Vestibular and psychological symptoms screening in children with hearing impairment

Thesis project by Chan Le Yuan

Under the supervision of Ms. Kek Tze Ling and Ms. Ivy Serafico

NUS National University of Singapore

National University Hospital

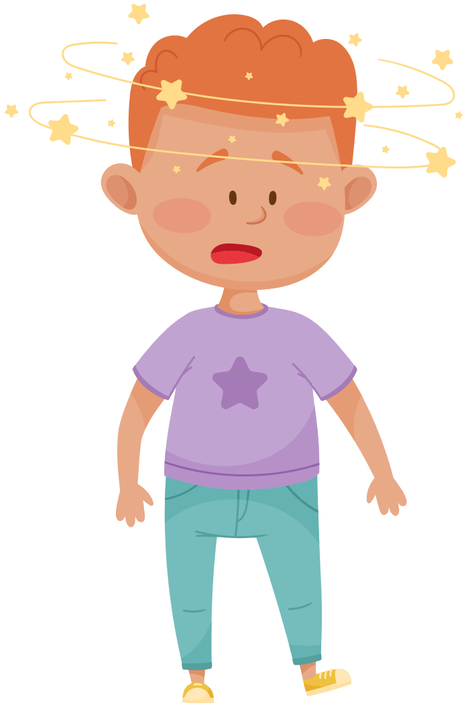
Objectives of Study

Methodology

Results

Vestibular and psychological symptoms screening in children with hearing impairment

Significance of Topic



Discussion

Background

Conclusion

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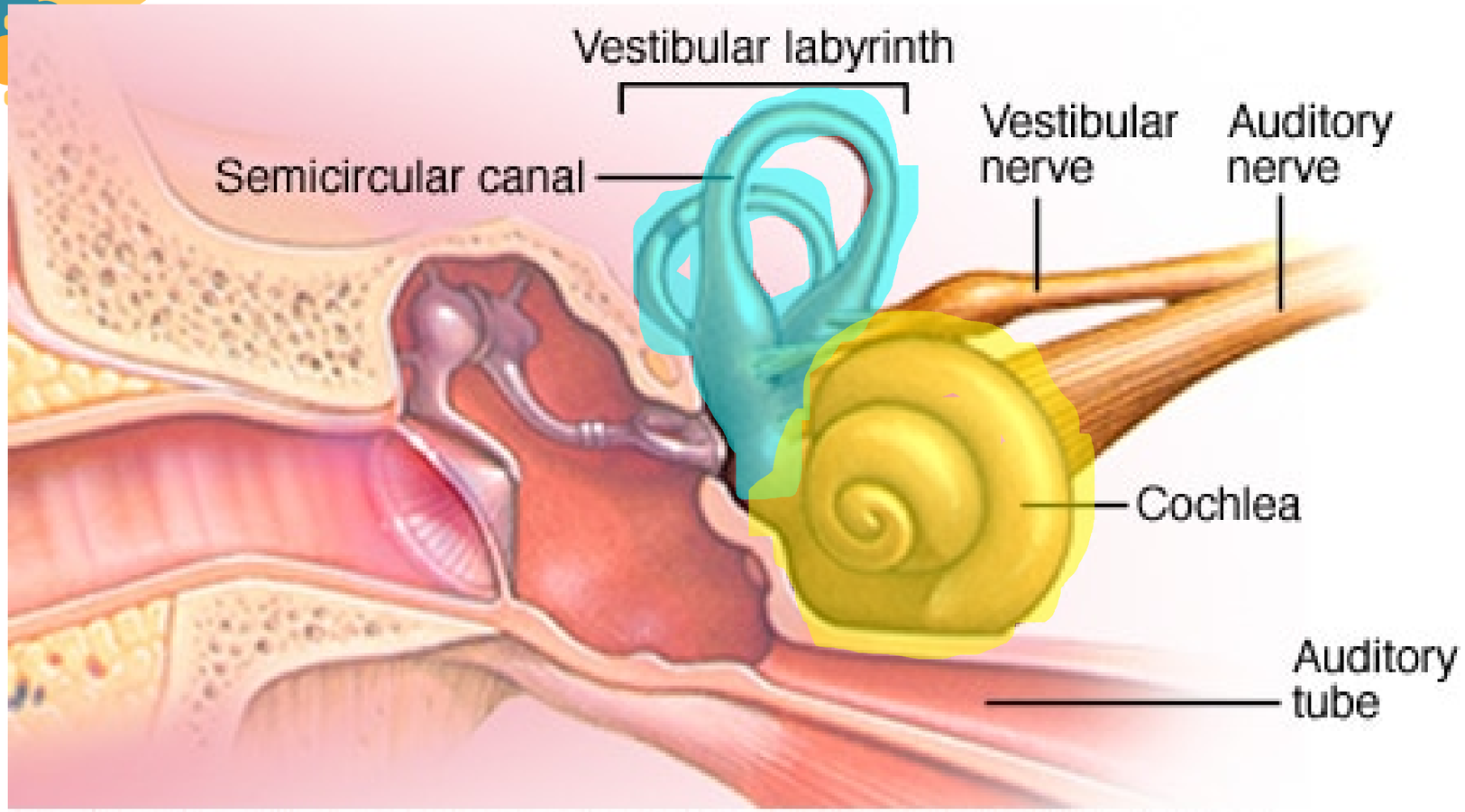
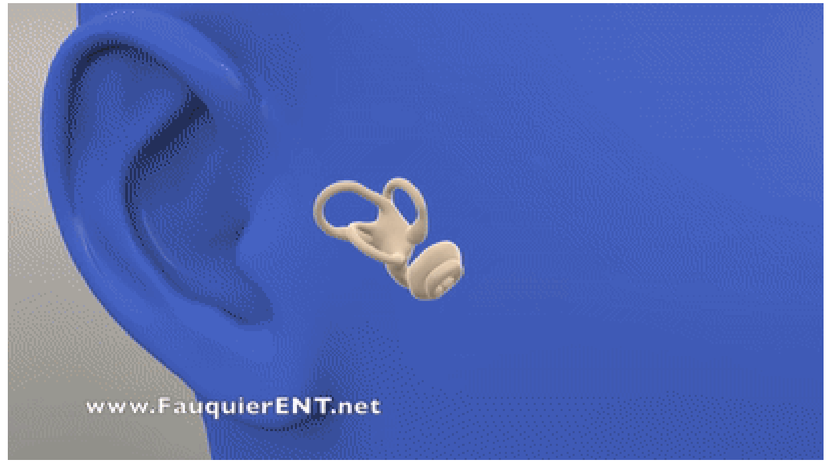
Background

