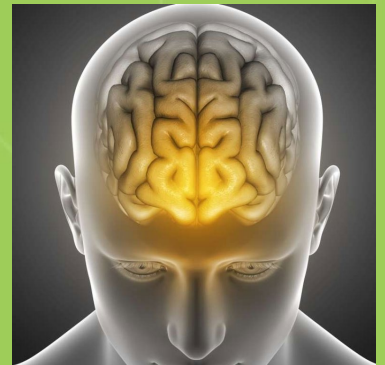


ABA, Brains, & Development: What does the research tell us?



Please note that this deck is not eligible for CE credit.
To learn more about our eligible courses, please
email continuing_education@thebhpn.org.



Objectives

- Describe the typical order of brain development for the 3 major systems that effect learning.
- List 2 factors that effect learning.
- Define critical and sensitive periods for brain development.
- List 3 developmental milestones for language.
- Describe how an adolescent brain is different from a child's or adult's brain.
- List at least 2 reasons for the increasing heterogeneity in the ASD population.
- Discuss the estimated prevalence for an intellectual disability in the ASD population.
- Describe the characteristics associated with best ABA outcomes.
- Describe the quality of life vs. deficit approach to intervention/services.



Factors that Effect Learning

- Age or phases of life
- Past learning
- Personality traits
- Gender
- IQ
- Culture
- Trauma



And many other things because humans are complex!

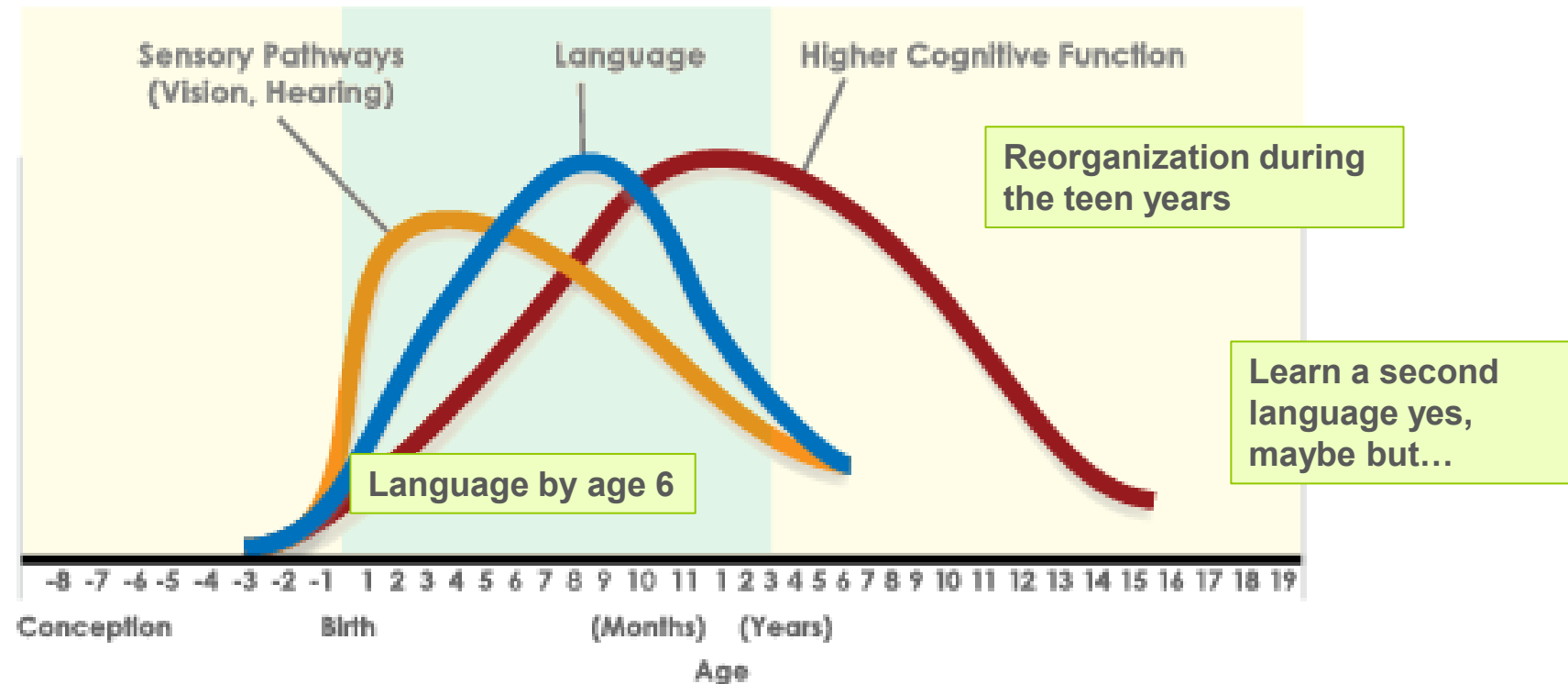


Typical Development

Human Brain Development

Human Brain Development

Synapse Formation Dependent on Early Experiences

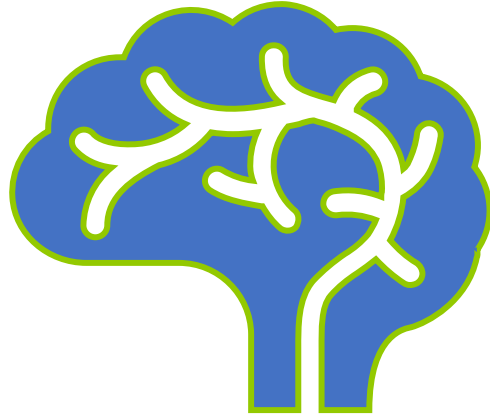


Source: Nelson, C.A., in *Neurons to Neighborhoods* (2000). Shonkoff, J and Phillips, D. (Eds.)

