Data-driven insights into maternal mortality: trends, risk factors, and racial disparities in the U.S. (2000-2023)A comprehensive analysis of CDC/NCHS data

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INTRODUCTION

The Alarming U.S. Trajectory:

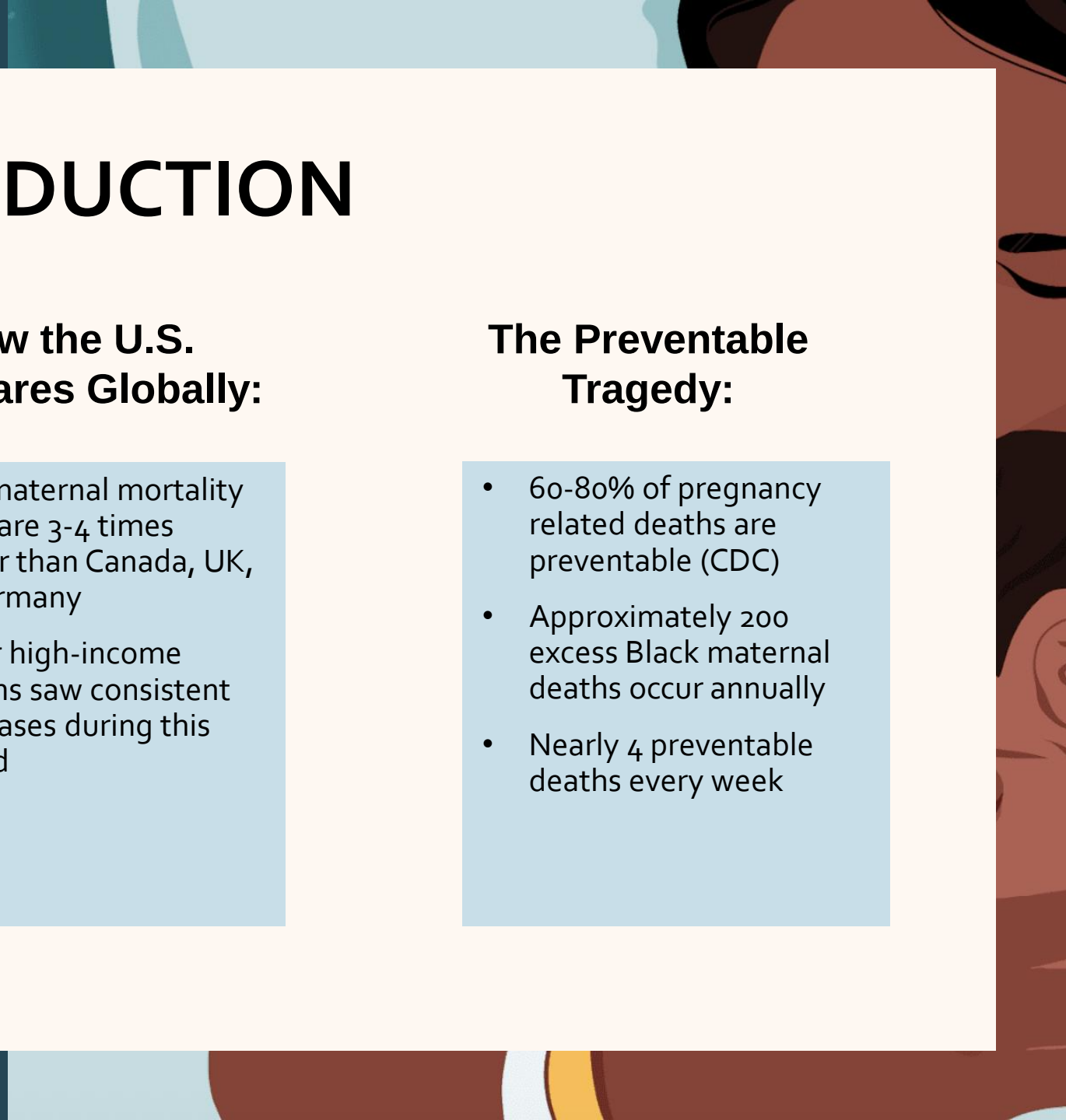
- 2000: 9.8 deaths per 100,000 live births
- 2021: 32.9 deaths per 100,000 (highest level in over 50 years)
- 2023: 18.6 deaths per 100,000 (declining but still unacceptably high)

How the U.S. Compares Globally:

- U.S. maternal mortality rates are 3-4 times higher than Canada, UK, or Germany
- Other high-income nations saw consistent decreases during this period

The Preventable Tragedy:

- 60-80% of pregnancy related deaths are preventable (CDC)
- Approximately 200 excess Black maternal deaths occur annually
- Nearly 4 preventable deaths every week



Project Objectives

1. **Temporal Trends** Examine maternal mortality nationally and by state across time periods
2. **Racial/Ethnic Disparities** Identify disparities and their evolution over the past two decades
3. **Risk Factors** Explore chronic conditions and maternal age as contributing factors
4. **COVID-19 Pandemic Impact** Assess how the pandemic differentially affected maternal mortality
5. **Severe Maternal Morbidity (SMM)** Link mortality data with SMM indicators to identify preventable patterns

Our Goal: Provide a data-informed narrative highlighting progress, persistent disparities, and how analytics can guide targeted interventions to save lives.

Research Questions & Hypothesis

Five Research Questions:

- What are the temporal trends in maternal mortality across racial/ethnic groups from 2018-2023?
- How did the COVID-19 pandemic differentially impact maternal mortality across racial/ethnic groups?
- What is the magnitude of racial disparities, and have these gaps widened or narrowed over time?
- Do regional variations suggest policy impacts on health equity?
- What statistical evidence supports systemic racial inequities?

