Relationship of Prenatal Maternal Weight Gain and Symphysis-Fundal Measurement with Risk of Pregnancy Complications

Group 04

Summary

In a cohort study of 755 pregnant women attending a single health clinic for prenatal care in Western Cape, South Africa, the associations between maternal weight and symphysis-fundal measurement between 20 and 30 weeks gestational age were studied, with the ultimate goal of identifying high risk women for escalation of prenatal care. Pregnancy complications of interest were preterm deliveries, having an infant of low birth weight or having an infant small for gestational age. After adjusting for all possible confounders measured in the study (sex of the fetus, maternal height, smoking status, maternal age, and number of previous deliveries (parity), the association between minimum maternal weight and high risk pregnancy (defined as a composite of all three complications) was significant (P=0.023) with an estimated decrease in odds of high-risk pregnancy of 3.3% with every pound increase in minimum maternal weight (95% CI=(0.937,0.995)). When examining the association between this composite outcome and minimum symphysis-fundal height measurement in a similar fashion, there was an estimated decrease in odds of high-risk pregnancy of 97.7% with every centimeter per week increase in fundal height measurement (95% CI=(0.000,1.151)). However, this result did not achieve statistical significance (p=0.059).

Comment [a1]: Start with a statement about the goals of the study

Comment [a2]: low income

Comment [a3]: Tell us how many relevant visits you had per woman

Comment [a4]: If this is really minimu maternal weight, that is mostly just a measure of when their first visit was and their prepregancy weight. Not both of those are of equal scientific relevance.

Comment [a5]: This wording is unfortunate. I think I know what you mean, but since the women are expected to gain 1 cm per week, it makes it sound like a woman's risk is changing rapidly during the pregnancy. You want to talk about using the ratio SFH / EGA

Comment [a6]: You tell us nothing about how this relates to prediction.

Background

Perinatal mortality remains an important health problem in much of the developing world. The World Health Organization reports that 1 in 5 African women experience loss of a baby compared with 1 in 125 women in resource rich countries. Complications contributing to this loss include newborn birth weight less than twenty-five hundred grams, pre-term deliveries prior to thirty-seven weeks gestational age and intra-uterine growth restriction (IUGR). These complications result in newborn failure to thrive, increased susceptibility to disease and increased respiratory complications. Identifying pregnant women at high risk of these complications remains difficult in low resource clinics that are often constrained by high patient volumes and minimal monetary support.

As such, prenatal care for African women is often inadequate and may contribute to the higher rates of poor outcomes compared to resource rich communities. Typical prenatal care visits currently consist of routine blood pressure, maternal weight and maternal symphysis-fundal height (SFH) measurements. Utilizing these measurements to identify potential high-risk pregnancies early in the second trimester may allow for re-allocation of resources or early transfer to higher level care reducing the risk for pregnancy complications. Therefore, this study was designed to follow high-risk women receiving prenatal care at an urban clinic to determine whether maternal weight and SFH measured between 20 and 30 weeks gestational age are associated with a high risk pregnancy complication (low birth weight, pre-term delivery or small for gestational age newborn).

Research questions:

1. Are minimum maternal weight and SFH measured between 20 and 30 weeks of

Comment [a7]: It would be more typical for us to measure weight change during the pregnancy owing to the extremely high variability in maternal weight prior to pregnancy gestational age associated with a complicated pregnancy?

2. Are minimum maternal weight and SFH measured between 20 and 30 weeks of gestational age associated with a complicated pregnancy independent of other potential risk factors, including maternal age, smoking status, parity, height, and sex of the fetus?
3. Are minimal maternal weight and SFH between 20 and 30 weeks of gestational age predictive of having a complicated pregnancy?

