



Uncertainty in prediction of speech perception outcomes of adult cochlear implant users

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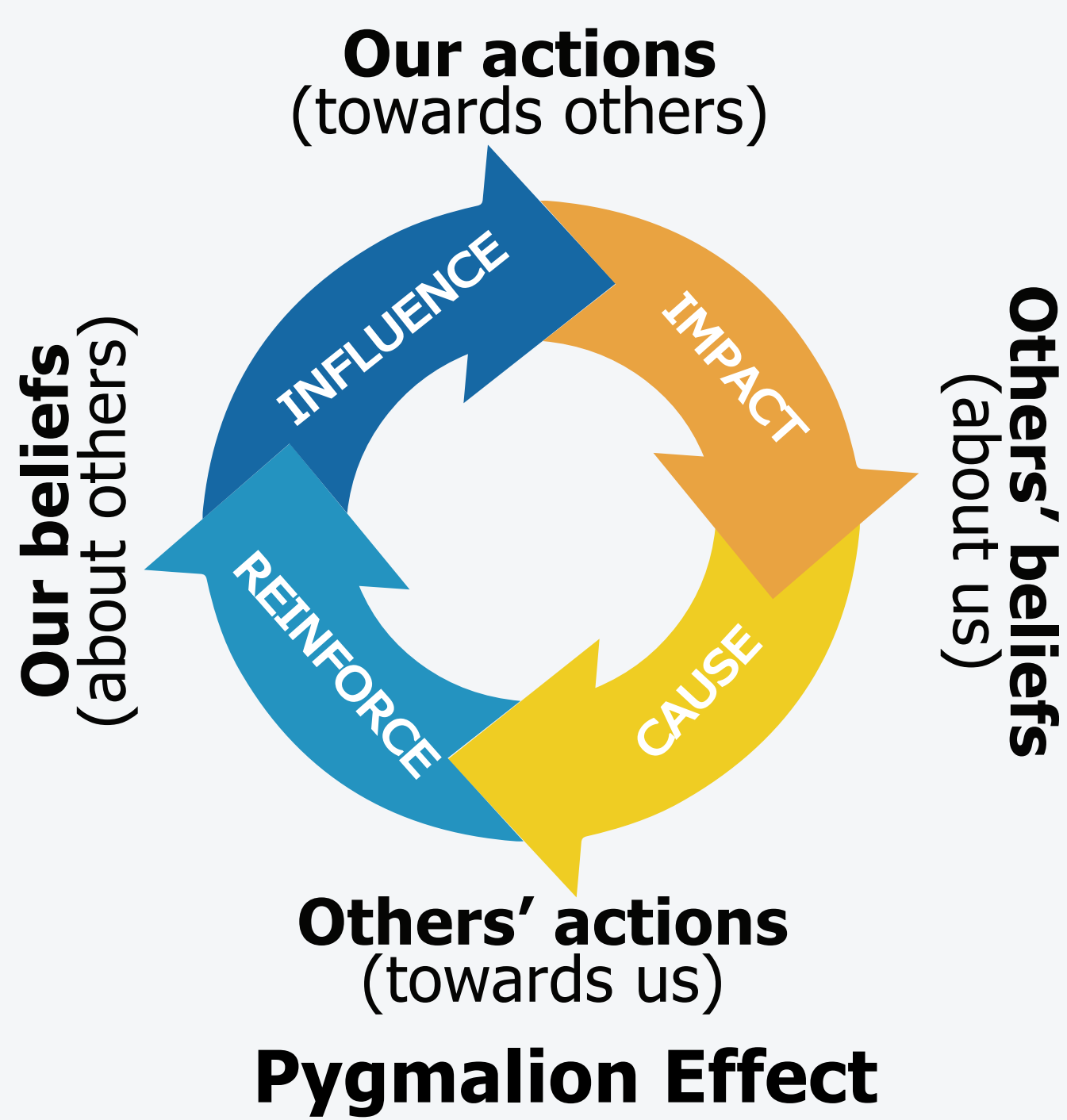
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Unexplained variability in adult patient outcomes post-cochlear implantation (CI) continues to be a prevalent topic for investigation, with current research only being able to account for ~22% of variance related to various pre- and post-implantation factors¹. Furthermore, current prediction models for post-CI speech perception outcomes have not yielded valuable clinical use for explaining outcome variability².