Background

Background

Inner Ear = Auditory system + Vestibular system





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Background

Universal Newborn Hearing Screening

In Singapore, 4 in 1000 babies have hearing loss

(Low et al., 2005)

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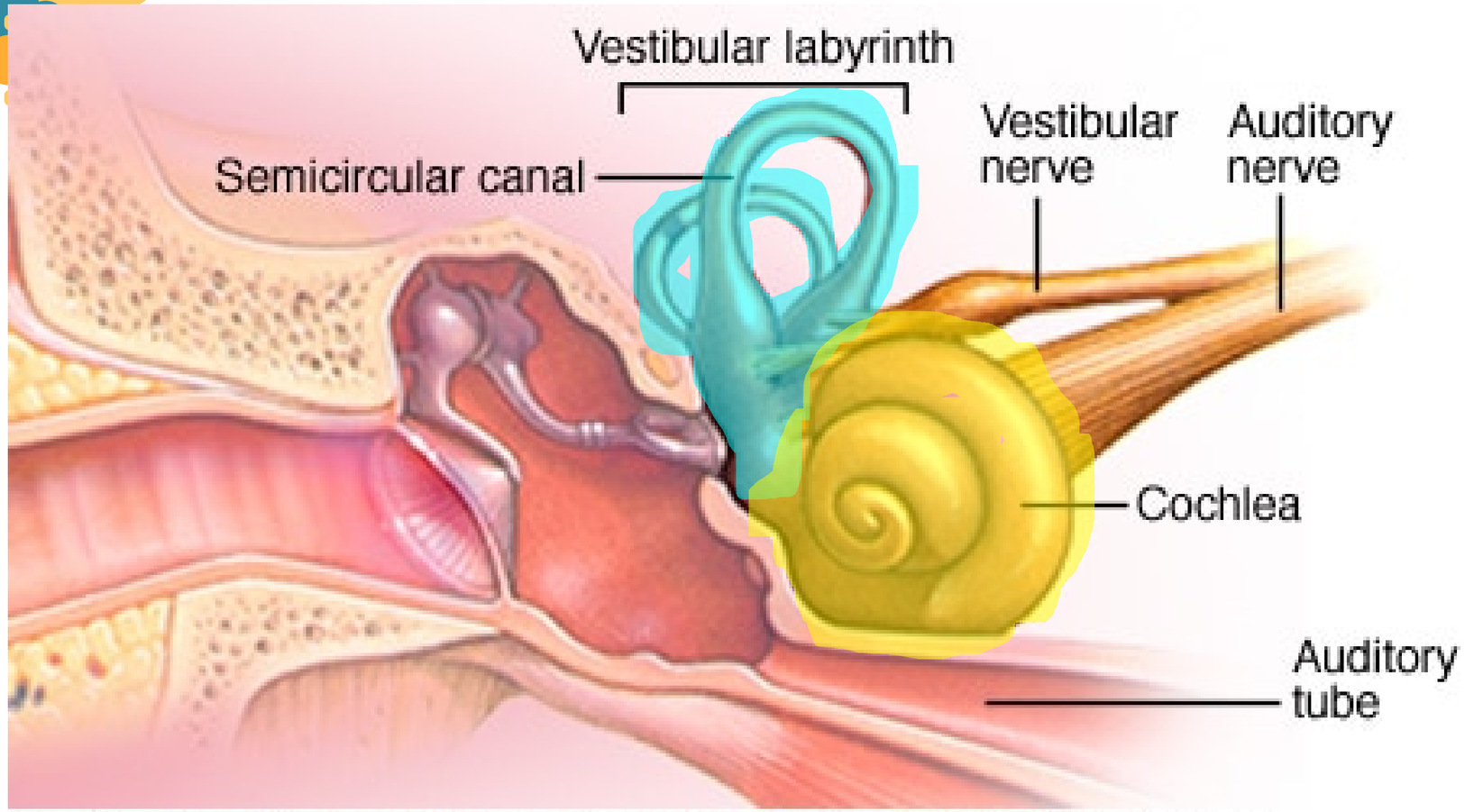
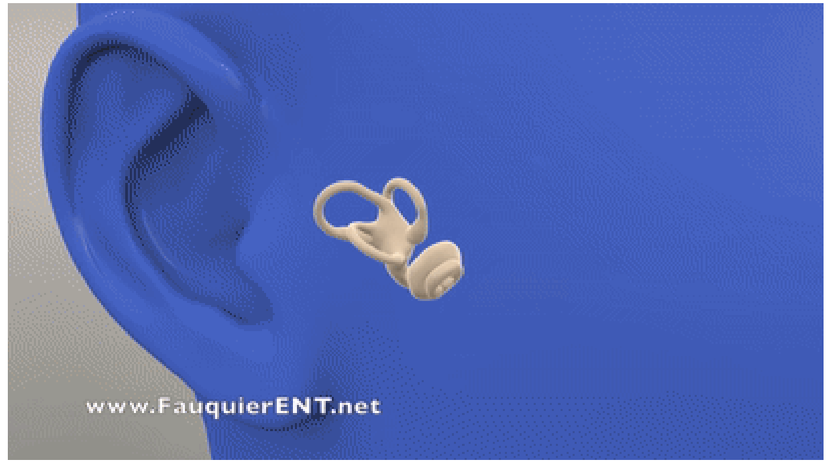
Background

