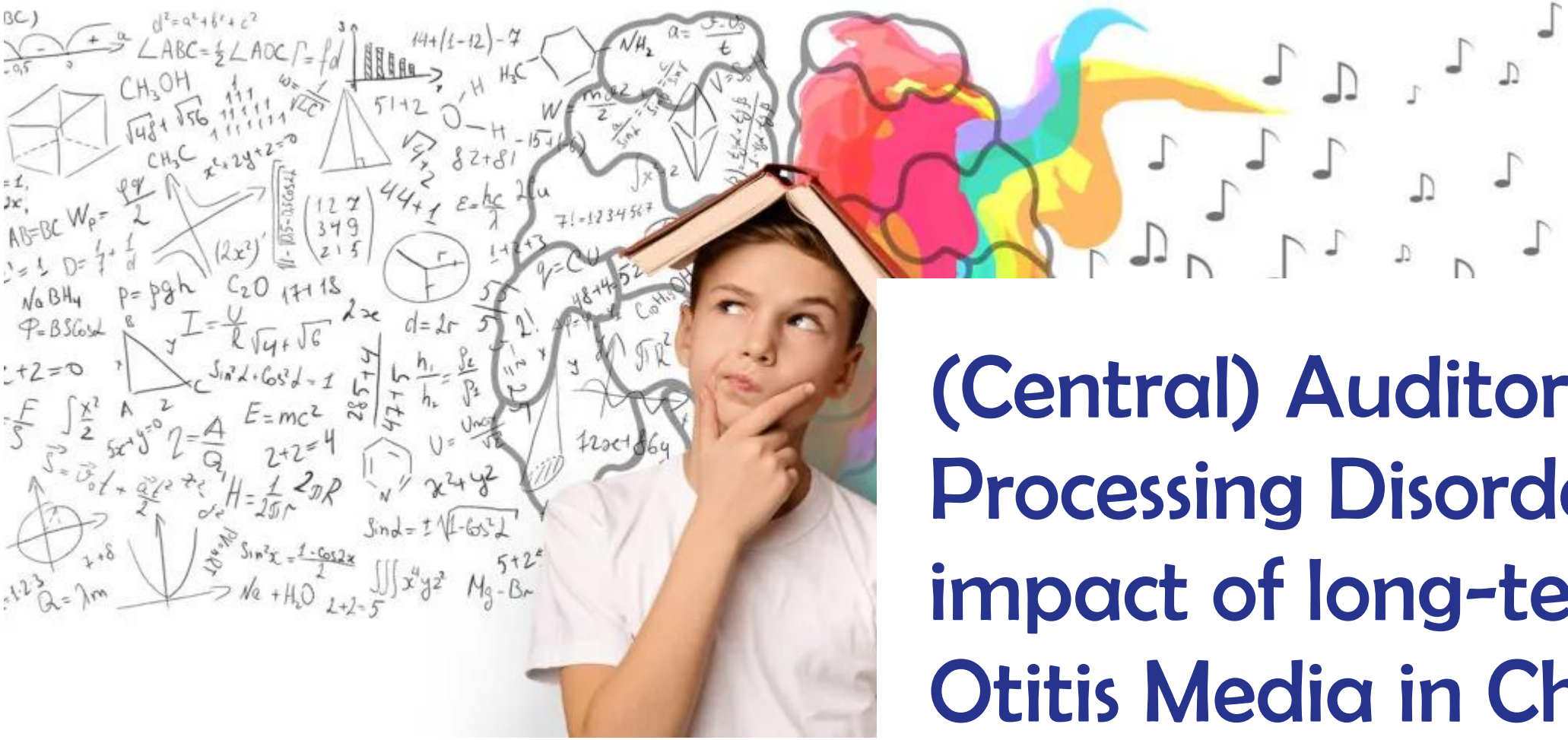

(Central) Auditory Processing Disorder: The impact of long-term Otitis Media in Children

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Artist: Dr Richard Barry Walley OAM

On Noongar land

The University of Western Australia acknowledges that we are situated on Noongar land and that Noongar people remain the spiritual and cultural custodians of their land and continue to practice their values, languages, beliefs and knowledge.

We also acknowledge and pay our respects to all Aboriginal communities throughout WA, their Elders of yesterday, today and emerging and, the significant role they play in helping to improve the lives of all Aboriginal children.

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What is (Central) Auditory Processing Disorder, (C)APD?

Umbrella term for children who have listening difficulty despite normal hearing thresholds.

