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CHALLENGES CREATED BY UNDERWEIGHT

Prenatal weight gain and perinatal outcomes among underweight pregnancies

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Disclosures

- Nothing to disclose

Outline

- Epidemiology of underweight among US pregnancies
- Physiology of gestational weight gain among underweight pregnancies
- Evidence from Texas
 - Gestational weight gain among underweight pregnancies
 - Predictors and links to adverse perinatal outcomes
- Conclusions and next steps

Underweight pregnancies in US, 2023

- Vital statistics birth records
- Of all US births in 2023 (3,596,017), 2.7% were in the underweight prepregnancy BMI category
 - Underweight pregnancies were in younger age groups
 - <20 y: 8.1%
 - 20-24 y: 4.6%
 - 25-29 y: 2.4%
 - 30-34 y: 1.9%
 - 35-39 y: 1.6%
 - 40-54 y: 1.4%

Characteristics of underweight pregnancies, 2014

Table 1. Prepregnancy body mass index, by selected maternal characteristics: 47 states and the District of Columbia, 2014

Maternal characteristics	Total number	BMI ¹				Not stated
		Underweight (BMI less than 18.5)	Normal weight (BMI 18.5–24.9)	Overweight (BMI 25.0–29.9)	Obese (BMI greater than 29.9)	
		Rate (percent)				
Total reporting area ²	3,837,663	3.78	45.86	25.58	24.78	150,976
Age group (years)						
Under 20	246,088	7.66	53.11	22.63	16.59	9,172
20–24	859,549	5.18	44.72	24.87	25.22	31,394
25–29	1,106,455	3.49	44.72	25.73	26.06	41,370
30–34	1,031,233	2.83	47.06	25.86	24.26	41,500
35–39	482,335	2.37	44.97	26.79	25.87	21,839
40–54	112,003	2.01	42.50	28.47	27.01	5,701
Race and Hispanic origin						
Non-Hispanic white	2,034,846	3.79	49.40	24.08	22.73	63,104
Non-Hispanic black	545,021	3.34	34.90	26.93	34.83	29,693
Non-Hispanic American Indian and Alaska Native	32,529	2.54	33.86	27.21	36.40	965
Non-Hispanic Asian	231,310	8.61	63.95	19.94	7.50	11,364
Hispanic	875,474	2.79	40.17	29.73	27.31	34,581
Educational attainment						
Less than high school	573,564	4.76	41.49	27.56	26.19	25,808
High school	953,831	4.32	41.11	25.72	28.84	39,752
Some college	812,796	3.49	40.67	26.04	29.81	24,767
College degree	1,447,635	3.18	53.54	24.45	18.83	47,546
Parity						
1st	1,489,089	4.74	50.84	23.73	20.69	54,805
2nd	1,216,483	3.55	45.87	25.76	24.82	45,433
3rd	644,154	2.91	41.38	27.31	28.39	24,772
4th or more	468,409	2.49	36.08	28.64	32.80	21,022
Source of payment						
Medicaid	1,662,904	4.38	40.28	26.11	29.22	62,072
Private insurance	1,812,581	3.14	50.38	24.96	21.52	62,893
Self-pay	155,331	4.93	52.50	25.01	17.56	10,364
Other	165,993	3.57	45.88	27.68	22.87	6,110

¹BMI is body mass index; see Methods for calculation.

²Total reporting area represented 96% of all U.S. births in 2014 and excluded Connecticut, New Jersey, and Rhode Island.

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Underweight pregnancies:

Younger

Higher proportion Asian

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Underweight
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Lower education

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Underweight pregnancies:

Higher proportion primiparous and receiving Medicaid

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Physiology of underweight pregnancy

- Driver of underweight
 - Constitutional thinness (e.g., younger age, smaller body size/genetics)
 - Health condition (e.g., maladaptive disorder, disordered eating)
 - Post-surgical intervention
 - Food access/insecurity

Physiology of underweight pregnancy

- Updated considerations
 - Weight loss drugs
 - GLP-1s, and other weight loss drugs
 - Uncertain safety during pregnancy, or postpartum

Physiology of underweight pregnancy

- Composition of weight gain
 - Components (Hyttén, 1980b)
 - Maternal supporting compartments/tissues (~67% of the weight)
 - Body water - most variable compartment
 - Body fat
 - » Breast tissue
 - » Subcutaneous & visceral adipose tissue
 - Uterus
 - Fetus (~25%)
 - Placenta (~5%)
 - Amniotic fluid (~6%)

Body composition change from 14 to 37 wk gestation

- Multi-compartment model data (Lederman, 1997)
 - Body weight, body volume with underwater weighing, total body water with stable isotope and DXA postpartum for bone

BMI	Weight (kg)	Fat mass (kg)	TBW (L)
<19.8	12.6±4.4	4.8±3.8	6.1±2.4
19.8-26	12.2±4.0	3.9±3.7	7.0±2.7
>26-29	11.0±4.6	2.8±5.4	7.8±3.5
>29	8.7±5.6	0.2±5.0	7.3±2.9

Lederman et al. (1997) Body fat and body water changes during pregnancy in women with different body weight and weight gain. *Obstet Gynecol.* 90, 483-488.

