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SYDNEY CHILDREN'S HOSPITAL RANDWICK

The Sydney children's Hospitals Network

Evidence-based approaches for management of incidental conductive hearing loss in neonates.

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- Six diagnostic audiologists.
- Patient age range neonate to adult, mainly children.
- Diagnostic Auditory brainstem response (tb-ABR, AC and BC) for babies referred by SWISH (the neonatal hearing screening program), and allowed 3 hours for an appointment.
- Follow up ABR only if initial ABR is incomplete or abnormal.

Impact of incidental conductive hearing loss

- All conductive hearing losses ~ 20% of all assessments
- Incidental transient conductive hearing losses (those without risk factor for hearing loss) ~ 12% of assessments and ~25% of all hearing losses.
- All these patients require management – and the management pathway is unclear.
- Should we see them for follow up? When and how often?
- Should some or all be referred for aiding or medical intervention?

JCIH recommendation

"In 2013, the JCIH recommended that children at-risk for delayed speech and language development due to chronic middle ear conditions receive intervention services. When present from the time of birth, if a conductive hearing loss … cannot be medically remediated by six months of age, the child should be considered for hearing aid amplification, communication supports, and referral to early intervention services, even if these services may be short-term. Such interventions are necessary to address and prevent developmental language delays."

Previous study results

- Incidental and transient conductive hearing loss was less likely to resolve:
  - before four months age, or
  - after six months and before twelve months of age if the patient had flat tympanometry at the first follow up assessment.
- Low level of air conduction hearing loss at 500 Hz appeared to correlate with better middle ear status at follow up.
- Lost to follow up: 10 % of patients are lost to follow up after the first follow up.

Our recommended referral pathway based on previous study

- First follow up pathway
  - Ad hoc, multiple follow ups.
- The 2023 pathway:
  - Follow up all neonates with conductive hearing loss, up to two times.

Can we better predict which babies might not need to see us again?

Do tympanometry results at ABR predict follow up results?

- Our recommended method implies that we believe initial tympanometry predicts follow up tympanometry.

		Bilaterally flat	Unilaterally flat	Both peaked
ABR tympanometry	Bilaterally flat	72	17	35
	Unilaterally flat	12	24	37

- Can we leverage the information we have at initial ABR to reduce follow up burden?

Let's change the target

- Method 0: Target all neonates with an incidental conductive hearing loss.
- Method 1: Target neonates with *one or both* follow up tympanograms expected to be flat.
- Method 2: Target neonates with *both* follow up tympanograms expected to be flat.
  - Those we expect to have one or both tympanograms peaked can be monitored by GP instead.
  - Assumes neonates with unilateral conductive hearing loss are less impacted than those with bilaterally conductive hearing loss.

Method 1: Use results at ABR to predict follow up results.

Target: Neonates with one or both follow up tympanograms flat.

		Follow up tympanometry	
		One or both flat	Both peaked
ABR tympanometry	Bilaterally flat	89	35
	Unilaterally flat	36	37

49.3% unilaterally flat

71.8% bilaterally flat

→ one or both flat at follow up

Sensitivity = 0.712, specificity = 0.514, AUC = 0.611

Method 2: Following up only predicted bilateral conductive losses

Target: Neonates with both follow up tympanograms fat.

		Follow up tympanometry	
		Bilaterally flat	One or both peaked
ABR tympanometry	Bilaterally flat	72	52
	Unilaterally flat	12	61