Originates from the central auditory nervous system and is characterized by defects in the perception of the auditory signal

Especially prominent in an unfavorable listening environment, e.g. classroom

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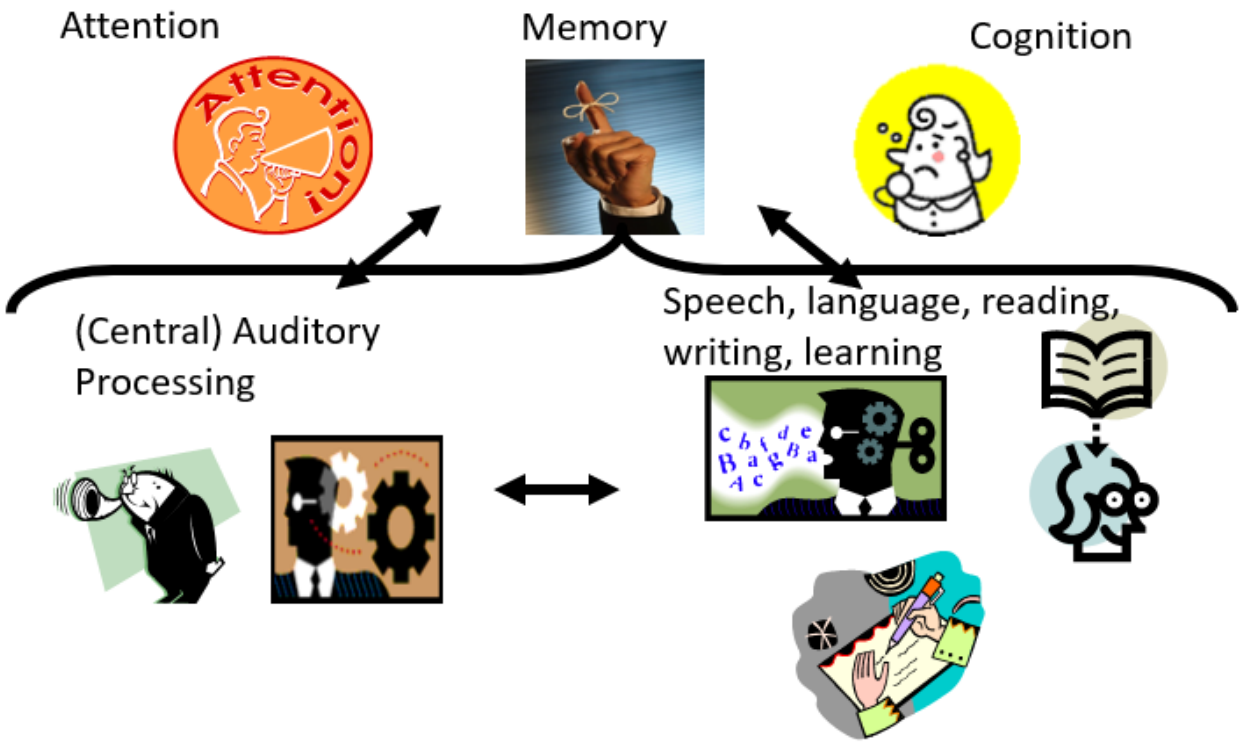
"Listening" Problems

"I tell her over and over again, but she doesn't listen"

The problem could be with:

- Hearing and/or
- Auditory processing and/or
- Cognition (attention, memory etc) and/or
- Language and/or
- Other
- Any combination of the above



(C)APD put too simply…

A complex interaction between:

- Attention
- Memory
- Cognition
- (Central) Auditory Processing
- Speech, language, reading, writing, learning

(C)APD is a failure of the CANS to determine

- What the sound was
- Where the sound came from
- When the sound occurred

Auditory Processes (ASHA, 2005)

Sound localization and lateralization:

identifying the location of a sound

Auditory discrimination:

identifying that two sounds are different

Auditory pattern recognition:

recognizing a sound pattern

Temporal aspects of audition, including temporal integration, temporal discrimination (e.g., temporal gap detection):

identifying when a sound occurred

(ASHA, 2005; AAA 2010)

Auditory Processes (ASHA, 2005)

Temporal ordering:

identifying what sound came first, what sound came second, etc

Temporal masking:

when one sound at one time prevents you from processing another sound at another time

Auditory performance in competing acoustic signals (including dichotic listening) :

when one sound at one time prevents you from processing another sound at the same time

(ASHA, 2005; AAA 2010)

Children with (C)APD often exhibit…

Individuals suspected of having (C)APD *frequently present with one or more of the following behavioural characteristics*:

