NHLBI Enduring Principles

- Value investigator-initiated fundamental discovery science.
- Maintain a balanced, cross-disciplinary portfolio (basic, translational, clinical, population science).
- Train a diverse new generation of leaders in science.
- Support implementation science that empowers patients and enables partners to improve the health of the nation.
- Innovate an evidence-based elimination of health inequities in the U.S. and around the world.
Focusing on Women’s Health Research to Advance Health Equity

- Commitment to Inclusive Excellence
- The Impact of COVID on Women
- Advancing Maternal Health
Inclusive Excellence in the Biomedical Workforce: Successes and Persistent Challenges

Despite strides made over the last half-century, women comprise only 27% of the STEM workforce. A Leaky Pipeline: equality in STEM education has not translated into gender occupational parity.

Female representation in STEM (%): 27%

- Bachelor’s: 53%
- Master’s: 60%
- Doctorate: 48%
- Workforce: 27%

Adapted from Huyer, 2015. UNESCO science report: towards 2030.

Promoting Diversity and Inclusive Excellence in Biomedicine: Demographic Profile of NHLBI Awards — The Next Generation

NHLBI FY2018 - FY2021 Awards

Sex / Gender

- Male
- Female
- Unknown

Percentage of Awards

<table>
<thead>
<tr>
<th>Year</th>
<th>All R01s</th>
<th>R01 ESIs</th>
<th>Ks</th>
<th>Fs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>71%</td>
<td>35%</td>
<td>41%</td>
<td>43%</td>
</tr>
<tr>
<td>2019</td>
<td>73%</td>
<td>35%</td>
<td>40%</td>
<td>37%</td>
</tr>
<tr>
<td>2020</td>
<td>68%</td>
<td>55%</td>
<td>47%</td>
<td>42%</td>
</tr>
<tr>
<td>2021</td>
<td>67%</td>
<td>54%</td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>

R01s shown are Percentiled R01s
Stepping Stones to Success: Promoting Diversity and Inclusive Excellence in Biomedicine Pipeline

- Fellowship and Training Grants
- Medical and Graduate School
- Post-doctoral fellowship
- Early Career
- Established Investigator
- PRIDE R25
  - Career Development Awards
  - ESI Grants
  - R01 ESI Awards
  - K Awards (extensions added)
  - K08 Mentored Clinician-Scientist
  - Loan Repayment Program

A diverse talent pool enriches the scientific workforce.

Medical and Graduate School

Fellowship and Training Grants

High School and College

Helena O. Mishoe Fellowships

NIH-FIRST
Faculty Institutional Recruitment for Sustainable Transformation

https://www.training.nih.gov/programs/sip
https://www.nigms.nih.gov/

ESI: Early-Stage Investigator

NIH: National Heart, Lung, and Blood Institute
ORWH and NHLBI: A Shared Legacy of Commitment to Women’s Health and Inclusive Participation in Research

1948

Framingham Heart Study
A Project of the National Heart, Lung, and Blood Institute and Boston University

• Each of 6 cohorts enrolled majority women.
• 55% of original cohort participants (1948) were female.

1990

Celebrating 30+ years of commitment to advancing women’s health:

Establishment of ORWH and Women’s Health Initiative.
Guided from Observation to Intervention: Helping Define Links Between Activity, Intensity, and Health for Older Women

**Observational**

The WHI Objective PA and Cardiovascular Health Study (OPACH)

**Interventional**

WHI Strong and Healthy Study (WHISH)

Associations of accelerometer-assessed physical activity and sedentary behavior with cardiovascular events

Ongoing PA Intervention trial for CVD prevention in ~50,000 older women

Light PA associated with reduced risk of CHD or CVD

Focusing on Women’s Health Research to Advance Health Equity

Commitment to Inclusive Excellence

The Impact of COVID on Women

Advancing Maternal Health

9
Women generally have experienced higher increases in blood pressure during the pandemic, compared with 2019 (red), than men.

Collecting Evidence of Sex Differences: ME/CFS, MIS-C & PASC

Women comprise 80% of all cases of autoimmune disease

Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS)

Immune symptoms more frequent in women

- Sjögren’s syndrome
- Hashimoto’s thyroiditis
- Syst. lupus erythematosus
- Primary biliary cirrhosis
- Rheumatoid arthritis
- Grave’s disease
- Multiple sclerosis
- Celiac disease
- Type 1 diabetes
- Crohn’s disease
- Ulcerative colitis
- Ankylosing spondylitis

- Female
- Male

- Female 40%
- Male 60%

Renaud’s phenomenon (19.3% vs 27.9%)
Generalized morning stiffness (76.5% vs 83.7%)
Migratory arthralgia (70% vs 86.4%)

Multi-System Inflammatory Syndrome in Children (MIS-C)

