survivors, the corresponding figures were 23%, 7%, 15% and 55%, respectively. With a logistic regression analysis, the odds ratio (OR) for dependency in the first year was 6.55 for age 80 years and older compared with age 60–69 years. When analysed by stroke type, the OR was 5.61 for intracerebral hemorrhage with ventricular rupture and 4.53 for cortical cerebral infarction compared with lacunar infarction. In the third year, the OR was significant for ages 70–79 years (3.30), decreased for intracerebral hemorrhage with ventricular rupture (2.98) and increased for cortical cerebral infarction (6.06).

Hachisuka et al. (34) studied whether there were gender differences in lifestyle and ADL performance in elderly stroke patients living in the community with a spouse or family members in Kitakyusyu. They compared 68 male (age 64.4 ± 4.4 years) and 34 female (age 65.1 ± 4.3 years) patients selected from among all registrants in a community-based rehabilitation program using the self-rating BI (SRBI), Frenchay Activities Index (FAI) (35), Stroke Impairment Assessment Set (SIAS) (36), the FIM, and a pedometer for physical activity. Although

Table III. *Discharge destination by ADL*

Discharge ADL	Home	Home, outpatient rehabilitation	Transferred for rehabilitation	Transferred for complications	Transferred for social reasons	Dead	Others	Data not available
$n = 1018$	395 (38.8%)	226 (22.2%)	193 (19.0%)	20 (2.0%)	120 (11.8%)	27 (2.6%)	25 (2.4%)	12 (1.2%)
Complete independence (%)	47.3	39.3	3.6	10.0	2.5	3.7	24.0	16.7
Supervision (%)	38.2	45.1	22.3	30.0	10.8	0.0	36.0	66.7
Minimal assistance (%)	7.6	10.5	23.3	15.0	15.8	0.0	8.0	0.0
Moderate dependence (%)	3.0	4.3	29.5	20.0	25.0	14.8	8.0	0.0
Complete dependence (%)	2.0	0.4	19.7	25.0	45.9	51.9	24.0	8.3
Data not available (%)	1.9	0.4	1.6	0.0	0.0	29.6	0.0	8.3

Data source: A Survey of Subacute Phase Rehabilitation for Stroke in Japan, 1998 (27).

Table IV. *Comparison between data from the Japanese Multicenter Study and the Uniform Data System*

Items	Multicenter Study in Japan (10 facilities) (24)	Uniform Data System (28)
Year	1993	1992
No. of patients	192	26634
Male/female (%)	58.9/41.1	47/53
Mean age (years)	62	71
Onset to admission (days, mean)	53	20
Admission FIM (raw score, mean)	87.2	62
Discharge FIM (raw score, mean)	109.6	85.9
FIM gain (mean)	22.4	23.9
Mean LOS (days)	94.9	26
LOS efficiency (FIM Gain/LOS, mean)	0.24	0.92
% Discharge to community	87	76
Long-term care facility	12	16
Acute care	1	6
Others	0	2

there were no significant differences in age, SRBI, motor score of the SIAS or physical activity, men had significantly lower values than did women for three FIM items (bathing, upper dressing and lower dressing) and total FIM score (112.1 ± 13.7 vs 117.0 ± 11.7, $p < 0.05$), and for six FAI items (preparing main meals, washing up, washing clothes, light housework, heavy housework, and local shopping) and total FAI score (12.0 ± 7.3 vs 23.1 ± 9.6, $p < 0.05$). Because the two groups did not differ in the severity of hemiplegia, the difference was attributed to differences in their lifestyle. Interestingly, among the age-matched healthy controls, men scored significantly lower for the total FAI score (26.8 ± 8.0 vs 34.6 ± 4.0, $p < 0.05$). Although Wade & Hewer (37) in the UK did not support a gender-based association for social activities after stroke, Hsieh et al. (38) in Taiwan found that men were more functionally disabled than women. Thus, it is possible that the traditional gender role differences with regard to household chores in Oriental cultures are associated with lower performance in ADLs and social activities in men, especially among the elderly who tend to maintain conservative notions on gender roles.

Handicap. To identify factors related to the discharge destination of stroke patients, Isagoda & Nakamura (39) compared 106 stroke patients discharged home with 17 patients discharged to institutions after finishing medical rehabilitation. Factors significantly differing between the two groups were discharge BI (100 ± 20 vs 55 ± 40), premorbid social adaptation status (good or moderate:poor 104:4 vs 12:5), premorbid income and the presence or absence of a spouse (100:6 vs 12:5). With a quantification theory type 2, discharge destination could be discriminated using the above four variables with a coefficient of determination of 0.559.

