Eye on the Border
From the Files of a Pediatric Ophthalmologist

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ABSTRACT

Purpose: To provide extensive data on the ten most frequent ophthalmic diagnoses encountered in a pediatric ophthalmology practice – The Children's Eye Center of El Paso.

Methods: This is a retrospective, computerized medical records study of 14,127 pediatric patients, aged 1 month to 18 years, with 66,223 total diagnoses, in El Paso, Texas between August 17, 1996 and April 11, 2005. The Children's Eye Center of El Paso utilized a computerized medical records software program known as *ifa Eyecare Software*®.

Results: The most common diagnoses were refractive amblyopia (12,789, 19%), esotropia (6,218, 9%), myopia (3,925, 6%), healthy eyes (3,429, 5%), stenosis of the nasolacrimal duct (2,940, 4%), alternating exotropia (2,805, 4%), vernal conjunctivitis (2,143, 3%), astigmatism (2,097, 3%), strabismic amblyopia (1,721, 3%), and chalazion (1,670, 3%). Ninety percent (11,441) of the diagnoses of amblyopia were made in patients 6 years of age or older, with the highest frequency at ages 8-10. Eighty-seven percent (5,424) of the diagnoses of esotropia were made in patients 4 years of age or older, with the highest frequency at ages 6-8. Finally, 78% (2,176) of the diagnoses of alternating exotropia were made in children 6 years of age or older, with a peak at ages 6-8.

Conclusion: Refractive amblyopia, esotropia, myopia, healthy eyes, nasolacrimal duct obstruction, alternating exotropia, vernal conjunctivitis, astigmatism, strabismic amblyopia, and chalazion were the ten most common diagnoses seen in a pediatric ophthalmology practice in the border community of El Paso, Texas. Amblyopia,

esotropia, exotropia, and astigmatism were diagnosed too late for effective therapeutic intervention. We recommend early examination and vision screening of young children (aged 3 to 5 years) for amblyopia, strabismus, and refractive errors, with subsequent follow-up via a computer database employing eyecare software. Accurate electronic charting not only facilitates tabulation of precise prevalence data but is also extremely beneficial to subsequent treatment coordination and follow-up.

INTRODUCTION

There have been no studies detailing extensive use of eyecare software to document and tabulate the most frequent ophthalmic diagnoses encountered by a pediatric ophthalmologist in a border community.

El Paso, Texas is one such community of almost 600,000 total inhabitants (70% Hispanic), with one-third of the population under 18 years of age and 50,000 under 5 years.[1] The inaccessibility to adequate health-insurance plans and medical care, the existence of *colonias,* and a burgeoning immigration problem all impede precise prevalence data collection and standard health care delivery. In fact, the 157 *colonias* in El Paso County with their inherent lack of running water (26%), inadequate sewage systems (66%), and an average household income of less than $15,000 a year (32%) face graver problems than preventive eyecare maintenance.[2] Add to this the fact that of 636 small businesses in El Paso, only 52, or 8%, offer a health-insurance plan, and the previsions by census trackers that El Paso's population is expected to reach a million people by 2025, and one begins to comprehend a clear and present recipe for disaster.

In order to stem the imminent tide and to provide better pediatric ophthalmic services to indigent border and inner city populations in El Paso and throughout the U.S., accurate electronic charting must first tabulate data precisely and then point the way to the most frequent ophthalmic diagnoses encountered, so that adequate therapeutic measures can be taken on a large and cost-effective scale.

PATIENTS AND METHODS

The electronic clinical records (ifa Eyecare Software®, Germany) of 14,127 pediatric ophthalmic patients (age range of 1 month to 18 years at the time of first visit), seen in El Paso, Texas between August 17, 1996 and April 11, 2005, were reviewed. All patients had undergone a complete ophthalmic and orthoptic evaluation, and a total of 66,223 individual ophthalmic diagnoses had been made.

