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# Common Health Conditions in Adults with Down Syndrome

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# Introduction

Common Conditions Chart						Less Common Conditions Chart
Achalasia	Adrenal insufficiency	Alzheimer's disease	Arthritis			Asthma
Atlantoaxial instability	Autoimmune diseases	Autism	Blood clotting			Atherosclerosis
Celiac disease	Cataracts	Cerumen impaction	Cervical myelopathy			Hypertension
Cholesteatomas	Chronic rhinosinusitis	Congenital heart disease	Constipation			Solid tumor cancers (except testicular)
Dental disease	Diabetes	Dysmotility	Dysphagia	Fatty liver	Food sensitivities	
Gallbladder disease	Hearing loss	Hernias	Hyperthyroidism	Hypothyroidism		
Joint laxity	Keratoconus	Macrocytosis	Mental health conditions (depression, anxiety, obsessive-compulsive tendencies, and behavioral issues)			
Osteoporosis	Overpronation					
Overweight and obesity	Neutropenia	Pes planus	Pneumonia and respiratory infections			
Polycythemia	Pulmonary hypertension	Seizures	Sleep apnea	Testicular cancer		
Urinary retention	Valvular heart disease	Vision impairment	Vitamin B12 deficiency			

The World Health Organization currently estimates that 250,000 persons with Down syndrome live in the United States, and many are living into their 60s.<sup>1</sup> Individuals with Down syndrome can have a variety of co-occurring conditions, the presence, number, and severity of which vary. Although having an extra 21<sup>st</sup> chromosome has some impact on these conditions, the interplay between the extra chromosome

and other chromosomes, the effect of family genetics, and the effect of environmental factors require further study. With appropriate medical, social, and educational support, individuals with Down syndrome can live long, fulfilling lives.

In addition to the common conditions discussed here, individuals with Down syndrome are universally affected by a degree of intellectual

disability, which may be less severe in persons with mosaic trisomy 21.<sup>2</sup> It has been shown that individuals with intellectual disabilities have a higher prevalence of co-occurring conditions than those without an intellectual disability. However, while the number of conditions is similar in people with an intellectual disability with or without Down syndrome, the pattern of co-occurring conditions is different in individuals with Down syndrome when compared to individuals in the general population or those with other intellectual disabilities.<sup>3,4</sup> This article focuses on the more-prevalent conditions while the companion article reviews less-prevalent conditions.

Individuals with Down syndrome, even at a young age, tend to have multiple co-occurring conditions. One study found that multimorbidity (two or more chronic conditions) was present in 88.8% of study participants with Down syndrome with a mean age of  $38.3 \pm 12.8$  years. The mean number of medications used was 2.09, and polypharmacy (the concomitant use of five or more medications) was observed in 10.5% of the study sample.<sup>5</sup> In a second study of adults with Down syndrome, the increased prevalence of polypharmacy was found across the age ranges studied and did not increase with age. The study participants had a mean age of 43.9 years, the mean number of health conditions per participant was 11.04, and 98.7% had multimorbidity.<sup>4</sup> Conversely, a cross-sectional analysis of claims data found that the prevalence of co-occurring conditions increases after age 40 and with the diagnosis of Alzheimer's disease.<sup>6</sup> In this study,

comorbid conditions were more numerous in individuals with Down syndrome who had Alzheimer's disease, when compared with individuals with Down syndrome without the disease (mean 3.4 vs. 2.5 conditions, respectively), especially among those younger than 65.<sup>6</sup> In particular, four treatable conditions—hypothyroidism, epilepsy, anemia, and weight loss—were much more frequent in persons with Alzheimer's disease.<sup>6</sup>

The high prevalence of multimorbidity and the common use of multiple medications contributes to the clinical complexity observed in individuals with Down syndrome. This was compared in a study to the degree of complexity of the older non-trisomic population, and these authors concluded that a “comprehensive and holistic approach, commonly adopted in geriatric medicine, may provide the most appropriate care to persons with Down syndrome as they grow into adulthood.”<sup>5</sup>

As noted in the article [\*Decline in Skills and Behavioral Change in Adults with Down Syndrome\*](#), often a physical health condition will present as a behavioral, psychological, or functional change. Therefore, when assessing any change in an individual with Down syndrome, a differential diagnosis that includes these common medical conditions is an important part of the evaluation.

