National Institutes of Health
Office of Research on Women's Health

2024–2028

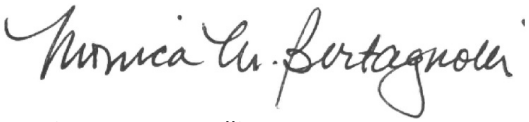
NIH-Wide Strategic Plan for Research on the Health of Women

FOREWORD

It is with great enthusiasm that I introduce the *NIH-Wide Strategic Plan for Research on the Health of Women 2024–2028*. This comprehensive roadmap reflects our unwavering commitment to addressing the unique health needs and challenges faced by women across the life course. The National Institutes of Health (NIH) is consistently recognized as being on the forefront of scientific research, particularly as we continue to pursue gender equity in health not only as a goal, but also as an imperative of our commitment to advancing science, promoting public health, and ensuring the well-being of all individuals. Our commitment extends beyond the laboratory as we actively seek to empower women and girls by addressing sex and gender disparities in health outcomes, promoting research that includes women across the life course, and supporting the advancement of women in biomedical careers.

Research on the health of women is at the forefront of the current national agenda. In March 2024, the President signed an Executive Order on Advancing Women's Health Research and Innovation, which is jointly spearheaded by the Office of the First Lady and the White House Gender Policy Council. We are excited that NIH will play a critical role in this work, which closely aligns with the mission of NIH and the Office of Research on Women's Health (ORWH). As leaders in shaping the landscape of women's health research, ORWH continues to drive innovation and progress through partnership with NIH institutes, centers, and offices. Our strategic plan on women's health research harmonizes seamlessly with the priorities outlined in the *NIH-Wide Strategic Plan for Fiscal Years 2021–2025*, focusing on biomedical and behavioral research, research capacity, and research conduct. This strategic plan further aligns with the five overarching themes of the NIH-wide strategy, including the imperative to enhance women's health across the life course, address health disparities, foster collaborative science, and harness the power of data science for biomedical discovery. These are just a few examples of the great strides that NIH is making toward our longstanding goal of improving health outcomes for all women.

As the plan outlined herein is implemented through our collective efforts, I look forward to contributing to the great progress that we will make together with other federal and non-federal agencies and partners. We will continue to promote research that fosters health equity to ensure that all women receive evidence-based disease prevention and treatment tailored to their unique needs and circumstances and that women in scientific careers reach their full potential.



Monica M. Bertagnolli, M.D.
Director, National Institutes of Health

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PREFACE

The Office of Research on Women's Health (ORWH) in the National Institutes of Health (NIH) was founded to promote research on the health of women both within and outside the NIH scientific community, with mission areas that span the full spectrum of science—from laboratory bench to patient bedside and beyond. ORWH developed this *NIH-Wide Strategic Plan for Research on the Health of Women* in partnership with NIH institutes, centers, and offices (ICOs), as well as the NIH Advisory Committee on Research on Women's Health (ACRWH), other federal partners, and the public. It outlines a vision for a biomedical, behavioral, and social science research enterprise that examines the myriad internal and external factors that influence the health of women using a whole-person approach. This vision includes basic and translational research, as well as innovative data science methodologies. The strategic plan recognizes that women's health research should incorporate diverse perspectives across all career levels and stages of research and from an array of disciplines.

Together with the ICOs, ACRWH, and other federal partners, ORWH used a comprehensive and data-driven approach throughout this strategic planning process and has gathered and synthesized information for this effort from many sources, contributors, and activities during the past several years. These analyses, described further below, served as the foundation for the goals, objectives, and metrics of the strategic plan.

During the strategic planning process, ORWH met with ICO directors to discuss how their respective ICOs' missions and investments in research align with the NIH-wide mission of supporting research on the health of women. These discussions identified multiple high-priority topics, which served as a critical framework for this strategic plan. Insightful opportunities for fostering meaningful collaborations across NIH, with a goal of achieving health equity for women, also emerged.

ORWH employed the NIH Office of Evaluation, Performance, and Reporting Strategic Tracking and Reporting Tool to further examine how our NIH partners carried out the goals and objectives of the previous strategic plan. Additionally, responses to a Request for Information on the *NIH-Wide Strategic Plan for Research on the Health of Women* (NOT-OD-22-186) from basic, clinical, and translational scientists; advocacy and patient communities; and the public were qualitatively and quantitatively analyzed and thoughtfully incorporated.

As part of the Advancing NIH Research on the Health of Women: A 2021 Conference, we convened working groups focused on four cluster areas that were identified during the conference: data harmonization, maternal morbidity and mortality, chronic debilitating conditions, and cervical cancer. Drawing on the insights from the conference discussions, we identified key gaps in and opportunities for research on the health of women. The report resulting from these findings contributed to the development of our new strategic goals, objectives, and metrics.

We also reviewed the *Report of the Advisory Committee on Research on Women's Health: Fiscal Years 2019–2020—Office of Research on Women's Health and NIH Support for Research on Women's Health* to identify gaps in current NIH women's health research. From this analysis, we identified 10 high-priority topics that reflect the current direction and momentum of NIH research on the health of women. These topics, as well as the gaps that were identified within each topic, have guided the direction of our new strategic plan.

As the NIH community moves forward with this strategic plan, we will continue to employ a data-driven approach to ensure that NIH's research agenda on the health of women is grounded in the most current scientific knowledge. I look forward to continuing to work together to advance research on the health of women, and I am confident that by leveraging partnerships and seeking new opportunities for collaboration and interdisciplinary approaches, we can successfully achieve our strategic goals over the next five years.

Janine Austin Clayton, M.D., FARVO
Associate Director for Research on Women's Health
Director, Office of Research on Women's Health
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OVERVIEW

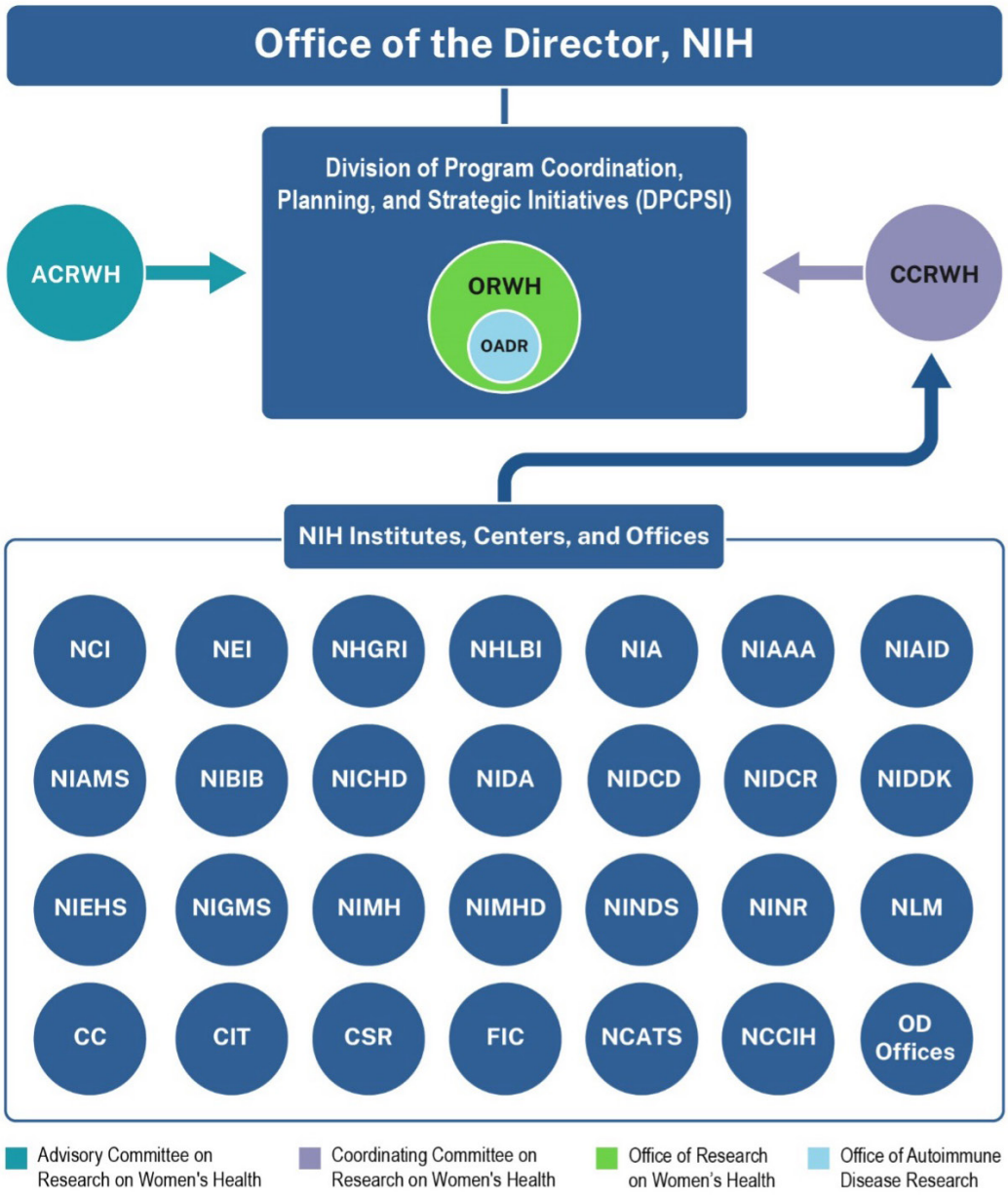
The National Institutes of Health Office of Research on Women's Health

