SCALES
Surrey Communication and Language in Education Study

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Royal Holloway, University of London
overview of talk

• what is ‘specific’ language impairment?
• how common is language impairment?
• what are the key questions SCALES will try to answer?
• what are the characteristics of our population sample?
• what have we learned from the screening phase?
what is ‘specific’ language impairment?

• child’s language abilities are below chronological age expectations

• language impairments are not explained by other developmental concerns such as sensory impairment, autism, extreme deprivation, head injury

• language impairments interfere with everyday life at home or at school
but very little agreement about precise diagnostic criteria!

- child’s language abilities are below chronological age expectations

- language impairments are not explained by other developmental concerns such as sensory impairment, autism, extreme deprivation, head injury, global developmental delay

- language impairments interfere with everyday life at home or at school
but very little agreement about precise diagnostic criteria!

• child’s language abilities are below chronological age expectations

• language may include:
  – speech sounds/phonology, vocabulary knowledge, grammar and sentence processing, narrative and discourse skills, using language in context (pragmatics), non-verbal communication (?), written language (?)
  – how low can you go? delay versus disorder?
but very little agreement about precise diagnostic criteria!

• language impairments are **not explained by other developmental concerns** such as sensory impairment, autism, extreme deprivation, head injury, global developmental delay

  – Language impairments often co-occur with these other concerns. Nature of the causal relationship is far from certain.
but very little agreement about precise diagnostic criteria!

• language impairments *interfere with everyday life* at home or at school

• how to measure?

• how much interference before intervention?
  – child ‘getting by’ versus reaching potential
how common is language impairment?

• depends very much on how language impairment is defined...

• depends on assessment materials used...

• depends on child’s age
Weindrich et al. (2000). Epidemiology and prognosis of specific disorders of speech and language. ECAP, 9, 186-194.

- 2SD on standard measure of language function
- non-verbal ability scores within normal range
- 1SD discrepancy between verbal and non-verbal abilities
Weindrich et al. (2000). Epidemiology and prognosis of specific disorders of speech and language. ECAP, 9, 186-194.

- **Strict ICD10 criteria**
  - 2.5% 4.5-yr-olds; 1% 8-yr-olds

- **“Clinical” criteria**
  - 4.3% 4.5-yr-olds; 3.4% 8-yr-olds

- -1.5SD on standard measure of language function
- non-verbal ability scores within normal range
- 1SD discrepancy between verbal and non-verbal abilities
Strict ICD10 criteria
2.5% 4.5-yr-olds; 1% 8-yr-olds

“Clinical” criteria
4.3% 4.5-yr-olds; 3.4% 8-yr-olds

“Nonspecific” Language Impairment
6.6% 4.5-yr-olds; 3.4% 8-yr-olds

Weindrich et al. (2000). Epidemiology and prognosis of specific disorders of speech and language. ECAP, 9, 186-194.
what is the connection between our diagnostic criteria and children’s needs?

does this change over time?
Strict ICD10 criteria

2.5% 4.5-yr-olds; 1% 8-yr-olds

more likely to qualify for services
most likely to resolve by age 8

“Nonspecific” Language Impairment

6.6% 4.5-yr-olds; 3.4% 8-yr-olds

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Strict ICD10 criteria
2.5% 4.5-yr-olds; 1% 8-yr-olds

“Nonspecific” Language Impairment
6.6% 4.5-yr-olds; 3.4% 8-yr-olds

least likely to qualify for services
least likely to resolve by age 8
most likely to have literacy difficulties
how common is language impairment?

• Tomblin et al. (1997). EPI-SLI study of 7200+ kindergarteners in Iowa, USA

• key findings
  – ~7% of children at school entry had language delays based on standard tests of vocabulary, sentence processing and narrative skill
  – these children were followed through to adulthood
    • at higher risk for literacy difficulties, social difficulties, and attention/behavioural problems
but...

• of 7% identified, fewer than half met diagnostic criteria for language impairment a year later

• of 7% identified by research team, only 1/3 had been identified by parents and teachers as having difficulties
  • some ‘hidden’ difficulties
  • no measure of IMPACT on education or daily life
how ‘specific’ is specific language impairment?

