Stability and change in developmental language disorder

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the SCALES teams

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2012-2013
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2018-2019
Jessica Banks, Laura Lucas, Sarah Griffiths, Lydia Yeomans
The many, many children and their families, who have taken part and taught me so much

Surrey County Council

Virginia & Jennifer! Cheryl, Katherine & Barbara

Teachers, SENCOs and all school staff for their enthusiastic support (and cups of tea)

Speech and language therapy

• specialist clinical input

• goal of many services is to move children into the ‘normal range’

• requires ‘greater than expected progress’

• feasible? (if so, how so?)

• contingent on other developmental factors?

• best metric of success?
Plan of talk

• Update on Developmental Language Disorder

• SCALES
  • Prevalence and profile
  • Stability and change

• Is rate of language change malleable?
  • Implications for treatment

Developmental Language Disorder – DSM5 (APA 2013)

• child’s language abilities are below chronological age expectations

• language deficits are not explained by other developmental concerns such as sensory impairment, autism, extreme deprivation, head injury, global developmental delay
  • although language disorder is frequently associated with other developmental concerns

• language deficits interfere with everyday life at home or at school
Included international, multidisciplinary input from English speaking countries

- SLTs, psychologists, charities, parents, teachers, etc

Agreed core diagnostic criteria and consistent terminology

- Replace ‘specific language impairment’ with ‘Developmental Language Disorder’

Non-verbal cognitive ability should not be used:
- as part of diagnostic criteria
- to limit access to clinical / educational service

Associated biomedical conditions (examples)
- brain injury,
- acquired epileptic aphasia in childhood,
- certain neurodegenerative conditions,
- genetic conditions such as Down syndrome,
- cerebral palsy
- sensori-neural hearing loss.
- autism spectrum disorder (ASD)
- intellectual disability
Developmental Language Disorder
- No known associated biomedical conditions
- Persistently (diagnosis under age 3 less reliable in many cases)
- Large discrepancy between verbal and non-verbal ability not required
- Children with low non-verbal IQ (who do not meet criteria for intellectual disability) can be included as cases of DLD

Co-occurring disorders
- Attention (e.g., ADHD)
- Motor (e.g., dyspraxia, dysarthria)
- Literacy
- Speech
- Adaptive behaviour
- Behaviour/emotional problems
- Auditory processing (e.g., APD)
Why DLD?

• Developmental – condition that arises from atypical development (i.e. not acquired)
  • Could drop the ‘developmental’ for adults

• Language – most ‘domains’ of language (phonology, semantics, syntax, discourse) load on a common ‘factor’ and language highly predictive of other developmental skills

• Disorder – serious! And on par with other developmental conditions (autism spectrum disorder; attention deficit hyperactivity disorder)

Bishop (2017). *IJLCD*

Concerns raised about these criteria...

• non-verbal IQ criteria – we won’t be able to help children with lower non-verbal abilities...?

• Language *delay* versus language *disorder*?
non-verbal ability and DLD

- Non-verbal ability single most common reason children with language disorders refused access to specialist speech-language therapy or placement in language units in the UK (Dockrell et al. 2006)

- Non-verbal ability key risk factor for persistent & severe language disorder (Bishop & Edmundson, 1987; Conti-Ramsden et al. 2012)

- need to consider functional impact

- could improving language drive other kinds of learning?

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Typical language</td>
<td>Language within normal range with non-verbal IQ (score of &gt;85)</td>
</tr>
<tr>
<td>SLI</td>
<td>Language impaired (&gt; 1.25 SDs below the population mean on language score) &amp; non-verbal IQ in the normal range (score of &gt;85)</td>
</tr>
<tr>
<td>Non-Specific LI</td>
<td>Language impaired (&gt; 1.25 SDs below the population mean on language score) &amp; non-verbal IQ low (score of &lt;85)</td>
</tr>
<tr>
<td>Low non-verbal IQ</td>
<td>Language with normal range and low non-verbal IQ (score of &lt;85)</td>
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Reilly et al. (2014) IJLCD
What is the causal relationship of language and non-verbal ability?

Language is a fantastic problem solving tool!!