The National Institutes of Health (NIH) established the Office of Research on Women's Health (ORWH) on September 10, 1990, to expand research on the health of women, as recommended by the U.S. Public Health Service Task Force on Women's Health Issues. ORWH was reaffirmed by statute in the NIH Revitalization Act of 1993 (Public Law No. 103-43, Section 486) and was charged with serving as the focal point for coordinating research at NIH on the health of women. Congress mandated that the ORWH Director:

1. Advise the NIH director and staff on matters relating to research on women's health
2. Strengthen and enhance research related to diseases, disorders, and conditions that affect women
3. Ensure that research conducted and supported by NIH adequately addresses issues regarding women's health
4. Ensure that women are appropriately represented in biomedical and behavioral research studies supported by NIH
5. Develop opportunities and support for the recruitment, retention, re-entry, and advancement of women in biomedical careers
6. Support research on women's health issues

The NIH Reform Act of 2006 (Public Law No. 109-482) paved the way for ORWH to become part of the Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI) in the NIH Office of the Director. DPCPSI coordinates NIH-wide initiatives and identifies emerging scientific opportunities, rising public health challenges, and scientific knowledge gaps that merit further research. Being located within DPCPSI, ORWH is well positioned to coordinate the NIH institute, center, and office (ICO) efforts to highlight needs in research and set the agenda for new research on the health of women. The NIH Revitalization Act of 1993 established both the NIH Advisory Committee on Research on Women's Health (ACRWH) and the Coordinating Committee on Research on Women's Health (CCRWH). The NIH ACRWH consists of non-federal advisors to ORWH, while the ORWH-led CCRWH consists of ICO directors or their designees who provide guidance to ORWH. This robust advisory structure ensures that ORWH considers an external, non-federal perspective, as well as an NIH-wide perspective. Congress directed NIH to establish an Office of Autoimmune Disease Research (OADR-ORWH) within ORWH in 2022 to amplify advancement of research for these chronic conditions, with approximately 80% of people affected being women (Figure 1).

Figure 1. ORWH Organizational Advisory Structure



Signed into law on December 13, 2016, the 21st Century Cures Act (Public Law No. 114-255) reaffirms NIH's commitment to advancing research on the health of women. Specifically, the Act advocates for the importance of including women in clinical research and considering sex as a biological variable (SABV) in research using humans and nonhuman vertebrate animals. Furthermore, the Act requires that people of all ages be represented in NIH clinical research, expands sex or gender–based and race and ethnicity–based results reporting requirements for applicable phase III clinical trials, and incorporates changes to encourage research collaboration among ICOs, with the goal of improving the health of all people.

The implementation of the legislative provisions serves as a major milestone in achieving ORWH's mission by ensuring that women, people of all ages, and underrepresented racial and ethnic groups are appropriately represented in clinical research and that these studies will inform treatment and prevention for these populations. The NIH vision is for sex and gender influences to be integrated throughout the biomedical research enterprise; for every woman to receive evidence-based disease prevention and treatment tailored to their circumstances, needs, and objectives; and for all women in scientific careers to reach their full potential. ORWH continues to work toward these goals by building on past successes and forging an increasingly interdisciplinary path for the next generation of researchers focused on the health of women, as well as those focused on exploring the intricacies of sex and gender.

Health of Women

Research on women's health is an essential part of the NIH research agenda. Researchers are discovering the critical roles that sex (i.e., a multidimensional biological construct based on anatomy, physiology, genetics, and hormones) and gender (i.e., a multidimensional construct that encompasses gender identity and expression, as well as social and cultural expectations about status, characteristics, and behavior as they are associated with certain sex traits) play in health, wellness, and disease progression. Understanding the influences of sex and other biological factors across the entire biomedical research continuum—as well as social factors across as much of the research continuum as possible—is crucial to improving the health of women. ORWH is committed to advancing research relevant to the health of all women and all people assigned female at birth. More broadly, the study of how sex and gender influence health and disease is central to the NIH mission of enhancing health, lengthening life, and reducing illness for all people. Together with others in the NIH community, ORWH is committed to setting the example that considering sex and gender is critical for rigorous, relevant, and responsible science and for establishing a future in which every person can receive safe, effective, and evidence-based medical care.

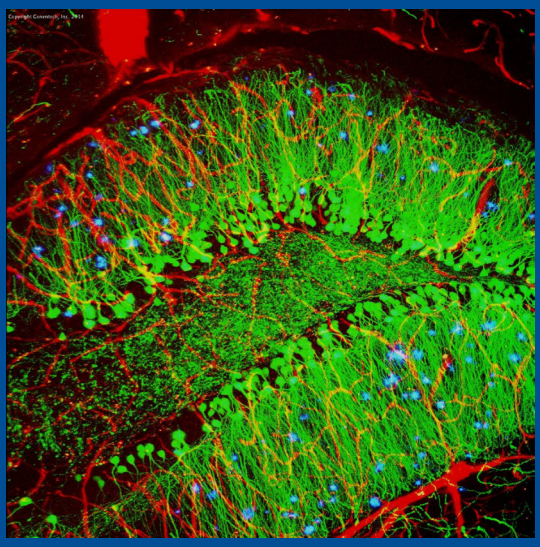


Image credit: Alvin Gogineni, Genentech

Brain Showing Hallmarks of Alzheimer's Disease

Sex and gender differences have been reported for Alzheimer's disease (Zhu et al., 2021).

Along with blood vessels (red) and nerve cells (green), this mouse brain shows abnormal protein clumps known as plaques (blue). These plaques multiply in the brains of people with Alzheimer's disease and are associated with the memory impairment characteristic of the disease. Because mice have genomes nearly identical to our own, they are used to study both the genetic and environmental factors that trigger Alzheimer's disease. Experimental treatments are also tested in mice to identify the best potential therapies for human patients (Gogineni, 2016).

