Predicting Health of Newborns

With Machine Learning

Patrick Arnold

For academic purposes only. I am not affiliated with any listed organizations.

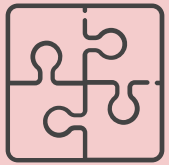
Meet The Team

Patrick Arnold
GitHub
LinkedIn

Hi! I am a Data Scientist and lifelong geek with a degree in Biochemistry from the University of Houston. I have 5 years experience working in petrochemical research and engineering and I have a passion for data-driven solutions.

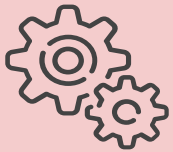
Agenda

Objectives



Data Overview

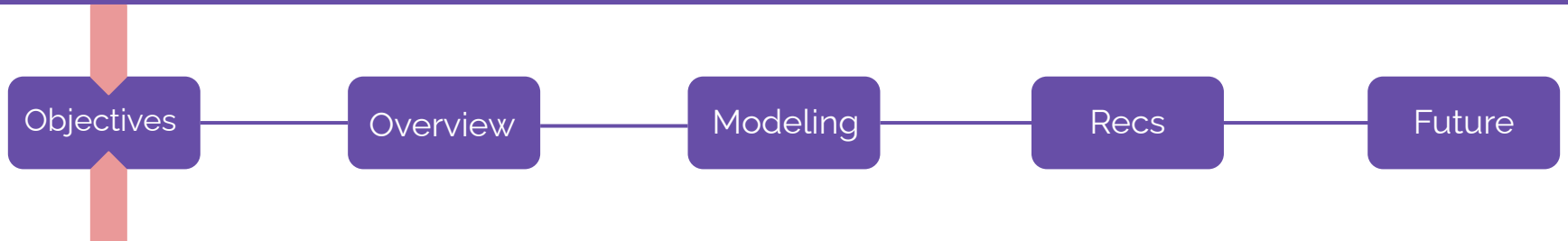
Modeling



Recommendations

Future Insights

Objectives



PRAMS Birth Preparedness Initiative

- USA infant mortality rate is 6 in 1,000
- Predict poor health outcomes during pregnancy
- Best ways to prepare mothers and doctors for birth

Using APGAR Score as a Newborn Health Indicator

A	Appearance	0 - 2
P	Pulse	0 - 2
G	Grimace (Reflex)	0 - 2
A	Activity	0 - 2
R	Respiration	0 - 2

Healthy: 7 - 10

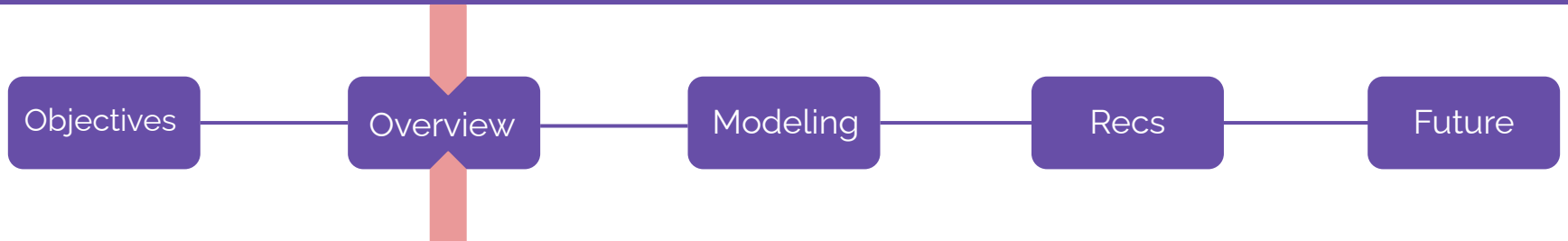
Unhealthy: 0 - 6

Source:
https://www.hopkinsallchildrens.org/Patients-Families/Health-Library/HealthDocNew/What-Is-the-Apgar-Score

Bottom Line

- Model Identified **65%** of At-Risk Newborns
- Recommend launching a prenatal care program and providing emergency support

