

## HEALTH

# Medical conditions and medication use in adults with Down syndrome: A descriptive analysis

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**Background:** We examined the presence of medical conditions and medication use within a sample of adults with Down syndrome. **Methods:** Retrospective chart review using a sample of 141 adults with Down syndrome and age range of 30 to 65 years. **Results:** We identify 23 categories of commonly occurring medical conditions and 24 categories of medications used by adults with Down syndrome. **Conclusion:** Approximately 75% of older adults with Down syndrome in our sample experience memory loss and dementia. Hypothyroidism, seizures, and skin problems also occur commonly. The prevalence of cancer (i.e., solid tumours) and hypertension is extremely low. Older adults with Down syndrome use anticonvulsant more often than younger adults with Down syndrome. The use of multivitamins and medications such as pain relievers, prophylactic antibiotics, and topical ointments is common.

Adults with intellectual disabilities such as Down syndrome are experiencing simultaneous increases in life expectancy and the prevalence of certain medical conditions<sup>[1]</sup>, including hypothyroidism<sup>[2]</sup> and sleep apnoea<sup>[3]</sup>. Premature aging is not uncommon for older adults with Down syndrome<sup>[4]</sup>. Dementia is common among adults with Down syndrome<sup>[5]</sup>, as dementia and neuropsychological decline may accompany increased life expectancy for adults with Down syndrome. Prevalence data available with regard to dementia in adults with Down syndrome suggest that dementia occurs in 36 - 66% of adults between the ages of 50 to 59 years old and 9 - 11% of adults between the ages of 40 to 49 years old<sup>[6,7,8]</sup>. Additionally, increases in the use of certain medications are believed to occur among adults with Down syndrome when compared to adults without Down syndrome. Yet, little information has been published with regard to the types of medications and their indications for use.

Numerous medical conditions are believed to be associated with the aging of adults with Down syndrome. Generalised lens opacities such as total cataract<sup>[9]</sup> may result from increased amounts of free radical reactions in adults with

Down syndrome<sup>[10]</sup>. Hypercholesterolaemia is not uncommon in older adults with Down syndrome<sup>[11]</sup> and may be associated with family history<sup>[12,13]</sup>. Hypothyroidism may develop secondary to autoimmune thyroiditis<sup>[2]</sup>. Obstructive sleep apnoea may result from physiological and anatomical abnormalities in adults with Down syndrome<sup>[3]</sup>. Adults with Down syndrome experience limitations in cardio-respiratory capacity<sup>[14]</sup>, osteoporosis<sup>[15]</sup>, and late-onset seizures<sup>[16]</sup>. In fact, late-onset seizures are thought to occur in 75 - 85% of adults with Down syndrome who are affected by Alzheimer's disease after the age of 50<sup>[16]</sup>.

Adults with Down syndrome are susceptible to the presence of neuropsychological conditions such as anxiety, depression, and dementia. Due to the progressive, age-dependent nature of Alzheimer's disease pathology involving the deposition of diffuse amyloid plaques that accumulate in the brains of adults with Down syndrome who are older than the age of 30<sup>[5,17]</sup>, adults with Down syndrome are at heightened risk for developing Alzheimer's disease<sup>[5,18]</sup>. Research shows that the onset of Alzheimer's disease takes place at approximately 40 years of age<sup>[19]</sup>, an age which is considered 'young' by many standards

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in our society. Dementia is difficult to diagnose in adults with Down syndrome who concurrently experience co-morbid states<sup>[20]</sup>. Further, the rates of co-morbidities are high for adults with Alzheimer's disease<sup>[21]</sup>, thus creating a cycle in which dementia is not readily assessed and the prevention of neuropsychological decline takes on greater complexity.

## Purpose of this paper

Based on this information, the need exists for additional research that examines the aging process of adults with Down syndrome. This includes an examination of the presence of medical conditions affecting adults with Down syndrome as well as the medications prescribed for the treatment of these conditions. The purpose of this paper is to investigate the following two questions:

1. What are the medical conditions that commonly characterise adults with Down syndrome?
2. What types of medications are commonly used by adults with Down syndrome?