Modified, BHPN 2020

Experience during the early years has a profound effect on the wiring of skills and behaviors, such as language, music playing, visual processing, and emotional processing (Nabel & Morishita, 2013).





*During these times, there is increased sensitivity to regularities in sensory input that are readily extracted through exposure and interaction with the environment. As such, they are an **optimal time for learning**" (Werker & Tees, 2005)*

Sensitive and Critical Periods

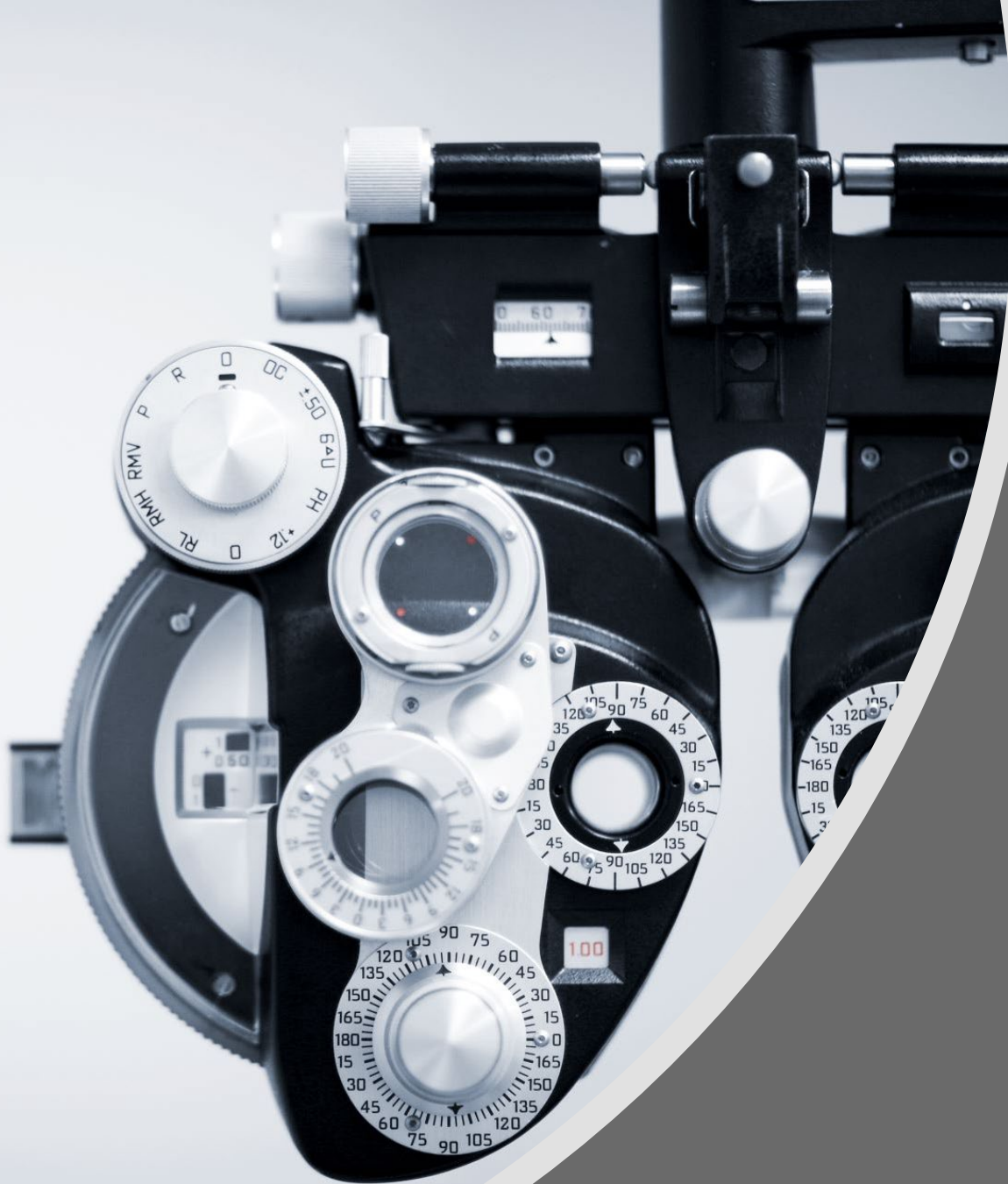
- **Sensitive Periods:** Time during brain development when the brain is the most receptive to learning/developing. Sensitive periods are the optimal time for learning.
- **Critical periods:** A defined window in time that learning must occur. If learning does not occur during a critical period learning is severely restricted.

Not all or Nothing

- Regions of the brain have critical periods that occur at different times and are activated and regulated by distinct mechanisms (Hensch, 2004).
- Some brain plasticity does remain (Hooks & Chen, 2007).

But age does matter in learning





Language, vision
and hearing have
been extensively
studied

Language

- Language sets us apart from other animals.
- Allows us to think abstractly.
- Needed for complex planning.
- More than basic communication.
- Language milestones have been extensively studied.