Data Overview



Data From National Center for Health Statistics

2019 National Survey

3.7 million entries

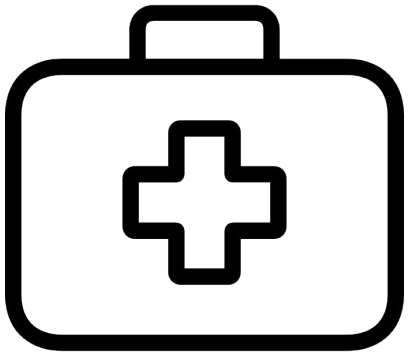
Sampled 20,000 Births

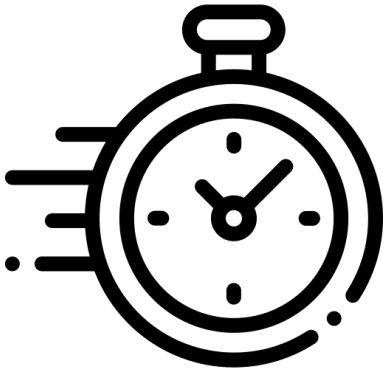
Some Facts About the Dataset

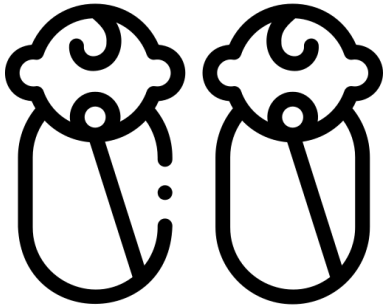
2% Low APGAR

12% Preterm Delivery

3% Plural Pregnancy

