Prevalence of Chronic Medical Conditions in Adults With Mental Retardation: Comparison With the General Population

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Abstract: We interviewed caregivers and reviewed medical records of 278 adults with mental retardation with and without Down syndrome, 45 to 74 years of age. Standardized morbidity ratios were used to compare frequency of medical disorders in these adults to frequency in the general population. In adults with mental retardation, the frequency of common age-related disorders was comparable to that in the general population, but there was an increased frequency of thyroid disorders, nonischemic heart disorders, and sensory impairment. Surveillance of health status and increased access to health care for screening and treatment of age-related disorders that are more frequent in adults with mental retardation would be important to prevent the development or delay the impact of these conditions and to promote healthy aging.

Improvements in the life expectancy of individuals with mental retardation over the last 50 years have been well-documented, with increases especially dramatic for individuals with Down syndrome (Baird & Sadovnik, 1987; Carter & Jancar, 1983; Dupont, Vaeth, and Videbech, 1986; Eyman, Borthwick-Duffy, Call, & White, 1988; Eyman, Call, & White 1991; McGrather & Marshall, 1990; McLoughlin, 1988; Thase, 1982). This has resulted in a rapid expansion of the population of older adults with mental retardation, stimulating researchers to assess the prevalence of age-related disease in order to provide estimates of the health care needs of older people with mental retardation.

Because many individuals with neurodevelopmental disorders have associated neurological, endocrine, and metabolic disorders, it is possible that the spectrum of age-related disease or the age at onset of disease might be different from that in the general population. The results of previous studies have been inconsistent. Some investigators have suggested that the most frequent physical health problems of older people with mental retardation are similar to those of older people in general, including loss of mobility, accidental injury, arthritis, sensory impairment, respiratory problems, and incontinence (Anderson, 1989; Janicki & Jacobson, 1986; Moss, Goldberg, Patel, & Wilkin, 1993). Other investigators have suggested that the prevalence of health problems is higher than in people without mental retardation (Beange, McElduff, & Baker, 1995; Day, 1987; Day & Jancar, 1994; Evenhuis, 1997; Hand, 1993; Haveman, Maaskant, & Sturmans, 1989; Lantman-de Valk et al., 1997; Maaskant & Haveman, 1990). Some of the differences between studies may be due to differences in the age range of the samples studied, the range of disorders surveyed, or differences in the distributions of type of mental retardation (e.g., with and without Down syndrome) and severity of disability, all of which can contribute to differences in age-specific and overall rates. Investigators have directly compared the prevalence of common chronic age-related disease with that in the general population. This

comparison requires estimates of the frequency of disease that make systematic adjustment for differences in age and in age-specific proportions of men and women between people with mental retardation and those in the general population. In assessing health status of adults with mental retardation, it is also useful to distinguish between conditions that appear to be comorbid with a syndrome or categorical disability (e.g., Down syndrome and Alzheimer's disease) and age-related chronic health problems that are prevalent among older people in general.

In the present study we used standardized morbidity ratios to compare the prevalence of common chronic medical conditions in a population-based sample of people with mental retardation with prevalence in the general population. The *standardized morbidity ratio* is a summary statistic of overall disease prevalence that adjusts for differences in the age and/or gender structure between two groups by computing the ratio of the number of people affected in the study population to the number that would be expected if the study population had the same age-specific or age- and gender-specific disease rates as the general population (Kelsey, Thompson, & Evans, 1986).

Method

Participants

The data for this study were collected as part of the Family Health Study of the New York State Institute for Basic Research in Developmental Disabilities (Schupf, Kapell, Lee, Ottman, & Mayeux, 1994). Adults with mental retardation with and without Down syndrome residing in the 9-county downstate region of New York were identified from a computerized database maintained by the New York State Office of Mental Retardation and Developmental Disabilities, supplemented by an independent survey of state and voluntary service providers to obtain information on Down syndrome status (Schupf et al., 1994; Zigman, Schupf, Sersen, & Silverman, 1996). We selected a random sample of adults with Down syndrome, 30 to 70 years of age, and a group of adults with mental retardation due to other causes, frequency matched to the adults with Down syndrome on the basis of age, gender, and severity of mental retardation. Informed consent to participate was provided by a responsible family member. Potential participants without first-degree relatives and without any contact with second-degree relatives were classified as ineligible (28%). Participation among eligible families was 72%. Participants did not differ with respect to major demographic and disability characteristics (e.g., gender, ethnicity, level of mental retardation, or etiological or categorical diagnosis) from those whose families refused or those who were ineligible. The participants were 131 adults with Down syndrome and 147 adults with other forms of mental retardation (hereafter called the non-Down syndrome group). Table 1 presents the demographic characteristics of the two groups of subjects. Adults with mental retardation due to Down syndrome and other causes were comparable with respect to the distribution of gender, level of mental retardation, and residential placement, whereas adults with Down syndrome