Inner Ear = Auditory system + Vestibular system





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Background

Universal Newborn Hearing Screening

In Singapore, 4 in 1000 babies have hearing loss

(Low et al., 2005)

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Significance of Topic

Significance of Topic

Why are looking into this?

Prevalence

Impacts

13% to 50%

children with *profound hearing loss* have vestibular deficits

* (Cushing et al., 2013; Cushing, Papsin, et al., 2008; Buchman et al., 2004; Tribukait et al., 2004; Brookhouser et al., 1991; Selz et al., 1996; Arnvig, 1955)

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Significance of Topic

Why are looking into this?

Prevalence

Impacts

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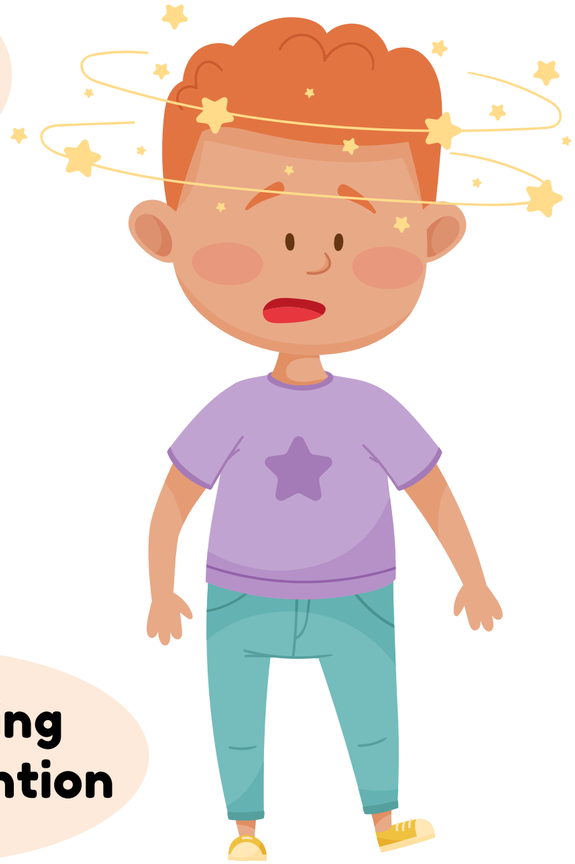
Significance of Topic

Why are looking into this?