## General Health

### Vital Signs

When assessing an adult with Down syndrome, differences in blood pressure, pulse, and body temperature are often noted<sup>7-9</sup> which are caused by alterations in the autonomic nervous system.<sup>9</sup> Individuals with Down syndrome often have low normal pulses (commonly in the 60s) or even a little bradycardic (in the 50s). Their blood pressure is often on the lower end of normal (systolic of 90-100) or low (systolic 70s to 80s). The lower blood pressure and pulse make individuals with Down syndrome more susceptible to symptoms such as syncope, particularly if additional factors occur such as an illness, dehydration, fear, pain, or elevated body temperature. However, further evaluation and treatment are usually only necessary if the person is symptomatic or there is a significant change from previous recordings. Attention to these differences is recommended, however, when administering anesthesia.<sup>9</sup>

The body temperature of individuals with Down syndrome may be lower; indeed, infants with Down syndrome have higher rates of hypothermia (30%) compared to controls (11%).<sup>10</sup> Depending on body region, it may be approximately 1.03-1.57°C lower for women and 1.07-1.28°C for men.<sup>8</sup> Typically this is not of clinical concern, although it can make it less likely that some individuals will develop a fever (by the usual definition) because their core temperature starts at a lower value.

### Weight

Being overweight or obese is more common in adults with Down syndrome.<sup>11-13</sup> There are likely multiple reasons, some of which, such as a lower resting metabolic rate, are not well understood. Lower levels of physical activity, poor nutrition choices, use of medications that contribute to weight gain (such as anti-psychotics<sup>14</sup>), poor sleep (including sleep apnea<sup>13</sup>), hormonal issues (hypothyroidism,<sup>15</sup> leptin resistance<sup>16</sup>), and other factors likely play a role. Compared to their peers without Down syndrome, individuals with Down syndrome tend to have higher fat and lower lean mass in their body composition, making traditional measurements of adiposity (e.g., BMI) less helpful.<sup>17</sup> Research suggests that addressing several contributing factors is more likely to promote weight loss than addressing only a single factor.<sup>12,18</sup> The use of medications for weight loss in individuals with Down syndrome is in the early stages of research, though many practitioners are using these successfully. There are little data available on bariatric surgery, though case reports exist.<sup>19</sup> More information on weight management is available in the article [Weight Management for Adults with Down Syndrome](#).

Unintentional weight loss can have multiple causes, and Type 1 diabetes mellitus, hyperthyroidism, gastritis, celiac disease, depression, and Alzheimer's disease are all more common in individuals with Down syndrome. Weight loss in individuals with Down syndrome may be an early symptom of Alzheimer's disease.<sup>20,21</sup>

Loss of appetite may also be found in adults with Down syndrome; additional information is available in the article [Eating Refusal in Adults with Down Syndrome](#).

## Hematology, Immunology, and Oncology

### Autoimmune Diseases

Thyroid disease, type 1 diabetes mellitus, celiac disease, inflammatory bowel disease, and inflammatory arthritis are just some of the conditions that are more common.<sup>15,22,23</sup> Several autoimmune skin diseases such as hidradenitis suppurativa, alopecia, and psoriasis are also more common.<sup>23,24</sup>

### Blood Clotting

The higher prevalence of autoimmune diseases may theoretically increase the risk of venous thrombosis. However, while one study found that this holds for children with Down syndrome<sup>25</sup> there are no data for adults. A 2015 study found embolic strokes to be more common,<sup>26</sup> a finding attributed to long-term complications of congenital heart disease such as atonic portions of the heart, abnormal heart structure, and arrhythmias rather than hypercoagulability. Although there is an association between Down syndrome and Moyamoya disease as a cause of cerebrovascular events, this is still a rare finding.<sup>27</sup> Care [guidelines for adults with Down syndrome](#) agree with the American Heart Association/American Stroke Association guidelines for primary prevention of stroke for the general population.<sup>28</sup>

### Polycythemia

An elevated hemoglobin is often found on a complete blood count (CBC) and is often idiopathic. Inadequate fluid intake, sleep apnea,<sup>29</sup> and cyanotic congenital heart disease<sup>30</sup> are some of the more common causes of this in individuals with Down syndrome.