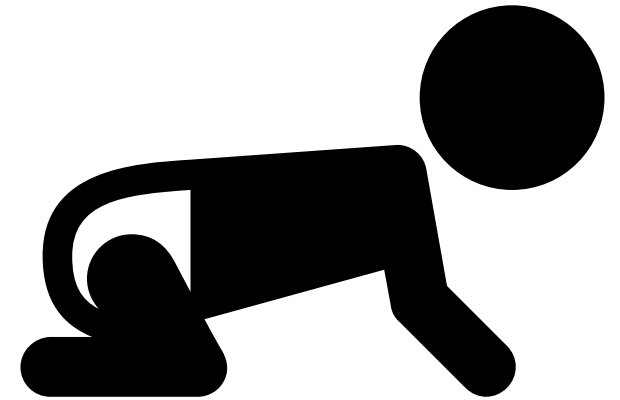
First 12 months

Birth–3 Months

- Startles at loud sounds.
- Quiets or smiles when you talk.
- Seems to recognize your voice. Quiets if crying.

7 Months–1 Year

- Babbles long strings of sounds, like *mimi upup babababa*.
- Uses sounds and gestures to get and keep attention.
- Points to objects and shows them to others.
- Uses gestures like waving bye, reaching for “up,” and shaking his head no.
- Imitates different speech sounds.
- Says 1 or 2 words, like *hi*, *dog*, *dada*, *mama*, or *uh-oh*. This will happen around their first birthday, but sounds may not be clear.



1-2 years

Hearing and Understanding	Talking
• Points to a few body parts when you ask. • Follows 1-part directions, like "Roll the ball" or "Kiss the baby." • Responds to simple questions, like "Who's that?" or "Where's your shoe?" • Listens to simple stories, songs, and rhymes. • Points to pictures in a book when you name them.	• Uses a lot of new words. • Uses <i>p</i>, <i>b</i>, <i>m</i>, <i>h</i>, and <i>w</i> in words. • Starts to name pictures in books. • Asks questions, like "What's that?", "Who's that?", and "Where's kitty?" • Puts 2 words together, like "more apple," "no bed," and "mommy book."

3 years

Hearing and Understanding	Talking
• Understands opposites, like go-stop, big-little, and up-down. • Follows 2-part directions, like "Get the spoon and put it on the table." • Understands new words quickly.	• Has a word for almost everything. • Talks about things that are not in the room. • Uses <i>k, g, f, t, d,</i> and <i>n</i> in words. • Uses words like <i>in, on,</i> and <i>under</i>. • Uses two- or three- words to talk about and ask for things. • People who know your child can understand him. • Asks "Why?" • Puts 3 words together to talk about things. May repeat some words and sounds.

5 years

Hearing and Understanding	Talking
• Understands words for order, like <i>first</i>, <i>next</i>, and <i>last</i>. • Understands words for time, like <i>yesterday</i>, <i>today</i>, and <i>tomorrow</i>. • Follows longer directions, like "Put your pajamas on, brush your teeth, and then pick out a book." • Follows classroom directions, like "Draw a circle on your paper around something you eat." • Hears and understands most of what she hears at home and in school.	• Says all speech sounds in words. May make mistakes on sounds that are harder to say, like <i>l</i>, <i>s</i>, <i>r</i>, <i>v</i>, <i>z</i>, <i>ch</i>, <i>sh</i>, and <i>th</i>. • Responds to "What did you say?" • Talks without repeating sounds or words most of the time. • Names letters and numbers. • Uses sentences that have more than 1 action word, like <i>jump</i>, <i>play</i>, and <i>get</i>. May make some mistakes, like "Zach gets 2 video games, but I got one." • Tells a short story. • Keeps a conversation going. • Talks in different ways, depending on the listener and place. Your child may use short sentences with younger children. He may talk louder outside than inside.

American Speech and Language Hearing Association
<https://www.asha.org/public/speech/development/chart/>