16.4% unilaterally flat

58.1% bilaterally flat

→ both flat at follow up

Sensitivity = 0.857, specificity = 0.540, AUC = 0.699

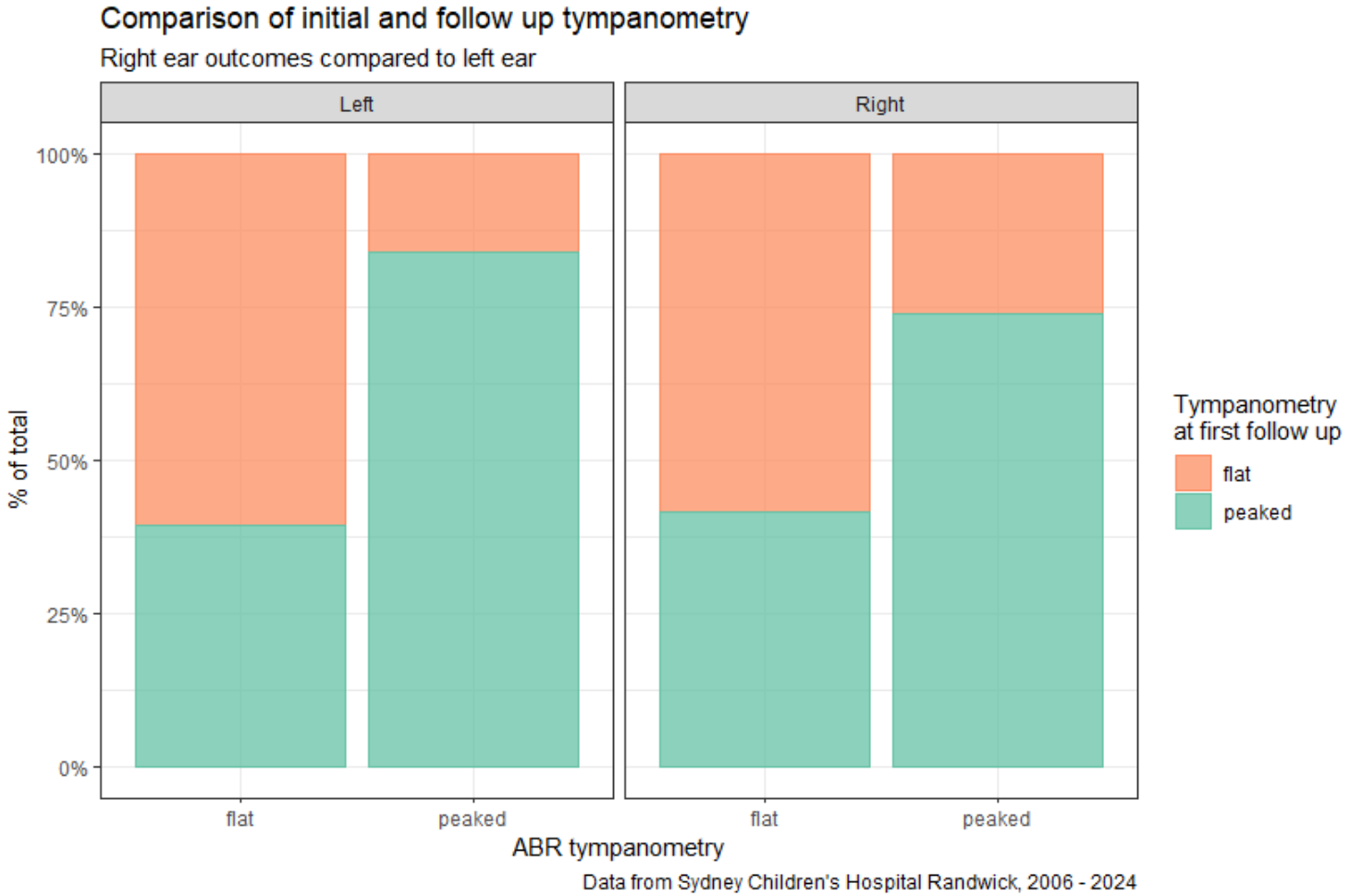
Comparison so far:

- Method 0: Follow up all neonates with a conductive hearing loss.
  - Reduces follow up by 0%, false negatives 0% of total, lost to follow up 10% of total
- Method 1: Targetting bilaterally flat to predict outcome of "one or both flat":
  - Reduces follow up by 37.1%, false negatives 18.3% of total
- Method 2: Targetting bilaterally flat to predict outcome of "both flat":
  - Reduces follow up by 37.1%, false negatives 6.5% of total

What other information can we use?

Maybe outcomes are different for *left ears* and *right ears*?