### Macrocytosis

This refers to the premature death of red blood cells, resulting in immature, larger red blood cells being released into the bloodstream. It is common,<sup>31</sup> often not of clinical significance, and thought to be related to differences in folic acid metabolism and other inflammatory and metabolic differences.<sup>32</sup> Macrocytosis may be present with a normal hemoglobin and hematocrit and normal vitamin B12 and folate levels.<sup>33</sup> A 1992 study found no cases of vitamin B12 or folate deficiency in individuals with Down syndrome and macrocytosis.<sup>34</sup> This suggests that testing for vitamin B12 and folate may not be necessary in an individual with Down syndrome with normal hemoglobin and hematocrit.

### Neutropenia

Individuals with Down syndrome have multiple immune deficiencies, many of which derive from a low white blood cell count (WBC) on the CBC.<sup>33,35</sup> A mildly low WBC which is stable on multiple readings and with limited infections can often just be monitored as a common feature of Down syndrome.

## Cancers

Testicular cancer is one of the few solid tumors which is more common in Down syndrome.<sup>36</sup> Leukemia is more common, and though there are cases of adults with Down syndrome having leukemia,<sup>37</sup> it is primarily diagnosed in children. Most other cancers are less common, and this is addressed in the article [Less Common Health Conditions in Adults with Down Syndrome](#).

## Eyes

Refraction errors are more prevalent<sup>38,39</sup> in individuals with Down syndrome and are the most common eye condition.<sup>40</sup> During an eye exam, using devices that can measure refractive error without requiring the patient to report their visual perception can often provide a measurement that results in adequate correction. Unfortunately, some individuals have difficulty wearing glasses. There are glasses designed specifically for individuals with Down syndrome that can improve fit and comfort, and gradual desensitization may be helpful.

Other common causes of impaired vision include cataracts and keratoconus,<sup>41,42</sup> which can occur at a younger age. Most adults with Down syndrome can successfully undergo cataract surgery, although it may require general anesthesia. Keratoconus in adults with Down syndrome has been successfully treated with the use of hard contact lenses, cross-linking, and corneal transplantation.

Many individuals with Down syndrome have impaired depth perception. This may worsen with the development of Alzheimer's disease and, conversely, has been hypothesized to contribute to progressive cognitive impairment.<sup>43</sup> Finally, cognitive visual impairment (CVI) refers to visual symptoms arising from dysfunction in the brain's visual processing pathways. This most commonly occurs in adults when Alzheimer's disease is present.<sup>43</sup>

## Ears

Hearing loss can be caused by cerumen impaction, serous otitis,<sup>47</sup> damage to middle ear structures and/or the tympanic membrane due to previous infections, or neurologic hearing loss.<sup>48</sup> Treatment of the potentially reversible causes often successfully restores hearing. Many adults with Down syndrome successfully use hearing aids,<sup>49</sup> allowing them to maintain function in daily life and participate in social activities.<sup>50</sup> The link between hearing impairment, decreased socialization, and increased dementia has not been studied in individuals with Down syndrome as it has in the general population.<sup>51,52</sup> However, hearing loss in those with Down syndrome can mimic Alzheimer's disease.

Cerumen impaction can be quite debilitating, causing hearing impairment, loss of balance, tinnitus, and speech problems.<sup>44-46</sup> In the primary care office, most adults can tolerate ear irrigation and/or use of a curette. For individuals in which the cerumen is difficult to remove,

some can allow removal with a suction device, often in an otolaryngologist's office. Because otitis media is common in children with Down syndrome, persistent perforations and/or ear tubes are common in this population. For these individuals, use of a suction device, instead of irrigation, is indicated.

Finally, cholesteatomas are more common in individuals with Down syndrome. Early diagnosis and appropriate treatment can have significant benefit in preserving hearing.<sup>53,54</sup>

## Nose and Sinuses

While allergic rhinitis appears to be less common, chronic rhinosinusitis<sup>48,55</sup> is seen often. Diagnosis and management can provide significant symptom relief and may allow for greater social participation by reducing others' intolerance of nasal drainage in work or social settings.

## Mouth and Pharynx

### Dental Disease

Gingivitis and periodontitis are more common,<sup>56</sup> but caries are less common.<sup>57</sup> Dental loss is more commonly associated with gum disease than with caries.

### Airway

Individuals with Down syndrome tend to have smaller and more compressible airways.<sup>58</sup> This is a risk factor during anesthesia that must be considered.<sup>59</sup> In addition, it contributes to

increased sleep apnea.<sup>13,60</sup> Both the anatomy and function of the upper airway also contribute to higher prevalence of dysphagia.<sup>61-63</sup> Clinically, the tendency of some individuals to eat too fast, not chew well, or not moisten food with liquids can also contribute.

