Dyslexia
The Hidden Disability
What Health and Safety Professionals Need to Know

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Goals for Today

- What is Dyslexia?
- History and Prominence in Our Population
- Neurophysiology of Dyslexia
  - Proficient readers
  - Readers with dyslexia
- Accommodation for Dyslexia
  - Phonologic reading intervention
  - Ergonomics
  - Wellness
  - Employees that may have dyslexia
  - Colleagues with dyslexia
What is Dyslexia?
What is Dyslexia?

The International Dyslexia Association (IDA) Definition (2002)

- A specific learning disability in reading
- Neurological in origin (primarily an educational solution)
- Problems with:
  - Decoding reading abilities
  - Accurate and fluent word recognition of the written word
  - Poor spelling
- Deficit in phonological component of language
- Unexpected because they have:
  - Other cognitive abilities (strengths)
  - Received normal classroom instruction
- Secondary impacts:
  - Reading comprehension
  - Reduced growth of vocabulary and background knowledge
About Dyslexia

- Two main components of dyslexia:
  - **Visual**: have trouble with phonics, decoding & spelling. “They don’t hold onto images of printed words in their mind’s eye.”
  
  - **Auditory**: trouble learning sound-symbol correspondences, sounding out words, and problems often with fluency and comprehension. “They don’t hold onto the differences in speech sounds and word sequences in their mind’s ear.”
  
  - Often occur together, or one may be more prominent

-- Jean Osman
Learning to Read

- 70–80% of children learn to read seemingly with little effort.
- 20–30% of children struggle for various reasons
  - Some from a combination of socio-economic and other experiential factors
- Researchers estimate about 5% to 17% of school-aged children have dyslexia, or 3–4 in every class.
- Out of 100 students with dyslexia, only 5 are recognized and receiving intervention
- Issues continue into adulthood and the workforce.
  - 5% to 17% of the workforce have dyslexia!
The Concern:
National Assessment of Educational Progress (NAEP) 2009 Statistics

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<td>All Students</td>
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Problems Learning to Read

- Teens with dyslexia who continue to feel dumb in school and do not have other fulfilling life experiences (e.g. sports, arts):
  - Risk for depression
  - 3 times higher drop out rate
  - Often seek acceptance in fringe social groups and activities – e.g. using drugs

- Over 75% of those in our juvenile crime system and prisons are below minimum standards in reading
  - Dr. Timothy Shanahan, National Reading Panel
1877 – The term "word blindness" coined by German neurologist Adolf Kussamaul to describe in an article “Eine besondere Art der Wortblindheit” (Word blindness)
  ◦ Trauma/Stroke on the left side of the brain
    • Understand spoken language but could not read
    • Acquired Alexia
  ◦ Normal patients with difficulty interpreting written symbols although the power of sight, the intellect and the powers of speech are intact.

1887 – German physician Rudolf Berlin refines our definition of reading problems, using the term "dyslexia" to describe a "very great difficulty in interpreting written or printed symbols."
Everyone speaks but not everyone reads
Speaking in natural reading is not
Reading is a human invention
Dyslexia is not a visual issue
Dyslexia is a weakness in within the language system, specifically at the level of the phonologic module.
The neural tracts are laid down at birth and therefore the individual will not “outgrow” their dyslexia
Speech is broken down into basic parts called Phenomes

- Fundamental element of the language system, the essential building block of all spoken and written words.
- 44 phonemes produce tens of thousands of words in the English language
  - One adds onto another to make a language
  - It is a matter of coding and decoding
When two phenomes (particles) combine and still maintaining the original properties the new form is unique and entirely new.

Thousands of sounds are created.
Similarities

- Atoms, Molecules, Compounds
- Atoms, Amino Acids, Nucleotides, DNA, Proteins
- Impulse, Depolarization, Actine Myocine Reaction, Muscle Contraction
Example of a Phonological Model

CAT

- KKKKK
- AAAAAAAA
- TTTTTT

“CAT”
Neurophysiology of Reading
Quick Review of the Brain

Anatomy and Functional Areas of the Brain

Functional Areas of the Cerebral Cortex
1. Visual Area
   - Sight
   - Image recognition
   - Image perception
2. Association Area
   - Short-term memory
   - Equilibrium
   - Emotion
3. Motor Function Area
   - Initiation of voluntary muscles
4. Broca's Area
   - Muscles of speech
5. Auditory Area
   - Hearing
6. Emotional Area
   - Pain
   - Hunger
   - "Fight or flight" response
7. Sensory Association Area
8. Olfactory Area
   - Smelling
9. Sensory Area
   - Sensation from muscles and skin
10. Somatosensory Association Area
    - Evaluation of weight, texture, temperature, etc., for object recognition
11. Wernicke's Area
    - Written and spoken language comprehension
12. Motor Function Area
    - Eye movement and prestation
13. Higher Mental Functions
    - Concentration
    - Planning
    - Judgment
    - Emotional expression
    - Creativity
    - Inhibition
14. Functional Areas of the Cerebellum
    - Coordination of movement
    - Balance and equilibrium
    - Posture

Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe
Brain stem
Cerebellum
Pituitary gland
Respiratory centers
Corpus callosum
Brain is a complex organ – it controls the body and behavior and receives, analyzes, and stores information

Brain anatomy:
- Two Hemispheres
- Frontal lobe
- Parietal lobe
- Occipital lobe
- Temporal lobe
Visual Tracts
Seeing Brains Read

- Two basic types of brain scans – structural and functional
- Standard MRI and CT scans show structural detail only – not brain activity
- SPECT, PET, fMRI, DTI, and MSI allow mapping of brain circuits related to function or activity
Done while doing tasks in the scanner
- fMRI, MSI, and DTI:
  + noninvasive
  + no radiation exp.
  + safe for children
- Resolution $\sim 1.5 \times 1.5 \text{ mm}$
- Takes less than 1 hr.
- Cost $\sim$ $500 - $1000
- Still research tool

S. Shaywitz, *Overcoming Dyslexia*, 2003
Show three common patterns of activation and underactivation

Referred to as “systems” of activation because each of the areas of the brain related to reading typically involves more than a single region

S. Shaywitz, *Overcoming Dyslexia*, 2003
Proficient Readers

- Use two parts of the left side to analyze a word when it is first encountered.
  - Anterior System – Broca’s Area,
  - Left parieto–temporal region system
- Enables us to make letter–sound associations and to manipulate them to make words.
- After five to forty encounters, we know how to pronounce it, spell it, and understand its meaning – we own it!
- A neural model of this word is then stored in the left occipito–temporal region system in the visual word–form area (VWFA). When a word resides in this area, we can do reading tasks with that word easily and efficiently.
- Note there is no significant activation in the right hemisphere – right side of the brain

Do not use:
- Left parieto–temporal region system, or
- Left occipito–temporal word form area

We see more brain activation in the left anterior system suggesting a compensatory, but inefficient strategy.

Also, they use two anatomically analogous areas in the right brain:
- Right anterior
- Right occipito–temporal region: appears related to compensatory strategies for word formation and retrieval

Net result is accuracy at the expense of speed and efficiency

Displace Neuropathway

- Broca’s area
- Right side of the brain activation
- Slow laborious reading and takes a lot of energy
- Pathways laid down at birth!!
  - Once a dyslexic….always a dyslexic
  - You don’t grow out of it
  - There is no cure

You can over come dyslexia with early intervention and coping skills
Male vs Female Reading

- Males tend to activate mainly the left side of the brain
- Females activate the left as well as the right side of the brain while reading
Race 2016 Tesla vs 1939 Ford Pick Up
Example: Rochester to Minneapolis
Does the pattern of brain activation change in response instruction?

- 8 children with severe dyslexia (7 to 17) with control children without dyslexia
- 8 week intense phonologically-based instruction (2 hours a day = up to 80 hours of instruction)
- MSI scans before and after interventions showed expected patterns in non-proficient readers to transform towards that of proficient readers.
- Very large improvements in reading ability

Simos et al., *Neurology*, 2002
Effects of 8 Weeks of Intense Remedial Instruction on Brain Functioning:

Decreased activity in right hemisphere

Increased activity in left hemisphere

Simos et al., NEUROLOGY 2002;58:1203–1213
Manifestations of Dyslexia

- Slow laborious reading
- Lack of fluency
- Avoids reading orally
- No recreational reading
- Atrocious spelling
- Terrible penmanship
- Poor performance with mathematical word problems
- Poor performance on multiple choice tests
  - Despite excellent knowledge
  - Perform well with oral tests and essays
- Test anxiety
- Speech slips
  - Can’t find words
  - “Ummms”, “Ya know”, “on the tip of my tongue” “OK”
They Are In Pain!!!!!

- Teased as a child
- Scolded by (ignorant) teachers
- Reprimanded by (ignorant) bosses and (ignorant) HR
- Very low self esteem
- Depressed
  - Reflects years of assaults on their sense of self-worth
Sea of Strengths In Children

- Curiosity
- A great imagination
- The ability to figure things out
- Eager to embrace new ideas
- A good understanding of new concepts
- A talent for building models
- Excellent comprehension of stories read or told to them
Exceptional empathy and warmth and feeling toward others
Compassionate
Success in areas not dependent on rote memory
A talent for high level conceptualization and the ability to come up with original insights
Big picture thinking
Innovators
Creative and thinking out of the box
A noticeable resilience and ability to adapt
A Strength in All Individuals with Dyslexia