Five Testable Hypotheses:

- **H1:** Racial disparities persist across all years Black and AI/AN women experience rates 2.5-4x higher
- **H2:** COVID-19 increased disparities Black and Hispanic women experienced disproportionately larger increases
- **H3:** Unequal recovery post-pandemic recovery differs significantly by race in 2022-2023
- **H4:** Regional variations reflect policy impacts states with expanded Medicaid show smaller disparities
- **H5:** Disparities cannot be explained by chance statistical testing will demonstrate significance ($p < 0.001$)

Data Sources & Methodology

Three Primary Datasets from CDC/NCHS:

Dataset 1: Maternal Mortality Annual Trends (2018-2023)

- Annual rates by race/ethnicity
- Pre-pandemic, pandemic, and post-pandemic periods

Dataset 2: Regional Maternal Mortality (2019)

- Four U.S. regions: Northeast, South, Midwest, West
- Disaggregated by race/ethnicity including AI/AN populations

Dataset 3: Long-term Trends (1999-2019)

- Two-decade comparison
- Documents historical trajectory and worsening disparities

Historical Context(1999-2019)

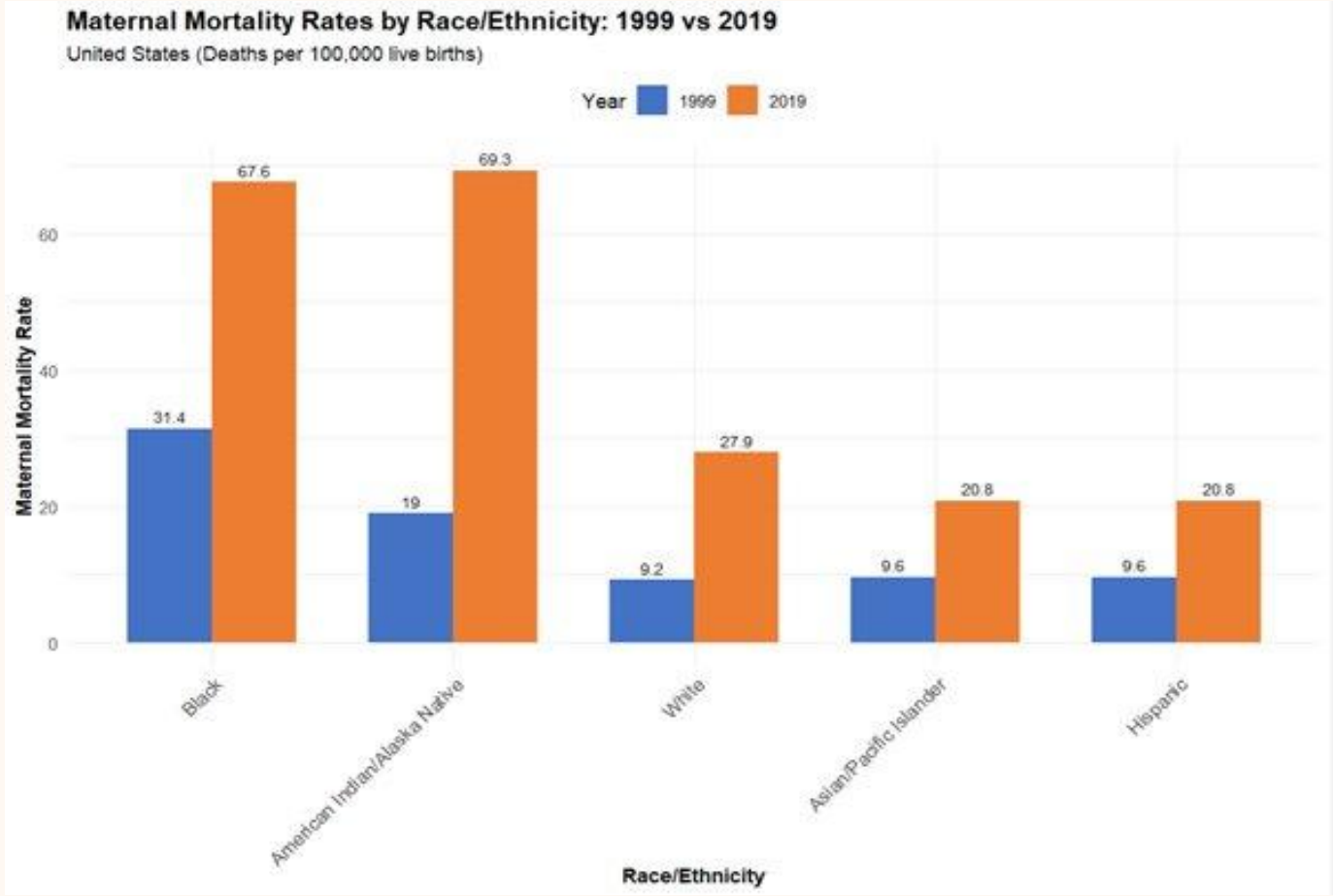
Long-Term Historical Crisis: Every Group Worsened (1999-2019)

Critical Insights:

- Unlike most health metrics that improved from 1999-2019, maternal mortality moved in the WRONG DIRECTION for every single group
- American Indian/Alaska Native women experienced the most dramatic increase (265%: from 19.0 to 69.3)
- White women increased 203% (from 9.2 to 27.9)
- By 2019, a clear two-tier system emerged:

  Crisis tier: Black and AI/AN women (≈67-69 deaths per 100,000)

  Concerning tier: White, Asian/PI, Hispanic women (≈21-28 deaths per 100,000)



Current Racial Disparities (2018-2023)

Maternal Mortality Rates by Race/Ethnicity (6-Year Average)

- **Black:** 51.1 per 100,000 (SD 12.5, Range 37.3–69.9)
- **White:** 19.2 per 100,000 (SD 4.3, Range 14.5–26.6)
- **Hispanic:** 16.6 per 100,000 (SD 6.0, Range 11.8–28.0)
- **Asian:** 13.2 per 100,000 (SD 2.1, Range 10.7–16.8)

Disparities Compared to Asian Women:

- Black women: **3.9× higher**
- White women: **1.5× higher**
- Hispanic women: **1.3× higher**

Observations:

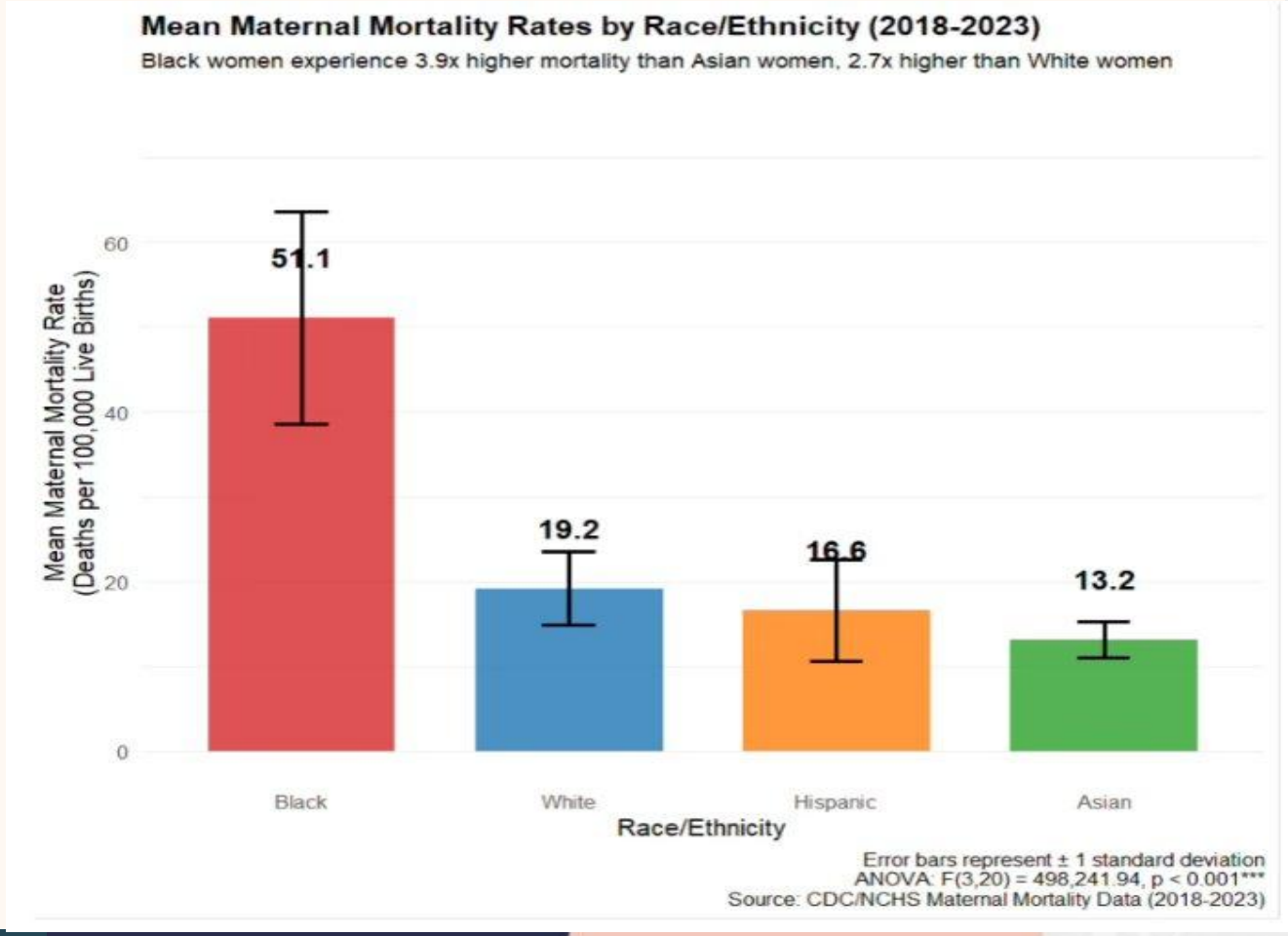
- Black women face **nearly 4× higher maternal mortality than Asian women** and **2.7× higher than White women**.
- High standard deviation (12.5) for Black women indicates **greater year-to-year volatility** and **vulnerability to systemic shocks**.
- With ~530,000 Black births annually, the 37.9-point difference translates to **~200 excess deaths per year,** nearly **4 preventable deaths every week**.
- **Conclusion:** Racial disparities are persistent and significant across all years.

Hypothesis 1 Confirmed: Racial disparities persist across all years

MEAN MATERNAL MORTALITY RATES WITH STATISTICAL VALIDATION (2018-2023)

Key Points:

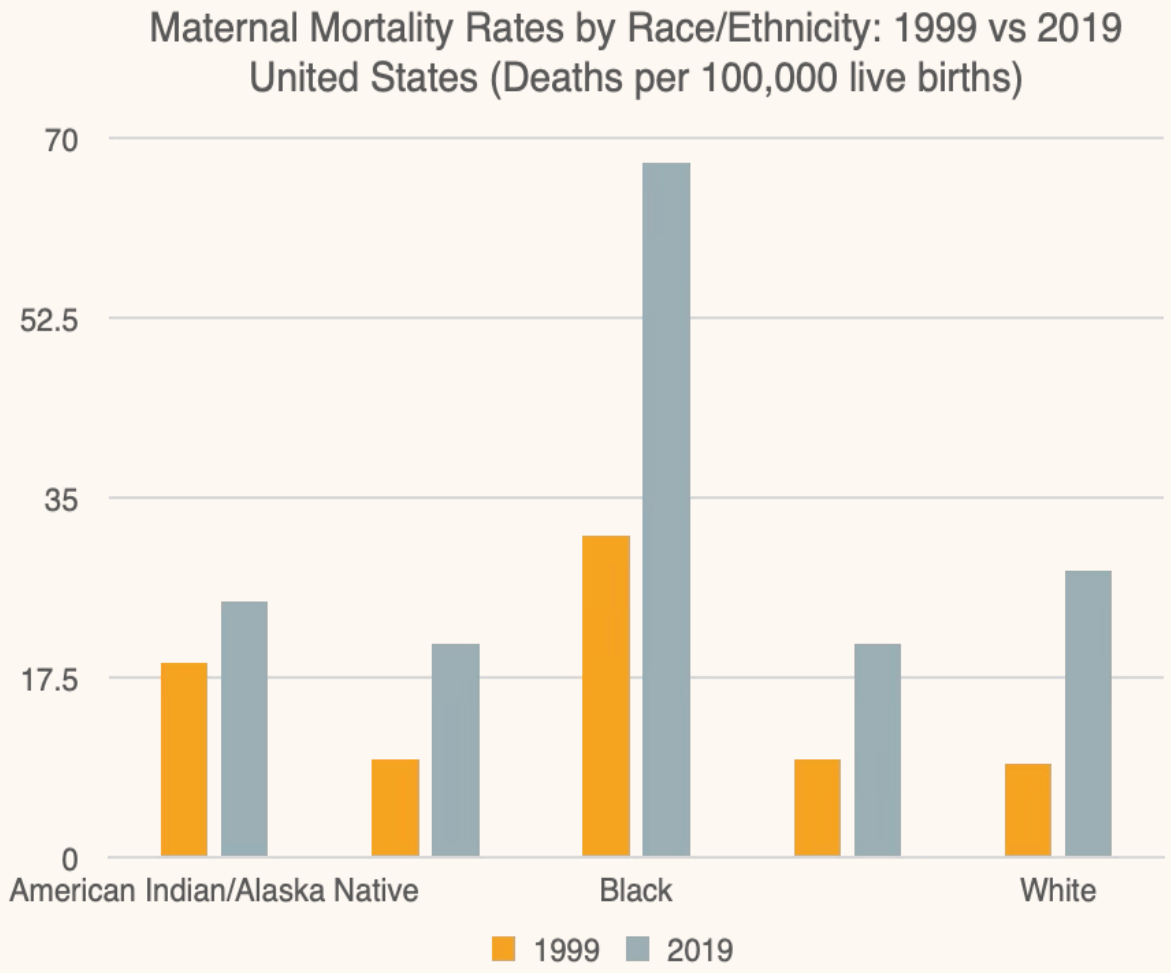
- Black women: 51.1 with largest standard deviation (12.5)—greater vulnerability to systemic shocks
- Asian women: 13.2 with smallest standard deviation (2.1)—greater stability
- Error bars represent ±1 standard deviation
- Source: CDC/NCHS Maternal Mortality Data (2018-2023)