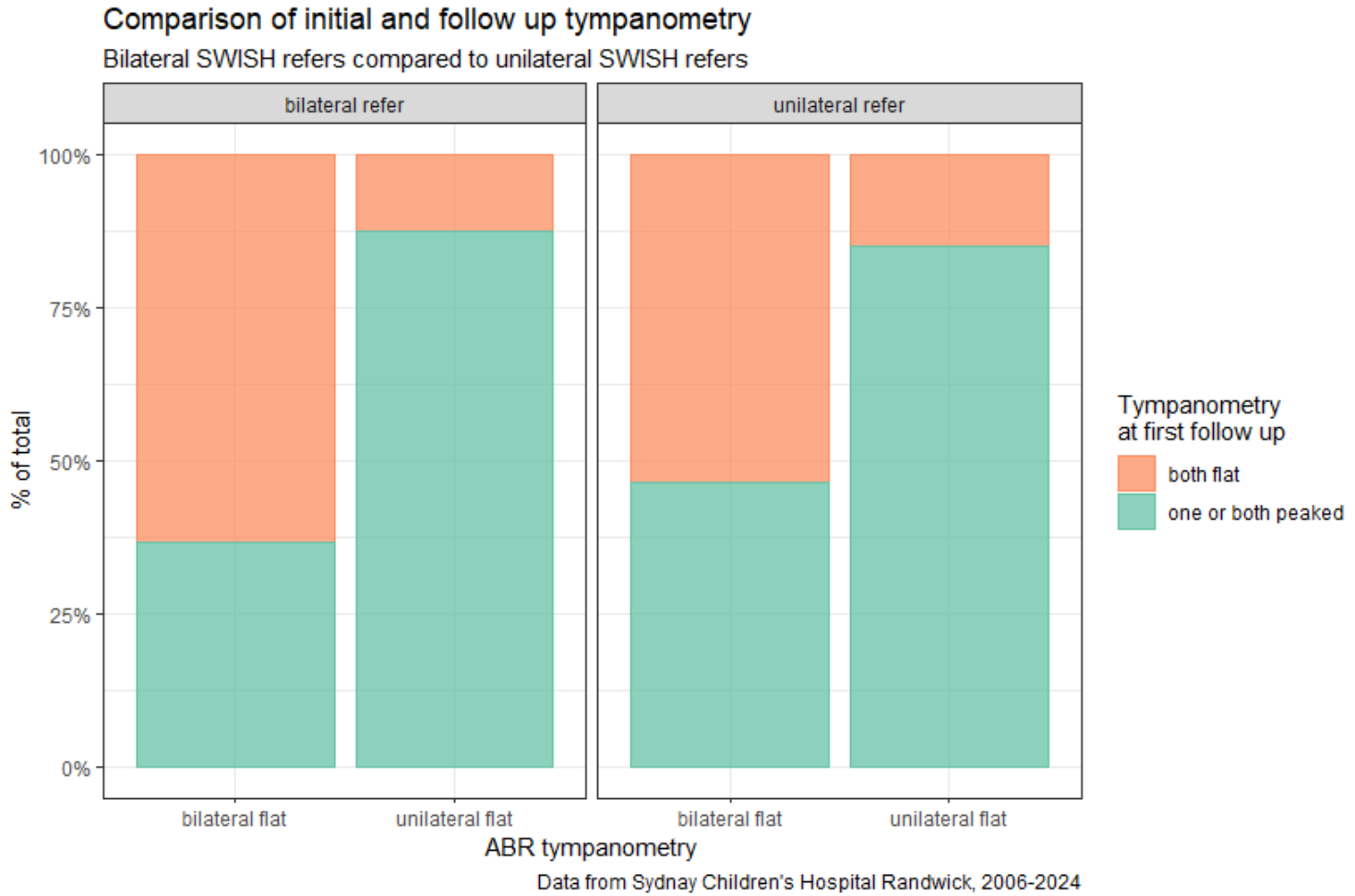
No significant difference in outcome dependant on ear.



What other information can we use?