Description of the Data

We have data available for 755 pregnant women (identified prospectively) with singleton pregnancies followed at a single, public urban clinic in Western Cape, South Africa. Women were followed until delivery with serial measurements of maternal weight and SFH. Maternal baseline factors including parity, smoking status, height and age were collected at time of enrollment. For each woman, we have the number of clinic visits denoted by gestational age (in weeks) for each visit. Maternal weight (in kilograms) and symphysis-fundal height (in centimeters) were recorded for each woman at each clinic visit. In addition, information is available on the women's age (in years), height (in centimeters), parity (number of prior deliveries), smoking status (yes or no) and sex of the newborn (boy or girl).

We do not have some pertinent data available:

1. Data is only available for women who opted to seek prenatal care. We do not have data available for individuals who did not seek care. It is likely that the women who did not seek care represent a distinctly different population than the women who did seek care. However, since the overall goal of our study is to create a tool to identify high-risk women in prenatal care clinics, this is less of a limitation to our study.
2. While we have data available on some maternal factors including age, height, parity, and smoking status, there are other important maternal factors omitted from the available data.
3. Ideally, we would have collected blood pressure measurements at each prenatal visit as pre-eclampsia (manifested by prenatal hypertension) is a risk factor for pregnancy complications.

Statistical Methods

Data Preparation

These data comprise multiple observations corresponding to clinic visits for 755 pregnant South African women who are known to have singleton pregnancies and are receiving prenatal care at a public urban clinic in Western Cape. We are provided with two datasets, the first of which contains data measured at prenatal care clinic visits while the second dataset contains primarily baseline data and data corresponding to the time of birth.

We first evaluated missing data in key variables of interest in the dataset containing information from prenatal care visits, namely 'wk' (estimated gestational age), 'sfh' (symphysis-fundal height [SFH]) and 'wt' (maternal weight at associated estimated gestational age). Two visits for two different subjects were missing gestational age, but in looking more closely at the data these observations appear to be duplicates of the immediately preceding observations. As such, we dropped these two observations from the dataset. However, missing data for 'sfh' and 'wt' did not appear to be duplicates, so these were retained unchanged in the dataset and will be

Comment [a8]: This is the question you do not include in the summary

Comment [a9]: estimated

Comment [a10]: Almost always you should avoid using the Stata names of the variables, and instead use English. Of course, sometimes we use acronyms like SFH and EGA. But "wk" and "wt" are not okay.

discussed in further detail below.

Low SFH and maternal weight are thought to be important predictors of poor pregnancy outcomes, and so we considered how to best model these variables. As SFH is known to be linear with gestational age, we believe that it is useful to transform SFH, dividing its value by estimated gestational age (SFH/EGA). We feel that it is not necessary to transform maternal weight. Leaving it in its original state will ease interpretation of models including maternal weight.

Comment [a11]: approximately, during the time period of greatest interest

Comment [a12]: After making this adjustment, I would use different words. You could try "SFH:EGA ratio" or just the "standardized SFH". But it is higly confusing to call it the SFH as you do in your Results section.

Comment [a13]: but you might want to look at change in weight, which is a transformation of sorts.

The ultimate goals of these analyses are to identify associations between these predictors and poor pregnancy outcomes as well as to generate a model predictive of poor pregnancy outcomes based on obtainable measurements during pregnancy. As low SFH (which we suggest modeling as SFH/EGA) and low maternal weight are thought to be associated with poorer outcomes, we created variables to identify minimum SFH/EGA and minimum maternal weight during the gestational period of primary interest defined as 20-30 weeks.

The proposed outcomes of interest are low birth weight (LBW), small for gestational age (SGA) and preterm delivery, which will be assessed as individual outcomes. But, because we suspected that many of the infants who had one of these outcomes likely had one or more of the others, we also generated a composite outcome to identify all infants who had LBW, SGA or preterm delivery as a complication. We will refer to this outcome as "high risk pregnancy."

Comment [a14]: good to do it both ways

Statistical Analyses

We performed descriptive statistics of the baseline characteristics of women in this cohort stratified by each of LBW, SGA and preterm delivery and present these tables in correlation with the results section below for your review (see Table 1 in Appendix). We also provide information detailing the number of clinic visits each woman attended, also stratified by each of the individual outcomes (see Table 2 in Appendix).

