

Prevalence of visual impairment, ocular pathology, and ability to achieve a thorough examination in an eye clinic for patients with disabilities



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PURPOSE	To report the demographics, types of visual/ocular pathology, and ability to achieve a comprehensive examination at a university-based outpatient clinic for individuals of all ages with disabilities.
METHODS	The medical records for all patients with disabilities examined from January 2014 through December 2016 at our monthly clinic staffed by a pediatric ophthalmologist were reviewed retrospectively. Descriptive statistics were calculated for demographics, visual acuity, ocular diagnoses, nonocular diagnoses, refractive error, and achievable examination data. Ocular diagnoses were categorized as treatable or nontreatable and noted if newly diagnosed.
RESULTS	A total of 178 patients with disabilities were examined at 281 visits; 119 patients (66.9%) were nonverbal. Of the 178, 140 patients (78.7%) had pathology or refractive error requiring glasses; 126 had pathology and 14 had no pathology. Of the 126 patients with pathology, 113 had treatable ocular diagnoses and 13 had only nontreatable diagnoses. Of the 113 with treatable conditions, 56 (49.6%) were newly diagnosed. Cycloplegic refraction was attained in 168 patients (94.4%); 85 had a significant refractive error, 66 of whom had another treatable ocular diagnosis. Lack of cooperation precluded slit-lamp examination in 1 patient, cycloplegic refraction in 3 (1.7%), dilated fundus examination in 4 (2.2%), and iCare or Goldmann intraocular pressure measurement in 28 (15.7%).
CONCLUSIONS	<i>Patients</i> with disabilities in our cohort had a high prevalence of ocular pathology, which was often treatable and previously unrecognized. Refractive errors were common and frequently accompanied by other treatable conditions. A thorough ophthalmic examination was achievable in most individuals with disabilities. (J AAPOS 2019;23:274.e1-5)

Individuals with disabilities have an increased prevalence of visual and ocular conditions,¹⁻¹³ yet difficulty with communication and inability to cooperate often makes examination and diagnosis challenging in these patients, and services and eye care professionals willing or able to provide them are scarce.^{1,6,10,14} In January 2014 our university-based eye center established a monthly outpatient clinic specifically for individuals of all ages with disabilities, staffed by one pediatric ophthalmologist. To better understand the visual needs and pathology in this population, which has received little study in the ophthalmic literature, a retrospective

chart review of patients seen in the clinic was undertaken to determine the prevalence of ocular pathology, whether conditions encountered were treatable, whether the conditions were newly diagnosed, and the completion rate for comprehensive ophthalmic examinations.

Subjects and Methods

Patients with intellectual and/or motor disabilities were referred to the clinic at the Emory Eye Center, Atlanta, Georgia, for routine eye examinations as well as for specific ocular/visual concerns by both nonuniversity and university-affiliated primary care physicians, ophthalmologists, optometrists, neurologists, and geneticists. The medical records of all patients examined at this monthly clinic from January 2014 through December 2016 were reviewed retrospectively. Emory University Institutional Review Board approval was obtained for this study, which adhered to the tenets of the Declaration of Helsinki and complied with the US Health Insurance Portability and Accountability Act of 1996. The following demographic characteristics were collected: age at initial presentation, sex, type of insurance, whether the patient could communicate verbally or nonverbally.

Descriptive statistics were calculated for demographics, visual acuity, ocular diagnoses, nonocular diagnoses, refractive error,

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and ability to complete examination. Nonrefractive diagnoses related to the eyes and visual system were categorized as treatable or nontreatable, and statistics were calculated for whether they were newly diagnosed. Conditions for which treatment by an eye care physician is customarily available to provide resolution or improvement were designated as treatable. Ocular conditions that were unable to be rehabilitated and nonocular visual problems were designated as nontreatable. In an effort to delineate amblyopia in children from long-standing amblyopia in older individuals, an age criteria of ≤ 17 years was chosen to divide this diagnosis into treatable versus nontreatable groups based on previously published results from the Pediatric Eye Disease Investigator Group (PEDIG).¹⁵

All examinations were performed in their entirety by the same pediatric ophthalmologist (SJM). Ophthalmology residents rotated through this clinic as observers and assistants. Visual acuity was measured using Lea, HOTV, or Snellen charts in patients who could cooperate verbally or by matching Lea or HOTV characters to a lap card. For patients unable to cooperate for such measurement, fixation and following were assessed by response to visual stimuli and whether there was a fixation preference on base down prism testing or preferred eye when strabismus was present. Intraocular pressure (IOP) measurement was first attempted using iCare tonometry (<https://www.icare-usa.com/>), with multiple measurements taken if necessary to document repeatability. In case of an unsuccessful or a questionable result, Goldmann tonometry was then used. Finger tension estimate of IOP was documented if unable to be measured by iCare or Goldmann tonometry. Alignment was assessed using cover-uncover and alternate cover testing. If fixation or cooperation precluded such assessment, alignment was evaluated by corneal light reflexes, measuring with prism when possible when strabismus was present.

