Predicting Preterm Infants’ Ideal Individual Growth Trajectories

Erin Landau-Crangle¹; Niels Rochow¹; Tanis R. Fenton²; Kai Liu³; Anaam Ali¹; Gerhard Fusch¹; Michael L. Marrin¹; Christoph Fusch¹

¹Pediatrics, McMaster University, Hamilton, Ontario, CAN
²Department of Community Health Sciences, University of Calgary, CAN
³Mathematics and Statistics, McMaster University, Hamilton, Ontario, CAN

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Are Growth Rates Related to Body Composition?

(Rochow et al., Pediatric Research, 2016)
Common Growth Charts

- Developed from cross sectional birth weight data from infants of known gestational ages
- Smoothed from 36-50 weeks with WHO Growth Standards to show transition from intrauterine to postnatal growth
- Doesn’t show postnatal adaptation and weight loss
- Doesn’t have a target trajectory or body composition
Non-Smoothed Reference Data

1. Fenton growth chart data for intrauterine period
2. WHO Growth Standards are gold standard for term infants/post-term period
   - Reflect postnatal adaptation and weight loss with dip in 1st two weeks
   - Not smoothed
3. Term infants born at the 50th percentile undergo postnatal adaptation and weight loss and transition to the 50th percentile on the WHO curves.
4. Preterm infants also experience postnatal weight loss (PreCES) and have an offset of growth trajectories.
Need Physiological Growth Charts for Preterm Infants

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**PreCES:** Preterm Contraction of Extracellular Spaces

Physiological postnatal growth curves for preterm infants are missing.
How to fill the gap?

• At what point should preterm infants return to birth weight percentile?

• Most physiological trajectory connecting preterm infants after postnatal adaptation and weight loss to term infants after their postnatal adaptation and weight loss.
Objectives:

- To predict individual growth trajectories from day of life 21 (end of preterm infants’ postnatal adaptation) to 42 weeks postmenstrual age (end of term infants’ postnatal adaptation).
Individualized Trajectories

**Postnatal-Percentile Approach:**
Staying on the “new” percentile

**Growth-Velocity Approach:**
Applying daily median growth velocities
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Results - Growth Approaches

**Postnatal Percentile Approach:** The degree of deviation varied amongst infants of different gestational ages and with different birth weight percentiles.
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**Optimized Growth Velocity Approach:** Using a single correction factor for the Fenton median growth rates, the deviation to the target weight was minimized.
The correction factor in the optimized growth velocity approach corresponds to a 10% increase of the Fenton daily growth velocities.

Assuming identical accretion of lean mass as well as fat mass in intra- and extrauterine environments, extrauterine growth rates expressed as g/kg/d will be calculated to be higher by a factor of 10% since the denominator (postnatal body weight) is about 10% lower.

The consistency of the Growth-Velocity Approach seems to reflect an underlying biological principle.
Discussion

• These results show that simple, physiological principles can be used to predict individual growth trajectories for preterm infants

• The 4 previously described evidence-based principles were used:
  1. Fenton growth chart data for the intrauterine period
  2. WHO growth chart data for the post-term period
  3. Term infants born at the 50th percentile will transition to the 50th percentile after postnatal adaptation and weight loss
  4. Postnatal adaptation and weight loss also occurs in preterm infants but earlier
Summary

• Our concept puts these principles together to guide growth from the end of postnatal adaptation in preterm infants to the end of postnatal adaptation in term infants
• Provides a deeper understanding of physiological growth in preterm infants
Individualized Growth Trajectories

Individualized postnatal growth trajectories can be predicted, and provide new reference curves for clinicians to use to guide growth.

Reference Curves and Target Trajectory
Individualized for: Female, 29 + ⅔, 950g

Gestational age [weeks]
Growth Trajectory Calculator
Example Infants
www.growthcalculator.org

Two different real infants’ weights plotted (red):

B  Male: 29 + ½, 830g
C  Female: 26 + ½, 900g
Next Steps

• Validate growth concept in large, international, multicenter study
  – Test whether adherence to individualized growth trajectories leads to improved body composition, neurodevelopment (Bayley III), and cardiovascular outcomes

• Our pilot data with 57 infants showed promising results using the Optimized Growth-Velocity Approach to individualized growth trajectories
  – We found that infants that grew above their target growth trajectory had a high percentage of fat mass than infants growing below their target growth trajectory
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www.growthcalculator.org

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