Affects ~1 in 3,000 children and requires hospitalization

- MIS-C Patients By Sex
- Unknown <1%
- Female 40%
- Male 60%

Post-Acute Sequelae of SARS-COV-2 infection (PASC)

REsarching COVID to Enhance Recovery (RECOVER)

Characterizing PASC, including sex differences in:
- Incidence
- Severity
- Underlying mechanisms
- Clinical features

National Heart, Lung, and Blood Institute

Sudre, 2021, *Nat Med*
RECOVER: Research to Delve Into Sex Differences in PASC

Goal
Rapidly improve understanding of and ability to predict, treat, and prevent PASC

Key Scientific Aims
1. Understand clinical spectrum/biology underlying recovery
2. Define risk factors, incidence/prevalence, and sub-phenotypes
3. Study pathogenesis over time and relation to other organ dysfunction/disorders
4. Identify interventions

Guiding Principles
- Patient-centered, participants as partners
- Inclusive, diverse participation & community engagement
- Adaptive approaches based on emerging science
- Leverage big data and digital platforms to expand program reach
Focusing on Women’s Health Research to Advance Health Equity

- Commitment to Inclusive Excellence
- The Impact of COVID on Women
- Advancing Maternal Health

[Images of healthcare professionals and women with masks and a baby]
Advancing Health Equity
With a Multifaceted Approach to Maternal Health

Rise in Maternal Mortality During the Pandemic
Exacerbated Disparities

The challenge: Reducing disease burden in communities facing health disparities & risk factors driven by SDOH

Gestational Diabetes Mellitus Cases
% attributed to overweight and obesity (2004-2007)

Cause-specific MM Proportionate Cause of Death
% attributed to each cause (2007-2016)

U.S. Maternal Mortality Rates by Race (2020)
White: 19
Black: 55
Hispanic: 18

Hoyert. NCHS Health E-Stats. 2022.
Kim SY et al. Prev Chronic Dis 2012
Pregnancy is a “Stress Test” That Identifies Women With Long-Term Risk Trajectory for CVD

The changing **health profile** of pregnant women **increases future risk** of heart disease.

**Common Risk Factors for Adverse Pregnancy Outcomes and Heart Disease**

<table>
<thead>
<tr>
<th>High Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructive Sleep Apnea</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>Diet/Eating Habits</td>
</tr>
<tr>
<td>Obesity/Weight Management</td>
</tr>
<tr>
<td>Smoking and Alcohol</td>
</tr>
<tr>
<td>Genetics</td>
</tr>
</tbody>
</table>

- Older maternal age (women age ≥ 30)
- Increasing prevalence of comorbid conditions in women of reproductive age: hypertension, obesity, diabetes
- Up to 10% of pregnancies are complicated by hypertensive disorders of pregnancy.

Optimizing Health of All Women Before, During, and After Pregnancy

Implementing a Maternal health and PRegnancy Outcomes Vision for Everyone

IMPROVE Initiative

CHAP
Chronic Hypertension and Pregnancy

nuMOM2b

ENRICH

Sleep-Disordered Breathing Study

nuMOM2b

Heart Health Study

NIH REPORTER, 2020, 2021

IMPROVE INITIATIVE
Evaluating the Underlying, Interrelated Mechanisms of Adverse Pregnancy Outcomes in First-time Mothers

Nulliparous Pregnancy Outcomes Study: Monitoring Mothers-to-Be (nuMoM2b)

Blood pressure category and trajectory in early pregnancy independently associated with risk of preeclampsia and gestational hypertension.

<table>
<thead>
<tr>
<th>Pregnancy Outcomes by Blood Pressure Category</th>
<th>Normal BP</th>
<th>Elevated BP</th>
<th>Stage 1 HTN</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 7,034</td>
<td>N = 975</td>
<td>N = 890</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n(%)</td>
<td>n(%)</td>
<td>n(%)</td>
<td></td>
</tr>
<tr>
<td>Gestational Diabetes</td>
<td>248 (3.5%)</td>
<td>53 (5.4%)</td>
<td>55 (6.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gestational age at delivery (weeks)</td>
<td>38.9 ± 2.1</td>
<td>38.7 ± 2.5</td>
<td>38.6 ± 2.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Indicated preterm birth</td>
<td>148 (2.1%)</td>
<td>36 (3.7%)</td>
<td>47 (5.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous vaginal</td>
<td>4,611 (65.6%)</td>
<td>608 (62.4%)</td>
<td>519 (58.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Operative vaginal</td>
<td>635 (9.0%)</td>
<td>72 (7.4%)</td>
<td>62 (7.0%)</td>
<td></td>
</tr>
<tr>
<td>Cesarean section</td>
<td>1,784 (25.4%)</td>
<td>295 (30.3%)</td>
<td>309 (34.7%)</td>
<td></td>
</tr>
<tr>
<td>Birthweight (grams)</td>
<td>3279 ± 548</td>
<td>3269 ± 598</td>
<td>3258 ± 611</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*mean ± standard deviation

Stage 1 HTN associated with poorer outcomes for mother and child.
Thinking Beyond the Severe Maternal Mortality Paradigm: Preventive Intervention Before Clinical Catastrophe

Chronic Hypertension (CHTN) in Pregnancy

Disturbing trend in pre-pregnancy hypertension, with significant urban-rural disparities

Randomized trial to evaluate benefits and risks of pharmacologic treatment of mild CHTN during pregnancy

Antihypertensive Therapy during Pregnancy for Mild Chronic Hypertension
Tita et al. NEJM. 2022.

