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Reading and dyslexia in deaf children

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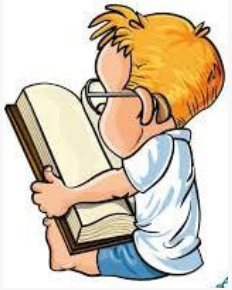
Nuffield Foundation

Reading in deaf children



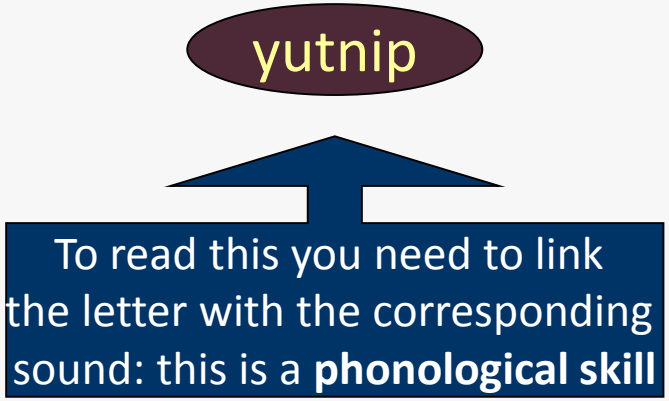
- Reading develops more slowly, delays increase with age[1,2]
- Good deaf readers do exist[3,4]
- Communication *mode* influences the use of phonological recoding:
  - Oral deaf children - reading develops the same was as hearing children, phonological skills are important[5]
  - Hearing children rely on listening, deaf children additionally use lip-reading (speech reading)[5,6]
  - Signing deaf children - conflicting views about role of phonological skills[7,8,9]

[1]Conrad 1979; [2]Wauters et al. 2006; [3]Marschark et al. 2007; [4]Gravenstede & Roy 2009; [5,6]Kyle & Harris 2010, 2011; [7]Mayberry et al. 2010; [8,9]Miller 2002, 2006

Identifying dyslexia in deaf children: challenges

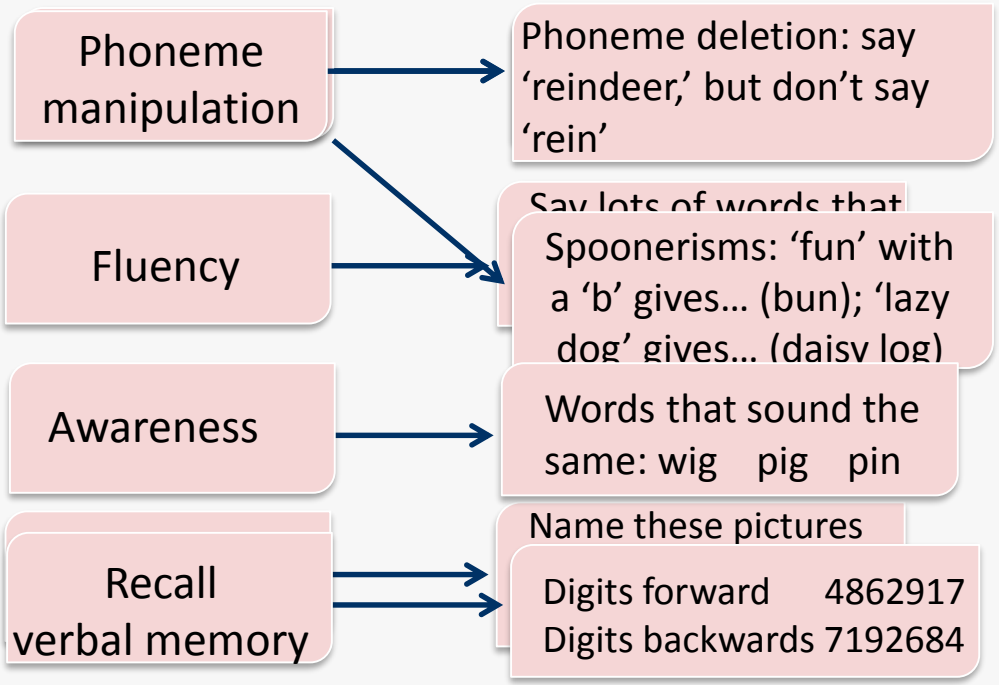
- *Some* poor readers may be dyslexic
- There are no reading or dyslexia tests for deaf children
  - How can we know when we don't have deaf norms on reading and dyslexic tests?
  - Can we use tests designed for hearing children?
  - What about deaf children who cannot attempt these tests?