Sex and gender health disparities remain a significant issue in the United States (NIH, 2022). For example, researchers have reported differences between men and women in the epidemiology, pathogenesis, diagnosis, and treatment of such conditions as autoimmune diseases, cardiovascular disease, cancer, chronic pulmonary disease, stroke, Alzheimer's disease, diabetes, influenza and pneumonia, chronic kidney disease, chronic liver disease, and mental illness (Mauvais-Jarvis et al., 2020). Differences in life expectancy between men and women have been reported, with women in the United States having a life expectancy at birth of 79.3 years, compared to 73.5 years for men (Xu et al., 2022). The global average years of healthy life expectancy for men and women is 62.5 and 64.9, respectively (WHO, 2023). Although the life expectancy of women exceeds that of men, women live approximately 20% more years with a disability. Heart disease remains the leading cause of death globally for both males and females, yet Alzheimer's disease and other dementias account for the greatest increase in female deaths. (WHO, 2019). Multimorbidity rates are higher in women, and there is a need to understand the role of sex and gender in chronic debilitating conditions. Additionally, sex and gender play a complex role in contributing to health disparities related to climate change (van Daalen et al., 2020). Recently, researchers have recognized the importance of considering sex and gender in research on, prevention of, and therapeutics for COVID-19 (Nordhues et al., 2021; Spagnolo et al., 2020). Reducing maternal mortality and severe maternal morbidity remains a long-standing, worldwide challenge, with evident disparities across racial, ethnic, and geographic lines (Ahn et al., 2020; Chinn et al., 2020).

NIH is committed to advancing research on the health of women and ensuring that the complexities of sex and gender in health outcomes are considered in the design, analysis, and reporting of research funded by NIH (NOT-OD-15-102). A call to action was disseminated four years after the SABV policy was born, urging the scientific community to consider SABV across the entire spectrum of the biomedical research enterprise (Arnegard et al., 2020). NIH remains committed to enhancing the reporting of results by sex and gender by hosting workshops, online educational resources, funding opportunities, and an NIH-wide SABV Working Group. In October 2022, ORWH and the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) hosted a scientific workshop titled Gender & Health: Impacts of Structural Sexism, Gender Norms, Relational Power Dynamics, and Gender Inequities in collaboration with nine ICOs. During the workshop, participants discussed conceptual frameworks, methodologies, and interventions related to structural sexism, gender norms, relational power dynamics, and gender inequities. They also explored opportunities for advancing research and fostering collaborations in this area (Barr et al., 2024). A resulting Notice of Special Interest (NOSI) (NOT-OD-24-038) urged the scientific community to apply for research and/or training grants focused on the health impacts of gender-related social and structural variables.

OVERVIEW

The *NIH-Wide Strategic Plan for Research on the Health of Women* represents NIH's commitment to filling gaps in knowledge about the health of women, as well as the effects of sex and gender factors, across the life course and in the context of a wide range of diseases and conditions. In carrying out these efforts, NIH is keeping pace with rapid changes in science and technology and evolving public health needs, and is following legislative mandates, such as the 21st Century Cures Act.

ORWH led the development of this strategic plan, on behalf of NIH and in collaboration with ACRWH, ICO representatives, and federal partners. The strategic planning process leveraged a data-driven approach that considered diverse input from partners across NIH, ACRWH, the federal government, and the public (Appendix A). Through this process, strategic goals and objectives were defined in the areas of biological, behavioral, social, structural, and environmental factors; data science and data management practices; scientific workforce training and education; biology underlying sex influences; and community-engaged science across the research and practice continuum.

Synergistic Interdisciplinary Connections: Advancing Science for the Health of Women in Key Areas

Partnerships among ICOs and ORWH ensure that rigorous NIH-funded research, training, and programs are relevant to the health and careers of women (Appendix B). The NIH Revitalization Act of 1993 formed two committees—ACRWH and CCRWH—to serve as partners in advising the ORWH director on topics related to research on the health of women.

ACRWH is composed of physicians, scientists, and other health professionals who are not federal employees and whose clinical practice, research specialization, or professional expertise enables them to advise the ORWH director on NIH research on the health of women (Appendix C).

CCRWH is an NIH-wide group of ICO directors or their senior-level designees who serve as direct liaisons between ICOs and ORWH. CCRWH identifies research priorities that are focused on the health of women, provides guidance, fosters collaboration, serves as a platform for sharing information, and supports ORWH program goals, including ORWH's career development programs and outreach efforts (U.S. Department of Health and Human Services, 2013).

In addition, Congress has elevated the health of women in recent years through an uptick in requests for briefings on relevant topics, as well as legislative requirements set forth in appropriation bills. In response to a congressional request to address NIH efforts related to research on the health of women, ORWH, on behalf of ACRWH, hosted an event in October 2021 titled Advancing NIH Research on the Health of Women: A 2021 Conference. Key discussion topics included research activities related to rising maternal morbidity and mortality rates, the increasing rates of chronic debilitating conditions in women, and stagnant cervical cancer survival rates. A summary report highlighted knowledge gaps in evidence concerning conditions affecting women that hinder the provision of evidence-based care. Furthermore, the report underscored the importance of enhanced implementation and intentional clinical research to women's health (Temkin et al., 2022).

In response to a congressional mandate directed at NIH, the National Academies of Sciences, Engineering, and Medicine (NASEM) convened an ad hoc committee with specific scientific, ethical, regulatory, and policy expertise to develop a framework for addressing the persistent knowledge gaps in research on the health of women across ICOs. Ultimately, this consensus study will outline opportunities to bridge gaps in NIH research on the health of women. A distinct NASEM committee has been charged with developing a framework for the consideration of chronic debilitating conditions in women, an additional topic of congressional interest.

Convening expertise, engaging visionary thinking, and leveraging collaborative funding across NIH catalyzes breakthroughs in basic, translational, and clinical research that are relevant to health and disease in populations of women. Impactful interdisciplinary research considers the influences of life course, life context, and environment, and spans diverse populations and groups. Additionally, such partnerships facilitate workforce development to promote the representation of women in biomedical research careers and encourages the use of novel tools, evidence-based approaches, and resources.

Health and Disease

Accounting for sex and gender in research is critical to understanding health and preventing, diagnosing, and treating disease and illness. The existence of disparities in the prevalence and severity of diseases affecting women highlights the need for further research in this area. Historically, women have been underrepresented in biomedical research, often leading to poorer health outcomes than those reported for men. To address this gap, NIH-funded researchers are exploring various conditions—including HIV, cancer, cardiovascular disease, nervous system disorders, diabetes, autoimmune diseases, and COVID-19—in the context of the health of women.

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Cardiovascular disease is the leading cause of death for women. Cardiovascular conditions and risk factors are associated with adverse pregnancy outcomes such as preeclampsia, which also substantially increases the risk of a woman developing hypertension and other cardiovascular diseases later in life (Stuart et al., 2018). NIH-funded investigators are developing interventions to promote cardiovascular health in women across the life course. For example, the National Heart, Lung, and Blood Institute (NHLBI) launched the Early Intervention to Promote Cardiovascular Health of Mothers and Children (ENRICH) initiative to test the effectiveness of an implementation-ready intervention to determine whether a cardiovascular health module delivered within the context of a home visiting program can enhance maternal and early childhood cardiovascular health. NHLBI also funds the Women's Health Initiative Strong and Healthy (WHISH), which is testing whether increasing physical activity will reduce heart disease and stroke in older women.

Cancer is a significant cause of morbidity and mortality among women, with breast cancer being the most common cancer diagnosed in women. Lung cancer is the second most common cancer diagnosed in women and is responsible for the highest number of cancer deaths among women. Sex and gender influence cancer incidence, progression, and outcomes. Distinct sex-specific molecular, genetic, and immunologic features affect response to treatment and adverse event rates across multiple cancer types; gender affects cancer-risk behaviors, access to care, and social support during and after cancer treatment. NIH supports basic, translational, and clinical research across the cancer continuum, as well as research to reduce cancer health disparities. The Advancing NIH Research on the Health of Women: A 2021 Conference included a focus on stagnant cervical cancer survival and highlighted gaps and opportunities in advancing research on female-specific malignancies.

