Infant Growth Trajectories and Lipid Levels in Adolescence: Evidence from a Chilean Infancy Cohort

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Disclosures

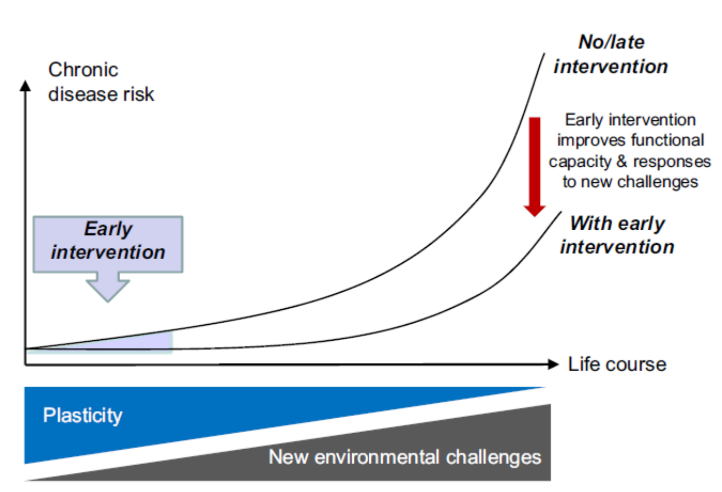
FINANCIAL DISCLOSURE:

The authors of this research project have no relevant financial relationships to disclose.

Introduction

Developmental Origins of Health and Disease (DOHaD) concept

Early infant growth influences phenotype change for adverse cardiovascular disease risk factors later in life



Hanson et al. (2011)

Evidence for an association between increase in postnatal weight/length change and lipid levels.

Country	Publication Year	Growth Association: LDL-C	Growth Association: HDL-C	Growth Association: TG	Age at outcome (years)	2+ obs in first year?
Sweden	2007		−	+	17	
Chile	2009	+	−	+	4	
U.K.	2010	−	+	−	15	yes
Finland	2010		+	−	31	yes
Japan	2013	−	−		13-14	
Netherlands	2014		−	+	4-5	
Spain	2014	+	−	+	5	
Canada	2017	−	−	+	10-12	

Majority of observational studies point towards a positive association between postnatal weight/length change and unfavorable lipid profile later in life.

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Canada	2017	−	−	+	10-12	

Project aim

Aim: Examine the association between well-characterized infant growth trajectories and lipid levels at 17 years of age.

Hypothesis: Faster growth during infancy is associated with unfavorable lipid levels in adolescence.

Methods

Sample: Santiago Longitudinal Study (SLS)

Design	Randomized preventive trial for iron deficiency anemia, 1991-1996 (n=602)
Participants	Admixed Latino families from low- to middle-income neighborhoods in Santiago, Chile. Over 95% were intially breastfed.
Inclusion criteria	All infants $\geqslant$ 3 kg at birth with no evident health problems.

Method: Latent growth mixture models (LGMM)

LGMM is a way to distinguish heterogeneous growth patterns in a group of individuals

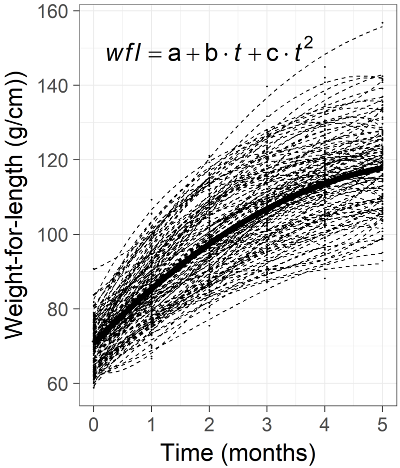
Exposure Early infant growth trajectories for

1. weight (kg),
2. length (cm), and
3. weight-for-length (WFL) (g/cm)