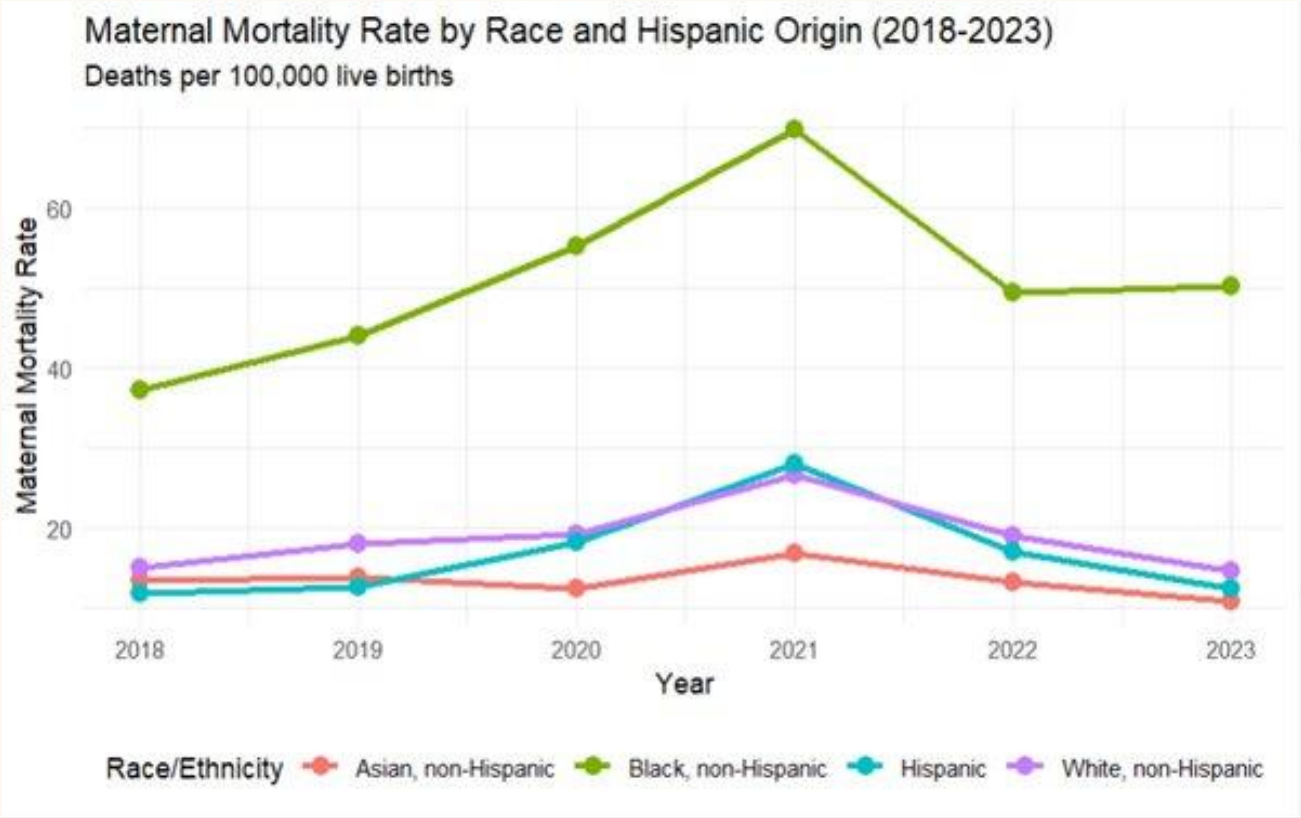
Divergent Trajectories:
maternal Mortality Rates By Race/Ethnicity: 1999 Vs 2019

Critical Finding: While Asian and White women improved, Black women's mortality worsened .