Treatment of mild CHTN during pregnancy to achieve BP <140/90 reduced adverse pregnancy outcomes without compromising fetal growth
Targeting Community-Embedded, Evidence-Based Interventions Addressing Maternal Health Disparities

ENRICH: Early Intervention to Promote Cardiovascular Health of Mothers and Children

Home visiting evidence-based interventions focused on:

- Lifestyle (diet, sleep, stress management) and Simple 7
- SDoH indicators, home environment, responsive parenting
- Access to health care, counseling, support groups, treatment delivery

Partners:
- HRSA
- Administration for Children and Families (ACF)
- NIDDK
- NIMHD
- ODP
- ORWH
Racial/Ethnic Sleep Disparities Among Pregnant Women: The Potential Impact on Health Outcomes

Age-Standardized Prevalence of Sleep Disturbances During Pregnancy by Race/Ethnicity

Elevation in measures of sleep-disordered breathing in pregnancy and 2–7 years after delivery associated with:

- >3x increased risk for incident high blood pressure
- >2x increased risk for metabolic syndrome

**Challenge/Opportunity:** Understanding the root causes of sleep health disparities and developing appropriate interventions to improve outcomes
Women’s Health Research Agenda: Impact of Sleep-Disordered Breathing on Adverse Pregnancy Outcomes and CVD Risk

Sleep Disordered Breathing and Obstructive Sleep Apnea (OSA) in Pregnancy

CPAP for Sleep Apnea in Pregnancy (SLEEP)
Randomized trial of 2,700 women:
- Sleep advice counseling + CPAP
- Sleep advice counseling alone

Question: Does CPAP for OSA reduce pregnancy-related high blood pressure?

Currently recruiting

Opportunity: Test novel interventions in high-risk pregnant women to reduce adverse pregnancy outcomes and potentially influence the long-term trajectory of CVD risk

Facco, et al., Obstet Gynecol., 2017

https://clinicaltrials.gov/ct2/show/NCT03487185
Building a Repeatable Resource With Communities to Address Social Determinants of Health (SDOH) and Advance Health Equity

**Environment**
- Socio-Cultural Context
- Health Systems
- Economy
- SDOH
- Schools
- Parks
- Quality
- Medical Care
- Family
- Culture
- Behavior
- Individual
- Genetics

Include SDOH, target research to local needs
- Leverage community research platforms
- Promote inclusive participation in studies
- Promote uptake for Community benefit

**Principles of Community-Engaged Research**
- Build on Partnerships with Communities
- Address Misinformation
- Increase Trust in Science
- Accelerate Uptake of Beneficial Interventions
Building a Community-Engaged Platform to Improve Maternal Health and Narrow the Health Equity Gap

Maternal Health Community Implementation Project (CIP)

Intervention Strategies to Implement:
- Pre-pregnancy counseling for women and/or partner/father
- Diabetes prevention programs
- Prenatal nutrition counseling
- Bridging maternal lifestyle education and counseling with CHWs

Lifestyle
Diet
Education
WHAT IF: Transformative Research Addresses Health Disparities Through a Life Course Approach—Kamilah’s Story

- Kamilah lives in rural Louisiana in a predominantly African American community with limited access to health care and healthy food.
- She experiences high blood pressure and pre-eclampsia in her first pregnancy, requiring prolonged hospitalization.
- Kamilah works with a community health worker to get access to WIC and SNAP benefits through a local clinic and use more fruits and vegetables in meals for her family.
- Based on the clinic’s advice, Kamilah figures out a schedule for feedings with her partner so she can get some sleep at night.
- Kamilah measures her blood pressure with a monitor from the clinic.

How can community-based research partnerships improve the cardiovascular health trajectory of Kamilah and her baby and prepare Kamilah for a healthy future pregnancy?
Circle of Collaborative Partners: A Diverse Ecosystem Enabling Innovation for Public Health Impact

- Researchers
- Policymakers & Government Agencies
- Academic Health Centers
- International Organizations
- Community Organizations
- Primary Care
- Patients Citizen-Science
- Professional Societies/Foundations
- Private Sector/Industry
- Researchers

[Graphic depicting the circular relationships between the elements listed above with NIH logos indicating National Institutes of Health and National Heart, Lung, and Blood Institute]