Labor complications and Prenatal Care (2015 US Natality)

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Questions we will be exploring along the way

- Do mothers with any risk factors tend to have complications during labor?
- How early do mothers with knowledge of having risk factors receive prenatal care?
- Should there be more emphasis on starting prenatal care early among risk factored pregnant mothers?

What is Prenatal care?

Prenatal care is healthcare a mother receives when pregnant. With Prenatal care, health problems can be addressed earlier. With early treatment, health problems are maintained and many are prevented.

Risk Factors: using Discrete Features

- Risk factors include (created bins):
  - Pre-pregnancy Diabetes
  - Gestational Diabetes
  - Pre-pregnancy Hypertension
  - Gestational Hypertension
  - Hypertension Eclampsia
- Created variable indicating:
  - risk factor present → 1
  - no risk factor present → 0
- FIltered out unknown values

Labor Complications Occurring

"A complication of birth is any problem that is a risk to the health of the mother or the baby that occurs during the birth."

Labor Complications: using Discrete Features

- Position of Baby at time of labor (created bin)
  - Complication if either breech or other position.
- Maternal morbidity: Unplanned operating room procedures (created bins):
  - Maternal Transfusion
  - Perineal Laceration
  - Ruptured Uterus
  - Unplanned Hysterectomy
  - Admit to Intensive Care
- Created complication occurrence variable:
  - 1 → complications occurred
  - 0 → no complications occurred
- FIltered out unknown values

Predicting Labor complication occurrences

- Logistic regression used
- Response:
  - labor complications occurred → 1
  - no labor complications occurred → 0
- Features include risk factors

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.7123	0.00232	1366634.50	<.0001
RF_PDIAB_bin	1	1	0.4179	0.0196	454.5615	<.0001
RF_GDIAB_bin	1	1	0.2098	0.00839	624.5386	<.0001
RF_PHYPE_bin	1	1	0.4346	0.0141	944.1108	<.0001
RF_GHYPE_bin	1	1	0.3665	0.00804	2077.5455	<.0001
RF_EHYPE_bin	1	1	0.7605	0.0316	577.4999	<.0001