Dyslexia:
The underlying problem



Phonological skills: skills that involve speech sounds

Tests for dyslexia used with hearing children

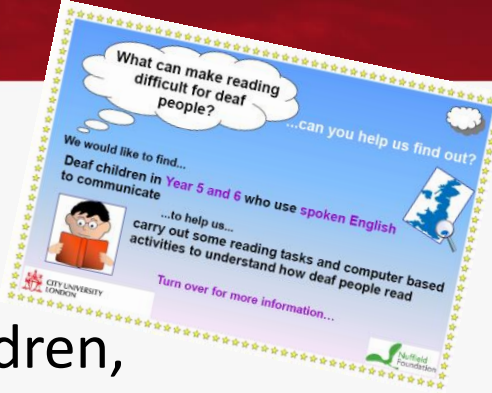


Deficits can occur at any level

Study aims

1. Develop a test battery, including tests developed for hearing children, and collect data from a representative sample of deaf children
2. Compare oral and signing deaf readers with hearing children with and without dyslexia
3. Compare deaf readers according to communication preference
4. Find out if some deaf children have dyslexia

Participants



- 130 severely-profoundly prelingually deaf children,

  106 with normal NVIQ
  - 68 oral OD
  - 38 signing SD
- 20 hearing dyslexic (HD) children
- Children's ages 8-12 years, primary education in English
- Information collected on amplification, other languages, additional disabilities, etc.

Comparing the groups

	DO group N=68	DS group N=38	HD group N=20
Age	MA 132mths (SD 4.4)	MA 130 mths (SD 6.9)	tbc
Gender	55% girls 45% boys	40% girls 60% boys	tbc
Parent D/H	1% deaf parents 99% hearing parents	26% 2 deaf parents, 11% 1 deaf & 1 hearing parent, 63% 2 hearing parents	100% parents hearing
Amplification	61% cochlear implants 39% digital hearing aids	19% cochlear implants 63% digital hearing aids, 18% no amplification	n/a

Test battery

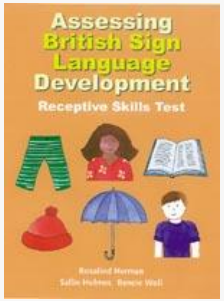
Non verbal IQ
Digit span

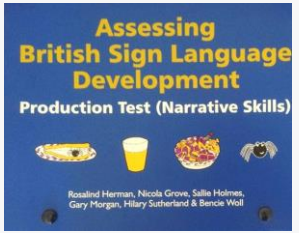
Speech
Intelligibility
Rating **S**cales

Test **o**f **C**hild
Speechreading

Sequencing

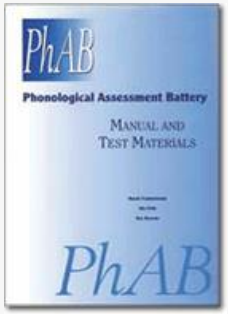
Vocabulary
for reading:
English & BSL





BSL grammar

Single word reading
& spelling



Rhyme fluency
Phoneme deletion
Spoonerisms
Rhyme awareness
Naming speed

Word Initial Phoneme Awareness
James et al 2005

Non-Word Reading
Sterne & Goswami 2000

For children with* low SIRS scores

Deaf-friendly test administration

- Quiet, distraction free test environment
- Amplification fully functional
- Optimal seating and lighting
- Access to clear speech patterns to support speech reading
- Experienced

Tester skills

- Signing/gesture/writing used as needed to explain tasks
- Additional practice items offered where needed
- Sensitivity to deaf children's speech patterns in scoring

Could the children do the tests?

- All measures were successful with the OD and HD children
- 73% SD group had unintelligible speech, unable to do phonological tests that involved speech

Effect of amplification device?