Second Language Learning

DeKeyser, 2000

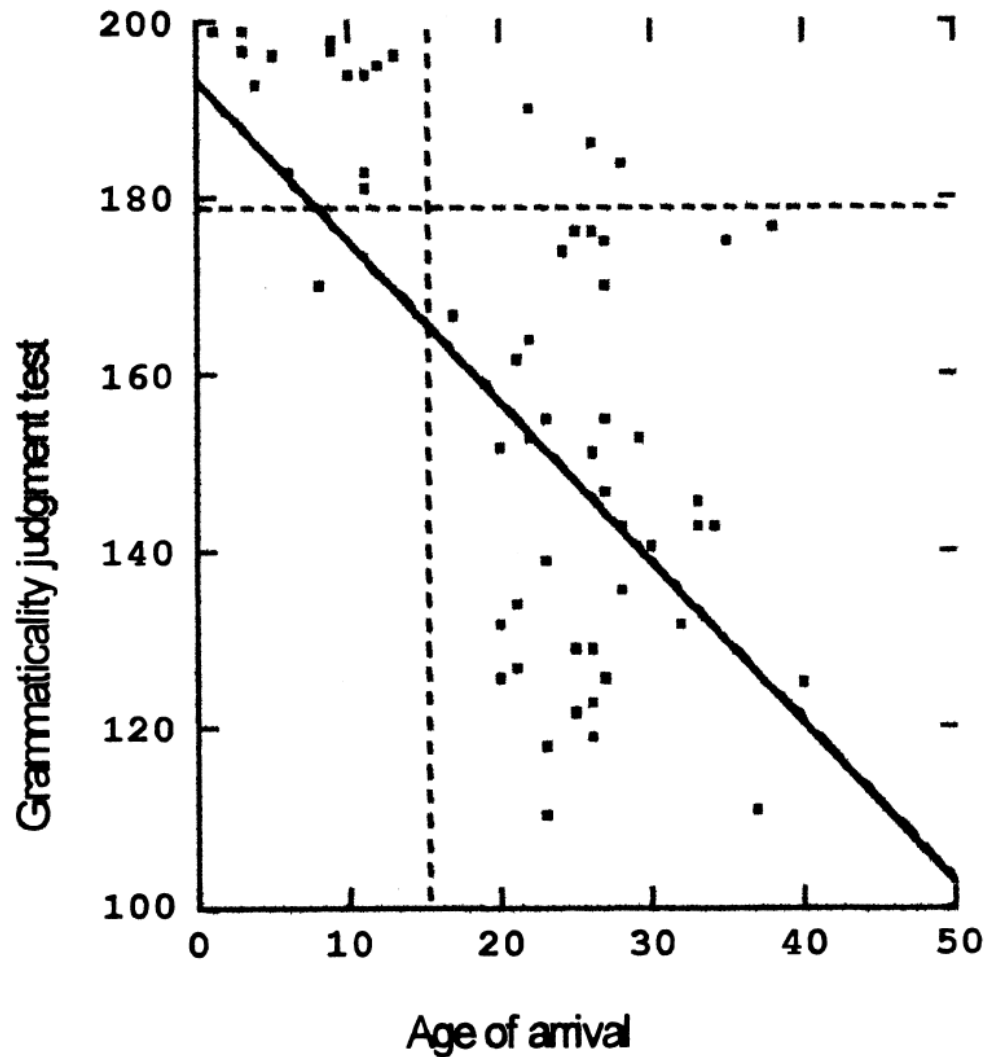
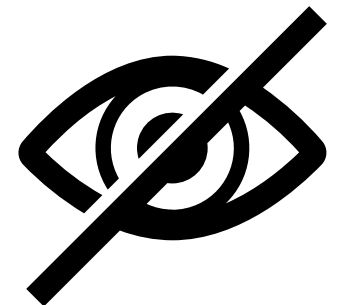
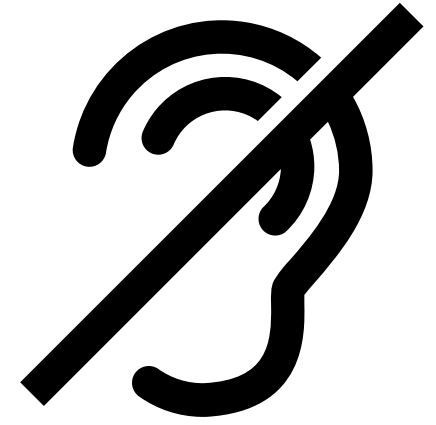


Figure 1. Scores on the grammaticality judgment test (out of 200) as a function of age of acquisition.

Vision and Hearing

- Deprivation of vision during typical age-defined critical periods results in poor vision in animals and humans (Kalia et al., 2013).
- Total absence of hearing experience prevents the neuro-patterning of the auditory system (Kral, 2013).
 - For this reason early cochlear implantation is important (Harrison, Gordon, & Mount, 2005).



The Teen Brain



Teens Uneven Development and Reorganization!

Teen brains are different than the brains of children and adults:

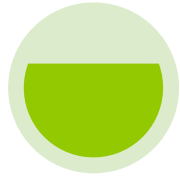
- Significant functional and structural changes occur in the brain during adolescence (Blakemore, 2008).
- During the teen years the development of the front part (frontal lobe) of the brain which helps with self-control and reason lags behind development of some of the emotional parts of the brain. This explains the emotionality of the teen brain (Casy, 2008).

Brain Development



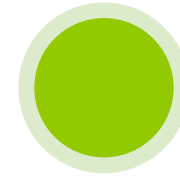
Child brain

Different parts
of the brain
develop
together



Teen brain

The emotional
parts of the
brain develop at
a faster rate



Adult brain
(about age 25)

Emotional and
thinking parts of
the brain are
both developed

Just because someone has ASD doesn't mean their brain doesn't change during adolescence.

The Teen Brain Means:

- Teens don't think before they act. **This is normal!**
- Teens aren't supposed to be compliant with everything. **This is normal!**
- Teens don't like to be seen with their parents. **This is normal!**
- Teens, regardless of their disability, are working on identity development. **This is very important work!**

Overly compliant teen behavior is not normal!





Think twice about creating goals for these behaviors!

Some typical teen behaviors

- Moody and secretive, spend a lot of time alone in their room.
- Get frustrated, stomps and slams doors.
- Short-tempered and more impatient with adults and siblings.
- Declines to hang out with family, doesn't want to be seen with family.
- Has poor time management.
- Say things like, "Only my friends understand me! I hate it here! I wish I could leave."
- Is discontented and restless.
- Doesn't do chores or puts off chores.
- Is generally noncompliant.
- Is impulsive.