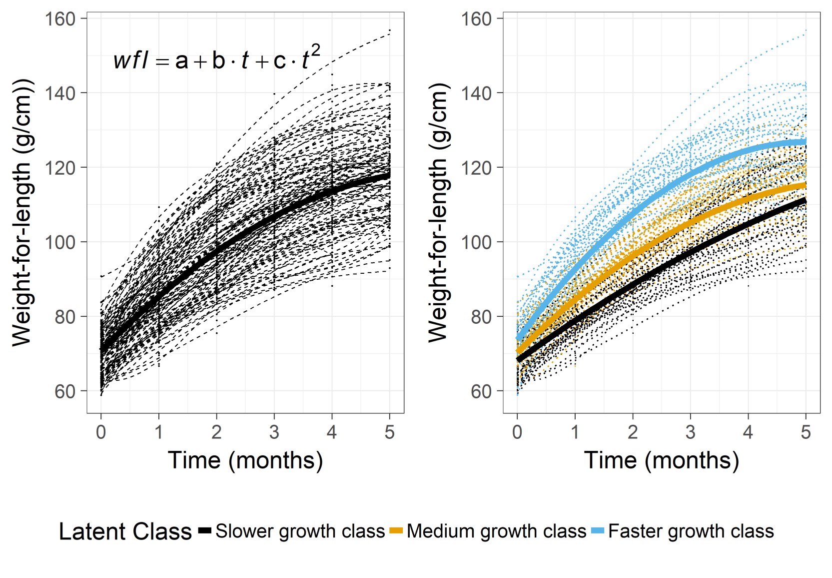
Outcome Fasting lipid levels at 17 years, including HDL-C, LDL-C, TG, and TG:HDL ratios, each evaluated separately

Confounders randomization status, sex of child, and socioeconomic status

Example of latent growth curve mixture model (LGMM) analysis, 1



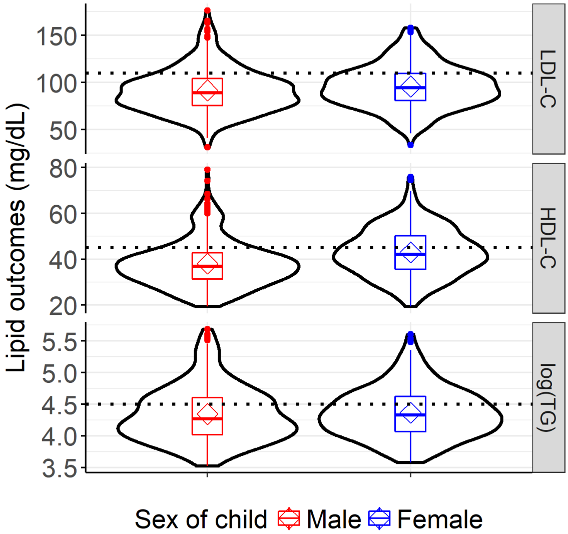
Example of latent growth curve mixture model (LGMM) analysis, 2



Results

Descriptive Statistics

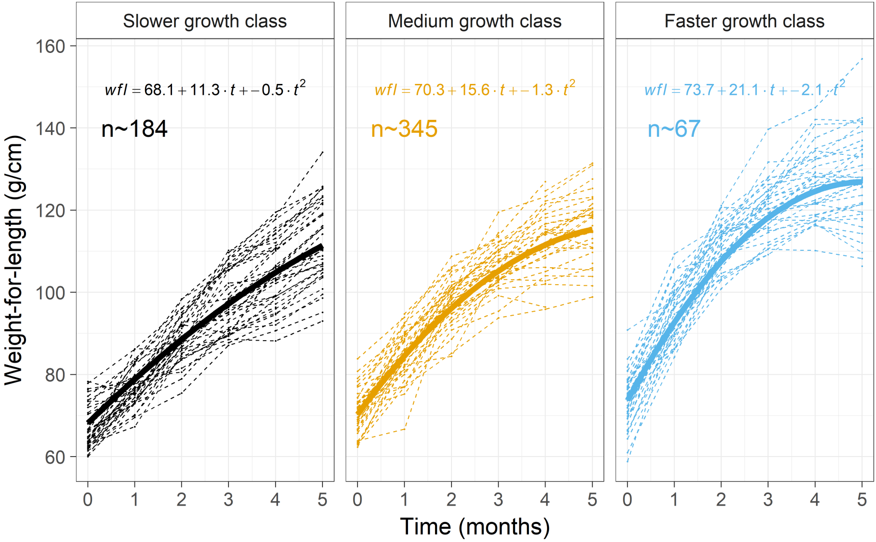
Fasting lipid profile (17 years)



Note: Dotted lines represent threshold for acceptable thresholds according to National Cholesterol Education Panel (NCEP) Expert Panel on cholesterol levels in children.