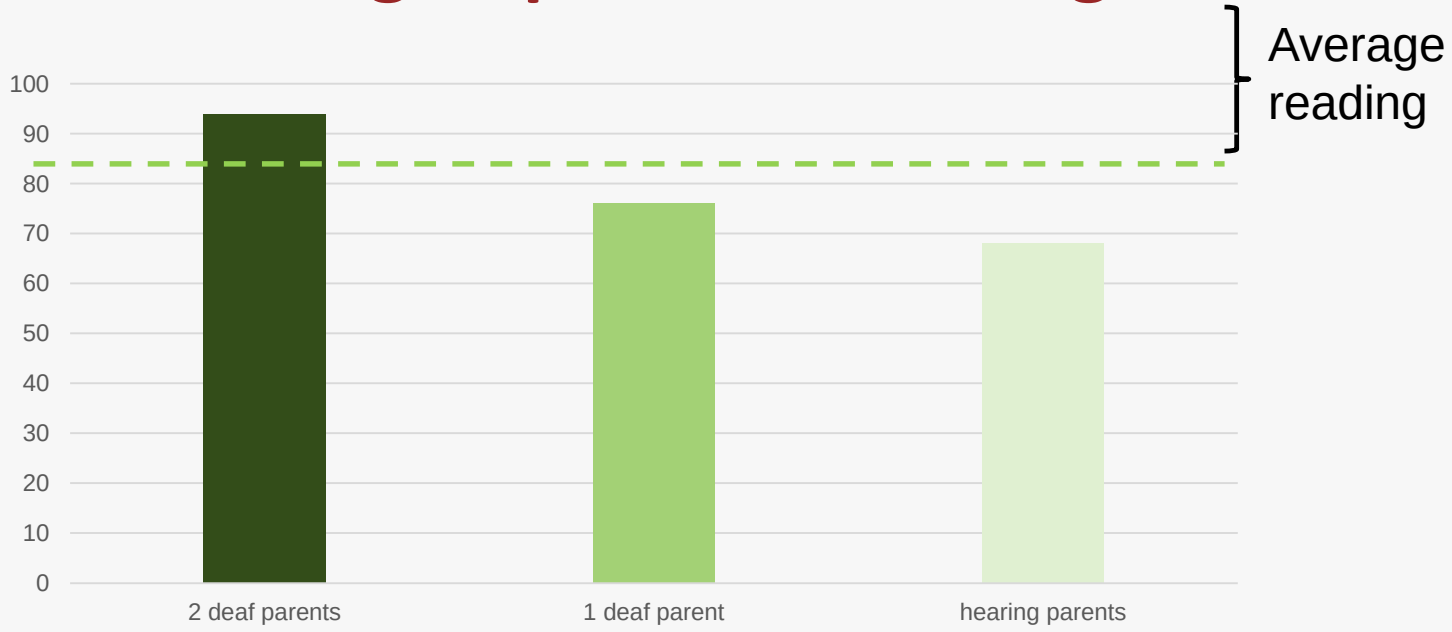
- No significant differences between scores of children with cochlear implants vs digital hearing aids vs no amplification
- Therefore data presented from combined groups

Comparing group means on standardised tests of literacy, language and phonological skills

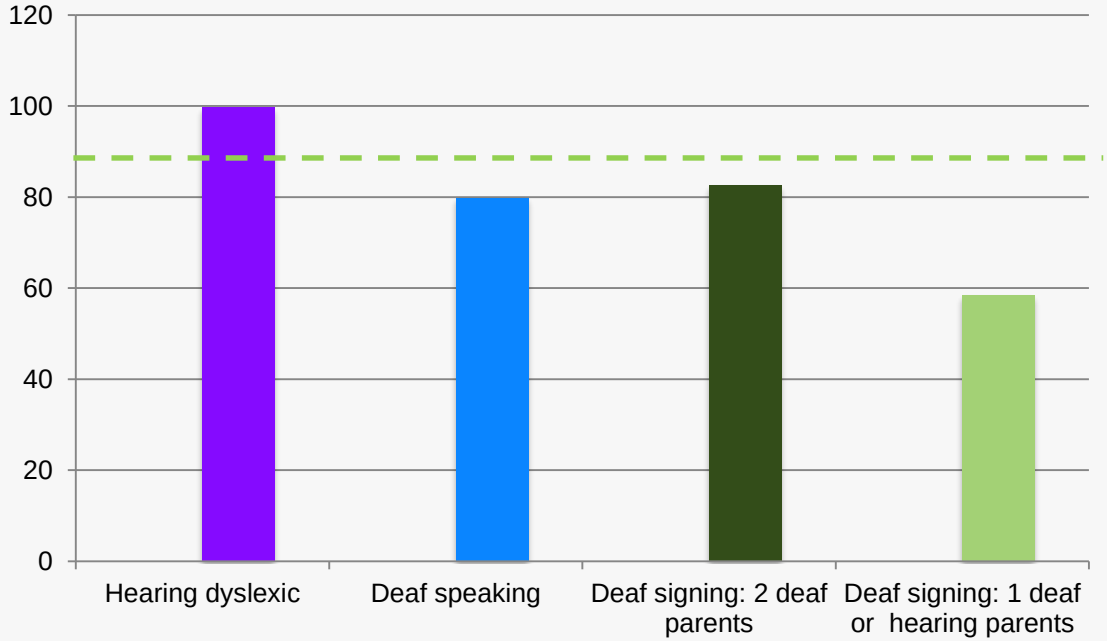
Measure	DO (mean/SD)	DS (mean/SD)	Sig	HD (mean/SD)
NVIQ* (centile)	48 (18)	45 (18)	ns	
Single word reading*	89 (14)	77 (13)	.008	
Spelling*	91 (16)	84 (16)	.001	
English vocabulary*	80 (16)	65 (18)	ns	
Speechreading+	107 (17)	95 (19)	.003	
Rhyme*	86 (16)	72 (7)	.07	