• increased rates of co-occurring difficulties in cognition, motor development, attention control, social skills, literacy and other academic attainments

• some evidence for increased psychiatric disturbance by adolescence
  – typically in clinically referred samples

• longitudinal studies have generally NOT measured associated concerns at school entry
  • co-occurring problems with similar underlying causation?
  • or consequence of navigating school with language/communication difficulties?
questions we are trying to answer

• if children are identified with a possible language/communication impairment when they start school, what other developmental concerns are present?
  – motor skills, attention control, learning aptitude, speed of information processing, social understanding and social interaction, pre-literacy
questions we are trying to answer

• are particular patterns of language/communication impairment associated with particular co-occurring deficits?
  – e.g. grammar and motor skills OR vocabulary and social weaknesses

• which patterns of language/communication impairment and co-occurring deficit have the greatest impact on academic achievement?
questions we are trying to answer

• how do these patterns of language/communication impairment and co-occurring deficit change over time?
  – can we identify at individual or school level factors that protect/promote improvement over time?
  – can we identify at individual or school level factors that increase risk for difficulty over time?
questions we are trying to answer

• how many children are actually starting school in the UK with significant language and communication needs?
  – can we identify those children who will have persistent needs over time?
Stage 1: Screening for language/communication ‘risk’

14,281 children in target population (332 schools)

~8,299 children in sample (187 schools)

50 schools opted out
95 schools no reply (~5,982 children)

23 parent opt-outs

7,532 children screened (Stage 1) (170 schools)

17 schools did not complete screen (~744 children)
Stage 1: Screening for language/communication ‘risk’

- ~281 teachers completed an on-line screening questionnaire for every child in their reception class (!)

- screening questionnaire included:
  - background information on child ethnicity, home language, SEN status, any existing diagnostic information, teacher concerns
  - Children’s Communication Checklist-Short
  - Strengths and Difficulties Questionnaire
  - New Early Years Foundation Stage Profile
  - (existing EYFSP also available for all children in the screening sample)
Stage 1: population characteristics  
(n = 7532)

- **Age:** all children aged between 4;9 and 5;10
- **Gender:** 51% boys and 49% girls
- **Ethnicity:** 6213 children (82%) of white British ethnic origin (83% England; 83% Surrey)
- **English as additional language:** 797 (11%) were rated as having English as an additional language (17% UK total; 10% Surrey)
Stage 1: population characteristics

Socio-economic status (SES): Income Deprivation Affecting Children Index (IDACI)
1 = most deprived
32482 = least deprived
Stage 1: population characteristics

Special Educational Needs (SEN) Status

- No: 87%
- Yes - School Action: 7%
- Yes - School Action Plus: 3%
- Yes - Statement of SEN: 2%
- Other, please specify: 1%
Stage 1: population characteristics

• Special educational needs:
  – 2% have existing statement of SEN
  – 4% have sensory impairment (hearing/vision)
  – 6% have existing diagnosis of developmental disorder
  – 13% on SEN register
  – 30% elicited some teacher ‘concern’ about aspects of development
    • ~60% concern language, literacy and communication
    • ~40% concern social, motor, learning and behaviour
Stage 1: teacher concerns

- Speaking: 15%
- Understanding: 10%
- Communication: 11%
- Listening: 9%
- Reading/Writing: 13%
- Social Skills: 10%
- Motor Skills: 2%
- Learning: 10%
- Behaviour: 9%
- Other: 11%
Stage 1: population characteristics

- No Phrase Speech:
  - teachers reported that 1% (n = 90) of children were NOT speaking in sentences by the end of reception!
  - 62 boys: 28 girls
  - 70 (78%) were in mainstream schools (!)
    - 23 children had no existing diagnosis
    - 21 had statements and were in special classes
    - 10 were not receiving any specialist support at school level (i.e. were not on school action or school action plus)
Stage 2: in-depth, longitudinal assessment of language/communication and associated developmental skills

Current opt-in rate is >85%
Stage 2: in-depth, longitudinal assessment of language/communication and associated developmental skills

• aim to see 500 children from initial screening phase for in-depth assessment
  – high risk (n= 300): children scoring in bottom 14\textsuperscript{th} centile on the screening measure
  – low risk (n = 200): a random sample of everyone else

• these 500 children assessed in detail by research team in Years 1 and 3.
decisions about cohort for Stage 2

• need to randomly select 600 (allowing for no consent) from population

• preliminary exclusion criteria (n = 871)
  – already attending SLD school
  – no phrase speech
  – English as additional language

• oversample girls
  – gender differences in rates of co-morbidity/prognosis

• where to make the ‘at-risk’ cut-off

Ability to access test battery
Ability to answer questions about ‘specific’ language impairment
distribution of scores on the CCC-S
distribution of scores on the CCC-S

2:1 boys to girls
691: 347

47% of sample is SUMMER BORN!