- **The Disparity Gap WIDENED:** By 2023, Black women experienced:
- 4.7x higher than Asian women
- 3.5x higher than White women
- 4.1x higher than Hispanic women
- ✓ **H3 CONFIRMED:** Unequal recovery patterns



Temporal Trends In Maternal Mortality By Race/Ethnicity (2018-2023)



Three Critical Patterns:

- **Extreme racial disparity persists throughout**—Black women's rates 2-4x higher.Even at their lowest point (37.3 in 2018), Black women exceeded the 2021 pandemic peak for all other groups
- **2021 COVID surge affected all unequally** Black women reached catastrophic 69.9; Hispanic had largest % increase (122%)
- **Post-pandemic recovery diverged dramatically** Asian and White women returned to or improved beyond pre-pandemic; Black women remained elevated
- Source: CDC/NCHS Maternal Mortality Data (2018-2023)

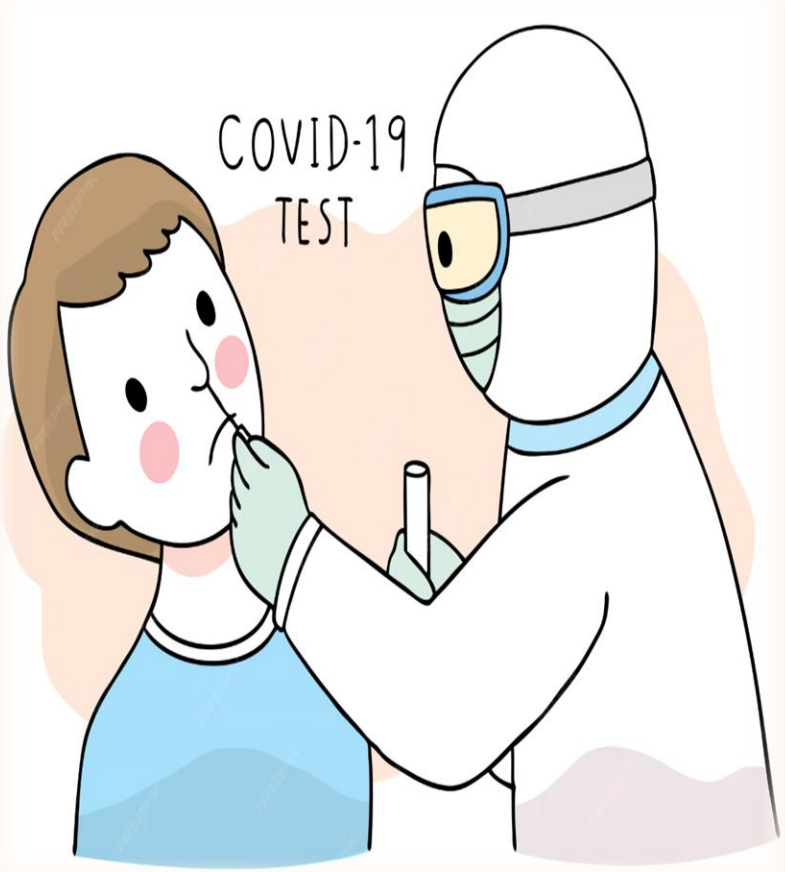
COVID-19 IMPACT **(2019-2021)**

Key Findings:

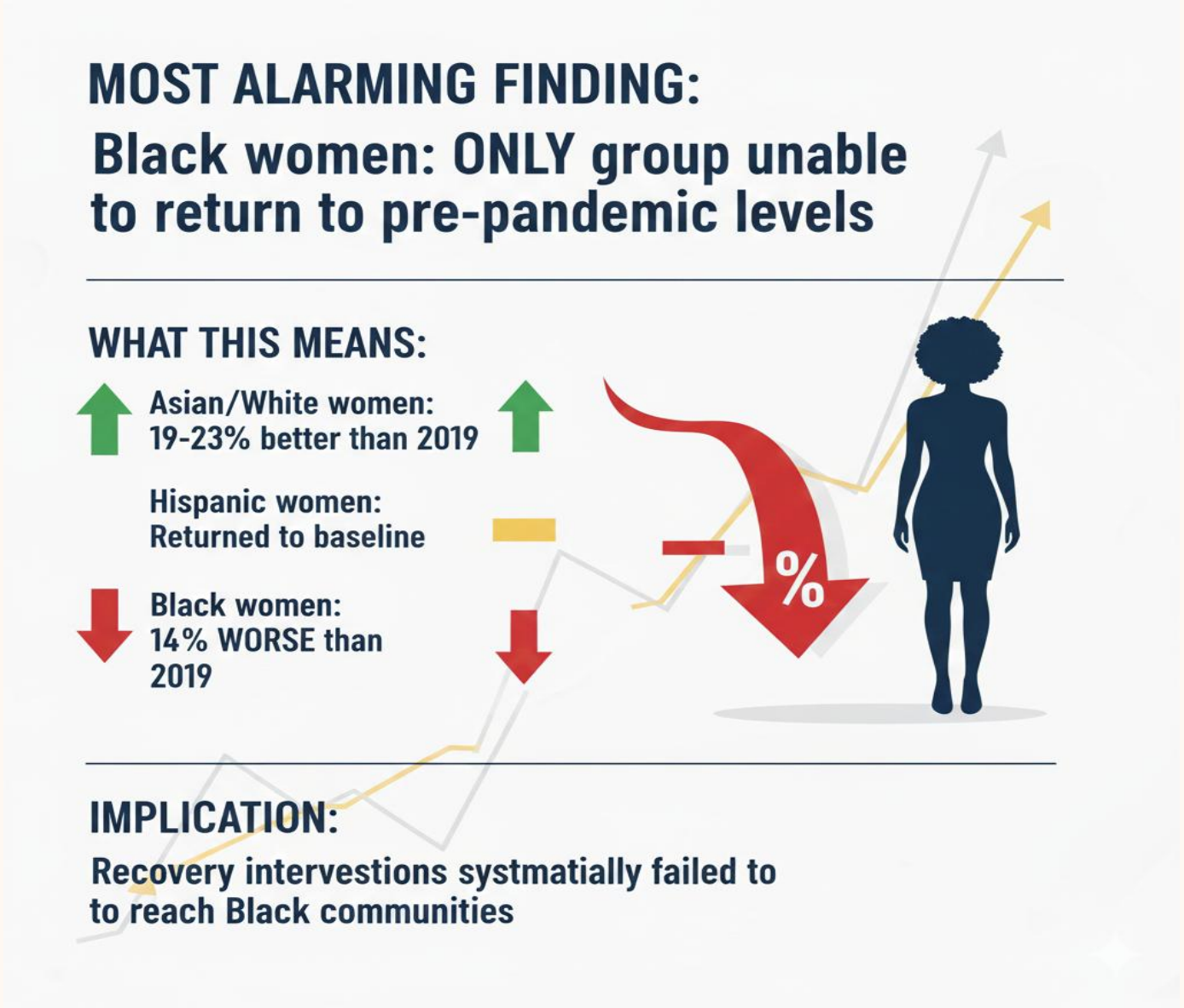
- Hispanic women: Largest percentage increase (122%)—rate more than doubled
- Black women: Highest absolute increase (+25.9) and reached highest peak (69.9)
- White women: 49% increase—substantial but started/ended lower
- Asian women: Smallest increase (22%)