Table 1
Demographic Characteristics by Group

Characteristic	Down syndrome		Non-Down syndrome	
	n	%	*n*	%
Age (mean, *SD*)	53.8	6.1	56.3	7.3*
Age group				
45–64	117	91.4	124	84.4
65+	11	8.6	23	15.6
Gender				
Male	72	55.0	71	48.3
Female	59	45.0	76	51.7
Level of mental retardation				
Mild	20	15.3	24	16.3
Moderate	20	15.3	27	18.4
Severe	58	44.3	60	40.8
Profound	33	25.2	36	24.5
Residential placement				
Institution	33	25.2	45	30.6
Community residence	98	74.8	102	69.4

*$p < .05$.

were slightly younger and had a lower proportion of people in the oldest age group (Table 1).

Medical History

A semi-structured interview was conducted with a caregiver (family member, direct-care staff member, or staff supervisor) at the subject's residential or day-treatment facility. The interviewer obtained information on age, gender, ethnicity, etiological and functional diagnoses, and medical history. Medical history information included questions on history of infections, neurodegenerative disorders (e.g., Alzheimer's disease), cardiovascular and cerebrovascular disease, malignancy, diabetes, thyroid disorders, hypertension, autoimmune disorders, gastrointestinal disorders, sensory impairment, history of seizures and seizure disorders, and medications taken. For each condition named, we ascertained age at onset, duration, and treatment history. Past and current medical records were reviewed for all subjects to confirm information obtained on interview. We classified as prevalent only conditions that were present at the time of the interview and had a duration of at least 3 months. Chronic conditions were coded using the ninth revision of the International Classification of Disease (World Health Organization, 1980) to enable comparison with data derived from the general population survey described next.

National Health Interview Survey

We used data from the 1993 National Health Interview Survey (National Center for Health Statistics, 1994) to estimate the prevalence of chronic medical conditions in the general population because the methods of data collection employed for this survey are most comparable to those that we used. The National Health Interview Survey is a continuing nationwide survey conducted via household interview. Each week a probability sample of the civilian noninstitutionalized population of the United States is interviewed to obtain information about health and other characteristics of each member of the household. Information is provided by each adult family member residing in the household, from proxy respondents when the household members are not at home at the time of the interview, and from proxy respondents for children or family members who are physically or mentally incapable of responding for themselves.

We chose the 1993 data because it represents the mid-point of our own period of data-collection. The interview sample for 1993 consisted of 43,007 households containing 109,671 persons. Information was collected on demographic characteristics, illnesses, injuries, disabilities, impairments, use of health care, and other health topics. Only episodes of illness that resulted in a visit to a physician or in restricted activity were included in the estimates. Illness was coded using the ninth revision of the International Classification of Disease (World Health Organization, 1980). A condition was considered chronic if it had lasted at least 3 months before the date of the interview or was a condition that ordinarily had a duration of more than 3 months (National Center for Health Statistics, 1994).

Statistical Analysis

We used standardized morbidity ratios to compare the age-adjusted prevalence of chronic medical conditions in adults with mental retardation with the prevalence of medical conditions in the general population (Kelsey et al., 1986). Comparison of crude summary rates across populations can be misleading because populations with different age structures will yield different unadjusted summary rates, even if the age-specific disease rates are comparable. The standardized morbidity ratio provides an overall comparison using the ratio of the observed number of people affected with a medical condition to the number that would be expected to be affected on the basis of a table of age- or age- and gender-specific rates for the general population. Disease rates from the National Health Interview Survey were applied to the numbers of individuals in two age groups used by the National Health Interview Survey (45 to 64 and 65 to 74) to obtain the expected number of cases for each age group. The observed and expected number of cases were then summed over the two age groups and the standardized morbidity ratio was computed as (total observed/total expected). Standardized morbidity ratios greater than 1.0 indicate an excess, and those less than 1.0, a decrease of observed cases over the number expected. We used standardized morbidity ratios to compare age-adjusted and age- and gender-adjusted rates for individuals with mental retardation with and without Down syndrome to those in the general population. For analyses of disease preva-