Slit-lamp examination was performed using standard or portable equipment. Cycloplegia was attained in adults with instillation of phenylephrine 2.5% and tropicamide 1%; in children and adolescents without a seizure history, using either a combination phenylephrine 2.5%/tropicamide 1%/cyclopentolate 1% drop or tropicamide 1% and cyclopentolate 1% drops. For children and adolescents with a seizure history, phenylephrine 2.5% and tropicamide 1% were used, repeated once in 10 minutes. Refractive error was ascertained by cycloplegic refraction using streak retinoscopy, recorded in in plus cylindrical notation, and classified as “significant” if it met the age-related criteria defined in previously published guidelines.¹⁶ Dilated fundus examination was performed with indirect ophthalmoscopy using a 20 D lens. Direct ophthalmoscopy was performed if further assessment was needed. If cooperation permitted, B-scan ultrasonography was used when no fundus view was possible.

Results

A total of 188 patients were seen during 293 visits. Ten patients were excluded because they were erroneously scheduled and had no disability. Included in the study were 178 patients with disabilities examined at 281 visits. Of these, 119 patients (66.9%) were nonverbal; 11 could

communicate through pointing or gestures, leaving 108 (60.7%) patients who could not communicate verbally or nonverbally. Demographic data are summarized in Table 1.

A complete ophthalmic examination was achieved in the majority of patients. Cooperation allowed slit-lamp examination in 177 patients (99.4%). Intraocular pressure (IOP) testing via iCare or Goldmann applanation tonometry was achieved in 150 patients (84.3%). Cycloplegic refraction was accomplished in 168 (94.4%) patients, bilaterally in 162 (91.0%) and unilaterally in 2 right eyes (1.1%) and 4 left eyes (2.2%). Cycloplegic retinoscopy could not be obtained bilaterally in 10 patients (5.6%): 3 (1.7%) because of inability to cooperate and 7 (3.9%) because of ocular pathology (4 with corneal pathology, 2 with cataracts, and 1 with retinal detachments). All of the 6 patients (3.4%) in whom cycloplegic refraction could not be obtained in only one eye had ocular pathology (3 with retinal detachment, 2 with cataract, and 1 phthisical eye).

Dilated fundus examination was completed bilaterally in 164 of the 178 patients (92.1%). Inability to cooperate prevented dilated fundus examination bilaterally in 4 patients (2.2%), and pathology precluded fundus evaluation in another 10 (5.6%)—3 binocularly (2 with cataracts, 1 with corneal edema) and 7 monocularly (4 with retinal detachment, 2 with cataract, and 1 phthisical eye). The 4 patients whose cooperation precluded fundus examination also accounted for those who could not cooperate for slit-lamp examination or cycloplegic refraction. Of these, 2 already had examinations under anesthesia by their referring ophthalmic subspecialists, 1 had a history of retinitis pigmentosa and was scheduled for examination under anesthesia, and 1 family declined further evaluation.

The most common nonocular diagnoses were autism (30.3%), Down syndrome (20.2%), cerebral palsy (17.4%), and intellectual disability of unspecified etiology (11.2%). Table 1 provides a complete list of the nonocular diagnoses. The most common ocular/visual diagnoses were strabismus (48.3%), cortical visual impairment and optic neuropathy (each 14.0%), and amblyopia (12.9%). A complete list of the ocular diagnoses, including the number newly diagnosed, is provided in Table 2.