Impacts

Spatial awareness

Cognition



Idea of oneself

Psychosocial development

Sustaining joint attention

Reading and writing abilities

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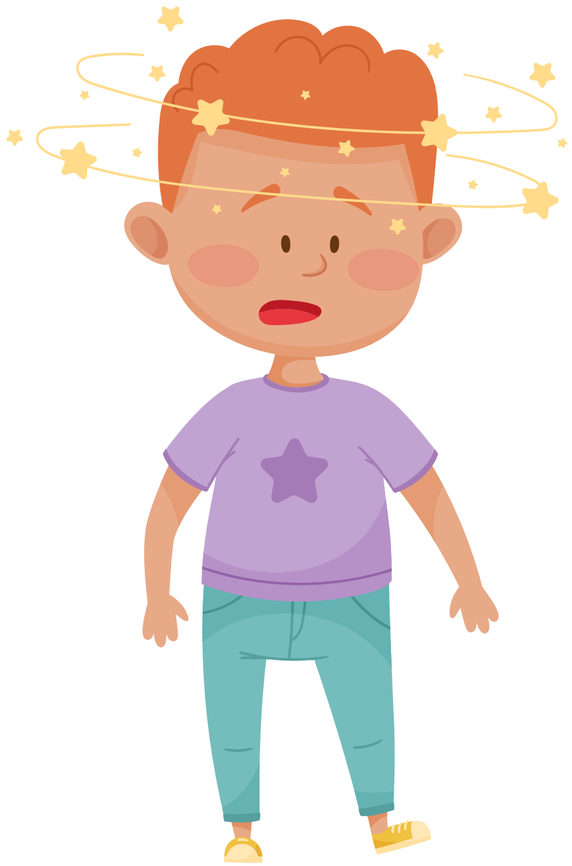
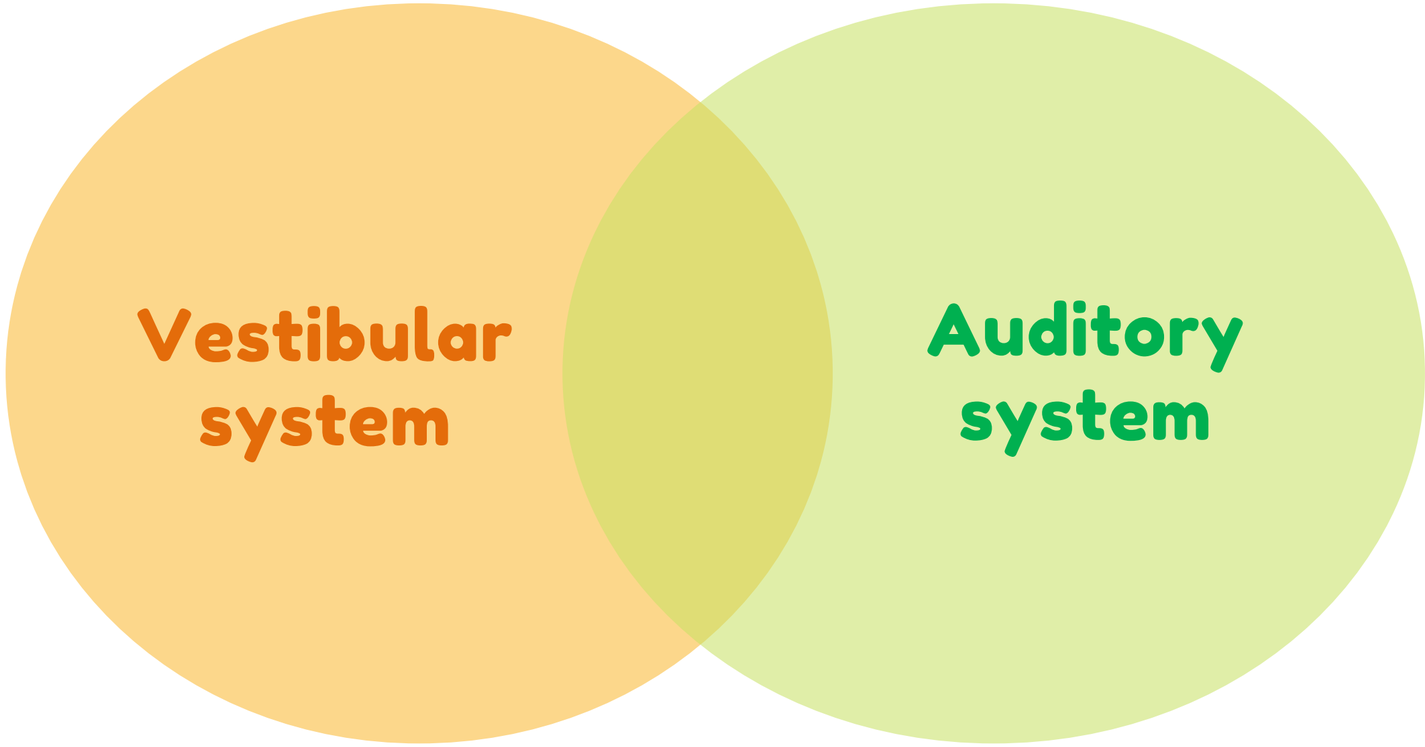
* (Wiener-Vacher, 2008; Bart et al., 2009; Hanes & McCollum; Jacob & Furman; Smith, Darlington, & Zheng; Smith, Zheng, Horii, & Darlington, as cited in Martens et al., 2019)

Significance of Topic

Why are looking into this?