lence by level of mental retardation, we collapsed individuals with mild or moderate mental retardation and individuals with severe and profound mental retardation into two groups to provide sufficient sample size within groups. All calculations were made using Quattro Pro 4.0 for DOS (Borland). We compared the prevalence of chronic diseases among persons with mental retardation with and without Down syndrome by direct age-adjustment of rates and logistic regression. In direct adjustment, disease rates from each comparison group are applied to a standard population, which supplies the weights, or proportion of individuals within each age group. For these analyses we used the total population of the two comparison groups stratified by 10-year age intervals as the standard population. Differences in prevalence were evaluated by logistic regression, with the odds ratio adjusted for age, gender, and level of mental retardation. All logistic regression procedures were conducted using SPSS (SPSS, 1992).

Results

Table 2 presents the standardized morbidity ratios for chronic medical conditions for each group separately. All individuals with mental retardation had a significantly higher than expected frequency of thyroid conditions, heart disease, and visual impairment. All individuals with thyroid conditions were diagnosed with hypothyroidism, and all were receiving synthroid treatment ($n = 55$). Although the frequency of heart disease was elevated, the frequency of ischemic heart disease was comparable to that in the general population in both groups with mental retardation. The excess of heart disease in individuals in both groups with and without Down syndrome was accounted for by nonischemic heart disorders, including heart murmur, prolasped mitral valve, and bradycardia. For thyroid disorders, nonischemic heart disorders, and visual impairment, the excess of affected persons was greater for individuals with Down syndrome than for individuals with other forms of mental retardation. The prevalence of chronic medical conditions that are common in the general population, such as diabetes, ischemic heart disease, stroke, and ulcers, were not elevated among adults with Down syndrome or among adults with other forms of mental retardation. Adults with Down syndrome, but not

Table 2
Age-Specific Prevalence and Standardized Morbidity Ratios of Selected Chronic Medical Conditions

Medical condition/Age group	NHIS[a]	Down syndrome	SMR[b] (95% CI)[c]	Non-Down syndrome	SMR (95% CI)
Diabetes					
45 to 64	6.2	4.3		2.4	
65 to 74	10.2	9.1	0.72 (0.3, 1.6)	4.3	0.40 (0.1, 1.1)
Thyroid					
45 to 64	2.7	33.6		5.7	
65 to 74	3.7	45.5	12.5 (9.1, 16.8)*	9.1	2.2 (1.0, 4.2)*
Ulcers					
45 to 64	2.5	1.8		5.1	
65 to 74	3.6	10.0	0.96 (0.2, 2.8)	0.0	1.6 (.60, 3.5)
Hypertension					
45 to 64	21.7	1.7		23.6	
65 to 74	34.3	9.1	0.10 (0.2, 0.3)*	21.7	0.98 (0.7, 1.4)
All heart					
45 to 64	11.9	42.7		20.2	
65 to 74	27.9	27.3	3.1 (2.3, 4.1)*	34.8	1.6 (1.1, 2.2)*
Ischemic heart					
45 to 64	4.6	3.4		4.1	
65 to 74	13.2	9.1	0.74 (0.2, 1.7)	13.0	0.92 (0.4, 1.8)
Other heart					
45 to 64	4.4	33.3		12.9	
65 to 74	9.2	27.3	6.8 (4.9, 9.1)*	13.0	2.5 (1.5, 3.9)*
Visual impairment					
45 to 64	4.9	3.2		1.5	
65 to 74	6.5	70.0	7.2 (5.3, 9.7)*	17.4	2.9 (1.8, 4.4)*
Stroke					
45 to 64	1.9	2.6		0.8	
65 to 74	4.7	9.1	1.5 (0.4, 3.7)	0.0	0.3 (0.0, 1.6)

[a]National Health Interview Survey. [b]Standardized morbidity ratio. [c]Confidence interval.
*$p < .05$.

adults with other forms of mental retardation, had a significantly lower prevalence of hypertension compared with the general population.