Of the 178 patients, 38 (21.3%) had a normal eye examination without pathology or need for glasses, and 140 (78.7%) had pathology or refractive error requiring glasses, including 126 with pathology and 14 who needed glasses but had no pathology. Of the patients with pathology, 113 had treatable ocular diagnoses and 13 had only nontreatable diagnoses. Of the 113 with treatable conditions, 71 (62.8%) were nonverbal; 56 (49.6%) with treatable conditions were newly diagnosed, as were 6 with nontreatable diagnoses. Newly diagnosed treatable conditions were often vision threatening, including 10 of 17 patients (59%) with glaucoma or glaucoma suspect status, 7 of 14 (50%) with cataracts, and 14 of 18 (78%) ≤ 17 years of age with

Table 1. Patient demographics (N = 178)

Study parameter	No (%)
Sex	
Male	107 (60.1)
Female	71 (39.9)
Age at first visit ^a	
≤10 years	99 (55.6)
11-19 years	24 (13.5)
20-39 years	35 (19.7)
40-59 years	12 (6.7)
≥60 years	8 (4.5)
Verbal ability	
Verbal	59 (33.1)
Nonverbal	119 (66.9)
Nonverbal, can point/communicate	11 (6.2)
Nonverbal, cannot point/communicate	108 (60.7)
Insurance status	
Medicaid	100 (56.2)
Private Insurance	47 (26.4)
Medicare	26 (14.6)
Tricare	3 (1.7)
No insurance/Self pay	2 (1.1)
New patient	123 (69.1)
Nonocular diagnosis	
Autism	54 (30.3)
Down Syndrome	36 (20.2)
Cerebral Palsy	31 (17.4)
Intellectual disability (no other specified diagnosis)	20 (11.2)
Neuropathology	16 (9.0)
Chromosomal genetic disorder	12 (6.7)
Stroke	9 (5.1)
Hydrocephalus	8 (4.5)
Diabetes	5 (2.8)
Metabolic disease	5 (2.8)
Traumatic brain injury	5 (2.8)
Mitochondrial disorder	4 (2.2)
Deafness	4 (2.2)
Psychiatric disorder	3 (1.7)
Encephalopathy	2 (1.1)
Lowes syndrome	1 (0.6)
Parkinson's	1 (0.6)
Craniofacial syndrome	1 (0.6)
Hemangioma/vascular	1 (0.6)

^aMean, 16.7 ± 18.8 years; range, 0.4-95 years.

amblyopia. Together, the 113 patients with treatable ocular diagnoses and 14 patients who needed glasses but had no other pathology comprised 127 study patients (71.3%) with a treatable ocular condition.

Visual acuity testing was possible in 70 of 178 patients (39.3%) using Snellen, Lea, or HOTV eye charts; 108 patients (60.7%) were unable to cooperate for such assessment. Of the 70 patients able to cooperate, visual acuity ranged from 20/20 to no light perception, with a median of 20/30 in the right eye and 20/40 in the left (1st quartile = 20/20 in each eye; 3rd quartile = 20/60 in the right eye and 20/50 in the left eye). Of the 108 patients who were unable to cooperate, visual acuity ranged from central, steady, and maintained (CSM) to no fixation/following. In 94 of the 108 (87.0%), visual acuity was equal between the eyes; 55 (58.5%) were CSM and 14 (14.9%) had no fixation or following motions in each eye.

Table 2. Visual/ocular diagnoses

Ophthalmic diagnoses	Overall (N = 178), no. (%)	New diagnosis, no. (%)
Nontreatable diagnoses		
Cortical visual impairment	25 (14.0)	1/25 (4.0)
Optic neuropathy	25 (14.0)	12/25 (48.0)
Nystagmus	21 (11.8)	2/21 (9.5)
Retinal abnormality, anatomical	9 (5.1)	5/9 (55.6)
Amblyopia (>17 years old)	5 (2.8)	2/5 (40)
Retinal detachment; chronic, total	5 (2.8)	3/5 (60.0)
Phthisis/microphthalmia	3 (1.7)	1/3 (33.3)
Retinal pigmentary dystrophy	3 (1.7)	1/3 (33.3)
Visual field deficit	3 (1.7)	2/3 (66.7)
Ophthalmoplegia	2 (1.1)	0/2 (0)
Coloboma, chorioretinal	1 (0.6)	0/1 (0)
Treatable diagnoses		
Strabismus	86 (48.3)	24/86 (27.9)
Esotropia	41 (23.0)	13/41 (31.7)
Exotropia	26 (14.6)	6/26 (23.1)
Intermittent exotropia	15 (8.4)	7/15 (46.7)
Hypertropia	5 (2.8)	4/5 (80.0)
Dissociated vertical deviation	2 (1.1)	0/2 (0)
Convergence insufficiency	2 (1.1)	1/2 (50.0)
Trochlear nerve palsy	2 (1.1)	0/2 (0)
Duane syndrome	1 (0.6)	1/1 (100)
Amblyopia (≤17 years old)	18 (10.1)	14/18 (77.8)
Cataract	14 (7.9)	7/14 (50.0)
Corneal pathology (nonkeratoconus)	12 (6.7)	6/12 (50.0)
Nasolacrimal duct obstruction	9 (5.1)	2/9 (22.2)
Glaucoma	7 (3.9)	2/7 (28.6)
Torticollis, ocular	6 (3.4)	0/6 (0)
Glaucoma suspect, ocular hypertension	5 (2.8)	4/5 (80.0)
Ptosis	4 (2.2)	1/4 (25.0)
Blepharitis	3 (1.7)	3/3 (100)
Glaucoma suspect, cup:disk ratio	3 (1.7)	2/3 (66.7)
Glaucoma suspect, narrow angles	2 (1.1)	2/2 (100)
Keratoconus	2 (1.1)	2/2 (100)
Lens subluxation	2 (1.1)	2/2 (100)
Trichiasis	2 (1.1)	2/2 (100)
Chalazion	1 (0.6)	0/1 (0)
Photophobia intense	1 (0.6)	1/1 (100)

