The School Achievement of Children with Asthma

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Structure of Presentation

1. Limitations of Literature
2. Community Study
3. Prospective Cohort Study
4. Pilot: Children’s Oral Reading Study
5. Questions
Previous Studies of Children with Asthma and School Performance

• Mixed results
• Any differences assumed association with school absence
• Limitations
  – Mixed age groups, no controls for length of time in school
  – Exclusion of children with learning disabilities
  – Lack of controls for known confounds of achievement in design/ measurement or analysis
  – Comparison of mean scores instead of looking at distributions: i.e., % of children substantially below peers
## Achievement of 9 Year Olds

| • Funding from University of Canterbury |
| • Approval from UC Human Ethics Committee |
| • Design |
|   – Community Sample |
|   – First standard achievement tests administered at Age 9 |
|   – Invitations by schools to 572 parents, 232 consented (40.6%) |

| • Recruitment to minimise impact of low SES on |
| • 11 randomly selected mid-decile Schools |
|   – Inclusion Criteria: children turning 9 years of age during study year |
|   – Exclusion Criteria: children receiving ongoing special education services for severe disability |

Community Study

Measures

• Parent Interview
  – Demographics
  – Health
  – Social Factors
  – Home Situation

• School Records
  – Attendance
  – School Health Card and Records
  – Achievement Test Scores
    • March of School Year age 9
  – Participation in Remedial Programmes
  – School Changes

Sources for Parent Interview

• National Health Interview Survey (US); Centers for Disease Control, Atlanta
• National Survey of American Families (US);
• Child Behavior Checklist
• Connors Scale
• Pediatric Symptom Checklist
• Child Trends: Positive Behavior Scale
Age 9 Study Sample

We achieved a predominantly mid and high income sample, as planned

<table>
<thead>
<tr>
<th>Data Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>229</td>
</tr>
<tr>
<td>Gender</td>
<td>48% Boys, 52% Girls</td>
</tr>
<tr>
<td>Family Income</td>
<td>30.2% High, 54.9% Mid, 14.9% Low</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>86.5% NZ European/Pakeha, 5.7% NZ Maori, 1.8% Pacific Island, 1.7% Asian, 4.4% Other</td>
</tr>
<tr>
<td>Lived with biological mothers</td>
<td>97.4%</td>
</tr>
<tr>
<td>Attended early childhood education</td>
<td>98.3%</td>
</tr>
</tbody>
</table>
Results: Health vs. Reading Achievement Age 9

Mean Parent-Reported Health Problems Last 12 Months

Stanines

reading achievement test

Low

Average

High

1

2

3

4

5

6

7

8

9
Which health condition was most often linked to low achievement?

**Asthma** was the health condition most frequently linked to low achievement in the 9 year olds from the mid-decile schools we studied.

- 38% of children had “asthma ever” by parent-report
- Accounting for:
  - 66% of all low achievers in reading
  - 70% of all low achievers in maths
## Results: Mean Achievement of 9 Year Olds

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Reading Score</th>
<th>Mean Math Score</th>
<th>Listening</th>
<th>Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children with Asthma Ever</td>
<td>5.40</td>
<td>5.64</td>
<td>5.82</td>
<td>5.90</td>
</tr>
<tr>
<td>Children without Asthma</td>
<td>5.74</td>
<td>5.89</td>
<td>5.93</td>
<td>6.08</td>
</tr>
</tbody>
</table>
Results: Functional Analysis of Achievement

- Functional Analysis
  - Concern of educationalists
- Low Achievement
  - Definition used in this study = >1.5 years behind peers
  - After 3 years of school

Frequency of Low Achievement in 9 year old Mid-Decile School Children

- Reading
- Math
- Spelling
- Listening

Asthma
Non-Asthma
## Prediction of Low Achievement

The presence of asthma at age 5 was a significant predictor of low achievement in reading [OR 2.26 (95%CI 1.049;4.734)] and math [OR 4.789 (95%CI 1.648;1.533)] even when confounding factors were included in the predictive model.