Life Course

To understand the full breadth of research on the health of women, studies on health outcomes that span the life course—including, childhood, adolescence, early adulthood, midlife, and late adulthood—are needed. Menarche and menopause are female-specific life stages that are important to overall health. Menarche, pregnancy, and menopause represent health inflection points for women. For example, frequent use of some personal care products during puberty may affect breast cancer risk (Goldberg et al., 2024). Following menopause, the accumulation of chronic diseases accelerates. By studying the interplay between hormonal changes and health outcomes that are associated with health inflection points, researchers can better understand, prevent, and develop new treatments for age-related diseases that occur commonly in women, such as osteoporosis, age-related macular degeneration, Alzheimer's disease, and other dementias.

NIH-funded investigators are also studying the dynamics of two key health inflection periods, pregnancy and menopause, in the context of health, disease risk, and disease progression. For example, 30 ICOs participate in the NIH Coordinating Committee for Maternal Morbidity and Mortality, which is part of the Implementing a Maternal health and Pregnancy Outcomes Vision for Everyone (IMPROVE) initiative. The IMPROVE initiative aims to advance research addressing preventable maternal deaths and enhancing women's health before, during, and after pregnancy, with a particular focus on reducing health disparities among racial and ethnic minorities, very young and older women, and individuals with disabilities. This comprehensive effort encompasses various integrated components, including:

- The **Maternal Health Research Centers of Excellence** are a centerpiece of the IMPROVE initiative and includes up to seven research centers, one data innovation and coordinating hub, and one implementation science hub to collaboratively design and implement research projects to address the biological, behavioral, environmental, sociocultural, and structural factors that affect maternal morbidity and mortality in populations that experience health disparities.
- The **Connectathon** engages stakeholder communities to develop technologies that standardize available data in electronic health records.
- The **Notice of Special Interest (NOSI)** solicits applications focused on dissemination and implementation science research that drives our understanding of the biological, behavioral, environmental, sociocultural, and structural factors that affect pregnancy-related and pregnancy-associated morbidity and mortality and builds an evidence base for improved care and outcomes.

- The **IMPROVE Community Implementation Program (IMPROVE-CIP)** ensures that evidence-based interventions promoting maternal health are delivered to, accepted by, and utilized by all individuals, especially in communities of greatest need.
- The **Connecting the Community for Maternal Health Challenge** supports community-based 501(c)(3) organizations to develop the infrastructure and capabilities to pursue maternal health research in areas that specifically impact their communities.
- The **RADx® Tech for Maternal Health Challenge** accelerates the development of home-based and point-of-care maternal health diagnostic devices, wearables, or other remote sensing technologies to enable extension of care and improve health outcomes in maternity care deserts.

In recognition of National Women's Health Week in May 2023, ORWH hosted the 7th Annual Vivian W. Pinn Symposium titled Menopause and Optimizing Midlife Health of Women. Symposium participants examined the menopausal transition, the accumulation of morbidity after menopause, menopause in special populations, the influence of social determinants of health on the menopausal experience, the use of menopausal hormone therapy, and interventions to promote healthy aging. The focus of The 8th Annual W. Pinn Symposium on autoimmune disease highlights the critical significance of this group of diseases for women's health.

Life Context and Environment

Many factors related to life context and the environment are likely to influence a person's health. These factors may include diet, physical activity, substance use and addiction, and exposure to pollutants, among others. Other aspects of life context include family life and caregiving, socioeconomic status, structural factors, stigma, and trauma. NIH and NIH-supported researchers are studying how factors such as these influence different aspects of health and disease in women.

NIH supports research focused on the health of women in the context of alcohol and substance use, as well as smoking and tobacco use. For example, the Helping to End Addiction Long-term® Initiative, supports the Women's Justice Community Opioid Innovation Network, which organizes outreach and research focused on the unique challenges of opioid use disorder for women. The National Institute on Alcohol Abuse and Alcoholism has developed fact sheets and other resources on alcohol use during pregnancy. Additionally, as a part of its smokefree.gov initiative, the National Cancer Institute maintains online resources to address the unique challenges that women face when quitting smoking.

The Model Continuums of Care Initiative to Advance Health Equity Among Women and Girls in Racial/Ethnic Minority and Other Marginalized Communities is aimed at reducing the prevalence and impact of mental health disorders, substance use disorders, chronic stress, cardiopulmonary diseases, common metabolic disorders (e.g., diabetes), cancer, and HIV among historically marginalized women of reproductive age. This multi-ICO initiative will apply implementation and dissemination science to advance racial equity and reduce health disparities in these populations. This continuum-of-care approach integrates primary care, reproductive health, behavioral health, cardiopulmonary, and endocrine specialties to fully address health care needs in each of these domains, and to have maximum impact on the overall health and well-being of women who are from racial and ethnic minority populations and women who are underserved, understudied, and underreported. By addressing gaps in the continuum of health care for these populations and optimizing coordination of care, this whole systems approach is anticipated to have a transformative impact on the health care of women.

Diet and physical activity are known to affect health and well-being, and NIH supports initiatives in this area that are relevant to the health of women. The Office of Nutrition Research developed the 2020–2030 Strategic Plan for NIH Nutrition Research in May 2020. This plan is centered around a vision of precision nutrition research and incorporates a cross-cutting focus on the health of women. In addition, the National Institute of Diabetes and Digestive and Kidney Diseases established Sisters Together: Move More, Eat Better, a community program that encourages African American women to reach and maintain a healthy weight by being more physically active and making healthier food choices.

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Various environmental factors—including air and water pollution, chemical exposures, and the effects of climate change—can contribute to health outcomes for women. The NIH Climate Change and Health Initiative provides funding for health research on climate change and prioritizes vulnerable populations, including women. Additionally, the National Institute of Environmental Health Sciences established the Women's Health Awareness Community Engagement Program to provide evidence-based community interventions, increase community health resiliency, and advance health equity.

Populations and Groups

ICOs have supported research and other initiatives to promote the health of women from diverse populations and groups, including underrepresented racial and ethnic populations; sexual and gender minority populations; rural populations; underserved communities disproportionately affected by adverse health outcomes; and understudied, underrepresented, and underreported populations.

For example, the National Institute on Minority Health and Health Disparities (NIMHD) established the Health Disparities Research Institute, which offers annual training to support early career investigators who are conducting research in the areas of minority health and health disparities. NIMHD also led an initiative to understand and reduce racial and ethnic, geographic, and socioeconomic HIV disparities among women in the United States through health services, interventions, and implementation research.

Workforce Development

The NIH commitment to promoting diversity in the extramural scientific workforce is a fundamental step to the success of the NIH mission. NIH is committed to developing and effectively implementing innovative programs aimed at attracting, retaining, and advancing women in biomedical science careers. Additionally, it seeks to increase the representation of women at the senior faculty and leadership positions. ICOs are promoting the inclusion of female scientists in the biomedical workforce by encouraging eligible researchers who are women to work with their institutions to apply for training grants and diversity supplements. The NIMHD and National Institute of Nursing Research Science Collaborative for Health disparities and Artificial intelligence bias Reduction Think-a-Thons target women and other underrepresented populations in data science to upskill cloud computing knowledge and offer hands-on research using big data. These efforts have increased the presence of women in data science.