There are genetic influences on language development and disorders

- **Family aggregation**: rates of language/learning difficulties higher in relatives of children with language disorder, compared to children without language disorder
- **Twin studies**

Genetic influences similar regardless of NVIQ status

Diagnosis in co-twins of probands with specific speech/language impairment (SSLI)

- SSLI
- low language
- speech therapy
- intellectual impairment

MZ: n = 63
DZ: n = 27

Bishop et al. 1989

Language in the brain

- ‘modules’ are emergent feature of learning
- Early in development, unlikely to have ‘selective’ impairments
- Deficits in language are associated with other developmental challenges: motor skills, attention control (behaviour), social interaction
Disorder of language or learning?

- Early language learning involves multiple cortical/subcortical systems
  - Modularity long-term outcome of learning process

- Propose children with DLD have deficient cortistriatal loops involving the dorsal striatum

- These circuits implicated in complex rule-governed LEARNING

Key research questions

• If child has language disorder at school entry, what other developmental challenges are present from the start?

• How do co-occurring challenges affect language change over time?

• What is the impact of language disorder and co-occurring challenges over time?

Stage 1: population characteristics (n = 7267)

• Age: all children aged between 4;9 and 5;10

• Gender: 51% boys and 49% girls

• Ethnicity: 5959 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)

• Socio-economic status: Income Deprivation Affecting Children Index (IDACI)
  • 1 = most deprived; 32482 = least deprived
  • Mean = 21592.16 (Mean for UK 2010 = 16241.50)
  • <10000 = low SES for this study
distribution of scores on the Children’s Communication Checklist - Short

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

Stage 2: in-depth assessment

Stage 1: 7267 children screened

Exclusions
- 5499 LR
- 912 HR
- 48 NPS

636 children selected for stage 2

EAL pilot study: 61/80 EAL children seen for assessment (76%)

31 children attending special school

777 EAL children

529 children seen for Y1 assessment (83%) (150 schools)

499 children seen Y3 (95% of Y1 cohort) (180 schools)

107 children did not participate in stage 2

Oversampled "high-risk"

Oversampled girls

777 EAL children

2:1 boys to girls

69: 347

47% of sample is SUMMER BORN! (should be 33%)

this cut identifies 39% of EAL children

1% No Phrase Speech

No. Children

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38

CCC-S score (max 39: poor language)

SCALES Male

SCALES Female

12
SCALES: diagnostic framework
(after Tomblin et al. 1997)

-1.5SD on 2/5 composite scores
(below 7th centile)

NVIQ >70
(above 3rd centile)

| Non-verbal ability assessed using WPSSI block design and matrix reasoning |
|-------------------|-------------------|
| ROWPVT Receptive vocabulary | EOWPVT Expressive vocabulary |
| TROG receptive grammar | SASIT-E32 sentence recall |
| ACE Narrative comprehension | ACE Narrative Recall (info units) |

Prevalence Year 1

<table>
<thead>
<tr>
<th>Language Disorder (cause unknown)</th>
<th>% of population</th>
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<tbody>
<tr>
<td>Language Disorder (other clinical condition and/or intellectual impairment)</td>
<td>2.34%</td>
</tr>
<tr>
<td>Total Language Disorder</td>
<td>9.92%</td>
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Fewer than 12% meet early curriculum targets.
Clinical profile by diagnosis & non-verbal IQ band

<table>
<thead>
<tr>
<th></th>
<th>Low NVIQ (&gt;-2SD &amp; &lt;=-1SD)</th>
<th>High NVIQ (&gt;= -1SD)</th>
<th>Lang Disorder+</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDACI rank</td>
<td>17987</td>
<td>17770</td>
<td>18923</td>
</tr>
<tr>
<td>Communication checklist</td>
<td>19.61</td>
<td>18.06</td>
<td>25.24</td>
</tr>
<tr>
<td>Language composite (z-score)</td>
<td>-1.88</td>
<td>-1.60</td>
<td>-2.16</td>
</tr>
<tr>
<td>% Social, emotional, behavioural probs</td>
<td>9.38</td>
<td>9.85</td>
<td>51.36</td>
</tr>
<tr>
<td>Academic attainment</td>
<td>27.20</td>
<td>28.32</td>
<td>25.79</td>
</tr>
<tr>
<td>% referred to SLT</td>
<td>52.05</td>
<td>31.50</td>
<td>66.00</td>
</tr>
</tbody>
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Language is incredibly stable

![Graph showing the stability of total language score over three years with ICC = .95](image)
Language is stable
(Marc Bornstein et al.)

