Comprehensive Early Childhood Development Support Systems and Academic Achievement

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New York University

NBER SI Children 2022
July 29th, 2022
Comprehensive Support Systems

- Early childhood interventions aims to reduce early inequalities.
- **Shonkoff and Philips (2000)**: fragmented + multiple entry points ⇒ inconsistent early **detection** systems and lack of **complementarity** of interventions to solve complex problems.

- **Comprehensive support systems** Array of early detection systems and array of services for children and their families.

- 2007: **Chile Crece Contigo** (*Chile Grows with You*)
Objective: *promote the development of children who participate in the public health network*

Target Population: all children and their families from gestation until the first years of schooling.

Changes introduced:

- Introduce *coordination* of all services for children and their mothers from age zero to five.
- Supply of services *expanded* with the focus changed from biomedical to bio-psychosocial approach.

ChCC offers multiple services to all children that attends the public health system, but some services are offered only based on need.

Gradual Implementation: June 2007 - July 2008
Chile Crece Contigo Rollout

Proportion of Municipalities Participating in ChCC:
- June 2007
- July 2007
- August 2007
- September 2007
- October 2007
- November 2007
- December 2007
- January 2008
- February 2008
- March 2008
- April 2008
- May 2008
- June 2008
- July 2008

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Research Question

What are the long-term effects of exposure to the comprehensive support system in human capital accumulation?

Main results:
- Exposed since gestation vs Non-eligible: 0.25SD in mathematics and 0.30SD language standardized test scores.
- Heterogeneous returns and heterogeneous exposure
  - Male recipients have higher returns to exposure than female recipients.
  - Referral mechanism partially explains these differences.

Main contributions:
- Contributes to the existing literature on the effects of early childhood interventions later in school outcomes.
- Provides evidence of the returns of comprehensive support systems.
- Contributes to the limited evidence of Chile Crece Contigo.
Data

- Combines three sources of data: Ministry of Education, Quality of Education Agency and Ministry of Social Development.
- Seven cohorts of first-time 4th graders (2012-2018) in public or private subsidized schools.
- Born between July 2001 and June 2009.

**Standarized Test Scores 4th-grade**
- (+) Reading Test Scores
- (+) Mathematics Test Scores
- (+) Background Information

**MINEDUC Enrollment Data**
- (+) Municipality of residence
- (+) Attendance
- (+) GPA

**Implementation Dates ChCC**
- (+) Month and Year of Implementation

**Descriptive Statistics**
Empirical Strategy: Measuring Exposure to ChCC

- Leverage institutional implementation: (i) gradual roll-out of the policy and (ii) only children younger than 60 months eligible.
- Child $i$ who lived in municipality $m$ born in period $t$ had $A_{imt}$ when ChCC was implemented

\[ A_{imt} = t - E_{mt} \]

- Level of exposure $D_{imt}$

\[
D_{imt} = \begin{cases} 
1 & \text{if } A_{imt} < -8 \\
(67 - A_{imt})/67 & \text{if } -8 < A_{imt} < 60 \\
0 & \text{if } A_{imt} \geq 60 
\end{cases} \quad (1)
\]
Empirical Model: Cumulative Exposure Event-study design

- Event-study design

\[ Y_{imt} = \alpha + \sum^{70}_{a=-18[a \neq 60]} \pi_a \mathbb{I}[A_{imt} = a] + X_{imt} \beta + \gamma_m + \tau_r t + \delta_s + \epsilon_{imt} \]  

(2)

Where:

- \( Y_{icst} \): outcome (annual attendance, language and mathematics test scores)
- \( X_{ics} \): vector of control variables: maternal schooling, and gender and age of the student (in months).
- \( \gamma_m \): municipality time-invariant effects.
- \( \delta_s \): school time-invariant effects.
- \( \theta_r \times t \): regional month-of-birth trends
- \( \epsilon_{imst} \): error term clustered at municipality level.

