

IHearYou®

A modern tele-audiology system

Peter Blamey

for

Audio Engineering Society,

Melbourne section,

8th August 2016



IHearYou® is a Trademark of Blamey Saunders hears

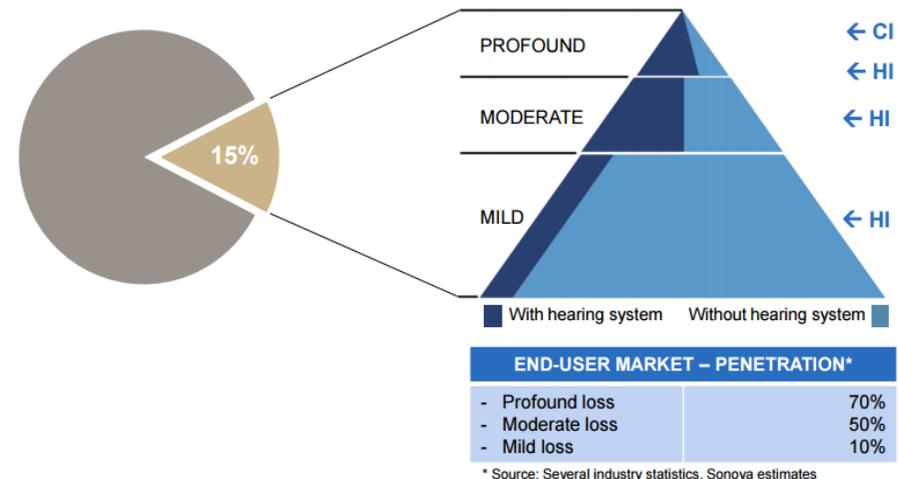


Conventional audiology is failing 75% of Australians who have hearing difficulties.



Blamey Saunders hears is a profit-for-purpose company with the purpose of improving the hearing health of the four million Australians who would benefit from hearing aids but have not been helped by the existing clinical audiological service model.

Around 15% of adults have some degree of hearing impairment



The majority of our market have mild to moderate hearing loss

Low penetration rate – Around 20% in developed countries

Why is the hearing aid market so poorly penetrated after 50 years?



Common excuses are:

- I don't have a hearing loss
- I can't be bothered visiting an audiologist
- Hearing aids don't work well
- Hearing aids are too expensive
- Hearing aids are hard to use
- Hearing aids will make me look older
- There is a stigma associated with wearing hearing aids

IHearYou® is a complete tele-audiology system including hearing aids, hearing tests, and audiology services that address these issues systematically.

Our tele-audiology model enables customers to test their hearing, purchase hearing aids, customise them, and receive support at home or anywhere they have a data connection.



Central database

Speech hearing test (SPT)

1. Test hearing online

2. Purchase hearing aids online

3. Hearing aids arrive and you personalise them at home

4. Web based help from your clinician at HQ if needed

Our AUTOMATED FITTING patent has been allowed in Australia and USA and is pending in Europe

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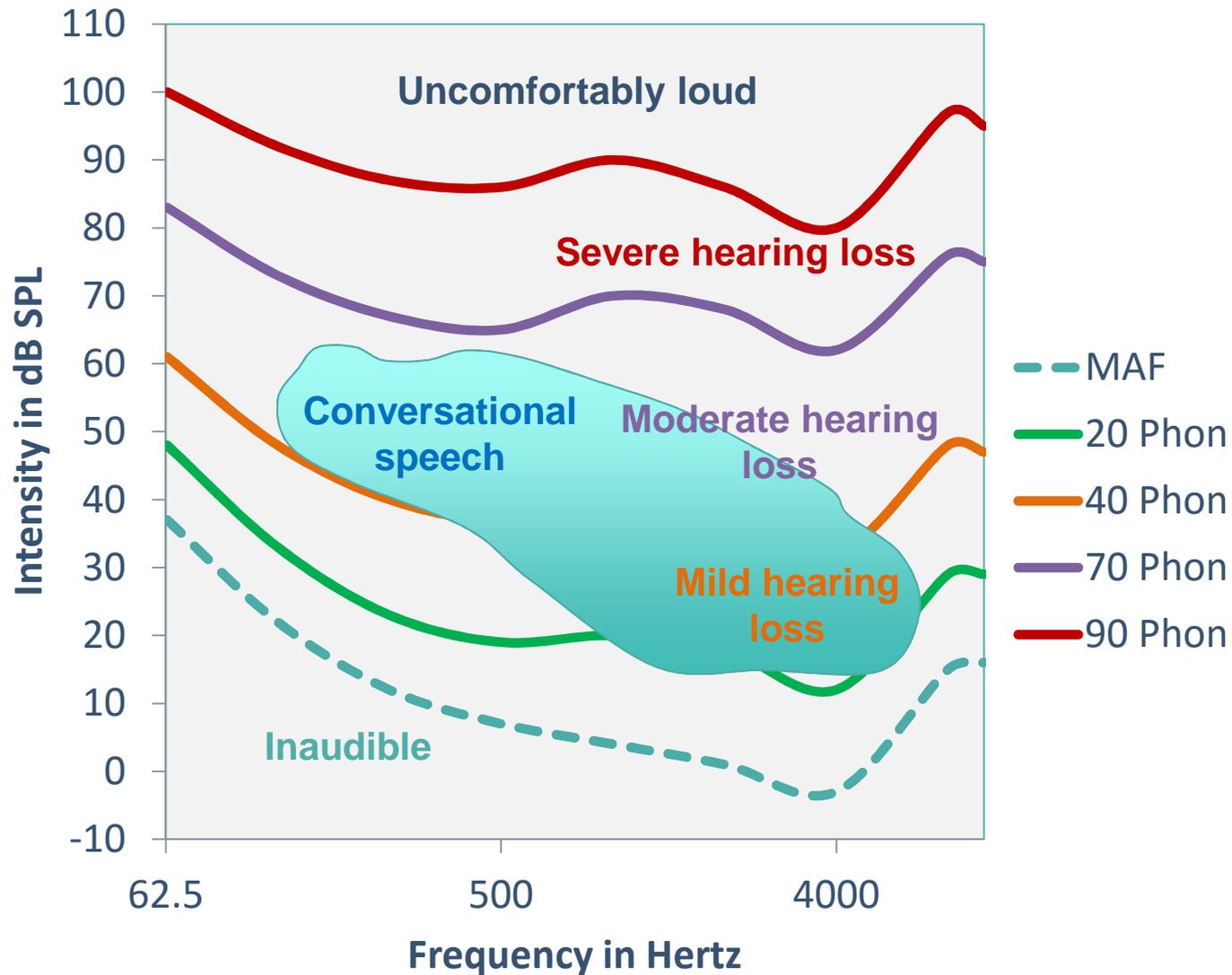


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The online Speech Perception Test can measure hearing loss with a high degree of sensitivity and specificity.

Speech perception depends on hearing across a wide range of frequency and intensity.



The Online Speech Perception Test (SPT) is a monosyllabic word test that provides information about the hearing of the person performing the test.



- Fifty consonant-vowel-consonant words
- Designed to be used in any quiet environment
- Australian English
- Thirty two phonetically balanced lists
- Random list selection and random word order within lists
- Normative data
- Automatic analysis and reporting of:
 - Word, consonant and vowel scores
 - Information transmission for phonetic features
- Provides a good starting point for HA fitting

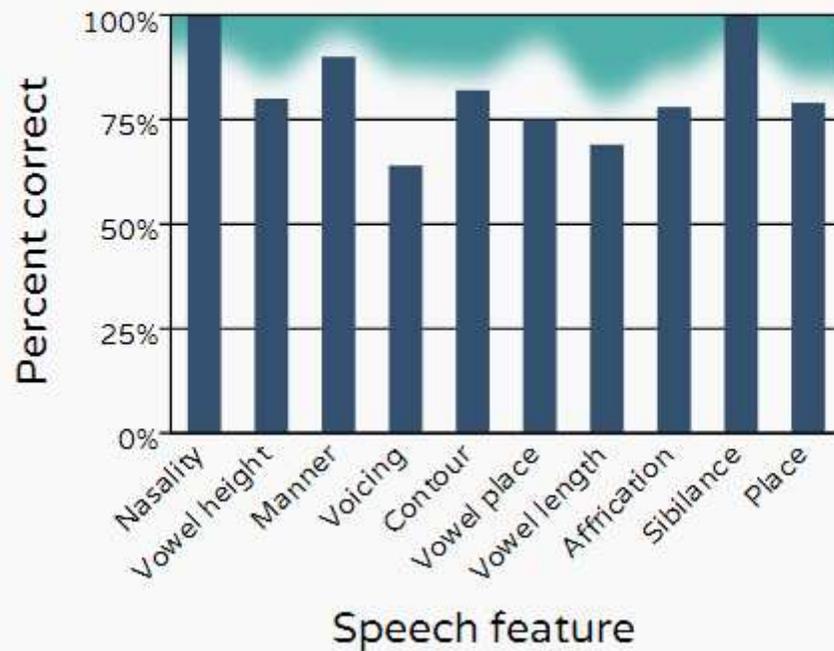
Speech Perception Test results (the Infogram™)



Vowels correct: 45/50
Consonants correct: 82/100

Words correct: 30/50
Words entirely missed: 0/50

Your results indicate you may have a hearing loss.