Visual acuity testing was measured by Snellen chart, Allen figures and Allen cards, and E game. Cover testing was employed as an aid to demonstration of small-angle or intermittent strabismus. Slit lamp exam and indirect ophthalmoscopy was used to complete the eye examination. Cycloplegic retinoscopy and subjective refractions were also done. Ifa Eyecare Software®, with the ability to run statistics for detailed diagnoses in all patients, analyzed ICD-9 codes and age group distribution for purposes of this study.

RESULTS

Of the 14,127 patients (age range of 1 month to 18 years) with a total of 66,223 ophthalmic diagnoses, 39,737 diagnoses (60%) were among the most commonly seen.

The most frequent diagnosis was refractive amblyopia, with a total of 12,789 or 19%. The second most frequent diagnosis was esotropia, with a total of 6,218 (9%), followed by myopia (3,925, 6%) and healthy eyes (3,429, 5%). Thus, almost 40% of the total ophthalmic diagnoses involved only four ocular conditions, with predominance (almost half of those or 19%) attributed to refractive amblyopia **(Table 1).**

In order of frequency, the remaining six of the ten most common ophthalmic diagnoses encountered were: stenosis of the lacrimal duct (2,940 diagnoses, 4%), alternating exotropia (2,805, 4%), vernal conjunctivitis (2,143, 3%), astigmatism (2,097, 3%), strabismic amblyopia (1,721, 3%) and chalazion (1,670, 3%). They accounted for 13,376 diagnoses or 20% of the 66,223 total.

Refractive amblyopia, esotropia, myopia, and healthy eyes made up the vast majority of most frequent ophthalmic diagnoses (26,361 of 39,737, or 66%), with the others noted above accounting for 13,376 of 39,737, or 34%.

Ninety percent (11,441) of the diagnoses of amblyopia were made in patients 6 years of age or older **(Table 2).** Amblyopia was diagnosed most frequently in 8-10-year-olds **(Tables 3-4).** Eighty-seven percent (5,424) of the diagnoses of esotropia were made in patients 4 years of age or older. Esotropia was diagnosed most frequently in 6-8-year-olds **(Tables 3-4).** The diagnosis of myopia was made most often in the 10-16-year-old age range **(Tables 3-4).** Healthy eyes were most frequently diagnosed in children older than 6 years of age. The highest frequency of stenosis of the lacrimal duct was noted in children 4-6 years of age, with alternating exotropia occurring predominantly in the 6-8-year-old age group. Astigmatism became preponderantly evident in 8-10-year-olds. While vernal conjunctivitis was most frequently diagnosed in children older than 6 years

of age, chalazion became evident somewhat earlier at 4 years (age range 4-10). Finally, 777 (45%) diagnoses of strabismic amblyopia, slightly less than half, were made in children ≥ 10 years of age, with peak at precisely 10 years.

DISCUSSION

During the first six months of life, normal visual development is rapid and continues through the first decade. As a group, young children are extremely sensitive to conditions that interfere with vision and visual development. Pediatric ophthalmologists, as well as pediatricians, must therefore detect the most important ophthalmic condition of early childhood. Amblyopia, the most prevalent, may be caused by common vision problems such as strabismus, uncorrected refractive errors, and deprivation secondary to occlusion. When detected early, it is treatable, but the potential for correction (best prognosis) and normal visual development is inversely related to age.[3]

We studied our computer-based records of 14,127 patients (age range of 1 month to 18 years) with a total of 66,223 ophthalmic diagnoses, including amblyopia, in order to determine the prevalence of the ten most frequent ocular conditions present in young children in a U.S.–Mexico border community. To date, the incidence of amblyopia in the general population had been estimated to be between 2 and 5%.[4]

The fact that refractive amblyopia, esotropia, myopia, and healthy eye examinations made up the clear majority of our ten most frequent ophthalmic diagnoses (66%) was in, and of, itself encouraging. It meant that our energies were being efficiently directed to areas where they might promote the most benefit. When identified early, those ocular disorders could be effectively treated with beneficial results to the children's

vision in the future.[5] On the other hand, the fact that 89% of our diagnoses of amblyopia and strabismus were made in patients 6 years of age or older (school age) was undesirable from a therapeutic point of view. Detection at an earlier age (< 6 years) will result in superior treatment outcomes and compliance.