- This models allow me to estimate difference only “from above” (Hoynes et al. (2016), Bailey et al. (2021), Bailey et al. (2020))
Event Study Parameters, full sample

(a) Mathematics

(b) Language

(c) Annual Attendance

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Event Study Parameters, by student gender

(a) Mathematics

(b) Language

(c) Annual Attendance
Gender Differences (cont)

- Previous research have shown higher returns for girls compared to boys (Conti et al., 2019; García et al., 2018; Magnuson et al., 2016; Heckman et al., 2013).

\[
\hat{\pi}_j^a = Pr(N = 1|j) \times \Delta^j \text{ for } j = M, F
\]

- Then, from the previous results,

\[
\hat{\pi}_a^M - \hat{\pi}_a^F = Pr(N = 1|M)\Delta^M - Pr(N = 1|F)\Delta^F > 0
\]

\[
\frac{Pr(N = 1|M)}{Pr(N = 1|F)} \frac{\Delta^M}{\Delta^F} > 1
\]

- If \( Pr(N = 1|M) > Pr(N = 1|F) \) it is possible have higher returns for female recipients but exposure returns higher for male recipients.
Ratio of Tested Children Referred to Stimulation Services, by gender and age

Note: Author’s calculation based on the 2018 Monthly Statistical Reports from the Chilean Department of Health Statistics and Indicators (DEIS). Each point represents the proportion of children that a psycho-motor screening test was applied and receive a referral to assist to stimulation services. This can be calculated based on the sum of service code 06902601, 06902602, and 06902603 divided service code 02021740 for each age and gender group.
Conclusion

- Children exposed since the prenatal period have returns of $0.25\sigma$ in mathematics and $0.3\sigma$ in language.
- Returns concentrate in the first 36 months of age.
- Male recipients have 50% higher returns in mathematics and 30% in language when exposed before 12 months of age.
- Intensity of treatment is higher for male recipients (need-based services).
Thank you
Bio-psychosocial evaluation applied during prenatal care stage

Pauta de Riesgo Psicosocial

Nombre: ____________________________
F echa de nacimiento de la gestante: ____________
E edad gestacional al ingreso: ____________
Fecha control de ingreso: ____________
Fecha control 3° trimestre: ____________

Nombre evaluador/ a: ____________________________
F irma evaluador/ a: ____________________________

1. Ingreso a control prenatal posterior a las 20 semanas
2. Excaridad menor a ocho meses
3. Hdad menor a 17 años y 11 meses
4. Rechazo al embarazo.
   ¿Ha pensado en interrumpir la gestación?
   ¿Preferiría no estar embarazada?
   Marque SI, si pensó en interrumpir o aún se siente así.
5. Insuficiente apoyo social o familiar
   ¿Se siente insatisfecha con el apoyo de la familia y/o pareja durante el embarazo?
   Marque SI, si siente que no cuenta con el apoyo necesario.
6. Síntomas depresivos, persisten de dos semanas.
   a. ¿Se ha sentido cansada o decaída casi todos los días.
   b. ¿Se ha sentido triste o depresiva o pesimista casi todos los días.
   c. ¿Siente que ya no disfruta o ha perdido interés por las cosas anteriores que antes le resultaban agradables y entretenidas?
   Marque SI, si una o más respuestas son afirmativas
7. Uso o abuso de sustancias
   a. ¿Uso o abuso de sustancias durante el embarazo?
   b. si no
   1. Cigarrillo
   2. Cerveza, vino trago fuerte u otras bebidas con alcohol
   3. Tranquilizante sin receta médica
   4. Marihuana, coca pasta base anfetamina u otra droga
   Marque SI, si ha consumido durante alguna de estas sustancias (subraye las que usa) y especifique la cantidad.
8. - Violencia, pareja u otra figura masculina.
   a. ¿Alguien la ha insultado, humillado o amenazado, le ha dicho que no debiera estar embarazada?
   b. ¿le controlan con quien conversa o sus actos? VIOL ENCIA SOCIAL
   c. ¿le controlan el dinero que gasta. ¿VIOL ENCIA ECONOMICA
   d. ¿Alguien la ha golpeado o empujado? VIOL ENCIA FISICA
   e. ¿Este embarazo es consecuencia de una relación sexual no consentida? VIOL ENCIA SEXUAL
   Marque SI, si ha sucedido cualquiera de estas manifestaciones de violencia, subraye el tipo de violencia del que ha sido víctima.
9. ¿Hay algún otro factor de riesgo que deba ser considerado?
   Que no este señalado en los anteriores. Considerar en especial los riesgos señalados en este rubro en la nota metodológica.