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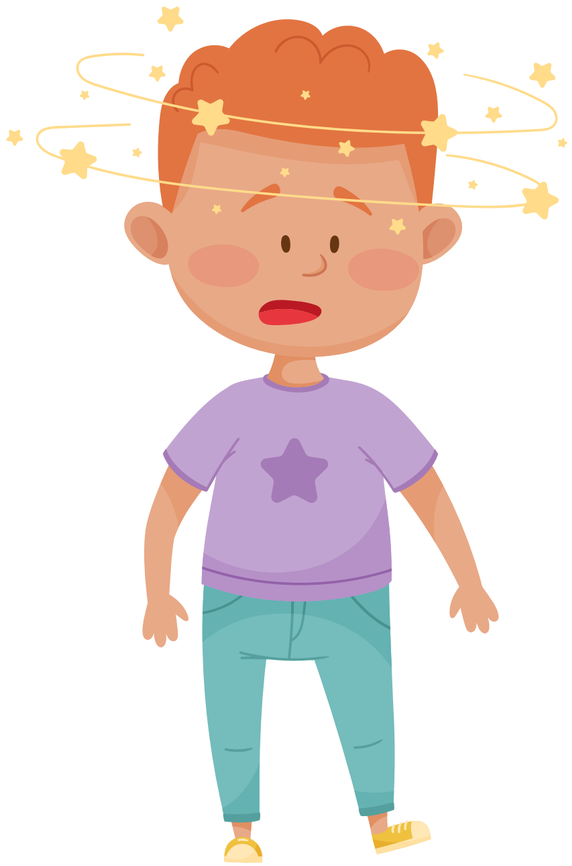
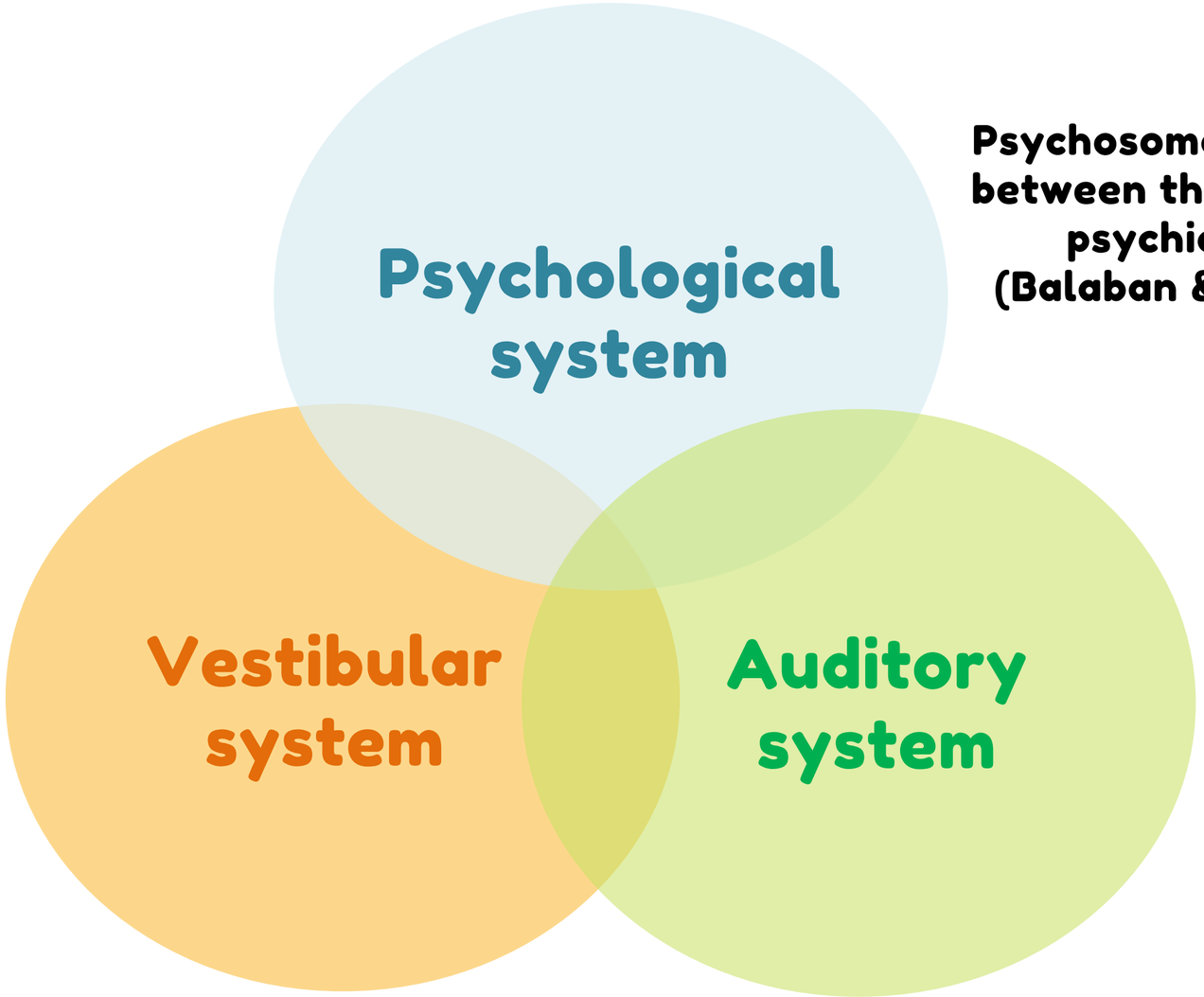
Significance of Topic

Why are looking into this?





Psychosomatic interactions between the vestibular and psychiatric sphere (Balaban & Thayer, 2001).

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Objectives of Study

Objectives of Study

What were we trying to find out?

1. What is the incidence of self-reported vestibular symptoms in children?

2. Are children with hearing loss at a greater risk for vestibular deficits?

3. Are there any relationships between vestibular and psychological symptoms in children with hearing loss?

Methodology

Methodology

How did we do it?

Participants

Children with HL

- 6 - 17 years old
- Singaporean/PR

Controls

Process

Questionnaires

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Methodology

How did we do it?

Participants

Children with HL

with hearing impairments

- referred from NUH
- bilateral or unilateral SNHL
- degree of moderate and above

Controls

Process

Questionnaires

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Methodology

How did we do it?

Participants

Process

Questionnaires

Children with HL

Controls

- recruited from the public
- passed UNHS in both ears
- passed primary 1 hearing screening