Tables 3 and 4 present the standardized morbidity ratios for chronic medical conditions for men and women separately by group. In general, we did not observe gender differences in the prevalence of age-related disorders such as thyroid disorders and ischemic heart disease that are typical of adults in this age range in the general population. For individuals with Down syndrome (Table 3), the pattern of results is similar to that observed for the total group, with a significant excess in the frequency of thyroid disorders, nonischemic heart disorders, and visual impairment and a significant decrease from expected in the frequency of hypertension, especially among men with Down syndrome. The prevalence of thyroid disorders was similar among men and women with Down syndrome, whereas women in the general population have a higher prevalence of thyroid disorders then do men. For individuals with other forms of mental retardation (Table 4), the pattern of results is also similar to that observed for the total group, although a statistically significant excess of affected persons over that expected was found only for nonischemic heart disorders and visual impairment because of small sample size and large confidence intervals.

Table 5 presents the standardized morbidity ratios for chronic medical conditions by level of mental retardation. Individuals with Down syndrome with mild/moderate and with severe/profound mental retardation showed a statistically significant excess of thyroid disorders, nonischemic heart disorders, and visual impairment as well as a statistically significant decrease in the frequency of persons with hypertension. Similarly, individuals with other forms of mental retardation had an increased frequency of thyroid disorders, nonischemic heart disorders, and visual impairment, but the increase was not as great as that for adults with Down syndrome and did not reach statistical significance for thyroid disorders. Within both groups, the prevalence of chronic medical conditions was similar for those with mild/moder-

Table 3
Age-Specific Prevalence and Standardized Morbidity Ratios of Selected Chronic Medical Conditions in Down Syndrome by Gender

Medical condition/ Age group	Females NHIS[a]	Females with Down syndrome	SMR[b] (95% CI)[c]	Males NHIS	Males with Down syndrome	SMR (95% CI)
Diabetes						
45 to 64	5.9	0.0		6.5	7.5	
65 to 74	10.4	12.5	0.3 (0.0, 1.5)	10.0	0.0	1.1 (0.4, 2.5)
Thyroid						
45 to 64	4.3	44.9		0.9	25.4	
65 to 74	6.0	50.0	10.1 (6.6, 14.8)*	1.0	33.3	27.5 (16.4, 43.8)*
Ulcers						
45 to 64	3.1	2.1		1.9	3.2	
65 to 74	4.2	14.3	1.1 (0.1, 4.1)	2.9	0.0	0.8 (0.1, 4.3)
Hypertension						
45 to 64	22.3	3.9		21.1	0.0	
65 to 74	35.9	12.5	0.2 (0.1, 0.6)*	32.3	0.0	0.0 (—)
All heart						
45 to 64	10.8	52.0		13.1	35.8	
65 to 74	22.4	25.0	3.9 (2.6, 5.6)*	34.7	33.3	2.5 (1.6, 3.7)*
Ischemic heart						
45 to 64	2.7	2.0		6.6	4.5	
65 to 74	9.3	12.5	0.96 (0.1, 3.5)	17.9	0.0	0.6 (.12, 1.8)
Other heart						
45 to 64	5.7	42.0		3.0	26.9	
65 to 74	9.3	25.0	6.4 (4.1, 9.6)*	9.2	33.3	8.2 (4.9, 12.9)*
Visual impairment						
45 to 64	4.9	26.5		4.4	35.8	
65 to 74	6.5	50.0	6.0 (3.5, 9.7)*	9.2	100.0	8.3 (5.5, 12.1)*
Stroke						
45 to 64	1.9	0.0		1.9	4.5	
65 to 74	4.2	12.5	0.8 (0.1, .43)	5.3	0.0	2.1 (0.4, 6.2)

[a]National Health Interview Survey. [b]Standardized morbidity ratio. [c]Confidence interval.
*$p < .05$.

Table 4
Age-Specific Prevalence and Standardized Morbidity Ratios of Selected Chronic Medical Conditions in Non-Down Syndrome Group by Gender

