

Moving Beyond Birthweight: Examining Developmental Origins of Disease Using Dynamic Postnatal Growth Indicators

Conclusion

NOVEL NONLINEAR MODEL APPLICATION LINKS PARADOXICAL PFOA-INDUCED CHILD GROWTH PATTERNS

Background

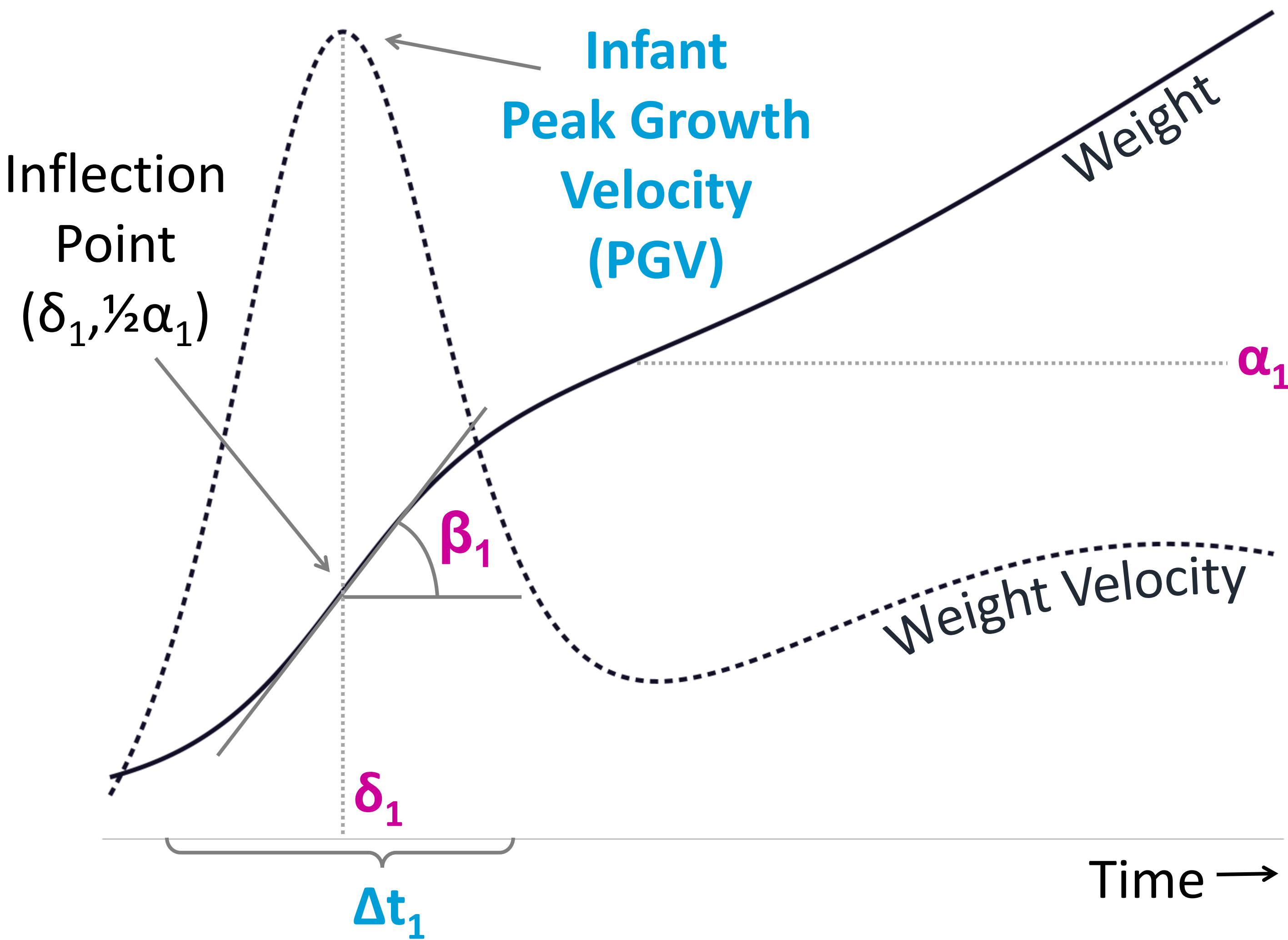
- Most prenatal exposure and growth studies use cumulative outcome measures (e.g. weight, BMI)
- PFOA related to lower birthweight, but higher weight later on