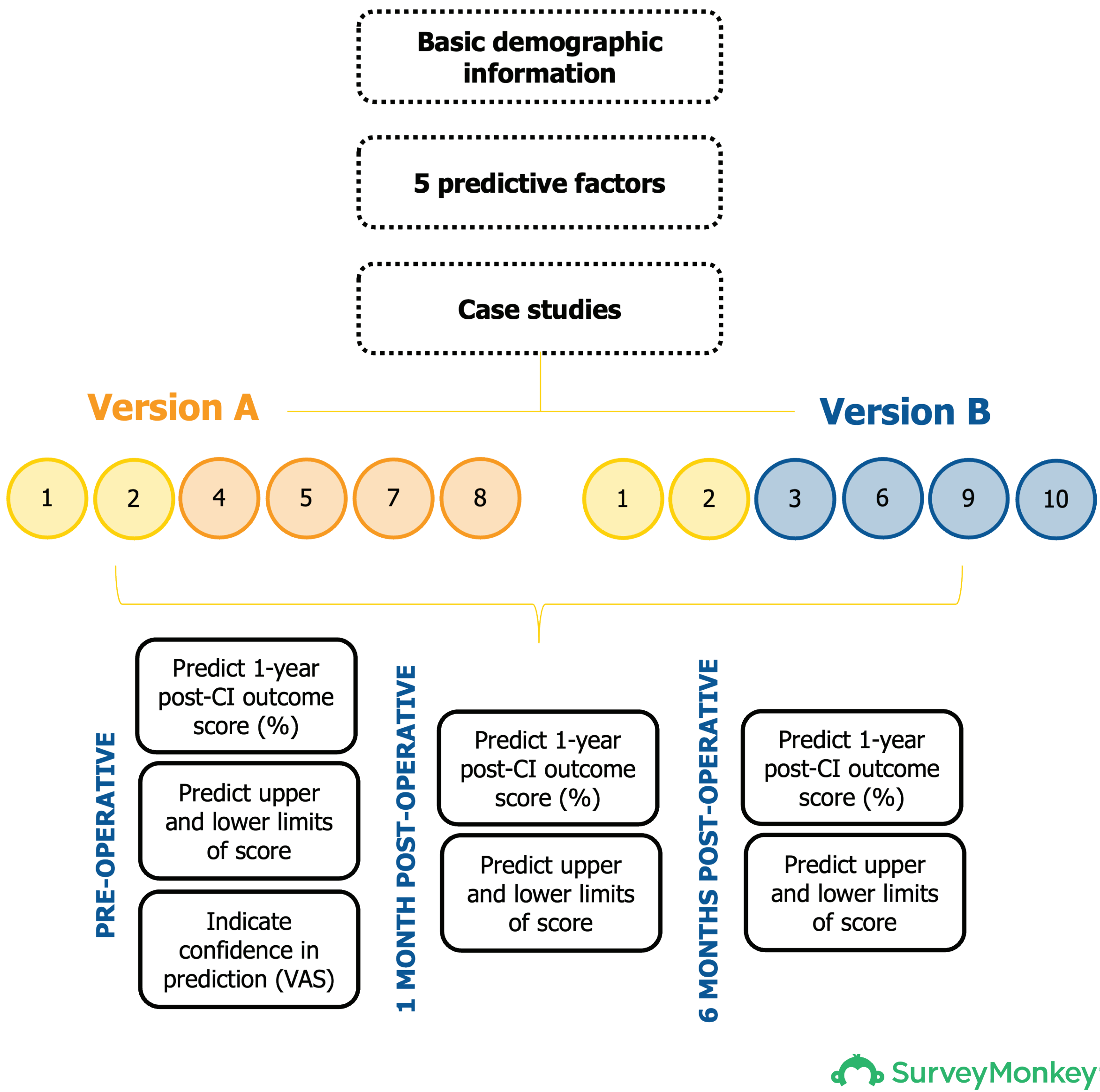
To accurately manage expectations, especially in the “poorer performing” group of adult CI users, pre-operative counselling should include predicted speech perception outcomes³. However, large outcome variability makes it challenging for clinicians to provide an accurate prognosis for post-operative speech perception ability⁴.