Score of 17 or more = 14% of the total sample

this cut identifies 30% of EAL children

No. Children

Score of 17 or more = 14% of the total sample

CCC-S score (max 39: poor language)

Next slide timing 33:05
### Distribution of Scores on the CCC-S

<table>
<thead>
<tr>
<th></th>
<th>Autumn</th>
<th>Spring</th>
<th>Summer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>High</td>
<td>230</td>
<td>127</td>
<td>225</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>(20%)</td>
<td>(12%)</td>
<td>(21%)</td>
<td>(11%)</td>
</tr>
<tr>
<td>Low</td>
<td>922</td>
<td>933</td>
<td>857</td>
<td>927</td>
</tr>
<tr>
<td></td>
<td>(80%)</td>
<td>(88%)</td>
<td>(79%)</td>
<td>(89%)</td>
</tr>
<tr>
<td>Total</td>
<td>1152</td>
<td>1060</td>
<td>1082</td>
<td>1043</td>
</tr>
</tbody>
</table>

Gender effect apparent for each season of birth
our solution:

• we stratified by both gender and season of birth, taking the bottom 14% in each of those cells as ‘high risk’
• random selection of 600 children, specifying equal numbers of boys and girls
• for monolingual children, have selected ~39% of all high-risk children and ~3.5% of low-risk children
is the CCC-S any good as a screening tool?

• don’t know yet – currently collecting in-depth data that will allow us to provide sensitivity and specificity estimates but...

<table>
<thead>
<tr>
<th></th>
<th>CCC-S: entire sample</th>
<th>CCC-S: selected cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDQ</td>
<td>.54</td>
<td>.57</td>
</tr>
<tr>
<td>New EYFSP</td>
<td>.66</td>
<td>.78</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th></th>
<th>High risk</th>
<th>Low risk</th>
</tr>
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<tbody>
<tr>
<td>% teacher concern</td>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td>% school action</td>
<td>48</td>
<td>1</td>
</tr>
</tbody>
</table>
Stage 2: diagnostic criteria
Tomblin, Records, Zhang (1996)

**Modality**

<table>
<thead>
<tr>
<th>picture identification</th>
<th>picture naming</th>
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</thead>
<tbody>
<tr>
<td>grammatical understanding</td>
<td>grammatical production</td>
</tr>
<tr>
<td>narrative understanding</td>
<td>narrative recall</td>
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</tbody>
</table>

-1.2 SD or greater on 2/5 composites
sensitivity .92
specificity .98

Identifies large number of false positives

Overall severity of -1.2SD
Stage 2: diagnostic criteria

<table>
<thead>
<tr>
<th>Receptive One Word Picture Vocabulary Test</th>
<th>Expressive One Word Picture Vocabulary Test</th>
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</thead>
<tbody>
<tr>
<td>TROG (short form)</td>
<td>SASIT-E32</td>
</tr>
<tr>
<td>ACE Narrative (bespoke questions)</td>
<td>ACE Narrative (information units)</td>
</tr>
</tbody>
</table>

- **vocabulary composite**
- **grammar composite**
- **narrative composite**

- comprehension composite
- expression composite
## Stage 2: additional assessments

<table>
<thead>
<tr>
<th>Developmental area</th>
<th>Assessment</th>
</tr>
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<tbody>
<tr>
<td><strong>Hearing</strong></td>
<td>Pure tone audiometer screen</td>
</tr>
<tr>
<td><strong>Non-verbal reasoning</strong></td>
<td>WPPSI Block Design</td>
</tr>
<tr>
<td></td>
<td>WPPSI Matrix reasoning</td>
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<tr>
<td><strong>Clinical language</strong></td>
<td>Past tense task (Conti-Ramsden et al. 2011)</td>
</tr>
<tr>
<td>‘markers’</td>
<td>Non-word repetition</td>
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<tr>
<td><strong>Speech</strong></td>
<td>DEAP articulation screen</td>
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<td>Diadokokinetice rate</td>
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<tr>
<td><strong>Literacy</strong></td>
<td>YARC Letter Sound Knowledge</td>
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<td></td>
<td>YARC Phoneme Deletion</td>
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<tr>
<td></td>
<td>CastlesColtheart-2: regular, irregular, non-word reading</td>
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<tr>
<td></td>
<td>Teacher questionnaire</td>
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<tr>
<td><strong>Speed of processing</strong></td>
<td>WISC Coding</td>
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<td></td>
<td>Visual search</td>
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<td></td>
<td>Rapid automatic naming</td>
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</tbody>
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## Stage 2: additional assessments

