Table 1. Demographic categories and neonatal outcomes by elevated glucose screening among women with term pregnancies and no pre-gestational or gestational diabetes

Demographic Categories	Glucose screening results (n, row percent): No elevated glucose tests		Any elevated glucose screening test[a]		p value[b]
Maternal Age					
13-17 years	165	(90.2%)	18	(9.8%)	p<.01
18-34 years	5,946	(86.6%)	921	(13.4%)	
35-39 years	446	(82.0%)	98	(18.0%)	
>40 years	66	(78.6%)	18	(21.4%)	
Maternal Race					
Non-Hispanic white	3,994	(85.8%)	662	(14.2%)	p<0.001
Non-Hispanic black	951	(91.2%)	92	(8.8%)	
Hispanic	1,143	(86.7%)	176	(13.3%)	
Asian	218	(77.3%)	64	(22.7%)	
Other	317	(83.9%)	61	(16.1%)	
Maternal Education					
Less than high school	530	(87.9%)	73	(12.1%)	p<0.05
High school/GED	781	(87.7%)	110	(12.3%)	
Some college	1,317	(88.0%)	180	(12.0%)	
Associates/technical	665	(85.9%)	109	(14.1%)	
Completed college	1,835	(85.6%)	310	(14.4%)	
Degree work after college	1,491	(84.5%)	273	(15.5%)	
Maternal Poverty					p=0.10
>200% of poverty level	3,660	(84.7%)	663	(15.3%)	
100-200% of poverty level	792	(86.5%)	124	(13.5%)	
<100% of poverty level	867	(87.7%)	122	(12.3%)	
Maternal BMI					
Underweight (<18.5)	149	(85.6%)	25	(14.4%)	p<0.001
Normal weight (18.5- <25)	3,435	(87.9%)	473	(12.1%)	
Overweight (25 - <30)	1,631	(86.4%)	256	(13.6%)	
Obese (30-<35)	718	(82.8%)	149	(17.2%)	
Morbidly obese (>35)	553	(80.6%)	133	(19.4%)	

a) Elevated A1c >5.7, elevated 1h GTT >135 and <200, elevated fasting >95, or elevated random glucose >200 without diagnosis of pregestational or gestational diabetes during index pregnancy
b) Chi-square or Fisher's exact test as indicated

Table 2. Adjusted logistic regressions[a] for the association between elevated glucose screening, BMI, and neonatal outcomes for women delivering at term without a diagnosis of pre-gestational or gestational diabetes

	Odds Ratio	95% Confidence Interval
Birthweight >97th percentile		
Any elevated glucose screening	1.66	(1.04, 2.67)
BMI category		
Underweight (BMI<18.5)	0.75	(0.10, 5.58)
Overweight (BMI 25-29)	1.15	(0.65, 2.03)
Obese (BMI 30-34)	2.25	(1.24, 4.08)
Morbidly obese (BMI >35)	5.21	(3.04, 8.91)
Shoulder dystocia		
Any elevated glucose screening	1.71	(1.08, 2.70)
BMI category[b]		
Underweight (BMI<18.5)	----	----
Overweight (BMI 25-29)	2.07	(1.31, 3.27)
Obese (BMI 30-34)	1.65	(0.89, 3.04)
Morbidly obese (BMI >35)	2.21	(1.20, 4.08)
Composite neonatal consequences of LGA		
Any elevated glucose screening	1.12	(0.62, 2.00)
BMI category[b]		
Underweight (BMI<18.5)	----	----
Overweight (BMI 25-29)	1.05	(0.60, 1.86)
Obese (BMI 30-34)	1.42	(0.70, 2.87)
Morbidly obese (BMI >35)	0.58	(0.26, 1.29)

a) Adjusted for maternal age, race/ethnicity, education, and poverty
b) Underweight category was dropped from analysis due to small cell size