## Methods

A retrospective chart review was conducted of 187 adults ages 30 - 65 and with documented intellectual disability. All adults were established patients at a major teaching hospital in a metropolitan area of the United States in which faculty (e.g., certain geriatricians) possessed extensive experience in working with adults with intellectual disabilities. As a result, adults with intellectual disabilities were referred to the hospital from throughout the entire statewide region for geriatric evaluations that included specialised Down Syndrome Mental Status testing and physical assessments.

Approval from the Institutional Review Board of the University School of Medicine was obtained prior to carrying out this study. Data obtained from the chart review were entered into a software spreadsheet created using the Statistical Package for the Social Sciences (SPSS). Identifiers were removed for each chart. No medical record numbers or names of individuals were obtained or entered into the SPSS database.

Within the sample of 187 adults with intellectual disabilities, a total of 141 had a diagnosis of Down syndrome. Based upon the literature, categories of age, physical health conditions, neuropsychological conditions, medications, and demographic variables were created. Categories of age include: (1) up to 39 years old, (2) 40-49 years old, (3) 50-59 years old, (4) and 60 years old or older.

A total of 23 categories of medical conditions

	Less than 50 years old		50 years old or older		Total	
	number	%	number	%	number	%
Gender of individual: Male	52	67	32	50	84	59
Gender of individual: Female	25	33	32	50	57	41
Total	77	100	64	100	141	100

Table 1 | Gender and age of individual with Down syndrome

	Less than 50 years old		50 years old or older		Total	
	number	%	number	%	number	%
<b>Anxiety or depression</b>						
Anxiety:	4	5	6	9	10	7
Depression:	17	22	8	13	25	18
Both:	5	7	0	0	5	7
Neither:	51	66	50	78	101	72
Total:	77	100	64	100	141	104
<b>Other mental illness</b>						
Yes:	14	18	10	16	24	17
No:	63	82	54	84	117	83
Total:	77	100	64	100	141	100
<b>Dementia</b>						
Yes:	55	71	52	81	107	75
No:	23	30	12	19	35	25
Total:	78	100	64	100	142	100
<b>Arthritis</b>						
Yes:	6	8	12	19	18	13
No:	71	92	52	81	123	87
Total:	77	100	64	100	141	100
<b>Cancer</b>						
Yes:	2	3	1	2	3	2
No:	75	97	63	98	138	98
Total:	77	100	64	100	141	100
<b>Cardiac condition:</b>						
<b>Murmur</b>						
Yes:	10	13	10	16	20	14
No:	67	87	54	84	121	86
Total:	77	100	64	100	141	100
<b>Cardiac condition:</b>						
<b>Other</b>						
Yes:	14	18	12	19	26	18
No:	63	82	52	81	115	82
Total:	77	100	64	100	141	100
<b>Cataract</b>						
Yes:	10	18	9	14	19	14
No:	67	84	55	86	122	87
Total:	77	100	64	100	141	101
<b>Diagnosed disability of any type</b>						
Yes:	12	16	11	17	23	16
No:	65	84	53	83	118	84
Total:	77	100	64	100	141	100
<b>Diverticulosis/ Diverticulitis/ Crohn's disease</b>						
Yes:	3	4	5	8	8	6
No:	74	96	59	92	133	94
Total:	77	100	64	100	141	100
<b>GERD (Gastroesophageal reflux disease)</b>						
Yes:	11	15	9	15	20	14
No:	66	85	56	85	121	86
Total:	77	100	64	100	141	100