Collinearity will need to be checked

Model Performance

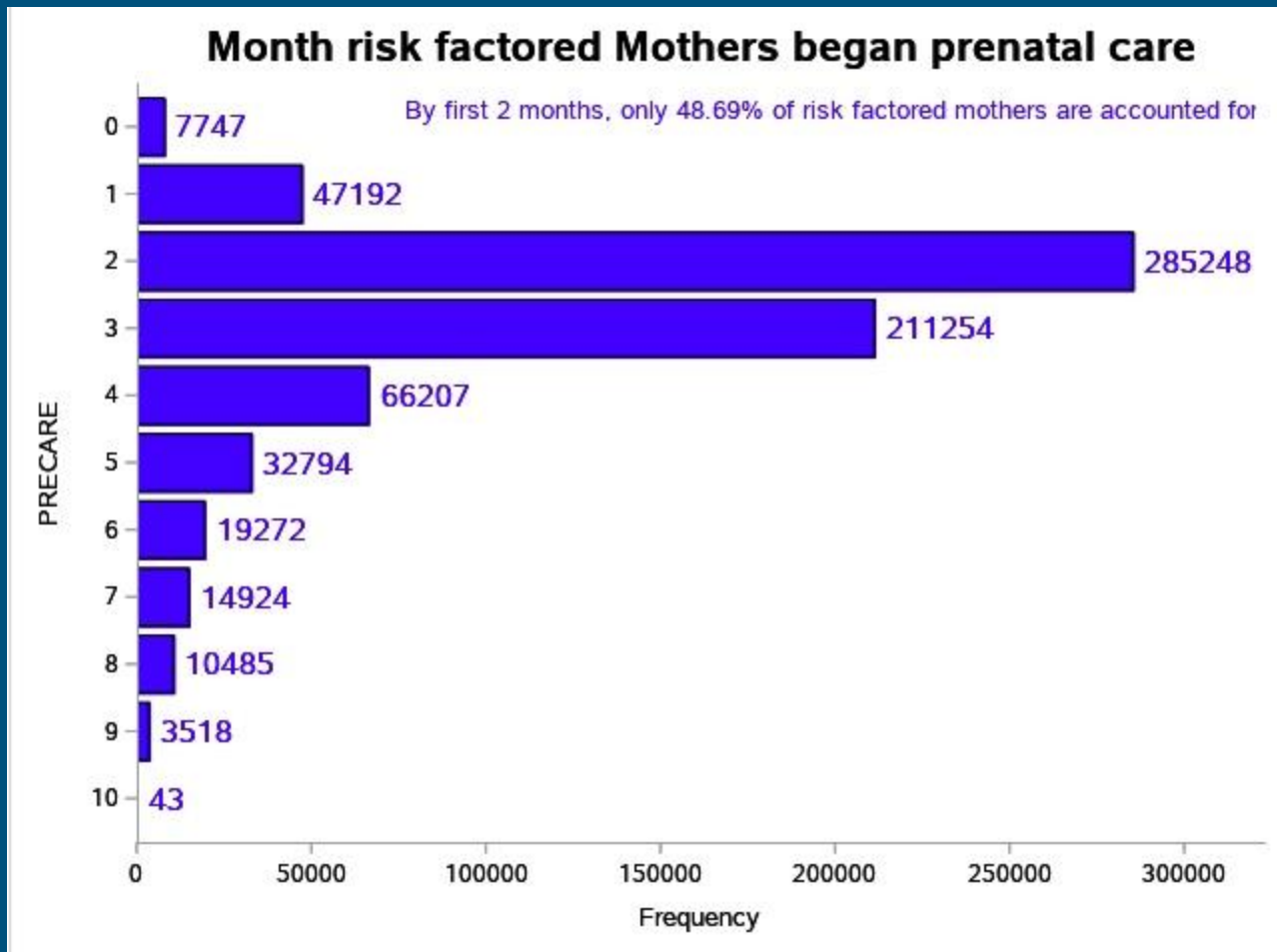|	RF_PDIAB_bin	RF_GDIAB_bin	RF_PHYPE_bin	RF_GHYPE_bin	RF_EHYPE_bin	comp_occur
					Spearman Correlation Coefficients, N = 3666900	
					Prob > |r| under H0: Rho=0	
RF_PDIAB_bin	1.00000	-0.02186 <.0001	0.09684 <.0001	0.03570 <.0001	0.00901 <.0001	0.01450 <.0001
RF_GDIAB_bin	-0.02186 <.0001	1.00000	0.04949 <.0001	0.06321 <.0001	0.01103 <.0001	0.01679 <.0001
RF_PHYPE_bin	0.09684 <.0001	0.04949 <.0001	1.00000	-0.03099 <.0001	0.01829 <.0001	0.01847 <.0001
RF_GHYPE_bin	0.03570 <.0001	0.06321 <.0001	-0.03099 <.0001	1.00000	0.02865 <.0001	0.02664 <.0001
RF_EHYPE_bin	0.00901 <.0001	0.01103 <.0001	0.01829 <.0001	0.02865 <.0001	1.00000	0.01496 <.0001
comp_occur	0.01450 <.0001	0.01679 <.0001	0.01847 <.0001	0.02664 <.0001	0.01496 <.0001	1.00000

No apparent collinearity. Correlations of less than 10%.

Model Performance

Model seems to be randomly predicting response.

Association of Predicted Probabilities and Observed Responses				
Percent Concordant		15.9	Somers' D	0.048
Percent Discordant		11.1	Gamma	0.177
Percent Tied		72.9	Tau-a	0.006
Pairs	791672825048		c	0.524

Table of comp_occur by med_cond			
comp_occur	med_cond		
	0	1	Total
0	2789152 76.06 81.28 93.97	642316 17.52 18.72 91.93	3431468 93.58
1	179064 4.88 76.06 6.03	56368 1.54 23.94 8.07	235432 6.42
Total	2968216 80.95	698684 19.05	3666900 100.00

Large percentages of misclassifications.

How early do mothers with knowledge of having risk factors receive prenatal care?

Month risk factored Mothers began prenatal care

By first 2 months, only 48.69% of risk factored mothers are accounted for

PRECARE	Frequency
0	7747
1	47192
2	285248
3	211254
4	66207
5	32794
6	19272
7	14924
8	10485
9	3518
10	43

When do mothers begin prenatal care?

Risk Factored Mothers

Mothers with no prenatal care: 1.11%
Began by month two in pregnancy: 48.69%

Recommendations include meeting with a doctor once a month by "Weeks 4 to 28 of pregnancy."

Conclusion

- Use variable selection to improve predicting model
    - Try out more features
    - For example, create bin for extremely obese and underweight.
- More research into what population of cities have high precare attendance.
- More emphasis on risked factored Mothers to start prenatal care early.