Language patterns
2-10 years

Cate Taylor
Child Language Research Conference
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Collaborators in studies of language patterns

- LOOKING at Language Study
  - Mabel Rice
  - Stephen Zubrick

- Longitudinal Study of Australian Children
  - Daniel Christensen
  - Stephen Zubrick
  - David Lawrence
  - Francis Mitrou
Practical reasons to look for patterns

• We want to know what to expect of children at different ages, where they are heading next and how predictable the patterns are from one age to the next
• We want to know what factors influence these patterns
• We want to fit policies and services to these patterns
Fitting policies and services to language patterns

• The job of fitting policies and services to language patterns will be easier if language patterns are stable and predictable
• The job of fitting policies and services to language patterns will not be easy if language patterns are unstable and unpredictable
• Based on the patterns we see, we have to ask the question, “How well do policies and services fit these language patterns?”
Fitting our patterns to your context

• Speech pathologists
  – The patterns you observe in children in specialist service systems may not fit the patterns we see in the general population
  – Your job is to change growth trajectories
  – Unstable growth patterns provide more scope for change than stable growth patterns (e.g., height)
Fitting our patterns to your context

- Teachers and principals working in schools in disadvantaged communities
  - The most vulnerable children in the highest risk contexts are under-represented in our studies and the patterns you see in children in your school may differ from the patterns we see in the general population
  - Do our patterns fit your patterns?
Fitting our patterns to your context

• Policies and service systems
  – Population level cohort studies are designed so the patterns fit the general population
  – With the caveats for children in specialist services and the most vulnerable children and families who are under-represented in our studies
Children in our studies

• Children in our longitudinal population based cohort studies are recruited from universal service systems (e.g., birth records)
  – The most vulnerable children and families are under-represented

• The Australian Early Development Index (AEDI) captures the total population of children in their first year of formal school and includes children who are under-represented in our studies
## WA 2009 AEDI Results

<table>
<thead>
<tr>
<th>AEDI Domain</th>
<th>At-risk 10-25&lt;sup&gt;th&lt;/sup&gt; percentile</th>
<th>Vulnerable &lt;10&lt;sup&gt;th&lt;/sup&gt; percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language &amp; cognitive skills</td>
<td>21</td>
<td>12</td>
</tr>
</tbody>
</table>

How are ‘at-risk’ and ‘vulnerable’ children distributed across suburbs in metropolitan WA?
Language patterns 2-7 years (Zubrick et al., 2007 & Rice et al., 2008)

- LOOKING at Language Study
- 1766 single-born children
  - Recruited from WA birth records
  - English spoken at home
  - No developmental disorders (e.g., Intellectual Impairment, Autism)
Low language at 2

• Ages and Stages Questionnaire Item Composite Measure
• Parent-report measure of expressive and receptive language abilities
  – Pointing to pictures, combining words, following instructions, naming objects in pictures, pointing to body parts, and using personal pronouns
• Low language was a score 1 SD or more below the mean on the ASQ Item Composite we developed using an IRT approach
Low language at 2 in the prospective cohort study

- 1766 2-year-olds
- 13% prevalence of language delay at age 2
- 3250/25,000 children born each year
Language patterns 2-7 years in a nested case-control study

• 128 children with language delay at 2
• 109 children with typical language development at 2 randomly selected
Low language at 7

- Low language defined as a score 1 SD or more below the mean on a test of general language ability (TOLD:P-3)
Four language patterns 2-7 years (Rice et al., 2008)

• Children who started behind and stayed behind
• Children who started behind and caught up
• Children who started on track and stayed on track
• Children who started on track and fell behind
Language patterns 2-7 years (Rice et al., 2008)

- Children who started behind and stayed behind
  - 20% late talkers
- Children who started behind and caught up
  - 80% late talkers
- Children who started on track and stayed on track
  - 89% of children on track at 2
- Children who started on track and fell behind
  - 11% of children on track at 2
Language growth (Taylor et al., 2013)

• Looking at language patterns from one age to the next is a study of language change not language growth

• To study language growth, we need measures of language at a minimum of 3 ages
Longitudinal Study of Australian Children

- National coverage
- Kindergarten cohort – 4, 6, 8 & 10 years
- Extensive data from multiple sources (children, parents, carers, teachers, data linkage)
One dimension of language measured

• Receptive vocabulary
• The Adapted Peabody Picture Vocabulary Test (PPVT) given at 4, 6 and 8 years
• Face-to-face measure of words understood
• Item response theory
• Vertical scaling to allow the measurement of growth
Contribution of age to growth

• Age contributed a lot to language growth
  – Accounted for 53% of the variance

• The importance of ‘date of manufacture is not as preposterous as Ken Robinson (2009) suggests:
  – “Students are educated in batches, according to age, as if the most important thing they have in common is their date of manufacture.”