Controls

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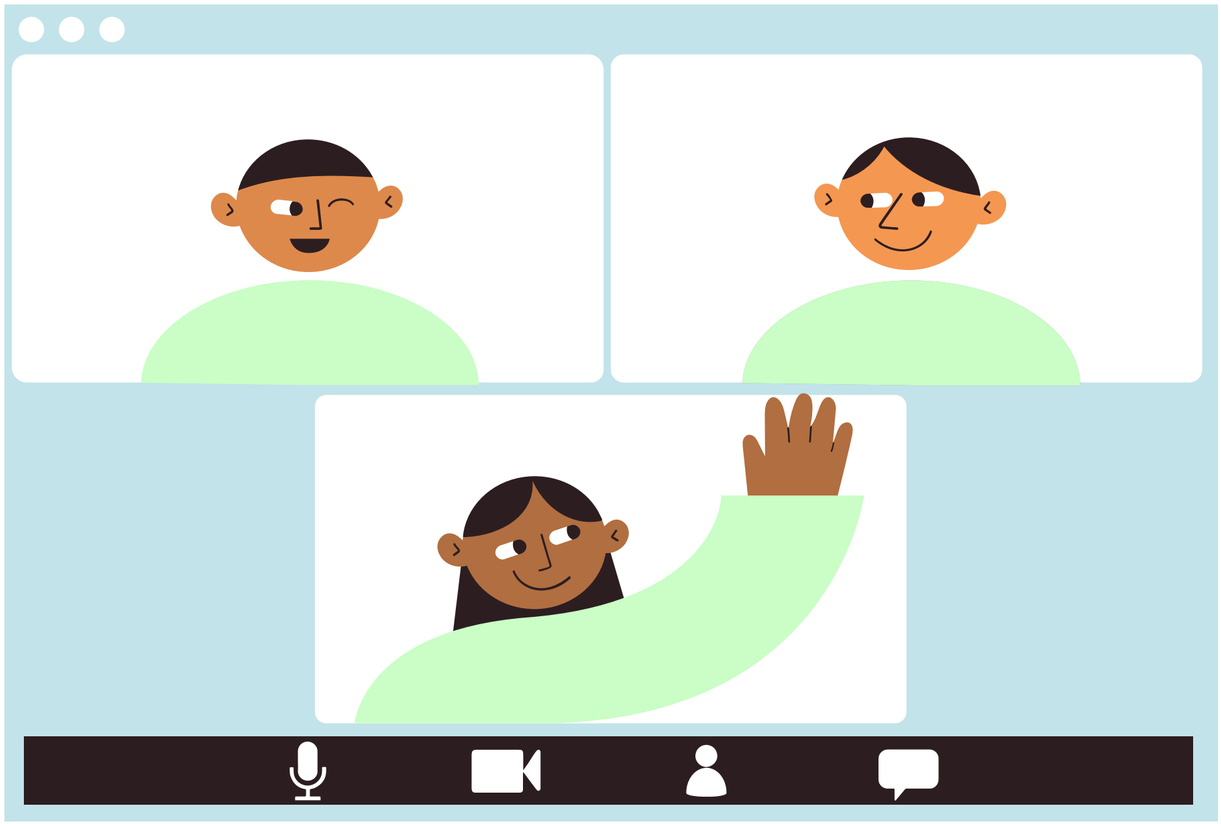
Methodology

How did we do it?

Participants

Process



- 15 minutes consent taking
- 15 minutes online survey

* reimbursed with $5 cash through Paynow transfer.

Questionnaires

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Methodology

How did we do it?

Participants

Process

Questionnaires

Vestibular symptoms

Paediatric Vestibular Symptom Questionnaire (PVSQ)

Psychological Questionnaire

Strengths and Difficulties Questionnaire (SDQ)

6-10 year-olds completed with their parents
11-17 year-olds completed the entire survey by themselves.

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Methodology

How did we do it?

Participants

Process

Questionnaires

Vestibular symptoms

Paediatric Vestibular Symptom Questionnaire PVSQ

11 questions on dizziness and unsteadiness

Most of the time - 3 points
Sometimes - 2 points
Almost - 1 point
Never - 0 points

$\geq$ 0.68 → Positive for vestibular symptoms (Pavlou et al. 2016)

6-10 year-olds completed with their parents
11-17 year-olds completed the entire survey by themselves.