The “Rosenthal effect” or “Pygmalion effect”⁵ explores the effect of expectations on performance. In an educational setting, it has been shown that high expectations lead to improved performance. This performance expectation phenomenon has yet to be explored in the context of expectation management and performance outcomes in the hearing loss domain.

In this study, we investigate whether clinicians can accurately and confidently predict speech perception outcomes for adult CI users.



SURVEY CONTENT



CASE STUDIES

PRE-OPERATIVE

Age
Duration of deafness
Residual hearing
Hearing aid use
Aided tone thresholds
Aided speech thresholds
Social support
Working status
Expectations
Health status

1 MONTH POST-OPERATIVE

Implant information
Electrode insertion
Aided speech perception
Patient experience

6 MONTHS POST-OPERATIVE

Aided speech perception
Patient experience

1-year post-operative phoneme score* per case

Case	Score
1**	27%
2**	45%
3	51%
4	59%
5	66%
6	69%
7	77%
8	84%
9	84%
10	92%

* CVC (NVA) word lists at 70 dB SPL for CI-only, in quiet

** Same case in both Version A and B

■ Poorer performers (<70% phoneme score)

RESULTS

PARTICIPANT DEMOGRAPHICS

Country	Total	Experience (years)	Total	Caseload (patients)	Total
Argentina	1	0-2	2	1-50	6
Australia	1	3-5	7	51-200	9
Belgium	14	6-10	7	210-500	10
France	3	11-15	7	501-1000	8
South Africa	4	>15	18	>1000	8
The Netherlands	12				
United Kingdom	5				
United States	1				