As studies of the prevalence of amblyopia and undetected vision abnormalities among children in border communities like El Paso, Texas are nonexistent, this is the first such study of its kind. Knowing the most common ocular disorders of children in this and similar areas of the U.S. will help direct efforts aimed at achieving optimum, cost-effective, therapeutic and preventive benefits and outcomes.

Vision screening of children ≥ 6 years of age is performed by school nurses and pediatricians. There are currently no standardized vision screening programs for preschool children in El Paso, Texas. Consequently, local pediatric ophthalmologists are detecting amblyopia and strabismus much too late for effective therapeutic intervention. We recommend development and implementation of early vision screening in 3-5-year-old children already enrolled in Head Start programs.[6]

Visual acuity screening, cover testing, and direct ophthalmoscopy, are tools well within the reach of primary care physicians and pediatricians to detect serious eye disorders.[7] The extremely high prevalence of amblyopia, esotropia, and myopia in our series of patients probably reflected competent use of those techniques by local primary care physicians and pediatricians who subsequently referred their findings and patients to us.

The population of El Paso, Texas is 70% Hispanic with a preponderance of Mexican culture and heritage. It is a Mexican-American, border community of low

socioeconomic and education level, with a high migratory influx of uninsured children from its urban neighbor, Juárez, Mexico, which has a population of 1,000,000 and a travel time from El Paso of only 5 minutes. The frequency of amblyopia and strabismus appears to be higher here than in other areas of the U.S. There is therefore a need for further studies detailing the incidence of amblyopia and strabismus in Hispanic populations and U.S.-Mexico border communities. Late diagnosis and referral of children to a pediatric ophthalmologist for amblyopia, strabismus, and refractive errors (myopia and astigmatism) in our study may have been due to inaccessibility of health insurance plans and medical care to an indigent population.

Models of preventive intervention in both preschool and older pediatric populations are not exclusive to this side of the world either. A six-year Italian experience demonstrated similar prevalence rates to our own and stressed the importance of early therapeutic intervention in amblyopia to allow complete visual rehabilitation.[8] Published studies of the prevalence of amblyopia and undetected vision abnormalities among preschool children in Mexico itself have also begun to appear.[9]

With 66% of our ten most frequent diagnoses and almost 40% of our total ophthalmic diagnoses involving the four conditions of amblyopia, esotropia, myopia, and healthy eyes, the obvious and immediate importance of preschool vision screening comes to the fore. It is given added importance by the possibility that our frequency data may have been underestimated, because current ICD-9 diagnostic classification codes do not consider myopic astigmatism, which is quite common in Hispanic children. It is our recommendation to create ICD-9 codes for hyperopic and myopic astigmatism, in order to more accurately tabulate frequency data in this population.

Amblyopia, strabismus, and refractive errors in Hispanic populations must be detected at 3 years of age, not the current 6 years or older, to promote better treatment outcomes. The remaining 34% of our ten most frequent diagnoses, in the form of stenosis of the nasolacrimal duct, alternating exotropia, vernal conjunctivitis, astigmatism, strabismic amblyopia, and chalazion, while by no means unimportant, carry far less weight in terms of the collective price to be paid by society and public/private health care systems.

We recommend early examination and vision screening of young children ages 3-5 years, with subsequent follow-up via computer database employing eyecare software. Accurate electronic charting not only enhances collection of precise prevalence data, but also facilitates treatment coordination.