398 Gestational diabetes screening following normal early testing results

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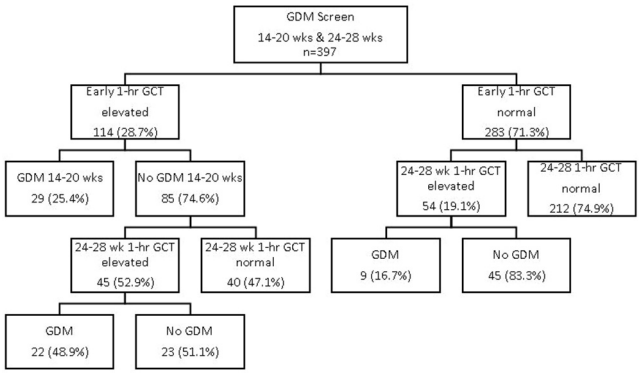
OBJECTIVE: While early gestational diabetes (GDM) screening has been expanded to a larger patient proportion, no standard protocol for follow-up after normal early screening has been adopted. Uncertainty exists as to whether patients should be re-screened at 24-28 weeks and, if so, which test (1-hour or 3-hour) should be performed at that time. In women who had normal early GDM screening, we evaluated the results of subsequent GDM screening and diagnostic tests at 24-28 weeks to determine the optimal approach to follow-up.
STUDY DESIGN: Planned secondary analysis of an RCT examining the clinical utility of early GDM screening. Pregnant women <20 weeks GA with a BMI ≥30 kg/m^2 were randomized to GDM screening at 14-20 wks (early) versus 24-28 wks (routine). Screening for GDM included a 50-g, 1-hr glucose challenge test (1-hr GCT) followed by a 100-g, 3-hr glucose tolerance test (3-hr GTT) if 1-hr GCT was ≥ 135 mg/dL. Diagnosis of GDM was made using Carpenter- Coustan criteria. Those with negative early screening were re-screened at 24-28 wks, starting with repeat 1-hr GCT, regardless of the early GCT results. Women with pregestational diabetes, major medical problems (cardiac, hematologic), steroid use, bariatric surgery, and prior cesarean were excluded from the initial RCT.
RESULTS: Of the 397 who underwent early 1-hr GCT screening in the RCT, 29 (7.3%, 95% CI 4.9-10.3) received a diagnosis of GDM following 3-hr GTT at 14-20 weeks. Of the 85 women with an elevated early 1-hr GCT but normal 3- hr GTT, 45 (52.9%, 95% CI 41.8-63.9) again had a screen-positive 1-hr GCT when repeated at 24-28 wks, and 22 (48.9%, 95% CI 33.7-64.2) of these were diagnosed with GDM on 3-hr GTT. Among the women who initially passed the early 1-hr GCT, only 9 (3.2%, 95% CI 1.5-6.0) were ultimately diagnosed with GDM during re-screening at 24-28 weeks GA.
CONCLUSION: Only half of women with an abnormal early 1-hr GCT but normal early 3-hr GTT required a second 3- hr GTT. Given the time and resources required for the 3-hr GTT, we recommend repeating the 1-hr GCT in lieu of proceeding directly to the 3-hr GTT for screening at 24-28 wks. Additionally, among women with a normal early 1-hr GCT, only 3% were ultimately diagnosed with GDM on repeat screening at 24-28 wks; the need for re-screening this population at 24-28 wks should be reconsidered.

Figure: Gestational diabetes screening results



399 1,5-Anhydroglucitol: A new diagnostic test for gestational diabetes?

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OBJECTIVE: Current screening for gestational diabetes (GDM) relies on glucose tolerance testing, which is burdensome, expensive, and

unreliable. 1,5-Anhydroglucitol (AG) is an unmetabolized monosaccharide excreted in the urine during hyperglycemia. Its steady state concentration is unaffected by fasting or pregnancy; results <10 μg/mL are abnormal outside of pregnancy. We tested the hypothesis that AG can be used as a screening test for GDM in obese women.

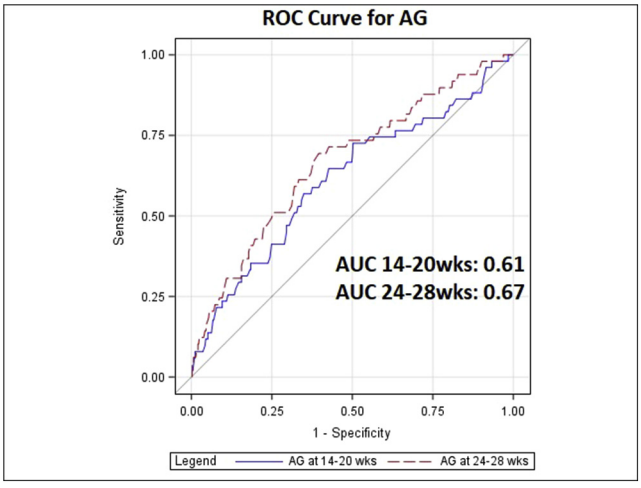
STUDY DESIGN: Prospective observational study as a sub-study of an RCT (n=954) that enrolled obese women (BMI≥30 kg/m^2) with non-anomalous, singleton gestations <20wk. Women were included if serum samples were obtained at 14-20 wk and/or 24-28 wk. GDM screening was performed using a 50-g, 1-hr glucose challenge test followed by a 100-g, 3-hr glucose tolerance test if ≥135 mg/dL. GDM was diagnosed using Carpenter Coustan criteria at 24-28 wk (gold standard). Serum AG levels were measured with a commercially available assay. AG levels of women with and without GDM were compared and an ROC curve was created to assess the association of AG and GDM. A cutoff for AG was selected using the Liu method, and the test characteristics of AG at this cutoff determined. Association of AG with a perinatal composite outcome of macrosomia (>4000g), primary cesarean, hypertensive disease of pregnancy (PIH), shoulder dystocia, neonatal hyperbilirubinemia, and neonatal hypoglycemia was also examined.

