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## Abstract

**Background:** Indication criteria for cochlear implantation vary greatly from country to country. In practice, the candidacy is based on combination of limits for puretone thresholds and speech recognition scores. For speech recognition usually the best aided (i.e. binaural aided) condition is used. The aim of our analysis was to compare the effects of different candidacy criteria based on a large clinical data set.

**Methods:** We analysed a clinical audiological database comprising 27,564 complete data sets for puretone thresholds and speech audiometric data in adults. Cochlear implant (CI) candidates were identified on the basis of different audiometric candidacy criteria. The influence on the number of cases was simulated for different indication criteria from different countries.

**Results:** The strongest influence on the number of potential CI candidates has the ear by ear analysis. Most of the existing guidelines do not take into account for asymmetric hearing. Hence, a significant number of patients with asymmetric hearing do not fulfill these CI criteria.

## Materials and Methods

Average Puretone loss (4FPTA) at 0.5, 1, 2, and 4 kHz was extracted. It was used to estimate word and phoneme scores based on previous studies.

**German criteria (GC):** Aided word recognition less than 60 % at 65 dB on the ear to be implanted [1]

**British criteria (BC):** Bilateral phoneme score <50% at 70 dB SPL and two frequencies >80 dB [2]

**Flemish criteria (FC):** Bilateral phoneme score <50% at 70 dB and 4FPTA>70 dB [2]

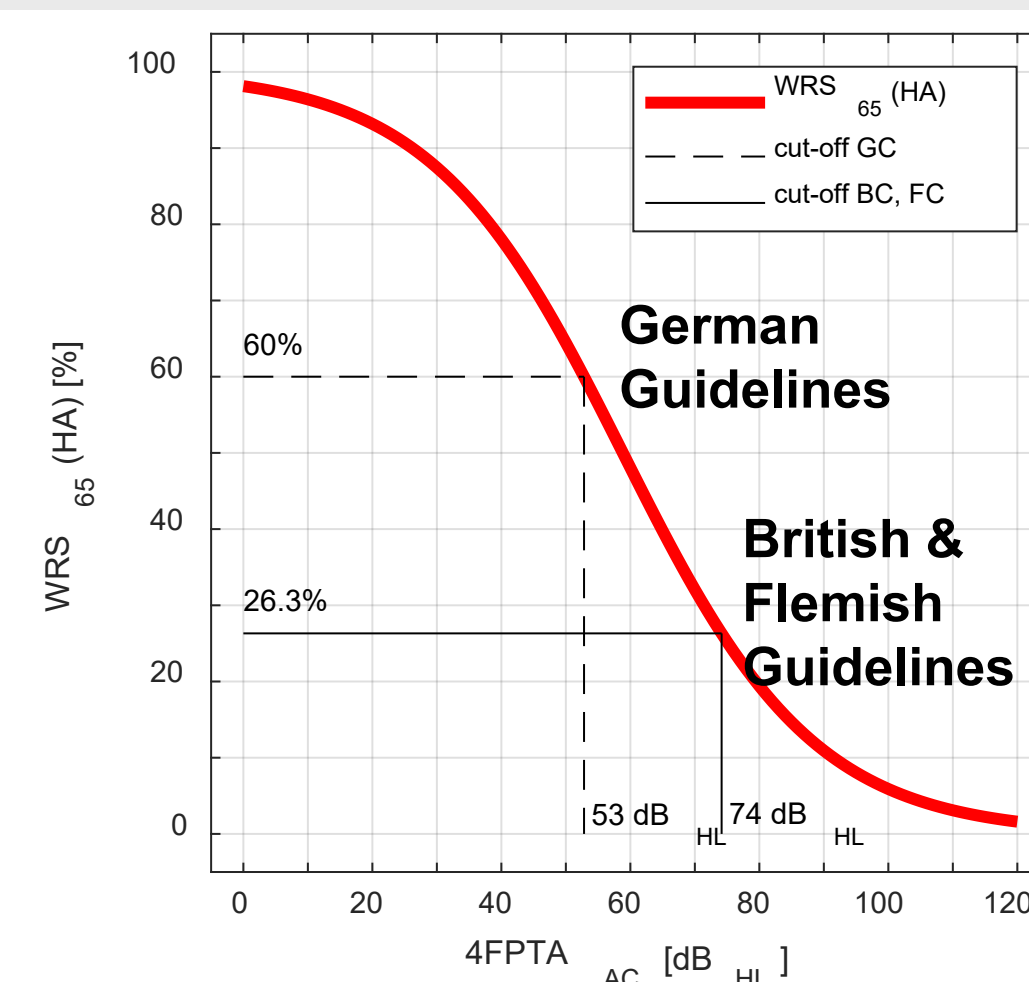


Fig. 1: Average word recognition scores (WRS) as a function of puretone loss.

## Results I

- 50 % phoneme (at 70 dB SPL) score is equivalent to 26.5% word score (at 65 dB)
- 26.5% word score is equivalent to 4FPTA>74 dB HL
- 60% word score is equivalent to 4FPTA >53 dB HL

## Results II

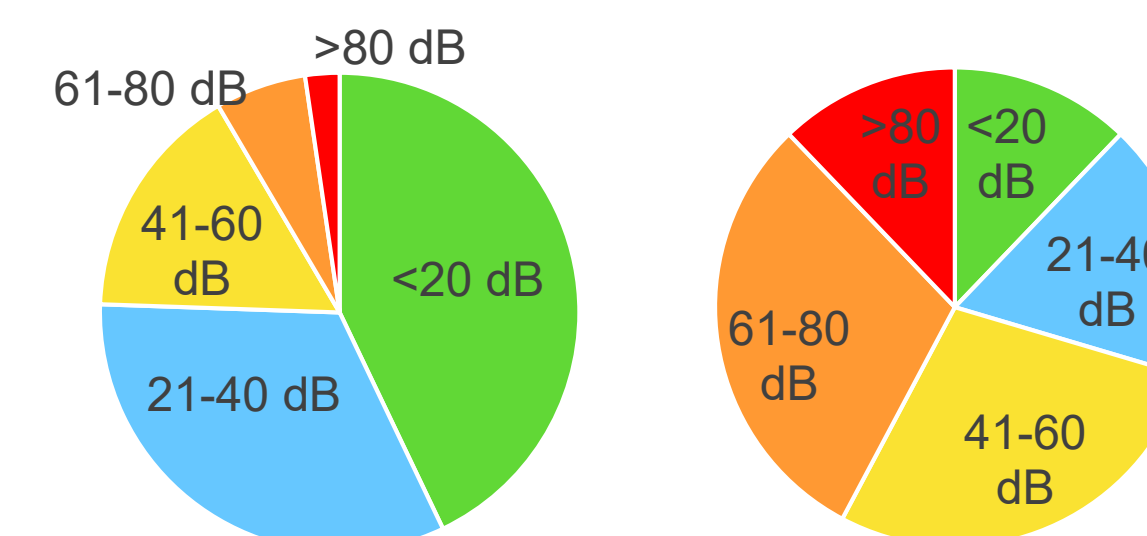


Fig. 2: PTA for better ear and worse ear

Flanders	822
UK (NICE)	715
Germany better ear	3267
Germany worse ear	8906

Fig. 3: Number of CI indications for different European regions

Distributions of puretone loss for better and worse ear is shown in Fig. 2. The number of candidates for a cochlear implant varies among the European regions investigated. It is determined by different audiometric cut-off criteria for word recognition, pure-tone loss, and whether evaluation is binaural or monaural. While criteria for Flanders and UK are very similar, the audiological criterion for Germany is significantly more relaxed. This is justified by comparisons with hearing aid outcome measurements and not influenced by economic factors.