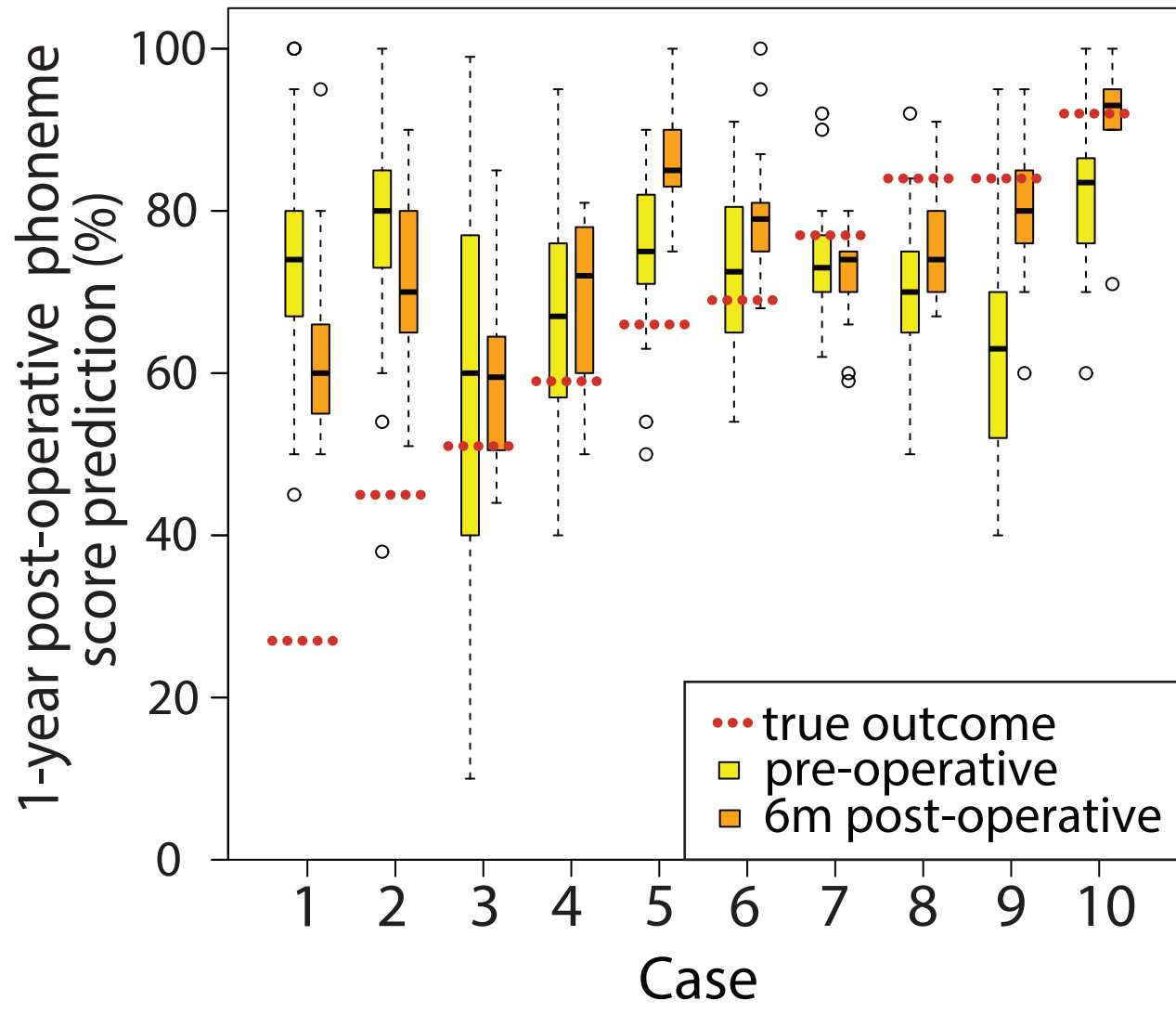


Fig 1. Over-prediction of phoneme scores was common, especially for poorer performers (Case 1-6). While prediction accuracy did not improve over time (in relation to the true outcome), clinicians did become more agreeable with one another (smaller spread for post-operative predictions).