Methods

- Modeled weight trajectory from birth to 5.5 years among 1334 children in the SELMA Study

$$\mu(t) = \frac{\alpha_1}{1 + e^{-\beta_1(t-\delta_1)}} + \frac{W - \alpha_1}{1 + e^{-\beta_2(t-\delta_2)}}$$

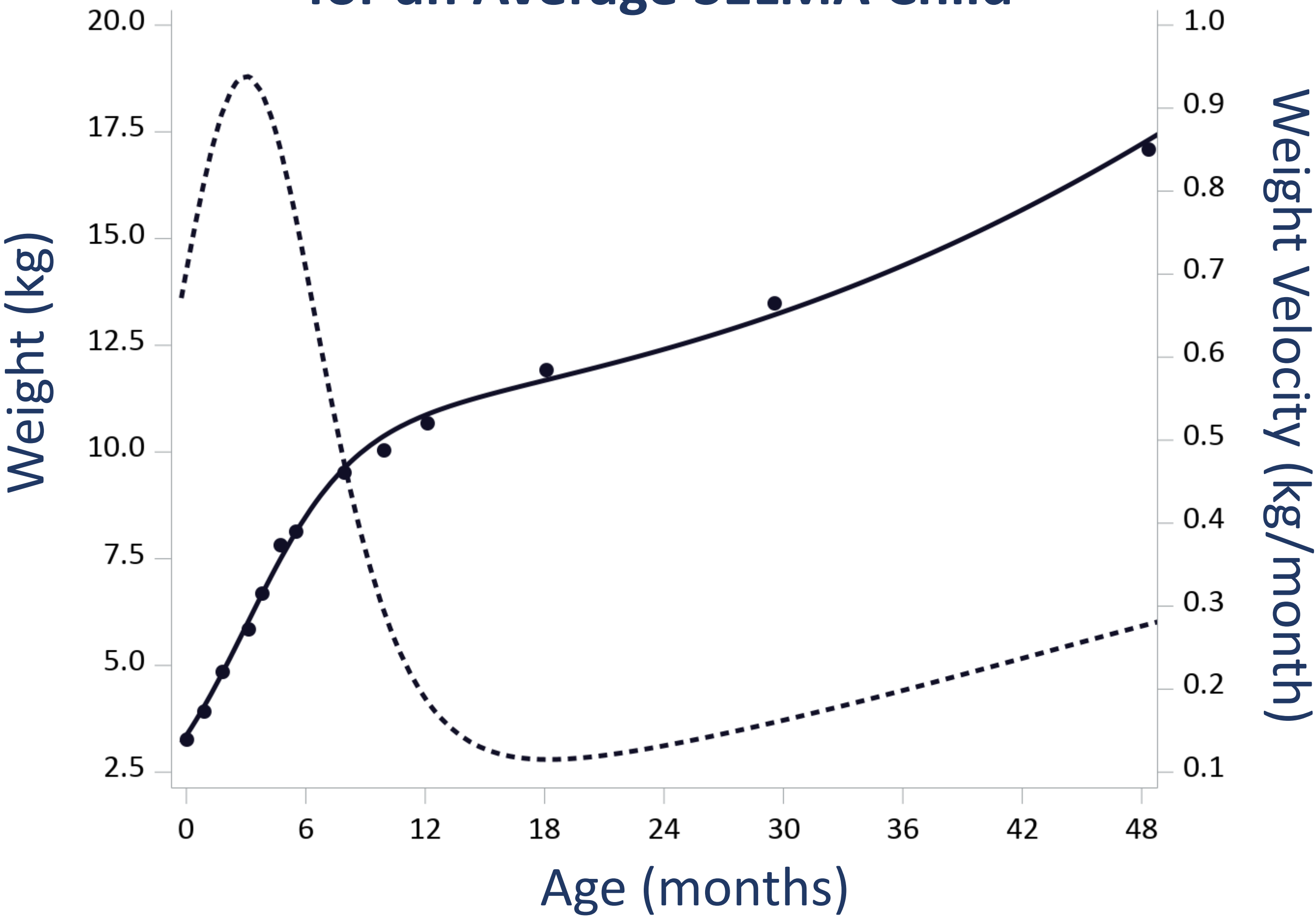