ICOs also support *Research Supplements to Promote Re-entry and Re-integration into Health-Related Research Careers* (NOT-OD-21-134), which provide support for a mentored research training experience for individuals with high potential to re-enter or re-integrate into an active research career after an interruption for family responsibilities or other qualifying circumstances, including an unsafe or discriminatory work environment. Unsafe environments may consist of threatening behavior such as sexual and gender harassment; harassment based on being a member of a racial, ethnic, sexual, or gender minority group; disability-based aggression; aggressions associated with religion; and other similar circumstances. Moreover, an extension of this supplement consisting of the Re-training and Re-tooling Program (NOT-OD-23-170) provides support and protected time for a mentored research experience. This opportunity enables early or mid-career candidates to obtain new skills so that they can pivot to a new research direction while augmenting the parent grant. The intent of the program is to facilitate interdisciplinary partnerships and cross-sector collaborations that would enable the scholar to acquire specialized skills and novel perspectives that would enhance their potential career advancement. The National Institute of Arthritis and Musculoskeletal and Skin Diseases has partnered with ORWH and the Office of Data Science Strategy to launch the Accelerating Medicines Partnership® Autoimmune and Immune-Mediated Diseases science leadership scholars program in women's health and autoimmune and immune-mediated diseases. The intention of this program is to prepare the next-generation leaders of team science that will improve women's health. Additionally, administrative supplements (NOT-OD-21-070) are available to Ruth L. Kirschstein National Research Service Award postdoctoral fellows to support childcare costs, which is expected to be renewed in 2024.

OVERVIEW

Sexual harassment remains an ongoing issue within the biomedical research enterprise. The NASEM report *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine* demonstrates the urgent need to develop new partnerships to address this challenge. NIH supports the development of interventions designed to transform the culture within the biomedical research community to address and eliminate instances of sexual harassment. Ten ICOs have signed on to fund or co-fund projects focused on sexual harassment (NOT-OD-21-150), with two research awards currently funded by the National Institute of General Medical Sciences and ORWH.

Tools, Approaches, and Resources

Synergistic collaborations among ICOs encourage the use of innovative tools, approaches, and resources for research on the health of women. These examples might include the use of novel imaging techniques, precision medicine, biomarkers, data science, and non-animal in silico models. Collaborations can foster the sharing of data, biospecimens, information, and other resources all aimed at enhancing interdisciplinary research. For example, the National Center for Advancing Translational Sciences leveraged data from its National COVID Cohort Collaborative to gain insight into questions related to COVID-19 and pregnancy. NICHD is developing a publicly accessible, interoperable health care resource implementation guide to link electronic health records of pregnant and postpartum women to their children's health records and other vital medical records.

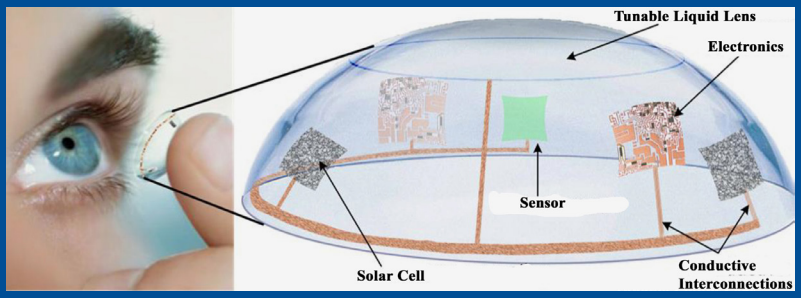


Image Credit: Hongrui Jiang, Ph.D., University of Wisconsin, Madison

Illustration of Advanced Contact Lens for Presbyopia

According to Patel & West, 2009, "Women have a higher prevalence of, and more severe, presbyopia. Despite this, women in low- and middle-income countries are less likely to have spectacle correction. Men and women have different needs for near vision but are equally likely to report problems with daily activities due to near vision impairment." (p.1)

Scientists are designing an accommodating contact lens for presbyopia, a condition that tends to occur in one's forties when a stiffening of the eye's lens makes it difficult to focus on close objects. Many of the components for the contact lens – the sensors, electronics, solar cells – would be embedded along the edge of a flexible material (Jiang, 2016).

ICOs are also supporting community-engaged research to better understand the health of women. This work involves close collaboration with patients, health care workers, community organizations, and other partners to set research priorities and ensure that the research outcomes are relevant to the affected communities. For example, NHLBI's Maternal Health Community Implementation Project is supporting community-engaged research to ensure that evidence-based maternal health interventions are implemented appropriately among underserved communities. Through the IMPROVE initiative, several ICOs participated in a funding opportunity focused on community interventions to address the consequences of the COVID-19 pandemic among populations facing health disparities and those facing adverse health outcomes of the pandemic. Beyond NIH, an interagency collaboration is driving the Connectathon, which will provide the scientific community with a roadmap for leveraging longitudinal clinical data from electronic health records.

Conclusion

The NIH focus for research on the health of women spans the full spectrum of science, and the examples presented here highlight the importance of supporting NIH-wide partnerships focused on the health of women. Within NIH and the broader scientific community, ORWH aims to advance the inclusion of women in clinical trials, increase understanding of the importance of SABV, and stimulate research pertaining to the health of women and the influences of sex and gender on health and disease across the life course. Additionally, it seeks to promote the representation of women in biomedical careers and advancement of their roles within the field. Sustained partnerships among ICOs and federal and non-federal agencies will be essential for further progress in these areas.

The Guiding Principles to Advance Science for the Health of Women

This strategic plan is driven by three guiding principles:

1. Consider the complex intersection among multiple factors that affect the health of women.
2. Include diverse populations of women in clinical research.
3. Integrate perspectives from a diverse workforce of scientists with differing skills, knowledge, and experience.

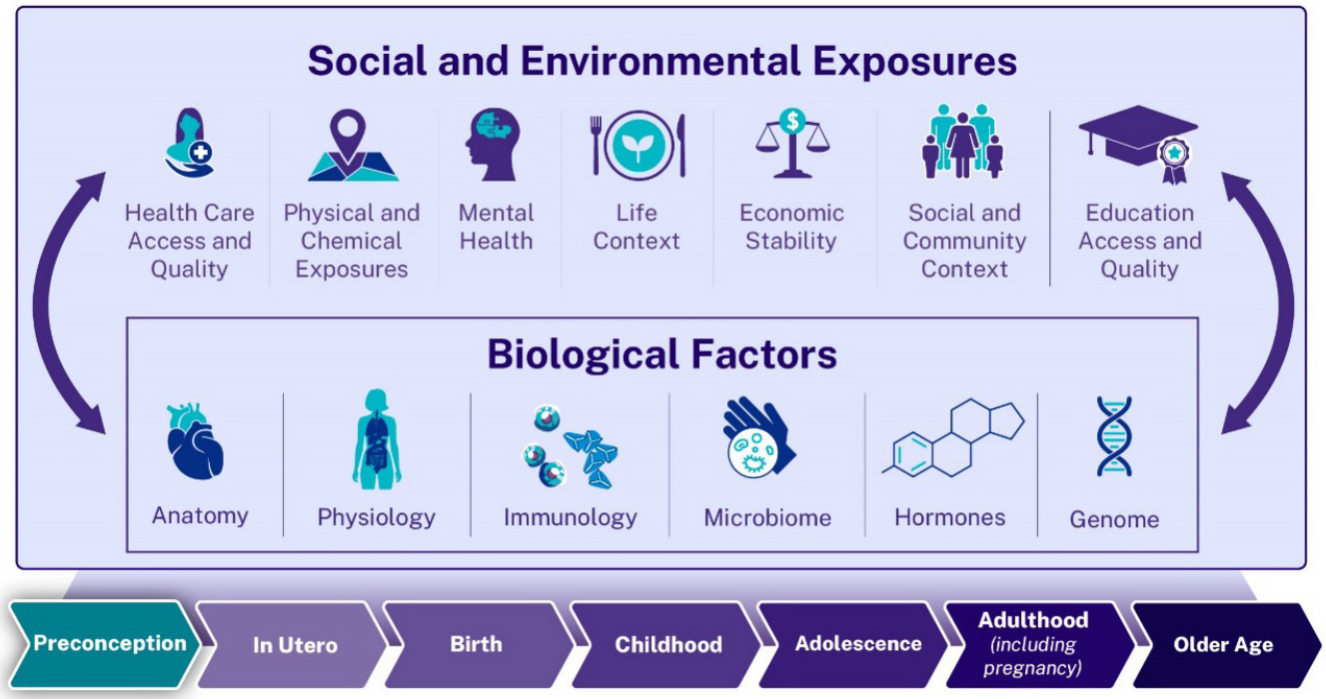
Applying these principles across the entire research continuum is critical to addressing the strategic goals of this plan, which aim to improve the health of women.