<table>
<thead>
<tr>
<th>Factor</th>
<th>$R^2$ Nagelkerke</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days absent</td>
<td>.056</td>
<td>.011</td>
</tr>
<tr>
<td>Short attention span</td>
<td>.125</td>
<td>.001</td>
</tr>
<tr>
<td>Presence of asthma</td>
<td>.167</td>
<td>.014</td>
</tr>
</tbody>
</table>
We lifted Rosie up.  
She looked at the lion.  
It walked up and down, up and down, looking at us.

"Feel that?"
Pete nodded.  "You wouldn’t really break it, would you?"

Without Pete noticing, Patrick hid the egg in his other hand.  He tapped Pete’s head with two of his fingers instead.  
"Feel that?"
"Is it broken?" Pete asked.
"It’s cracked,“ said Patrick.  He tapped harder with his fingers.  “Now it’s broken.”  
Pete squirmed, full of anticipation.  
Patrick opened his fingers and fanned them down the sides of Pete’s head.
Limitations of Community Study

• Sample
  – low recruitment rate
  – not representative
  – likely to under-represent low achievement
• No independent confirmation of asthma or severity
• No measure of ability
• No independent measure of achievement
Prospective Cohort Study at Age 5

Why study 5 year olds from the start of schooling?

- Prospective-before low achievement is manifest
- Community study children were about 1.5 years behind after completing 3 years of school, so logically, children must start to fall behind during the first year in school

Design

- **Prospective Cohort**
  - Measures at School Entry and after 12 months

- **Ethics Approval Upper South A**

- **Recruitment**
  - Randomly selected schools / stratified by decile
  - Consecutive entrants
  - 93.7% recruitment
  - 93.3% Retention

- **Measures**
  - Parent Interview
    - ISAAC
  - Wechsler Intelligence Scale for Children
    - Vocabulary
    - Block Design
  - Wechsler Individual Achievement Test
    - Word Reading
    - Math
  - Individual Test of Oral Reading
    - Story Reading
  - School absences
Age 5 Study Sample Characteristics

More representative sample than in age 9 Study

- **N=298**
- **Gender**
  - Boys 48.9%
  - Girls 51.3%
- **Living Situation**
  - Living with two parents 77.8%
  - Living with one parent 20.5%
  - Living in other situation 1.7%
- **SES**
  - High 21.7%
  - Mid 40.9%
  - Low 37.6%
- **Ethnicity**
  - European 74.8%
  - Māori 15.8%
  - Other 9.4%
# Classification of Respiratory Status

1. Parent Report using ISAAC
2. Physician report
3. Clinical Review
4. Two Groups

**Children with Current Asthma**
- (N=55); 18.5%
- Diagnosis of asthma & current wheeze past 12 months
- Asthma severity
  - low (23.6%),
  - mild (32.7%),
  - moderate (34.5%),
  - high (9.1%)

**All Other Children (N=243)**
# Respiratory Classification at Age 5

<table>
<thead>
<tr>
<th>Respiratory Category</th>
<th>Current</th>
<th>Past</th>
<th>Ever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>18.5%</td>
<td>2.7%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Wheeze</td>
<td>9.7%</td>
<td>12.1%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Other</td>
<td>7.0%</td>
<td>6.4%</td>
<td>13.4%</td>
</tr>
<tr>
<td>Total</td>
<td>35.2%</td>
<td>21.1%</td>
<td>56.4%</td>
</tr>
<tr>
<td>Never Resp.</td>
<td></td>
<td></td>
<td>43.6%</td>
</tr>
</tbody>
</table>
Baseline Comparisons on Variables Associated with Achievement

No significant differences between asthma & control for any variable

- SES
- Single parent household
- Gender (Boys)
- Minority status
- Low Estimated IQ
- Low Readiness for Reading
- Low Readiness for Math
Results

- Low Achievement
- Definition used in this study = >6 months behind peers
- (about same as in community study)
- Only been in school for 12 months