Our Population

Fastest Growing

- According to the Centers for Disease Control and Prevention (CDC) Autism is the fastest growing developmental disability in the United States.



Our Population is Heterogeneous

“Since the documented observations of Kanner in 1943, there has been great debate about the diagnoses, the sub-types, and the diagnostic threshold that relates to what is now known as autism spectrum disorder (ASD). Reflecting this complicated history, there has been continual refinement from DSM-III with ‘Infantile Autism’ to the current DSM-5 diagnosis. The disorder is now widely accepted as a complex, pervasive, heterogeneous condition with multiple etiologies, sub-types, and developmental trajectories.”
(Masi et al., 2017)



Our extremely diverse population includes many people with an intellectual disability (ID).

Intellectual Disability

Previously called “mental retardation,” intellectual disabilities are defined as:

- Significant limitations in both **intellectual functioning** and in **adaptive behavior**, which covers many everyday social and practical skills occurring before the age of 18:
 - *Intellectual functioning* (also called intelligence) refers to general mental capacity. Usually measured by an IQ score. IQ below 70 is usually considered the cut off but individuals with IQ in the 70s also have significant impairments in learning.
 - *Adaptive Behavior* refers to behavior that enables a person to get along in his or her environment with greatest success and least conflict with others.

<https://aidd.org/home>



Intellectual functioning in the ASD population

- Individuals with ASD present with a range of intellectual abilities. Historically it was thought that about 70% of those with Autism have an intellectual disability. Changes in autism criteria; movement to the spectrum concept may have increased the number of individuals with average intellectual functioning receiving an ASD diagnosis.
- A recent study found that 55% of their sample of children with ASD had an ID, 17% had below average or borderline intellectual functioning, 28% had average intellectual functioning, and 3% had above average intellectual functioning (Charman et al., 2011).
- Has ASD become the “preferred” diagnosis...

Shift in Diagnoses?

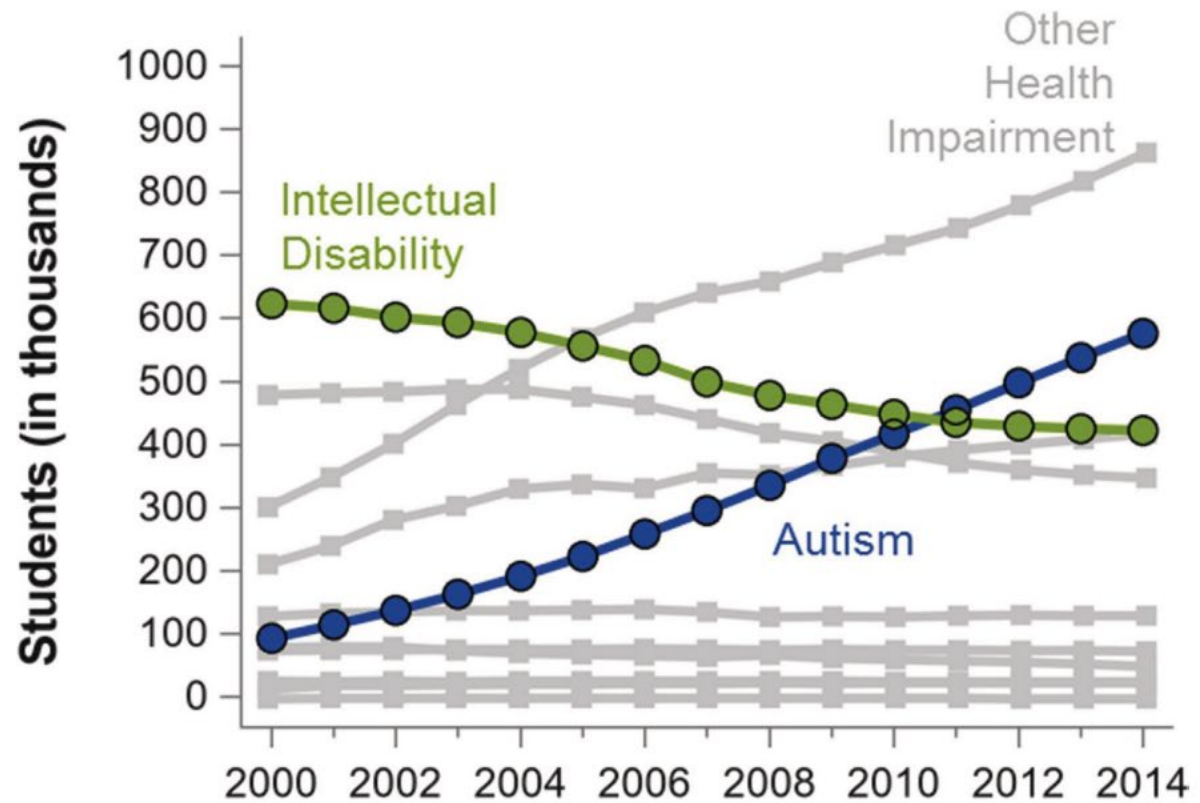


FIGURE 1 | Number of students (in thousands) in the US who receive special education services pursuant to the Individuals with Disabilities Education Act, adapted from a previous publication (6). Numbers are plotted by the beginning of academic year (X-axis) and by diagnostic group, which are mutually exclusive. Other diagnoses not explicitly labeled include deaf-blindness, developmental delay, emotional disturbance, hearing impairment, multiple disabilities, and orthopedic impairment. The most common diagnoses, specific learning disabilities (in 2014, $n = 2,278$), and speech or language impairment (in 2014, $n = 1,332$) are not shown. Figure produced from data obtained from the U.S. Department of Education (7).