• Over and above growing older, between 4-8, children started school
## Language gain

<table>
<thead>
<tr>
<th></th>
<th>Mean PPVT Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 4</td>
</tr>
<tr>
<td>Low starters</td>
<td>55</td>
</tr>
<tr>
<td>Middle starters</td>
<td>64</td>
</tr>
<tr>
<td>High starters</td>
<td>74</td>
</tr>
</tbody>
</table>

- Low starters gained 20 PPVT points
- Middle starters gained 15 PPVT points
- High starters gained 8 PPVT points
Inequalities in language growth

<table>
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While low starters gained the most points look where they finished at 8 compared to high starters.
Contribution of age to growth

• Age contributed a lot to language growth
  – Accounted for 53% of the variance
• What other child, maternal and family factors contribute to language growth?
Started with 28 predictors modelled individually in relation to language at 4

**CHILD**
- Gender
- Birthweight
- Aboriginal status
- Ear infections
- Persistent temperament
- Reactive temperament
- Sociable temperament
- School readiness

**MATERNAL**
- Age
- Education
- Work hours
- Parenting consistency
- Parenting reasoning
- Parenting warmth
- Parenting hostility
- Smoking
- Mental health distress
- Alcohol problem

**FAMILY**
- Family structure
- Number of siblings
- Income
- Health care card
- Financial hardship
- Non-English speaking
- Socio-economic area disadvantage
- Reading to child
- Playgroup
- Hours in care
16/28 predictors had an effect size $d > 0.30$ (small)

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In the multivariate model, 10/16 predictors were associated with lower language at 4.

<table>
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<tr>
<th>CHILD</th>
<th>MATERNAL</th>
<th>FAMILY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthweight</td>
<td>Age</td>
<td>Siblings</td>
</tr>
<tr>
<td>Aboriginal status</td>
<td>Education</td>
<td>Income</td>
</tr>
<tr>
<td>Persistent temperament</td>
<td>Work hours</td>
<td>Health care card</td>
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<td>Financial hardship</td>
</tr>
<tr>
<td>School readiness</td>
<td>Mental health distress</td>
<td>Non-English speaking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Socio-economic area disadvantage</td>
</tr>
</tbody>
</table>
### 10 risks for lower language at 4 from highest – lowest risk

<table>
<thead>
<tr>
<th>Risk variables modeled with the lowest level of risk as the reference category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal NESB compared to English</td>
</tr>
<tr>
<td>Low school readiness compared to high</td>
</tr>
<tr>
<td>Child not read to at all compared to child read to daily</td>
</tr>
<tr>
<td>Four or more siblings compared to none</td>
</tr>
<tr>
<td>Low family income compared to high</td>
</tr>
<tr>
<td>Low birthweight compared to normal</td>
</tr>
<tr>
<td>Low maternal education compared to high</td>
</tr>
<tr>
<td>Maternal mental health distress compared to none</td>
</tr>
<tr>
<td>Low maternal parenting consistency compared to high</td>
</tr>
<tr>
<td>High child temperament reactivity compared to low</td>
</tr>
<tr>
<td>High area socio-economic disadvantage compared to low</td>
</tr>
</tbody>
</table>
The effects of these risks on language at 4

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Age 4 Months behind in language growth</th>
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</thead>
<tbody>
<tr>
<td>Maternal NESB</td>
<td>-16</td>
</tr>
<tr>
<td>Low school readiness</td>
<td>-15</td>
</tr>
<tr>
<td>Child not read to at all</td>
<td>-12</td>
</tr>
<tr>
<td>Siblings 4+</td>
<td>-10</td>
</tr>
<tr>
<td>Low family income</td>
<td>-7</td>
</tr>
<tr>
<td>Low birthweight</td>
<td>-6</td>
</tr>
<tr>
<td>Low maternal education</td>
<td>-6</td>
</tr>
<tr>
<td>Maternal mental health distress</td>
<td>-5</td>
</tr>
<tr>
<td>Low maternal parenting consistency</td>
<td>-5</td>
</tr>
<tr>
<td>High child temperament reactivity</td>
<td>-3</td>
</tr>
<tr>
<td>High area socio-economic disadvantage</td>
<td>0.30 ns</td>
</tr>
</tbody>
</table>
The effects of these risks on language growth from 4-8