Frequency of Low Achievement in 6 year old Children after One Year of School

* p < .05
### Prediction of Low Achievement

Logistic Regression for Low Achievement in Word Reading

<table>
<thead>
<tr>
<th>Final Model</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor readiness</td>
<td>5.56</td>
<td>3.2-9.6</td>
</tr>
<tr>
<td>Current asthma</td>
<td>2.29</td>
<td>1.13-4.67</td>
</tr>
</tbody>
</table>

Logistic Regression for Low Achievement in Story Reading

<table>
<thead>
<tr>
<th>Final Model</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor readiness</td>
<td>5.70</td>
<td>3.26-9.95</td>
</tr>
<tr>
<td>Low SES</td>
<td>2.50</td>
<td>1.43-4.38</td>
</tr>
<tr>
<td>Current asthma</td>
<td>2.03</td>
<td>1.01-4.07</td>
</tr>
</tbody>
</table>
Low Achievement

“No. No. No.
I don’t like pie.”

High Achievement

When spring came again,
Sally was not a little lamb.
She was a big woolly sheep.

“Sally is as woolly
as a big fat cloud,”
said Oscar.

“Time for Sally’s haircut,”
Grandpa said.
Why learning to read is challenging

- Information Processing Demands
- Phonological Processing
- Orthographic Processing
- Oral Motor Planning and Execution
- Breathing and Speech Coordination

• What New Zealand does to help children learn to read in the junior years
  - Devotes a significant amount of time each day to reading
  - Careful control of introduction of sounds and words in stories
  - Quality of stories respected internationally
  - Teachers individualise beginning reading progression
Why would children with asthma have more problems?

1. Not more likely to have low intelligence
2. School absence not satisfactory explanation
3. Studies have shown differences in the speech breathing of children with asthma.
4. Could the difficulty of managing breathing at the same time the child with asthma was learning to read contribute to low achievement?
5. No studies on the relationship between breathing and asthma and beginning reading.
Pilot Investigation of Breathing During Oral Reading

Research Question

• Does asthma affect breathing patterns during children’s oral reading?
  • Does increased story difficulty disrupt breathing while reading?
Method

- Two groups: children with asthma and normal controls
  - N= 11 per group
  - 4 girl and 7 boys
  - age- and gender-matched (somewhat)
  - Chronological age: 5-9 years
  - Language age not significantly different
  - Asthma severity: high (6) moderate (4) mild (1)

- Measure of breathing must not interfere with reading or cause stress
- Child must be able to hold book, turn pages, etc.
- Non-contact measurement of breathing
  - Laptop computer with a built-in omni-directional microphone
  - Audacity 1.2 software
Breathing Measured Across a Task Sequence of Increasing Challenge

1. Quiet Breathing
2. Sustain the ‘ā’ sound
3. Recite the alphabet
4. Talking
5. Easy Reading (age 5.5)
6. Instructional Reading (age-based)
7. Hard Reading (age + 1 year)
8. Quiet Breathing
Results

When reading aloud became challenging,

• Children with asthma
  – Breathed more slowly
    as compared to easy reading
    (28 v. 21)
    as compared to controls
    (21 v. 27)
  – Paused for longer periods of time
    as compared to easy reading
    (502 v. 1036)
    as compared to controls
    (1036 v. 620)

  – Showed increased duration of expiration (could be saying more words on a single breath)
    as compared to easy reading
    (1732 v. 2042)
    as compared to controls
    (2042 v. 1708)

- HIGH INDIVIDUAL VARIABILITY
Sample reading
Implications

• Of course, more research

• Considerations
  – Once fall behind, do not tend to catch up
  – Self-concept as a reader?

• Children with asthma
  – As they start school, explain about learning to read as a long-time process
  – May need encouragement to persist in learning to read
  – Breathing training?
References

References


References


One last thought to consider: If children with asthma grow up to be poor readers, their ability to read, understand and follow asthma care plans as adults is likely to be affected.

Questions?