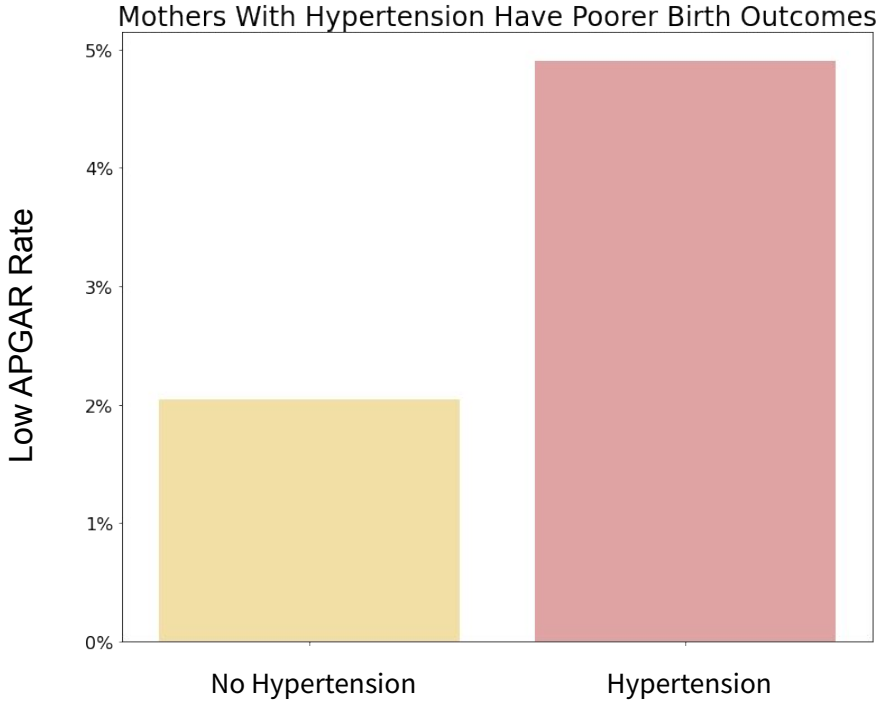


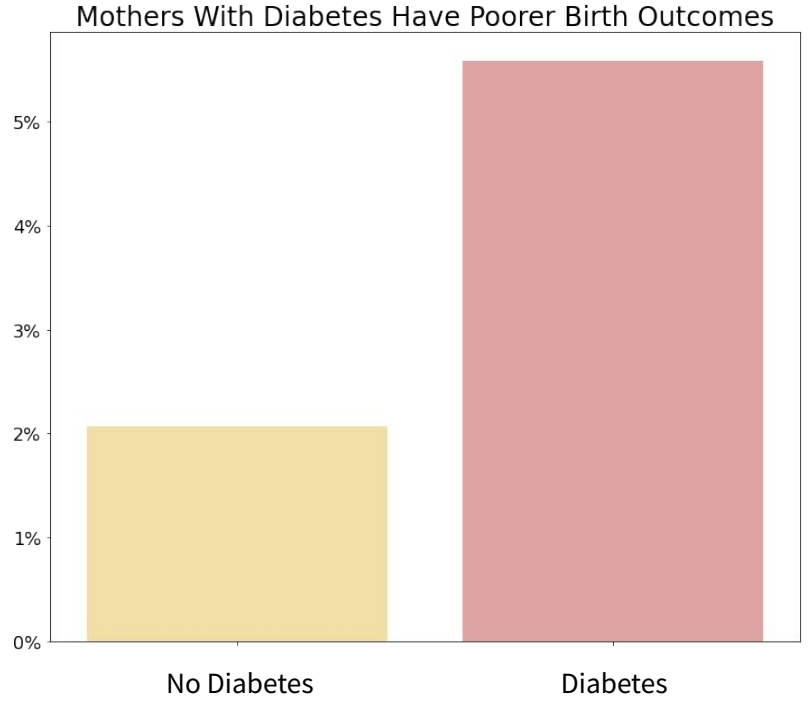




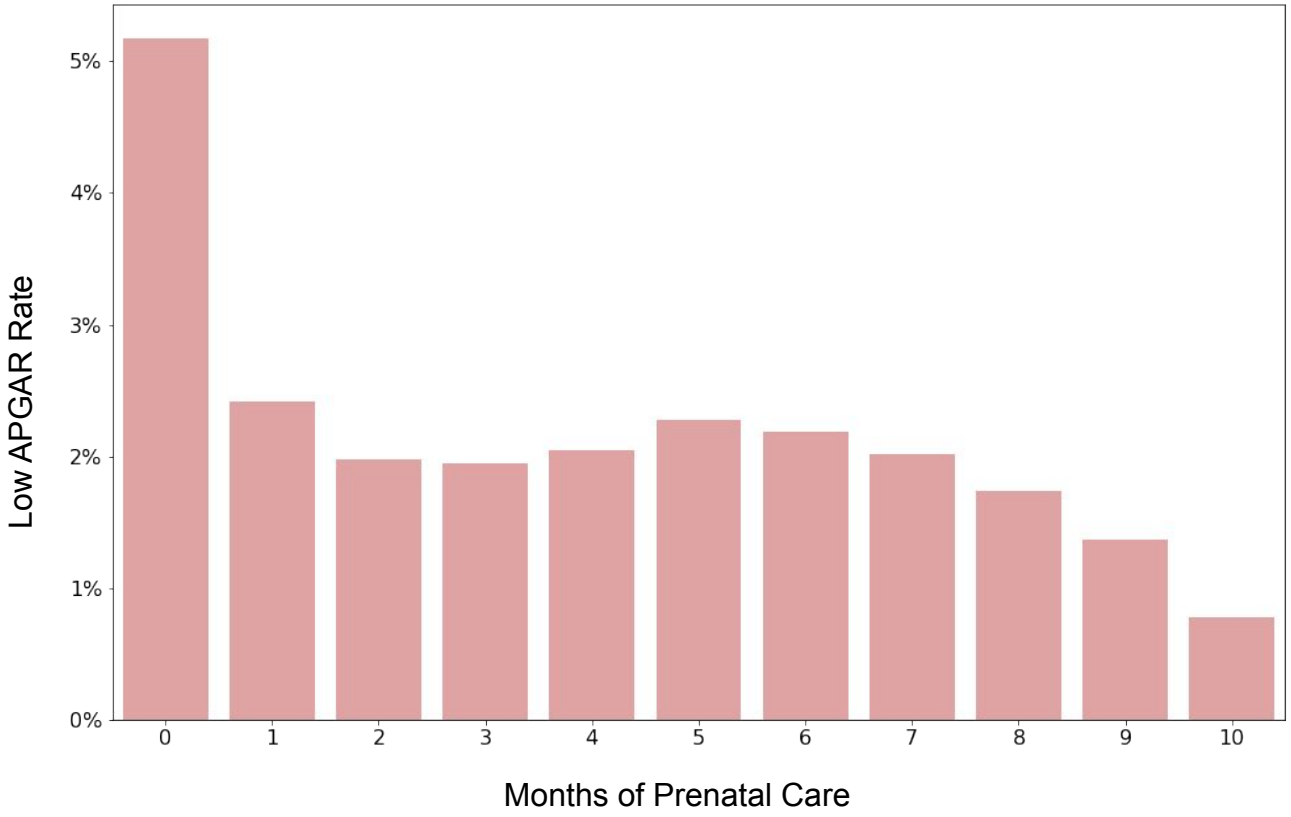
Source:
https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

Maternal Health Indicators Strongly Associated With APGAR Score



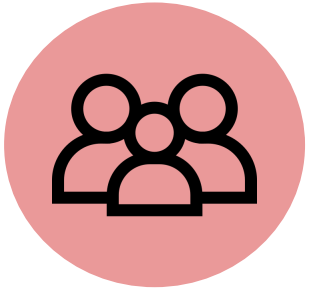


Prenatal Care Associated With Better APGAR Scores: Socioeconomic Gap?



