

Dyslexia: Causes, Performance Differences, and Treatment

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## Introduction

Dyslexia is a disorder that is normally diagnosed in childhood and its symptoms are displayed throughout a person's lifespan. This disorder has been estimated to be prevalent in about ten to fifteen percent of all school aged children (Youman & Mather, 2013). Dyslexia is the most common neurobiological disorder that hinders reading ability (Youman & Mather, 2013). It affects the development of decoding and encoding skills, but there is very little agreement regarding the definition and the exact causes of dyslexia (Youman & Mather, 2013). This disorder is often characterized by difficulties in word recognition, poor spelling, and poor decoding abilities (Eklund, Torppa, Aro, Leppanen, & Lyytinen, 2014). Dyslexics have poor performances on tasks that require phonological awareness, verbal short term memory or verbal working memory, and rapid automatized naming (Agus, Carrion-Castillo, Pressnitzer, & Ramus, 2014). This disorder is not caused due to a specific intelligence level, a lack of schooling, or an uncorrected sensory disorder (Agus et al., 2014). Cognitively, dyslexia is a deficit in phonological representation and processing systems, and it is commonly thought that these deficits could be the possible cause of the disorder (Agus et al., 2014). However, it is important to note that there has not been a significant amount of research that proves a causal relationship between these deficits and the disorder.

Dyslexia makes it difficult for the people who suffer from it to succeed in school settings. It also makes it a challenge to accomplish other everyday tasks that require reading, spelling, atomization, or visual spatial input (Sternberg & Sternberg, 2012). It is important for dyslexics to receive early interventions and treatments in order to reduce the long term challenges and difficulties that are caused by the disorder. Early intervention can help to promote future success in school and the work place, it can also help to create the resiliency, confidence and above

average coping abilities that can in turn prevent the anxiety and depression that is found in many adults that have learning disabilities (Nelson & Gregg, 2012). Most schools provide some sort of accommodation and/or intervention for students with reading disabilities, but other treatments can be sought from other outside agencies (Youman & Mather, 2013).

### **Causes**

There are two subtypes of dyslexia: developmental dyslexia and acquired dyslexia. Acquired dyslexia is normally caused by a traumatic brain injury (Sternberg & Sternberg, 2012). Unfortunately, research has not found a specific thing that is responsible for causing developmental dyslexia. It is thought that the complex interplay of certain risk factors at many different levels will increase the likelihood of a child displaying the symptoms of dyslexia (van der Leij, et al., 2013). Research supports that genetics are one of the major risk factors for developmental dyslexia (van der Leij et al., 2013). There have been several candidate susceptibility genes that recent research suggests may possibly be linked to the acquirement of developmental dyslexia (Eklund et al., 2014). Children born to one or more parents that have dyslexia have not only an increased risk of being diagnosed with developmental dyslexia, but also even if they are not diagnosed as dyslexics they still have a tendency to show milder symptoms of the disorder and underperform their peers (van der Leij et al., 2013). In the first years of school, 34-66% of children that have a family member with dyslexia experience severe difficulties in spelling and reading (Eklund et al., 2014)

Anomalies in areas in the frontal, parietal, and temporal regions of the brain may also contribute to dyslexia (Richards et al., 2007). Specifically, areas such as the precentral gyrus, superior frontal gyrus, middle frontal gyrus, postcentral gyrus, parietal lobe, temporal pole,

middle temporal gyrus, and inferior temporal gyrus are found to be different in dyslexics (Richards et al., 2007).

People suffering from dyslexia also report visual attention difficulties along with literacy difficulties. According to research using a visual tilt discrimination task done by Cassim and Talcott (2014), this is because dyslexics show asymmetric and weaker attention especially when it comes to their left field of vision. Their research also showed that dyslexics have a reduced ability to ignore any distracting stimuli (Cassim & Talcott, 2014).

Quantitative and qualitative differences in lexical organization and phonological representations have been found between dyslexic children and their typically developing peers (Farquharson, Centanni, Franzluebbbers, & Hogan, 2014). There are two main theories that try to explain why a person who has dyslexia's lexicon differs from those that do not suffer from the disorder: the phonological deficit hypothesis, and the lexical restructuring model. The phonological deficit hypothesis states that the ability to distinguish and store individual sounds creates a person's phonological awareness, and because dyslexics have difficulty with these types of tasks their formation of lexical representations are disrupted (Farquharson et al., 2014). The lexical restructuring model says that the lexical features of the words create phonological awareness, and that mental representations of words require more detail as a child's vocabulary grows (Farquharson et al., 2014). According to this theory, because dyslexics have difficulty perceiving phonemic detail, they struggle more when learning new and longer words as their vocabulary expands (Farquharson et al., 2014).