Comment [a15]: "calculated" or "performed descriptive analyses"

Comment [a16]: Because you put these in the appendix, it is not too bad to put these things here. But I still think it better to go in Results.

In analyzing these data, we are interested in the associations of each of minimum SFH/EGA and minimum maternal weight measured during 20 to 30 weeks gestation with each of LBW, SGA, preterm delivery and composite pregnancy complications. Using univariate logistic regression models, we can estimate the association of each predictor with each outcome. However, if no other variables are included in the model, it is possible that our observed estimates are confounded by the fact that women with lower minimum SFH/EGA and maternal weight may also have lower maternal height, be smokers, be at extremes of age or parity and deliver male infants. Therefore, we suggest multivariable logistic models to include these variables. We can then interpret our estimates of the effect of minimum SFH/EGA and maternal weight on the outcomes when all other variables in the model are held constant. Specifically, by including additional covariates in the model (i.e., adjusting for these covariates), we are able to make comparisons within groups of women who are similar with respect to these variables.

Comment [a17]: Because our ultimate goal is prediction, we are less concerned with "confounding" and more concerned with whether the new measurements are providing additional info beyond the baseline. A very subtle distinction.

As such, in the results section below, we present estimates of the effect of each predictor on each of the outcomes of interest (LBW, SGA, preterm delivery and composite pregnancy complications) modeled individually in univariate logistic regression models and when accounting for other important covariates in multivariable logistic regression models. We carefully deliberated which variables seemed scientifically important when considering the potential confounders *a priori.* We selected maternal height, maternal age, parity, smoking status and sex of the infant as initial covariates. We then used backward elimination stepwise model building to determine retaining variables with a p-value <0.20 in our multivariate regression models.

In addition, it is important to assess whether the observed associations between our predictors and our outcomes, consisting of LBW, SGA, preterm delivery and high risk pregnancy, are more than would be expected by random chance. To do so, we can perform a hypothesis test of the null hypothesis of no change, corresponding to an odds ratio (OR) of 1.00. We express the results of these hypothesis tests as P-values, and when a P-value is less than 0.05, we will take that as evidence of a significant association. In conjunction, we should also estimate a range of reasonable values for ORs for the outcomes as described above, using *95%* confidence intervals. When these confidence intervals include 1.00, we will conclude that we do not have sufficient evidence to detect a significant association between the specific predictor and outcome. As the relationships between these variables and high risk pregnancy remain relatively unknown, the goal of this analysis will be to explore the relationships between our predictors of interest and high risk pregnancy. We will not perform cross-validation with a test set and validation set in this sample in order to preserve power for understanding the associations between these variables. We will create receiver operator curves to determine the area under the curve (AUC) for the predictive models generated by backwards elimination. We will report the AUC and display the ROC as indicators of the overall performance of the predictive model.

Comment [a18]: Tell us what these are. In particular, tell us what ROC curves tell us. And most importantly, explain to me what AUC tells you, because I don't think it very useful in this particular problem.

Missing data

Importantly, subjects were excluded from a particular analysis if they were missing data for a variable included in that analysis. In doing so, we have made the assumption that the missing data is "missing at random" conditional on the modeled covariates. Unfortunately, no methods exist to ensure that this assumption is valid. We will need to keep in mind that subjects missing data for potentially confounding factors who were not included in our logistic regression models may have different associations of minimum SFH/EGA and minimum maternal weight with the outcomes as described above.

Results

The following regressions were generated in order to examine the associations outlined in the introduction above. However, the development of a framework for a predictive model was also of interest. The predictive abilities of the models formed below are not examined, beyond report of the AUC, in this analysis. An association was determined to be significant for any model below if the p-value of the regression coefficient was below 0.05.

Comment [a19]: Start with the descriptive statistics and tell us about the cases that had to be excluded from your analyses. You said you had 755 women, but your results in Table 1 do not add up to this.

Comment [a20]: Why not? It does not take much to look at the results and say that the predictive capabilities are nil.