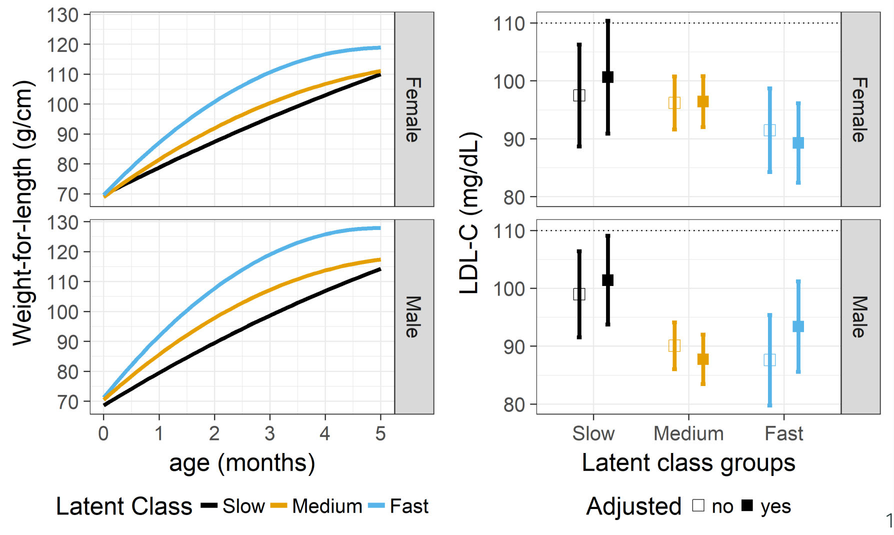
Weight-for-length trajectory description

Evidence supports growth heterogeneity: three LGMM trajectories after rigorous model fit evaluation



Slowest weight-for-length growth pattern associated with highest mean LDL-C.

Stratified by sex of child



Summary

Findings do not support faster infant growth with unfavorable lipid profiles

Instead, slower growth groups carry higher risk

- Why are results not consistent with previous findings?
    - Differences across:
        - Time period (window of time or secular)
        - Population
        - Age at outcome
        - Methods
- Public health implications
    - The choice of developmental period important when designing interventions.

Many thanks to...

- Participants in Santiago Longitudinal Study (SLS)
- Support from MAA AHA 2016 Predoctoral Fellowship
- My graduate advisor, Dr. Kari E. North
- SLS research team

Questions?

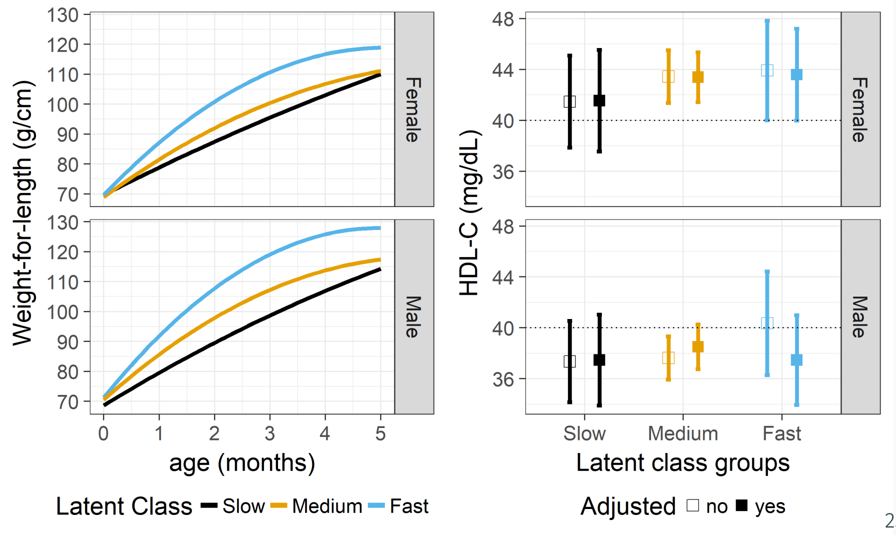
References

Hanson, M., Godfrey, K. M., Lillycrop, K. A., Burdge, G. C., and Gluckman, P. D. (2011). Developmental plasticity and developmental origins of non-communicable disease: Theoretical considerations and epigenetic mechanisms. 106(1):272–280.

