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Discovering Social Determinant of Health Risk Factors for Perinatal Morbidity through Real World Data

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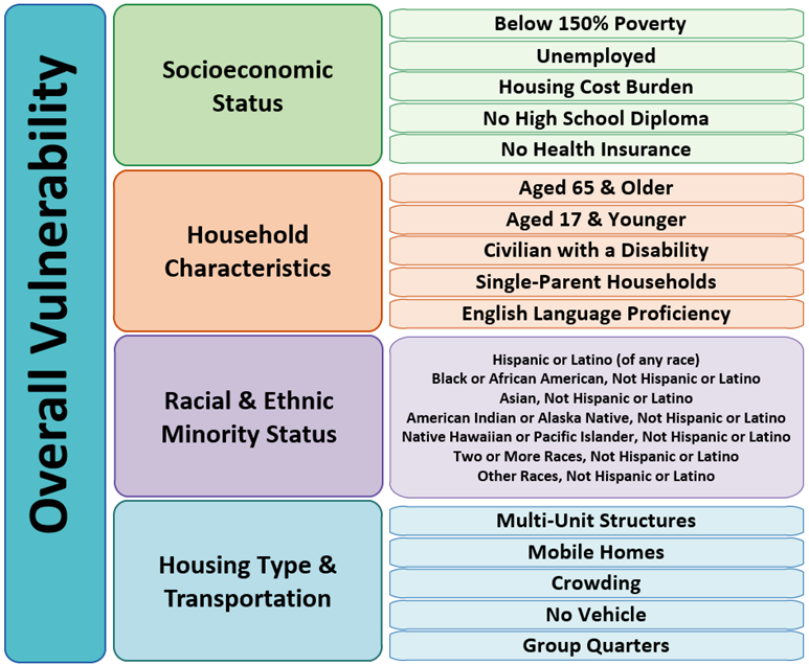
Social determinants of health

- WHO: the conditions in which people are born, grow, live, work, and age. These circumstances are shaped by the distribution of money, power, and resources at global, national, and local levels
- US CDC: Social Vulnerability Index (SVI) – community level



Gestational diabetes mellitus

- A condition in which a woman without diabetes develops high blood sugar levels during pregnancy
- The prevalence of GDM in the US increased from 6.0% in 2016 to 8.3% in 2021 [global: 14.7%]
- Mothers: type 2 diabetes and cardiovascular disease later in life
- Babies: low blood sugar after birth, and jaundice. Obesity and impaired glucose tolerance (long-term)

SDoH and GDM

- In a cohort of 17,659 Chinese pregnant women in Tianjin, China, they found high education and high family income were associated with decreased risk of GDM, and increasing socio-economic status tended to decrease GDM risk via decreasing body mass index [1]
- 956,738 births between 1995 and 2005 in New South Wales, Australia, was used to examine the association between sociodemographic characteristics and the occurrence of GDM, and they found maternal age, socioeconomic position, and ethnicity correlate with GDM [2]

[1] Liu J, et.al. Diabetes Research and Clinical Practice. 2018 Oct 1;144:192-9.
[2] Anna V, et.al Diabetes care. 2008 Dec 1;31(12):2288-93.

Preterm birth

- Deliveries with less than 37 weeks of pregnancy
- Globally, preterm birth affects approximately 11% of all pregnancies, with wide variations across different regions and populations (US: 10.5% in 2021)
- Babies: cerebral palsy, chronic lung disease, and neurodevelopmental disorders, and infant mortality
- Mothers: subsequent preterm births, cardiovascular disease, and other health complications

SDoH and preterm birth

- Assess the causes of preterm birth in Brazil and Canada [1]
  - Canada: multiple gestations, maternal age, cesarean section, hypertension and diabetes, as well as ultrasound scan, were highly associated with preterm delivery [developed country]
  - Brazil: lack of prenatal care, low family income, teenage pregnancy and maternal schooling, as well as type of delivery [developing country]
- Educational level of mother, psychosocial factor (maternal anxiety and stress during pregnancy), behavioral factor and maternal circumstance (violation and trauma) and in health system, lack of prenatal care [2]

[1] Veras RM, Traverso-Yépez M. Saúde em debate. 2009;33(83):429-42.
[2] Dolatian M, et.al Global journal of health science. 2013 Jan;5(1):52.