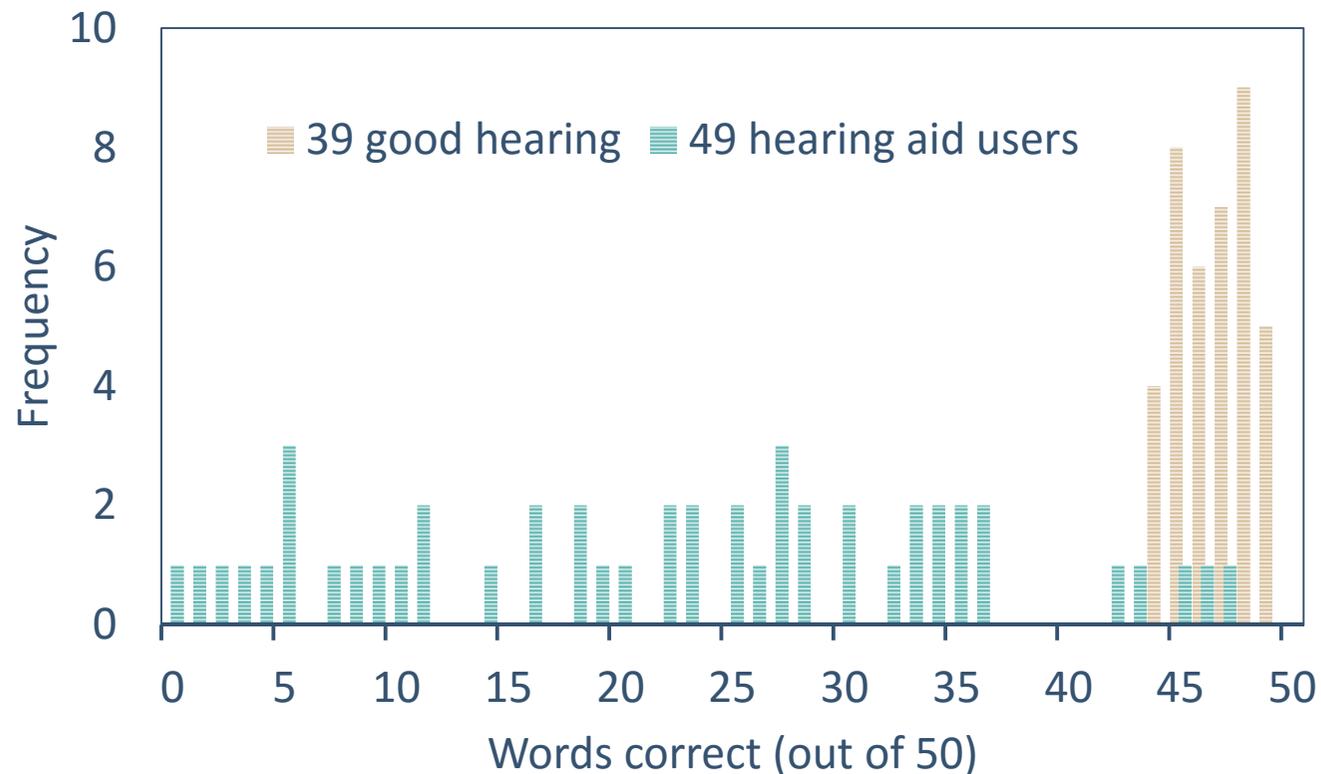
The shaded region indicates a good hearing range for each feature of speech.

Infogram™ is a Trademark of BlameySaunders hears

The SPT word scores for a sample of 88 people showed 94% sensitivity, 100% specificity, and 98% accuracy for hearing loss.



HISTOGRAM OF WORD SCORES



Compares favourably with 80% sensitivity and 83% specificity for the commonly used telephone digit screening test (Watson et al, JAAA, 2012)

Why is the hearing aid market so poorly penetrated after 50 years?

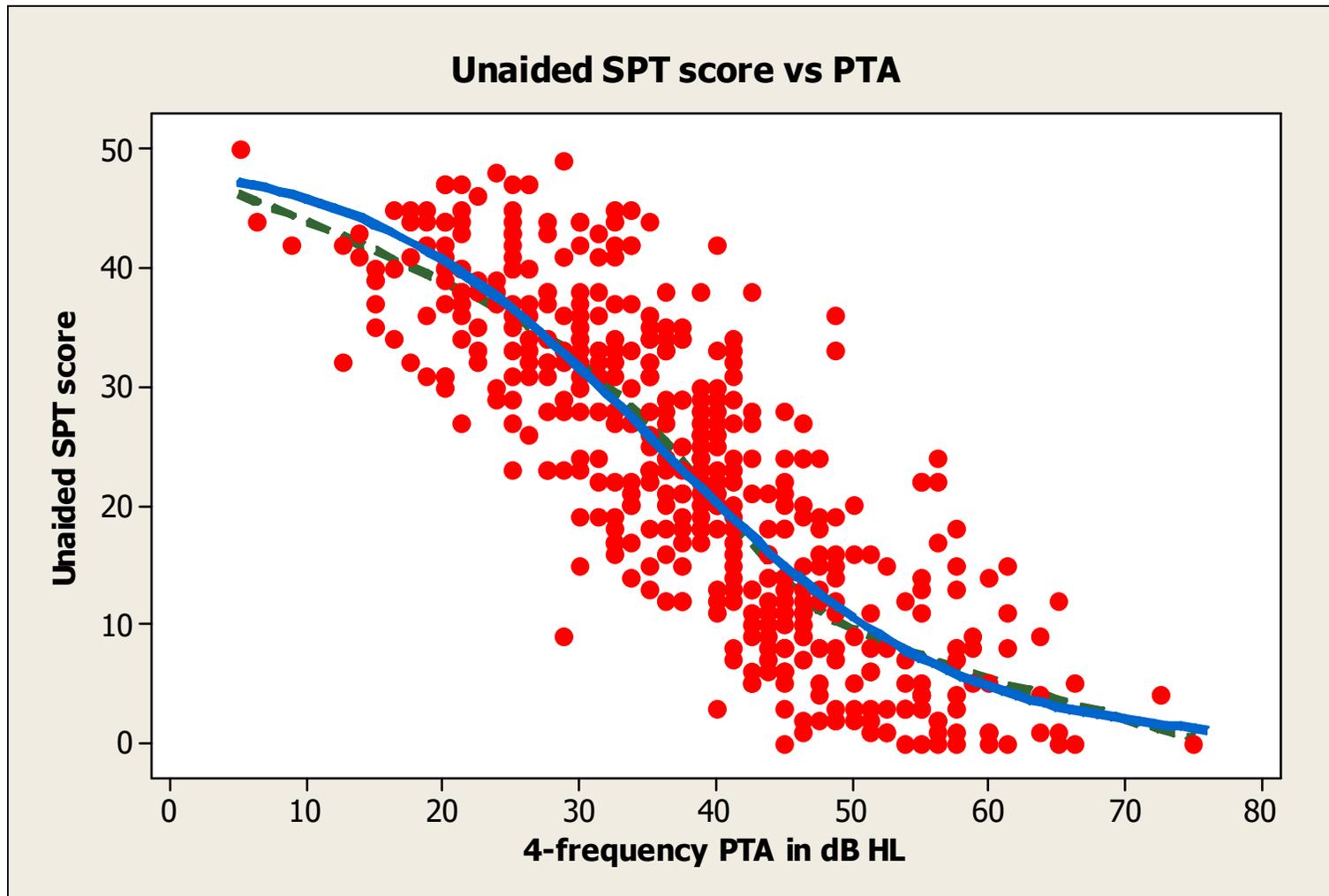


Common excuses are:

- I don't have a hearing loss
- **I can't be bothered visiting an audiologist**
- Hearing aids don't work well
- Hearing aids are too expensive
- Hearing aids are hard to use
- Hearing aids will make me look older
- There is a stigma associated with wearing hearing aids

IHearYou® enables the audiogram to be estimated from the Infogram.

492 HA users did both an SPT and an audiogram. A typical sigmoid curve fitted the data well, with 50% point at 35.9 dB HL and width of 11 dB.



408 speech audiograms were compared with the corresponding better ear conventional audiograms.



The two measures were highly correlated ($p < 0.001$) at every frequency with small mean differences and reasonable standard deviations given the high variability between threshold and other suprathreshold measures in the literature ^{1,2}.