Thurm et al., 2019

Okay, but we have powerful tools
based in science that can overcome all
this critical period, intellectual
disability, diagnosis, brain
developmental stuff right?

Not really



Our heterogeneous, complex population demands that we stop looking at behavior through the Nature or Nurture frame.

Findings from biology, genetics and other “nature” sciences and even diagnostic trends must inform how we do behavioral science.

BF Skinner Acknowledged Nature

- “...the behavior of organisms is a single field in which both phylogeny (evolutionary history/biology) and ontogeny (development of an individual) must be taken into account” (1977).
- *What is ‘original nature of man?’ I mean, what are the basic psychological characteristics of human behavior – the inherited characteristics, if any, and the possibilities of modifying them and creating others? That’s certainly an experimental question – for a science of behavior to answer” (Skinner, 1948).*
- Skinner studied maze bright and “maze-dull” rodent strains!

Biological or Genetic Differences Effect Learning

- Genetic differences in conditionability can explain why individuals are differentially affected by environmental stimuli (Genovese, 2007).
- Maltreatment (punishment) effects children based on genetic differences related to high or low levels of the MAOA neurotransmitter (Moffitt, 2005).

ASD Population: Intellectual Abilities and Age Matter

ABA Outcomes

“Higher cognitive functioning significantly predicted faster growth across all four developmental domains, age at entry predicted initial status, and other variables only predicted growth rates in one or two domains.” (Tiura et al., 2017).



Strongest evidence for increase in ABA is in young children; best results in children with higher IQ; best outcome language (Makryginni et.al, 2018; Tiura et al., 2017)



Younger age at start best results (Tiura et.al, 2017; Shattuck et al., 2007).



Earlier age of first words predicts better outcomes (Mayo et al., 2013).



The absence of communicative speech at age 5–6 is predicts poor long term outcome (McGovern & Sigman 2005).

Duration, Core Features of Autism and Daily Living Skills?



Average duration of ABA is
about 2 years
(Romanczyk et al., 2014).



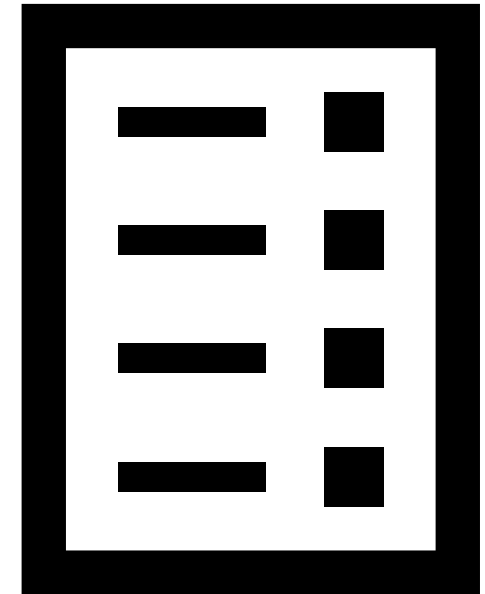
Most improvement seen in
first year
(Smith et al., 2015).



Overall less progress is seen
in daily living skills and core
features of autism.
(Makrygianni et al., 2018).

Lack of Evidence

- While we know behavioral strategies can be helpful for anyone there is a lack of research evidence for ABA in youth and adults.
- Along with some limited evidence for ABA there is also evidence for non-ABA behavioral treatment like CBT/DBT for emotional regulation or social skills treatments.