Table 2 | Medical condition and age of individual with Down syndrome

	Less than 50 years old		50 years old or older		Total	
	number	%	number	%	number	%
<b>Hepatitis B carrier</b>						
Yes:	4	5	8	13	12	9
No:	73	95	56	88	129	92
Total:	77	100	64	100	141	101
<b>Hydrocephalus</b>						
Yes:	0	0	2	3	2	1
No:	77	100	62	97	139	99
Total:	77	100	64	100	141	100
<b>Hypercholesterolaemia</b>						
Yes:	6	8	6	9	12	9
No:	71	92	58	91	129	92
Total:	77	100	64	100	141	101
<b>Hypertension</b>						
Yes:	2	3	2	3	4	3
No:	75	97	62	97	137	97
Total:	77	100	64	100	141	100
<b>Hypothyroidism</b>						
Yes:	30	39	27	42	57	40
No:	47	61	47	58	84	60
Total:	77	100	64	100	141	100
<b>Osteoporosis</b>						
Yes:	20	26	14	22	34	24
No:	57	74	50	78	107	76
Total:	77	100	64	100	141	100
<b>Pulmonary condition</b>						
Yes:	13	17	13	20	26	18
No:	64	83	51	80	115	82
Total:	77	100	64	100	141	100
<b>Seizure disorder</b>						
Yes:	8	10	22	34	30	21
No:	69	90	42	66	111	79
Total:	77	100	64	100	141	100
<b>Skin condition</b>						
Yes:	15	19	22	34	37	26
No:	62	81	42	66	104	74
Total:	77	100	64	100	141	100
<b>Sleep apnoea</b>						
Yes:	16	21	11	17	27	19
No:	61	79	53	83	114	81
Total:	77	100	64	100	141	100
<b>Stool incontinence</b>						
Yes:	4	5	3	5	7	5
No:	73	95	61	95	134	95
Total:	77	100	64	100	141	100
<b>Urinary incontinence</b>						
Yes:	14	18	11	17	25	18
No:	63	82	53	83	116	82
Total:	77	100	64	100	141	100

Table 2 | Medical condition and age of individual with Down syndrome (continued)

were created. They include: anxiety or depression, other mental illness (e.g., psychosis), dementia, arthritis or other musculoskeletal condition, cancer, cardiac condition (murmur), other cardiac condition (e.g., atrioventricular septal defect/AVSD), cataract, diverticulosis/diverticulitis/Crohn's disease, gastroesophageal reflux disease (GERD), Hepatitis B carrier, hydrocephalus, hypercholesterolemia, hypertension, hypothyroidism, osteoporosis, pulmonary conditions (e.g., asthma, chronic obstructive pulmonary disease, pneumonia), seizure disorder, skin con-

ditions, (obstructive) sleep apnoea, stool incontinence and urinary incontinence. Likewise, a separate category entitled "diagnosed disability of any type" (e.g., physical, emotional, learning) was developed, as we believe that this category is distinctive and differs conceptually from medical or neuropsychological conditions.

A total of 24 categories of medications were created and reflect prescribed medications only. The categories of medications are: anti-anxiety medications, anticonvulsants, antidepressants, anti-hypertension medications, antipsychotic medications, antispasmodics, cholesterol-lowering medications, cholinesterase inhibitors, Fosamax – or alendronate sodium, a bisphosphonate that inhibits bone resorption without impeding mineralisation<sup>[22]</sup>, GERD-related medications (e.g., proton pump inhibitors), hormones (other than thyroid-related hormones), hypothyroid-related medications, respiratory medications (e.g., metered dose inhalers/MDIs), Vitamin A, Vitamin B12, Vitamin C, Vitamin E, calcium, folic acid, iron, multivitamin, no vitamin/mineral, other vitamin/mineral, and other medications (e.g., pain relievers, prophylactic antibiotics, and topical ointments).

## Results

We examined the presence of medical diagnoses and medication utilisation as they pertain to adults with Down syndrome. Cross-tabulations were performed for all categories of medical conditions and medications. The number of medications used by adults with Down syndrome ranged from 0 - 16 medications per adult.

The data contain multiple cohorts of adults. However, we specifically focused on: (1) adults with Down syndrome (n = 141), and (2) adults without Down syndrome (n = 45). The group of adults with Down syndrome was divided into (1) adults under the age of 50 years, known as 'younger adults' (n = 77) and (2) adults 50 years old or older, known as 'older adults' (n = 64). The average age of this sample was approximately 51 years old (50.98 years), with a range of 31-65 years. The sample contained greater numbers of men (n = 84) as compared to women (n = 57). Fewer men were found in the 50+ group (n = 32) than in the group of adults under the age of 50 (n = 52). More women were found in the 50+ group (n = 32) as compared to those under the age of 50 years (n = 25). (See TABLE 1.)

