Pediatric ophthalmology and childhood reading difficulties

Overview of reading development and assessments for the pediatric ophthalmologist

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SUMMARY Reading difficulties are common in the pediatric population, and large socioeconomic disparities exist. In the United States 46% of white children achieved expected reading proficiency by the end of fourth grade, while only 21% of Hispanic and 18% of African American children were reading at the expected level. Reading is an involved cognitive process with many subskills; likewise, development of reading proficiency is a complex and continuous process. Failure to achieve reading proficiency or even early difficulty with reading can affect a child's academic performance for years to come. Some studies suggest reading proficiency may be related to later success in life. Although many problems with reading are not related to vision, a vision assessment is recommended for children with reading difficulties and a suspected vision problem. The process of reading development as well as the varied educational assessments of reading are presented here for pediatric ophthalmologists. (J AAPOS 2017;■:1-4)

Reading difficulties are common in the pediatric population. According to the 2015 National Assessment of Education Progress, only 46% of white children achieved expected reading proficiency by the end of fourth grade.[1] An even poorer performance was found among minority students, with only 21% of Hispanic and 18% of African American students reading at grade level. In addition to racial disparities, significant socioeconomic disparities exist. Of children who did not qualify for a subsidized school lunch (an indicator of poverty), 52% achieved reading proficiency at the 4th grade level, whereas only 21% of students qualifying for free or reduced cost lunch achieved the same metric.

In order to read well, children need to see clearly and have the neurocognitive skills to process what is seen.[2] Because some vision problems can interfere with the process of reading, it has been recommended that children with a suspected learning disability undergo a comprehensive eye examination to detect treatable vision problems.[3]

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There is a significant body of literature related to reading difficulties and vision problems, and whereas the vast majority of reading disorders are not directly related to vision, it is anticipated that pediatric eye care providers will continue to evaluate many children with reading difficulties.[4-7] We present an overview of the process of learning to read and the most widely used reading assessments for preschool and school-age children.

Understanding Reading

Reading is a multifaceted and complex skill. McCardle and colleagues[8] define skilled reading as "the ability to derive meaning from text accurately and efficiently." The National Reading Panel[9] identified five main components of reading instruction: phonemic awareness, phonics, fluency, vocabulary, and comprehension. *Phonemic awareness* is the ability to discriminate and manipulate individual phonemes (or sounds) in spoken words and is related to speaking and listening.[10] Although it does not require printed material, it is highly correlated with later reading skills and is considered necessary for learning to read. *Phonics* is the knowledge of the relationships between letters and sounds. This skill allows students to decode written text into spoken words.[11] *Fluency* describes how well a child is able to produce oral language from written text.[12] It includes speed, accuracy, and expression used when reading aloud. Without mastering fluency, children are not able to advance on to higher levels of reading.[13] *Vocabulary* refers to the words known by a child. A strong vocabulary

Table 1. Reading development by age[a]

	Emergent reader	Early reader	Transitional readers	Self-extending readers
Approximate age range	2-7 years	5-7 years	5-7 years	6-9 years
Approximate grade	Preschool to early 1	K-1	K-2	Grades 1-3
Description	Beginning to make links between oral and written language but obtains most information from pictures	Reads familiar texts with fluency and relies less on pictures for information	Reads most texts with fluency and reads longer more complex text	Reads a wide range of texts independently for meaning and problem solving

K, kindergarten.
[a]Adapted from Fountas and Pinnell[19] and US Department of Education Reading Milestones.[20]

assists with decoding, fluency, and comprehension; a limited vocabulary hampers a child's ability to read. *Comprehension* describes the ultimate goal of reading, which is generating meaning from a text.[14] Together, development of these five component skills leads to children becoming expert readers.

Although each component is necessary for skilled reading, they are taught and assessed at different time points as children are learning to read. Phonemic awareness is the first skill and is assessed in young children, beginning in preschool and continuing until first grade. Phonics is assessed during the first years of formal schooling (grades kindergarten [K]-2). Fluency is assessed starting in first grade and continuing each year, as students develop skills of decoding and word recognition. It is used throughout elementary grades as a quick and reliable indicator of reading progress. Vocabulary is assessed throughout reading development. Comprehension assessment generally occurs later in the development of reading skills when students are able to read simple text for meaning. As students develop more expert reading skills, comprehension becomes the main component assessed. For students with reading difficulties, all areas should be tested in order to identify weaknesses and plan an appropriate instructional intervention.

Reading Development

Reading is taught in the early years of elementary school education. Students who experience difficulty reading are at risk for difficulty with academic achievement.[15] In fact, achieving reading proficiency on the Woodcock Johnson reading battery by the end of second grade accurately predicts later reading ability.[16,17] Other longitudinal studies have reported that early reading proficiency is related to better midlife wellbeing and less alcohol use.[18] Table 1 outlines four broad capabilities that may be distinguished.[19,20]

Effects of Socioeconomic Status on Reading Development

Reading subskills develop at different rates in children.[20] There is substantial evidence that reading development varies with socioeconomic status (SES) and early childhood exposure to literacy. Liu and colleagues[21] created a statistical model of children's reading development and found that those children with higher SES were more likely to move into a higher reading ability group. Bhattacharya and colleagues[22] found that for American children from lower SES, less home literacy exposure was associated with slower reading development. However, in households where reading was encouraged as part of the family routine (such as reading charts or recipes together), children tended to exhibit age-expected reading ability. Conradi and colleagues[23] investigated the variance of specific reading subskills in children of lower SES and found that fluency was associated most with silent reading comprehension, and semantic knowledge was most associated with oral reading comprehension. Since these are skills that can be improved with practice and feedback from an adult, the work of Bhattacharya[22] and Conradi and colleagues[23] supports the importance of positive and plentiful in-home literacy experiences in reading development, especially in lower SES families.

Reading in preterm children develops differently and often more slowly. A meta-analysis by Kovachy and colleagues[24] reported that preterm children (≤32 weeks' gestational age) perform significantly worse than those born at term in reading ability, particularly in the subskills of decoding (phonics) and comprehension, and this deficit was independent of SES, intellectual disability and major disability. They also found that preterm children did not "catch up" to their peers, with an increasing disparity in reading comprehension with increasing age.

Reading Assessments

There are four different types of reading assessments performed to monitor reading development: screening, diagnostic, progress monitoring, and outcomes. Depending on age and indication, these assessments can be used for different purposes and measure a variety of reading subskills or focus on a single skill. For example, the Woodcock-Johnson Diagnostic Reading Battery includes subtests in phonemic awareness, phonics, fluency, vocabulary, and comprehension.[25] The commonly used reading assessments are described in the Appendix.

Screening assessments are used to identify students at risk of reading failure and provide appropriate intervention. Screening assessments tend to be short and simple to administer because they are given to all students and