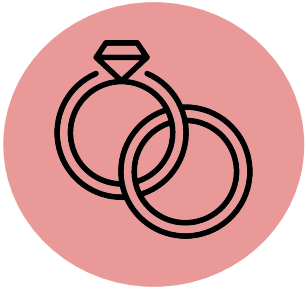
Socioeconomic Indicators: Lower Incomes Had Lower APGAR Scores

Education



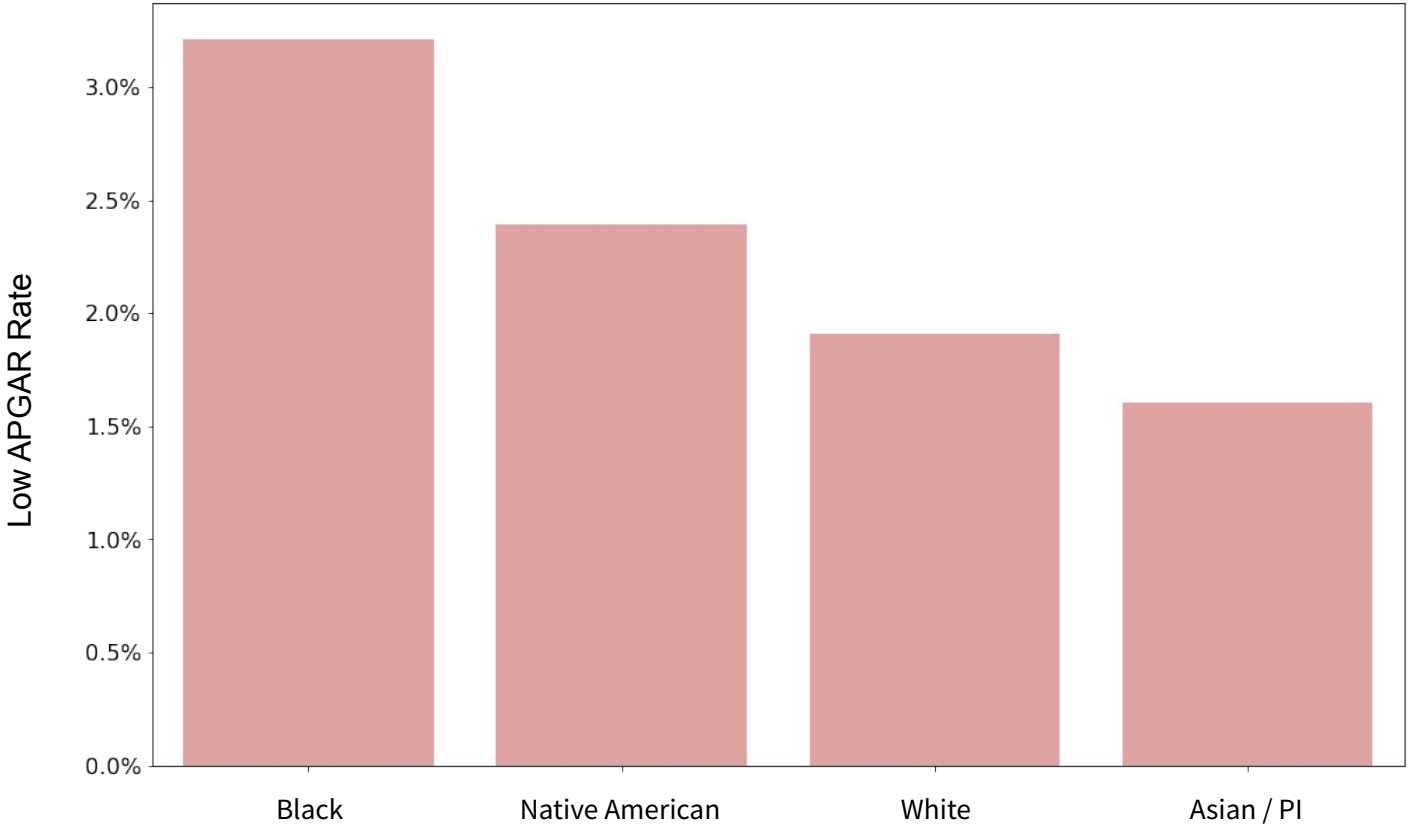
Race and Ethnicity

Food Assistance



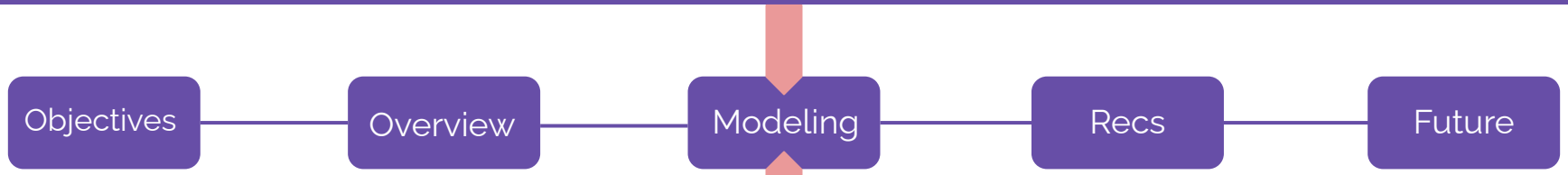
Marital Status

Black Mothers Have Lower APGAR Scores: Socioeconomic or Systemic Issue?



Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4843483/

Modeling



Modeling Process

Health Condition

Prenatal Care

Demographics

Healthy

Not Healthy

Evaluation: Recall Score Maximizes Correctly Classifying Potential Emergencies

Model	Recall Score
Baseline Model	0%
First Model	42%
Final Model	**65%**

Detect 65% of birth emergencies during pregnancy!

Example: Meet Jane, An Expectant Mother

- 26 Years Old