Medical condition/ Age group	Females NHIS[a]	Females without Down syndrome	SMR[b] (95% CI)[c]	Males NHIS	Males without Down syndrome	SMR (95% CI)
Diabetes						
45 to 64	5.9	1.6		6.5	3.4	
65 to 74	10.4	7.1	0.4 (0.1, 1.4)	10.0	0.0	0.4 (0.1, 1.5)
Thyroid						
45 to 64	4.3	9.8		0.9	1.6	
65 to 74	6.0	7.7	2.1 (0.8, 4.1)	1.0	11.1	3.0 (0.3, 10.9)
Ulcers						
45 to 64	3.1	4.8		1.9	6.9	
65 to 74	4.2	0.0	1.2 (0.2, 3.5)	2.9	0.0	2.3 (0.5, 6.8)
Hypertension						
45 to 64	22.3	24.2		21.1	23.0	
65 to 74	35.9	28.6	1.0 (0.6, 1.6)	32.3	11.1	0.9 (0.5, 1.6)
All heart						
45 to 64	10.8	25.8		13.1	14.5	
65 to 74	22.4	21.4	1.9 (1.2, 3.0)*	34.7	55.5	1.2 (0.7, 2.1)
Ischemic heart						
45 to 64	2.7	6.5		6.6	1.6	
65 to 74	9.3	7.1	1.7 (0.5, 3.9)	17.9	22.2	0.5 (.1, 1.5)
Other heart						
45 to 64	5.7	14.5		3.3	11.3	
65 to 74	9.3	7.1	2.1 (1.0, 3.8)*	9.2	22.2	3.3 (1.5, 6.3)*
Visual impairment						
45 to 64	4.9	12.9		4.4	16.1	
65 to 74	6.5	21.4	2.7 (1.3, 4.9)*	9.2	11.1	3.1 (1.5, 5.5)*
Stroke						
45 to 64	1.9	0.0		1.9	1.6	
65 to 74	4.2	0.0	0.0 (—)	5.3	0.0	0.6 (0.1, 3.4)

[a]National Health Interview Survey. [b]Standardized morbidity ratio. [c]Confidence interval.
*$p < .05$.

Table 5
Age-Specific Prevalence and Standardized Morbidity Ratios of Selected Chronic Medical Conditions by Level of Mental Retardation

Medical condition/ Level of retardation/ Age group	NHIS[a]	Down syndrome	SMR[b] (95% CI)[c]	Non-Down syndrome	SMR (95% CI)
Diabetes					
Mild/moderate					
45 to 64	6.2	5.4		6.8	
65 to 74	10.2	50.0	1.2 (0.2, 3.5)	0.0	0.9 (0.2, 2.6)
Severe/profound					
45 to 64	6.2	3.8		0.0	
65 to 74	10.2	0.0	0.5 (0.1, 1.5)	5.9	0.2 (0.0, 0.8)
Thyroid					
Mild/moderate					
45 to 64	2.7	25.0		6.7	
65 to 74	3.7	50.0	9.6 (4.6, 17.7)*	0.0	2.1 (0.4, 6.1)
Severe/profound					
45 to 64	2.7	37.5		5.1	
65 to 74	3.7	44.4	13.8 (9.5, 19.2)*	12.5	2.2 (0.8, 4.9)
Ulcers					
Mild/moderate					
45 to 64	2.5	2.8		4.7	
65 to 74	3.6	0.0	1.0 (0.1, 5.7)	0.0	1.6 (0.2, 5.6)
Severe/profound					
45 to 64	2.5	1.3		5.3	
65 to 74	3.6	12.5	0.9 (0.1, 3.3)	0.0	1.6 (0.4, 4.2)

(Continued on next page)

Table 5 (continued)

Medical condition/ Level of retardation/ Age group	NHIS[a]	Down syndrome	SMR[b] (95% CI)[c]	Non-Down syndrome	SMR (95% CI)
Hypertension					
Mild/moderate					
45 to 64	21.7	2.8		26.7	
65 to 74	34.3	50.0	0.2 (0.1, 0.8)*	50.0	1.3 (0.7, 2.1)
Severe/profound					
45 to 64	21.7	1.3		21.8	
65 to 74	34.3	0.0	0.05 (0.0, 0.3)*	11.8	0.8 (0.5, 1.3)
All heart					
Mild/moderate					
45 to 64	11.9	45.9		20.0	
65 to 74	27.9	0.0	3.4 (2.0, 5.5)*	50.0	1.7 (0.9, 3.0)
Severe/profound					
45 to 64	11.9	41.3		20.3	
65 to 74	27.9	33.3	3.0 (2.1, 4.4)*	29.4	1.5 (0.9, 2.3)
Ischemic heart					
Mild/moderate					
45 to 64	4.6	0.0		4.4	
65 to 74	13.2	0.0	0.0 (—)	16.7	1.1 (0.2, 3.1)
Severe/profound					
45 to 64	4.6	5.0		3.8	
65 to 74	13.2	11.1	1.0 (0.3, 2.4)	11.8	0.9 (0.3, 2.0)
Other heart					
Mild/moderate					
45 to 64	4.4	37.8		13.3	
65 to 74	9.2	0.0	7.6 (4.2, 12.8)*	33.3	3.1 (1.4, 6.2)*
Severe/profound					
45 to 64	4.4	31.3		12.7	
65 to 74	9.2	33.3	6.4 (4.2, 9.2)*	5.9	2.2 (1.1, 3.9)*
Visual impairment					
Mild/moderate					
45 to 64	4.9	16.2		8.9	
65 to 74	6.5	50.0	3.8 (1.5, 7.9)*	16.7	2.0 (0.6, 4.6)
Severe/profound					
45 to 64	4.9	39.2		17.7	
65 to 74	6.5	75.0	8.7 (6.1, 12.0)*	17.6	3.4 (1.9, 5.4)*
Stroke					
Mild/moderate					
45 to 64	1.9	0.0		0.0	
65 to 74	4.7	0.0	0.0 (—)	0.0	0.0 (—)
Severe/profound					
45 to 64	1.9	3.8		1.3	
65 to 74	4.7	11.1	2.1 (0.6, 5.3)	0.0	0.4 (0.1, 2.4)