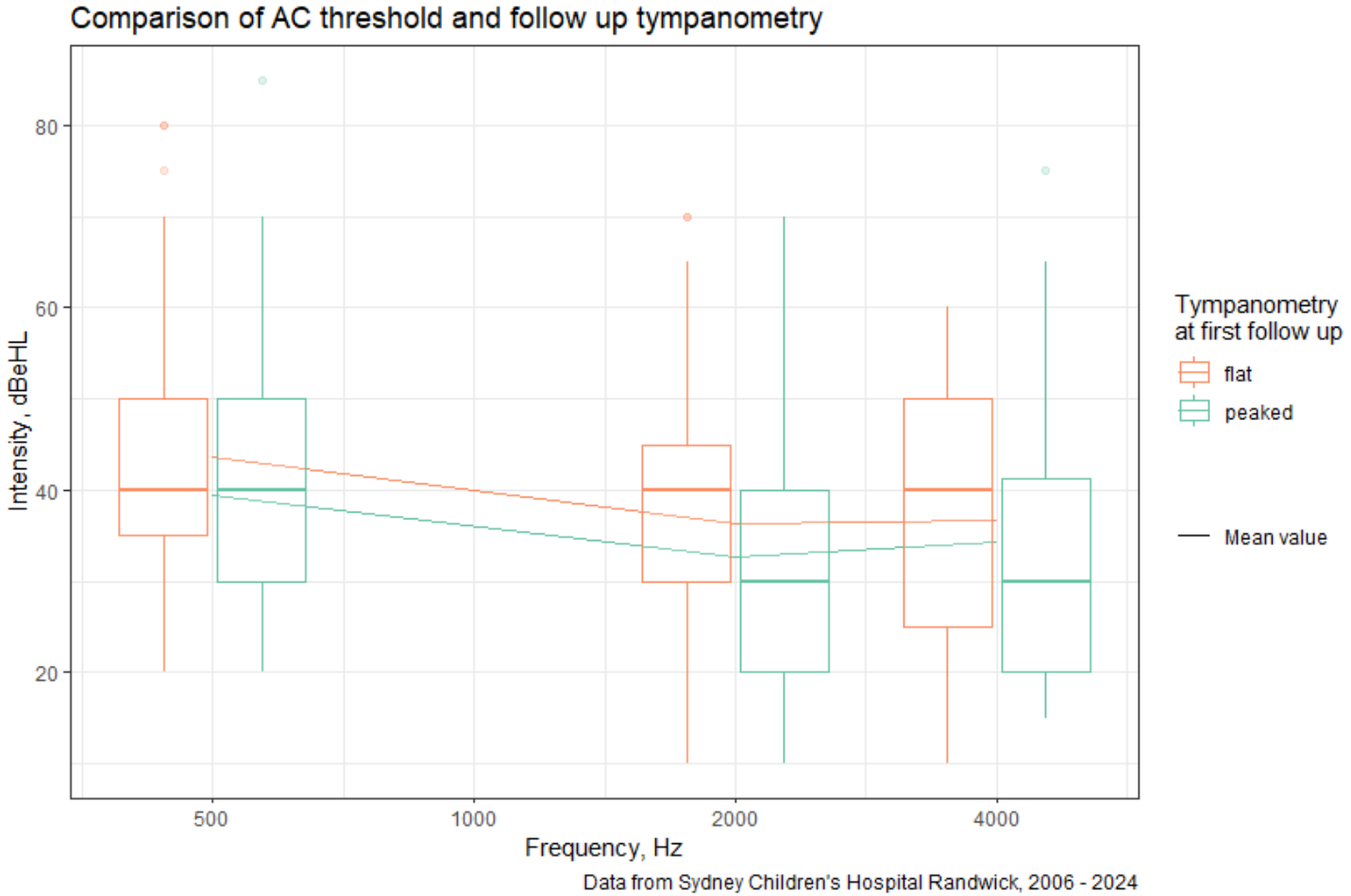
Compared to ABR tympanometry, is the SWISH refer type informative?

No significant difference in outcome dependant on SWISH refer type.



What other information can we use?