Frequency (Hz)	250	500	750	1,000	1,500	2,000	3,000	4,000	6,000
Correlation coefficient	.480	.512	.579	.608	.680	.702	.648	.628	.565
Mean difference (dB)	0.02	0.09	-0.16	0.09	-0.02	0.00	0.00	0.00	0.00
Standard deviation (dB)	12.3	12.7	12.4	13.4	13.4	13.6	16.0	17.4	20.1

1. Kamm C, Dirks DD., & Mickey MR. Effect of sensorineural hearing loss on loudness discomfort level and most comfortable loudness judgments. *J Speech Lang Hear Res*, 1978; 21(4), 668-681.
2. Hellman RP, Meiselman CH. Rate of loudness growth for pure tones in normal and impaired hearing. *J Acoust Soc Am*, 1993; 93(2), 966-975.

Information transmission analysis of the vowel and consonant confusions of the SPT shows the pattern of errors associated with the hearing loss (Infogram™).



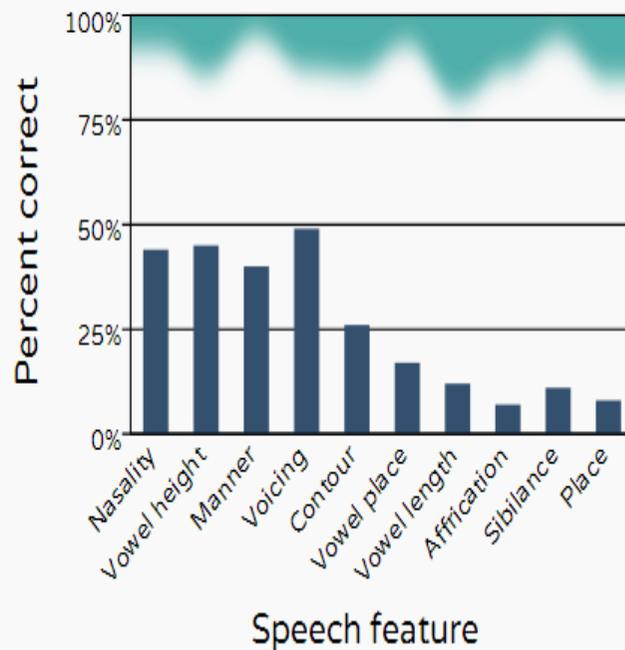
Vowels correct: 18/50

Words correct: 6/50

Consonants correct: 31/100

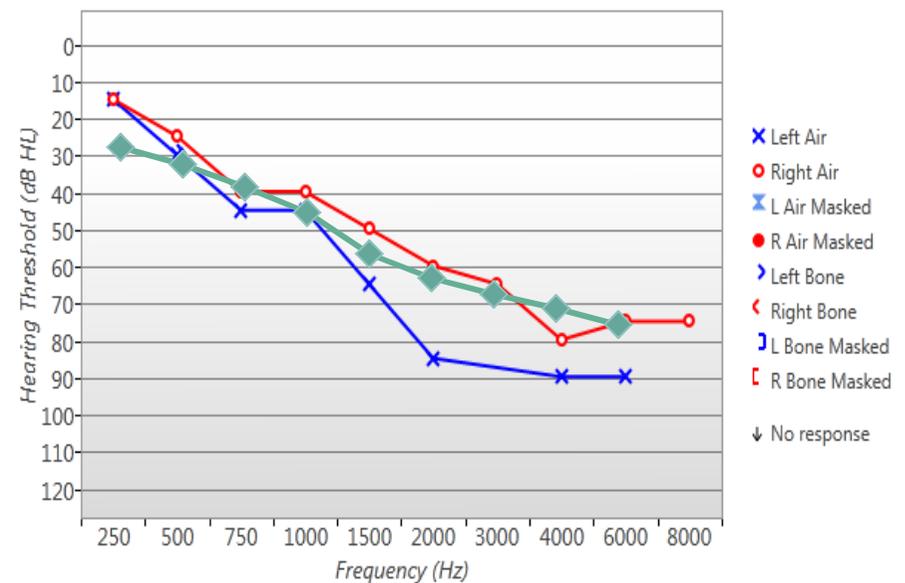
Words entirely missed: 3/50

Your results indicate you may have a hearing loss.



The shaded region indicates a good hearing range for each feature of speech.

The “speech audiogram” (green) calculated from the Infogram™ matched the better ear conventional audiogram



Why is the hearing aid market so poorly penetrated after 50 years?



Common excuses are:

- I don't have a hearing loss
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- **Hearing aids don't work well**
- Hearing aids are too expensive
- Hearing aids are hard to use
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IHearYou® clearly demonstrates the benefits of hearing aids to individual clients.

The SPT can be done with and without hearing aids, and the difference in scores is a measure of hearing aid benefit.