## Sleep

### Sleep Apnea

Both central and obstructive sleep apnea are found in individuals with Down syndrome.<sup>64,65</sup> Obstructive sleep apnea is particularly common, affecting up to 82%.<sup>66</sup> Obstructive sleep apnea can be linked to the general physical attributes of individuals with Down syndrome, including midface and maxillary hypoplasia, relative macroglossia, hypertrophy of the tonsils and adenoids, laryngomalacia, and generalized hypotonia.<sup>60,65</sup> In addition, conditions which increase sleep apnea risk, such as hypothyroidism and obesity, are more common. Symptoms include snoring, fatigue, restless sleep, hyperactivity, behavioral or mood changes, decline in skills, daytime sleepiness, nocturnal gasping or choking episodes, or unusual sleep postures.<sup>67</sup>

The consequences of untreated obstructive sleep apnea range from mild to severe. Mild consequences are behavioral disturbances, decreased executive function, and learning difficulties. Severe consequences include increased risk for pulmonary hypertension, right-sided heart failure, and Alzheimer's disease.<sup>73</sup> Initial treatments for all people with sleep apnea include weight loss, dental appliance use, and

adenotonsillectomy, followed by continuous or bilevel positive airway pressure (CPAP or BiPAP). In adults with Down syndrome, there are case studies of effective use of a dental device, but the gold standard is CPAP or BiPAP.<sup>68,69</sup> Although some individuals have difficulty complying with sleep studies and the use of CPAP or BiPAP, many adults with Down syndrome successfully use it and benefit.<sup>68</sup>

In practice, for adults with Down syndrome and OSA, a multi-disciplinary approach is initiated when OSA is diagnosed. In addition to starting CPAP or BiPAP, refer to nutrition and exercise counseling for weight loss if needed, or to otolaryngology. Adenotonsillectomy is commonly used and can be effective for treating children with Down syndrome, but there is little to no data evaluating the benefit in adults.<sup>71</sup> Given its success in younger people, adenotonsillectomy is reasonable to consider as a first-line treatment in adults, especially if tonsillar hypertrophy is present. Additionally, hypoglossal nerve stimulation has been used successfully in adults with Down syndrome.<sup>70</sup> The uvulopalatopharyngoplasty (UP3), which was commonly used in the past, is no longer considered a reliable procedure to treat sleep apnea.<sup>72</sup>

## Pulmonary

### Pneumonia and Other Respiratory Infections

Pneumonia is the leading cause of hospital admission and the second leading cause of death in adults with Down syndrome<sup>74–76</sup> so

primary care physicians should be vigilant in identifying and treating all respiratory infections. Differences in airway anatomy and function, immunodeficiency, dysphagia, and other factors contribute to the risk.<sup>55,74</sup> Clinical experience finds that this diagnosis can be challenging because patients don't complain of symptoms and may have difficulty taking deep breaths during the physical examination. As previously discussed, individuals with Down syndrome may not develop the usual temperature elevation consistent with a fever nor a WBC that rises to the abnormal range. Given this, oxygen saturation assessment and X-ray imaging can be very important in assessing respiratory infections.

Adults with Down syndrome should be immunized against influenza, pneumonia, pertussis, respiratory syncytial virus (RSV) and SARS-CoV2/COVID-19 according to the current vaccine schedule published by the Centers for Disease Control and Prevention. Because one of the indications for pneumonia vaccine at younger ages is immunodeficiency, which is common in Down syndrome, providing this vaccine to young adults should be considered even though the beneficial immune response to some vaccines may be reduced.<sup>77–80</sup> For this reason, vaccine boosters may be more helpful for adults with Down syndrome compared to adults without Down syndrome.<sup>80</sup> Most individuals with Down syndrome can learn and benefit from infection control and prevention measures such as hand hygiene and covering their mouth when they cough or sneeze.