*hearing norms, +deaf norms

Single word reading scores in signing group according to parental hearing status



Deaf and hearing dyslexic children: English vocabulary

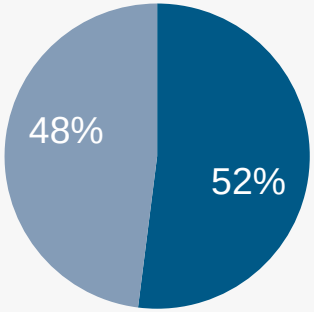


Comparing deaf and dyslexic participants with hearing test norms – phonological skills

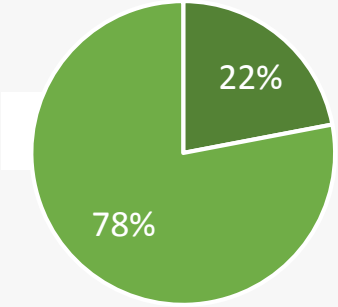
- All groups had below average scores on standardised phonological tasks
- Signing group poor on non-standardised tasks:
  - Letter sound knowledge 22/32
  - Rhyme awareness 11/21
  - Non-word reading 12/20*
  - Word initial phoneme awareness 15/28*

Deaf children and hearing dyslexic children: single word reading

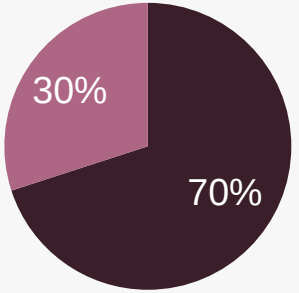
Oral deaf children



Signing deaf children

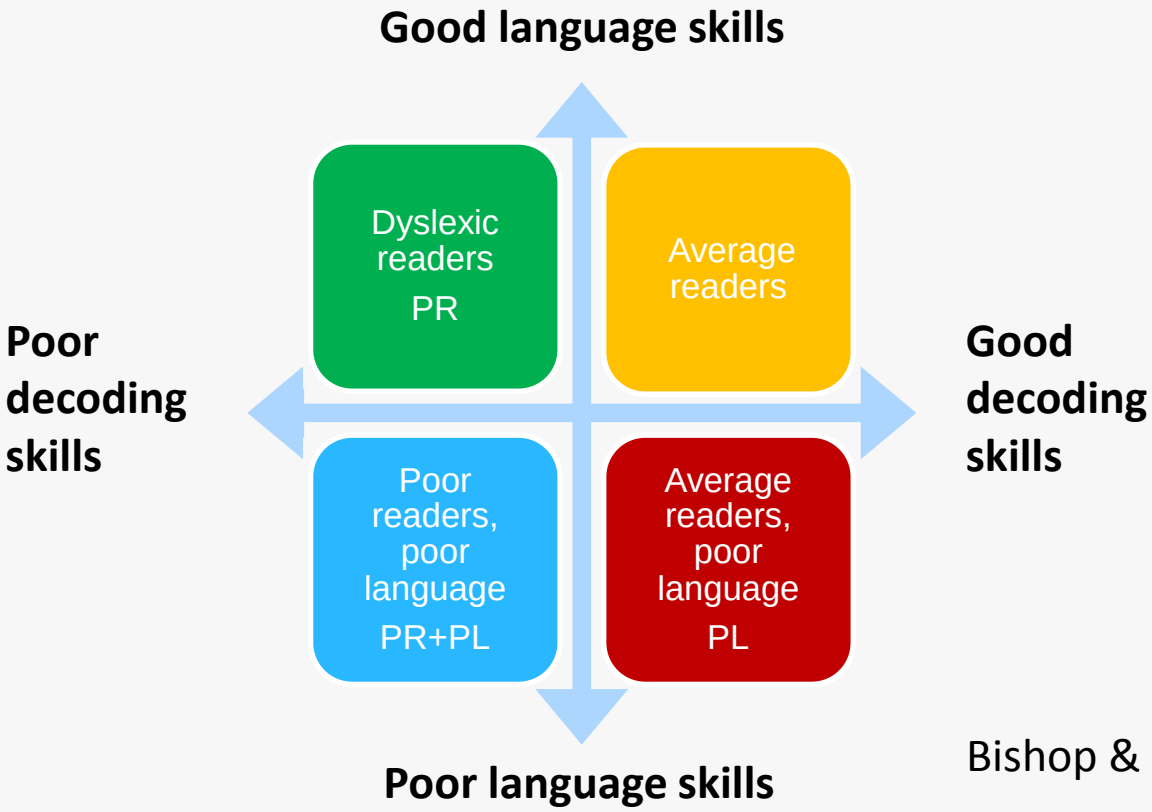


Hearing dyslexic children



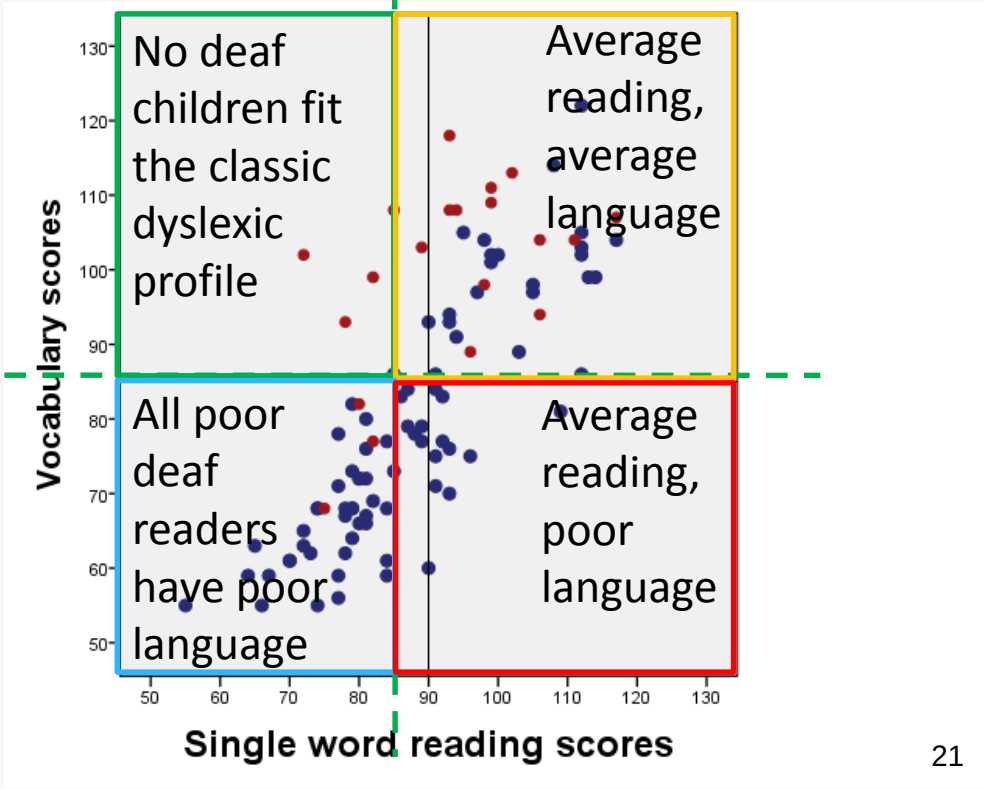
Darker shading = average readers
Lighter shading = poor readers

