A Composite Reproductive Cardiometabolic Risk Index: Socioeconomic Access Determinant, Trajectory Prediction, and Chronic Disease Risk After Pregnancy Complications

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BACKGROUND

Gestational diabetes and hypertensive diseases of pregnancy, such as gestational hypertension, preeclampsia, and pre-existing hypertension before pregnancy, are well established down-stream markers of type 2 diabetes and cardiovascular disease in women, respectively. Previous research in this field has treated socioeconomic status and impacts as additive and isolated factors and has tested such complications independently, rather than examining their likelihood of jointly transforming risk into disease. Health equity research in maternal health has tended to treat “rural” and “poor” as overlapping and interchangeable factors for underserved populations. A 2022 CDC MMWR report notes that no population-level surveillance link exists between women's pregnancy complications and their later-life chronic disease risk in US public health data systems.

OBJECTIVES

Research Claim: Reproductive cardiometabolic risk is not adequately captured by a single pregnancy complication or by treating socioeconomic status as an isolated additive risk factor. Rather, insurance access determines whether that composite risk translates into diabetes and cardiovascular disease, which produces state risk archetypes and trajectories that can inform maternal policy decisions when most urgently needed.

- Construct a composite reproductive cardiometabolic risk (RCR) index by combining gestational diabetes, gestational hypertension, and pre-pregnancy hypertension rates into a single score
- Test whether the composite RCR score predicts later diabetes and cardiovascular disease, such as stroke/CHD prevalence, at a state level beyond socioeconomic factors.
- Classify US states into distinct risk-profile archetypes based on composite risk
- Identify states trending toward higher risk relative to other states and slowest-improving insurance access

REFERENCES

Bellamy et al. Lancet. 2009;373:1773–1779., Bellamy et al. BMJ. 2007;335:974., Mpofu et al. MMWR. 2022;71(17)., CDC/NCHS. WONDER Natality. 2016–2024., CDC. BRFSS. 2016–2024., CDC. Diabetes Surveillance System. 2016–2024., U.S. Census Bureau. ACS Table B17001. 2016–2024., U.S. Census Bureau. 2020 Decennial Census, Table P2.