## Other Lung Conditions

Compared to individuals with similar congenital heart disease, individuals with Down syndrome have more pulmonary hypertension, which can impair oxygenation.<sup>81</sup> Pulmonary hypertension may also result from pulmonary co-occurring conditions.<sup>82</sup> In clinical experience, pulmonary hypertension can cause prolonged hypoxemia secondary to infections. Wheezing may be recurrent and due to airway malacia, generalized hypotonia, or recurrent gastroesophageal reflux disease (GERD). There is often suboptimal responsiveness to traditional asthma medications.<sup>65,83</sup>

## Cardiac

Congenital heart disease occurs in about 50% of infants with Down syndrome.<sup>80</sup> Whether surgically corrected or not, the adult health care guidelines recommend regular long-term follow up with a cardiologist to monitor for complications.<sup>28</sup> Whether or not the patient has a history of congenital heart disease, development of valvular heart disease is more common in adults with Down syndrome.<sup>84–87</sup> However, the clinical implications of this are not clear, as these conditions are often asymptomatic. Clinical monitoring via history and physical exam is recommended. At this time, regular, scheduled echocardiograms (ECGs) are not recommended for adults with Down syndrome without congenital heart disease. In many cases, murmurs may not be detectable with a stethoscope. Current evidence supports obtaining an echocardiogram for those who did not have one in childhood and

for patients presenting with a new murmur or any clinical signs of heart failure.<sup>88</sup> For those with a history of congenital heart disease, ECGs are indicated as per the cardiologists' recommendation based on the clinical picture.

## Gastrointestinal

### Celiac Disease

As noted above, autoimmune disease is more common. Celiac disease can develop over one's lifetime and should not be considered a one-time diagnosis.<sup>89,90</sup> Celiac disease may be asymptomatic or may present with a combination of gastrointestinal (diarrhea, constipation, abdominal pain, weight loss, bloating, flatulence) and non-gastrointestinal conditions (growth impairment, iron-deficiency anemia, metabolic bone disease, abnormal liver function tests, infertility, and skin disorders).<sup>91</sup> Per the [GLOBAL Medical Care Guidelines for Adults with Down Syndrome](#), careful assessment by history and physical is recommended with an understanding that the symptoms of celiac disease may be subtle and are often overlooked.<sup>28</sup>

Currently, there are no data to support regular screening for celiac disease in asymptomatic individuals with Down syndrome using blood testing (i.e., anti-tissue transglutaminase IgA or tTGA). However, blood testing is indicated as part the diagnostic evaluation of related symptoms in individuals with Down syndrome. After testing, based on the value, confirmatory endoscopy and biopsy of the small intestine may be indicated. When ordering blood testing

for celiac disease, it is also recommended to order a total IgA as well as tTGA. In those with low total IgA, a low tTGA may be a false negative. Regardless of which screening approach a healthcare professional chooses to take, one should be vigilant for signs and symptoms of this condition, as earlier diagnosis and implementation of a gluten-free diet are important to decrease morbidity.<sup>89</sup> It should be noted that conditions such as autism, anxiety, or depression can manifest as behavioral changes and abdominal symptoms in individuals with Down syndrome. Functional gastrointestinal disorders are common in these situations.<sup>92</sup>

Additional food sensitivities, including lactose intolerance, are a frequent clinical finding in individuals with Down syndrome.<sup>93,94</sup> Clinically, the assessment requires attention to the individual's unique symptoms and, often, a food diary.

### Gallbladder Disease

The symptoms may be subtle, particularly early in the natural history of gallstones, and may present as a behavioral change.<sup>95</sup>

### Constipation and Hernias

Constipation may cause significant pain but may also present as a change in mood, behavior, or even an apparent loss of skills.<sup>96</sup> Hernias are clinically more common including inguinal, ventral, umbilical, and incisional. Differences in the mechanical properties of connective tissue, specifically collagen,<sup>97,98</sup> likely account for the difference. Asymptomatic hernias can often

be observed. Surgical referral is recommended if the hernia is causing discomfort or other symptoms, is getting larger and obtrusive, or per patient preference.