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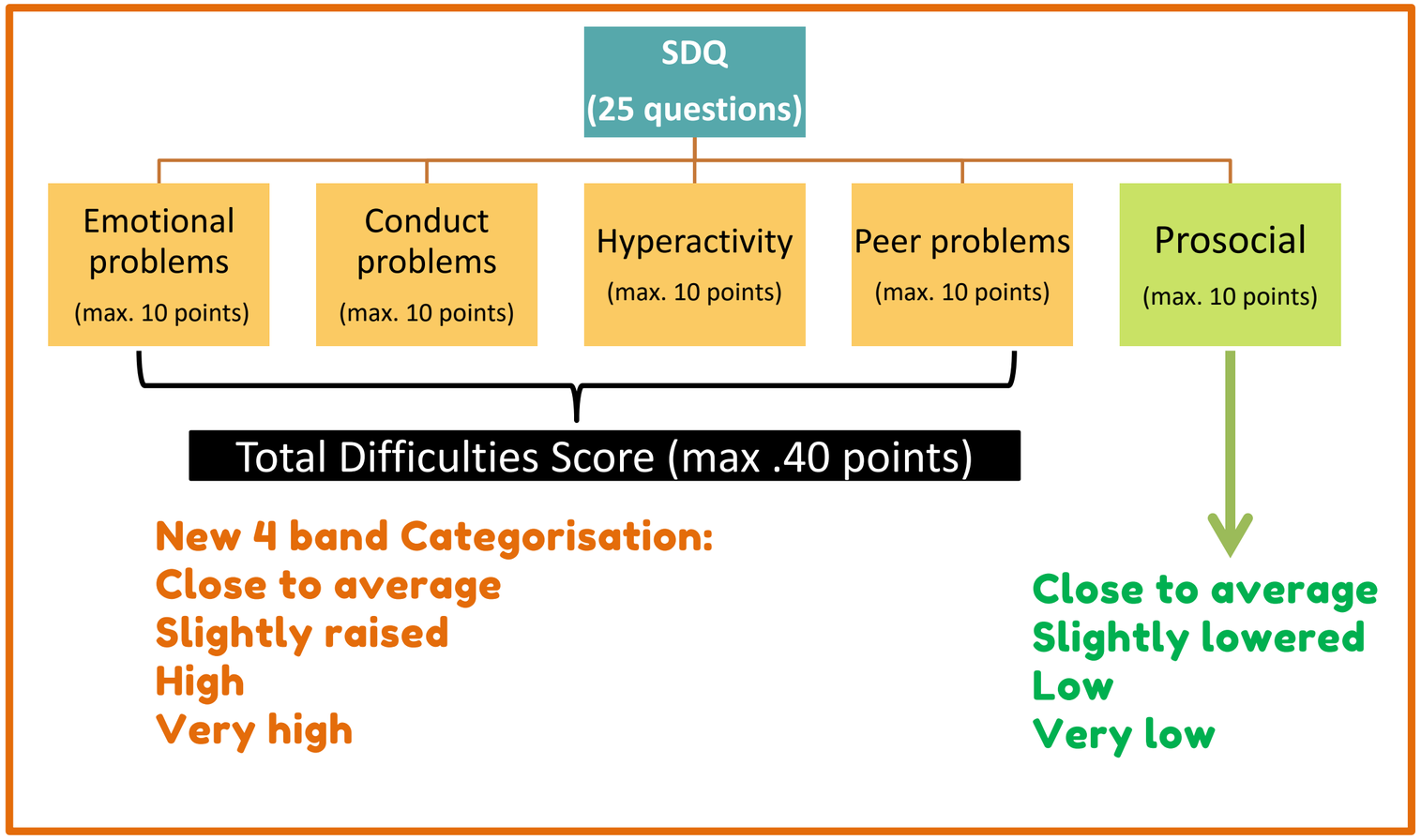
Methodology

How did we do it?



Participants

Process

Questionnaires

Psychological Questionnaire

Strengths and Difficulties Questionnaire

(SDQinfo, 2016)

6-10 year-olds completed with their parents
11-17 year-olds completed the entire survey by themselves.

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Results

Results

What did we get?

75 participants in total

30 Participants with hearing loss

45 participants as control

24 Bilateral hearing loss

6 unilateral

- **23/30 severe-profound**
- **Mean age 11.5 years old**
- **Mean age of intervention = 1.81 yo**

Children with HL

- **Mean age 12.2 years old**

Controls

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Results

What did we get?

Most common symptom reported - "a feeling of pressure in the ear(s)"

PVSQ (Vestibular Quesitonnaire)

30 Participants with hearing loss	45 participants as control

Children with HL

6/30 positive for vestibular symptoms

20%

9/30 positive for vestibular symptoms

20%

Controls

- **No significant differences in the scores**
- **No association found between PVSQ rating and presence of hearing loss**
- **No correlation between age of intervention and PVSQ scores**

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Results

What did we get?

SDQ
(25 questions)

- Emotional problems (max. 10 points)
- Conduct problems (max. 10 points)
- Hyperactivity (max. 10 points)
- Peer problems (max. 10 points)
- Prosocial (max. 10 points)

Total Difficulties Score (max .40 points)

30 Participants with hearing loss	45 participants as control

Children with HL

11.9/40

11.4/40

Controls

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Results

What did we get?

SDQ (25 questions)

- Emotional problems (max. 10 points)
- Conduct problems (max. 10 points)
- Hyperactivity (max. 10 points)
- Peer problems (max. 10 points)
- Prosocial (max. 10 points)

	Children with HL		Controls	
Subscale scores (out of 10)	Mean score	Median score	Mean score	Median score
Emotional problems scale				
Conduct problems scale				
Hyperactivity scale				
Peer problems scale				
Prosocial scale				

Children with HL

Controls

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Results

What did we get?

SDQ (25 questions)

- Emotional problems (max. 10 points)
- Conduct problems (max. 10 points)
- **Hyperactivity (max. 10 points)**
- Peer problems (max. 10 points)
- Prosocial (max. 10 points)

Children with HL

	Children with HL		Controls	
Subscale scores (out of 10)	Mean score	Median score	Mean score	Median score
Emotional problems scale	2.53	2.00	2.53	2.00
Conduct problems scale	2.47	3.00	2.33	2.00
Hyperactivity scale	4.50	4.00	4.36	4.00
Peer problems scale	2.40	2.50	2.16	2.00
Prosocial scale	7.60	8.00	7.56	8.00

Controls

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Results

What did we get?