Considering Multiple Factors

The health of women must be examined in a holistic manner whereby the combinatorial effects of social and environmental exposures, as well as biological factors on both protective and deleterious health outcomes are considered across the life course (Figure 2).

Figure 2. Multidimensional Framework Representing Health of Women Across the Life Course

(Developed by Samia Noursi, Ph.D.; Kelly Chandler, Ph.D.; Elizabeth Barr, Ph.D.; Sarah Heilman, M.S.; and Janine Clayton, M.D., FARVO)



Social and environmental exposures, such as health care access and quality, physical exposures, mental health, life context, economic stability, social and community context, and education access and quality, can influence the health of women. For example, women who live in a maternity care desert (defined by Wallace et al. as "a county with no hospital offering obstetric care and no OB/GYN or certified nurse midwife providers") have decreased health care access and quality and are more likely to die of obstetric causes than women who have access to maternal health care (Wallace et al., 2021). Physical exposures ranging from chemicals found in drinking water to rising temperatures due to climate change may contribute to environmental injustice, disproportionately affecting women based on their residential locations and leading to higher rates of adverse health outcomes (Van Horne et al., 2023).

It is important to recognize a person's internal dialog or mental health, which may influence how they experience and react to the outside world. Evidence indicates that increased incidences of adverse childhood experiences are associated with decreased quality of health in midlife women (Williams & Finch, 2019). Life context captures various exposures that may contribute to health outcomes, including factors such as exercise, nutrition, alcohol, and drug use. Furthermore, night shift work is associated with an

increased risk of adverse health outcomes, and research has shown that workers who eat daytime meals may have reduced health risks (Chellappa et al., 2021).

Social and community context exposures, such as household income, or green spaces, can affect the health status of women in a variety of ways (Collin et al., 2021; Krieger et al., 2020a; Krieger et al., 2020b; Nardone et al., 2020a; Nardone et al., 2020b). Researchers showed that people exposed to poverty had increased activity in the portion of the brain that responds to stress, which was linked to an increase in arterial inflammation and higher risk of adverse cardiovascular health outcomes (Tawakol et al., 2019). Racial discrimination has been shown to increase disease risk among Black women. NIH-funded research has described a relationship between racial discrimination and inflammatory mechanisms, with links to increased inflammation in Black women who have experienced racial discrimination and have been diagnosed with the autoimmune disease lupus (Marz et al., 2023). Access to green spaces has been shown to promote health and decrease mortality among women (James et al., 2016). Education access and quality can also impact the health status of women. For example, women with college-educated parents tend to experience a slower increase in body mass index across their life span (Yang et al., 2021).

A complex intersection of social and environmental exposures with individual-level biological factors affects the health status, disease presentation, treatment response, resilience, and quality of life for women. Examples of individual-level biological factors include anatomy, physiology, immunology, microbiome, hormones, and the genome. These life-course interactions occur under the influence of intergenerational factors such as maternal or paternal exposure to violence, wealth, or endocrine-disrupting chemicals (Greeson et al., 2023).

As we strive to enhance the quality of women's lives, reduce their disease burden across the life course, and address health disparities for populations of women at greatest risk for disease (Schweinhart & Clayton, 2018), it is imperative to consider a theoretical model that incorporates these factors holistically when designing research that informs implementation and policy.

Consideration of sex, gender, and other key factors is fundamental to achieving the goals and objectives outlined in this strategic plan. Several NIH policies support the consideration of multiple factors across the biomedical research continuum. NIH maintains a policy to enhance reproducibility through rigor and transparency. The research community increasingly has recognized that the quality and generalizability of biomedical research depends on the incorporation of key biological variables, such as sex. Therefore, NIH expects that SABV will be factored into research designs, analyses, and reporting in vertebrate animal and human studies.

Including Diverse Populations

To advance science on the health of women, researchers must recognize the ways in which health outcomes vary among different populations of women. To understand and address the health of all populations of women, especially those that bear a disproportionate burden of illness, researchers must consider factors that differ among populations of women (e.g., race and ethnicity, socioeconomic status, education, geographic location, gender identity, disability status).

NIH-designated U.S. health disparity populations include underrepresented racial and ethnic groups–including people who are American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Middle Eastern or North African, and Native Hawaiian or Other Pacific Islander; people with lower socioeconomic status; underserved rural communities; people with disabilities, and sexual and gender minority groups (NOT-OD-19-139). Groups that have historically been excluded from biomedical research include pregnant and lactating women, older and younger individuals, and populations experiencing health disparities (Thiele et al., 2022). Thus, individuals in such groups might not have the benefit of clinical research findings arising from study populations similar to themselves.

As mandated by the Public Health Service Act, section 492B, 42 U.S.C. section 289a-2, NIH supports a policy on the inclusion of women and minorities as participants in research involving human subjects. The primary goal of this law is to ensure that

research findings can be generalizable to the populations affected by diseases or other conditions under study. Additionally, the statute requires clinical trials to be designed to analyze whether study outcomes differ for women and members of racial and ethnic minority groups. NIH also maintains a policy on inclusion across the life span, which ensures that individuals are included in clinical research in a manner appropriate to the scientific question under study so that the knowledge gained from NIH-funded research is applicable to all those affected by the researched diseases and conditions. This policy aligns with the 21st Century Cures Act and requires investigators conducting clinical research to submit individual-level data on the sex or gender, race, ethnicity, and age of participants at enrollment in annual progress reports.

Integrating Diverse Perspectives

Interdisciplinary research initiatives integrating perspectives from multiple disciplines–as well as researchers with diverse skills, knowledge, and experiences–are crucial to capturing the complex interplay of multiple factors affecting the health of all women. An interdisciplinary approach leverages unique expertise, enables innovative methodologies, and leads to novel discoveries with high scientific impact (Hall et al., 2019). Interdisciplinary research stimulates novel ways to perform research on the health of women and has the potential to solve increasingly complex, multilevel, and multifactorial problems encountered in research on the health of women that cannot be addressed by any one discipline alone. Moreover, the performance, innovation, and collective intelligence of research teams may be further enhanced by increasing team diversity in terms of sex and gender, race and ethnicity, and background (Wiley et al., 2023; Yang et al., 2022).

Compared to men, research shows that women scientists are more likely to engage in research that pertains specifically to women's health. However, women are considered underrepresented in the U.S. biomedical, clinical, behavioral, and social sciences research enterprise. Women from underrepresented racial and ethnic groups, with disabilities, and from disadvantaged backgrounds face challenges at the graduate level and beyond, and women are underrepresented at senior faculty levels in some fields (NOT-OD-20-031). In addition, NIH is committed to ensuring that diverse perspectives are included across the biomedical research workforce. Scientists and trainees from diverse backgrounds and life experiences bring different perspectives, creativity, and individual enterprise to address complex scientific problems. NIH encourages institutions to diversify their student and faculty populations, through means consistent with applicable law, to enhance the participation of individuals from groups that are underrepresented in the biomedical, clinical, behavioral, and social sciences. These groups include, but are not limited to, individuals from racial and ethnic groups that have been shown by the National Science Foundation to be underrepresented in health-related sciences on a national basis; individuals with disabilities, defined as those with a physical or mental impairment that substantially limits one or more major life activities; and individuals from disadvantaged backgrounds.