- In general population using multi-age, -measure, -domain, -informant (Dev Psych, 2012)
- In children at increased biological/social risk (JCPP, 2016)
- In children with contrasting language skills (Dev Psych, 2016)

- Even when taking account of maternal education, maternal language, home environment, child NVIQ, child social behaviour

![Image of scatter plot showing language stability over years with ICC = .95]
diagnostic ‘instability’ likely reflects measurement error

McKean et al. (2017). Subgroups in language trajectories from 4 to 11 years. JCPP

94% STABLE
2% low-improving:
most were learning English as an additional language

change in raw total language composite scores

What predicts slope (growth)?

• Socio-economic status
• Non-verbal IQ at intake
• Social, emotional, behavioural problems (SDQ)

• All predict starting point (i.e. associated with poorer language ability at Year 1)
• None associated with growth

Cf. Bornstein et al. (2014, 2016)

change in raw total language composite scores

features of child language...

- **growth**: individual change/development on a particular characteristic over time

![Diagram showing growth from 4 years to 11 years]

- **stability**: maintain position within a distribution on a particular characteristic over time

![Diagram showing stability from 4 years to 11 years]
Language (and height)...
- distributed within the population
- arbitrary cut-offs for ‘extreme’ scores
- highly heritable
- highly stable
- ultimately subject to environmental influences

Some challenges and questions that arise from stability...
improvement not enough to “narrow the gap” with TD peers

Stability is a challenge for understanding causal relationships

- Non-verbal cognition age 4
- Environment Age 4
- Language ability at age 11
Stability is a challenge for understanding causal relationships

Non-verbal cognition age 4

Environment Age 4

Language ability Age 4

Language ability at age 11

best predictor of later language ability is earlier language ability!!

Developmental changes in stability

School entry
Ages 4-6 years

- Golden period of developmental plasticity (get in early)?
- ‘normal’ variation
- Measurement error

- (more) Consistency in measurement
- Consistency in environmental experience
- Fewer studies of language change in adolescence

Stability estimates range from .15 to ~.50

Stability estimates exceed .85
Language delay...

• Age at onset of spoken language
  • ‘late-talkers’ (Rescorla et al. 2011): children between the ages of 18 to 20 months who have fewer than 10 words and children between the ages of 21 to 30 months who have fewer than 50 words and/or no two-word combinations

• Note 1: huge range of normal variation in onset of first words/phrases (McGillion et al.: range 355 days – 575 days for four consistent words)

• Note 2: ~50% of those identified catch up,
  • Barring any other associated risk factors, most of these children resolve early difficulties and do reasonably well on all outcome measures WITHOUT ADDITIONAL SUPPORT

Measurement of language at 2

• Duff et al. (2015): the stability of vocabulary skills from infancy to later childhood is too low to be sufficiently predictive of language outcomes at an individual level
  • Vocabulary at age 2 explained only 4% of variation in language outcome at ages 5-9 (and 11% of reading outcome)

• Bornstein et al. (2016): 15 months was too early to form reliable skill groups that predicted later outcomes.
  • only 44% of variation in language at 5 explained by language at 25 months
  • Prediction doubles at age 5
consider other risk factors...

- Family history
- Low SES background
- Behaviour problems
- Poor language comprehension
- Reported language regression
- Global developmental delay
- Lack of gesture
- Poor social engagement
- Male sex

Language is malleable...

...but *rate* of language learning may not be

*So what are the clinical/educational implications?*
change a developmental trajectory?

‘normalisation’ of language / narrow gap
  e.g. improve significantly on a standardised test of language
  LD groups must learn language faster than the TD group...

could narrow range of distribution

pre-school intervention (coupled with high quality nursery provision) to increase language capacity prior to school entry
  this will take time and considerable effort!
and someone will always be at the bottom of the language distribution...

- Ensure ‘bottom’ is functional level of language/communication/literacy
- EXTRA support at vulnerable transition periods
- Non-language/academic outcome measures

Cascading impacts

children with DLD become adolescents and then adults with DLD...

- Poor literacy
- Increased risk poor mental health
- Problems with peer relationships
- Unemployment

Key priority: mitigate risk of adverse outcomes in other developmental areas
Need to acknowledge and plan for:

• persistent language disorders: from early years to adulthood

• ‘narrowing the gap’ is unlikely without targeted, intensive, and persistent support

• on-going support from multi-disciplinary, specialist services is needed to mitigate risks of cascading, negative impacts of language disorder

Find out more about language disorder and the impact of language disorder on children and young people!

https://www.youtube.com/RADLD

http://www.lilac-lab.org

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