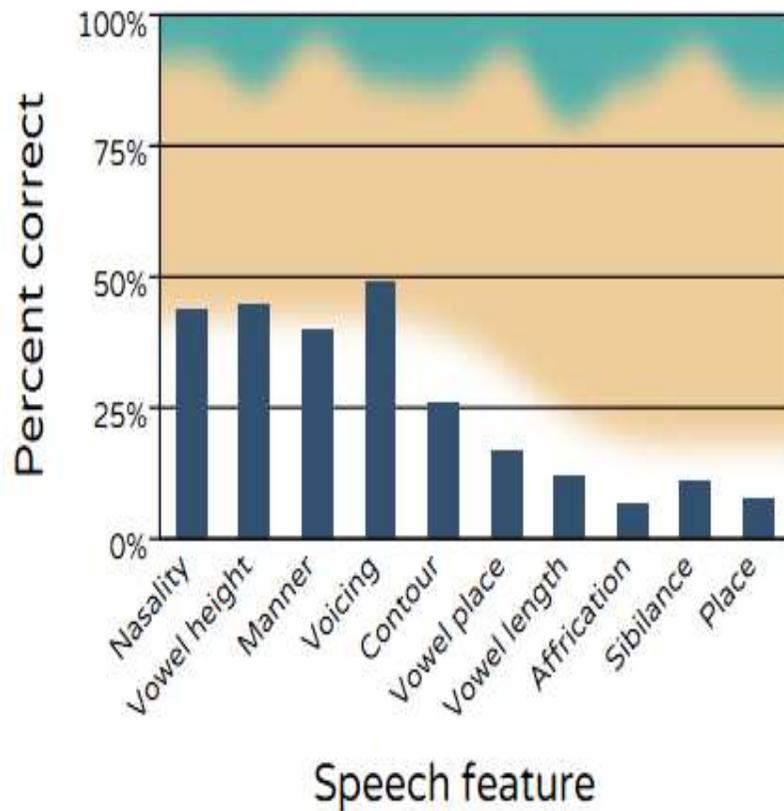
Without hearing aids

Vowels correct: 18

Words correct: 6

Consonants correct: 31

Words missed: 3



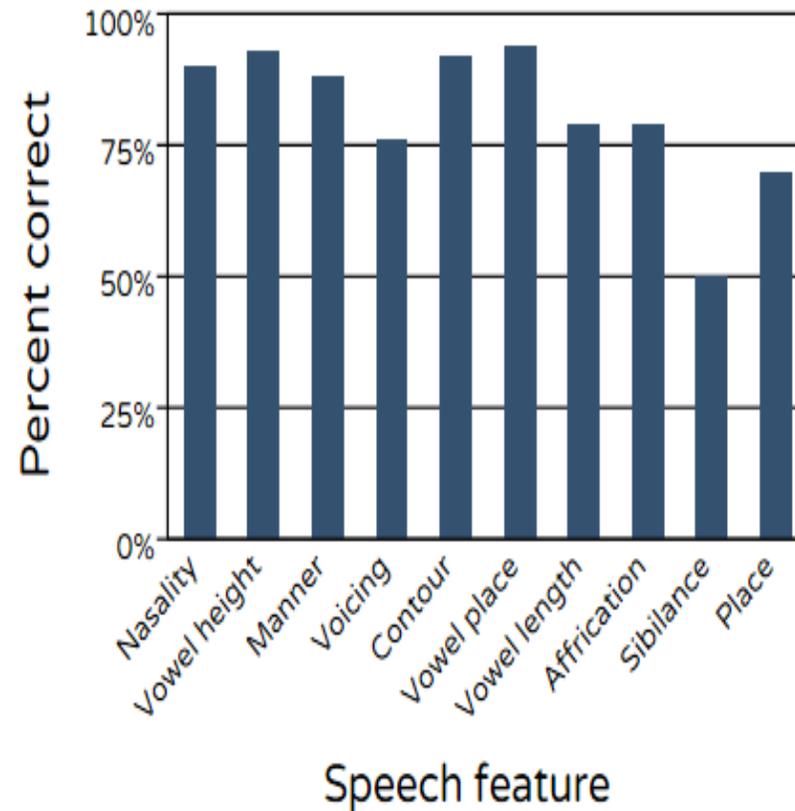
With hearing aids

Vowels correct: 48

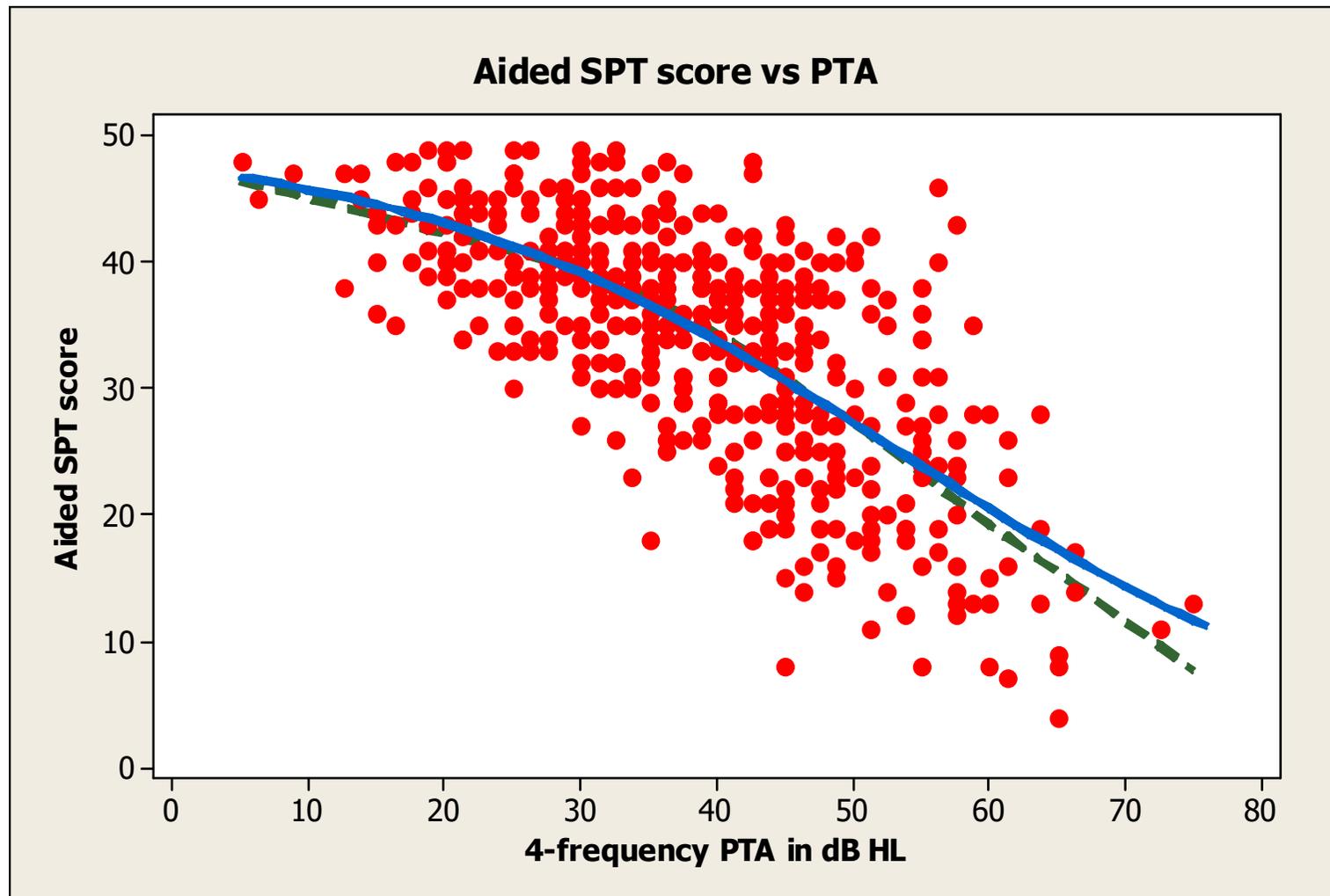
Words correct: 38

Consonants correct: 84

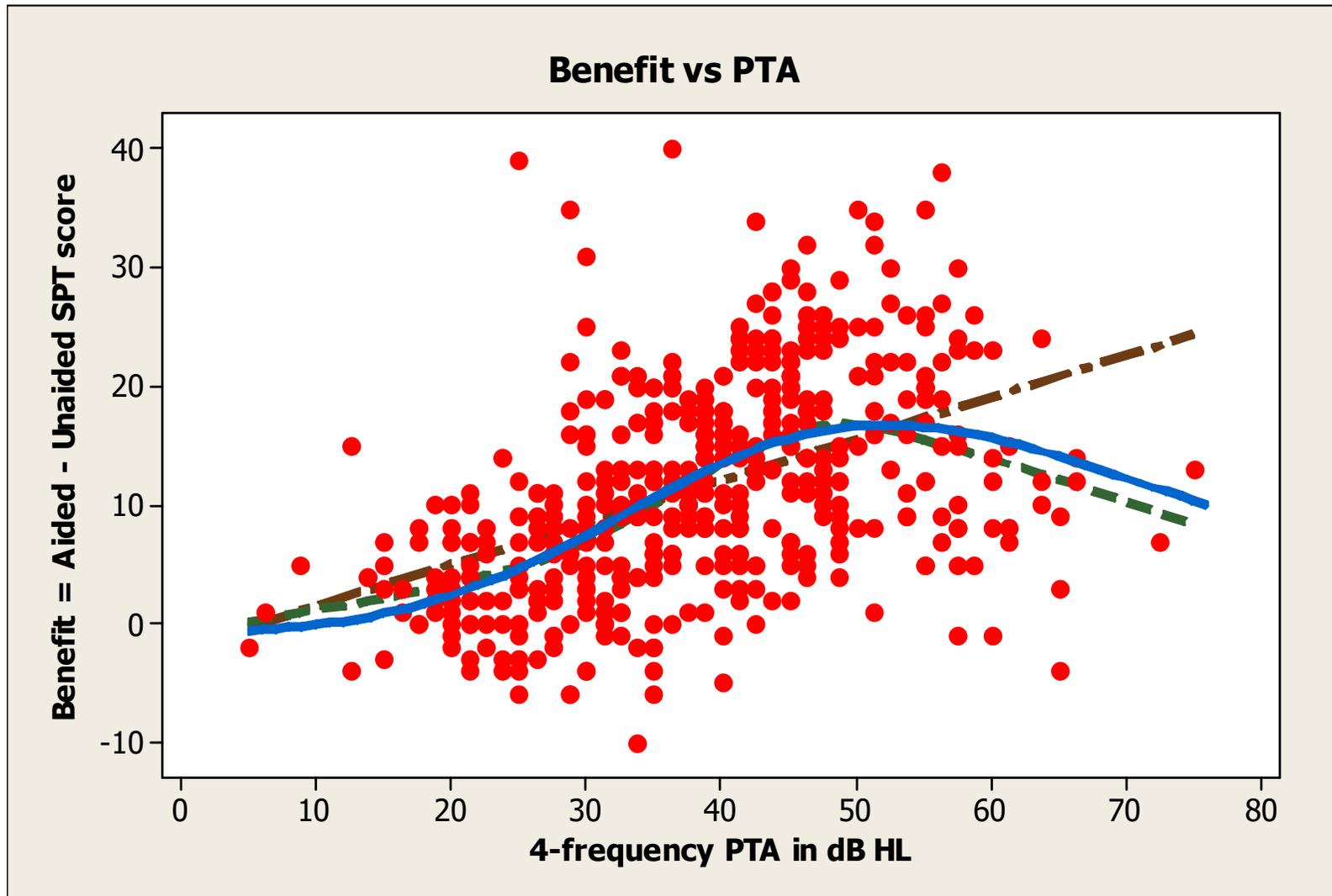
Words missed: 0



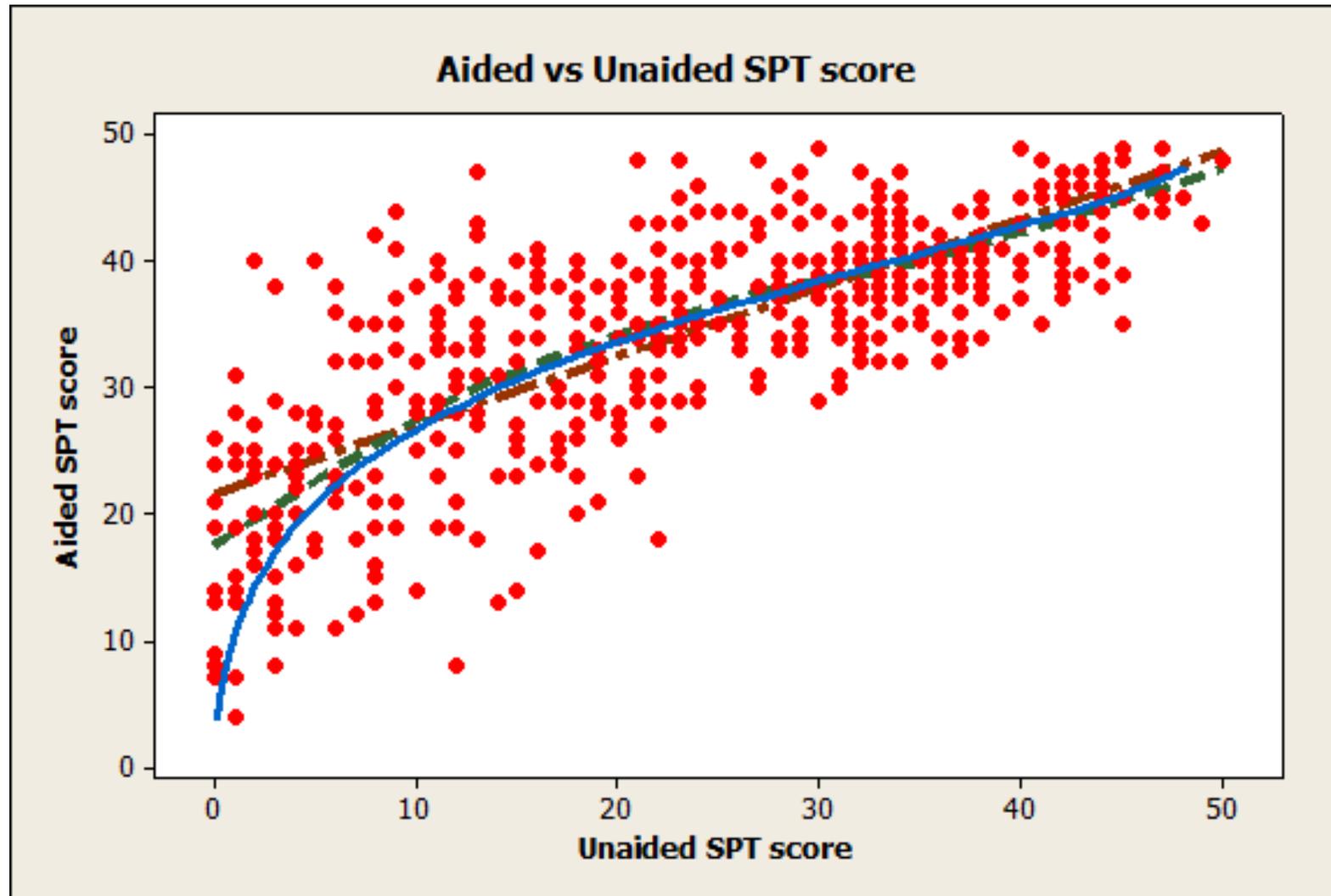
After hearing aid fitting, the SPT was performed in the aided condition. A typical sigmoid curve fitted the data well, with 50% point at 53.4 dB HL and width of 18 dB.