Evidence-Based Practices Wong et al., 2015

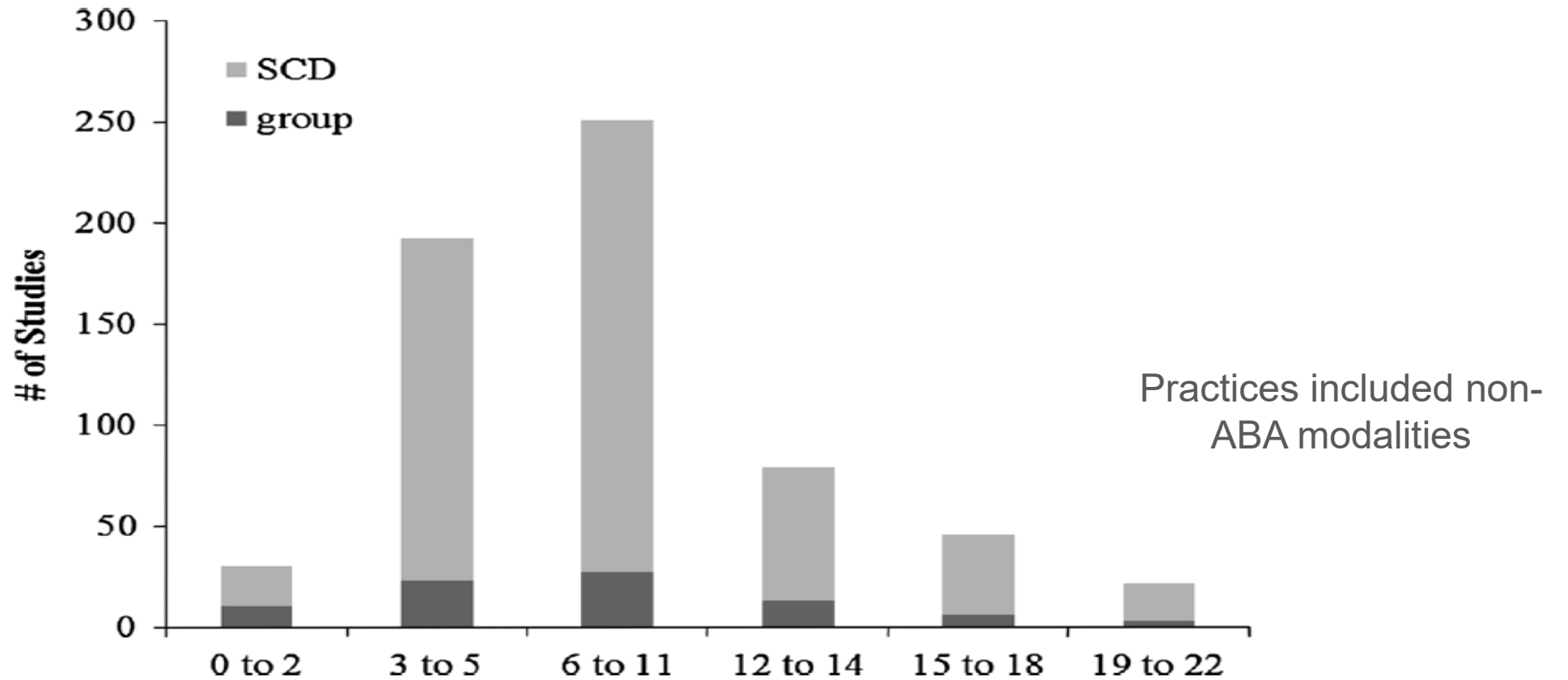


Fig. 2 Ages of participants in included studies

So What Now?

Consider Critical Factors

- Age
- Language at age 5/6
- Intellectual ability
- Quality of life!

Indications of Intellectual Disability

6 years and above

- Moderately low or lower language abilities.
- In special education.
- Genetic disorder (e.g. Fragile X).
- Inability to generalize.
- Diagnosis of intellectual disability.

Quality of Life vs. Deficit Approach

Deficit approach:

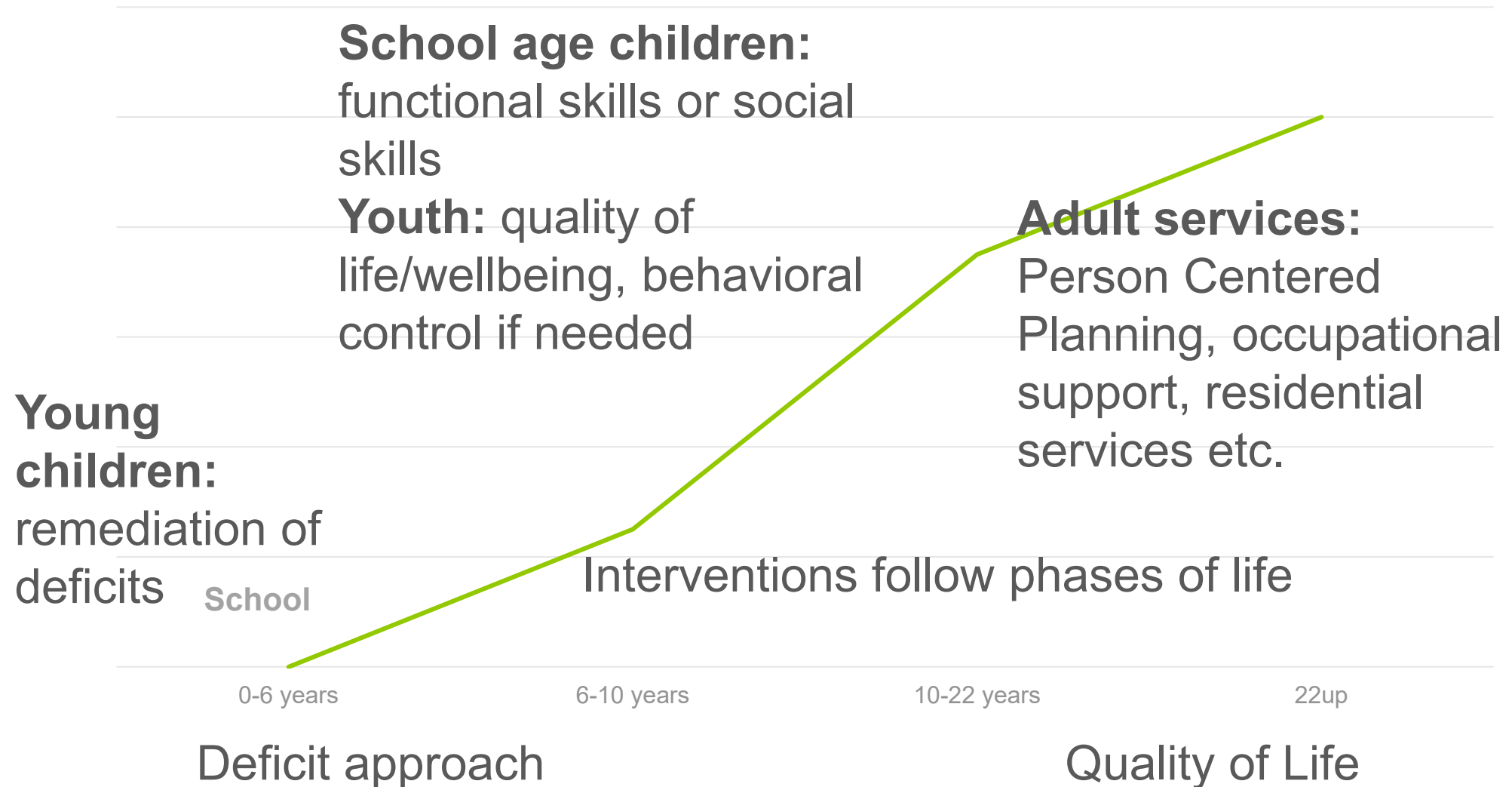
- Weakness focus.
- Expects remediation.