- Difficulty understanding spoken language in competing messages, noisy backgrounds, or in reverberant environments
- Misunderstanding messages
- Inconsistent or inappropriate responding
- Frequent requests for repetitions, saying “what” and “huh” frequently
- Taking longer to respond in oral communication situations
- Difficulty paying attention
- Being easily distracted
- Difficulty following complex auditory directions or commands
- Difficulty localizing sound
- Difficulty learning songs or nursery rhymes
- Poor musical and singing skills
- Associated reading, spelling, and learning problems

(ASHA, 2005; AAA 2010)

Burden of (C)APD

Affects about 3 - 7% of children in general population

~9 – 15% of children in Aboriginal populations

Prevalence higher in populations with neurodevelopmental disorders, e.g., ADHD, ASD

CAPD can lead to:

- Increased anxiety and frustration
- Social Withdrawal
- Low self-esteem
- Behavioural issues
- Poor academic performance

(Sharma, Muralidharan & Hall, 2016; Bishop, 2014; ASHA, 2005; Cacace & McFarland, 2018, Goorhuis-Brouwer & de Vries, 2017, Schneider& Riecker, 2014, Schow & Nerbonne, 2007)

Aetiology of (C)APD

Unknown

Neurological deficits within the auditory system such as specific lesions, disorganisation or immaturity

Possible genetic traits

Possible result of auditory deprivation, e.g., early and frequent otitis media (OM)

OM and (C)APD

Broad term encapsulating numerous middle ear inflammatory conditions that occur on a continuum

Most prevalent condition in early childhood, with 80% of children suffering from OM in first 3 years.

OM can cause hearing loss due to accumulation of fluid in the middle ear

- Mild to moderate conductive hearing loss

(Kong & Coates, 2009; Williams & Jacobs, 2009; Morris et al., 2010)

OM and (C)APD

While OM itself does not cause (C)APD, it can cause fluctuating hearing loss.

- Inconsistent sound stimulation of the auditory central nervous system
- Distortion of sound perception
- Speech discrimination and phonological awareness skills can also be affected

Children with recurrent OM perform worse on tests that assesses the following skills:

- Binaural interaction
- Temporal processing

(Khavarghazalani et al., 2016; Moore et al., 2013; Borges et al., 2013; Gyawali et al., 2024)

(C)AP skills affected in children with recurrent OM

Binaural processing

- Ability to process sounds using interaural intensity or time differences (e.g., localisation, sound segregation etc).
- Critical in noisy environments such as classroom

Temporal processing

- Ability to analyse acoustic signals over time (e.g., sequencing and patterns, gap detection etc).
- Important in processing speech and environmental stimuli

(Khavarghazalani et al., 2016; Moore et al., 2013; Borges et al., 2013; Gyawali et al., 2024)

OM and (C)APD

Insufficient binaural stimulation that results from recurrent OM and OME could result in binaural processing deficits later in life.

Potential link between unequal bilateral auditory stimulation and poor attention skills later in life.

Auditory deprivation?

(Khavarghazalani et al., 2016; Moore et al., 2013; Borges et al., 2013)

Comorbidities of (C)APD

CAPD often coexists with several other conditions, which can complicate the diagnosis and treatment.

Common comorbidities include:

- Attention-Deficit/Hyperactivity Disorder (ADHD) Language Disorders
- Learning Difficulties/Disabilities
- Autism Spectrum Disorder (ASD)
- Anxiety Disorders

(Katz & Stevens, 2013; Bishop, 2014; Choi et al, 2019; Ramus & Szenkovits, 2008; Miller & Kearney, 2010; Becker & Bowers, 2015)

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Screening for (C)APD

No tool for mass screening

First screening left to parents, teachers and/or GP

- Positive first screening when the parent and/or teacher reports the child showed behaviours associated with (C)APD, such as those listed by ASHA (2005) and AAA (2010)
- Mitigated by overlap with behaviours shown in other disorders, although any resulting increase in false positive findings may be acceptable in screening
- Parents often visit GP/Paediatrician as first port of call

Current treatments for (C)APD

Improving the SNR for children in the classroom (bottom-up)

- Remote microphone systems

Auditory training to train specific auditory processing skills (top-down)

- E.g., SoundStorm, ARIA

Speech language therapy/ Cognitive Behavioural Therapy

Compensatory strategies

- Active listening, metacognitive and metalinguistic strategies

Current treatments for (C)APD

Disadvantages of current treatments

- High cost
- Require high cognitive levels (increased difficulty)
- Low engagement

No single option currently exists that addresses CAPD and co-occurring challenges!