What Happened:

- Direct COVID complications: preeclampsia, thrombosis, respiratory failure
- Indirect effects: healthcare strain, limited prenatal care, delayed emergency care
- Care barriers: infection fears delayed seeking care



H2 CONFIRMED: COVID-19 increased disparities disproportionately



UNEQUAL RECOVERY(2019-2023)

Regional Disparities(2019)

Three Critical Regional Patterns:

1. Northeast Paradox—Resources Don't Equal Equity

- Best healthcare infrastructure yet highest Black mortality (89.5) and largest disparity (3.8x)
- Proves abundant resources don't ensure equity without anti-racism interventions

2. AI/AN Crisis—Geographic Isolation

- Catastrophic rates in Midwest (94.2) and West (83.3)—highest of any group anywhere
- Reflects under-resourced Indian Health Service, geographic isolation

3. Midwest Success—Policy Works

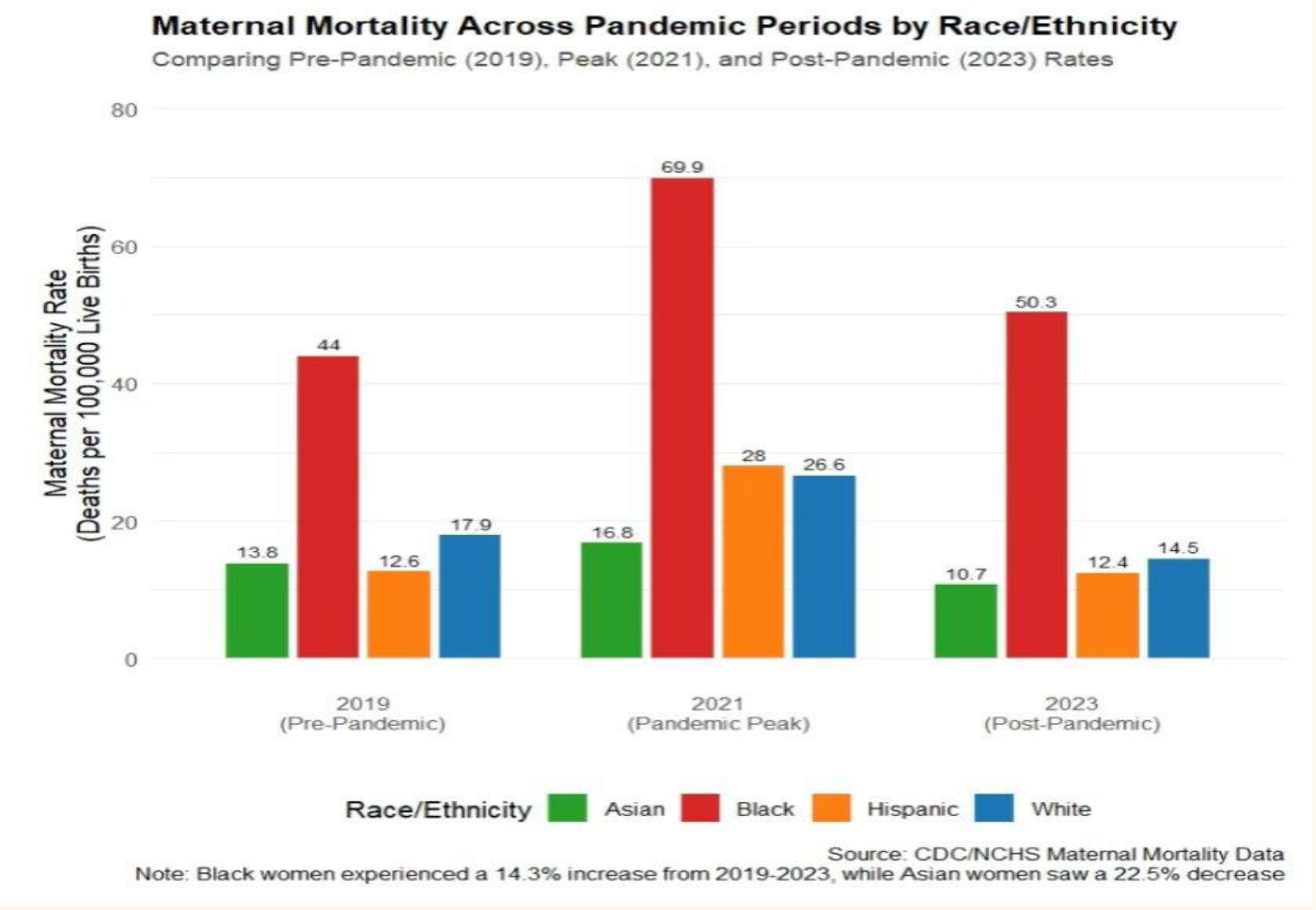
- Smallest Black-White ratio (1.5x vs. 2.2-3.8x elsewhere)
- Medicaid expansion, community health centers, social safety nets

H4 CONFIRMED: Regional variations reflect policy impacts

Pandemic Comparison
Maternal Mortality Across Pandemic Periods By Race/Ethnicity

Visual Story:

- 2019: Baseline disparities already exist
- 2021: ALL bars taller universal spike, Black reaches 69.9
- 2023: Asian, White, Hispanic return to or below 2019; Black remains elevated above 2019
- Source: CDC/NCHS Maternal Mortality Data (2019, 2021, 2023)



Regional Comparison
Regional Variations In Maternal Mortality By Race/Ethnicity (2019)