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Age 4 Months behind in language growth</th>
<th>Age 8 Months behind in language growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal NESB</td>
<td>-16</td>
<td>-4</td>
</tr>
<tr>
<td>Low school readiness</td>
<td>-15</td>
<td>-6</td>
</tr>
<tr>
<td>Child not read to at all</td>
<td>-12</td>
<td>-7</td>
</tr>
<tr>
<td>Siblings 4+</td>
<td>-10</td>
<td>-8</td>
</tr>
<tr>
<td>Low family income</td>
<td>-7</td>
<td>-3</td>
</tr>
<tr>
<td>Low birthweight</td>
<td>-6</td>
<td>-4</td>
</tr>
<tr>
<td>Low maternal education</td>
<td>-6</td>
<td>-6</td>
</tr>
<tr>
<td>Maternal mental health distress</td>
<td>-5</td>
<td>-0.3</td>
</tr>
<tr>
<td>Low maternal parenting consistency</td>
<td>-5</td>
<td>-2</td>
</tr>
<tr>
<td>High child temperament reactivity</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>High area socio-economic disadvantage</td>
<td>0.30 ns</td>
<td>-8</td>
</tr>
</tbody>
</table>
What to make of language growth patterns 4-8

• Starting position mattered
• The gap between children with and without risks narrowed but did not close completely
• Socio-economic area disadvantage was the only risk associated with lower growth
• The risks accounted for an additional 7% of the variance over and above age which accounted for 53%
• Small effect sizes equated to noteworthy developmental differences (language growth in months)
Language and literacy measures

• 4, 6 and 8 years
  – Adapted Peabody Picture Vocabulary Test (Adapted PPVT-III)

• 10 years
  – Academic Rating Scale
  – Teacher-report measure of language and literacy
The academic rating scale

- Teacher rates the child on a five-point scale (not yet proficient) on these language and literacy skills:
  - Conveys ideas when speaking
  - Understands and interprets
  - Uses strategies to gain information
  - Reads fluently
  - Comprehends text
  - Composes stories
  - Clarifies and elaborates writing
  - Corrects written drafts
  - Uses computer for reports, stories
Putting language and literacy on the same scale

- Converted PPVT scores and ARS scores to z scores
  - Mean = 0 and standard deviation = 1
- z scores retain the original relationship between the raw scores on the tests
Individual language & literacy trajectories for 20 children selected at random
5 most common language and literacy patterns from 16 possible patterns for 2792 children

<table>
<thead>
<tr>
<th>Age 4 Language</th>
<th>Age 6 Language</th>
<th>Age 8 Language</th>
<th>Age 10 Literacy</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle-High</td>
<td>Middle-High</td>
<td>Middle-High</td>
<td>Middle-High</td>
<td>1915</td>
<td>69</td>
</tr>
<tr>
<td>Middle-High</td>
<td>Middle-High</td>
<td>Middle-High</td>
<td>Low</td>
<td>202</td>
<td>7</td>
</tr>
<tr>
<td>Low</td>
<td>Middle-High</td>
<td>Middle-High</td>
<td>Middle-High</td>
<td>118</td>
<td>4</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Middle-High</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>26</td>
<td>1</td>
</tr>
</tbody>
</table>

- Start on-track and stay on-track is the most common pattern
- Start behind and stay behind is the least common pattern
Observations about language patterns

• We can identify children with low language at all ages starting at 2 years
• We can identify child, maternal and family risks for low language at all ages
• We know that children move in and out of ‘low language’ groups 2-10 years
• We know risks for low language change over time and that children grow out of some risks and into other risks
• Looking forward, from any age, we can’t tell which children will ‘stay the same’, ‘catch up’ or ‘fall behind’
How to respond to language patterns 2-10 years

- Findings point to integrated services to improve child outcomes and reduce parental and family risk factors
How to respond to language patterns 2-10 years

- Identifying children with ‘low language’ at any age will include children who catch-up and miss children who fall behind with age
How to respond to language patterns 2-10 years

- Finland, the highest ranking country on early childhood education quality indicators (Economist Intelligence Unit, 2012) applies a ‘light touch’ to identifying ‘at risk’ children for targeted services and a ‘heavy hand’ to the quality of universal services.