### **Performance differences**

People suffering from dyslexia differ not only in ability but also in processes when it comes to reading. Letter by letter decoding is relied upon more in dyslexics than in average readers when reading (Eklund et al., 2014). Dyslexics have also been found to not benefit as much from context clues as a reader without the disorder would (Eklund et al., 2014).

Dyslexics often times do poorly on tasks that require attention and the manipulation of individual speech sounds, which are known as phonological awareness tasks (Agus et al., 2014). They have less accuracy when it comes to identifying and repeating sounds in words (Farquharson et al., 2014). Multi-syllabic words are especially hard for dyslexics to identify differences in and for them to repeat (Farquharson et al., 2014). That finding suggests that dyslexia infringes upon a child's ability to store, process, and encode phonological information into their long term memories; which can in turn contribute to the child having a weak lexical representation of the word (Farquharson et al., 2014). Dyslexics also have difficulty with their verbal short term memory and their verbal working memories (Agus et al., 2014). Early information processing has also been found to be impaired in people with this disorder (Van der Leij et al., 2013).

Tasks requiring rapid automatized naming is another thing that dyslexics have a tendency to underperform their typically developing peers in (Eklund et al., 2014). Second grade students without dyslexia outperformed fourth through sixth grade students with dyslexia in a word learning and picture naming task in one study (Farquharson et al., 2014). In many tasks, not just reading and naming, the ability to automatize is impaired in dyslexics (Sternberg & Sternberg, 2012).

It is a common belief that dyslexics have a tendency to write slower than their peers. This perception is not completely true. Dyslexics write individual letters as fast as their peers (Sumner, Connelly, & Barnett, 2014). However, dyslexics do end up pausing more and writing fewer words for minute, which is most of the time due to spelling errors and rewriting in adults (Sumner et al., 2014). Spelling errors are much more likely to be made by people with dyslexia than those without it (Sumner et al., 2014).

There are some early signs of dyslexia. In dyslexics, the cortical speech evoked processing differs from other babies immediately after birth (Van der Leij et al., 2013). One biomarker for dyslexia is the early processing of speech sounds (Van der Leij et al., 2013). Research also suggests that a possible early diagnostic test for dyslexia could be to measure their ERPs to habituation to visual stimuli (Van der Leij et al., 2013).

It is also important to note that people with dyslexia are more likely to suffer from certain mental health problems and low self-esteem. Adults with learning disabilities have a tendency to suffer from depression and anxiety (Nelson & Gregg, 2012). Children with dyslexia who were given an IRAP tests displayed a pro-other bias and lower self-esteem than their peers without a learning disability (Scanlon, McEnteggart, Barnes-Holmes, & Barnes-Holmes, 2014). If a child receives early an early intervention for dyslexia, he or she may develop above average coping abilities, confidence, and resiliency that contributes to less mental illness and the heightened probability of success in college and other higher learning institutions (Nelson & Gregg, 2012).

### **Treatment**

There are some early warning signs displayed in early childhood that will prompt dyslexia testing. Some red flags for dyslexia, according to a handbook released by the state of

South Dakota, are: difficulty remembering the names and shapes of letters, confusion of similarly sounding letters, and spelling errors (Youman & Mather, 2013). The state of Louisiana released a list of symptoms for dyslexia that included delayed speech development, low expressive language skills, illegible handwriting, and difficulty identifying or manipulating phonemes (Youman & Mather, 2013). If a child displays these symptoms he or she can be tested either by an evaluation in the private sector, or they can be tested by the school. If the child wants accommodations from the school however, they need to be tested by the school district and judged to meet the school districts specific criteria for intervention (Youman & Mather, 2013).