Double Logistic Model



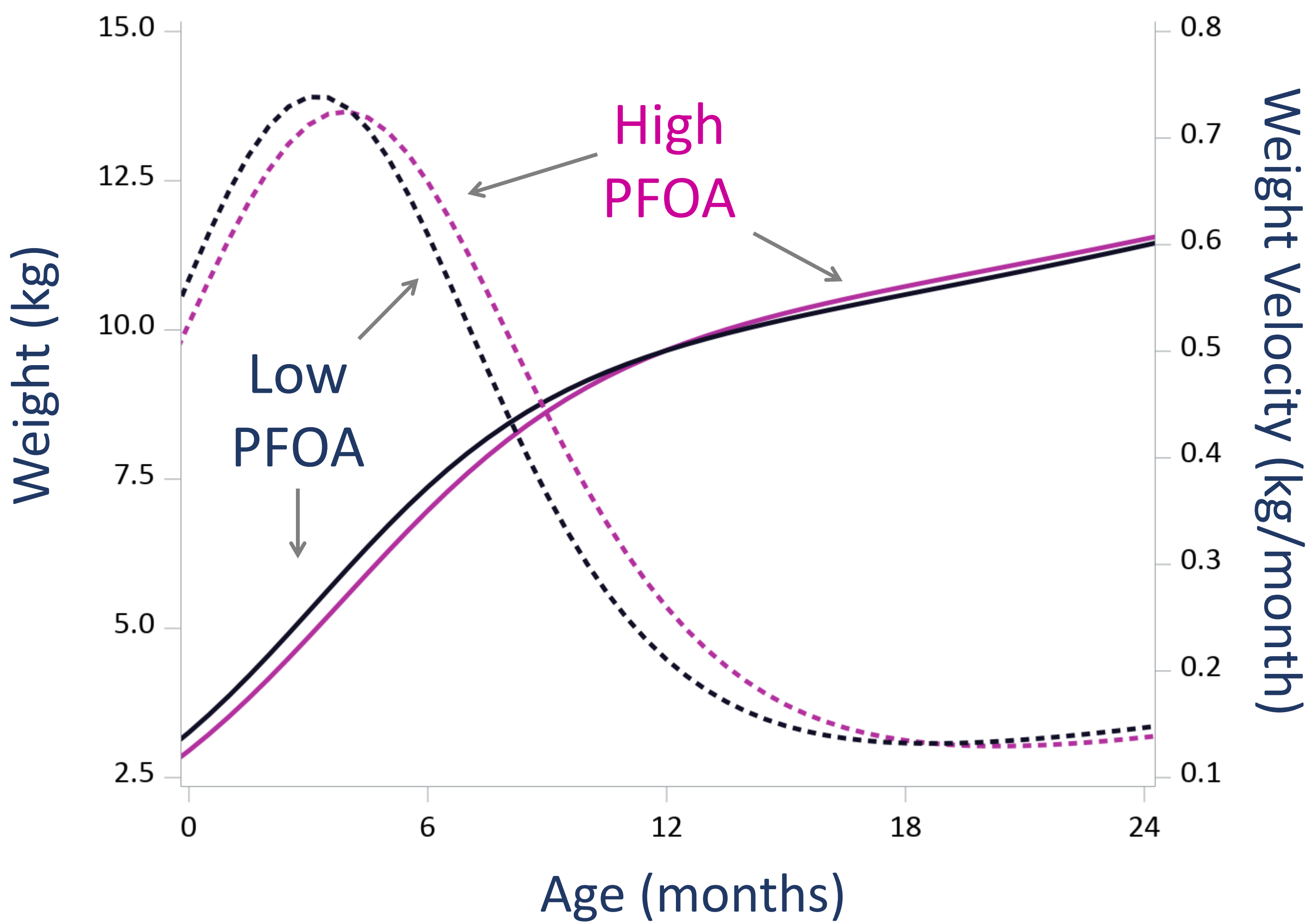
- Assessed prenatal PFOA exposure in relation to growth
 - Infant **PGV**
 - Age at infant PGV (δ_1)
 - Infant growth spurt length (Δt_1)
 - Post-spurt weight plateau (α_1)