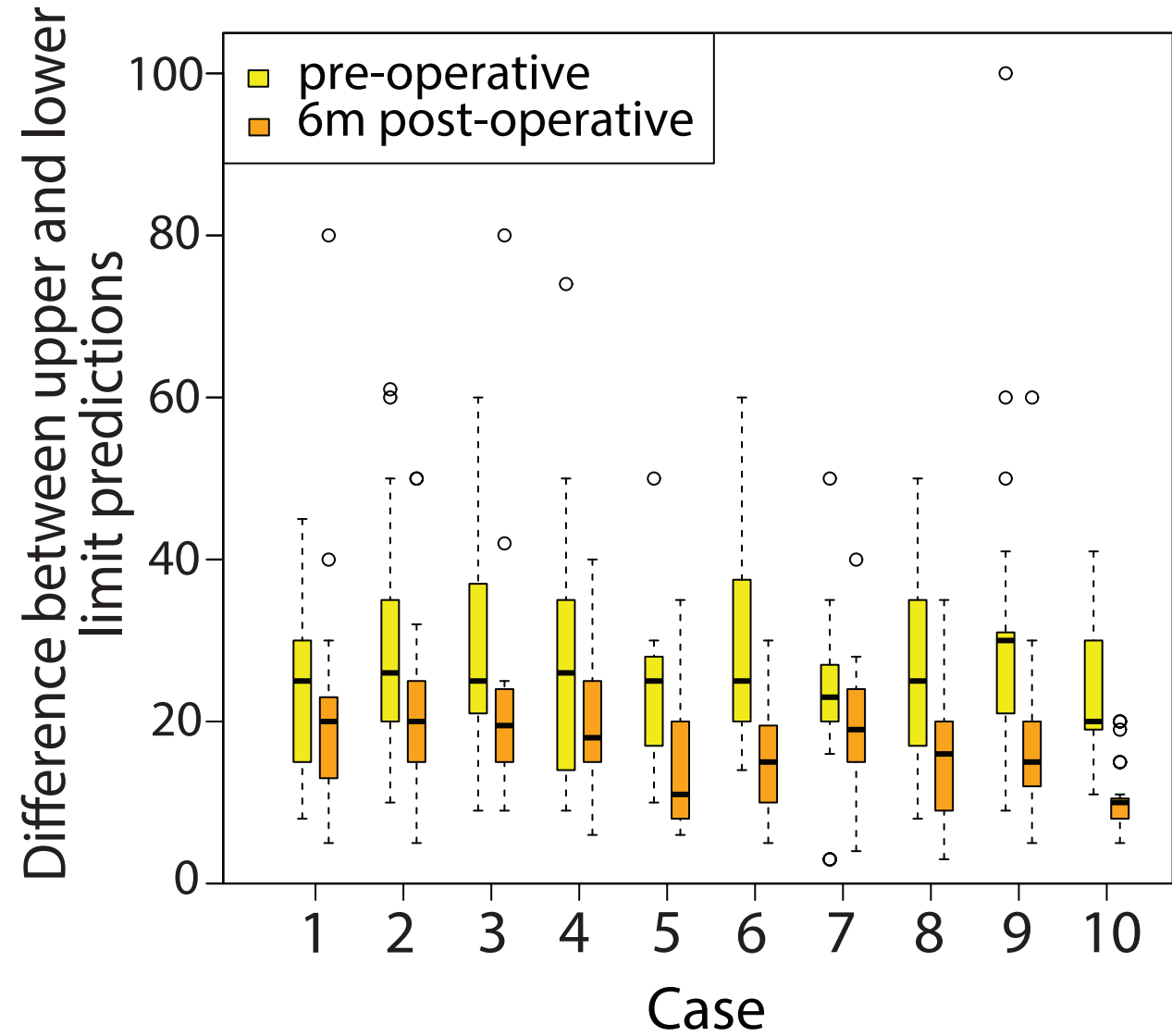


Fig 2. On average, upper and lower limit prediction ranges decreased for the post-operative timepoint, where more information was provided. This suggests an increase in prediction confidence. In other words, the upper and lower limit predictions made were closer to the final predictions made for each score (even if these final predictions were incorrect).