TABLE 2 contains information pertaining to medical conditions by age group. Regarding the entire sample of adults with Down syndrome, relatively large percentages of dementia (75.9%), hypothyroidism (40.4%), skin conditions (26.2%), seizure disorder (21.3%), and pulmonary conditions

(18.4%) exist. Relatively small percentages of hydrocephalus (1.4%) and hypertension (2.8%) exist for this sample of adults with Down syndrome. In both groups, the presence of certain cardiac conditions (e.g., AVSD) and GERD exist in nearly equal percentages (18.4% and 14.2%, respectively). Overall, older adults (50+ years old) with Down syndrome experience more instances of all medical conditions *except* depression, other mental illnesses, cancer, osteoporosis, sleep apnoea, and stool and urinary incontinence as compared to the younger group of adults (>50 years old) with Down syndrome.

Anxiety is present for 9.4% of older adults with Down syndrome, and dementia occurs in over 80% of cases in this group. Adults with Down syndrome who are 50 years old or older are found to have higher percentages of arthritis/ other musculoskeletal conditions (19%), heart murmurs (16%), and cataracts (14%) when compared to the younger group. Greater percentages of older adults with Down syndrome experience diverticulosis or a related condition (8%), are carriers of the Hepatitis B virus (13%), and have higher cholesterol levels (9%) as compared to the younger group of adults with Down syndrome. Over 40% of older adults with Down syndrome experience hypothyroidism, and nearly 35% have been diagnosed with seizure disorder or skin conditions.

TABLE 3 represents medication use according to the age of adults with Down syndrome. Comparable percentages of younger adults and older adults with Down syndrome use anti-anxiety medications (16% vs. 16%), cholesterol-lowering agents (9% vs. 11%), hormones other than thyroid-related hormones (13.0% vs. 14%), and calcium (30% vs. 30%). Less than 10% of this sample of adults with Down syndrome uses folic acid, iron, vitamin A, vitamin B12, or vitamin C while more than 50% use vitamin E. Less than 10% of the entire sample of adults with Down syndrome

	Less than 50 years old		50 years old or older		Total	
	number	%	number	%	number	%
<b>Anti-anxiety medications</b>						
Yes:	12	16	10	16	22	16
No:	65	84	54	84	119	84
Total:	77	100	64	100	141	100
<b>Anticonvulsants</b>						
Yes:	12	16	24	38	36	26
No:	65	84	40	62	105	75
Total:	77	100	64	100	141	100
<b>Antidepressants</b>						
Yes:	19	25	9	14	28	20
No:	58	75	55	86	113	80
Total:	77	100	64	100	141	100
<b>Anti-hypertension medications</b>						
Yes:	3	4	12	19	15	11
No:	74	96	52	81	126	89
Total:	77	100	64	100	141	100
<b>Antipsychotic medications</b>						
Yes:	7	9	12	19	19	14
No:	70	91	52	81	122	87
Total:	77	100	64	100	141	101
<b>Antispasmodics</b>						
Yes:	1	1	3	5	4	3
No:	76	99	61	95	137	97
Total:	77	100	64	100	141	100
<b>Cholesterol-lowering agents</b>						
Yes:	7	9	7	11	14	10
No:	70	91	57	89	127	90
Total:	77	100	64	100	141	100
<b>Cholinesterase inhibitors</b>						
Yes:	9	12	5	8	14	10
No:	68	88	59	92	127	90
Total:	77	100	64	100	141	100
<b>Fosamax</b>						
Yes:	16	21	15	23	31	22
No:	61	79	49	77	110	78
Total:	77	100	64	101	141	100
<b>GERD-related medications</b>						
Yes:	14	18	14	22	28	20
No:	63	82	50	78	113	80
Total:	77	100	64	100	141	100
<b>Hormones</b>						
Yes:	10	13	9	14	19	14
No:	67	87	55	86	55	87
Total:	77	100	64	100	141	101
<b>Hypothyroid-related medications</b>						
Yes:	27	35	24	38	51	36
No:	50	65	40	63	90	64
Total:	77	100	64	101	141	100
<b>Respiratory medications</b>						
Yes:	20	26	18	28	38	27
No:	57	74	46	72	103	73
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Vitamin A</b>						
Yes:	1	1	0	0	1	1
No:	76	99	64	100	140	99
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Vitamin B12</b>						
Yes:	2	3	5	8	7	5
No:	75	97	59	92	134	95
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Vitamin C</b>						
Yes:	3	4	4	6	7	5
No:	74	96	60	94	134	95
Total:	77	100	64	100	141	100