Describa brevemente, riesgo señalado en punto 9:

Nombre evaluado/a: ____________________________
Fecha evaluado/a: ____________________________
Services Provided by ChCC

Three main components:

- **Newborn Support Program (PARN)**
  - Materials (trousseau) and educational workshops about newborn care and basics of early parenting and respectful parenting
  - Annual Budget (2019): $19.61M USD (107 USD per beneficiary)

- **Biopsychosocial Development Support Program (PADB)**
  - Main program in ChCC (“Programa Eje”)
  - Detection Instruments + Interventions + Nutrition
  - Annual Budget (2019): 25.36M USD (46 USD per beneficiary)

- **Mental Health Support Program (PASMI)**
  - Target population: 5-9 years old
  - Screening services and interventions to detect and support the alterations in the socio-emotional development
Note: Figure based on the annual budget report by the Chilean Budget Office. The amount are in US dollars of October 2021.
# Descriptive Statistics

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Full-Sample Mean (SD)</th>
<th>Low-SES Sample Mean (SD)</th>
<th>Fully Exposed Mean (SD)</th>
<th>Not Exposed Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>93.20 (5.89)</td>
<td>92.91 (6.21)</td>
<td>93.53 (5.70)</td>
<td>93.03 (6.19)</td>
</tr>
<tr>
<td>Language</td>
<td>266.04 (51.09)</td>
<td>258.98 (50.78)</td>
<td>270.50 (52.44)</td>
<td>263.45 (51.89)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>260.76 (48.10)</td>
<td>253.71 (48.02)</td>
<td>261.99 (46.83)</td>
<td>259.07 (50.07)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Background Characteristics</th>
<th>Full-Sample Mean (SD)</th>
<th>Low-SES Sample Mean (SD)</th>
<th>Fully Exposed Mean (SD)</th>
<th>Not Exposed Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (Male=1)</td>
<td>0.50 (0.50)</td>
<td>0.49 (0.50)</td>
<td>0.48 (0.50)</td>
<td>0.52 (0.50)</td>
</tr>
<tr>
<td>Attended PreK</td>
<td>0.88 (0.33)</td>
<td>0.85 (0.35)</td>
<td>0.90 (0.30)</td>
<td>0.79 (0.41)</td>
</tr>
<tr>
<td>Attended Kindergarten</td>
<td>0.95 (0.22)</td>
<td>0.93 (0.25)</td>
<td>0.94 (0.24)</td>
<td>0.89 (0.31)</td>
</tr>
<tr>
<td>Mother MS Dropout</td>
<td>0.09 (0.28)</td>
<td>0.13 (0.33)</td>
<td>0.06 (0.23)</td>
<td>0.13 (0.34)</td>
</tr>
<tr>
<td>Mother HS Dropout</td>
<td>0.23 (0.42)</td>
<td>0.30 (0.46)</td>
<td>0.19 (0.39)</td>
<td>0.28 (0.45)</td>
</tr>
<tr>
<td>Mother HS Graduate</td>
<td>0.38 (0.49)</td>
<td>0.38 (0.49)</td>
<td>0.42 (0.49)</td>
<td>0.36 (0.48)</td>
</tr>
<tr>
<td>Mother College Dropout</td>
<td>0.11 (0.31)</td>
<td>0.08 (0.28)</td>
<td>0.09 (0.29)</td>
<td>0.07 (0.25)</td>
</tr>
<tr>
<td>Mother Two-Year College</td>
<td>0.11 (0.32)</td>
<td>0.07 (0.26)</td>
<td>0.14 (0.35)</td>
<td>0.10 (0.30)</td>
</tr>
<tr>
<td>Mother Four-Year College</td>
<td>0.08 (0.28)</td>
<td>0.03 (0.17)</td>
<td>0.10 (0.30)</td>
<td>0.06 (0.23)</td>
</tr>
<tr>
<td>Low SES</td>
<td>0.51 (0.50)</td>
<td>1.00 (0.00)</td>
<td>0.51 (0.50)</td>
<td>0.50 (0.50)</td>
</tr>
<tr>
<td>Age</td>
<td>9.58 (0.58)</td>
<td>9.60 (0.60)</td>
<td>9.51 (0.51)</td>
<td>9.82 (0.66)</td>
</tr>
</tbody>
</table>

N 1,148,296 584,716 215,796 124,089
Cumulative Distribution of Exposure to ChCC IU-5, by year of birth

![Graph showing cumulative distribution of exposure to ChCC IU-5 by year of birth. The x-axis represents age in months at the moment of ChCC implementation, ranging from -20 to 60. The y-axis represents frequency, ranging from 0 to 1.5e+04. Each year from 2012 to 2015 is represented with a different color and pattern, allowing for the visualization of exposure distribution over time.]
Empirical Model: Linear Cumulative Exposure

- Based on Equation 1 it is possible to estimate the linear cumulative exposure effect to ChCC.