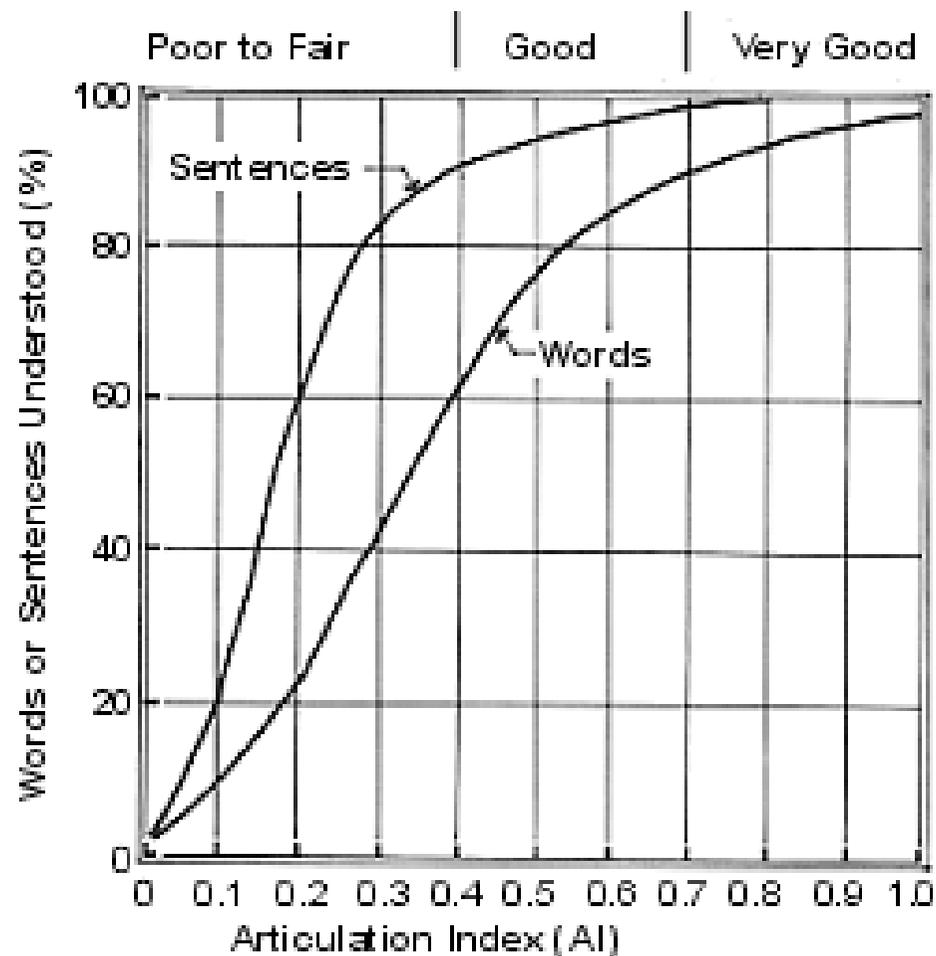
Maximum average benefit on the SPT was 16.8 words (33.6%) at 52 dB HL. Up to 60 dB HL, benefit increased by 0.72% per dB of hearing loss.



On average, people made about half as many errors in the aided conditions as they did in the unaided condition.

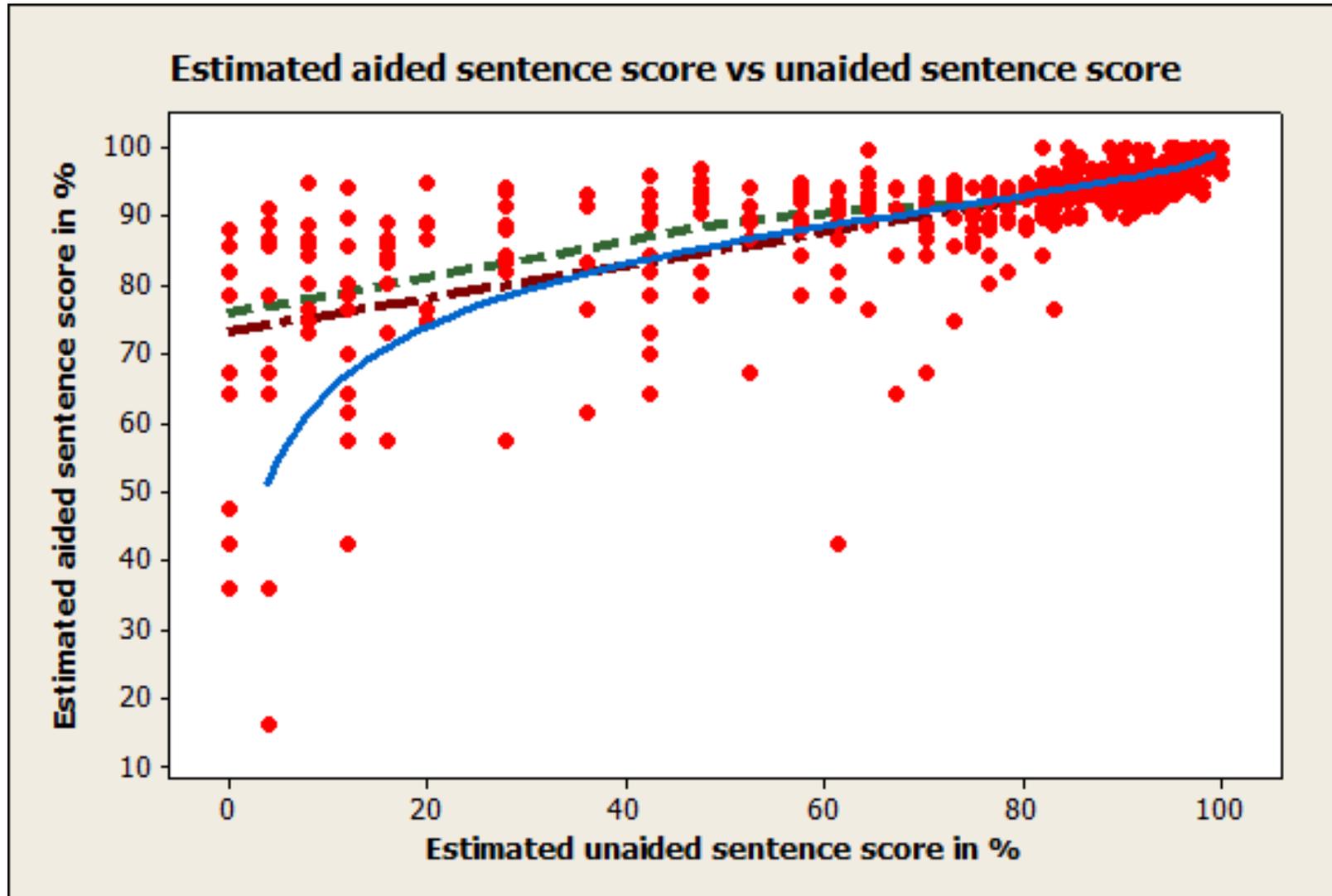


People are often surprised at how many mistakes they make on the word test. To estimate how people would score on sentences, we transformed the data using the graph below.



