

Gestational Weight Gain in Adolescent Pregnancy: A Study among Sisters

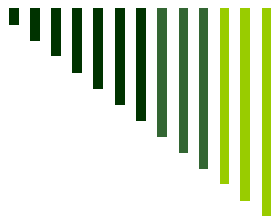
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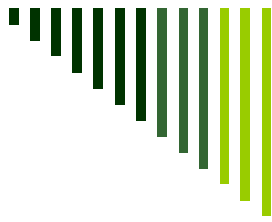
Department of Epidemiology

Maternal & Child Public Health Leadership Training Program



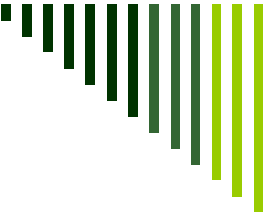
Background

- Adolescent girls continue to grow for up to 5 years after menarche
- Adolescent pregnancy complicates growth process
 - Reduced potential skeletal growth in mothers and reduced infant birth weight
- Clinical research indicates that fetus and adolescent mother compete for nutrients
- Possible that larger weight gains than those recommended for adults may be appropriate for adolescents in order to permit simultaneous growth of the mother and fetus



Background

- Some studies do not support the hypothesis of fetal-maternal growth competition
- Much recent research focuses on excessive gestational weight gain in adolescents
 - Concerns about high postpartum weight retention and long-term consequences of overweight and obesity
- Issue of appropriate gestational weight gain in adolescent pregnancy remains controversial

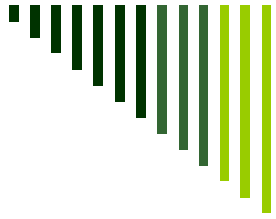


Background

Gestational weight gain guidelines (IOM)

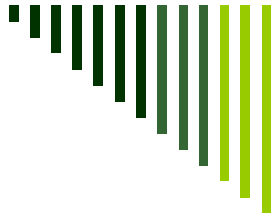
- **1990:** Adolescents should gain in the upper end of the recommended range
- **2009:** Adolescents should gain in the same ranges as adults until further research is available

Pre-pregnancy BMI	Recommended Total Weight Gain Range
Underweight	28-40 lbs
Normal	25-35 lbs
Overweight	15-25 lbs
Obese (all classes)	11-20 lbs



Study objective

To evaluate the difference in association between gestational weight gain and infant birth weight in adolescent and adult primiparas



Study design

Design: Population based, retrospective cohort

Data source:

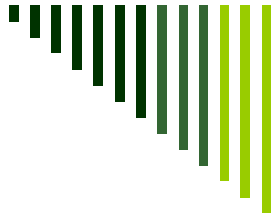
- 'Sisters' dataset (UW)
- Births in Washington state 1987-2008
- ~43,000 sister pairs
- Maternally linked birth certificate and hospital discharge (CHARS) data



Study design

Inclusion criteria:

- Full biological sister pairs
- One sister age ≤ 18 at delivery
- Other sister age 22-34 at delivery
- First pregnancy
- Full-term (37-42 weeks gestation), singleton infant
- Excluded if infant had any type of malformation
- Excluded if BW or GWG was missing for either sister

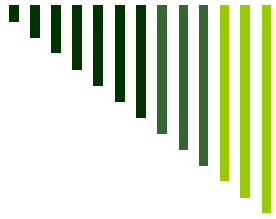


Methods

Exposure: Gestational weight gain (GWG), (kg)

Outcome: Birth weight (BW), (g)

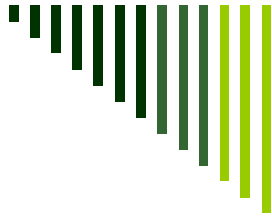
Model: BW as a function of GWG, maternal age group (adolescent vs. adult), and other potential confounding factors



Methods

Covariates assessed for inclusion in the model:

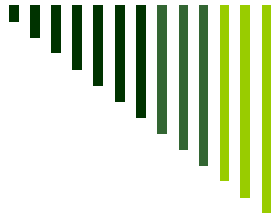
- Prepregnancy weight (PPW)
- Medicaid payer status
- Maternal smoking
- Adequacy of prenatal care, Kotelchuck Index
- Marital status
- Gestational diabetes
- Preeclampsia



Methods

Multilevel mixed-effects linear regression

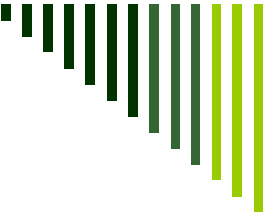
- Standard regression model assumes that observations are independent
- This method accounts for both age group and sister pair associations to make more precise comparisons



Results

Cohort characteristics

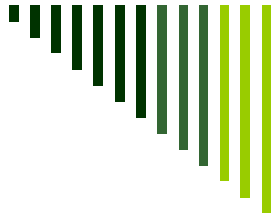
Characteristic	Adolescents (n=1,283)	Adults (n=1,283)
Mean age, years	17.2 (0.0)	24.7 (0.1)
Gestational age at delivery, weeks	39.6 (0.0)	39.4 (0.0)
Mean prepregnancy weight (kg)	61.3 (0.4)	72.8 (0.6)
Mean gestational weight gain (kg)	16.7 (0.2)	15.8 (0.2)
Birth weight (g)	3435 (12)	3456 (13)