<table>
<thead>
<tr>
<th>Motor skills</th>
<th>Go task (reaction time)</th>
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<tr>
<td></td>
<td>Coin posting</td>
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<tr>
<td></td>
<td>Bead threading</td>
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<td></td>
<td>Developmental Co-ordination Disorder Questionnaire</td>
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<th>Attention/executive control</th>
<th>Go no-go task</th>
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<tr>
<td></td>
<td>Visual search</td>
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<tr>
<td></td>
<td>Self-ordered pointing tasks (Cragg &amp; Nation, 2009)</td>
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<td></td>
<td>SWAN Questionnaire</td>
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<table>
<thead>
<tr>
<th>Social understanding, interaction and communication</th>
<th>Theory of Mind experimental battery (Wellman &amp; Liu, 2004)</th>
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<tbody>
<tr>
<td></td>
<td>Social Responsiveness Scale</td>
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<td></td>
<td>Children’s Communication Checklist-2</td>
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<table>
<thead>
<tr>
<th>Learning tasks</th>
<th>Serial Reaction Time task</th>
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<tbody>
<tr>
<td></td>
<td>Implicit associative learning task</td>
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</tbody>
</table>
Procedural learning deficit

- Neural procedural memory circuits
  - Difficulties with learning rules and motor sequences
    - Speech sequences
    - Motor sequences
    - Grammar

Social learning deficit

- Neural circuits serving speech/social perception
  - Difficulties with speech processing and social engagement
Social learning deficit

neural circuits serving speech/social perception

difficulties with speech processing and social engagement

- speech memory
- social development
- vocabulary
Atypical brain development hypothesis: co-morbid disorders as a consequence of shared aetiological risk for atypical brain development

shared risk factors across disorders

atypical brain development and organisation

underlying cognitive risks (probabilistic)

behavioural comorbidities

SLI    ADHD    ASD
mediated by school failure or social rejection
associated projects
no phrase speech

• children with most severe language difficulties at the end of reception
  – more than half are in mainstream classrooms, with little additional support

• what distinguishes those in specialist settings from those in mainstream?
  – Special school: marginally more affluent (p = .09); significantly more difficulties on SDQ (p = .03).

• small grant application to interview families about their attitudes/experiences of different education placements
“I have never successfully referred any child in Foundation or Key Stage 1 to speech-language therapy. We have to demonstrate that they don’t improve before anyone will look at them.”
English as an additional language

within our sample there are more than 30 different languages:
English as an additional language

• currently running pilot study:
  – 30 ‘high-risk’ versus 30 ‘low-risk’ children with EAL
  – unlikely to (a) have valid assessments in all of those languages or (b) anyone qualified to administer them
    • what English language measures differentiate the two groups?
    • do non-verbal ‘cognitive’ measures distinguish the two groups? (e.g. processing speed; learning)

• application to test measures identified in the pilot on the larger cohort
  – more detailed information about home language environment
  – information about rates of development in high vs low risk cohorts
“We cannot get speech-language therapy involved because he has EAL – the assumption is that it is just a delay in learning English and he’ll get better”
summary: what have we learned from screening phase?

• in our screening sample: boys, summer born children and children with EAL were much more likely to be identified as ‘high-risk’
• 1% of the children were reported to have no phrase speech at the end of reception
• children in the high-risk group were more likely to have broader behaviour problems and were struggling more at school relative to low-risk peers
• while children with EAL are more likely to be ‘high-risk’, 2/3 of children with EAL are NOT rated as having language or communication difficulties
looking to the future...

• prevalence rates of language delay at school entry
• rates of co-occurring deficit in motor, social, attention and cognitive abilities
• pattern of language and co-occurring deficit that impedes academic success
• changes over time and stability of diagnosis
SCALES investigators

Tony Charman

Debbie Gooch

Emily Simonoff

Gillian Baird

Andrew Pickles
SCALES testing team
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• Wellcome Trust for funding us
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• Teachers, SENCOs and all school staff for their enthusiastic support – we could not do it without them!
Thank you for listening!

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www.scalestudy.co.uk (scientific website)

www.scalesstudy.wordpress.com (blog about day to day running of project)

THANK YOU FOR LISTENING!!