## Discussion and Conclusions

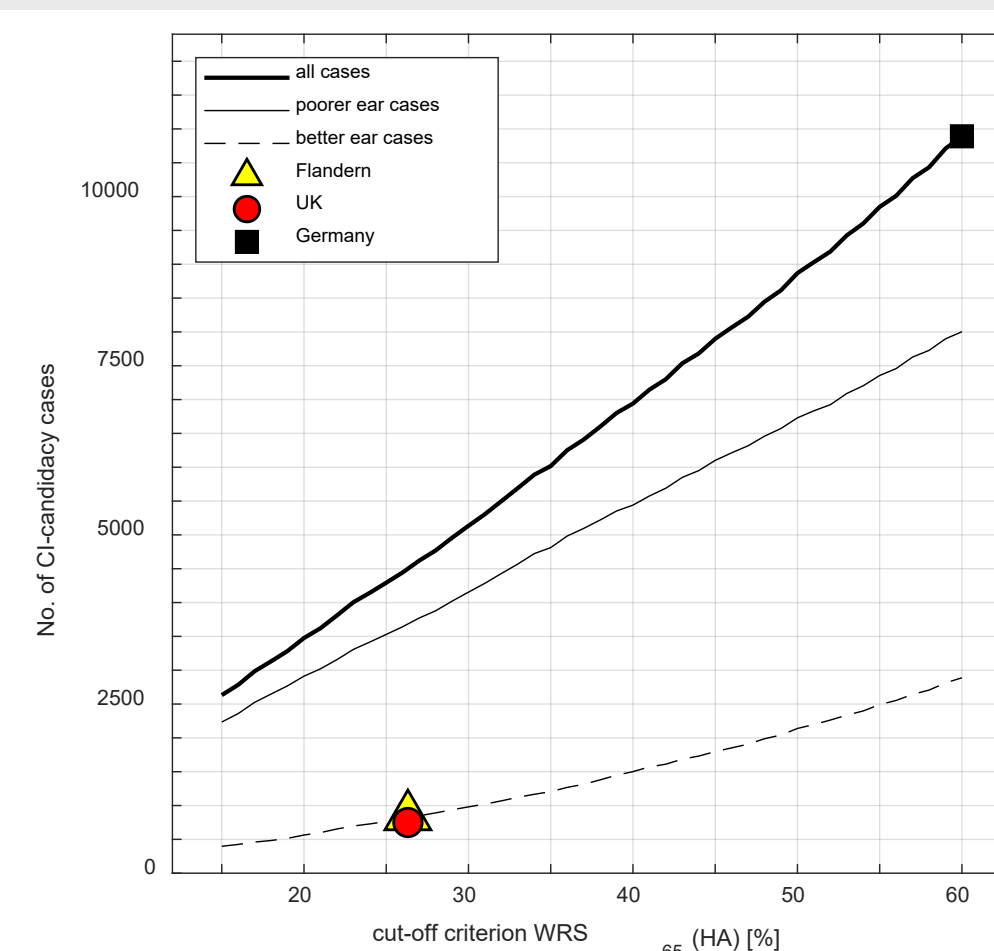


Fig. 4: Effect of different European CI criteria on the number of CI cases.

- Analyses of large audiological databases provide information for possible numbers of CI candidates.
- Audiological CI candidacy criteria should be based on unilateral measurements rather than binaural results.
- Expanding the indication criteria does not necessarily lead to an increase in candidacy as estimated by our simulation. Rather, it opens up the possibility of improving the accurate identification of individual cases suitable for cochlear-implant provision.

## References

- [1] Hoppe U, Hocke T, Hast A (2024) Impact of unilateral and bilateral evaluation of cochlear implant candidacy. *Acta Oto-Laryngologica*, 144(3), 207-218.
- [2] van der Straaten TFK, Briare JJ, Vickers D, et al. (2021) Selection criteria for cochlear implantation in the United Kingdom and Flanders: toward a less restrictive standard. *Ear Hear*. 2021;42(1):68-75.