Of the 168 patients in whom cycloplegic refraction was attained, 85 (50.6%) met the criteria set for significant refractive error in one or both eyes. Table 3 summarizes significant refractive error data. Our results show that refractive errors are not only common in this patient population but also frequently accompanied by other treatable conditions.

Cycloplegic refraction data obtained in 330 eyes of 168 patients showed that spherical equivalent refractive error ranged from -19.63 D to +6.75 D. With refraction represented in plus cylindrical notation, the sphere ranged from -21.75 D to +6.75 D. No patient had a plano refractive error in either eye. Figure 1 depicts the full distribution of refractive error for patients in this study. Anisometropia was present in 22 of 162 patients (13.6%) in whom cycloplegic refraction was achieved bilaterally. High myopia was present more frequently than high hyperopia, with a spherical equivalent of > +5 D in 7 of 330 eyes (2.1%) and a spherical equivalent of ≥ -6 D in 36 of 330 eyes

Table 3. Significant refractive error statistics (cycloplegic refraction acquired in 168 of 178 patients)^a

Statistical significance parameter	No. (%)
At least one significant refractive diagnosis	85/168 (50.6)
Myopia significant	54/85 (63.5)
Astigmatism significant	44/85 (51.8)
Anisometropia	22/85 (25.9)
Hyperopia significant	11/85 (12.9)
Significant refractive error, new diagnosis	37/85 (43.5)
Significant refractive error plus ≥ 1 other treatable diagnosis	66/85 (77.6)
Significant refractive error plus only nontreatable diagnoses	6/85 (7.1)

^aThresholds for classification of significant refractive error in study patients as follows:¹⁶

Age, months	Astigmatism	Hyperopia	Anisometropia	Myopia
12-30	>2.0 D	>4.5 D	>2.5 D	> -3.5 D
31-48	>2.0 D	>4.0 D	>2.0 D	> -3.0 D
>48	>1.5 D	>3.5 D	>1.5 D	> -1.5 D

(10.9%); myopia ≥ 10 D spherical equivalent was present in 18 of 330 eyes (5.5%).

Astigmatic error ranged from zero to 8.50 D. In 301 of 330 (91.2%) eyes astigmatism was < 3 D. Of the 330 eyes, no astigmatism was present in 76 eyes (23.0%), ≥ 0.25 D to < 1.5 D was present in 149 (45.2%), ≥ 1.5 D to < 3 D was present in 76 (23.0%), and ≥ 3 D was present in 29 (8.8%).

Glasses were prescribed for 93 of 178 patients (52.2%) examined and was the first eyeglass prescription for 42 of the 93 (45.2%). Forty-seven patients (26.4%) already had glasses on presentation. Of the 14 patients (7.9%) who needed glasses but had an otherwise normal examination, 13 had a significant refractive error, and 1 missed our defined threshold for this designation by 0.25 D; 9 of these 14 (64.3%) did not have glasses previously.

Discussion

Our results clearly demonstrate that there is a high prevalence of visual and ocular pathology in an outpatient population of individuals with disabilities, much of it treatable and often newly diagnosed. Refractive errors are common and frequently accompanied by other treatable conditions. A complete ophthalmic examination was the rule rather than the exception in our patient cohort.