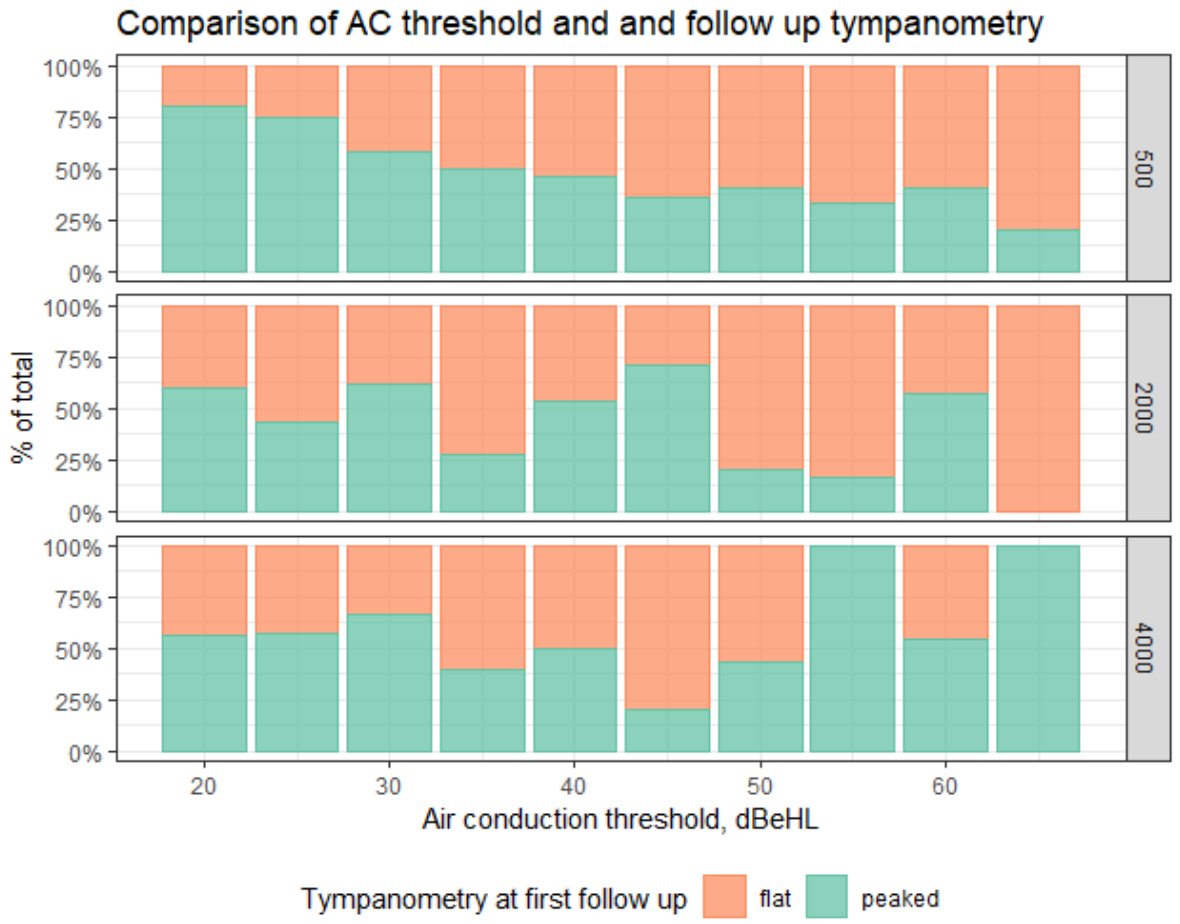
Can the ABR air conduction threshold help us classify patients well enough for a screening test?



What other information can we use?

Better 500 Hz AC threshold might correlate with better outcomes.

Leverage this to improve Method 2.