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TABLE 1

TEN MOST FREQUENT PEDIATRIC OPHTHALMIC DIAGNOSES

(Total Diagnoses 66,223 from August 17, 1996 – April 11, 2005)

ICD-9 Code	Diagnosis	Number	Percent
368.03	Refractive amblyopia	12,789	19
378.0	Esotropia	6218	9
367.1	Myopia	3925	6
V72.0	Healthy eyes	3429	5
375.56	Stenosis nasolacrimal duct	2940	4
378.15	Alternating exotropia	2805	4
372.13	Vernal conjunctivitis	2143	3
367.20	Astigmatism	2097	3
378.01	Strabismic amblyopia	1721	3
373.2	Chalazion	1670	3
Total		**39,737**	**60**

TABLE 2

PREVALENCE OF FREQUENT PEDIATRIC OPHTHALMIC DIAGNOSES

(Most Frequent Diagnoses 39,737 from August 17, 1996 – April 11, 2005)

Diagnosis	Age Group (yrs)	Number	Percent Cases
Refractive amblyopia	≥ 6	11,441	90
Esotropia	≥ 4	5424	87
Myopia	10-16	2132	54
Healthy eyes	≥ 6	3145	92
Stenosis nasolacrimal duct	4-6	1544	53
Alternating exotropia	6-8	995	36
Vernal conjunctivitis	6-16	1798	84
Astigmatism	6-16	1579	75
Strabismic amblyopia	4-10	1222	71
Chalazion	4-10	904	54
Total		**30,184**	**76**

Table 3

DETAILED STATISTICS OF TEN MOST FREQUENT OCULAR DIAGNOSES

(39,737 Frequent Diagnoses of 66,223 Total – August 17, 1996 to April 11, 2005)

Diagnosis	Total	Yrs 0	Yrs 2	Yrs 4	Yrs 6	Yrs 8	Yrs 10	Yrs 12	Yrs 14	Yrs 16	Yrs 18	%
Refractive amblyopia	12789	44	370	934	2039	2861	2753	2248	1045	423	72	**19**
Esotropia	6218	151	643	1128	1443	1278	725	435	206	146	63	**9**
Myopia	3925	18	31	54	174	361	528	789	937	734	299	**6**
Healthy eye exam	3429	9	72	203	422	614	700	592	419	306	92	**5**
Stenosis nasolacrimal duct	2940	345	466	748	859	372	73	33	19	21	4	**4**
Alternating exotropia	2805	43	274	312	630	496	369	313	226	95	47	**4**
Vernal conjunctivitis	2143	13	41	114	264	331	441	338	324	199	78	**3**
Astigmatism	2097	47	76	183	296	410	383	289	214	144	55	**3**
Strabismic amblyopia	1721	26	72	187	302	357	392	210	122	48	5	**3**
Chalazion	11670	16	119	236	279	298	269	163	132	123	35	**2**
Percent of 66,223 total												**60**
Total frequent diagnoses	**39737**	**712**	**2164**	**4099**	**6708**	**7378**	**6633**	**5410**	**3644**	**2239**	**750**	
Percent 39,737 frequent		**2**	**5**	**10**	**17**	**19**	**17**	**14**	**9**	**6**	**2**	

Table 4

AGE-SPECIFIC PREVALENCE CLUSTERS OF OPHTHALMIC DIAGNOSES

(Most Frequent Diagnoses 39,737 from August 17, 1996 – April 11, 2005)

Diagnosis	Prevalent Age Group	Number	% Diagnoses
Refractive amblyopia	6 – 12 yrs	9,901 / 12,789	77
Esotropia	4 – 8 yrs	3,849 / 6,218	62
Myopia	10 – 16 yrs	2,988 / 3,925	76
Healthy eyes	8 – 12 yrs	1,906 / 3,429	56
Stenosis nasolacrimal duct	2 – 6 yrs	1,299 / 2,940	44
Alternating exotropia	6 – 10 yrs	1,045 / 2,805	37
Astigmatism	6 – 12 yrs	1,378 / 2,097	66
Vernal conjunctivitis	8 – 14 yrs	1,434 / 2,143	67
Strabismic amblyopia	6 – 10 yrs	1,051 / 1,721	61
Chalazion	4 – 10 yrs	869 / 1,670	52
Total		**25,720 / 39,737**	**65**