Initial univariate logistic regressions were run to assess the association between the predictors of interest (minimum maternal weight and minimum symphysis-fundal height growth (SFH) between 20 and 30 weeks of gestational age) and outcomes of interest (low birth weight, small for gestational age, and preterm deliveries). Each of these univariate logistic regressions suggested a significant association between each predictor of interest and the odds of each outcome of interest with one exception. Minimum maternal weight was not significantly associated with preterm delivery in the univariate regression (P=0.075). Among the univariate regressions, the strongest association within the sample (determined by magnitude of p-value) was between minimal maternal weight and odds of low birth weight, with estimated odds of

Comment [a21]: In what scientific sense is this the strongest association? I think it is in this case, because we have population based sampling.

low birth weight 6.4% lower among mothers with minimal weight one pound higher (P<0.001, 95% CI=(0.904,0.970)). Maternal weight also had a stronger association than fundal height with the odds of SGA, with an estimated decrease in odds of SGA of 4.6% (P<0.001, 95% CI=(0.930,0.979)) with each pound increase in weight. Fundal height had a stronger association with preterm delivery than maternal weight, with estimated odds of preterm delivery over 99% lower in fetuses with one centimeter per week higher fundal height measurement (P=0.002, 95% CI=(0.000,0.069)).

Comment [a22]: What are the units here? An OR of 0 is rather amazing! Or it would be if the groups you were comparing were scientifically relevant.

It should be noted that the intercept in any model generated is not of scientific or statistical interest because the intercept represents an estimate for a fetus with fundal height of zero or a mother with weight of zero, which is irrelevant in this analysis.

Comment [a23]: And because of that, I would not even report the intercept in the Results

The effects of potential confounding factors of maternal height, maternal age, smoking status, and sex of the fetus were of interest for each association between each predictor of interest and each individual outcome. After initially generating a regression that included all these potentially confounding factors along with the predictor of interest, backwards elimination was implemented using a p-value threshold of 0.2. These predictive models were built for each of the significant associations between predictors of interest and individual outcome, yielding five total models. Table 3 below displays the lack of consistency of any single covariate between all final predictive models.

Comment [a24]: This criteria is of course not the best from a prediction standpoint, but it is not that bad. This approach is not appropriate for a question that relates entirely to detecting associations, but that is not our question. So all in all, this is an acceptable approach here, I think.

One interesting final predictive model is the model with fundal height as the predictor and odds of preterm birth as the outcome. After adjusting for parity, there is still a significant association between fundal height and odds of preterm delivery, with an estimated difference in odds of 99% between two fetuses with a difference in average fundal height growth of one centimeter, with higher odds in the fetus with lower fundal height. This regression suggests that fundal height is highly indicative of a preterm delivery after adjustment for potential confounding.

Comment [a25]: You would have to explain this far better. You are comparing, say, one woman whose SFH:EGA ratio is 0.5 (e.g., SFH of 12.5 at EGA 25) to a woman whose SFH:EGA ratio was 1.5 (e.g., SFH of 37.5 at EGA 25). This is not within the range of our data. Choosing a more reasonable comparison would be good.

The relationship between maternal weight gain or fundal height with having a small for gestational age infant or low birth weight infant was confounded by maternal smoking status, sex of the baby and maternal height. However, none of the potential confounders (age, sex of the baby, maternal height, smoking status or parity) were significantly independently associated with each of the pregnancy outcomes of interest. Therefore, no single factor appeared to confound all of the relationships between maternal weight and fundal height with high risk pregnancy.

Final models developed through backward elimination included a composite outcome of high risk pregnancy (low birth weight and/or small for gestational age and/or preterm delivery) with two final models for each of the main predictors of interest adjusting for all potential confounders.

In the final predictive model with minimum maternal weight as a predictor, age, smoking status, sex of the fetus, and maternal height were included. After adjusting for each of these covariates, the odds of a high-risk pregnancy was estimated to be 0.967 times as high in a woman whose minimum weight is one pound more between 20 and 30 weeks of gestational age than an otherwise comparable woman with respect to the other covariates in the model. This association is significant (P=0.030) and these results would not be uncommon from a relatively narrow range of true odds ratios in the population (95% CI=(0.937,0.997)).