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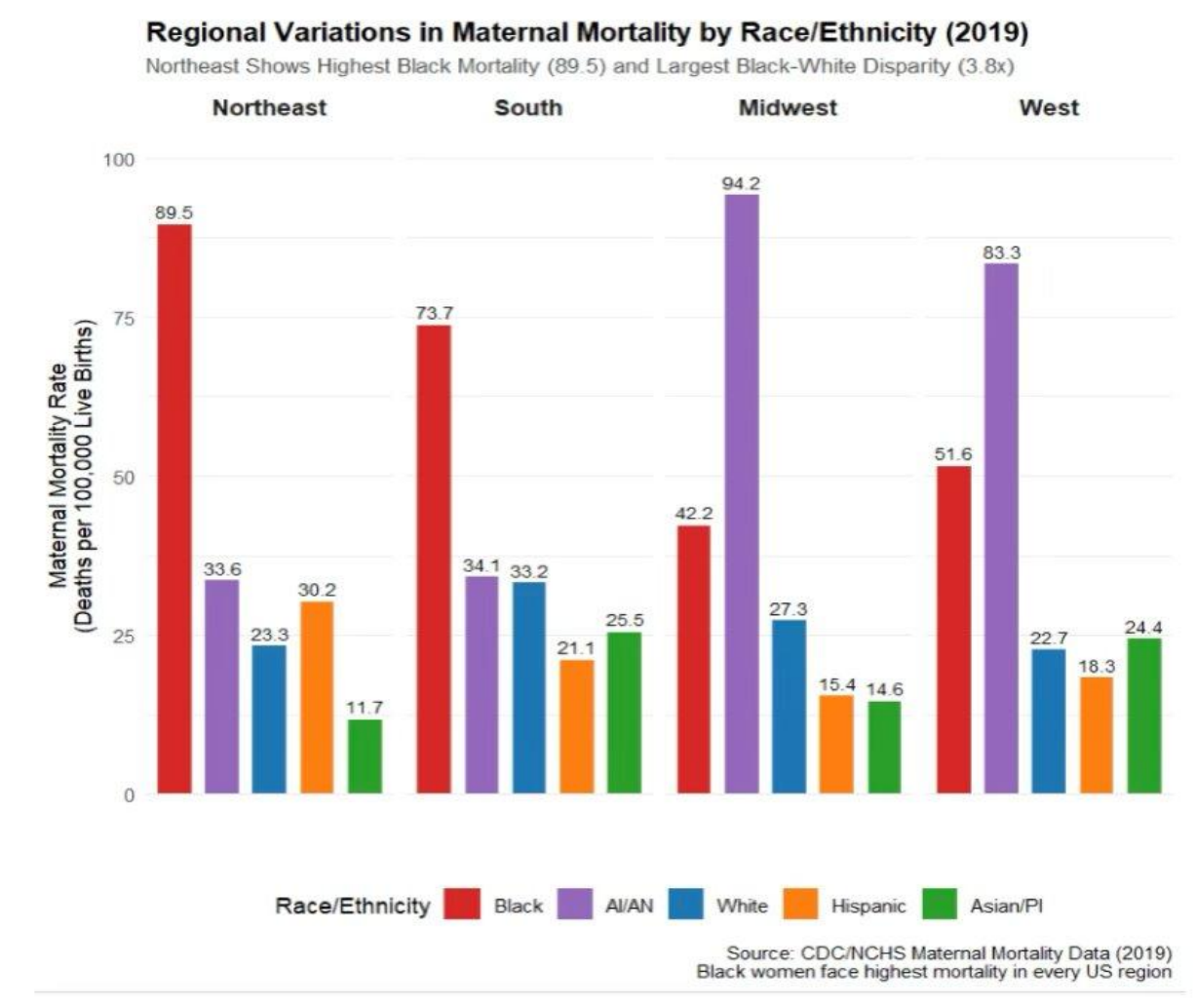

Root Causes:

Statistical Evidence Eliminates Individual Factors:

If individual factors were primary, we'd see:

- Black women in rich regions approaching White women's outcomes
- Narrowing gaps as healthcare access expanded
- Smaller disparities among high-income Black women

What we actually observe:

- Black women highest in EVERY region (even Northeast: 89.5)
- Gaps WIDENED 2018-2023 (Black +35%)
- Disparities persist across income/education

This Points to SYSTEMIC Factors:

Healthcare System:

- Implicit bias dismissing Black women's symptoms
- Quality of care differentials
- Inadequate postpartum follow-up
- Fragmented insurance (Medicaid ends 60 days postpartum)

Social Determinants:

- Chronic stress from discrimination (weathering)
- Housing instability, food insecurity
- Transportation barriers
- Lack of paid family leave

Historical:

- Medical mistrust (Tuskegee, forced sterilizations)
- Intergenerational trauma
- Under-representation in medical research

The Midwest Model

Why Midwest Achieved Smallest Disparity (1.5x vs. 2.2-3.8x)?

Four Successful Policy Interventions:

1. Medicaid Expansion

- Coverage from 60 days → 12 months postpartum
- Eliminates coverage cliff during high-risk period

2. Community Health Centers

- FQHCs provide culturally competent care
- Regardless of insurance status
- Build trust with marginalized communities

3. Strong Social Safety Nets

- WIC, SNAP nutrition programs
- Housing assistance
- Paid family leave policies

4. Active Maternal Mortality Review Committees

- Systematic review of every death
- Evidence-based policy changes
- Rapid implementation of lessons learned

Key Lesson: Policy interventions can reduce racial gaps even without coastal resource advantages. Success requires intentional equity focus, addressing socialdeterminants, and community-based approaches.

Policy Recommendations:

Federal Policy:

- Mandate 12-month postpartum Medicaid coverage (all states)
- Triple funding for community health centers
- National paid family leave (12 weeks)
- $500M investment in doula programs
- Strengthen maternal mortality review systems

State/Healthcare Level:

- Expand Medicaid postpartum coverage where not implemented
- Mandatory implicit bias training (all obstetric providers)
- Public reporting of outcomes by race
- Address maternity care deserts
- Strengthen social safety nets

These Aren't Aspirational Midwest Proves They Work

Economic Impact

Costs of Inaction:

- Preventing 1 maternal death saves: $3-5 million
- Preventing 1 SMM case saves: $20,000-$100,000

Annual Economic Analysis:

- ~200 excess Black maternal deaths annually
- Thousands of SMM cases with racial disparities

Economic Benefit of Achieving Equity:

- Direct savings: $600M-$1B from prevented deaths
- Additional savings: $200-400M from prevented SMM
- Total annual benefit: >$1 billion

Return on Investment:

- Intervention costs: ~$400-600M annually
- Net savings: $400-600M annually
- Plus immeasurable value of lives saved