Saeki et al. (40) performed a retrospective cohort study on the association between characteristics of stroke patients at admission and return to work after first stroke in 183 patients younger than 65 years. Using the Kaplan–Meier method, the curve of proportion of return to work had two steep slopes, and the proportion was at its maximum at 18 months from admission. With Cox's proportional hazards models, the ORs of return to work for patients with normal muscle strength versus severe weakness, without apraxia versus with apraxia, and with white-collar versus blue-collar occupations were 5.16, 4.16 and 1.43, respectively. They concluded that normal muscle strength and absence of apraxia were significant predictors of return to work.

Toikawa et al. (41) studied the relationship of impairment (assessed with the SIAS) and disability (measured with the FIM) to handicap as measured with the Craig Handicap Assessment and Reporting Technique (CHART) (42). The subjects were 34 stroke patients (mean age 62.1 years, 28 males, 6 females) discharged home after rehabilitation. The median duration from discharge to the assessment was 23.9 months. The total CHART score was 275.6 ± 84.5 (full score = 500), and the domain scores (full score = 100 for each) were 88.7 ± 34.2 for physical independence, 79.1 ± 25.7 for mobility, 37.5 ± 34.7 for occupation and 70.3 ± 28.6 for social integration. The occupation score was significantly lower than the other three domain scores. Total and domain scores did not differ significantly by lesion side or age, although scores for physical dependence, mobility and occupation tended to be low in older patients. The SIAS score did not correlate significantly with the CHART score (Spearman's $\rho = 0.36$), but the FIM scores did ($\rho = 0.76$). They suggested that the handicap of community stroke patients was related to their disability.

RESEARCH RELATED TO STROKE REHABILITATION

Stroke is an important and frequently studied research topic in Japan. When the topics of articles appearing from 1990 to 1999 in representative rehabilitation journals in Japan, Europe and the USA (Jpn J Rehabil Med, Scand J Rehabil Med and Arch Phys Med Rehabil) were analysed by disease category, stroke comprised the greatest proportions in all three journals (31.6%, 16.7% and 11.4%, respectively), and was highest in the Japanese journal. Table V lists articles by Japanese authors related to stroke rehabilitation published in the English rehabilitation literature. Topics that are frequently covered are measurement (24, 43–47), kinesiology (48–54), exercise physiology (55, 56) and osteoporosis (57–60). However, because

Table V. *Articles by Japanese authors relating to stroke rehabilitation appearing in the English literature*

Category of topics	Arch Phys Med Rehabil	Am J Phys Med Rehabil	Scand J Rehabil Med
Measures and measurement			
Comorbidity	Liu et al. et al., 1997 (24)	Liu et al., 1999 (44)	
Impairment		Kurabayashi et al., 1996 (43)	
		Sonoda et al., 1997 (45)	
		Tsuji et al., 1998 (47)	
Disability		Tsuji et al., 1995 (46)	
Handicap	Hachisuka et al., 1998 (34)		
Kinesiology	Kitamura & Nakagawa, 1996 (49)	Tanaka et al., 1997 (53)	Morita et al., 1995 (50)
	Suzuki et al., 1999 (52)	Tanaka et al., 1998 (54)	Fujiwara et al., 1999 (48)
		Suzuki et al., 1999 (51)	
Imaging		Saeki et al., 1994 (66)	
Electrophysiology		Maeshima et al., 1994 (64)	
Exercise physiology		Tsuji et al., 1999 (56)	Fujitani et al., 1999 (55)
Higher cortical functions			
General	Maeshima et al., 1997 (65)		
Neglect	Arai et al., 1997 (61)		
	Suzuki et al., 1997 (68)		
Speech	Sakamoto et al., 1999 (67)		
Histopathology		Hachisuka et al., 1997 (62)	
Complications			
Shoulder		Ikai et al., 1998 (63)	
Osteoporosis	Liu et al., 1999 (58)	Iwamoto et al., 1999 (57)	
		Sato et al., 1999 (59)	
		Sato et al., 1999 (60)	

many of the important studies performed in Japan are published in the Japanese literature, it is hard for them to reach international colleagues. The productivity of research articles in English needs to be raised to disseminate important Japanese work globally and to contribute to the development of the field. In addition, randomized controlled trials, which have not yet been performed in the field of stroke rehabilitation in Japan, need to be planned to make the field more evidence-based.

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