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Evidence from underweight pregnancies in Texas, Vital Statistics Records 2022

- Of the singleton 380,857 births in 2022, 10,796 (2.83%) were in the underweight prepregnancy BMI category
- Examine (1) predictors of GWG and (2) whether GWG relates to perinatal outcomes
- GWG calculated from birth records
 - Pre-pregnancy weight & weight at delivery
 - Gestational weight-gain Z-scores
 - Based on Magee population reference values (Hutcheon et al. AJCN 2013, Hutcheon et al. Obesity 2015)

Evidence from underweight pregnancies in Texas, 2022

- NAM guidelines for underweight: 28-40 lbs

	Term Births (n=8,858)		Preterm Births (n=1,401)	
NAM adherence	n (%)	GWG Z-score Mean±SD	n (%)	GWG Z-score Mean±SD
Inadequate	3,186 (36.0%)	-1.22±0.79	748 (53.4%)	-0.94±0.84
Adequate	3,358 (37.9%)	-0.01±0.29	405 (28.9%)	0.43±0.45
Excessive	2,314 (26.1%)	1.20±0.57	248 (17.7%)	1.79±0.70

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 - NAM adherence does not vary between pregnancies among those under 18 years, and those over 18 years

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Factors associated with NAM guideline adherence among term underweight pregnancies (n=8,440), Texas, 2022

- Predictors of excessive GWG
 - Higher risk
 - Longer gestational age, Medicaid (vs. Private), Older maternal age
 - Lower risk
 - Prior pregnancy, Foreign Born, Higher education
 - Compared to non-Hispanic White, lower risk of excessive - Hispanic ethnicity, or Asian
- Predictors of inadequate GWG
 - Lower risk
 - Longer gestational age; Lower education (associate degree, and under)
 - Higher risk
 - Compared to non-Hispanic White, higher risk of inadequate among Black or Hispanic

GWG and perinatal outcomes

	Preterm IRR (95%CI)	GDM IRR (95%CI)	Gest. HTN IRR (95%CI)	NICU IRR (95%CI)
NAM				
Excessive	0.88 (0.74, 1.02)	0.84 (0.58, 1.20)	1.50 (1.17, 1.93)	0.90 (0.73, 1.10)
Inadequate	1.74 (1.54, 1.98)	1.22 (0.91, 1.63)	0.92 (0.71, 1.19)	1.22 (1.04, 1.44)
GWG z-score	1.05 (1.00, 1.10)	0.90 (0.80, 1.01)	1.16 (1.05, 1.27)	0.86 (0.82, 0.91)
Poisson regression adjusting for covariates. HTN, hypertension; NICU, neonatal intensive care unit Covariates: prepregnancy BMI, WIC, education, maternal age, insurance type, border county, parity, race/ethnicity, foreign born, gestational age (for outcomes other than preterm)				

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GWG and perinatal outcomes

	SGA IRR (95%CI)	LGA IRR (95%CI)	Continuous size-for- gest age b (95% CI)
NAM adherence			
Excessive	0.66 (0.59, 0.76)	1.62 (1.37, 1.92)	0.34 (0.25, 0.39)
Inadequate	1.44 (1.31, 1.59)	1.15 (0.98, 1.35)	-0.27 (-0.31, -0.22)
GWG z-score	0.78 (0.76, 0.81)	1.14 (1.07, 1.21)	0.23 (0.21, 0.25)
Linear and Poisson regression adjusting for covariates. SGA, small for gestational age, LGA, large for gestational age. Covariates: prepregnancy BMI, WIC, education, maternal age, insurance type, border county, parity, gestational age, race/ethnicity, and foreign born			

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Infant mortality on birth record by NAM among underweight pregnancies, Texas 2022

- Infant living at birth record differential by GWG adherence ($p < 0.001$)
 - Higher proportion of infants not living at birth certificate with inadequate GWG (0.41%), compared to adequate (0.15%) or excessive (0)

Limitations

- Birth record data
- Do not know reason for underweight

Research Gaps

- How to support adequate GWG among underweight
 - What is driving inadequate GWG?
 - Interventions to support optimal GWG

Research Gaps

- Focus areas
 - Adolescent pregnancy
 - Disordered eating
 - Adipose tissue changes and physiology
 - Weight changes prior to pregnancy
 - GLP-1s, surgery, and other weight loss drugs
- Links to morbidity and mortality

Conclusions

- Limited research on gestational weight gain among underweight pregnancies
- Texas birth records suggest a large proportion of underweight individuals gain outside of NAM guidelines with more than 1 in three term births showing inadequate GWG
 - Inadequate GWG associated with NICU admission, preterm delivery, and increased risk of small-for-gestational age
 - Excessive GWG associated with increased risk of large-for-gestational age and gestational hypertension

Thank you!

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