RESULTS: Of 954 enrolled, 519 (54.4%) had AG at 14-20 wks and 517 (54.2%) had AG at 24-28 wks. The mean gestational age at blood draw was 17.5 wk and 26.3 wk, respectively. The mean AG value was 13.3 ±5.7 μg/mL at 14-20 wk and 11.1 ± 5.1 μg/mL at 24-28 wk. AG value was significantly different by GDM status at both time points (Table). On ROC analysis, the 14-20 wk AG had an area under the curve (AUC) of 0.61 and the 24-28 week AG had an AUC of 0.67, demonstrating moderate association with a GDM diagnosis. Using a cutoff of 10 μg/mL at 14-20 wk, the sensitivity of an AG≥10 for diagnosing GDM was 45% with a specificity of 70%. Using a cutoff of 11.8 μg/mL at 24 -28 wk the sensitivity was 76% at a specificity of 43%. The primary composite outcome was not associated with AG at either time point (58.3% vs 62.3%, p=0.41 at 14-20 wk; 55.8% vs 63.4%, p=0.08 at 24-28wk).

CONCLUSION: AG at 14-20 wk or 24-28 wk is not sufficiently predictive of a diagnosis of GDM. The sensitivity for GDM is inadequate early in pregnancy and later the specificity is poor.

Table: AG Levels By GDM Status

	GDM	Glucose Tolerant	p
AG at 14-20 wks (μg/mL)	11.4 ± 6.0	13.7 ± 5.6	0.008
AG at 24-28 wks (μg/mL)	8.6 ± 4.8	11.5 ± 5.0	<0.001



400 Early Screening for Gestational Diabetes: What cutoffs should we use?

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OBJECTIVE: While ACOG recommends screening obese women for gestational diabetes (GDM) early, standards for early screening are not established. Many providers use the same GDM screening and diagnostic criteria regardless of gestational age, which may not be appropriate due to increasing insulin resistance throughout pregnancy. We hypothesize that lower screening and diagnostic thresholds are needed at 14-20 wks to identify GDM.

STUDY DESIGN: Planned secondary analysis of an RCT. Eligible women (BMI≥30 kg/m^2) were enrolled <20 wks and randomized to GDM testing (1-hr, 50-g glucose challenge test (GCT) followed by a 3-hr, 100-g glucose tolerance test (GTT) if GCT≥135 mg/dL) at 14-20 wks versus 24-28 wks. Carpenter-Coustan criteria were used to diagnose GDM. This analysis included only women with 14-20 wk and 24-28 wk GCT available. A receiver operator characteristics (ROC) curve was created to assess the test characteristics of early testing compared to GDM >24 wks (gold standard). The Liu method was used to determine the ideal cutoff for each test. The test characteristics of various cutoffs were determined. The incidence of a composite adverse outcome (>4000g, primary cesarean, pregnancy-induced hypertension, hyperbilirubinemia, and hypoglycemia) above and below cutoffs were compared using a chi- squared test.

RESULTS: Of 912 women completing the RCT, 319 (35%) had a GCT available at both time points and 30 (9.4%) were diagnosed with GDM >24 wks. 68 women had a GTT performed at 14-20 weeks. The gestational age at first screen was 17.3±1.7 wks and 26.2±1.3 wks at second. GCT at 14-20 wks was closely associated with GDM at 24-28 wks (area under the curve [AUC] 0.80) with an optimal cutoff of 130 mg/dL. Compared to the cutoff of 135 mg/dL, lowering the threshold to 130 mg/dL increases the sensitivity from 63% to 70% and increases the number of GTTs performed by 4/100 patients. Early GCT≥ 130 mg/dL was associated with the primary outcome (p=0.04). Liu cutoffs for early GTT diagnosis of GDM were 97 (fasting), 155 (1-hr), 127 (2-hr), and 95 (3-hr). Using these cutoffs, an additional 37 women would be diagnosed early with GDM: 43% were diagnosed with GDM at 24-28 wks and 75% had the adverse composite outcome.

CONCLUSION: Early screening for GDM may require lower cutoffs than those used at 24-28 wks. Information regarding whether or not outcomes are improved at these levels is needed before implementing new screening cutoffs.