



RESEARCH ARTICLE

Comparison of Health Status between At-Home-Care and Institutionalized Adults with Down Syndrome in Japan

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Abstract

Background: The mean life expectancy of individuals with Down syndrome has improved markedly, and it has become important that they are able to live a rich life. However, in Japan, the health status of adults with Down syndrome is unclear.

Aims: To examine and compare the health and disease status of Japanese adults with Down syndrome who were living either at home or in an institution.

Methods: Detailed inspection was performed of the medical records of adults (≥ 18 -years-old) with Down syndrome, comprising 59 who were institutionalized and 61 who lived at home. The health status of two cohorts was compared. The clinical findings and status of self-sufficiency of the institutionalized subjects were examined.

Results: In both cohorts, more than half of the subjects, regardless of gender, had dyslipidemia. Hyperuricemia and obesity were significantly more frequent in at-home-care men than in institutionalized men. The most common diseases in the institutionalized subjects were dyslipidemia (61%), ringworm (59.3%), hypothyroidism (30.5%), hyperuricemia (25.4%) and dementia (16.9%; 46% in those in their 60s). Subjects in their 50s or later showed a greater need for assistance in walking/moving, getting dressed and undressed, and bathing.

Conclusions: The health and disease status of Japanese adults with Down syndrome were similar to overseas reports. There is a need to prepare Japanese versions of guidelines for health care management of adults with Down syndrome and to develop a medical care provision system that will be readily accessible to individuals with Down syndrome.

Keywords

Down syndrome, Adult, Health care management

Introduction

Down syndrome (DS) is a representative chromosomal abnormality that is an underlying cause of intellectual disability. In Japan, the prevalence of DS is 1.74 per 1,000 births, and that rate shows an increasing trend [1]. The published literature shows differences among countries, with rates ranging from 0.6 to 2 per 1,000 births in European countries with different cultures, social backgrounds and laws [2,3]. The mean life expectancy of DS individuals has improved markedly from 9-12 years in the 1950s to 50-60 years due to recent advances in medical care for childhood complications, and it has become increasingly important that DS individuals are able to live a rich life, both physically and mentally, even after reaching middle age [4,5]. Due to the increased life expectancy of DS individuals, health care management challenges now range from pediatrics to internal medicine issues in adulthood [5]. In some countries that have population-based disease registration systems, the mean life expectancy, mortality and prevalence of individuals with DS have been elucidated [6-9]. Understanding of the characteristics of the health status of adults with DS has improved, and health care management guidelines have been prepared based on this knowledge [10-12]. With regard to the health issues of adults with DS in Japan, although there have been some case reports and responses from questionnaire survey to the staff of institutions and families [13-15], almost none have described disease status of adults with DS in specific populations from medical records.

Here, we report the health and disease status of Jap-

anese adults with DS who were living either at home or in an institution in Osaka, metropolitan area of Japan.

Materials and Methods

The subjects were adults with DS diagnosed by chromosomal test who were at least 18 years of age and for whom medical records were available at Institution A (59 subjects) or Institution B (61 subjects). The subjects whose medical records were kept at Institution A lived in a facility that admitted mainly children and adults with intellectual disability, while the subjects whose medical records were kept at Institution B lived at home. Clinical findings, diseases, anthropometric data and status of self-sufficiency (i.e., walking and moving, getting dressed and undressed, bathing, taking meals and toileting) were determined by inspection of the results of outpatient examinations and medical records for subjects from Institution A and by inspection of medical records for subjects from Institution B. The means of measured data and the prevalence of diseases and symptoms in each institution were compared between the two cohorts. Obesity was diagnosed using the criterion recommended by the Japan Society for the Study of Obesity, i.e., a Body mass index (BMI) of 25 or greater. The STATA10 statistical software package was used. Percentages were compared using the chi-square test and Fisher's exact test, while differences between the mean values of measured data were analyzed using Welch's t-test. A two-sided p value of < 0.05 was defined as statistically significant. This study was approved by the ethics committees of both participating institutions, and the study was conducted with careful attention to ethical issues and protection of personal information.

Results

Table 1 shows the anthropometric data for the subjects, stratified for institution and gender. The Institution A subjects were significantly older than the Institution B subjects. Body weight was significantly greater in the Institution B subjects in both men and women. BMI did not differ significantly between the two cohorts, although it was higher in both men and women in the Institution B subjects.

