

Improving Understanding of Wave V Latency in Neonatal ABR: A Study of Hearing Loss Effects

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Background

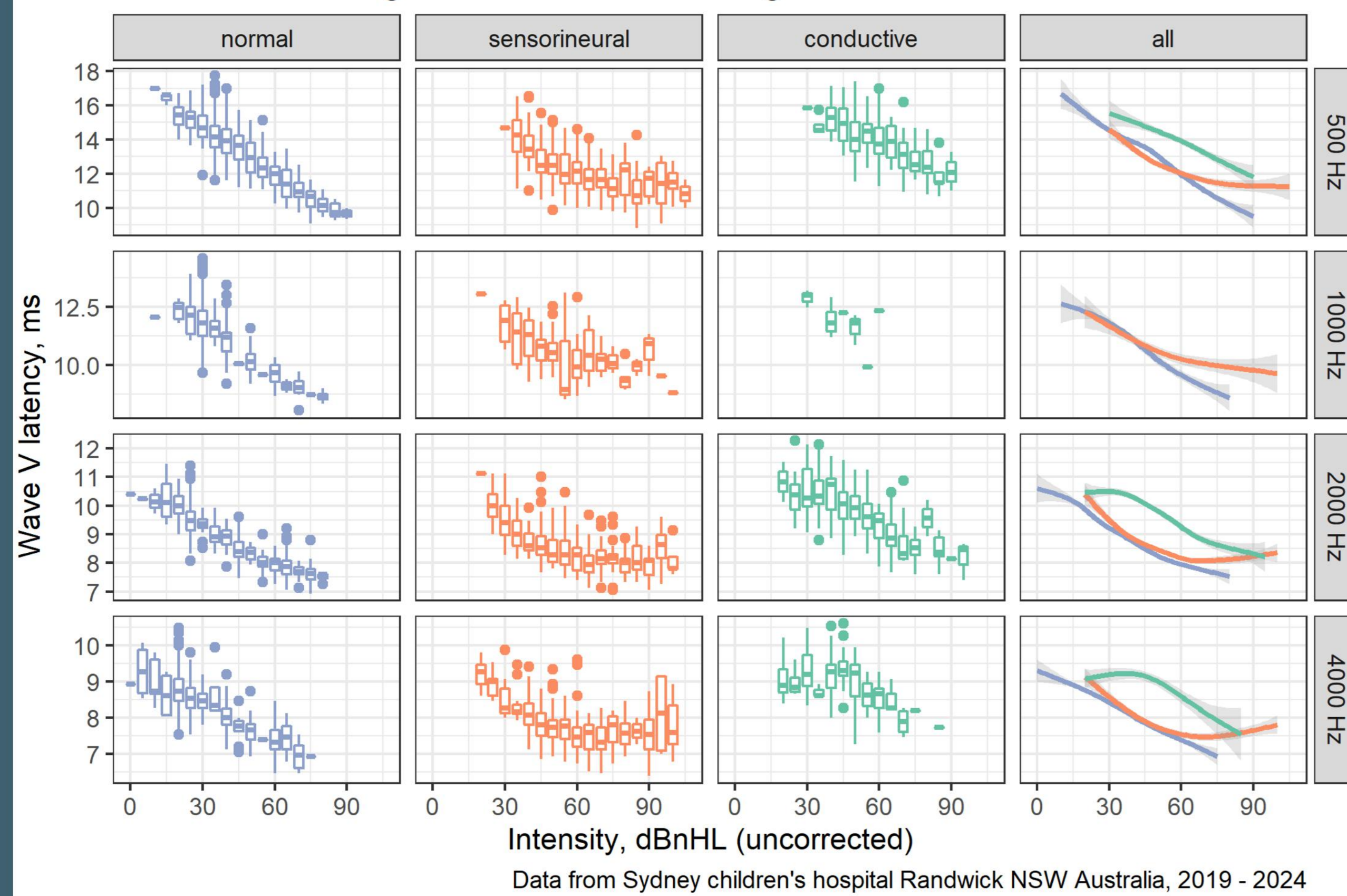
Sydney Children's Hospital is one of the three centres performing neonatal diagnostic assessment in NSW. In the more than twenty years of SWISH we have assessed many thousands of babies using the toneburst Auditory Brainstem Response (ABR).

Jewett wave peak latencies are an important measure of waveform morphology, however without normative values for comparison, clinicians must rely on experience or more experienced clinicians.

We have become familiar with wave V latency - intensity function (LIF) for normal hearing neonates, both from our own experience and from publications by other researchers. However, we see that neonates with conductive and sensorineural hearing losses have quite different – and non-linear – LIFs

Neonatal Wave V latencies

Data and GAM smoothed mean estimates for neonates with normal hearing, sensorineural hearing loss and conductive hearing loss



Method

This is a retrospective analysis of patient results between 2019 and 2024, including 1423 normal hearing ears, 233 ears with sensorineural hearing loss and 210 ears with conductive hearing loss. Insufficient data was available for conductive hearing losses with 1000 Hz thresholds; these results were not used for regression analysis.