Profiles of good and poor readers

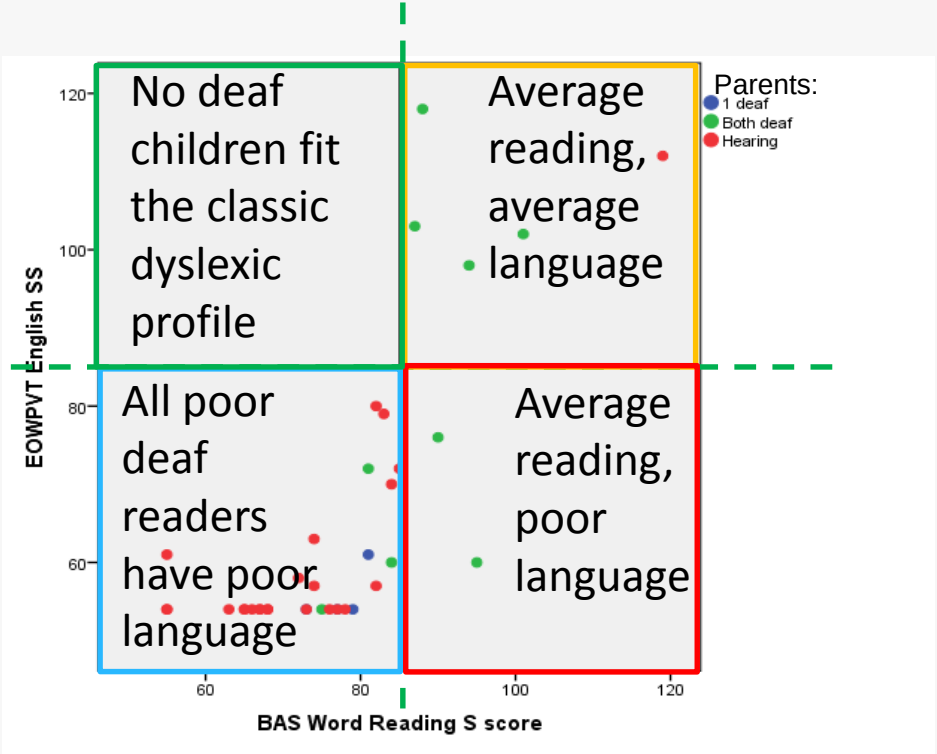


Bishop & Snowling, 2004

Reading and vocabulary: oral deaf children (blue) and hearing dyslexic children (red)



Reading and vocabulary: deaf signers



Deaf children's phonological skills

- All oral deaf children had low mean scores on all standardised phonological tasks
- Signing deaf children also had low scores on non-standardised phonological tasks - *hearing 6 year olds at ceiling on these*
- Are phonological skills correlated with reading?

James et al 2005

Sterne & Goswami 2000

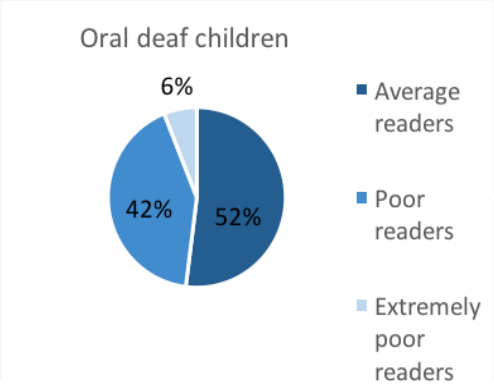
Relationships between single word reading and other measures (oral/signing)

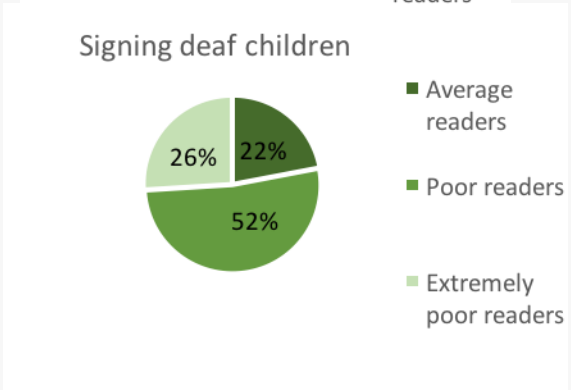
	NVIQ	Vocab English	Vocab BSL	SIRS	ToCS	Rhyme fluency	RA+	NWR+	IPM/ PD+
Single word reading	.39**	.85***	-	.55**	.36**	.65***	.59**	.85**	.71**
	.34*	.73***	.5**	.52**	.55**	.64***	.77***	.67***	.51***

KEY:

SIRS – speech intelligibility
ToCS – speech reading
RA – rhyme awareness
NWR – nonword reading
IPM/ – initial phoneme matching/phoneme deletion
+ *Note different tasks for each group*

Are the poorest deaf readers dyslexic?