[a]National Health Interview Survey. [b]Standardized morbidity ratio. [c]Confidence interval.
*$p < .05$.

ate and those with severe/profound mental retardation. However, the frequency of ischemic heart disease and stroke was higher in adults with Down syndrome with severe/profound mental retardation compared with those with mild/moderate mental retardation, whereas the frequency of diabetes was lower.

Table 6 presents age-adjusted prevalence for chronic medical conditions and compares the odds ratio and 95% confidence interval to compare prevalence in adults with Down syndrome to that in adults with other forms of mental retardation, adjusted for age, gender, and level of mental retardation. Adults with Down syndrome were significantly more likely to have hypothyroidism, heart disease, and visual impairment and significantly less likely to be hypertensive than were adults with other forms of mental retardation.

Discussion

We found that participants with mental retardation showed higher prevalence of hypothyroidism, nonischemic heart disorders, and visual impairment compared with their age and gender peers in the general population. In addition, we found that adults with Down syndrome had a higher frequency of thyroid

Table 6
Age-Ajusted Prevalence of Medical Conditions by Group

Medical condition	Down syndrome (%)[a]	Other MR (%)[a]	Odds ratio[b]	95% CI[c]
Diabetes	4.9	2.7	1.9	(0.5, 7.4)
Hypothyroidism	38.1	5.9	11.2*	(4.9, 25.5)
Ulcers	4.5	5.4	.73	(.23, 2.4)
Hypertension	2.6	23.4	.08*	(.02, .28)
All heart disease	40.9	21.4	2.8*	(1.6, 4.9)
Ischemic heart	4.4	4.8	.99	(.30, 3.3)
Other heart	8.8	4.3	1.9	(.70, 5.2)
Visual impairment	34.9	14.9	3.1*	(1.7, 5.4)
Stroke	3.8	0.6	10.8	(.96, 1.21)

[a]Age-adjusted prevalence. [b]Adjusted for age, gender, and level of mental retardation. [c]Confidence interval.
*$p < .05$.

dysfunction, cardiac disorders, and visual impairment compared with adults who had other forms of mental retardation. An excess of hypothyroidism, mitral valve prolapse, heart murmurs, and sensory impairment has been well-documented in adults with Down syndrome (Day & Jancar, 1994; Evenhuis, 1995a, 1995b; Haveman et al., 1989; Lantman-de Valk et al., 1997; Mani, 1988; Peuschel & Pezello, 1988), but has not been noted as frequently among adults with other forms of mental retardation, perhaps because people with mental retardation with and without Down syndrome were not always segregated in analyses of health problems or because individuals with other forms of mental retardation were used as the comparison group for individuals with Down syndrome. Our finding that adults with Down syndrome experience low rates of hypertension is consistent with the findings of Lantman-de Valk et al. and with results of studies of cholesterol and triglyceride metabolism suggesting that adults with Down syndrome are at lower risk of atherosclerosis than are age-matched adults in the general population (Dorner, Gaethke, Tolksdorf, Schumann, & Gustmann, 1984; Murdoch, Rodger, Rao, Fletcher, & Dunnigan, 1977;Ylä-Herttualäa, Luoma, Nikkari, & Kivimaki, 1989). The prevalence of other common age-related disorders such as diabetes, hypertension, ischemic heart disease, and stroke was comparable to that in the general population. In addition, we did not observe the same degree of gender differences in the prevalence of thyroid disorders, ulcers, and ischemic heart disease reported for adults in the general population.