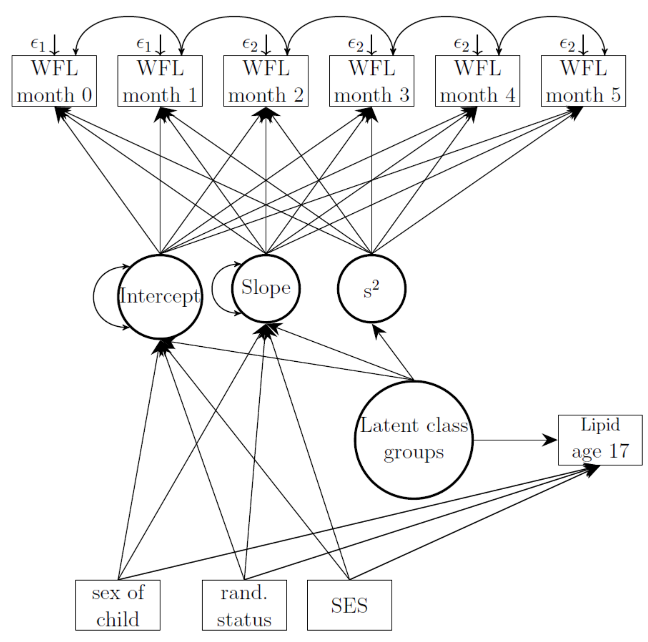
Extra slides

Fastest weight-for-length growth pattern not associated with lowest mean HDL-C.

Stratified by sex of child



LGMM model



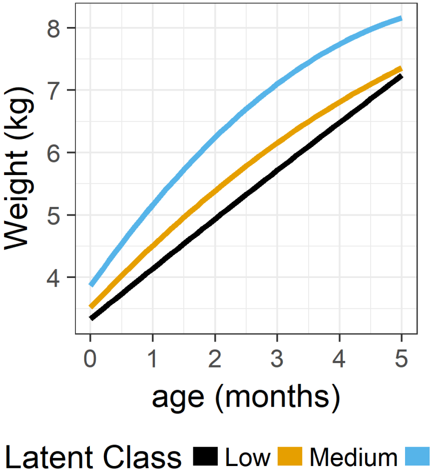
ϵ_1
WFL month 0
ϵ_1
WFL month 1
ϵ_2
WFL month 2
ϵ_2
WFL month 3
ϵ_2
WFL month 4
ϵ_2
WFL month 5
Intercept
Slope
s^2
Latent class groups
Lipid age 17
sex of child
rand. status
SES

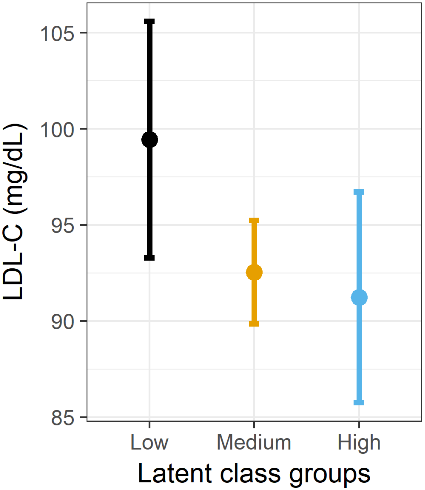
Table 1: Fasting lipid profile (median [IQR], mg/dL) at age 17 years

	Male (n=314)	Female (n=288)	Overall (n=602)
Total cholesterol	143.2 [130.5, 159.9]	154.2 [137.5, 170.1]	147.3 [133.0, 165.7]
Triglycerides	71.4 [55.7, 100.8]	76.5 [58.5, 103.3]	74.0 [57.0, 101.1]
LDL Cholesterol	89.2 [75.7, 104.3]	94.5 [80.8, 109.6]	91.7 [77.6, 107.0]
HDL cholesterol	36.8 [31.3, 42.7]	42.2 [35.5, 49.9]	39.4 [32.9, 46.4]