Comment [a26]: Again, I note that the scientific interpretation of this derived variable is very difficult and largely uninteresting.

In the final predictive model with fundal height as a predictor, age, smoking status, sex of the fetus, and maternal height were included as additional covariates. After adjusting for these covariates, the odds of high-risk pregnancy was estimated to be 0.023 times as high for an infant with fundal height measurement one centimeter per week higher, which was not determined to be a significant association (P=0.059) due to the likelihood that the data arose from true odds ratios from a wide range, including one (95% CI=(0.000,1.151)).

Because no single factor arose in each predictive model developed with an individual outcome, no single covariate can be considered a confounder for each of the regressions using composite outcomes. Classification of confounding in each individual regression requires further analysis of associations between predictors of interest and each potential confounder within the sample. Because inclusion of all covariates in final regressions remains despite classification as confounding or not (automatically considered a precision variable), investigation into confounding of specific factors of specific associations is recommended for further study, but is not addressed in this analysis.

Comment [a27]: Again note my belief that “confounding” is not as much an issue here.

The association between minimum maternal weight and SFH in the sample (see Figure 1) suggests a possible interaction between maternal weight gain and SFH that may impact the association with high-risk pregnancy. If a single predictive model is of interest using both maternal weight and fundal height measurements, further investigation into this relationship should be pursued. The inclusion of both these factors in a single model is not present in this analysis due to the statistician’s lack of understanding of the possible scientific interactions between maternal weight and fundal height.

Comment [a28]: A very good thing to note to your collaborators. It would be even better to explain what the issues are statistically, and ask them to comment on whether any interaction would be of scientific interest.

Using the ROC curve with the final model using minimum maternal weight as a predictor along with all relevant covariates with the composite outcome, the AUC for this predictive model is 0.692, which is promising for future study of this type of predictive model. Because this model was not used on a training sample and the fit of the model was not specifically analyzed, specific use of the ROC curve other than motivation for further analysis is not considered.

Comment [a29]: There is zero chance that your typical collaborator would know what the ROC curve is telling us scientifically in this case. I suspect you did not interpret this, because you were also unsure of what it was telling us. What I get out of this curve is that any rule that would identify half the high risk population (about 50 women), would also identify about 25% of the low risk population (about 150 women). So your PPV is only about 25% and you are missing half the women you care about.

You should also consider whether the SFH added very much beyond a model that had only the baseline data in it. (In my analyses, it did not.)

Discussion

As the above results were obtained from a single observational study, care should be taken to not place undue weight upon any singular finding due to concerns for residual confounding by factors not included in the analysis including quality and frequency of prenatal care and baseline maternal conditions that may result in higher than average risk for pregnancy complications.

In general, mothers who had higher minimum weights measured during pregnancy tended to experience fewer of the studied pregnancy complications compared to women with a lower measured weight during pregnancy. After adjusting for available potential confounders, there did appear to be confounding of the relationship by maternal smoking status, height and sex of the baby, but there remained a significant relationship between minimum maternal weight and perinatal pregnancy complications. Of the three measured types of poor pregnancy outcomes, minimum maternal weight is most strongly associated with delivery of a low birth weight baby with an increase in the odds of having a low birth weight infant if the mother’s minimum maternal weight were 10 lbs lower would be roughly equal the increase in odds for smoking mothers compared to nonsmokers of the same weight having a low birth weight child. The results also indicated that increased maternal symphysis-fundal height was also associated with lower odds of pregnancy complications, even though the results were not quite reach significance in all models after adjusting for potential confounding variables. Minimum SFH was most strongly associated both in significance and magnitude to preterm birth outcomes, but was also strongly associated with low birth weight.