As far as treatment goes, a few methods have been researched. Spelling training tended to increase reading skills due to the close relationship between spelling and reading (Eklund et al., 2014). Reading fluency may also be increased after visual perception training (Meng, Lin, Wang, Jiang, & Song, 2014). Phonological training is also fairly helpful (Richards et al., 2007). After children with dyslexia receives phonological treatment, their fMRI BOLD activation resembled someone who did not have their learning disability (Richards et al., 2007). Research on hemisphere specific stimulation and hemisphere-alluding stimulation in children is also very promising. According to a study by Kappers, after treatments of hemisphere specific stimulation and hemisphere-alluding stimulation, 86% of children showed improvement in word reading, 91% showed improvement in text reading, 46% obtained a normal word reading level, and 55% obtained a normal text reading level (Bakker, 2006). The improvements from hemisphere specific stimulation and hemisphere-alluding stimulation were not found to decrease when the children came in for follow ups (Bakker, 2006). It has also been found that if done in the pre-reading phase, an intervention program can be helpful in helping children with a familial risk of

developing dyslexia, but the improvements are just a matter of degree rather than complete prevention (Van der Leij, 2013). Currently, a majority of treatments used on dyslexic children are relatively short, they are independent of reading instruction in class, and they are targeted on a specific set of subset of skills, but according to van der Leij (2013) in order to be more effective they need to be restructured in order to be the exact opposite.

Each school district gets to decide upon their own definition and criteria for dyslexia, and at what level of prevalence of the disorder that they will start to provide accommodations for students at (Youman & Mather, 2013). This means that a student who has dyslexia may not get the services they need in order to better to succeed because they do not meet the school districts specific criteria (Youman & Mather, 2013). Due to federal laws, many schools do not classify dyslexic students as such, rather as having a specific learning disability or a reading disability (Youman & Mather, 2013). In some cases, this might mean that dyslexics do not receive the specific intervention strategies and accommodations that best fit their needs (Youman & Mather, 2013). However, due to the No Child Left Behind Act, many children, even if they have not been tested for or they do not meet the districts criteria for dyslexia, will be provided some sort of intervention for reading (Youman & Mather, 2013). Dyslexics normally have well developed vocabularies, good reasoning skills, and good language comprehension abilities (Youman & Mather, 2013). These things set them apart from other struggling readers, and due to their needs being vastly different, it is beneficial to separate dyslexics from other struggling readers (Youman & Mather, 2013). Accommodations that are common for dyslexics to receive in the American school system are no spelling penalizations, questions on assessments being read out loud to them, and additional time given to them on reading tasks and major assessments (Youman & Mather, 2013). Many states have started trying out several pilot projects to

determine the most effective intervention programs in schools (Youman & Mather, 2013). Some pilot programs have reported a twenty-three percent increase in passing scores on the reading section of the state wide assessments (Youman & Mather, 2013). In July 2012, twenty-two states had statewide laws regarding dyslexia, and two had created a dyslexia week or month in order to create more awareness for the learning disability (Youman & Mather, 2013).

### **Summary**

Dyslexia is a learning disability that affects many people. Research has not given us a definitive answer yet as to what causes developmental dyslexia, but there are currently many theories that try to explain it. Some of the most popular theories are abnormalities in sections of the brains, genetics, lexical differences, and processing differences (especially when it comes to phonological and visual spatial information). The most common theory is that all of those factors interact to create a severe dyslexic. The other type of dyslexia, acquired dyslexia, is in most instances caused by a traumatic brain injury.

Just as research has not given a definite cause of dyslexia, it has not agreed upon a definition for the disorder either. Dyslexia is known as a reading disorder, but there are other symptoms as well. Dyslexics often decode differently than other people, have trouble with tasks that require automatization, struggle with rapid automatized naming, have poor phonological awareness, and have a hard time when the verbal short term memory and verbal working memory needs to be used. It is also difficult for dyslexics to identify and repeat sounds, especially if they sound similar or if they are in a multi-syllabic word. Spelling is a very challenging task for dyslexics, and they often times are very poor at it. As with any other learning disability, dyslexia also comes with an increased risk of anxiety and depression. It is

important to get a diagnosis and effective treatment as soon as possible to a dyslexic child in order to minimize the symptoms of dyslexia.

There are several different types of treatments for dyslexia. Some of the more popular types of treatments are: phonological treatment, visual perspective training, spelling training, hemisphere specific stimulation and hemisphere-alluding stimulation. Very early intervention, although it cannot prevent dyslexia in children who have a genetic risk for it, can reduce the severity of the degree to which the child suffers from it. School systems can provide accommodations and interventions for children suffering from dyslexia. It is up to the school districts discretion to decide who receives the resources and the treatments they provide. The school may not provide specific enough focus on the subset of skills that dyslexics need, because they group them with all of the other children who are below average in reading. They also do not often times provide programs that are long enough to be of maximum benefit, and they try to separate the intervention from in class instruction. A few states have acknowledged the need for reform in their dyslexia programs and have started to institute new pilot programs that appear to be having promising results.

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