

## Aims

- Identify Latent Trajectories of Standardized Weight (zWeight).
- Describe these trajectories with respect to Child Health, Maternal, Socioeconomic, Environmental and Feeding Characteristics.

For details on latent class identification scan below.



## Introduction

Early childhood growth sets a trajectory for lifelong health, but there are limited data of growth trajectories and determinants from low- and middle-income country settings.

Weight at age 5 has been found to be strongly predictive of weight at age 9 (1). Additionally, measures of weight have been found to be predictive of metabolic health (1).

Multiple studies have identified latent growth classes within BMI, while latent classes within zWeight have only been investigated once previously. Three classes using zWeight scores were identified using the Growth Mixture Modelling approach in a white British and Pakistani cohort (2). Predictors of these classes were not investigated.

Rapid weight gain in early childhood (or catch-up growth) has been associated with an increased risk of overweight, obesity and other NCDs chronic diseases through adulthood (3–6). Various factors may modify the risk of rapid weight gain including bottle feeding, prematurity and being firstborn (7,8).

## Methods

The Drakenstein Child Health Study (DCHS) is a prospective South African birth cohort in which pregnant women were enrolled between March 2012 and March 2015 and followed through birth and childhood (9).

Latent Class Mixed Modelling was used to identify underlying latent profiles of growth for standardized height and standardized weight measurements from birth to five years for a sample of 1143 children from the DCHS (10).

Multinomial Logistic Regression allowed the identification of key exposure variables that describe allocation to the identified latent growth classes.

## Results

Four classes of growth within standardized weight were identified. A strong association was found between various growth classes and abnormal growth features such as rapid weight gain, stunting, underweight or overweight.