LGMM: fastest weight (kg) growth pattern associated with highest mean LDL-C

Pooled across sex of child, not adjusted

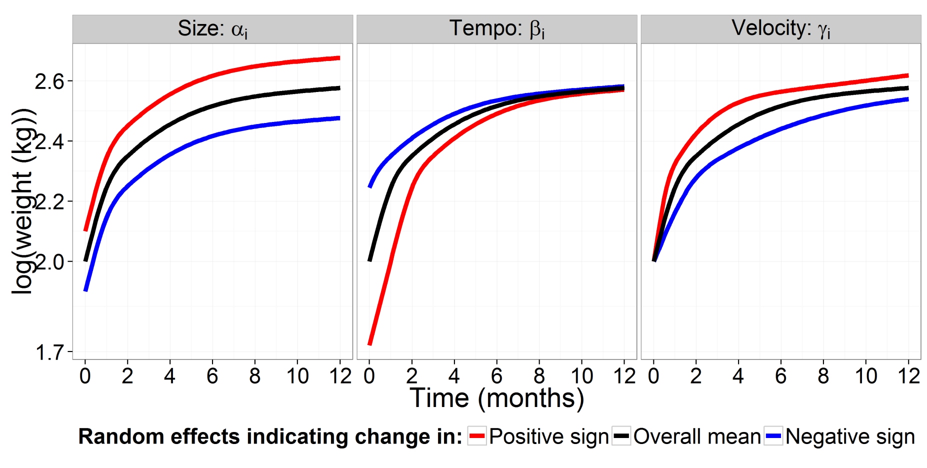




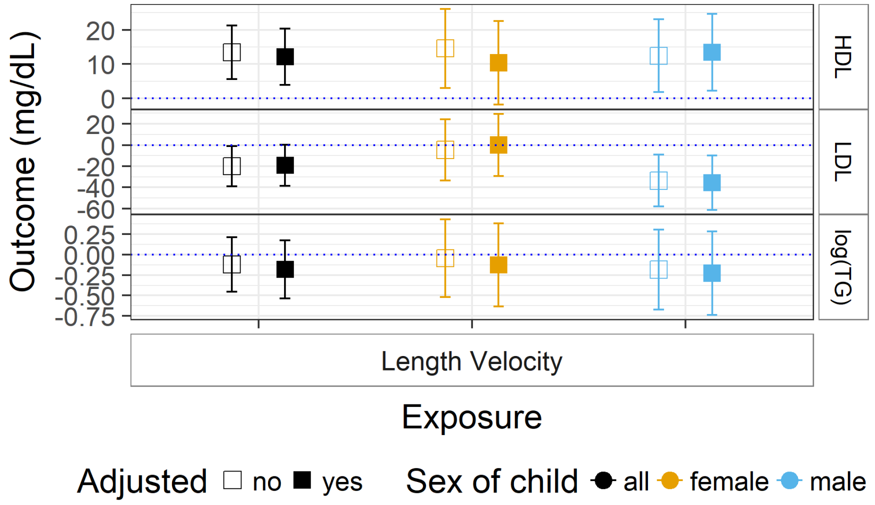
Method 2 SITAR is one method to capture up to three biologically meaningful observed components of nonlinear growth

Size	Shift growth curve up and down from average (units in body size measure)
Tempo	Shift growth curve left and right for individual from average (monthly units)
Velocity	Re-scale time axis for individual so rate of growth is faster or slower

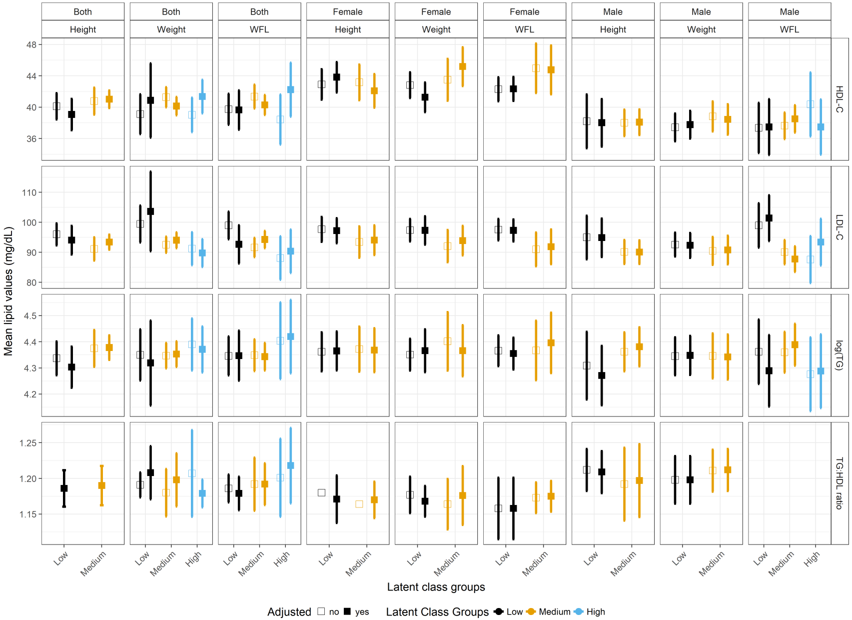
SITAR example



SITAR models: Length trajectory velocity characteristics indicate faster length growth associated with higher HDL-C



All LGMM comparisons



Note: Adjusted analyses includes sex of child (for pooled sample), randomization status, and socioeconomic status.