METHODOLOGY

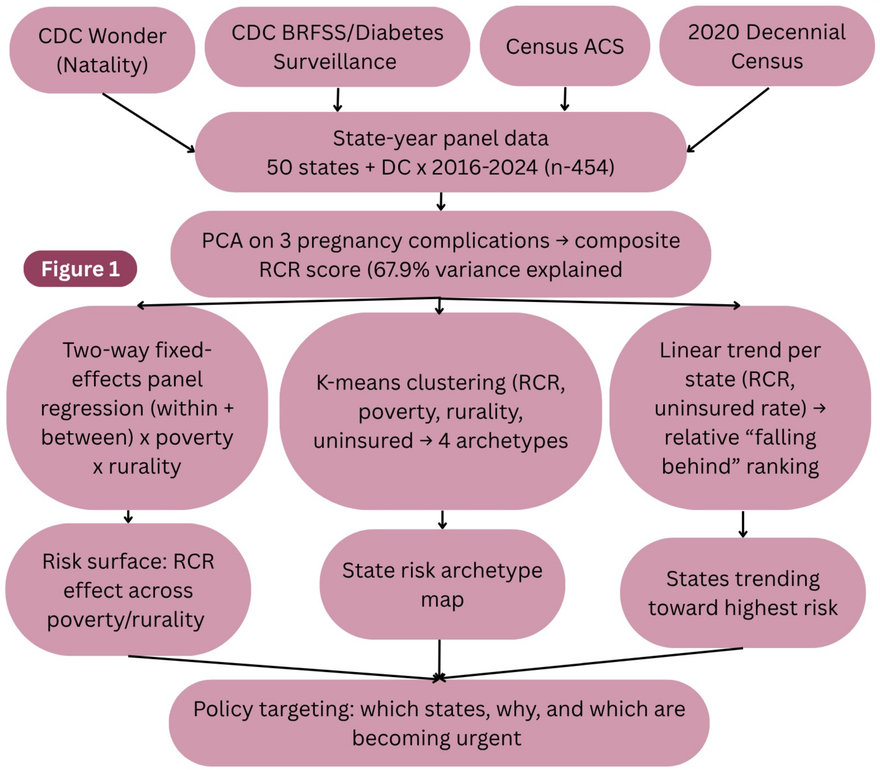


Figure 1

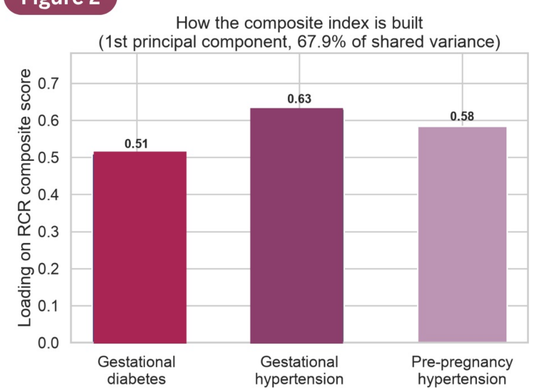


Figure 2

Figure 1:

Four public data sources are merged into one state-year panel data (51 states + DC, 2016-2024, n-454)

The panel feeds a PCA step that changes 3 pregnancy complications into a single RCR score

The score branches into 3 parallel analyses: fixed-effects panel-regression for poverty/rurality, K-means clustering (state archetypes), linear trends (trajectory)

Figure 2:

Shows how much of the 3 pregnancy complications contribute to the RCR score

Loadings balanced (0.51-0.63) across all 3, which shows the index has a shared risk signal rather than being driven by 1 variable

RESULTS

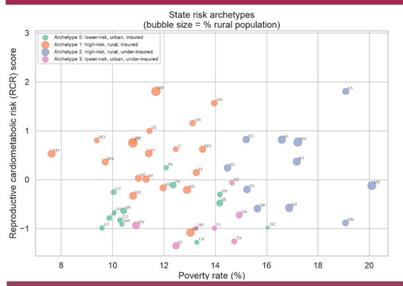


Figure 3

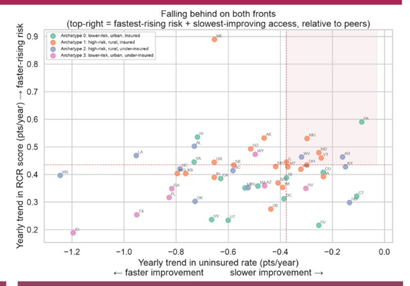


Figure 4

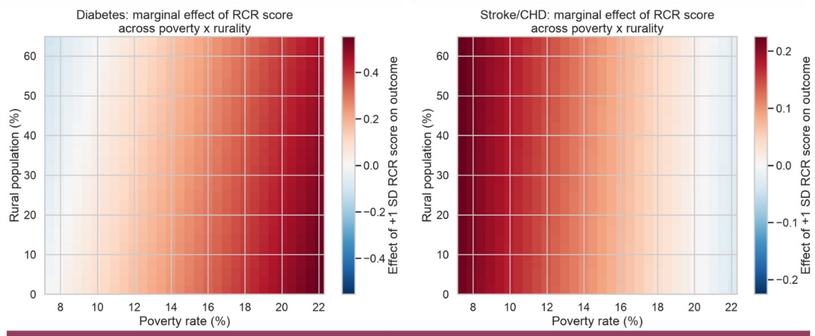


Figure 5

Risk Surface:

Diabetes: β=0.037, p=0.000

Stroke/CHD: β=−0.016, p=0.076

Rurality: not significant - p=0.42 diabetes, p=0.92 CVD

State Trajectory:

No state worsened in absolute terms (access improved nationwide)

8 states falling behind: PA, MN, MD, AR, WV, VT, IL, OH

AR/WV is already high-risk and worsening

State Risk Archetypes

Low-Risk/Urban/Insured: CA, CO, CT, DC, HI, MA, MI, NJ, NY, PA, RI, UT, VA

High-Risk/Rural/Insured: AK, DE, IA, IL, IN, KS, MD, ME, MN, MO, MT, ND, NE, NH, OH, OR, SD, VT, WA, WI)

High-Risk/Rural/Under-Insured: AL, AR, KY, LA, MS, NC, NM, OK, SC, TN, WV

Low-Risk/Urban/Under-Insured: AZ, FL, GA, ID, NV, TX, WY

CONCLUSIONS

- Reproductive cardiometabolic risk is better analyzed as a composite signal across several pregnancy complications
- Insurance access, not rural geography, determines whether elevated reproductive risk converts into cardiometabolic disease
- Four distinct state risk archetypes emerged that identified a specific high-risk, under-insured Deep South/Appalachian cluster as the clearest policy target
- A trajectory analysis identified states not yet in the highest-risk group but trending toward it fastest