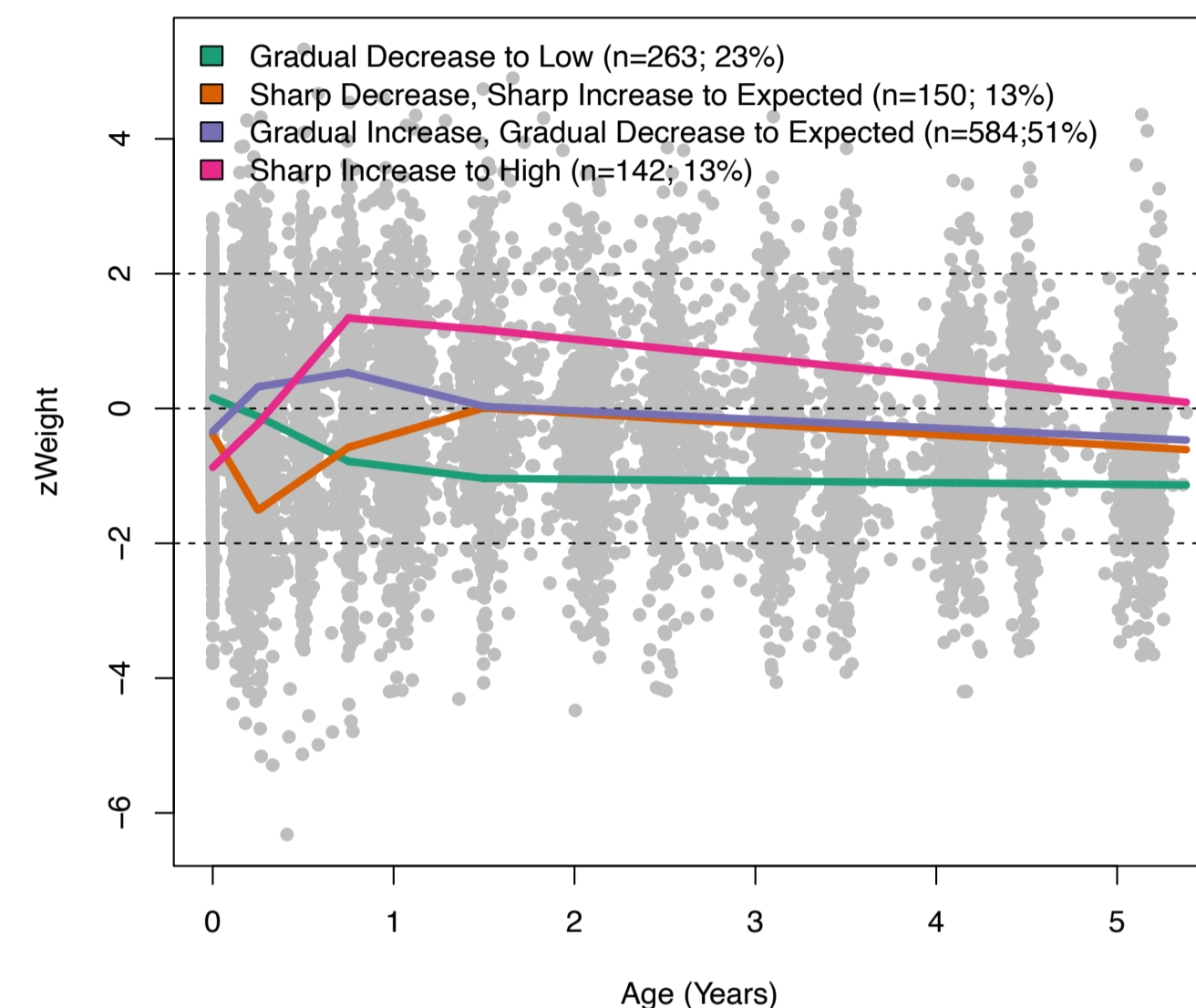


Figure 1: The average trajectories of latent classes identified within zWeight from birth until five years.

Exposures significantly associated with weight trajectories were:

- Child Health:** TB, prematurity, pneumonia,
- Maternal Factors:** Pregnancy complications, gravida, and
- Feeding:** Time of Breast feeding.

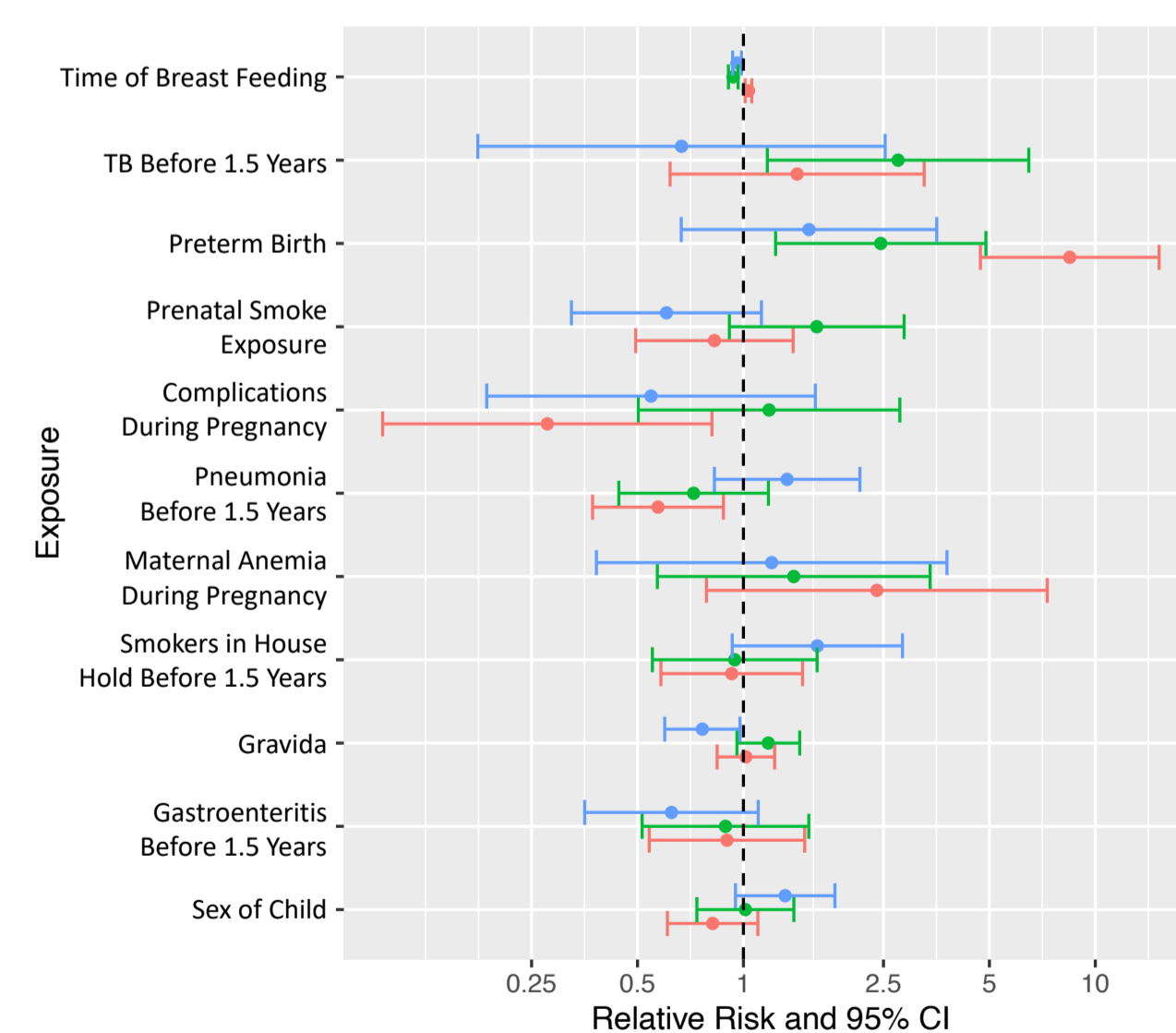


Figure 2: Relative Risk and 95% CI of key descriptor variables on Latent zWeight class allocation.