When all 3 types of pregnancy complications, preterm birth, low birth weight, and small for gestational age, were combined into one variable, minimum maternal weight reached higher levels of statistical significance than did SFH after adjusting for possible confounders. The fact that SFH was not significantly associated with the composite outcome variable, but was significantly associated with both preterm birth and low birth weight may be indicative of separate disease etiologies for the 3 birth outcomes. It may be more appropriate to assess each complication individually than as different manifestations of the same complication.

While the magnitude of the effects on birth outcomes for 1 unit changes in minimum SFH appear much larger than for 1 unit changes in minimum weight, it must be understood that the range in minimum weight is much larger than the range in minimum SFH. The standard deviation for maternal weight is approximately 11.5 lbs, but the standard deviation for SFH is .06. Therefore, the estimated differences in birth outcomes predicted by the regression model do vary substantially more across the range of the data than might initially be expected by looking only at the coefficients.

These results provide some evidence that higher minimum maternal weight and higher minimum SFH are associated with lower odds of certain pregnancy complications. However, it is not possible to know whether these relationships are truly causal or if residual confounding could still exist. Additional studies are warranted to further elucidate these relationships.

Appendix

Table 1: Maternal Characteristics Stratified by Pregnancy Complications

	N (missing)	Mean (SD)	Median (95% IQR)
Low birth weight infant			
Maternal weight	74 (1)	56.77 (11.04)	54.0 (49.7,61.9)
Fundal height	73 (2)	0.91 (0.06)	0.90 (0.88,0.95)
Age	75 (0)	23.9 (4.79)	23 (20,27)
Height	73 (2)	153.6 (5.80)	154(150,157)
Parity	75 (0)	0.9 (1.17)	1 (0,2)
Smoking status	75 (0)	0.31 (n/a)	n/a
Normal birth weight			
Maternal weight	631 (45)	63.49 (11.77)	61.4 (55.2,69.9)
Fundal height	631 (45)	0.93 (0.06)	0.93 (0.90,0.97)
Age	676 (0)	24.9 (5.42)	24 (21,28)
Height	672 (4)	157.0 (6.47)	157 (153,161)
Parity	676 (0)	1.1 (1.22)	1 (0,2)
Smoking	676 (0)	0.31 (n/a)	n/a

Comment [a30]: It is far better to put your two groups as columns rather than rows. This table is very hard to look at, because our most interesting comparisons are far away from each other.

Small for gestational age			
Maternal weight	103 (2)	58.27 (11.11)	56.9 (50.5,64.8)
Fundal height	102 (3)	0.91 (0.07)	0.9 (0.88,0.96)
Age	105 (0)	23.9 (4.90)	23 (20,27)
Height	99 (0)	154.6 (5.87)	155 (150,158)
Parity	105 (0)	0.9 (1.11)	1 (0,1)
Smoking	104 (1)	0.43 (n/a)	n/a
Normal size for gestational age			
Maternal weight	606 (44)	63.55 (11.83)	61.4 (55.1,70.1)
Fundal height	606 (44)	0.93 (0.06)	0.93 (0.90,0.97)
Age	650 (0)	24.9 (5.44)	24 (21,28)
Height	650 (0)	157.0 (6.54)	157 (153,162)
Parity	650 (0)	1.1 (1.23)	1 (0,2)
Smoking	647 (3)	0.29 (n/a)	n/a
Preterm birth			
Maternal weight	24 (0)	58.40 (10.04)	56.1 (52.9,64.7)
Fundal height	23 (1)	0.90 (0.05)	0.90 (0.88,0.92)
Age	24 (0)	23.9 (4.78)	23 (20,28)
Height	24 (0)	156.2 (4.78)	156 (154,158)
Parity	24 (0)	1.1 (1.10)	1 (0,2)
Smoking	24 (0)	0.31 (n/a)	n/a
No preterm birth			
Maternal weight	680 (46)	62.93 (11.92)	60.6 (54.7,69.5)
Fundal height	680 (36)	0.93 (0.06)	0.93 (0.90,0.97)
Age	726 (0)	24.8 (5.37)	24 (21,28)
Height	720 (6)	156.7 (6.54)	1567 (153,161)
Parity	726 (0)	1.1 (1.21)	1 (0,2)
Smoking	726 (0)	0.31 (n/a)	n/a
Overall			
Maternal weight	709 (46)	62.78 (11.87)	60.4 (54.5,69.0)
Fundal height	708 (47)	0.93 (0.06)	0.93 (0.89,0.96)
Age	755 (0)	24.8 (5.39)	24 (21,28)
Height	749 (6)	156.7 (6.50)	156 (153,161)
Parity	755 (0)	1.1 (1.21)	1 (0,2)
Smoking	751 (4)	0.31 (n/a)	n/a