STRATEGIC GOALS

The *NIH-Wide Strategic Plan for Research on the Health of Women* includes five strategic goals that are intended to provide a roadmap to guide and inform NIH-supported research on various diseases and health conditions that affect women. Innovative research methods and measurements are needed to understand the dynamics of the myriad social and biological factors that affect the health of women. Training and engagement of a diverse workforce of scientists with differing skills and a variety of experiences are also critical. ORWH prioritizes interdisciplinary research and considers NIH diversity, equity, inclusion, and accessibility goals, wherever appropriate.

Application of these strategies across the entire health research continuum—from basic and preclinical research to clinical investigations, community engagement, and implementation science—is critical to implementing this strategic plan.

The five strategic goals in the NIH-Wide Strategic Plan for Research on the Health of Women are as follows:

1. Advance research that examines the multiple biological, behavioral, social, structural, and environmental factors that influence the health of women, as well as the intersections of these factors.
2. Improve data science and data management practices with innovative research methods, measurements, and cutting-edge technologies to prevent and treat conditions affecting women.
3. Foster women scientists' career development and promote scientific workforce training and education that advances the health of women and the science of sex and gender influences.
4. Support the basic and translational study of the biology underlying sex influences and its intersection with disease and health preservation in women across the life course.
5. Advance community-engaged science across the research and practice continuum and enhance the dissemination and implementation of evidence-based solutions to improve the health of women.

Strategic Goal 1: Research

Advance research that examines the multiple biological, behavioral, social, structural, and environmental factors that influence the health of women, as well as the intersections of these factors.

The consideration of sex and gender factors in research is critical to the NIH mission of seeking knowledge to enhance health, lengthen life, and reduce illness and adverse health outcomes. Sex and gender are embedded in a complex milieu of biological, behavioral, social, structural, and environmental factors that influence health. Rigorous examination of these factors and their intersections is essential to advancing health research on the health of women.

Objectives

1 *Develop and support innovative research on the health of women in social, cultural, and historical contexts, with particular attention to the interplay of biological, behavioral, social, structural, and environmental factors.*

Advancing innovative research on the health of women requires investigating a range of biological, behavioral, social, structural, and environmental factors. Viewing these factors through the lens of social, cultural, and historical context will advance our understanding of how they affect the health of women. Examining the dynamic nature of these factors, as well as their interactions with one another, while adopting a life-course perspective, will further strengthen foundational knowledge and promote rigorous research on the health of women.

2 *Expand research to address health disparities experienced by diverse populations of historically marginalized women, with attention to intersectionality and health equity.*

More research on health disparities experienced by diverse populations of women that have been historically marginalized is needed. Health care inequities in the United States are evident in the disproportionate burden of disease and adverse health outcomes experienced by women who are members of populations affected by health disparities, yet women in these populations remain largely understudied, underrepresented, and underreported in health research. Achieving health equity requires innovative and tailored work to illuminate and address these issues.

3 *Support research on upstream causes of health disparities and modifiable factors or points of intervention to mitigate disparities rooted in structural sexism, structural racism, and other social determinants of health.*

To address social determinants of health, researchers must identify upstream causes of health disparities, as well as modifiable factors or points of intervention. Understanding the upstream causes of health disparities experienced by women—such as environmental, community, political, and structural factors—is an essential step toward identifying modifiable considerations and points of intervention to address these disparities. Gender intersects with other structural (e.g., health, economic, and social policies) and sociodemographic factors—including race, age, sexual orientation, rurality, socioeconomic status, and immigration status—requiring multilevel, multidimensional, and multifactorial approaches to advancing the health of women.

4 *Support innovative behavioral and social sciences research (BSSR) to enhance knowledge of biological, behavioral, social, environmental, and structural processes and promote equity-focused health research for women.*

To conduct equity-focused health research for women, an understanding of the complex interplay among biological, behavioral, social, environmental, and structural processes—including both internal and external phenomena—is needed. BSSR is focused on understanding such factors and plays an important role in understanding the health of women. Continued and expanded support for BSSR can enhance understanding of factors that influence the health of women and can facilitate the development of actionable interventions that address health disparities and advance equity for women.

5 *Develop and support research to investigate the multiple domains of gender (e.g., identity, roles and norms, relations, power) and their influence on health.*

Further investigation is needed to delineate the pathways by which the multiple domains of gender independently and interactively influence the health of women and to build the evidence base for data-driven interventions. Additional research is also needed to develop, test, and implement multilevel and multisectoral strategies to inform policies and programs that ensure that all women are provided opportunities to achieve optimal health.

6 *Expand research to advance the health of women across the life course, including during key social and biological transitions.*

Periods of key social and biological transition in the lives of women and girls have significant health implications yet remain understudied. Biological, behavioral, social, structural, and environmental factors influence health during childhood and adolescence and throughout adulthood, including older age. Additional research on these key transitions can inform evidence-based interventions to advance the health of women. Social and structural changes (e.g., conflict, natural disaster) that are not tied to a particular life stage should also be studied from a life-course perspective.

Strategic Goal 2: Data Science and Management

Improve data science and data management practices with innovative research methods, measurements, and cutting-edge technologies to prevent and treat conditions affecting women.

Advancing science for the health of women requires data science and data management practices with innovative research methods, measurements, and cutting-edge technologies to prevent and treat conditions affecting women. Deliberate application of these methodologies and practices will provide evidence-based knowledge with which research can inform health care for women. Additionally, these efforts should be aligned with the Findability, Accessibility, Interoperability, and Reusability (FAIR) data principles, which provide guidance to make data easier to share and reuse among researchers.

Objectives

1 *Increase data sharing and improve data management practices to align with FAIR principles and enhance the utility of new and existing data on the health of women.*

Data sharing encourages more scientific investigation, enhances analytical reproducibility and transparency, and provides a stronger evidence base for understanding the health of women. High-quality data management practices will improve the efficiency of using new and existing data for studies focused on the health of women. This objective is in alignment with the NIH Data Management and Sharing policy, which promotes the sharing of scientific data to enable validation of research results, provide accessibility to high-value data sets, and promote data reuse for future research studies.

2 *Promote the use of advanced statistical modeling, data visualization, artificial intelligence (AI), and machine learning (ML) methods for research on the health of women.*

Novel data science methodologies are essential to advancing research on the health of women. For instance, AI/ML and propensity score modeling have received increased attention in the field of health science research. The rapid developments in data science, data visualization, and statistical modeling enable researchers to assess more complex data structures and examine nonlinear relationships, which can provide new insights into the health of women. Careful consideration and reduction of potential bias in underlying algorithms and data will be critical for the health of women.

3 *Utilize longitudinal and repeated measurement designs and analytic approaches to characterize the health of women over time and across the life course.*

Modeling for longitudinal data and repeated measurement designs are essential to understanding the health of women over time and across the life course. These approaches allow researchers to examine disease progression, identify critical windows for diagnosis and intervention, and investigate both issues and effects of life-course transition that are unique to women.

4 *Support the development of cutting-edge computational tools and technologies to facilitate screening for prevention, diagnosis, and treatment of diseases that affect women.*

Cutting-edge computational tools and technologies are necessary to facilitate screening for prevention, diagnosis, and treatment of diseases that affect women. Developments in data and computational science occur alongside advancements in technologies, enabling progress in this area. Together, these efforts can lead to new findings and approaches that benefit the health of women.