Table 1: Proportion of children that experienced rapid weight gain in the first 9 months within the four zWeight growth classes.

	Gradual Decrease to Low	Sharp Decrease, Sharp Increase to Expected	Gradual Increase; Gradual Decrease to Expected	Sharp Increase to High
<b>Normal WG</b>	235 (98.7%)	108 (86.4%)	206 (43.7%)	9 (6.8%)
<b>RWG</b>	3 (1.3%)	17 (13.6%)	265 (56.3%)	124 (93.2%)

Table 2: Proportion of children ever underweight or overweight between birth and 5 years as defined by zWeight scores.

	Gradual Decrease to Low	Sharp Decrease, Sharp Increase to Expected	Gradual Increase; Gradual Decrease to Expected	Sharp Increase to High	Entire Cohort
<b>Underweight</b>	91 (35%)	75 (50%)	76 (13%)	44 (31%)	286 (25%)
<b>Overweight</b>	31 (12%)	18 (12%)	77 (13%)	58 (41%)	184 (16%)
<b>Total</b>	263	150	584	142	1139

## Discussion

Four latent profiles were identified within zWeight;

- The Gradual Decrease to Low Class** was characterised by an increased time spent Breast Feeding, prematurity, fewer pregnancy related complications and fewer events of pneumonia before 1.5 years.
- The Sharp Decrease, Sharp Increase to Expected Class** was characterised by TB before 1.5 years and prematurity; this class contains 50% of subjects that were ever identified as underweight.
- The Gradual Increase; Gradual Decrease to Expected Class** was characterised by more time spent Breast Feeding.
- The Sharp Increase to High Class** was characterised by lower gravida; this class was predominantly made up of Rapid Weight Gainers and 41% ever overweight children.

## Conclusion

Better understanding of distinct childhood growth trajectories and their predictors may be gained, through identification of these classes, informing interventions to promote optimal childhood growth.

## References

- Gardner DSL, Hosking J, Metcalf BS, Jeffery AN, Voss LD, Wilkin TJ. Contribution of early weight gain to childhood overweight and metabolic health: a longitudinal study (EarlyBird 36). *Pediatrics*. 2009 Jan;123(1):e67-73.
- Mebrahtu TF, Feltbower RG, Petherick ES, Parslow RC. Growth patterns of white British and Pakistani children in the Born in Bradford cohort: a latent growth modelling approach. *J Epidemiol Community Health*. 2015 Apr;69(4):368-73.
- Zheng M, Lamb KE, Grimes C, Laws R, Bolton K, Ong KK, et al. Rapid weight gain during infancy and subsequent adiposity: a systematic review and meta-analysis of evidence. *Obes Rev Off J Int Assoc Study Obes*. 2018 Mar;19(3):321-32.
- Karaolis-Danckert N, Buyken AE, Bolzenius K, Perim de Faria C, Lentze MJ, Kroke A. Rapid growth among term children whose birth weight was appropriate for gestational age has a longer lasting effect on body fat percentage than on body mass index. *Am J Clin Nutr*. 2006 Dec;84(6):1449-55.
- Li P, Lu Y, Qie D, Feng L, He G, Yang S, et al. Early-life weight gain patterns of term small-for-gestational-age infants and the predictive ability for later childhood overweight/obesity: A prospective cohort study. *Front Endocrinol*. 2022;13:1030216.
- Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet Lond Engl*. 2008 Jun 26;371(9609):340-57.
- Karaolis-Danckert N, Günther ALB, Kroke A, Hornberg C, Buyken AE. How early dietary factors modify the effect of rapid weight gain in infancy on subsequent body-composition development in term children whose birth weight was appropriate for gestational age. *Am J Clin Nutr*. 2007 Dec;86(6):1700-8.
- Karaolis-Danckert N, Buyken AE, Kulig M, Kroke A, Forster J, Kamin W, et al. How pre- and postnatal risk factors modify the effect of rapid weight gain in infancy and early childhood on subsequent fat mass development: results from the Multicenter Allergy Study 90. *Am J Clin Nutr*. 2008 May;87(5):1356-64.
- Zar HJ, Barnett W, Myer L, Stein DJ, Nicol MP. Investigating the early-life determinants of illness in Africa: the Drakenstein Child Health Study. *Thorax*. 2015 Jun;70(6):592-4.
- Proust-Lima C, Phillips V, Liqueur B. Estimation of Extended Mixed Models Using Latent Classes and Latent Processes: The R Package lcm. *J Stat Softw*. 2017 Jun 1;78:1-56.