Family Size Effects on Child Health: Evidence on the Quantity-Quality Trade-off using the NLSY

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Research Summary

Research Motivation

- The Quantity-Quality trade-off (QQ) theory predicts a negative relationship between family size and child quality.
- Family size literature has focussed mainly on children’s cognitive development.
- Lack of research with respect to child health outcomes of changes in family size.
- The study focuses on family size effects on important child health outcomes.
Analysis and Conclusion

- The study uses body weight indicators as the main outcomes of interest.
- **Data:** NLSY79 (mother’s cohort) matched with NLSY CYA (Child and Young Adult surveys).
- **Identification:** Instrumental variable regression (supported by multiple robustness checks) & panel data analysis using child fixed effects.
- **Key finding:** The study does not find strong evidence in support of the QQ theory.
Main Contributions

- First study to systematically analyze the effects of child health using a US-based sample.
- The study looks at multiple health and behavioral outcomes to explain the underlying mechanism of the observed impacts.
- Policy implications - Increase in family size has a negative relationship with chances of being overweight (obese), but in some cases, may also lead to an increase in the likelihood of being underweight.
Family Size and Child Quality

- The QQ theory was first proposed by Becker and his co-authors (Becker 1960; Willis 1973; Becker & Tomes 1973; Becker & Lewis 1976).
- Given fixed level of parental resources (time, money, care), exogenous increases in family size lead to an increase in the shadow price of child quality.
- Shortage of research and lack of consensus among researchers with respect to family size-child health relationship.
- Commonly used IV - Exogenous variations in family size are generated by twin births and parental preference for a mixed sex composition of their children.
Child Health & Family Size

Two existing theories:

- Considering child health is a function of parental resources and market based health inputs, the QQ theory would imply that there is an inverse relationship between family size and child health.

- The Hygiene Theory - Children in larger families are likely to experience early exposure to various diseases that develops future immune system (Strachan 1989).
Measures of Health Outcome

- Child’s body weight is an important health indicator.
- Obesity is associated with long term health implications including diabetes, heart diseases, hypertension, and cancer.
- Underweight increases risk of mortality and affects cognitive development.
- Economic hardships and food insecurity may place children at the risk of having extreme body weight outcomes.
- Childhood obesity is more prevalent in the US compared to childhood underweight (16.9 % Vs 3.5%, NHANES, 2012-2013).
The National Longitudinal Surveys

- Child information are obtained from the biennial Child and Young Adult Surveys (NLSY CYA, 1986-2012)
- NLSY CYA are based on a total 11,511 children belonging to 4,931 mothers from the original cohort of the National Longitudinal Surveys of Youth (1979).
- The mother-child dataset is created by matching mothers’ information with their children’s information.
- The analysis focuses on children aged between 2 and 17.
Dependent variables are child BMI and binary indicators for whether a child is overweight, obese, underweight (and of healthy weight) (CDC, 2000).

The explanatory variable is the number of household member aged under 18.

Controls:

- **Child**: Age, birthweight, sex, race, and birthorder.
- **Mother**: AFQT scores, Rotter Scale, Highest grade completed, and BMI.
- **Family**: Net total income (real terms) and HOME-SF raw score.

Additional child health and behavioral outcomes include sibling relationships, hours of watching TV during weekdays, and incidence of illness that requires medical attention.
Empirical Strategy- Cross-sectional Analysis

- We perform probit (OLS) regressions for binary (continuous) health indicators.
- For the IV regression analysis, we estimate:
  \[ Y_{it} = \beta_0 + \beta_1(\text{HHsize}_{it}) + X_{it}\beta_2 + \epsilon_{it} \]  
  \[ \text{HHsize}_{it} = \alpha_0 + \alpha_1 Z_{it} + X_{it}\alpha_2 + v_{it} \] 
- \( \beta_1 \) estimates the family size impact on child health outcomes measured by \( Y_{it} \).
- Equation (2)- The first-stage of the IV regressions, where \( Z_{it} \) is our instrumental variable.
  - Twin IV - \( Z_{it} \) is a binary indicator that equals 1 if there is a twin in the family.
  - Same-sex siblings IV- \( Z_{it} \) is a binary indicator that equals 1 if a family’s first two children are of the same sex.
Household size and Illness- What the data suggests