Results

Observed vs. Predicted Weight & Weight Velocity for an Average SELMA Child



Average Predicted Weight & Weight Velocity Trajectories for 10th vs. 90th PFOA Levels



Discussion

- PFOA-induced low birthweight followed by delayed PGV (δ_1), longer infant growth spurt (Δt_1), higher post-spurt weight (α_1)
- Nonlinear model useful to identify shifting growth patterns
- Future studies can extract additional dynamic growth metrics

More Info

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References:

- Bock RD, Wainer H, Petersen A, Thissen D, Murray J, Roche A. 1973. A parameterization for individual human growth curves. *Hum Biol* 45: 63–80.
- Bornehag C-G, Moniruzzaman S, Larsson M, Lindström CB, Hasselgren M, Bodin A, et al. 2012. The SELMA Study: A Birth Cohort Study in Sweden Following More Than 2000 Mother-Child Pairs. *Paediatr Perinat Epidemiol* 26:456–467; doi:10.1111/j.1365-3016.2012.01314.x.
- Gyllenhammar I, Diderholm B, Gustafsson J, Berger U, Ridefelt P, Benskin JP, et al. 2018. Perfluoroalkyl acid levels in first-time mothers in relation to offspring weight gain and growth. *Environ Int* 111:191–199; doi:10.1016/j.envint.2017.12.002.
- Høyer BB, Ramlau-Hansen CH, Vrijheid M, Valvi D, Pedersen HS, Zvezdai V, et al. 2015. Anthropometry in 5- to 9-Year-Old Greenlandic and Ukrainian Children in Relation to Prenatal Exposure to Perfluorinated Alkyl Substances. *Environ Health Perspect* 123:841–846; doi:10.1289/ehp.1408881.
- Lauritzen HB, Larose TL, Øien T, Sandanger TM, Odland JO, Van De Bor M, et al. 2018. Prenatal exposure to persistent organic pollutants and child overweight/obesity at 5-year follow-up: A prospective cohort study. *Environ Heal A Glob Access Sci Source* 17:1–12; doi:10.1186/s12940-017-0338-x.
- Maisonet M, Terrell ML, McGeehin MA, Christensen KY, Holmes A, Calafat AM, et al. 2012. Maternal concentrations of polyfluoroalkyl compounds during pregnancy and fetal and postnatal growth in British girls. *Environ Health Perspect* 120:1432–7; doi:10.1289/ehp.1003096.
- Negri E, Metruccio F, Guercio V, Tosti L, Benfenati E, Bonzi R, et al. 2017. Exposure to PFOA and PFOS and fetal growth: a critical merging of toxicological and epidemiological data. *Crit Rev Toxicol* 47:482–508; doi:10.1080/10408444.2016.1271972.