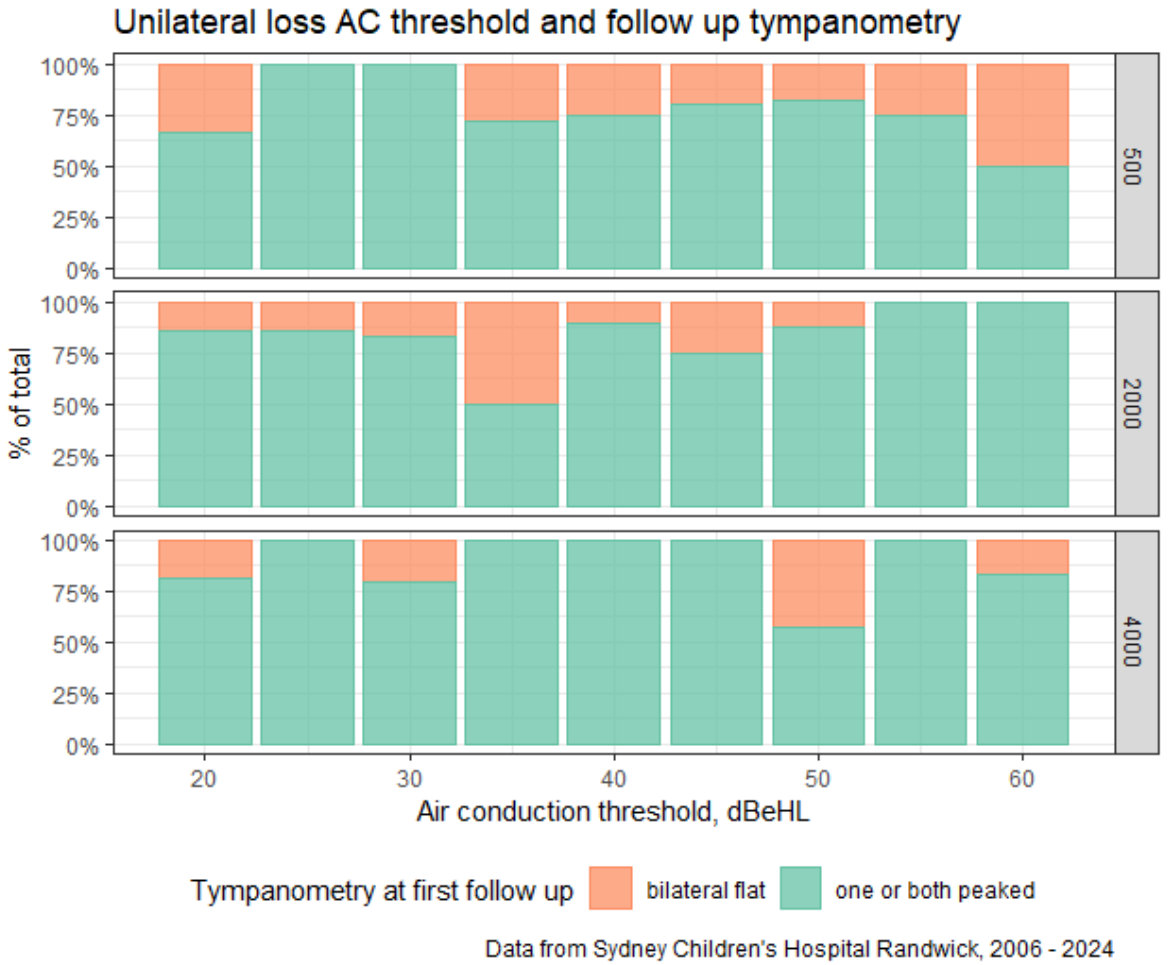


Method 3: Method 2 + unilateral loss AC threshold

Unilateral CHL threshold does not correlate with follow up tympanometry.

Unilateral CHL 500 Hz thresholds > 30 dB tend to have bilateral flat follow up tympanometry more often.