Table 2 shows the percentages of subjects with dyslipidemia, hyperuricemia and obesity at each institution. The criteria for these disorders were: For dyslipidemia, any one of a total cholesterol level ≥ 220 mg/dL, triglyceride level ≥ 150 mg/dL or HDL cholesterol level < 40 mg/dL; for hyperuricemia, a serum uric acid level > 7.0 mg/dL; and for obesity, a BMI ≥ 25 . In both cohorts, more than half of the DS subjects of both genders were classified as having dyslipidemia. Hyperuricemia and obesity were significantly more common in Institution B men than in Institution A men.

Table 3 shows the age-stratified percentages of the Institution A subjects with disease based on the detailed inspection of their medical records and examinations. Overall, 60% of the subjects had dyslipidemia or ringworm of the nails and/or skin, and the percentages increased with age. The percentage of subjects with hypothyroidism also increased with age, and more than half of the subjects were affected by their 60s. Men showed higher percentages of these diseases than women. Hyperuricemia were diagnosed in 25% of the total subjects, and hyperuricemia was more common in the 40s age group than in the other age groups. Neurogenic bladder was present in 20% of the total subjects,

Table 1: Comparison of anthropometric data for DS subjects living at Institution A and B.

Male	Institution A				p (< 0.05)	Female				
	Institution A n = 36		Institution B n = 34			Institution A n = 23		Institution B n = 27		p (< 0.05)
Age, mean (SD)	48.6	(13.5)	23.3	(5.7)	< 0.001	54.0	(11.3)	22.4	(3.4)	
Hight (cm), mean (SD)	149.3	(5.8)	153.2	(7.0)	0.020	139.6	(6.2)	140.9	(6.4)	n.s. ²
Body weight (kg), mean (SD)	49.9	(8.6)	57.2	(11.2)	0.005	43.8	(6.4)	49.6	(11.7)	0.042
BMI ¹ , mean (SD)	22.4	(3.6)	24.4	(4.8)	n.s.	22.5	(3.3)	24.8	(5.0)	n.s.

¹BMI: Body mass index

²n.s., no statistical significance

Table 2: Comparison of percentages of DS subjects with dyslipidemia, hyperuricemia and obesity living at Institution A and B.

Male	Institution A			p (< 0.05)	Female		
	Institution A n = 36	Institution B n = 34			Institution A n = 23	Institution B n = 27	p (< 0.05)
Dyslipidemia	55.6%	52.9%	n.s. ¹	69.6%	59.3%	n.s.	
Hyperuricemia	22.2%	73.5%	< 0.001	30.4%	44.4%	n.s.	
Obesity	13.9%	40.7%	0.018	17.4%	43.5%	n.s.	

¹n.s., no statistical significance

Table 3: The age-stratified percentage of DS subjects living at Institution A with disease.