Grant, K.W., and Seitz, P.F. (1997)

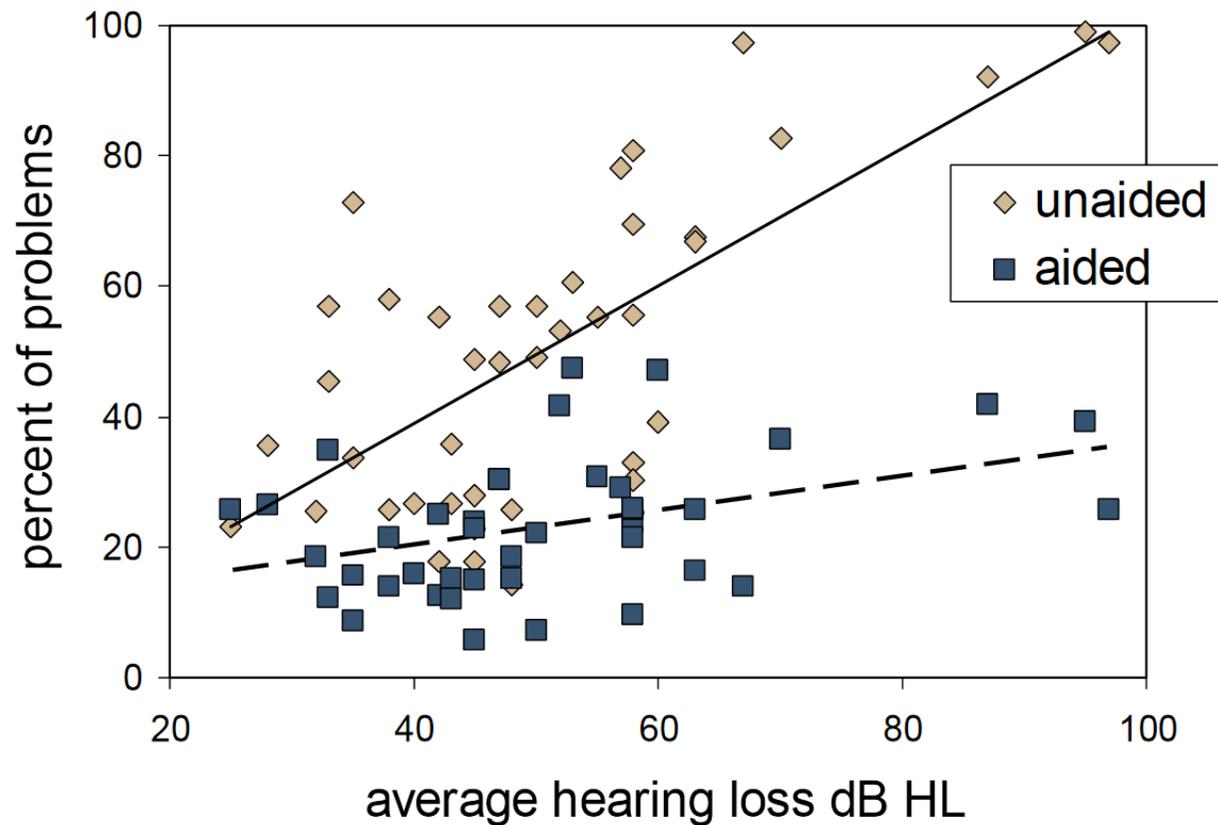
On average, people made about one quarter as many errors for estimated sentences in the aided condition as they did in the unaided condition.



In a previous study using the Profile of Hearing Aid Performance questionnaire, we showed that percentage of problems for communication in quiet decreased by 0.79% per dB of hearing loss.



Environment A (Quiet)



Realistic expectations depend on hearing loss



Realistically, people should expect that hearing aids will:

- Halve the number of errors they make on difficult listening tasks in quiet (such as monosyllabic word perception)
- Reduce the number of errors they make in running speech (such as sentences) to one quarter of their current rate
- Allow a person with a mild hearing loss to perform like a person with normal hearing
- Allow a person with moderate hearing loss to perform like a person with mild hearing loss
- Allow a person with severe hearing loss to perform like a person with moderate hearing loss.

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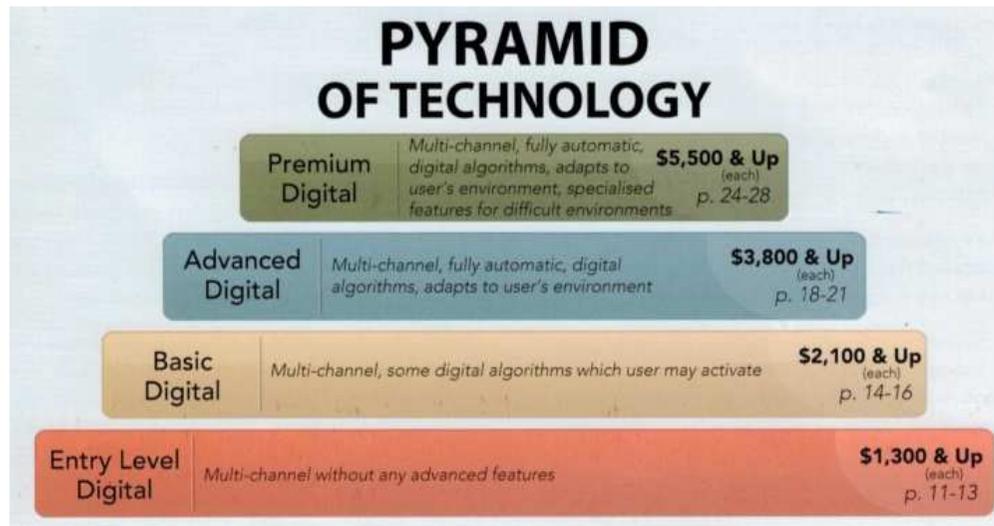
- I don't have a hearing loss
- I can't be bothered visiting an audiologist
- Hearing aids don't work well
- **Hearing aids are too expensive**
- Hearing aids are hard to use
- Hearing aids will make me look older
- There is a stigma associated with wearing hearing aids

IHearYou® unbundles the price of devices and services and cuts out the expensive middle men.

We use world-leading technology to produce premium quality hearing aids: we have unbundled the prices of devices and services to disrupt the traditional pyramid of technology pricing