### Fatty Liver Disease

Fatty liver, also known as metabolic dysfunction-associated steatotic liver disease (MASLD), is particularly common in individuals who are obese, but also occurs in those that are not.<sup>99</sup> MASLD has been found to be more common in children and adolescents with Down syndrome than children and adolescents without Down syndrome.<sup>100</sup>

### Gut Dysmotility

In addition to constipation noted above and achalasia noted below, anatomical differences, behavioral issues (e.g., eating too fast and not chewing well), and abnormal patterns of gut motility can result in the common problems of gastroesophageal reflux disease<sup>96,99</sup> and dysphagia.<sup>63,101</sup> Dysphagia needs to be managed symptomatically, with potential interventions including dietary restrictions on easily-aspirated foods, thickening liquids, strengthening exercises, and mealtime supervision to normalize eating rate.<sup>102</sup> Many individuals with Down syndrome eat very quickly, increasing the risk for aspiration.<sup>102</sup> It should be noted that dysphagia occurs in most patients with degenerative CNS disease and is very common in adults with Down syndrome who develop Alzheimer's disease.<sup>103</sup>

## Achalasia

Achalasia appears to be more common.<sup>104</sup> Research suggests that achalasia may have an autoimmune component by the presence of anti-myenteric plexus autoantibodies.<sup>105</sup> Dysphagia, recurrent aspiration pneumonia, and chest discomfort are common symptoms.

## Genitourinary

### Urinary Retention

Differences in autonomic nervous system function in individuals with Down syndrome result in reduced bladder muscle tone and increased urinary retention.<sup>106,107</sup> In addition, some individuals with Down syndrome tend to delay urinating, which can lead to stretching the bladder muscle and further reducing bladder function. Urinary incontinence can be a symptom of urinary retention. Urinary tract infections are more common in adults with Down syndrome, being frequent complications to surgical procedures and a common cause for hospital admission.<sup>108,109</sup>

### Kidney Function

Research on kidney function in individuals with Down syndrome is limited but has shown a reduced number of nephrons that may result in mild renal impairment as demonstrated by lab values.<sup>107,110</sup> Congenital malformations, inadequate fluid intake, and urine holding (as noted above) may all contribute to kidney damage.

## Endocrine System, Nutrition, and Vitamins

### Thyroid

Both hypothyroidism and hyperthyroidism are more common,<sup>15,111</sup> and routine asymptomatic screening is recommended.<sup>28</sup> Compensated (subclinical) hypothyroidism is also commonly found, presenting as a mild elevation of thyroid stimulating hormone (TSH) and a normal thyroxine (T4). Debate continues as to the necessity to treat compensated hypothyroidism, but one approach based on research and clinical experience is to consider treatment if the TSH >10, if thyroid antibodies for Hashimoto's are positive, and/or the individual has symptoms strongly suggestive of hypothyroidism. One may also recheck the lab values periodically as fluctuation is common.<sup>107,112</sup> Current consensus [guidelines](#) are to screen asymptomatic adults for hypothyroidism every 1-2 years after age 21 using a serum thyroid-stimulating hormone (TSH) level.<sup>28</sup>

### Diabetes

Type 1 diabetes mellitus is more common as are many autoimmune conditions as noted above.<sup>15</sup> Despite obesity being more common, the frequency of type 2 diabetes mellitus (DM) is less clear. One study, that did not stratify prevalence by age, reported type 2 DM was less prevalent.<sup>15</sup> Another study that stratified incidence by age found type 2 DM had a greater incidence between the ages of five and 34 years compared to matched individuals without

Down syndrome.<sup>3</sup> More data is needed to make a conclusive statement on risk of diabetes in adults with Down syndrome.

## Adrenal

Adrenal insufficiency is more common, but Cushing's disease is not.<sup>15</sup>

## Vitamin B12 Deficiency

This may be related to both autoimmunity and to celiac disease, both of which are more common in individuals with Down syndrome, as noted above. Vitamin B12 deficiency may present as a neurological change (e.g., dementia) or psychological change (e.g., depression), and macrocytosis without B12 deficiency is common in Down syndrome.<sup>31</sup>

## Musculoskeletal

Atlantoaxial instability (AAI) is much more common in Down syndrome.<sup>28,36</sup> Although the prevalence of spinal stenosis due to other causes (e.g., arthritic osteophytes) has not been reported in the literature, clinically it has been diagnosed in some individuals with Down syndrome. Symptoms can include change in use of arms or legs, change in bowel or bladder function, or neck pain. Investigation for persons of all ages should include flexion and extension radiographs of the cervical spine.<sup>113</sup> Note that an individual with Down syndrome may develop AAI later in life due to age-related joint degeneration.