Diagnosed disease	Total	Male						Female													
		Under the age 40 n = 8		40s n = 5		50s n = 18		60s n = 5		Male total n = 36		under the age 40 n = 2		40s n = 4		50s n = 9		60s n = 8		Female total n = 23	
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Dyslipidemia	36	3	(8.3%)	3	(8.3%)	11	(30.6%)	3	(8.3%)	20	(55.6%)	0	(0.0%)	3	(8.3%)	6	(16.7%)	7	(19.4%)	16	(44.4%)
Ringworm of the nails and/or skin	35	4	(11.4%)	4	(11.4%)	11	(31.4%)	4	(11.4%)	23	(63.9%)	1	(2.9%)	1	(2.9%)	4	(11.4%)	6	(17.1%)	12	(34.3%)
Hypothyroidism	18	1	(5.6%)	0	(0.0%)	5	(27.8%)	3	(16.7%)	9	(50.0%)	1	(5.6%)	2	(11.1%)	2	(11.1%)	4	(22.2%)	9	(50.0%)
Hyperuricemia	15	3	(20.0%)	2	(13.3%)	2	(13.3%)	1	(6.7%)	8	(53.3%)	0	(0.0%)	2	(13.3%)	2	(13.3%)	3	(20.0%)	7	(46.7%)
Cataracts	14	0	(0.0%)	0	(0.0%)	6	(42.9%)	2	(14.3%)	8	(57.1%)	0	(0.0%)	0	(0.0%)	2	(14.3%)	4	(28.6%)	6	(42.9%)
Neurogenic bladder	11	1	(9.1%)	0	(0.0%)	2	(18.2%)	1	(9.1%)	4	(36.4%)	0	(0.0%)	1	(9.1%)	5	(45.5%)	1	(9.1%)	7	(63.6%)
Heart disease	10	2	(20.0%)	2	(20.0%)	1	(10.0%)	1	(10.0%)	6	(60.0%)	1	(10.0%)	2	(20.0%)	1	(10.0%)	0	(0.0%)	4	(40.0%)
Dementia	10	0	(0.0%)	0	(0.0%)	3	(30.0%)	3	(30.0%)	6	(60.0%)	0	(0.0%)	0	(0.0%)	1	(10.0%)	3	(30.0%)	4	(40.0%)
Epilepsy	10	0	(0.0%)	0	(0.0%)	3	(30.0%)	2	(20.0%)	5	(50.0%)	0	(0.0%)	1	(10.0%)	0	(0.0%)	4	(40.0%)	5	(50.0%)
Obesity	9	1	(11.1%)	1	(11.1%)	3	(33.3%)	0	(0.0%)	5	(55.6%)	0	(0.0%)	2	(22.2%)	0	(0.0%)	2	(22.2%)	4	(44.4%)
Hypertention	7	0	(0.0%)	0	(0.0%)	4	(57.1%)	0	(0.0%)	4	(57.1%)	0	(0.0%)	0	(0.0%)	2	(28.6%)	1	(14.3%)	3	(42.9%)
Peripheral circulatory failure	6	0	(0.0%)	1	(16.7%)	2	(33.3%)	1	(16.7%)	4	(66.7%)	0	(0.0%)	1	(16.7%)	0	(0.0%)	1	(16.7%)	2	(33.3%)
Diabetes mellitus	5	1	(20.0%)	1	(20.0%)	0	(0.0%)	0	(0.0%)	2	(40.0%)	0	(0.0%)	1	(20.0%)	0	(0.0%)	2	(40.0%)	3	(60.0%)
Sleep apnea attacks	2	0	(0.0%)	0	(0.0%)	0	(0.0%)	1	(50.0%)	1	(50.0%)	0	(0.0%)	0	(0.0%)	0	(0.0%)	1	(50.0%)	1	(50.0%)
Testicular tumor	2	0	(0.0%)	0	(0.0%)	0	(0.0%)	2	(100.0%)	2	(100.0%)	-	(0.0%)	-	(0.0%)	-	(0.0%)	-	(0.0%)	-	(0.0%)

Table 4: Age-stratified status of physical self-sufficiency of DS subjects living at Institution A.

Status of self-sufficiency	< 40 y n = 9	40s n = 8	50s n = 26	60s n = 11	Total n = 54
Walking and moving					
Self-sufficient	9 (100.0%)	7 (87.5%)	18 (69.2%)	5 (45.5%)	39 (66.1%)
Able to walk with some help	0 (0.0%)	0 (0.0%)	2 (7.7%)	0 (0.0%)	2 (3.4%)
Moving is difficult	0 (0.0%)	1 (12.5%)	6 (23.1%)	6 (54.5%)	13 (22.0%)
Getting dressed/undressed and bathing					
Self-sufficient/nearly self-sufficient, although slow	9 (100.0%)	6 (75.0%)	17 (65.4%)	3 (27.3%)	35 (59.3%)
Needs some help	0 (0.0%)	1 (12.5%)	5 (19.2%)	2 (18.2%)	8 (13.6%)
Totally dependent	0 (0.0%)	1 (12.5%)	4 (15.4%)	6 (54.5%)	11 (18.6%)
Taking meals					
Self-sufficient/nearly self-sufficient if the food is served	9 (100.0%)	6 (75.0%)	17 (65.4%)	4 (36.4%)	36 (61.0%)
Need some help	0 (0.0%)	1 (12.5%)	4 (15.4%)	1 (9.1%)	6 (10.2%)
Totally dependent	0 (0.0%)	1 (12.5%)	4 (15.4%)	1 (9.1%)	9 (15.3%)
Can't take meals orally	0 (0.0%)	0 (0.0%)	1 (3.8%)	2 (18.2%)	3 (5.1%)

with most cases aged 50 years or above. Men under the age of 40 showed storage symptoms, with urge incontinence, while men in other age groups showed voiding symptoms and residual urine, and 40% of them had undergone urethral catheterization. The percentage of women suffering from neurogenic bladder was greater than that of men. Dementia was diagnosed in 15% of subjects in their 50s, and increased to half of subjects in their 60s. All cases of epilepsy developed after reaching adulthood and were seen in 10% of subjects in their 40s and 50s, and in about half of those in their 60s. Hypertension was seen in subjects aged 50 years or above. Heart disease was diagnosed in 15% of the total subjects and included four cases of ventricular septal defect (two after surgery), one case of postoperative tetralogy of Fallot, two cases of endocardial cushion defect (one after surgery), two cases of mitral valve prolapse and one case of aortic insufficiency. Each case of mitral valve prolapse and aortic insufficiency had its onset in late middle age, and the subjects were 50-years-old or older. In addition, all subjects in their 30s to 50s were confirmed external signs of senility (one or more of gray hair, loss of head hair, long eyebrow and ear hair, loss of teeth, rounding of the back, cataracts, sunken eyes, elongation and thickening of nails, decreased skin elasticity, wrinkles) [14].