Table 3 | Medication use and age of individual with Down syndrome

	Less than 50 years old		50 years old or older		Total	
	number	%	number	%	number	%
<b>Vitamin/Mineral: Vitamin E</b>						
Yes:	39	51	35	55	74	53
No:	38	49	29	45	67	48
Total:	77	100	64	100	141	101
<b>Vitamin/Mineral: Calcium</b>						
Yes:	23	30	19	30	42	30
No:	54	70	45	70	99	70
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Folic Acid</b>						
Yes:	1	1	3	5	4	3
No:	76	99	61	95	137	97
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Iron</b>						
Yes:	1	1	0	0	1	1
No:	76	99	64	100	140	99
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Multivitamin</b>						
Yes:	23	30	24	38	47	33
No:	54	70	40	63	94	67
Total:	77	100	64	101	141	100
<b>Vitamin/Mineral: None</b>						
Yes:	24	31	18	28	42	30
No:	53	69	46	72	99	70
Total:	77	100	64	100	141	100
<b>Vitamin/Mineral: Other</b>						
Yes:	0	0	1	2	1	1
No:	77	100	63	98	140	99
Total:	77	100	64	100	141	100
<b>Other Medication(s)</b>						
Yes:	26	34	30	47	56	40
No:	51	66	34	53	85	60
Total:	77	100	64	100	141	100

Table 3 | Medication use and age of individual with Down syndrome (continued)

uses cholinesterase inhibitors. Comparable percentages of younger and older adults with Down syndrome use Fosamax (21% vs. 23%) and medications for gastroesophageal reflux disease (18% vs. 22%), hypothyroidism (35% vs. 38%) and respiratory conditions (26% vs. 28%).

Extremely low percentages of younger and older adults with Down syndrome use antispasmodic medications (1% vs. 5%). Considerably low percentages of younger adults with Down syndrome use anti-hypertension medications (4%) as compared to older adults (19%). Likewise, lower percentages of younger adults than older adults with Down syndrome use anticonvulsants (16% vs. 38%) and antipsychotic medications (9% vs. 19%); however, greater percentages of younger adults with Down syndrome use antidepressants as compared to older adults with Down syndrome (25% vs. 14%). Greater percentages of older adults with Down syndrome use multivitamins as compared to younger adults with Down syndrome (38% vs. 30%). Finally, other medications such as pain relievers, prophylactic antibiotics, and topical ointments are used more often by older adults with Down syndrome as compared to younger adults with Down syndrome (47% vs. 34%).

## Discussion

Overall, our study involved 141 adults with Down syndrome. Our sample of adults with Down syndrome was approximately 60% male and 40% female. Slightly more than 75% of our sample experienced memory loss (as reported by family members or caregivers) and/or were diagnosed with dementia. This is not surprising, given that one of the primary reasons for the referral of adults with Down syndrome to the physician clinics at this metropolitan hospital setting occurs as a result of signs and symptoms of dementia in the adult patient. Nonetheless, adults with Down syndrome who are 50 years old or older constitute a greater percentage (81%) of those with dementia as compared to younger adults (71%). These findings are consistent with research demonstrating that memory loss and the likelihood of dementia increase with age for adults with Down syndrome.

Our study demonstrates that slightly more than 20% of adults with Down syndrome experience seizures, with greater percentages of older adults with Down syndrome diagnosed with seizure disorder (34%) as compared to the younger group (10%). Although the occurrence of seizures in adults with Down syndrome has been recognised for years, our data analysis suggests that (new onset) seizures may accompany the aging process.

While cardiac conditions such as murmurs (14%) and ASVD (18%) occur in this sample of adults with Down syndrome, extremely low percentages of hypertension (3%) and hypercholesterolaemia (9%) are found. In fact, coronary artery disease does not appear to occur in this sample of adults with Down syndrome. Further, due to the fact that very few adults with Down syndrome in this sample were diagnosed with diabetes mellitus, we do not have a category for the presence of diabetes mellitus. However, given the implications that diabetes mellitus has for the development of coronary artery disease, we are interested in future research that examines the individual and combined effects of diabetes mellitus, HTN, and hypercholesterolaemia on the development of coronary artery disease in adults with Down syndrome.