![Graph showing the relationship between household size and the chances of a child falling ill. The x-axis represents the age of the child as of the survey year, ranging from 0 to 18 years. The y-axis represents the chances of falling ill, ranging from 0.2 to 0.7. Two lines are depicted: one for children with only one sibling and another for children with two or more siblings. The graph indicates that the chances of falling ill decreases as the age of the child increases, and children with only one sibling are less likely to fall ill compared to children with two or more siblings.]
IV regression analysis

- Unrestricted sample (UR): Child resides with mother.
- Restricted sample (R): Child resides with both parents.

Table: Household size effects on child body weight

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>BMI</th>
<th>Overweight</th>
<th>Obese</th>
<th>Underweight</th>
<th>Healthy weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UR</td>
<td>R</td>
<td>UR</td>
<td>R</td>
<td>UR</td>
</tr>
<tr>
<td>OLS/ Probit</td>
<td>-0.210*</td>
<td>-0.234**</td>
<td>-0.012**</td>
<td>-0.015**</td>
<td>-0.013***</td>
</tr>
<tr>
<td>N (UR=11733) (R=7193)</td>
<td>(0.057)</td>
<td>(0.081)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Twin IV</td>
<td>0.444</td>
<td>-0.344</td>
<td>0.064</td>
<td>-0.037</td>
<td>0.017</td>
</tr>
<tr>
<td>N (UR=11280) (R=6915)</td>
<td>(0.344)</td>
<td>(0.649)</td>
<td>(0.041)</td>
<td>(0.069)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Sex-ratio IV</td>
<td>-0.642</td>
<td>0.206</td>
<td>-0.177</td>
<td>-0.183</td>
<td>-0.101</td>
</tr>
<tr>
<td>N (UR=3485) (R=2279)</td>
<td>(1.534)</td>
<td>(1.843)</td>
<td>(0.112)</td>
<td>(0.139)</td>
<td>(0.117)</td>
</tr>
</tbody>
</table>

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## Additional Outcomes

**Table:** Household size effects on additional outcomes

<table>
<thead>
<tr>
<th></th>
<th>Probit / OLS</th>
<th>Twin IV</th>
<th>Same sex IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UR</td>
<td>R</td>
<td>UR</td>
</tr>
<tr>
<td>Sibling relationship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.018**</td>
<td>0.048***</td>
<td>0.146***</td>
<td>0.526**</td>
</tr>
<tr>
<td>(0.008)</td>
<td>(0.010)</td>
<td>(0.049)</td>
<td>(0.239)</td>
</tr>
<tr>
<td>11673</td>
<td>7051</td>
<td>11278</td>
<td>3591</td>
</tr>
<tr>
<td>TV viewing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.017*</td>
<td>-0.035**</td>
<td>-0.050</td>
<td>-0.361</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.013)</td>
<td>(0.066)</td>
<td>(0.297)</td>
</tr>
<tr>
<td>8964</td>
<td>4726</td>
<td>8150</td>
<td>2711</td>
</tr>
<tr>
<td>Medical Illness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.029**</td>
<td>-0.030***</td>
<td>0.030</td>
<td>0.053</td>
</tr>
<tr>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.037)</td>
<td>(0.127)</td>
</tr>
</tbody>
</table>
| 18544                    | 11549        | 17840   | 5678        | 3810
Main findings - Cross-sectional Analysis

- OLS/ Probit estimates suggest that increase in household size by an additional member improves child health outcomes.

- We do not find any significant health effects of household size in the IV regressions.

- Consistent with some previous studies, we do not find evidence of a QQ trade-off.