## Arthritis

### Autoimmune

Although the onset is typically in children with Down syndrome, the diagnosis may have been missed in childhood due to subtleties of presentation and lack of report of symptoms by some individuals.<sup>114</sup>

### Osteoarthritis

Research is mixed on whether there is a difference in the prevalence or incidence of osteoarthritis in individuals with Down syndrome.<sup>36,115</sup> However, clinical assessment suggests that it is more common and at younger ages, possibly due to joint laxity. Adults with Down syndrome can successfully undergo joint replacement, but there does appear to be an increased risk of surgical complications.<sup>108,116-118</sup> In our clinical experience, many individuals with Down syndrome don't complain of pain, so osteoarthritis often presents as joint dysfunction.

## Joint Laxity

Connective tissue differences including structural differences in collagen and lower muscle tone contribute to joints that are lax and hypermobile.<sup>119-121</sup> Subluxation of the patella, AAI, and hip instability are more common.

## Osteoporosis

While research indicates osteoporosis is more common based on DEXA scan assessments,<sup>36</sup> the accuracy of DEXA scans is unclear in individuals with shorter stature, such as those

with Down syndrome.<sup>28</sup> In addition, the risk of fractures in individuals with Down syndrome is not known to be higher or lower.<sup>122</sup> [Adult health-care guidelines](#) state that there is insufficient evidence to deviate from standard population screening procedures.<sup>28</sup>

## Podiatry

Pes planus and overpronation are more common<sup>122</sup> and cause both pain and gait dysfunction. Inserts can be beneficial for individuals with Down syndrome.

## Neurologic

### Seizures

Seizures are more common in infancy and middle age, the latter typically associated with Alzheimer's disease.<sup>123</sup> Up to 84% of adults with Alzheimer's disease develop seizures,<sup>124</sup> and untreated seizures in this setting have been shown to hasten decline.<sup>125</sup>

### Spinal Cord Injury-Myelopathy

Cervical myelopathy is more common.<sup>36</sup> AAI appears to be the most common cause, but spinal stenosis related to arthritic osteophytes has also been found clinically.

### Alzheimer's Disease

The gene for amyloid protein is found on chromosome 21.<sup>126</sup> Current age-stratified prevalence estimates for Alzheimer's disease in individuals with Down syndrome are: 10% at 40-49 years, 20% at 50-60 years, and 40% in those over 60

years of age. However symptomatic Alzheimer's disease before age 40 is rare.<sup>127</sup> The current health guidelines for adults with Down syndrome suggest screening all six domains specified by the [National Task Group–Early Detection Screen for Dementia \(NTG-EDSD\)](#)<sup>39</sup> to identify early-stage dementia.<sup>28</sup> The differential diagnosis in this population is broad and includes depression, hypothyroidism, sleep apnea, hearing loss, vision loss, seizure disorder, infection, menopause, and developmental regression.<sup>128,129</sup> An Alzheimer's disease assessment must include both a medical and psychiatric evaluation, as multiple conditions can mimic the decline in skills, emotional changes, and memory lapses. Currently, all treatments for Alzheimer's disease are mainly supportive. There are several different medications claiming to treat Alzheimer's disease in adults with Down syndrome; however, according to recent Cochrane reviews, none are effective.<sup>130–133</sup>

### Autism

Autism is more common in individuals with Down syndrome.<sup>134,135</sup> While this is typically recognized in childhood, some adults with Down syndrome remain undiagnosed. Impaired communication, reduced social interaction, and repetitious behavior are hallmark symptoms. However, good social interaction is often a common trait of individuals with Down syndrome, so impaired socialization in those with autism may not be a strong finding.

## Mental Health

Several mental health conditions, including depression, anxiety, obsessive-compulsive tendencies, and behavioral issues,<sup>136,137</sup> are more common in individuals with Down syndrome. These are discussed in greater detail in the articles [\*Decline in Skills and Behavioral Change in Adults with Down Syndrome\*](#) and [\*Mental Health: Diagnosis and Treatment of Adults with Down Syndrome\*](#). A recent review of psychopharmacology outlines medications used for mental health diagnoses in Down syndrome.<sup>138</sup>

## Other

### Down Syndrome Regression Disorder

This is discussed in the [\*Down Syndrome Regression Disorder: Clinical Features, Diagnosis and Therapeutics\*](#) article.

## Conclusion

In this article, we have summarized the conditions that are common in adults with Down syndrome with review of relevant literature to serve as a resource for care. Of course, this resource is not comprehensive and other [\*Less Common Health Conditions in Adults with Down Syndrome\*](#) should be considered and care should be individualized to the person with Down syndrome.

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