- Linear Cumulative exposure model

\[ Y_{imt} = \alpha + \varphi D_{imt} + X_{imt} \beta + \gamma_m + \tau_r t + \delta_s + \epsilon_{imt} \] (3)

Where:

- \( Y_{ics} \): outcome (annual attendance, language and mathematics test scores)
- \( X_{ics} \): vector of control variables: maternal schooling, and gender and age of the student.
- \( \gamma_m \): municipality time-invariant effects.
- \( \delta_s \): school time-invariant effects.
- \( \theta_r \times t \): regional month-of-birth trends
- \( \epsilon_{imst} \): error term clustered at municipality level.
## Estimation Results of Cumulative Exposure to ChCC on Educational Achievement

<table>
<thead>
<tr>
<th></th>
<th>Attendance</th>
<th>Language</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure to ChCC IU-5</td>
<td>1.069</td>
<td>8.457</td>
<td>12.708</td>
</tr>
<tr>
<td>(0.179)***</td>
<td>(1.557)***</td>
<td>(1.105)***</td>
<td></td>
</tr>
<tr>
<td>Low SES</td>
<td>-0.729</td>
<td>-4.527</td>
<td>-3.335</td>
</tr>
<tr>
<td>(0.030)***</td>
<td>(0.116)***</td>
<td>(0.107)***</td>
<td></td>
</tr>
<tr>
<td>Gender (Male=1)</td>
<td>-0.071</td>
<td>-8.846</td>
<td>3.758</td>
</tr>
<tr>
<td>(0.011)***</td>
<td>(0.163)***</td>
<td>(0.151)***</td>
<td></td>
</tr>
<tr>
<td>Mother HS Dropout</td>
<td>-0.238</td>
<td>3.754</td>
<td>3.946</td>
</tr>
<tr>
<td>(0.028)***</td>
<td>(0.208)***</td>
<td>(0.186)***</td>
<td></td>
</tr>
<tr>
<td>Mother HS Graduate</td>
<td>0.294</td>
<td>10.780</td>
<td>10.914</td>
</tr>
<tr>
<td>(0.032)***</td>
<td>(0.231)***</td>
<td>(0.248)***</td>
<td></td>
</tr>
<tr>
<td>Mother College Dropout</td>
<td>-0.312</td>
<td>14.234</td>
<td>13.173</td>
</tr>
<tr>
<td>(0.041)***</td>
<td>(0.292)***</td>
<td>(0.280)***</td>
<td></td>
</tr>
<tr>
<td>Mother Two-Year College</td>
<td>0.264</td>
<td>14.972</td>
<td>14.123</td>
</tr>
<tr>
<td>(0.037)***</td>
<td>(0.313)***</td>
<td>(0.322)***</td>
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<tr>
<td>Mother Four-Year College</td>
<td>0.140</td>
<td>22.192</td>
<td>20.359</td>
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<tr>
<td>(0.040)***</td>
<td>(0.407)***</td>
<td>(0.403)***</td>
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<tr>
<td>R2</td>
<td>0.15</td>
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<td>N</td>
<td>1,148,296</td>
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<table>
<thead>
<tr>
<th>Variables</th>
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<tbody>
<tr>
<td>Municipality Dummy</td>
<td></td>
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<tr>
<td>Age Polynomial</td>
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<tr>
<td>School Dummy</td>
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</tr>
<tr>
<td>Region Month of Birth Trends</td>
<td></td>
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</tbody>
</table>

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Event Study Parameters, by low-SES classification

(a) Mathematics

(b) Language

(c) Annual Attendance
Sensitivity Analysis: Cohort Exclusion

Figure: Event-study estimations excluding cohorts

(a) Language

(b) Mathematics
Distribution of Age at Implementation of ChCC

Note: The figure shows the distribution of the age of the child at the moment when ChCC was implemented $A_{mt}$. The implementation dates used to calculate this are the ones reported by from the Ministry of Social Development.
w28268.pdf.

Hilary Hoynes, Diane Whitmore Schanzenbach, and Douglas Almond. Long-Run impacts of childhood access to the safety net, apr 2016. ISSN 00028282.


