Early language development: What we know about causes, behavioural outcomes and early school achievement from the QNTS twins

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...And the twins and their families!
Making empirical data useful

The questions:
- What places a child at risk of a language delay?
- How stable are early delays?
- What are the consequences of early language delays at school entry?

The contributions of research to policy
- Prospective population-based longitudinal studies
- The added benefits of family studies
- Experimental studies
- Studies of mechanisms
1. The course of preschool language development
   A. Overall stability of early individual differences: Trajectories
   B. Prospective outcomes of early delays
   C. Who do we miss in early assessments?
   D. Summary

2. Causes
   A. Predictors of early vocabulary
   B. Genetic and environmental etiology of language trajectories
   C. Predictors of language outcomes after an early delay
   D. Summary

3. Outcomes
   A. Achievement outcomes
   B. Behavioural outcomes
   C. Summary
The course of preschool language development
A few notes on language measures

Assessments at 18, 30, 60 and 84 months (ongoing) Longitudinal N=620

In this presentation the focus is on vocabulary:
- Because it has been shown to capture well between child variance in this age range

Type of language outcomes used:
- Individual measures, 18-month expressive vocabulary
- Longitudinal outcomes of early delays
- Longitudinal outcomes as developmental trajectories
Vocabulary development trajectories

- Stable high
- Average
- Low average
- Stable low

Outcome

18 months 30 months 60 months

Percent

4.1 24.6 59.7 116

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Prospective outcomes of early delays:

Where do children in the first quartile at 18-months end up?

- 58% remain below average whereas 42% make it up to the average trajectory.

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Who do we miss in early assessments?

Early vocabulary score range for children in the lowest trajectory (Z scores of mean = 0):
- 18 month: -2.16 to -.45  
  No false positives
- 30 month: -3.85 to -2.02

Early vocabulary score range of children in the low average trajectory (Z scores of mean = 0):
- 18 month: -1.96 to 1.54  
  10% false negatives
- 30 month: -2.91 to .81  
  25% false negatives

Early vocabulary score range of children in the highest trajectory (Z scores of mean = 0):
- 18 month: all above 1 SD  
  No false positives
- 30 month: all above average
- 60 month: 9% below average

Most false negatives are in low SES families: validity of parent assessment?
Summary for language trajectories

- Relative stability: a word of caution
- 42% of children in the first quartile at 18-months catch up to the average trajectory, 71% of those do so by 30-months
  - Conclusion: Most who catch up do so early
- All children in the lowest trajectory are below average at onset: no false positives.
- From 10% to 25% of children in the low average trajectory were not identified early
- Implications for early screening:
  - Need for early monitoring of language
  - Need for proper screening tools, especially in lower SES families

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Causes
A note on genetically informative data

We do not measure genes directly (not yet!) but make inferences based on two comparison criteria:

1. Genetic make-up: Identical twins (MZ) share 100% of their genetic make-up; Fraternal twins (DZ) share 50% of their genetic make-up

2. Family environment: Twin pairs grow up with the same parents in the same family

We look for twin similarities within pairs:

- If MZ twins are more similar than DZ = genetic effect
- If both types of twin pairs are highly similar = family effect of that is not genetic (environmental)
Predictors of 18-month vocabulary

What co-twin scores tell us:
- MZ co-twin score accounts for 78% of variance
- DZ co-twin score accounts for 51% of variance

Conclusion: Strong familial aggregation which is partly genetically mediated

Gender: Boys have significantly lower scores

Perinatal risk: Interaction effect between two risk factors: premature and low birthweight babies are at risk regardless of Apgar score, high birthweight babies are at risk if low Apgar score

Income and maternal education: No effect

Conclusions: Genetic and perinatal risks show early
Trajectory etiology

Cross-twin similarities for each trajectory
Trajectory predictors

- **Co-twin score**: All trajectories differ based on co-twin scores
- **Income**: All trajectories differ on income except for the two above normal trajectories

- **Maternal education**: Both below average trajectories differ from above average trajectories
- **Maternal perception of impact**: Both below average trajectories differ from above average trajectories
- **No gender or perinatal differences between trajectories**
- **Conclusions**: Double liability (genetic and environmental) for the lowest trajectory – perinatal risks have resorbed

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What predicts outcomes of early delays

The **stable low children**:  
- come from lower income families
- co-twin is more likely to also have low language
- assessed as less sociable at 5 months than those who make it to the **low average trajectory**

The children who make it up to the **average trajectory** have:  
- mothers with higher education attainments
- co-twins with higher language scores than the **stable low children**

There are no gender differences or perinatal risk differences for the different outcomes
Summary for predictors

- **Strong familial aggregation**: Most of it seems to have an environmental origin except for the lowest trajectory children who seem to have a strong genetic liability.
- **Early effect of perinatal risks** diminish over time.
- **Gender differences** disappear over time.
- **Temperamental differences** may have a protective effect: why?
- **Socio-demographic and parental variables** have an increasing effect over time.

**Conclusions:**

- **Genetic liability**: shows up early and predicts stability of the lowest group; children with early delays but low genetic liability have better outcomes.
- **Environmental conditions**: Is an added liability in the lowest group; can have a protective effect on early delays; make the difference between good and excellent?
Outcomes
Achievement outcomes

- **Non-verbal IQ** (rater 60 months): Differences between above and below average trajectories

- **School readiness** (rater 60 months): Lowest is the low average group; above average groups fair better

- **Reading** (teacher at 72 months and rater at 96 months): Stable low versus both above average groups

- **Math** (teacher at 72 months and rater at 84 months): Lowest is the low average group at 72 months; all trajectories differ on rater outcome at 84 months.

- **Language outcomes** (teacher at 72 months and rater at 96 months): All trajectories differ on outcome.
Achievement differences based on outcome of early delay

Late talkers versus **stable low** and **low average**

- Late talkers perform better than both below average groups on math, reading and language outcomes
- Late talkers perform as well as the average group on math, reading and language outcomes
- **Non verbal IQ**: Late talkers have higher NV IQ
Hyperactivity

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Summary for outcomes

- Overall, **language trajectories** predict both achievement and behavioural outcomes.
- **Stability of trajectories**: Trajectory groups continue to differ on language outcome at 84 months.
- The **low average** group seems more at risk on school readiness and math.
- The **stable low** group has the lowest reading outcome.
- The **late talkers** do as well as the average group on achievement outcomes **BUT** have **behavioural** outcomes similar to below average groups.

**Conclusion**: Language trajectories are highly predictive of early school achievement; early delays have enduring consequences on behaviour.
Take-home message

- What places a child at risk language-wise?
  - The genetic liability
  - The double genetic/environmental liability

- How stable are early delays?
  - By 30 months they are very stable

- What are the consequences of language trajectories at school entry?
  - They predict achievement and behavioural outcomes
  - Early delays have enduring consequences on behaviour