Bottom Line: Equity is economically smart, not just morally right

Real-world Application

Scenario: Northeast State Legislative Action

Problem Recognition:

- Highest Black maternal mortality: 89.5
- Disparity ratio: 3.8x despite best resources

Legislative Response: Black Maternal Health Equity Act

- **Six Provisions:**
- 12-month postpartum Medicaid coverage
- Mandatory implicit bias training
- State-funded community doula program
- Hospital quality standards with public reporting
- Enhanced MMRC with community representation
- $50M social determinants fund

Implementation:

- Baseline: Black mortality 89.5, ratio 3.8x
- 5-year targets: Reduce to 45, ratio to 2.0x
- Quarterly progress tracking

Projected Outcomes (5 years):

- 50 Black lives saved annually
- $75M healthcare cost savings
- Model for other states

THE HUMAN COST

200 Excess Black Maternal Deaths Annually

- 4 preventable deaths every week
- 120-160 from causes CDC identifies as 60-80% preventable

Each Death Represents:

- **For Children:**
- Growing up without mothers
- Increased poverty risk, educational challenges
- Health problems, psychological trauma
- **For Partners:**
- Single parenthood
- Economic devastation
- Grief compounded by caregiving
- **For Communities:**
- Losing leaders and contributors
- Trauma ripples through dozens of people
- Erosion of trust in healthcare

If Black Women Experienced:

- White women's rate (14.5): ~190 lives saved annually
- Asian women's rate (10.7): ~210 lives saved annually

These are achievable goals other groups prove these rates are possible

LIMITATIONS

Data Limitations:

- Maternal mortality coding changes affect comparisons
- Small numbers in some subgroups
- Lack of detailed clinical data on specific causes
- Missing socioeconomic variables

Analytical Limitations:

- Descriptive analysis can't prove causation definitively
- Regional analysis uses 2019 data
- Can't directly measure specific intervention impacts

Core Findings Are Robust:

- $p < 0.001$ statistical significance
- Consistent across datasets, time, geography
- Point to systemic causes

Seven Future Directions:

- Qualitative research with survivors and providers
- Cause-specific mortality analysis
- Intersectional analysis (race × income × geography)
- Policy evaluation using natural experiments
- Predictive modeling for high-risk identification
- International comparisons with equity-achieving countries
- Long-term outcomes of SMM survivors

KEY TAKEAWAYS

1. Statistical Certainty of Systemic Inequity

- ANOVA: $p<0.001$
- Black women 3.9x higher than Asian women
- ALL 5 hypotheses confirmed

2. COVID Amplified Pre-Existing Inequity

- All groups affected by 2021 spike
- Black women couldn't recover while others improved
- By 2023: Black 14% worse, Asian/White 19-23% better

3. Geography Proves Systemic Causation

- Black women highest in EVERY region
- Even resource-rich Northeast (89.5)
- Consistency eliminates geography, confirms systemic racism

4. Policy Matters—Midwest Success

- Smallest disparity (1.5x vs. 2.2-3.8x elsewhere)
- Medicaid expansion + community health centers + social safety nets
- Proves interventions work

5. Preventable Tragedy

- 60-80% preventable
- ~200 excess deaths annually = 4 per week
- We know solutions and they save money

CONCLUSION

The Moral Imperative:

- "The gap between current Black maternal mortality (50.3) and achievable rates (10-15) is a referendum on our national values."

What We've Proven:

- Disparities are real, significant, systemic ($p < 0.001$)
- Persist across geography, time, income, education
- Other groups achieve 10-15 rates—Black women's rates NOT inevitable
- We know what works (Midwest model)
- Economic benefits exceed costs (>$1B annually)
- ~200 Black mothers die unnecessarily every year

This Is:

- A public health imperative
- A civil rights imperative
- An economic imperative
- A moral imperative

What's Needed: WILL

- Political will to prioritize equity
- Institutional will to confront racism
- Collective will to ensure race doesn't determine survival

Every mother deserves to survive childbirth.
The data have spoken. Now we must act.

REFERENCES:

- Admon, L. K., Winkelman, T. N. A., Zivin, K., Terplan, M., Mhyre, J. M., & Dalton, V. K. (2018). Racial and ethnic disparities in the incidence of severe maternal morbidity in the United States, 2012-2015. *Obstetrics & Gynecology, 132*(5), 1158-1166. https://doi.org/10.1097/AOG.0000000000002937
- Centers for Disease Control and Prevention. (2023). *Maternal mortality review committees*. National Center for Health Statistics. Retrieved from https://www.cdc.gov/maternal-mortality/php/mmrc/index.html
- Centers for Disease Control and Prevention. (2025). *Health E-Stat 100: Maternal mortality rates in the United States, 2023*. National Center for Health Statistics. https://www.cdc.gov/nchs/data/hestat/maternal-mortality/2023/maternal-mortality-rates-2023.html
- Fink, D. A., Kilday, D., Cao, Z., Larson, K., Smith, A., Lipkin, C., Perigard, R., Marshall, R., Deirmenjian, T., Finke, A., Tatum, D., & Rosenthal, N. (2023). Trends in maternal mortality and severe maternal morbidity during delivery-related hospitalizations in the United States, 2008 to 2021. *JAMA Network Open, 6*(6), e2317641. https://doi.org/10.1001/jamanetworkopen.2023.17641
- Fleszar, L. G., Bryant, A. S., Johnson, C. O., Blacker, B. F., Aravkin, A., Baumann, M., Dwyer-Lindgren, L., Kelly, Y. O., Maass, K., Zheng, P., & Roth, G. A. (2023). Trends in state-level maternal mortality by racial and ethnic group in the United States. *JAMA, 330*(1), 52-61. https://doi.org/10.1001/jama.2023.9043
- Howell, E. A., Egorova, N., Balbierz, A., Zeitlin, J., & Hebert, P. L. (2016). Black-white differences in severe maternal morbidity and site of care. *American Journal of Obstetrics and Gynecology, 214*(1), 122.e1-122.e7. https://doi.org/10.1016/j.ajog.2015.08.019
- Hoyert, D. L. (2025). Maternal Mortality Rates in the United States, 2023. In *NCHS Health E Stats*. National Center for Health Statistics. https://doi.org/10.15620/cdc/174577

Any Questions?