Table 2: Number Subjects without Data at Each Gestational Age (Percent of Total Missing Data)

	Maternal Weight	Fundal Height	
20	132 (17.48%)	132 (17.48%)	
21	51 (6.75%)	51 (6.75%)	

22	89 (11.79%)	91 (12.05%)	
23	39 (5.17%)	40 (5.30%)	
24	68 (9.01%)	69 (9.14%)	
25	31 (4.11%)	30 (3.97%)	
26	43 (5.70%)	44 (5.83%)	
27	17 (2.25%)	17 (2.25%)	
28	28 (3.71%)	28 (3.71%)	
29	9 (1.19%)	9 (1.19%)	
30	14 (1.85%)	14 (1.85%)	
SFH and Weight Measurement Same Week (Frequency)			
22	2		
23	1		
24	1		
26	1		
33	1		
Number of visits per subject	N	Mean (sd)	Median (IQR)
Total	755	7.7 (2.28)	8 (6,9)
Normal birth weight	676	7.9 (2.22)	8 (6,9)
Low birth weight	75	6.8 (2.68)	7 (5,9)
Normal size for gestational age	650	7.9 (2.19)	8 (6,9)
Small for gestational age	105	7.1 (2.68)	7 (5,9)
Term delivery	726	7.8 (2.23)	8 (6,9)
Preterm delivery	24	5.3 (2.44)	6 (3,7)

Table 3: Adjusted associations between Maternal Weight and Fundal Height with Pregnancy Complications

	OR	SE	p-value	95% CI LB	95% CI UB
Composite outcome					
Maternal Weight					
Minimum maternal weight between 20-30 weeks GA	0.967	0.015	0.023	0.937	0.995
Maternal height	0.967	0.017	0.058	0.933	1.001
Maternal smoking	1.886	0.432	0.006	1.198	2.962
Parity	0.846	0.096	0.141	0.677	1.057
Sex of the baby	0.691	0.157	0.103	0.442	1.078
Symphysis-Fundal Height					
Minimum maternal SFH between 20-30 weeks GA	0.023	0.045	0.059	0.000	1.151
Maternal age	0.950	0.022	0.025	0.908	0.994
Maternal smoking status	1.956	0.453	0.004	1.243	3.081

Comment [a31]: You should have provided descriptive statistics about how SFH varies over time for the two groups. A very simple table would have been SFH by EGA, not worrying about who was measured when.

Sex of the baby	0.695	0.159	0.111	0.444	1.087
Maternal height	0.945	0.017	0.002	0.912	0.980
Preterm Delivery					
Maternal Weight					
Minimum maternal weight between 20-30 weeks GA	0.961	0.022	0.075	0.920	1.004
SFH					
Minimum maternal SFH between 20-30 weeks GA	0.001	0.002	0.001	0.000	0.064
Parity	1.043	0.159	0.778	0.775	1.406
LBW					
Maternal Weight					
Minimum maternal weight between 20-30 weeks GA	0.948	0.018	0.005	0.913	0.984
Maternal height	0.954	0.020	0.024	0.916	0.994
Maternal smoking status	1.646	0.431	0.057	0.985	2.750
Sex of the baby	0.691	0.179	0.153	0.415	1.148
SFH					
Minimum maternal SFH between 20-30 weeks GA	0.005	0.011	0.015	0.000	0.352
Maternal height	0.925	0.022	0.001	0.883	0.969
Maternal age	0.959	0.025	0.104	0.912	1.008
Maternal smoking status	1.763	0.476	0.035	1.039	2.991
Sex of the baby	0.689	0.182	0.159	0.410	1.157
SGA					
Maternal Weight					
Minimum maternal weight between 20-30 weeks GA	0.965	0.015	0.023	0.936	0.995
Maternal height	0.967	0.017	0.058	0.933	1.001
Maternal smoking status	1.883	0.435	0.006	1.197	2.962
Sex of the baby	0.690	0.157	0.103	0.442	1.078
Parity	0.846	0.096	0.141	0.677	1.057
SFH					
Minimum maternal SFH between 20-30 weeks GA	0.022	0.045	0.059	0.000	1.151
Maternal height	0.945	0.017	0.002	0.912	0.980
Maternal age	0.950	0.022	0.025	0.908	0.993
Maternal smoking status	1.956	0.453	0.004	1.242	3.081
Sex of the baby	0.695	0.159	0.111	0.440	1.087

