# Health Disparities are Heterogenous among High-Risk Subgroups and Context-Dependent Policies May Be More Effective At Reducing Disparities

Introduction

Adverse pregnancy outcomes **(APOs)** such as:

- **Gestational Diabetes Mellitus (GDM)**
- **Preeclampsia (PReEc)**
- **Preterm birth (PTB)**
- **New hypertension (NewHTN)**

are known to disproportionally affect racial/ethnic groups but the extent to which the disparities are present in high-risk subgroups have not been studied.
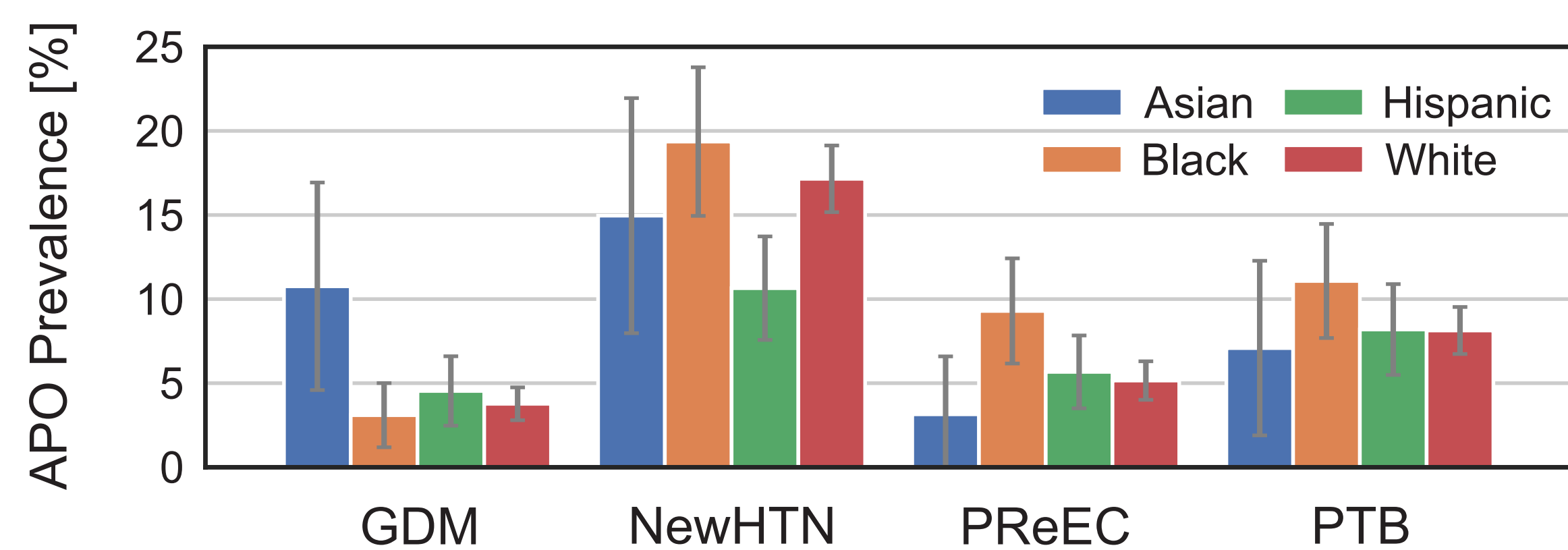
Method

We transformed the nuMOM2b cohort (n=8903) clinical data into transactional data and applied **association rules** to identify high-risk subgroups for each APO