Results

Cohort characteristics (continued):

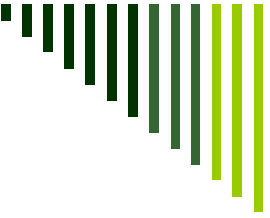
- Majority were White (85%)
- Adolescents:
 - More likely to smoke (27% vs. 21%)
 - Less likely to receive adequate PNC (62% vs. 71%)
 - Less likely to be married (17% vs. 56%)
 - More likely to have Medicaid payer (49% vs. 37%)
- Adults more likely to experience GDM (4% vs. 1%) and preeclampsia (7% vs. 10%)



Results

Unadjusted model

Variable	Regression coefficient (β)	P> z	95% Confidence Interval	
Weight_gain*adolescent	7.096	0.004	2.246	11.946
Weight_gain (kg)	9.873	0.000	6.603	13.142
Adolescent	-148.231	0.001	-233.422	-63.040
_cons	3329.450	0.000	3243.198	3357.114



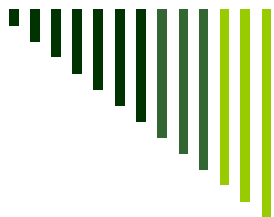
Results

Adolescent

- All else equal, for each 1kg $\uparrow$ in GWG, BW $\uparrow$ by an average of 16.97g

Adult

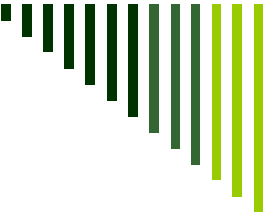
- All else equal, for each 1kg $\uparrow$ in GWG, BW $\uparrow$ by an average of 9.87g



Results

Adjusted model

Variable	Regression coefficient (β)	P> z	95% Confidence Interval	
Weight_gain*adolescent	5.829	0.032	0.507	11.152
Weight_gain (kg)	14.589	0.000	11.161	18.016
Adolescent	-80.961	0.103	-178.298	16.377
Prepregnancy weight (kg)	5.186	0.000	4.017	6.354
Smoked	-128.445	0.000	-171.756	-85.133
Preeclampsia	-141.966	0.000	-206.582	-77.349
_cons	2888.089	0.000	2773.319	3002.859