SDQ
(25 questions)

Emotional problems
(max. 10 points)

- Close to average difficulty
- Slightly raised difficulty
- High difficulty
- Very high difficulty

Conduct problems
(max. 10 points)

- Close to average difficulty
- Slightly raised difficulty
- High difficulty
- Very high difficulty

Hyperactivity
(max. 10 points)

- Close to average difficulty
- Slightly raised difficulty
- High difficulty
- Very high difficulty

Peer problems
(max. 10 points)

- Close to average difficulty
- Slightly raised difficulty
- High difficulty
- Very high difficulty

Prosocial
(max. 10 points)

- Close to average ability
- Slightly lowered ability
- low ability
- Very low ability

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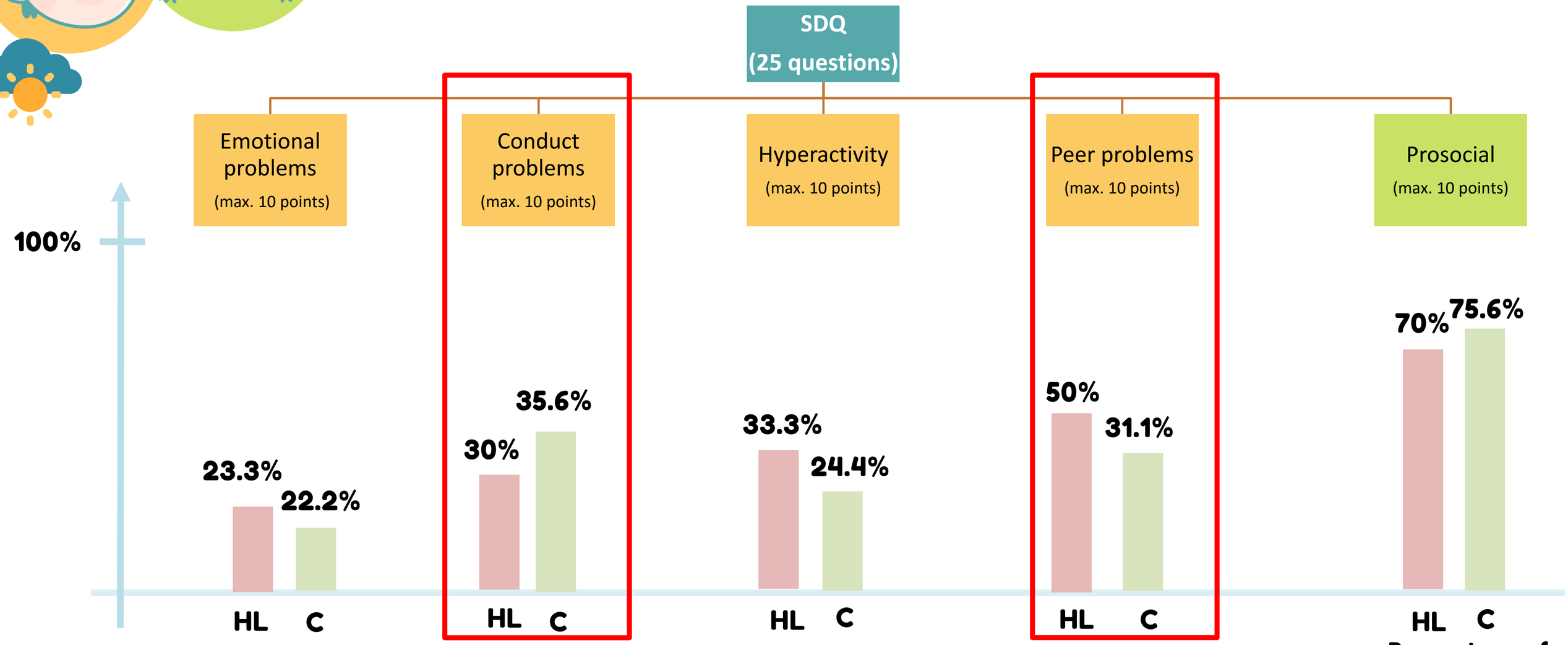
Results

What did we get?



Percentage of children in the "slightly raised", "high", "very high" difficulties category

Percentage of children in the "close to average" category

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Discussion

Discussion

What did we find out?

1. What is the incidence of self-reported vestibular symptoms in children?
   - Incidence is 20%. (Other studies: 13%-50%*)
     - Subjective mode of assessment
     - Effect of vestibular compensation
     - Cultural factors
     - Degree of hearing loss (majority of children with hearing loss found positive for vestibular symptoms had severe-profound hearing loss)

2. Are children with hearing loss at a greater risk for vestibular deficits?
   - Based on this study, no.

3. Are there any relationships between vestibular and psychological symptoms in children with hearing loss?
   - For children with hearing loss
     - Total difficulties score and hyperactivity have weak positive correlation with PVSQ score
   - For controls
     - Emotional problems has weak positive correlation with PVSQ score

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* (Cushing et al., 2013; Cushing, Papsin, et al., 2008; Buchman et al., 2004; Tribukait et al., 2004; Brookhouser et al., 1991; Selz et al., 1996; Arnvig, 1955)

Discussion

What did we find out?

70%

of children with hearing loss (21/30) reported that they balanced better with their devices switched on

(Buchman et al., 2004; Cushing, Chia, et al., 2008; Negahban et al., 2017)

Discussion

What were the challenges and limitations?

Limited in sample size

Affected by reliability of responses

No local normative data for comparison

Discussion

Future research possibilities

Larger sample size

Combination of balance function evaluation with questionnaires

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Conclusion

Conclusion

In summary...

- No significant difference in vestibular symptoms between HL vs Controls

- Provision of insights to the incidence of vestibular symptoms in children of Singapore

- PVSQ and SDQ are tools that can be used to retrieve subjective information that may complement objective test results.

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THANK YOU!

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Ms Kek Tze Ling and Ms Ivy Serafico. NUH paediatric audiologists,
Participants and friends
My loving parents and family members
and my fiancé, Ashley.

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