Table 4: Unadjusted Association between Maternal Weight and Fundal Height with Pregnancy Complications					
	OR	SE	p-value	95% CI LB	95% CI UB
Low birth weight					
Minimum maternal weight between 20-30 weeks GA	0.936	0.017	<0.001	0.904	0.970
Minimum maternal SFH between 20-30 weeks GA	0.006	0.012	0.011	0.000	0.314
SGA					
Minimum maternal weight between 20-30 weeks GA	0.954	0.013	<0.001	0.930	0.979
Minimum maternal SFH between 20-30 weeks GA	0.014	0.023	0.023	0.000	0.557
Preterm Delivery					
Minimum maternal weight between 20-30 weeks GA	0.961	0.022	0.075	0.920	1.004
Minimum maternal SFH between 20-30 weeks GA	0.001	0.002	0.002	0.000	0.069

Figure 1: Minimum weight vs. Fundal Height

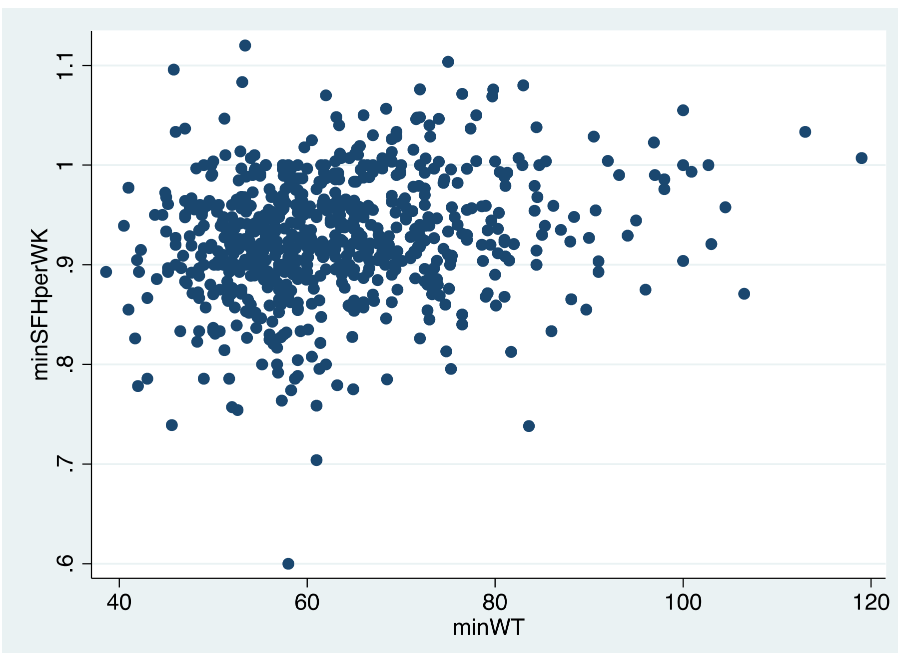

Figure 2: ROC of Minimum Maternal Weight and High Risk Pregnancy Model