- Strong work ethic. They have to be 24/7
- Develop an unusually strong interest in a very narrow area of study
- They find a passion
- Read and study about it over and over and over in great detail word by word and through the context of the material
- They work extremely hard and take up a tremendous amount of time to learn the material
- They become Superspecialists
I AM THE LEFT BRAIN
Decisive!
Logic
Accurate
Analytic
Reason
1,2,5,6,7,8,9
Practical
Strategic
Control
Science
Realistic
Www.cartoonaday.com

I AM THE RIGHT BRAIN!
Intuition
Love, Love, Love
Art
Petry
Freedom
Passion
Vivid
Creative
Yearning
Peace
How the English Language Works

- Sound/symbol associations – phonics
- Blending sounds together to make words
- Linguistics – reading and spelling rules
- Segmenting speech sounds in words
- 6 syllable patterns
- 7 syllable division rules
- 4 adding suffix rules
- Roots and affixes and how they work together = vocabulary building
Accommodation for Dyslexia

- Time
  - Dyslexia robs the person of time
  - Dyslexia can rob a childhood
- Need for total quiet.
- Find a champion
  - Behind every successful dyslexic is a caring parent (usually the mother)
  - Find an understanding editor
- Books on tape or CD
- Try to avoid multiple choice (guess) examinations
- Avoid standardized tests.
- Use recorded texts
- Evaluate for concepts and knowledge not reading
Safety and Ergonomic Accommodations

- Quick visual ques
- Use analog dials not digital
- Use visual and participatory learning not reading
- Easy fast screens
- Avoid repetitive drop down menus
- Keep learning linear
- Avoid information over load
- Allow for time and quiet space
Education and Learning

- Visual
- Practical hands on experience
- Active participation
- Group discussions
- Repetition, review, repetition, review, repetition………..
- Time management
- Oral / practical examination
- Tend towards specialization
  - Take a deep dive into area of interest
Education and Learning, Things to Consider:

- Not everything is learned from a book
- Computer based learning may not be the best
- Information overload
- Try to avoid multiple choice standardized tests
- Consider a study partner
- Tutoring
Computer Screens
Dashboard Displays (1941 Willys MB)
Analog Dashboards

1941 Willys Jeep

2010 Ford Focus
High Tech Dashboards
Digital vs. Analog
Wellness and Lifestyle for Dyslexia

- Rest and Sleep
- Stress Management
  - Mindful Meditation
- Regular Active Exercise
  - Repetitive
  - Aerobic
  - Coordination
- Proper Nutrition
- Hobbies
  - Find a passion
  - Fun
- Connection to the natural environment
- Avoid Drugs
  - Stimulants
  - Tobacco
  - Alcohol
  - Question any prescribed drugs
Employees With Dyslexia

- You most likely will not know it. It’s usually not in their employment history
- They may not inform you. Embracement
- 5 to 20% of the population have some form of Dyslexia
- Signs to be aware of
  - Coordination and manual dexterity issues
  - Handwriting
  - Speech issues and or limited vocabulary
  - Anxious look when giving them written instructions
  - Looking at the directions but not reading or interpreting them
  - Asking lots of repeated questions
Employees with Dyslexia

- Empathy and compassion (they got it!!!)
- Time
  - To read directions and materials
  - Write and record production notes
- Quite space with no disturbances (loud dictations)
- Written notes
  - Poor penmanship
  - Colleagues can’t read it
- May or may not keep up with professional literature
- Limit computerized education
  - Repeated drop down menus
  - Tons of text
  - Multiple choice options
- Specialize in one specific area
If you have Dyslexia

- Let the whole world know you have it!!!!
- It is you and the way your brain works
- Ask for accommodation (ADA is in your favor!)
  - Time
  - Quite space
- Seek out positive people who understand
- Seek out positive environments
- Have a positive support group at work and at home
- Laugh (find humor where you can even if you can laugh at yourself)
Successful Dyslexics

- Charles Schwab
- Sir Richard Branson
- Ted Turner
- Ingvar Kamprad, founder of IKEA
- Steven Spielberg
- Henry (“The Fonz”) Winkler
- Albert Einstein
- Michael Phelps
- Me!
Living with Dyslexia (Group Discussion)

- When was the problem noticed?
- How did it make me feel?
- Tutoring
  - Rochester Public Schools
  - The Reading Center
- Coping Skills
  - Break things down and build them up again
  - Time management
  - Repetition, Repetition, Repetition, Repetition, Repetition, Repetition
- Find a passion
Keys to “success”

- Work **REALLY** hard
- Be patient
- Accept yourself
- Seek out positive people
- Stay fit
- Never stop learning
- Accept set backs
  - Depression
  - Ignorant People
- Know when to stop and rest
- Learn the system
What Do people need to know

- These are very intelligent people
- They are extremely creative
- This is a chronic life long condition
- Fatigue and stress makes it worse
- It may get worse with age
- A support system is an absolute
- Writing and spelling will always be bad. Accept it!!!!
- They know adversity
- They are resilient
- They all have great potential to be “successful”