The Interacoustics Eclipse was used for all patients, using a 5 sinwave toneburst and a Blackman ramp.

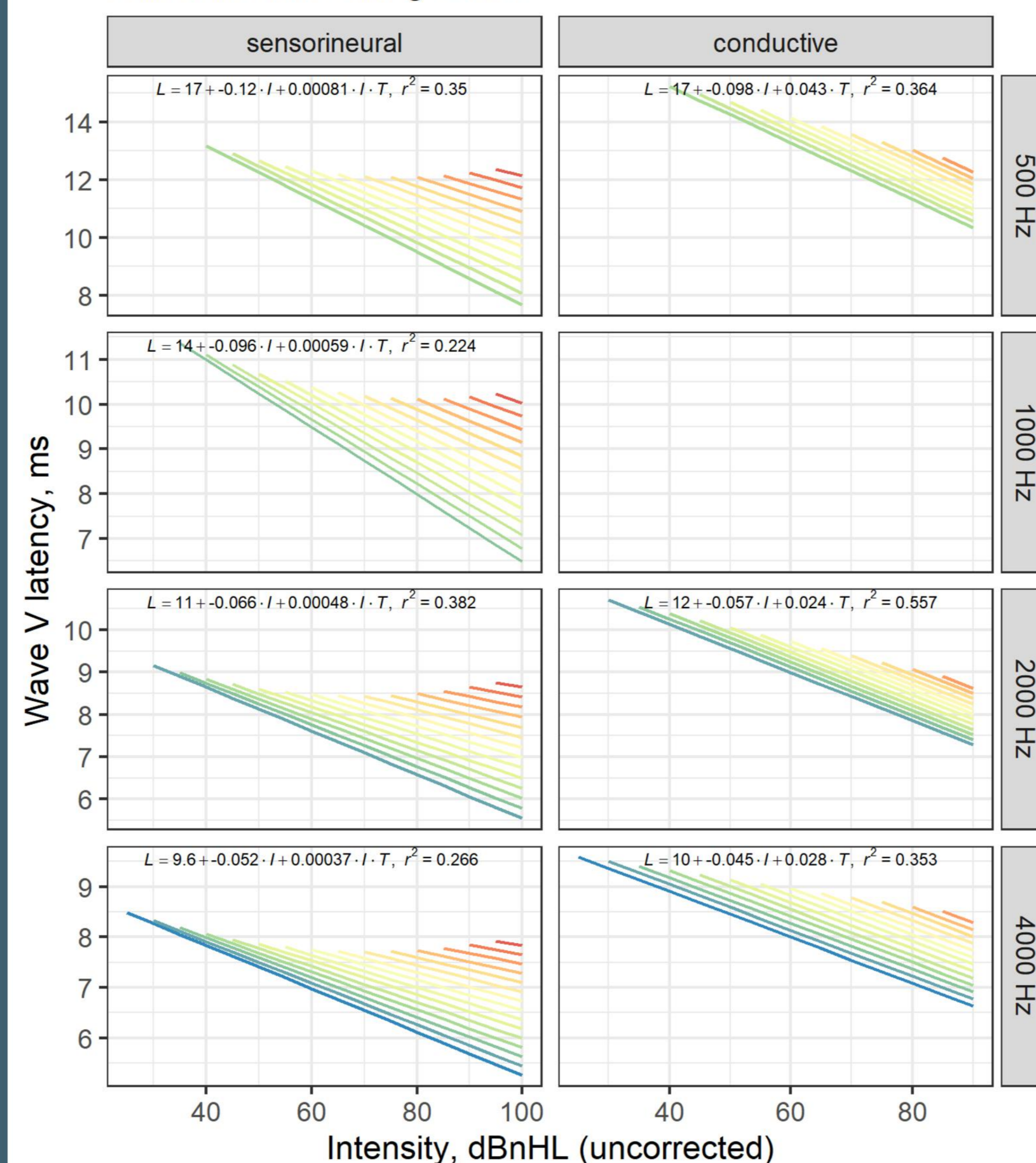
A comparison of Jewett wave V latencies suggests a linear LIF for normally hearing neonates, but not for those with a sensorineural or a conductive hearing loss.

It was our hypothesis that including air conduction thresholds as a variable might produce a linear regression model with better predictive outcomes for neonates with hearing loss and we considered several models, using the AIC (Akaike information criterion) as a comparison.

Results

Neonatal Wave V latencies

Model estimates for neonates with conductive or sensorineural hearing losses



Air conduction threshold, dBnHL (uncorrected)

Data from Sydney children's hospital Randwick NSW Australia, 2019 - 2024

Results (continued)

All coefficients $p \ll 0.001$. L=Latency, I = Intensity, T = air conduction threshold.

