What is the optimal time of intervention for promoting different capacities?

**Returns to an Unit U$S Invested**

*Source: Heckman (2008)*

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Human Brain Development

*Source: Thompson and Nelson (2001)*

Current research in developmental neuroscience that is pertinent to the central claims of media accounts of early brain development, (a) scientific understanding of formative early experiences, (b) whether critical periods are typical for brain development, (c) brain development as a lifelong process, (d) biological hazards to early brain growth,
Trend in cognitive scores by age by maternal education

Each score standardized within observed sample. Using all observations and assuming data missing at random. Source: Brooks-Gunn et al. (2006).

Intercept at early ages is the key determinant

Hart & Risley, 1995

**Meaningful Differences**

*By the time the children were 3 years old,* parents in less economically favored circumstances had said fewer different words in their cumulative monthly vocabularies than the children in the most economically advantaged families in the same period of time.

<table>
<thead>
<tr>
<th>Cumulative Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children from welfare families:</td>
</tr>
<tr>
<td>500 words</td>
</tr>
<tr>
<td>Children from working class families:</td>
</tr>
<tr>
<td>700 words</td>
</tr>
<tr>
<td>Children from professional families:</td>
</tr>
<tr>
<td>1,100 words</td>
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</tbody>
</table>
DNA methylation and histone acetylation patterns in young and old twins

We found that, although twins are epigenetically indistinguishable during the early years of life, older monozygous twins exhibited remarkable differences in their overall content

Source: Fraga, Ballestar et al. (2005)

Early Life Experiences Change The Way Genes Express Themselves

Up- and Down-Regulated Genes in Rhesus Monkeys

Differential gene expression (GO annotations, biological functions), SPR vs. MR monkeys

- Citokine-mediated signaling pathway (GO19221)
- Positive regulation of T cell proliferation (GO42102)
- Interleukin-27-mediated signaling pathway (GO70106)

Defense response (GO6952, GO42742, GO50832)
Immune response (GO6955)
Innate immune response (GO45087)
Antigen processing and presentation (GO19882)

Source: Cole, Conti, Heckman and Suomi (2012)

analyze changes gene expression profiles in 4-mo-old animals reared under adverse social conditions.
1. The Brazilian Progress

Child (up to 5 years old) mortality rate in Brazilian Municipalities

Source: HDI-M Atlas

LEGENDA:
- 15.01-20.00
- 14.01-15.00
- 13.01-14.00
- 12.01-13.00
- 11.00-12.00
- < 11.00

The Brazilian Progress 1993-2013

Probability of survival, children born last year: Brazil, 1993 e 2013


Inequality among socioeconomic groups has also declined at a fast pace -- greater equality of opportunity --
Rise of 25 p.p. among the 10% poorest

Fonte: Estimativas produzidas com base na Pesquisa Nacional de Amostra de Domicílios (PNAD).

Monitoring child development in Rio

510 milestones
4. Monitoring child development

Evolution of the percentage of children with development at least as expected: 2010-2012

percentage of children with development at least as expected: 2010

*New Generation of Early Childhood Initiatives

Policy Choices:

- Fulltime versus part-time daycare centers and other partial approaches (EX: Criança Feliz (Federal), PIM (Programa Infância Melhor in the State of Rio Grande do Sul) and PIC (Programa Infância Carioca in Rio de Janeiro City))

- From an approach based on negative rights to an approach based on positive rights (UN new Approach)

- Importance of Non-Cognitive habilites & Evaluation