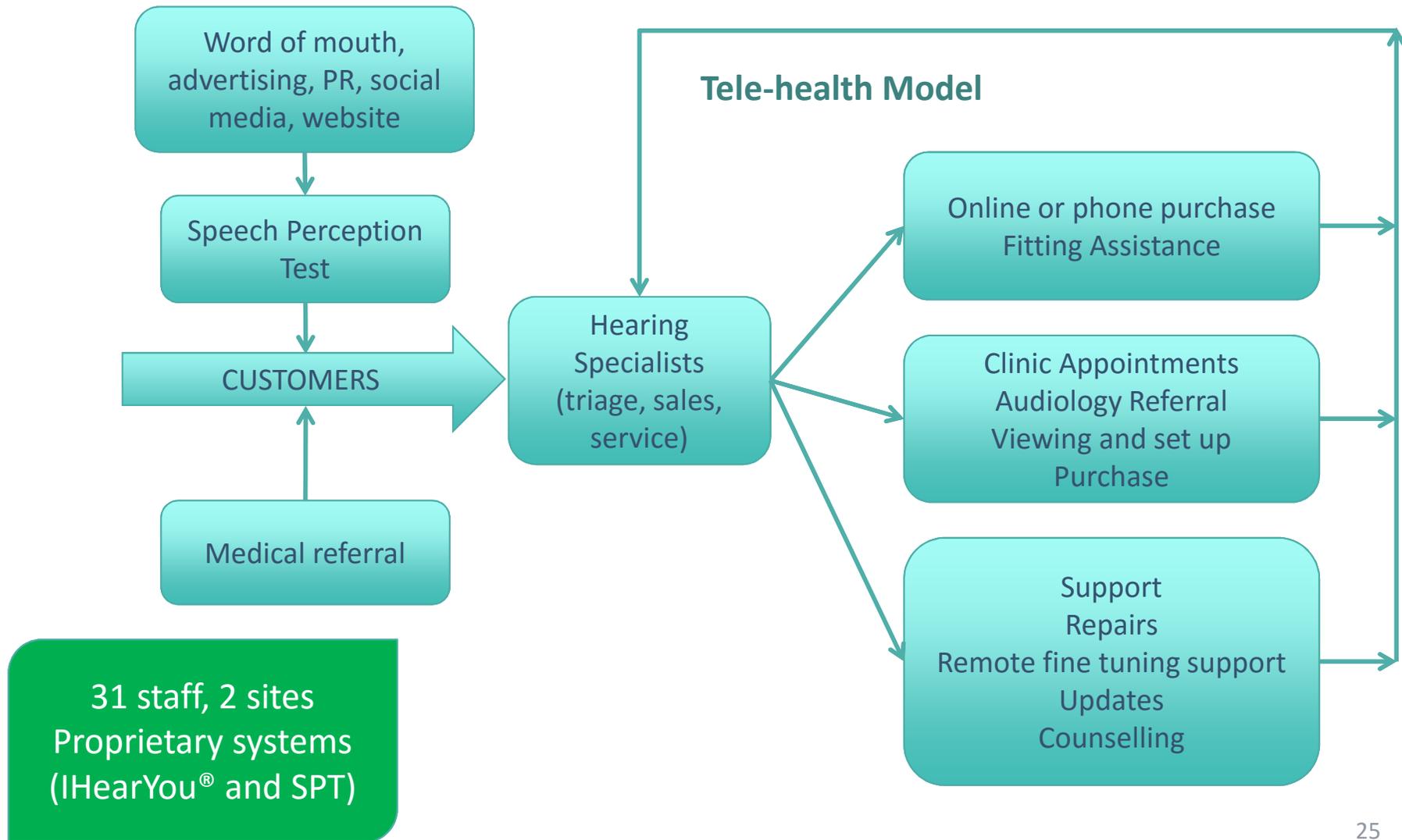
Blamey Saunders disrupts the market with high value premium hearing aids



Blamey Saunders hears	All of the below, PLUS I Hear You® self-fitting system, and a full online service model	\$1,415 & up (each)
Premium digital	Multi-channel, fully-automatic, digital algorithms, adapts to user's environment, specialised features for difficult environments	\$5,500 & up (each)
Advanced digital	Multi-channel, fully-automatic, digital algorithms, adapts to user's environment	\$3,800 & up (each)
Basic digital	Multi-channel, some digital algorithms which user may activate	\$2,100 & up (each)
Entry-level digital	Multi-channel without any advanced features	\$1,300 & up (each)

Survey published by Connect Hearing 2013

Blamey Saunders hears has a fully integrated tele-audiology hearing aid service so you only pay for what you need.

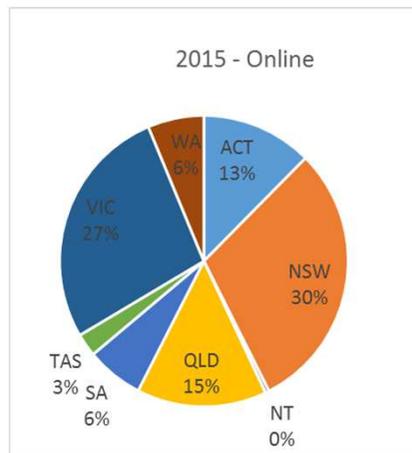


The combination of online and clinical services gives Blamey Saunders a competitive advantage

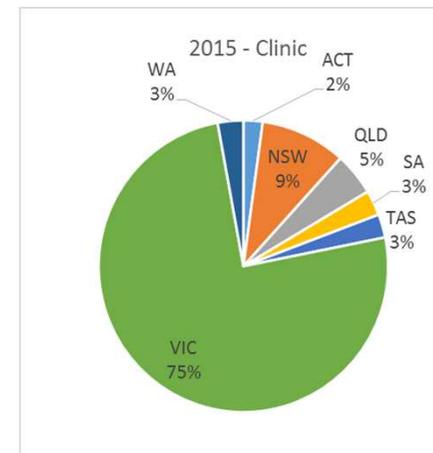
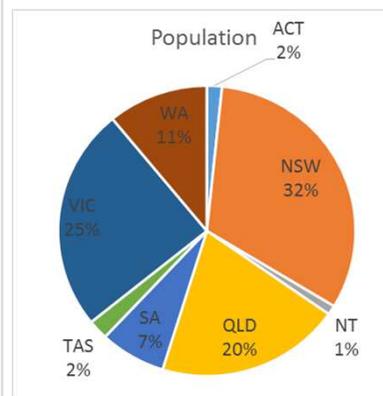


In 2012, there were about 800 audiology clinics in Australia. Today, there are over 1,700. This rather inefficient approach to the underlying issues is proving to be very expensive for consumers and government.

Blamey Saunders is about 20 times more effective than an average clinic with greater reach and scalability. Our combination of clinic and tele-audiology allowed us to service 1-2% of the Australian hearing aid market in 2015 with a single clinic situated in Melbourne.



Over half our clients are online, spread across all states in proportion to population.



Our clinic clients also come from all states but mostly from Victoria.

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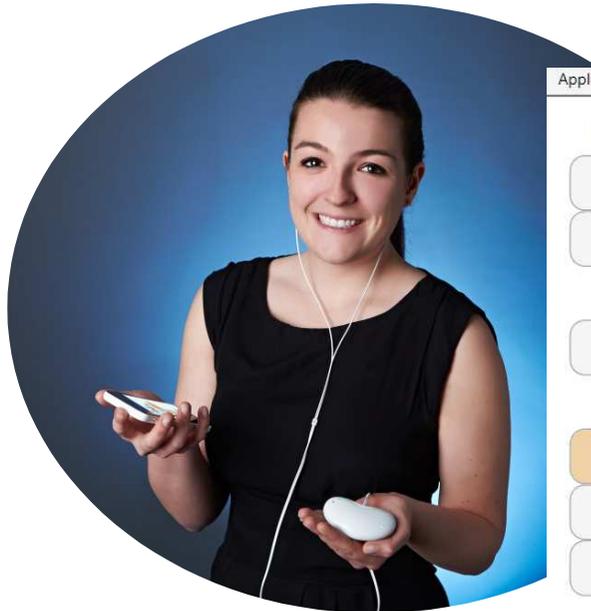


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The IHearYou® apps and Bluetooth programmer make effective fitting and adjusting your hearing aids easy.

Program your hearing aid yourself with options for different environments. Save money and have instant help



Application Settings Technician Settings (Hidden) Help

Perform loudness balancing once:

- Balance loudness left
- Balance loudness right

Adjust volume as needed:

- Volume

Optional further tuning:

- Problem solver**
- Special programs
- Advanced fine tuning

One-click solutions — Program 1

- Whistling or feedback**
When should I click this?
Undo Redo
- Own voice hollow**
When should I click this?
Undo Redo
- Soft little noises are too loud**
When should I click this?
Undo Redo
- Sharp sounds are too harsh**
When should I click this?
Undo Redo