- Gestational diabetes, inflammatory disease
- Comes in for prenatal exam

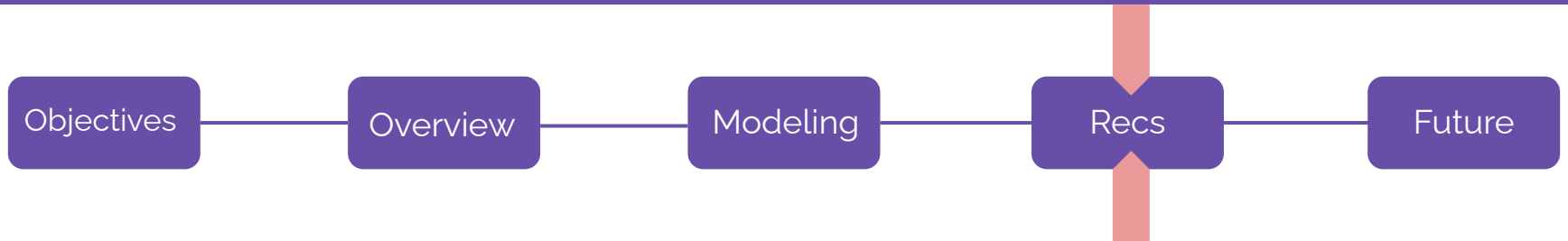
Model Prediction: 77% Chance Child Will Need Emergency Intervention

- Jane begins prenatal care
- Well-equipped major hospital
- Natal Intensive Care at birth

The True Story: Jane Is My Mom!

- Small hospital, not well-equipped
- Emergency: given 1% chance of survival
- Costly and harrowing experience

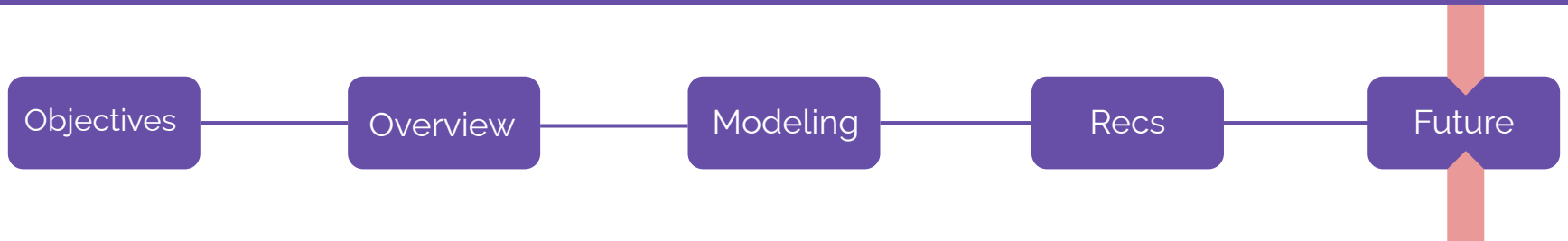
Recommendations



Model Deployment

- Flag at-risk cases early
- Prenatal aid program to close care gap
- Provide medical support during birth

Future Insights



- Other countries
- Compare resampling methods
- Distinguish minor and major emergencies

Thanks! Q&A Box Below

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