- 6% of the oral and 26% of the signing deaf group were extremely poor readers (-2SD):
  - Severe phonological deficits
  - Lowest scores across *all* measures
- We cannot tell if they have dyslexia
- Their response to intervention may be informative

Looking for a deaf dyslexic profile

- Only the oral deaf group completed all the same tests as the hearing dyslexic group
- Naming speed scores were normally distributed in the oral deaf group only
- We used naming speed scores and other *risk factors for dyslexia in hearing children* to profile the oral deaf children

Naming speed a key measure in identifying dyslexia

- 8 oral deaf children with average speech intelligibility and nonverbal scores BUT low on naming speed

3 with average non-word reading unlikely to be dyslexic

Of the 5 remaining, all were:

- Very poor spellers (mainly phonetic spelling errors)
- Very poor phonological skills
- Very poor sequencing skills
- 4/5 were boys

These children fit the typical dyslexic profile

Risk factors for dyslexia in oral deaf and hearing dyslexic groups

Dyslexia in signing deaf children?

Measure/risk factor	Oral deaf dyslexic sub-group & hearing dyslexics (i.e. distinct from other oral deaf readers)	**All poor readers in the deaf signing group**
Naming speed	Poor	Mostly poor
Phonological skills	Poor	Mostly poor
Sequencing (months)	Poor	Mostly poor
Non-word reading	Poor	Mostly poor
Type of spelling error	Phonetic > non-phonetic	Mostly non-phonetic

Can we diagnose dyslexia in a signing deaf child?

- Yes, but it's more complex
- Look for:
  - Large discrepancy between non-verbal, language and literacy skills (especially spelling) *compared with other deaf signing children*
  - Large discrepancy between naming speed scores: pictures>digits
  - Poor digit span (NB not always)
  - Reading motivation/engagement with books
  - Family history

Summary of findings

- Some deaf children are dyslexic
- Different dyslexic profiles for children with spoken vs sign language preferences
- Poor reading continues to be an issue for many deaf children
- Interventions are needed to address dyslexia but also poor reading in all deaf children, to address the underlying ***language and phonological deficits***
- Ideally, intervention should be early

What next?

- Research tells us ***why*** deaf children struggle with reading, but not ***what teachers should do about it***
- Translating research into practice is tricky:
  - Research can be difficult to access
  - Teachers interpret research in different ways - not all are successful
  - What one teacher feels works for their pupils may not work for others

The need for research evidence on *reading interventions*

- We need evidence-based research so that teachers know which reading interventions work
- Research should include large numbers of children so that results can be generalised
- There is limited research on reading interventions with deaf children and most is based on small numbers, so it is difficult to apply findings
- Large-scale reading intervention studies on hearing children ***always exclude deaf children*** …until now

Pilot research study underway: An integrated language and reading intervention for deaf and hearing children

- We have recruited deaf children from 4 HIRBs and hearing children from 4 mainstream classes
- Teachers in half trained to deliver the new intervention in reception classes for 1 year
- Children tested at the start and end of the school year to see if the intervention works
- If results are promising, there will be a larger study in future

Watch out for our results and please participate in future research!

- Watch for emails/tweets, or contact me
- Remember:
  - The study may involve changing how you teach reading
  - Not all schools get to try the intervention straight away
  - We want to include ***all children***, even those with additional needs, as long as they are able to take part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Publications

- Herman, R., Roy, P. & Kyle, F. (2014) Reading, dyslexia and oral deaf children. Research report. Available at: http://openaccess.city.ac.uk/3225/
- Herman, R., Kyle, F. & Roy, P. (2017) Reading and Dyslexia in Deaf Children. Research report (findings from both deaf groups). Available at: http://openaccess.city.ac.uk/18544/
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Acknowledgements

Thanks to…

- My research team: Penny Roy and Fiona Kyle, and Charles Hulme who joins us
- The Nuffield Foundation
- Our previous research assistants: Zoe Shergold and Catherine Barnett
- All of the children, families and schools who have taken part
- Our advisory group: Sue Brownson, Margaret Harris, Mairead MacSweeney, Barbara Maughan, Ian Noon, Kate Rowley, Karen Simpson, Maggie Snowling, Ruth Swanwick & Tyron Woolfe

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