Our study has several limitations with respect to the estimated prevalence of health problems. First, we did not conduct examinations of study participants ourselves; rather, we obtained information on current conditions from caregiver reports and medical record reviews. Beange et al. (1995) conducted physical and medical examinations to determine the frequency of medical disorders in a random sample of people with mental retardation living in Northern Sidney, Australia, and reported that the study group had an increased number of chronic diseases that were frequently not recognized or, when diagnosed, not treat appropriately. Similarly, Criscione, Kastner, O'Brian, and Nathanson (1994) found a high frequency of unrecognized thyroid dysfunction, cardiac disorders, epilepsy, and medication side effects among adults referred to a center specializing in medical care for individuals with developmental disabilities. These reports suggest that we are likely to have underestimated the prevalence of medical conditions in our participants. For this reason we chose to compare our prevalence estimates with those from the National Health Interview Survey, which also relied on reported, rather than on directly observed conditions. Nonetheless, the conditions reported in this study were not ascertained in exactly the same way as in the National Health Interview Survey, so that our comparisons must be considered only as preliminary indication of the direction and strength of the differences in prevalence between adults with mental retardation and prevalence in the general population. Further work utilizing examinations by physicians who are experienced in the diagnosis and treatment of conditions in adults with mental retardation will be required to provide more precise estimates of incidence and prevalence and their relation to prevalence in the general population.

Second, we could only evaluate health problems that were reported in common with

those in the National Health Interview Survey, which limited the range of conditions considered. For example, we did not obtain information on a variety of gastrointestinal and esophageal disorders, such as gastroesophageal reflux, which Lantman-de Valk et al. (1997) found to have a relatively high incidence, especially in older groups with mental retardation. One major omission is the lack of data on cancer prevalence. Cancer prevalence was low in our participants (3% among those with Down syndrome and 4% among those with other forms of mental retardation). Among adults with Down syndrome, there was one case each of cancer of the colon, breast, skin, and testicle. Among those with other forms of mental retardation, there was one case each of cancer of the bladder, breast, cervix, skin, thyroid, and uterus. However, most of our study participants were too young to have reached an age of high risk for neoplasms, and further study of older individuals is required to document age-specific incidence and prevalence of cancer in this population. Recently, Evenhuis (1997) reported that cancer prevalence in adults with mental retardation 60 to 90 years of age was comparable to that in the aging Dutch population. An exception appears to be increased risk of esophageal adenocarcinoma, which might be associated with increased prevalence of gastroesophageal reflux, caused by neurological and/or orthopedic problems and postural anomalies in people with mental retardation (C. J. M. Böhmer, cited in Evenhuis, 1997).

Third, our stratified analyses were based on a small number of cases in each stratum and lacked power to detect small differences in prevalence between our study groups and the general population. In addition, the etiology of mental retardation was not known for the majority of our study participants. Because our study population was over 45 years of age, they were born before the era of cytogenetic and molecular genetic diagnoses, and few service providers have tested their older consumers. Thus, we had too few participants who had been identified by genetic or metabolic disabilities to provide reliable estimates of cause-specific prevalence. Targeted sampling of study participants with known etiological or categorical disabilities will be required to identify cause-specific disease rates. The results of such studies are likely to have important implications for planning medical services and for the development of targeted health prevention and health maintenance programs.

In summary, our results suggest that adults with mental retardation have a frequency of common age-related health problems, such as diabetes or ischemic heart disease, that is comparable to that in the general population, although they are at higher risk for several specific medical conditions, which may adversely affect cognitive and adaptive abilities. As several recent investigators have noted, medical problems in adults with mental retardation may present atypically and require distinctive clinical skills to detect, diagnose, and treat. In particular, coordination of primary, specialist, and tertiary care with mental health, rehabilitative, residential, and behavioral services are required for optimal management of medical conditions and health promotion (Chicoine, McGuire, Hebein, & Gilly, 1994; Criscione, Kastner, Walsh, & Nathanson, 1993; Criscione et al., 1994; Kastner, Walsh & Criscione, 1997). Regular surveillance of health status and increased access to coordinated primary care and specialty clinics for screening and treatment of age-related disorders that are more frequent in adults with mental retardation would be important to prevent the development or delay the impact of these conditions on adaptive competence and to promote healthy aging.

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