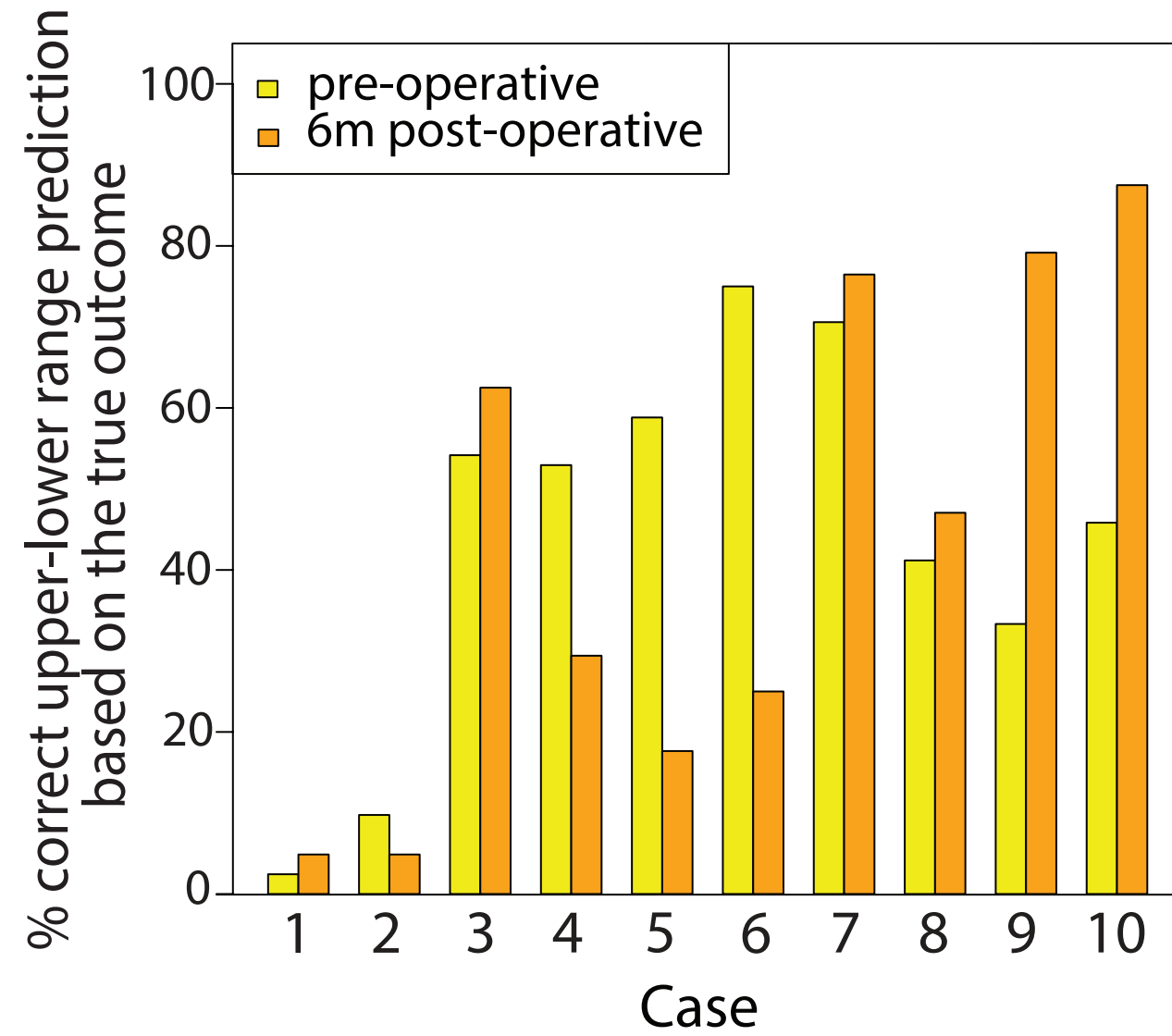


Fig 3. For poorer performer cases (1-6), increased prediction confidence (Fig. 2) was not related to increased prediction accuracy. Even where clinicians gave more refined upper and lower limit estimates post-operatively, these limits often did not encompass the true score of the given case and were therefore still inaccurate.

DISCUSSION

Poor performance remains both challenging to explain and predict, especially with a reasonable level of confidence.

Accurate outcome prediction is vital for expectation management, counselling and formulating an individualized post-implantation rehabilitation trajectory.

This is especially important for individuals at risk of poorer performance, who may need additional clinical visits for pre-operative counselling and post-operative rehabilitation.



¹ Lazard, D. S., Vincent, C., Venail, F., Van de Heyning, P., Truy, E., Sterkers, O., . . . Blamey, P. J. (2012). Pre-, per- and postoperative factors affecting performance of postlinguistically deaf adults using cochlear implants: a new conceptual model over time. *PLoS One*, 7(11), e48739. doi:10.1371/journal.pone.0048739

² Velde, H. M., Rademaker, M. M., Damen, J. A. A., Smit, A. L., & Stegeman, I. (2021). Prediction models for clinical outcome after cochlear implantation: a systematic review. *Journal of Clinical Epidemiology*, 137, 182-194. doi:https://doi.org/10.1016/j.jclinepi.2021.04.005

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⁴ Leigh, J. R., Moran, M., Hollow, R., & Dowell, R. C. (2016). Evidence-based guidelines for recommending cochlear implantation for postlingually deafened adults. *International Journal of Audiology*, 55 Suppl 2, S3-S8. https://doi.org/10.3109/14992027.2016.1146415

⁵ Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *The Urban Review*, 3(1), 16-20. doi:10.1007/BF02322211