Relatively large percentages of older adults with

Down syndrome (34%) experience skin conditions such as fungal infections, psoriasis, and skin rash as compared to younger adults with Down syndrome (20%), leading us to question whether the presence of such skin conditions is related to environment, the onset of memory loss and dementia, and poor self-care that may occur over time. Additionally, urinary incontinence is present in nearly 18% of this sample and may be related to the high percentage of skin conditions in this sample of adults with Down syndrome.

Hypothyroidism is present in over 40% of this sample of adults with Down syndrome, a finding that is consistent with prior research demonstrating the commonality with which this medical condition occurs in adults with Down syndrome. Osteoporosis occurs in about 24% of the overall sample of adults with Down syndrome. Interestingly enough, however, osteoporosis occurs more frequently in younger adults with Down syndrome (26%) as compared to the older group (22%). Other medical conditions that commonly occur in this sample of adults with Down syndrome include gastroesophageal reflux disease (14%), pulmonary conditions (18%), and obstructive sleep apnoea (19%). Geriatricians, geriatric nurses, and other members of the health care team should be aware of the occurrence of medical conditions such as these, so as to focus assessment and treatment options as well as improve the overall quality of life for adults with Down syndrome.

Our review of medication use in this sample of adults with Down syndrome confirms the presence of thyroid supplementation, anti-anxiety and antidepressant medications, and anticonvulsants as common and appropriate. Multivitamins are used at least a third of the time, and Vitamin E is used by over 50% of adults in this sample. We are encouraged by the use of calcium with Vitamin D (30%) and Fosamax (22%) to help in maintaining bone health, thereby decreasing the risk of osteoporosis in this vulnerable group of adults.

A relationship exists between medical conditions and medications occurring in this sample of adults with Down syndrome. Overall, the majority of medications are used to treat commonly occurring medical conditions, with the exception of memory loss and dementia. Relatively little use of cholinesterase inhibitors (10%) occurs in this sample of adults with Down syndrome; only 12% of younger adults with Down syndrome and 8% of older adults with Down syndrome use cholinesterase inhibitors. We believe that this can be explained by the fact that the use of cholinesterase inhibitors to slow the progression of memory loss in adults with Down syndrome has yet to be examined and under-

stood more fully.

Further research is necessary in order to assess the natural history of commonly occurring medical conditions such as those included in our study. The fact that certain medical conditions such as cancer and hypertension appear to occur infrequently in adults with Down syndrome warrants further study; this is particularly the case when comparing samples such as these to the general population. This sort of study may include comparisons of men and women with regard to incidence and prevalence of medical conditions. Barriers to health care services and appropriate diagnosing and treatment options for adults with Down syndrome should be examined. Finally, systems of care that allow for screening and prevention of commonly occurring medical conditions such as these must be developed and implemented.

## Limitations

Our study is primarily limited methodologically with regard to the cross-sectional nature of our research design and our sampling strategy. A longitudinal design that would permit the researchers to follow participants over time is ideal, particularly when considering research that applies to the aging process. The onset of certain, commonly occurring medical conditions (e.g., memory loss and dementia, hypothyroidism, seizure disorder) could be pinpointed, thereby facilitating a more thorough understanding of appropriate intervention, treatment, and cure. Further, our study is not powered for inferential statistical tests that have the potential to demonstrate significance.

In our sample of adults with Down syndrome, the point at which an adult in the "<50 years old" group develops dementia, hypothyroidism, or seizure disorder, for instance, is no clearer than for adults in the "50+" group. We have no data pertaining to family history of hypercholesterolaemia, even though the presence of this condition may be familial to a certain extent. Likewise, we are limited in our sampling design in that we are dependent upon a convenience sample of adults with Down syndrome. This creates difficulty with representation and the comparison of our sample to the larger population of adults with Down syndrome. As a result, the ability to generalise the findings of our study is present but hindered. Overall, we believe that a study such as this that identifies commonly occurring medical conditions and medications that characterise adults with Down syndrome is a beginning step to future research that more definitively addresses the aging process for adults with Down syndrome.

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