Table 4 shows the age-stratified data on the status of self-sufficiency of 54 DS individuals living at Institution A and for whom information was available. It was difficult for one of eight subjects in their 40s and more than half of subjects in their 60s to walk and move. Some level of assistance for getting dressed/undressed and bathing was needed by one fourth of subjects in their 40s and by two thirds of subjects in their 60s. With regard to taking meals, some level of assistance was needed by one fourth of subjects in their 40s and by one third of subjects in their 50s/60s. Until the age of 40, DS subjects were nearly self-sufficient in regard to walking/moving, getting dressed/undressed and bathing, and

taking meals.

Discussion

Some adults with DS are reported to have secondary diseases and disorders due to non-performance of proper health care management, such as delayed DS diagnosis and late initiation of appropriate therapy [6]. In order to prevent this situation, elucidation of the characteristics of the health status of adults with DS is urgently needed. Once it is clarified, DS individuals and their families can take the necessary health action and medical care workers can provide appropriate assistance.

In this study, we investigated middle-aged and elderly DS subjects living in an institution and young DS subjects living at home with the aims of understanding their lifestyle-related diseases and comparing the institutional and at-home situations in Japan. In addition, we analyzed the diseases and status of self-sufficiency of institutionalized middle-aged and elderly DS subjects.

The DS subjects living at home had been examined at a pediatric hospital and were thought to have at least some disease symptoms, despite their young age. For that reason, it is difficult to make generalizations regarding the results of the comparison between the two cohorts in this study. However, as reported by others [15], the DS subjects who lived at home were more likely to be obese and had dyslipidemia and hyperuricemia.

Institutionalized DS individuals lead an orderly life, and undergo annual health checkups and receive guidance and health care management based on the findings. While it is said the living environment during childhood can be a cause of onset of obesity during adulthood [16], the childhood living environment of the DS subjects in the present study was unclear. DS individuals who live in residential institutions receive health care management and are reported to be less obese compared with those who live at home [15,17]. In the

present study as well, the percentage of obese subjects was smaller among the institutionalized subjects than among the at-home-care subjects.

On the other hand, the prevalence of obesity in the at-home-care DS subjects was higher than that in the Japanese general population (29.5% in men and 20.8% in women ≥ 15 -years-old) [18]. It is important to prevent obesity in order to prevent diseases that are caused by or associated with obesity (e.g., dyslipidemia, liver dysfunction, hyperuricemia, orthopedic diseases, sleep apnea attacks). BMI has been reported to be an indicator of adiposity [19]. BMI is easily calculated from measurements of body height and weight, and it is hoped that it will be used for health care management and disease prevention in DS individuals. Also, there is a need to compile long-term data regarding the incidences of obesity-related diseases.

In Japan, hyperuricemia (including asymptomatic cases) occurs in about 20% of adult men, and its incidence peaks in the 30s and 40s, exceeding 30% in the 30s. In women, serum uric acid levels increase after menopause, showing incidences of 1.3% in those less than 50-years-old and 3.7% in those 50-years-old or older [18]. In the present study, the percentage of hyperuricemia was higher than in the general population for both genders, and it was especially high in women. Progression of hyperuricemia is often asymptomatic, making it difficult to detect. As hyperuricemia can cause conditions such as gout, renal dysfunction and urinary stones, it is necessary to achieve early detection by means of regular blood tests and to take appropriate countermeasures.

Hypothyroidism is said to be a common complication in adults with DS [6,10,12], and it was observed in approximately 30% of the subjects in this study. It is important to differentiate hypothyroidism from other diseases that show similar clinical pictures and manifest at about the same age, such as regression phenomena, depression and Alzheimer's dementia. Since treatment for hypothyroidism has been established, it is important to perform regular palpation and assay of the blood levels of Thyroid stimulating hormone (TSH) and thyroid hormones (fT3, fT4). It is also necessary to measure anti-thyroid antibody and confirm whether Hashimoto's disease is present as a complication.