Reduces false negatives to 0.4% but only reduces total follow ups by 8.4%



Summary

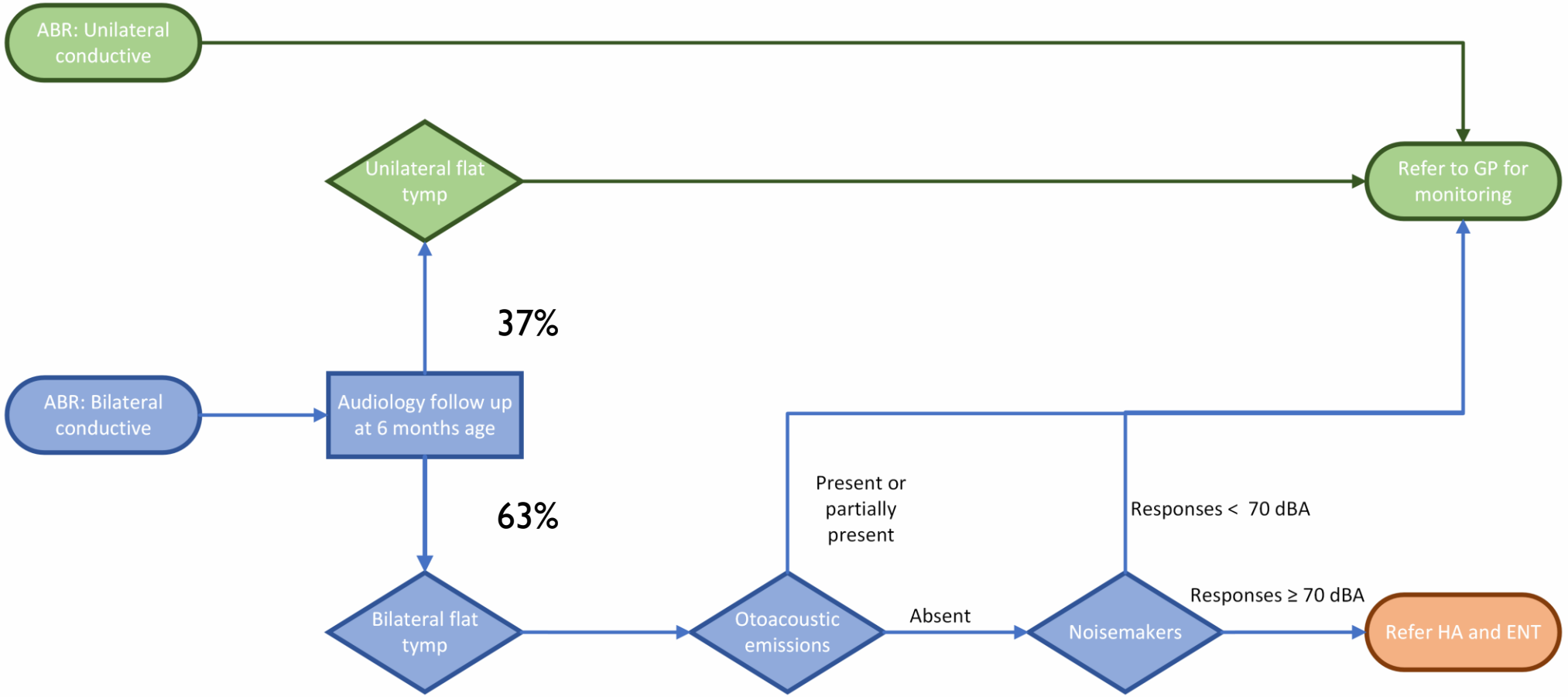
- Method 2 has lower false negative rate than the loss to follow up of Method 0
- Method 3 adds complications but doesn't make significant improvements.

Referral pathway	Target	Predictor	% reduction in first follow ups (expected yearly follow ups)	Expected yearly LTFU after first follow up	Expected false negatives
0	None	Any CHL	0 % (30)	3	0
1	One or both tympanograms flat	Bilateral CHL	37.1% (19)	0	5 to 6
2	Both tympanograms flat	Bilateral CHL	37.1% (19)	0	2
3	Both tympanograms flat	Bilateral CHL and unilateral CHL > 30dBeHL	8.4% (27 to 28)	0	< 1

Conclusion

- Previous pathways
  - After the first follow up, ~3 patients per year were lost to follow up
  - No adequate monitoring.
- New pathway
  - Only one follow up required, reducing patients lost to follow up
  - 37% fewer patients to follow up, or about 11 patients per year.
  - 6.5% of patients – about 2 per year – with ongoing bilateral OME will be monitored by a medical practitioner rather than an audiologist.

New and simplified pathway for managing conductive hearing losses



Epilogue – best referral pathway?

For neonates assessed at Evelina Hospital London:

- Mild or unilateral otitis media and CHL: Review at 8-9 months for behavioral testing.
- Moderate bilateral CHL:
  - Return in 3 months for bone conduction hearing aid fitting.
  - At fitting appointment refer to ENT 3 month follow up.

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