Table 1. Examples of statistically significant association rules for the nuMoM2b cohort.
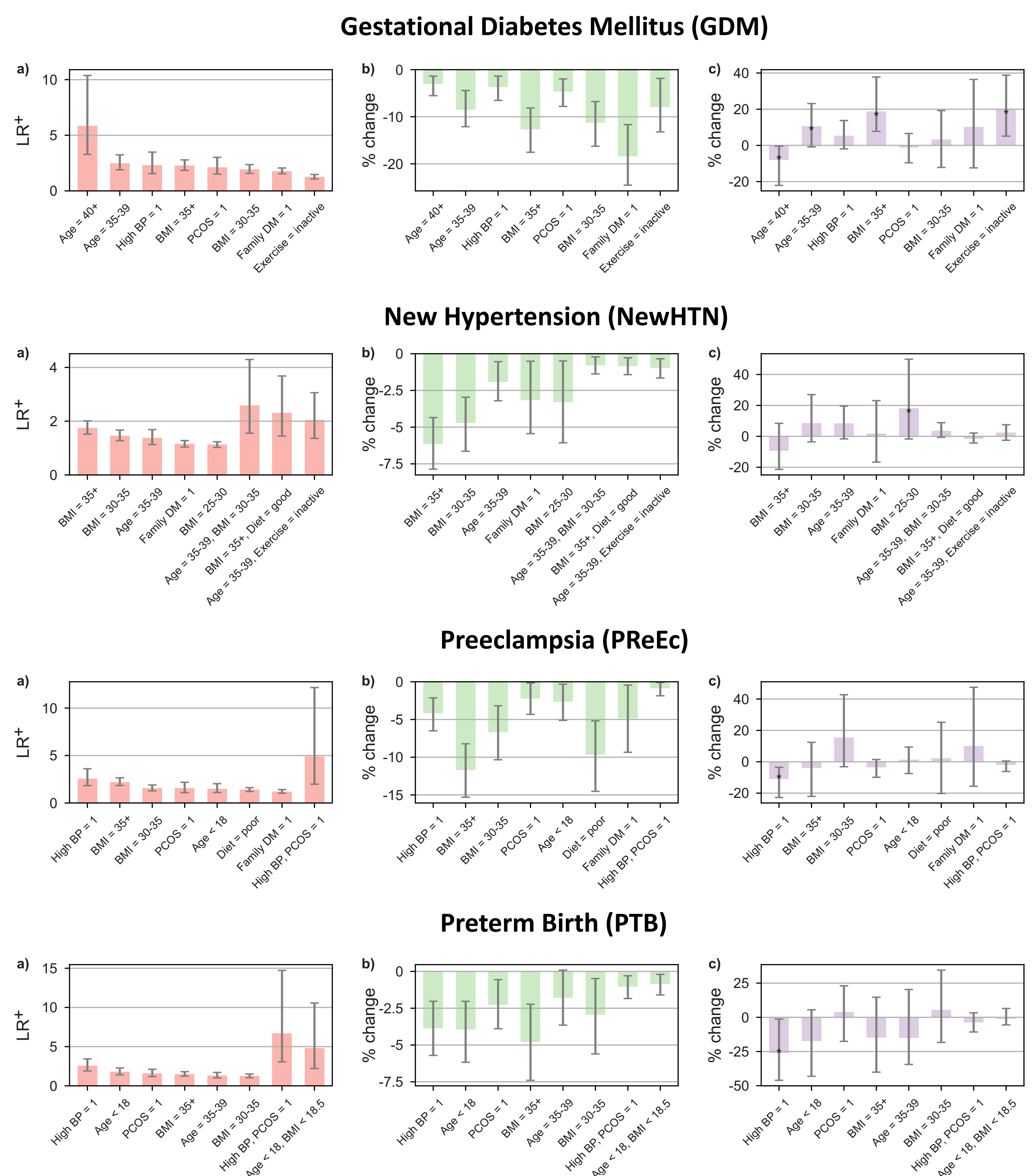
Antecedent	Consequent	Confidence	LR$^+$ [95% CI]	Adjusted p-value
{Age = 35-39}	{GDM = 1}	9.6% (51/531)	2.5 [1.9, 3.2]	4.7×10^{-7}
{Age = 35-39}	{NewHTN = 1}	21.1% (112/531)	1.4 [1.1, 1.7]	1.1×10^{-2}
{Age < 18}	{PTB = 1}	14.3% (70/489)	1.8 [1.4, 2.3]	1.7×10^{-4}
{BMI ≥ 35}	{GDM = 1}	8.8% (78/882)	2.3 [1.8, 2.8]	5.8×10^{-9}
{BMI ≥ 35}	{PTB = 1}	11.9% (105/882)	2.2 [1.8, 2.7]	7.2×10^{-4}
{BMI ≥ 35}	{NewHTN = 1}	25.3% (223/882)	1.8 [1.5, 2.0]	1.1×10^{-10}
{Diet = poor}	{PReEc = 1}	7.9% (146/1853)	1.4 [1.2, 1.6]	3.0×10^{-4}
{Exercise = inactive, High BP = 1}	{PTB = 1}	21.4% (19/89)	2.9 [1.8, 4.8]	5.7×10^{-3}
{Diet = poor, High BP = 1}	{PReEc = 1}	22.2% (16/72)	4.7 [2.7, 8.1]	1.2×10^{-3}
{Age = 35-39, BMI = 30-35}	{NewHTN = 1}	33.3% (22/66)	2.6 [1.6, 4.3]	3.6×10^{-3}