Quality of Life:

- Strength focus.
- Prioritizes functioning.
- Accepts individual differences that differ from “typical” development or behavior (e.g. accepts “stimming”).
- Person Centered.



Shifting the Focus of Interventions Over the Life Span



Core Domains of Quality of Life World Health Organization



Self-
determination



Emotional
well being



Interpersonal
relationships



Personal
development



Physical well-
being



Material well-
being



Social-
inclusion

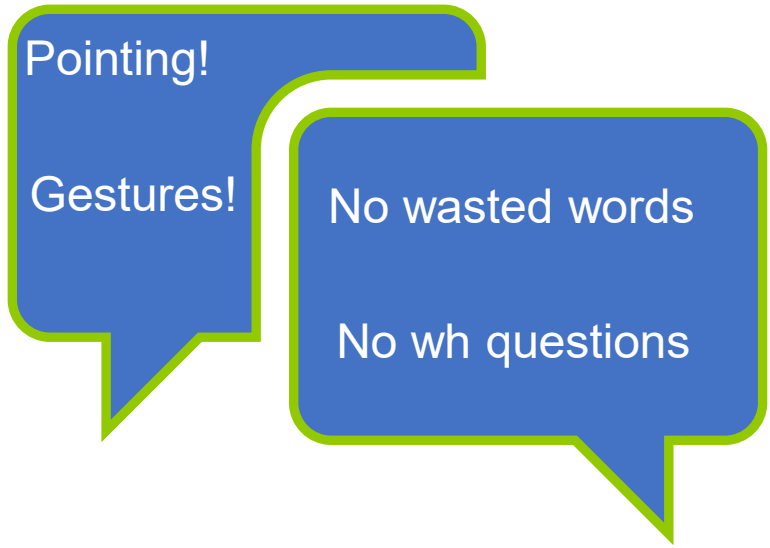


Rights

*Greater self-determination is associated with greater quality of life
in individuals with ID (Schalock et al., 2002)*

The older the person and
more limited the
communication, the more
important it is to focus on
practical functional
communication!

Functional Communication



Pointing!

Gestures!

No wasted words

No wh questions

Functional Communication is not ...

Not functional for older child/adult with ID

Hearing and Understanding

- Points to a few body parts when you ask.
- Follows 1-part directions, like "Roll the ball" or "Kiss the baby."
- Responds to simple questions, like "Who's that?" or "Where's your shoe?"
- Listens to simple stories, songs, and rhymes.
- Points to pictures in a book when you name them.

Talking

- Uses a lot of new words.
- Uses *p*, *b*, *m*, *h*, and *w* in words.
- Starts to name pictures in books.
- Asks questions, like "What's that?", "Who's that?", and "Where's kitty?"
- Puts 2 words together, like "more apple," "no bed," and "mommy book."

How does this improve someone with ID quality of life?

Not functional for older child/adult with ID

Functional communication doesn't follow typical milestones!

Repetitive Behaviors: Very Complex behaviors

- Restricted repetitive behaviors (RRBs) are heterogeneous group of behaviors. RRBs are associated with autism but also occur in other conditions like OCD, Tourette's syndrome and Parkinson's disease. (Lewis and Kim, 2009).
- Stereotypic behaviors (SB) are a type of RRB.
- Stereotypy can occur in any individual with ASD but it's more strongly associated with severe symptoms of ASD and developmental disabilities (ID) (Ghanizadeh, 2010).

Targeting SB in older client is rarely successful and not person centered

Noncompliance

- Most of us are “noncompliant.”
- Noncompliance is not a bad thing.
- Noncompliance can be a sign of autonomy!
- Being too compliant can be dangerous.
- People with disabilities get to be noncompliant too!



So what does all this mean for my practice

- Think about age and ID and how these client factors effect the treatment plan and discharge plan
- Little or no progress means changing the treatment plan or fading
- For clients who are 6 and older and do not have a vocal repertoire talk with families about an alternative communication system that will work for the client and the family (as they will be the ones implementing)
- With noncompliance think about if the behavior happens in peers. If so, the goal should not be about the client decreasing the behavior but a parent/caregiver goal where they are taught how to navigate this problem behavior effectively
- With stereotypic behavior that is not dangerous, consider how this stereotypy actually increases a client's quality of life.

Questions and Comments