Learning associations from real-world data

- Identification of GDM from electronic health records
  - The glucose levels of a patient's 1-hour, 50-gram glucose challenge test (GCT): ≥200 mg/dL and ≤130 mg/dL were used to diagnose GDM and non-GDM, respectively
  - Between 130-200 mg/dL: 100-gram, 3-hour oral glucose tolerance test (OGTT)
    - 95 mg/dL or higher for fasting glucose
    - 180 mg/dL or higher for 1-hour glucose
    - 155 mg/dL or higher for 2-hour glucose
    - 140 mg/dL or higher for 3-hour glucose

Identification of preterm birth from EHRs

- We manually extracted the gestational week (GW) information from the clinical notes in EHR and marked a delivery as a PB if the corresponding GW was less than 37 weeks

Logistical regression

- The association between each SVI variable and GDM/PB
- A variable was regarded as significant if it has a false discovery rate (FDR)-adjusted p-value < 0.05
- Confounders included age and BMI, singleton, and delivery method

Patient population across counties in Tennessee

County	# of Deliveries	GDM	PB	SVI
Davidson	8266	501 (6.06%)	827 (10%)	0.69
Williamson	1187	51 (4.30%)	143 (12.05%)	0.05
Rutherford	1186	75 (6.32%)	168 (14.17%)	0.41
Montgomery	1028	32 (3.11%)	302 (29.38%)	0.57
Wilson	881	39 (4.43%)	85 (9.65%)	0.23
Sumner	616	17 (2.76%)	127 (20.62%)	0.34
Robertson	249	15 (6.02%)	55 (22.09%)	0.36
Maury	225	11 (4.89%)	52 (23.11%)	0.33
Cheatham	204	11 (5.39%)	19 (9.31%)	0.31
Dickson	169	8 (4.73%)	16 (9.47%)	0.40

Patient population across race/ethnicity

	# of Deliveries	GDM	PB	SVI
Race (N (%))				
White	9457	426 (4.5%)	1356 (14.34%)	0.40
Black	2606	105 (4.03%)	**489 (18.76%)**	**0.60**
Asian	764	**84 (10.99%)**	105 (9.55%)	0.45
Other	2593	197 (7.6%)	294 (11.34%)	0.59
Ethnicity (N (%))				
Non-Hispanic	12861	622 (4.84%)	1906 (14.82%)	0.44
Hispanic	2307	180 (7.8%)	278 (12.05%)	**0.61**
Other	252	10 (3.97%)	28 (11.11%)	0.48

Socioeconomic status and GDM/PB

- Women who live in areas
  - with higher income are less likely to experience GDM and PB
  - that are below poverty and unemployed are more likely to have PB
- Women who do not have high school diplomas are more likely to have GDM

Household composition and disability

- Women who live in areas
  - where there are more people less than 17 years old are more likely to experience GDM
  - where there are more people who are older than 65, or with a disability, or single parent household are more likely to have PB

Racial/ethnic minority status

- Minority and persons who speak English less than well are associated with GDM

Housing type and transportation

- Women who live in areas
  - where there is more crowded living space (more people than the number of rooms) have a higher chance to experience GDM
  - with more mobile homes are more likely to deliver a baby prematurely

Limitations and future work

- Bias in patient population. As most patients in this study were from Davidson County, where VUMC is located. Patients who were from surrounding counties and seeking care at our facility may be at high risks during their pregnancy.
- SVI data used in this study was based on 2018 surveys, while our study period was from 2018 to 2021. The SVI for census tracts may change after 2018
- The diagnostic criteria for GDM vary between organizations and countries, which can affect the specific thresholds used to identify GDM patients from EHRs