Results

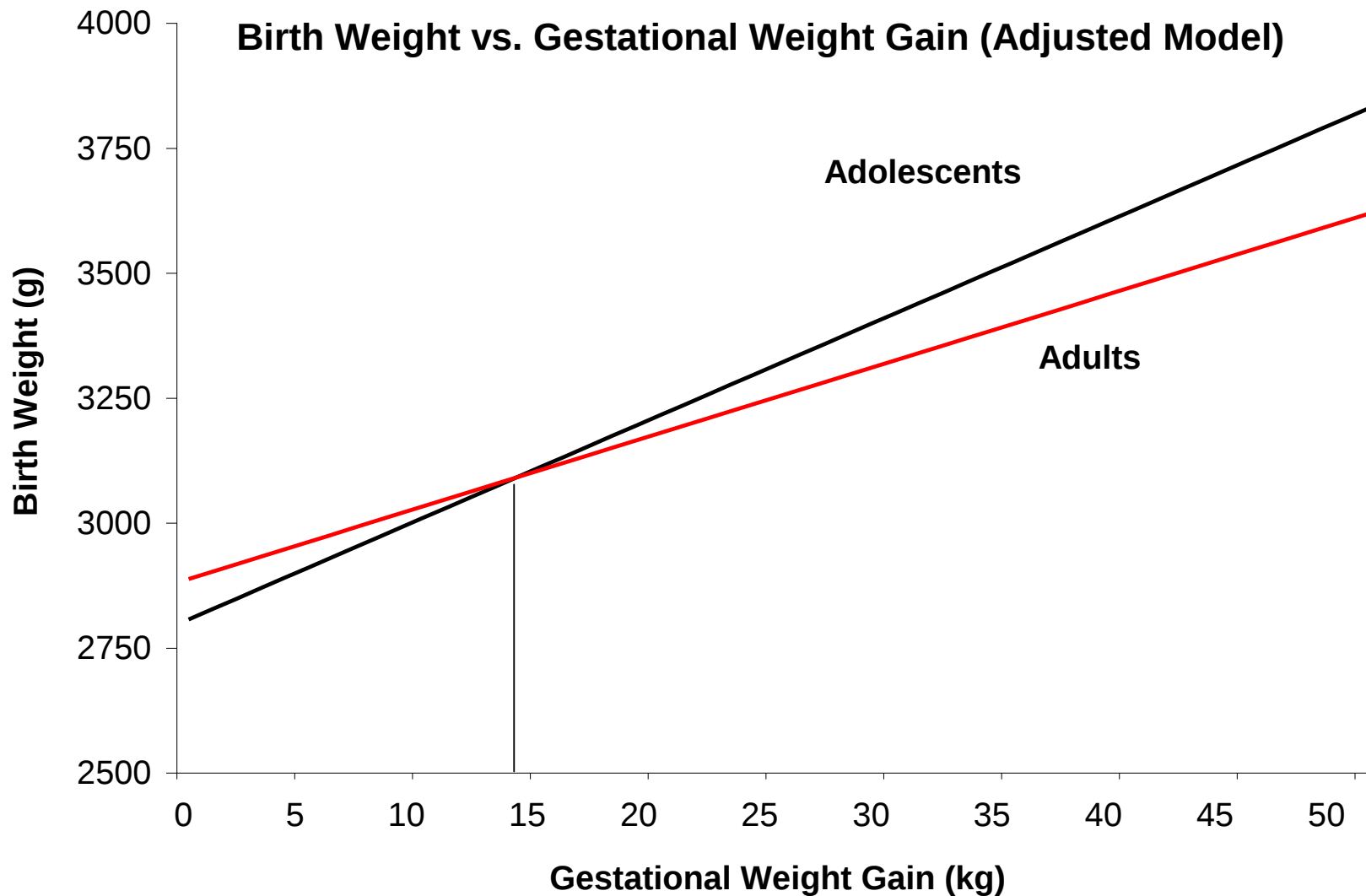
Adolescent

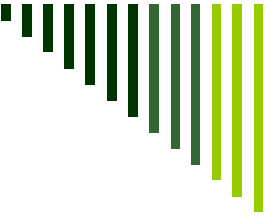
- All else equal, for each 1kg $\uparrow$ in GWG, BW $\uparrow$ by an average of 20.42g

Adult

- All else equal, for each 1kg $\uparrow$ in GWG, BW $\uparrow$ by an average of 14.59g

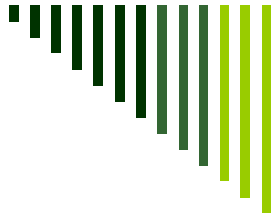
Results





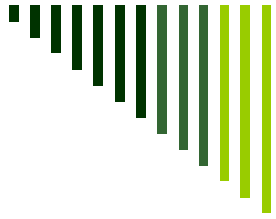
Results

- Results indicated a small, statistically significant difference in the BW-GWG relationship for adolescent mothers relative to their adult sisters
- Suggest that infants born to adolescents may have greater BW potential with increased GWG



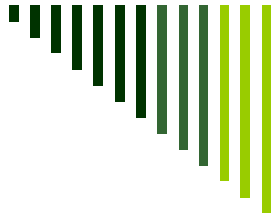
Strengths

- First study to examine the relationship between GWG and BW in a cohort of full biological sisters
- Use of sister pairs allows greater control over genetics, exposures
- Availability of population-based data provides a representative sample and reduces potential selection bias



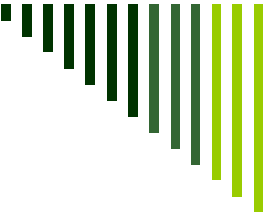
Limitations

- 15% missing data for PPW
- Birth certificate data typically underestimates:
 - prenatal care visits
 - pregnancy complications
 - tobacco and alcohol use during pregnancy
- Sample not sufficiently diverse to generalize to other populations



Conclusions

- More precise information on appropriate gestational weight gain is needed for adolescents
- Clinical research with monitoring of gestational weight gain throughout pregnancy would be particularly beneficial



Acknowledgements

Thesis committee members:

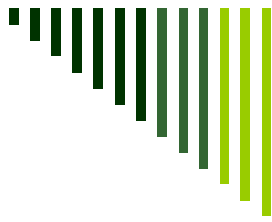
Marcia Williams, PhD, MPH, PT (Chair)

Jane Rees, PhD, MS, RD

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Models

Unadjusted

$$BW = \beta_0 + \beta_1(\text{adol}) + \beta_2(\text{GWG}) + \beta_3(\text{GWG} * \text{adol})$$

Adolescent: $BW = 3151.93 + 16.97(\text{GWG})$

Adult: $BW = 3300.16 + 9.87(\text{GWG})$

Adjusted

$$BW = \beta_0 + \beta_1(\text{adol}) + \beta_2(\text{GWG}) + \beta_3(\text{GWG} * \text{adol}) + \beta_4(\text{smoked}) + \beta_5(\text{preeclampsia}) + \beta_6(\text{PPW})$$

Adolescent: $BW = 2807.13 + 20.42(\text{GWG}) - 128.44(\text{smoked}) - 141.97(\text{preclamp}) + 5.19(\text{PPW})$

Adult: $BW = 2888.09 + 14.59(\text{GWG}) - 128.44(\text{smoked}) - 141.97(\text{preclamp}) + 5.19(\text{PPW})$