New treatment options for (C)APD

Music therapy

Exercise and Music

Dance and Music

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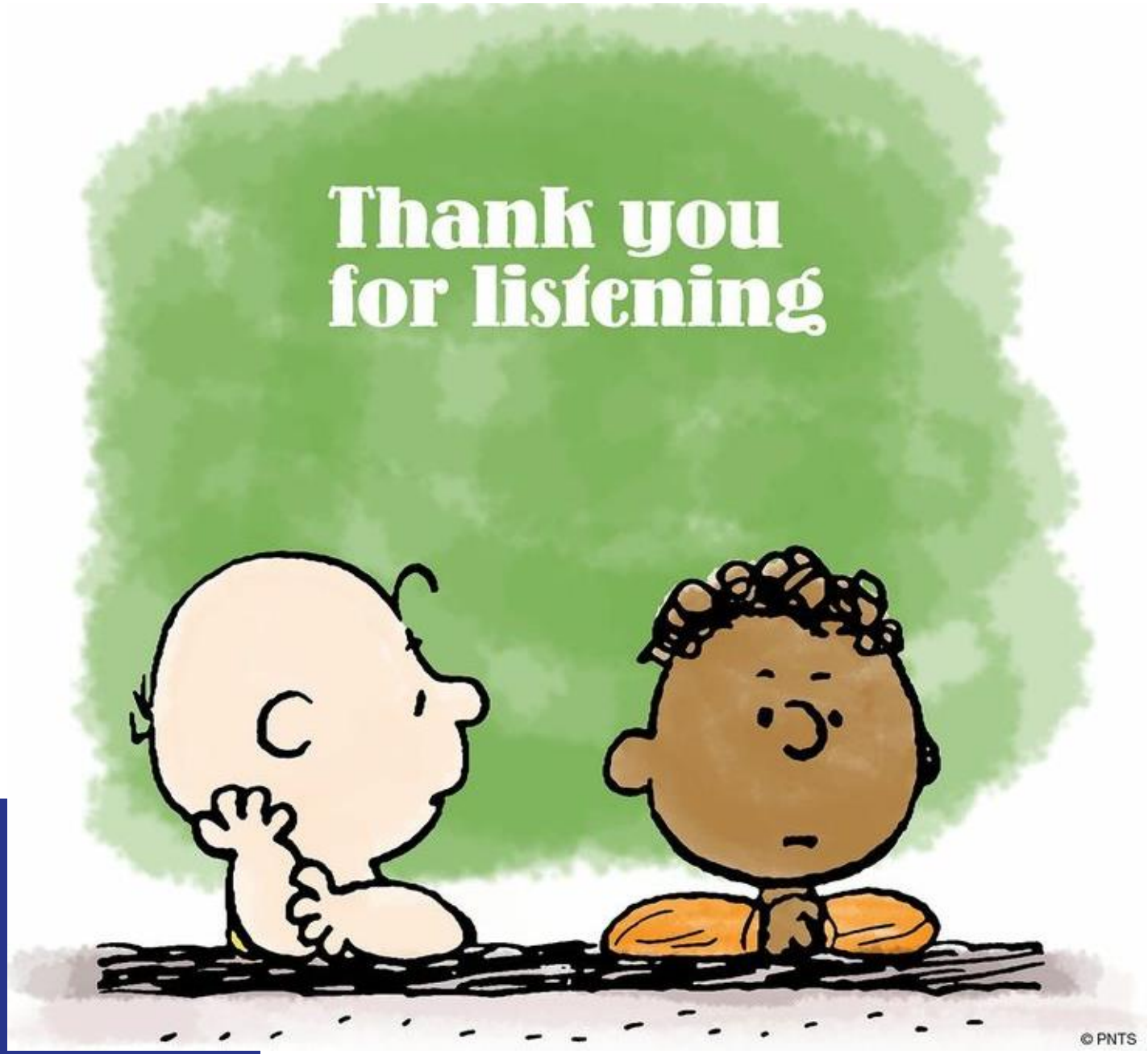
What should you do if you suspect a child suffering from (C)APD?

Before referring to an Audiologist for diagnostic (C)AP assessment:

- Potential hearing loss – Refer to Audiologist
- Potential speech/language difficulties – Refer to SLP
- Attention/behavioural issues – Refer to GP/Paediatrician
- Check mental health – GP/Child Psychologist

If unsure, refer the child to an Audiologist for diagnostic (C)AP assessment



Any Questions?