Conductive loss: $L = \text{constant} + a \cdot I + b \cdot T$

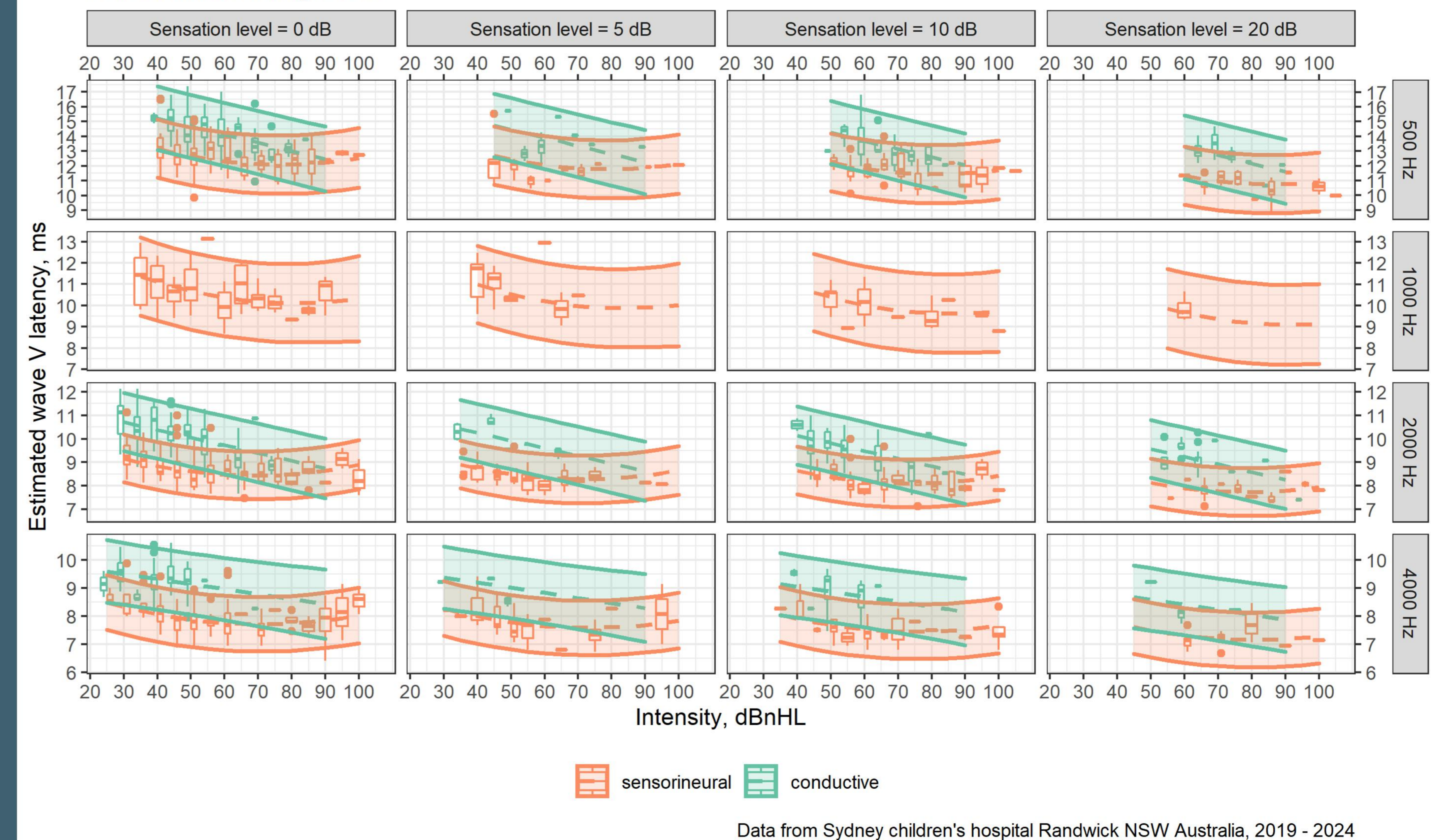
Sensorineural loss: $L = \text{constant} + a \cdot I + b \cdot I \cdot T$

In all cases R-squared was significantly higher for the chosen models compared to regression model not using threshold as a variable.

When applied to our historical results, the equations appear to model the data well:

Neonatal Wave V latencies for neonates

Model estimates and predicted data 95% interval for neonates with conductive or sensorineural hearing losses



Discussion

Although these models do not explain why or how air conduction thresholds might effect wave V latency, they do provide another tool for helping clinicians assess neonates' hearing.

Please email me for more details or more information – including inter-peak latency norms.

Thanks to all the parents that allowed us to use the data their babies generated, and to Florencia Montes and the whole Audiology Department at SCH Randwick.