- Increase in sibling size is likely to be associated with positive health externalities.
Potential Empirical Concerns & Panel Regression

- Exclusion restriction assumption may not be valid - Close birth spacing (twin IV) and economies of scale (Sex-ratio IV).
- Sample selection issues - Effects of family size variations in large families may differ from size changes in smaller families.
- Household size is a broader definition of family size.
- As a further robustness check, we perform panel regression analysis controlling for unobserved child fixed effects that may bias the causal estimates of family size effects.
- To accurately measure the effects of changes in family size, we look at the effect of birth of a younger sibling on health outcomes of older siblings.
Fixed Effects Regression Model

- Health effects of birth of a younger sibling -
  \[ Y_{ijt} = \gamma_0 + \gamma_1 \{after\}_{ijt} + X_{ijt} \gamma_2 + a_i + u_{ijt} \] (3)

- Variations in health outcomes across successive births of younger siblings -
  \[ Y_{ijt} = \rho_0 + \sum_{j=i+1}^{N} \mu_j \{after\}_{ijt} + X_{ijt} \rho_2 + a_i + e_{ijt} \] (4)
### Panel Analysis - Equation (3) estimates

**Table:** Fixed effects estimates of family size variations

<table>
<thead>
<tr>
<th></th>
<th>BMI</th>
<th>Overweight</th>
<th>Obese</th>
<th>Underweight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unrestricted Sample (N=17264)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth of a younger sibling</td>
<td>-0.344*** (0.114)</td>
<td>-0.021** (0.009)</td>
<td>-0.020** (0.008)</td>
<td>0.012** (0.006)</td>
</tr>
<tr>
<td>Short-term (0-3 years)</td>
<td>-0.276** (0.140)</td>
<td>-0.014* (0.011)</td>
<td>-0.018** (0.009)</td>
<td>0.013</td>
</tr>
<tr>
<td>Long-term (3+ years)</td>
<td>-0.385*** (0.126)</td>
<td>-0.027** (0.011)</td>
<td>-0.021** (0.009)</td>
<td>0.012*</td>
</tr>
<tr>
<td><strong>Restricted Sample (N =10359)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth of a younger sibling</td>
<td>-0.289* (0.157)</td>
<td>-0.026** (0.012)</td>
<td>-0.025** (0.010)</td>
<td>0.006</td>
</tr>
<tr>
<td>Short-term (0-3 years)</td>
<td>-0.275 (0.183)</td>
<td>-0.020 (0.013)</td>
<td>-0.020** (0.010)</td>
<td>0.006</td>
</tr>
<tr>
<td>Long-term (3+ years)</td>
<td>-0.301* (0.183)</td>
<td>-0.032** (0.014)</td>
<td>-0.028** (0.011)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

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*Family Size and Child Health*
Family Size Effects Across Successive Births - Body weight

Effects of additional siblings
Coefficients from fixed effects panel regression
(Unrestricted sample)

Effects of additional siblings
Coefficients from fixed effects panel regression
(Restricted sample)

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Additional Child Outcomes - Fixed Effects Analysis

Effects of additional siblings
Sibling relationship
Coefficients from fixed effects panel regression

Effects of additional siblings
Watching TV
Coefficients from fixed effects panel regression

Effects of additional siblings
Incidence of Illness
Coefficients from fixed effects panel regression
Increase in family size by an additional child reduces the likelihood of obesity for older siblings.

However, increase in family size may also lead to an increase in the probability of being underweight.

Birth of younger siblings (at lower parities) may lead to a decrease in the probability of falling ill (Hygiene theory) and lowers the frequency of watching TV during weekdays at higher parities.
Concluding Remarks

- Child quantity may not affect child health as increase in shadow price of parental investments are likely to be offset by positive health externalities in large sibship size.

- This study is an important empirical contribution to family and child health literature.

- Results from this study have important policy implications.

- Parental investments are not only determined by child quantity but may also depend on parental priorities regarding child development.

- In the presence of resource constraints, child health may be more important to parents than child’s cognitive development.
Thank you very much for your time!!