The results of our study emphasize the need to analyze the visual problems of this large patient population. Our data also support previous reports that show that treatable conditions are common in this demographic,^{9,13} with strabismus and refractive errors being especially prevalent,^{1-12,17-19} and that patients can generally cooperate with examiners.^{6,11} Our study found that in this patient population conditions that are found are frequently both newly diagnosed and treatable.

We chose to divide amblyopia into treatable and nontreatable categories based on age because we felt it was important to delineate between young and older individuals with amblyopia. Because there is no

generally accepted age at which amblyopia is considered untreatable, the cut-off of ≤ 17 years old was chosen based on previously published results of PEDIG,¹⁵ but we cannot assure that some older patients with potentially treatable amblyopia were included in the nontreatable group.

Although other studies have reported a high prevalence of significant refractive errors in patients with disabilities, there has not been a clear definition of what exactly this means. Therefore, before calculating descriptive statistics for refractive error, we felt it was important to establish a definition of what significant meant for the purposes of this study. Since there is no standardized designation for both children and adults, as needed for our patient population, the thresholds for significant refractive error were selected from previously published guidelines set for automated preschool screenings, because they were delineated by type of refractive error and could be applied to various ages. Although adhering to a clearly defined standard for classifying refractive errors is a strength of this study, one weakness is that it likely underestimates the number of patients with significant refractive error, because, for example, the threshold set for hyperopia as > 3.5 D is probably too high for adults. Although it would be of interest to know how many patients wore glasses when prescribed and whether glasses had an effect on quality of life, it was not within the scope of this descriptive study to evaluate outcome data. Such questions are worthy of future investigation.

As deinstitutionalization moves those with disabilities into the community,^{1,2,10,20} the need for outpatient resources for their eye care increases. Our results support the recommendation that individuals with disabilities should have routine comprehensive ophthalmic examinations. This new information regarding the types and prevalence of conditions encountered in such patients is of importance to the physicians providing their eye care. As previous reports have noted, the essential elements are having the time and expertise to perform such examinations.^{1,2,10} Individuals of all ages with disabilities are frequently referred to pediatric ophthalmologists because examining patients who are often complex, nonverbal, and uncooperative is the nature of their practice. Although comprehensive ophthalmologists possess the ability to evaluate adults with disabilities, time-consuming examinations often do not fit well into busy clinical schedules structured around nonchallenging patients who can easily converse and follow directions. A potential scenario could be screening by comprehensive or pediatric optometrists in a university setting who could refer patients found to have diagnoses requiring a higher level of care. We suggest that in a university-based setting, a dedicated eye clinic for individuals with disabilities staffed by experienced eye care physicians provides a desirable environment for examination because the needs of this patient population are anticipated, adequate time is factored into the schedule, and it

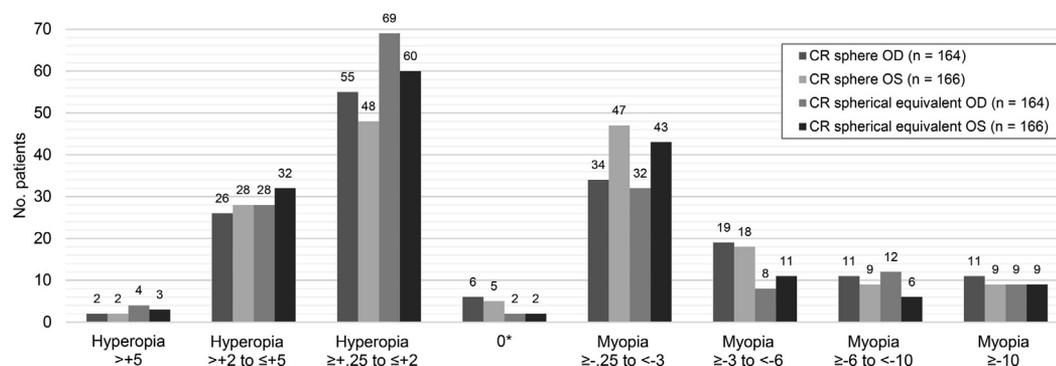


FIG 1. Refractive error by cycloplegic refraction (CR) in diopters. N = 178 patients; unable to obtain CR in 14 eyes OD and 12 eyes OS. All with plano sphere had cylinder; no patient had a plano refractive error. CR sphere, sphere of the refractive error, as recorded in plus cylindrical notation. OD, right eye, OS, left eye.

provides the opportunity to teach ophthalmology residents the skills necessary to perform challenging examinations they undoubtedly will encounter in their careers.

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