The percentage of subjects diagnosed with dementia was smaller among subjects in their 40s and 50s in the present study than the proportions reported in other countries [20]. Since it is difficult to assess cognitive function in subjects who also have intellectual disability and there are few opportunities for performing diagnostic imaging, it can be surmised that the number of cases actually diagnosed with dementia is smaller than the true number. There is thus a need to first establish objective assessment indices for the clinical symptoms associated with dementia in DS and other forms of intel-

lectual disability.

Epilepsy in DS individuals is said to manifest most often as infantile spasm and epilepsy that develops in adulthood. In the present study, all cases were adult-onset epilepsy, and the seizure type was tonic-clonic seizure. Epilepsy and apnea are diseases that are also seen from adulthood, and it is thus necessary to take this into account as a part of health care management.

DS is rarely accompanied by congenital abnormalities of the renal and urinary systems. It is said that the contractile force of the bladder during adulthood is reduced more than in the general adult population, and that this can cause urinary retention and difficulty in urination [5]. Since symptoms may be exacerbated when anti-psychotic drugs and antidepressants are administered in cases in which the chief complaints are psychological symptoms, such as irritability and anxiety, differential diagnosis is very important. In this study, all middle-aged and elderly subjects diagnosed with neurogenic bladder had voiding symptoms. In adults with DS, diagnosis and treatment are very important for achieving improvement in psychological symptoms and quality of life.

Our data show that the need for assistance in regard to walking and moving, getting dressed and undressed, and bathing increases in DS individuals in their 50s and 60s. In this study, our understanding of the age-stratified status of self-sufficiency of the DS subjects was horizontal, and for that reason it will be necessary to carry out a longitudinal study to determine what changes occur with age.

Hypertension is a disease that is associated with obesity, and it tends to increase with age. In Japan, 47.5% of adult Japanese men and 43.8% of adult Japanese women aged 30 years or above have a systolic BP of ≥ 140 mmHg, a diastolic BP of ≥ 90 mmHg, or are taking antihypertensive medication [21]. Approximately 10% of the subjects in this study had hypertension, which is lower than the percentage in the adult population without DS. The standards for high blood pressure itself that could cause health issues in DS individuals need to be investigated separately from general adults.

In the 1970s, Murdoch, et al. were the first to point out that DS is an 'atheroma-free model', and since then it has been pointed out that, even when DS individuals have lipid metabolism abnormalities, few have arterial heart disease or hypertension [22]. In our study as well none of the subjects had arterial heart disease, despite the fact that many had dyslipidemia.

Two of the subjects in our study cohort had testicular tumors, but no other malignant tumors were observed. DS individuals have been reported to be at a high risk of leukemia at all ages, but at low risk of solid tumors [23-27]. DS individuals often develop testicular tumors, and testicular palpation is recommended once

per year [5]. Japan has not seen any progress at all in the epidemiology of cancer in people with intellectual disabilities, including DS. Today, there is no consensus in Japan regarding what cancer screening adults with DS should undergo. However, they should certainly undergo at least the same public screening that is performed for the general populace.

Adults with DS include those who have had disease requiring management continuously since childhood and also those who develop issues after becoming adults. Thus, it is important to take a holistic approach to health care management of DS individuals, encompassing a broad range of internal medicine diseases, mental and psychological diseases, otolaryngologic diseases and ophthalmic diseases, orthopedic diseases and urological diseases. We need to prepare Japanese versions of guidelines for health care management of adults with DS [5,10-12]. To educate medical caregivers, DS individuals themselves and their families regarding the clinical characteristics of adult DS and strategy of how to cope with these conditions also is necessary. The development of a medical care provision system that will be readily accessible to individuals with DS will be expected.

Limitations of this study include the following: The number of DS subjects was small, and the at-home-care cohort did not include middle-aged to elderly subjects. In addition, the detailed inspection of medical records, which included examinations, that was performed for the institutionalized subjects could not be performed for the at-home-care subjects. In Japan today, we have no understanding of the health care management status that is received by adults with DS who live at home, that is, whether or not they undergo regular health checkups, where those checkups are performed and whether or not there is a primary care physician. Further research entailing a larger number of subjects is needed, along with surveys of DS individuals and their families regarding their health awareness, action of receiving medical treatment and lifestyle during childhood.

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Conflict of Interest

There are no conflicts, financial or personal for the authors that may potentially bias the work for all authors.

Authors Contribution

All authors contributed this work, including examination for subjects, data analysis and writing.

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