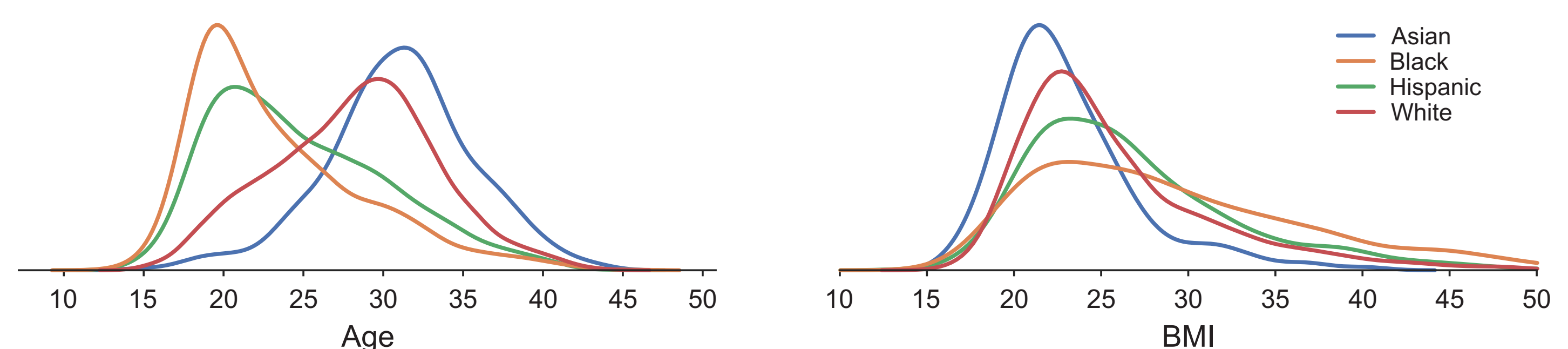We quantified racial/ethnic disparity in each subgroup using **Gini coefficients** and evaluated for each APO:

1. The subgroups with the highest statistically significant **positive likelihood ratios (LR+)**
2. The relative change in APO prevalence if the high-risk subgroups are omitted from the cohort
3. The relative change in Gini coefficient if the high-risk subgroups are omitted from the cohort

Results

Disparity is highly heterogeneous within and across APOs

Gestational Diabetes Mellitus (GDM)

New Hypertension (NewHTN)

Preeclampsia (PReEc)

Preterm Birth (PTB)

Major APO risk-factors are unevenly distributed by populations

Discussion

- Association rules are easily interpretable which enable findings to be accessible to wide audiences including clinicians and policy makers
- Significant differences in age and BMI distributions appears to play an important role in shaping the APO disparity landscape
- While the study does not model clinical intervention, our findings can be used to inform planning of policy interventions such as influencing resource allocation in communities where disparities and health outcomes need to be addressed. For example:
  - High prevalence of GDM among Asian participants above the age of 40 can serve as evidence for prioritizing education on the potential impact of maternal age on the risk of GDM in clinics that serve mostly Asian communities
  - High prevalence of PReEc among Black participants with high blood pressure could serve as evidence for providing resources for blood pressure management in clinics that serve mostly Black communities

Using Association Rules to Understand the Risk of Adverse Pregnancy Outcomes in a Diverse Population

Hoyin Chu[1], Rashika Ramola[1], Shantanu Jain[1], David M. Haas[2], Sriraam Natarajan[3], Predrag Radivojac[1]

[1]Northeastern University, [2]Indiana University School of Medicine, [3]University of Texas at Dallas

Email: chu.ho@northeastern.edu Url: hoyinchu.github.io/posters/ Twitter: @hoyin_chu

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