Click here to show/hide instructions

Left hearing aid
Disconnected
Mute Live Transferring data

Connect Save Disconnect

Right hearing aid
Disconnected
Transferring data Live Mute

Welcome to I Hear You



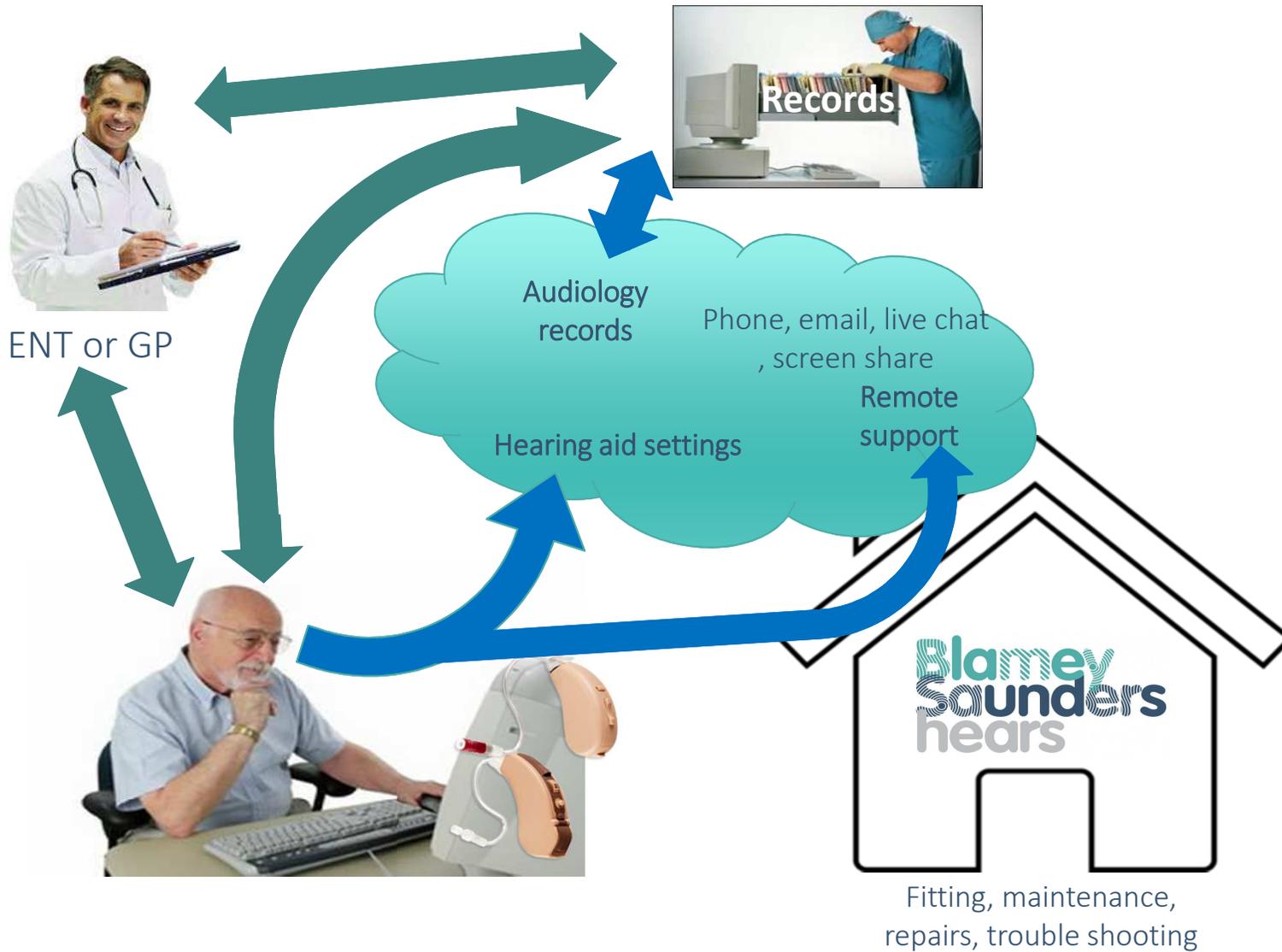
Over two years, 517 people had hearing aids fitted using the conventional audiogram and 484 using the Infogram (plus an audiogram if it was available).



A 2-sample t-test showed that the Infogram fittings resulted in greater benefit than the audiogram fittings ($t=2.2$; $p<0.05$).

	Fitting by audiogram	Fitting by Infogram
Number of participants	517	484
Unaided SPT score	46.1%	47.4%
Aided SPT score	65.7%	69.6%
Hearing aid benefit	19.6%	22.2%

The Blamey Saunders audiology cloud makes products, services, and advice available anywhere, anytime



The SPT and Infogram™ or “speech audiogram” are an effective alternative to the conventional audiogram for hearing aid fitting, with several advantages.



1. The unaided SPT is a measure of what the listener needs to hear and is readily understood by a lay person.
2. The SPT has high sensitivity and specificity for adult listeners with English as their first language.
3. The SPT is freely available online and does not require expensive equipment or highly trained personnel.
4. The SPT fitting method is an in-situ measurement that directly addresses the needs and preferences of the client for comfortable listening, improved speech intelligibility, and improved sound quality, not just improved audibility.
5. The method automatically takes into account individual differences between people, minimizing the need for fine-tuning. The method delivers a consistent improvement in speech intelligibility and a high level of satisfaction.
6. Using the Infogram™ to fit hearing aids led to significantly greater improvements in speech perception scores than audiogram based fittings in this study.
7. The aided Infogram™ is a validation measure that directly demonstrates the benefit of hearing aids to the listener.
8. The fitting method does not require expensive equipment or a high level of training, potentially reducing the cost of hearing health for millions of people.

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Blamey Saunders is designing and manufacturing new hearing aids in Australia and integrating them into the I Hear You® system to address these concerns.

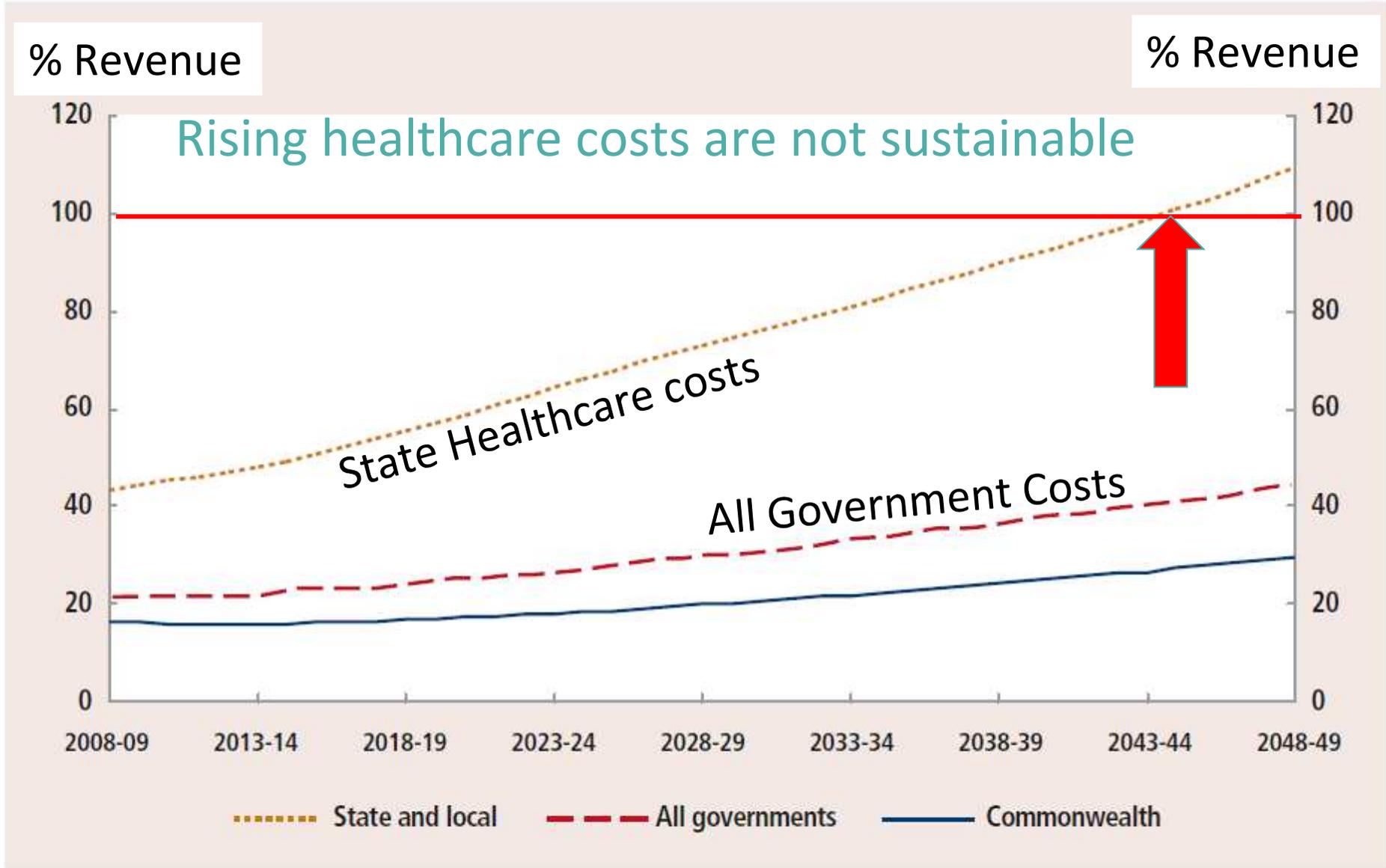
Our structure includes satellite clinics, one back office, and flexibility for truly client centred care



Blamey Saunders hears	Conventional Audiology
<ul style="list-style-type: none">• Client centred• Wellness• Personalised sound quality• Affordable• Transparent pricing• Flexible, self-managed or assisted support• Convenient – immediate help	<ul style="list-style-type: none">• Clinician centred• Medical/disability focus• Clinician determined sound quality• Expensive• Bundled pricing• Medical model: Clinician knows best• Travel and waiting times

Clients can choose the type of care and transition between models





Source: Treasury projections based on data from the Australian Institute of Health and Welfare. Tax held constant as a share of GDP. Based on current arrangements at the time of the 2010 Intergenerational Report.