Strategic Goal 3: Training and Education

Foster women scientists' career development and promote scientific workforce training and education that advances the health of women and the science of sex and gender influences.

A well-trained, diverse, and robust workforce serves as the engine of scientific progress and is essential to advancing research focused on the health of women. Diversity and inclusion of women strengthens science and will have a broader impact on the NIH mission. The metrics from this endeavor will complement NIH's ongoing efforts to advance gender equity in the NIH-funded workforce.

Objectives

1 *Integrate knowledge of sex and gender influences on health and disease at all levels of training to accelerate the translation of that knowledge into practice.*

The training of exemplary biomedical researchers at all career stages is critical to advancing research on the health of women. As part of this training, knowledge of sex and gender influences should be integrated with the skills that nurture effective researchers. As the pace of biomedical research accelerates, training and continuing education programs that incorporate updated knowledge of sex and gender influences on health need to be developed and implemented to ensure that current researchers and those returning or entering the workforce have the necessary competency to improve health for people who are male, female, or intersex.

2 *Develop the next generation of researchers to advance science on the health of women, including through diverse interdisciplinary avenues toward biomedical and health science research careers.*

Science on the health of women will advance with strengthened recruitment of the next generation of researchers focused on this topic and with the comprehensive development of their careers. Gaps in research exist for many of the diseases and conditions that predominantly affect women, and a continued need exists for further research on newly discovered sex and gender differences in normal biology and pathophysiology. Diverse interdisciplinary avenues are essential to better understanding the health of women from different perspectives. Additionally, with the increasing importance of precision medicine, the research workforce will be required to study diseases and conditions that are unique to or especially relevant to all women, as well as their risk factors, mechanisms, and diagnostic and treatment outcomes.

3 *Support and develop programs to recruit, support, retain, facilitate re-entry of, and advance women at all stages of their research careers, from early career to leadership positions, especially mid-career scientists.*

NIH programs should improve the recruitment, retention, and re-entry of women into biomedical research. NIH programs also should promote advancement of women in biomedical research careers, from early career to leadership positions, especially of mid-career scientists. These efforts—in particular, enhancing and developing programs to improve the retention and advancement of women in biomedical careers—will yield dividends for research on the health of women, interdisciplinary research efforts, and the broader biomedical research enterprise.

4 *Promote and support policies, mentoring, networks, collaborations, and opportunities to advance the cross-sectoral careers of women scientists, with special attention to populations underrepresented in the U.S. biomedical, clinical, behavioral, and social sciences research enterprise and persons with disabilities.*

NIH programs should improve the advancement of women in biomedical research, as well as the advancement of women in biomedical research careers, with special attention to populations underrepresented in the U.S. biomedical, clinical, behavioral, and social sciences research enterprise and individuals with disabilities. These efforts can include opportunities for women scientists—such as mentoring, networks, and collaborations—and policies that support their professional advancement to senior leadership positions across the research continuum.

5 *Promote and disseminate interventions to reduce barriers and facilitate recruitment, retention, re-entry, and re-integration to advance the behavioral and biomedical careers of women.*

Research is needed to develop and test interventions that improve the recruitment, retention, re-entry, and re-integration of women in biomedical research careers. Additional research and evaluations are also required to define the types and components of programs that substantially increase women's participation and advancement in biomedical research. These needs extend to all career levels in certain science, technology, engineering, and mathematics fields. Particular attention should be given to underrepresented women who face specific challenges that may require tailored approaches. Other priorities include identifying barriers to systematic or institutional implementation of effective interventions, developing new and innovative interventions, and developing effective approaches for disseminating and deploying evidence-based interventions.

Strategic Goal 4: Basic and Translational Science

Support the basic and translational study of the biology underlying sex influences and its intersection with disease and health preservation in women across the life course.

The health of women is affected by various external factors (e.g., gender, environment, policy) and internal factors (e.g., genetic, cellular, and physiological levels) and their interaction with sex. Both internal and external factors must be considered when assessing the health of women across the life course. Basic and translational science can help researchers better define factors that affect the health of women.

Objectives

1 *Advance mechanistic, basic, and translational research on the effects of sex and gender on biology, disease pathogenesis, therapeutics, and health outcomes that uniquely or differently affect women.*

By conducting mechanistic, basic, and translational research, researchers can examine how sex and gender influence biology, disease pathogenesis, therapeutics, and prevention. More work is needed to understand the biological underpinnings of how wellness and resilience affect health outcomes in different populations of women.

2 *Enhance the use of cell and animal models, organoids, engineered tissue matrices, in silico, and related systems to define the role of sex and gender in biomedicine.*

Multiple approaches are needed to better understand the role of sex and gender in biomedicine. Animal models have served as valuable resources that enable researchers to characterize various aspects of health and disease. Other models—such as cells, organoids, engineered tissue matrices, in silico models, and related systems—complement, and may even provide an alternative to, whole-animal systems. New methods for developing and validating different types of models are needed to define the role of sex and gender in biomedicine.

3 *Enhance research on the role of sex and gender in intrinsic processes (e.g., sleep, stress, pain) and in response to extrinsic factors (e.g., microbiome, nutrition, toxins) across the life course.*

Both intrinsic processes and extrinsic factors are likely to be affected by sex and gender across the life course, and more research on these interactions is needed. For example, climate change and environmental toxins have dynamic, far-ranging effects on human health and inherently affect the health of women.

4 *Stimulate transdisciplinary, systems-based approaches spanning biomedical domains, including molecular and cellular biology, genomics, immunology, and physiology.*

Many different biological and environmental variables are likely to affect the health of women at the molecular, cellular, and systems levels. A better understanding of these variables at the fundamental levels can offer insight into various topics that are relevant to the health of women, such as molecular and cellular biology, genomics, immunology, and physiology. By performing interdisciplinary and transdisciplinary research, investigators can leverage knowledge across multiple domains to enrich and advance research in this area.

5 *Expand research on female-specific conditions and diseases, including reproductive stages, and maternal and gynecologic health.*

There is a need for focused investigation of female reproductive health and illness, including menstruation (normal and dysfunctional), infertility, pregnancy, lactation, and menopause. There is also a need for increased attention to research gynecologic health and disease in women of all ages. Maternal health is critically important to the health of a woman during pregnancy and throughout her life course, and for the health of her children. Because the maternal mortality rate in U.S. women is on the rise (GBD 2015 Maternal Mortality Collaborators, 2016), particularly in women of color, investigation of disparities in mortality and morbidity related to pregnancy is needed (Nelson et al., 2018).

Strategic Goal 5: Community Engagement

Advance community-engaged science across the research and practice continuum and enhance the dissemination and implementation of evidence-based solutions to improve the health of women.

Research centered on the health needs of women requires community leadership, engagement, bidirectional listening, and trust-building across the research continuum, from study design and conduct to analysis and dissemination of results. The term "community" applies to groups of women affiliated by geographic proximity, special interest, or similar situations or affected by specific conditions. Effective community-engaged research and implementation science will help to ensure that relevant evidence for clinical and public health practices and policies is generated and translated so that all women receive individualized, sex- and gender-appropriate, evidence-based health care.

Objectives

1 *Train and educate researchers, clinicians, and public health practitioners on community-engaged research and implementation science methods and practice.*

By performing community-engaged research, investigators develop relationships that enable them to work with members of the community to address health-related issues, promote well-being, and achieve positive health outcomes. Such research is essential to developing effective methods and practices for implementation. Training and education of researchers, clinicians, and public health practitioners is essential for promoting community-engaged research on the health of women.

2 *Develop, promote, and leverage methods and practices that include bidirectional listening and culturally responsive communication and support for community participation and engagement in research.*

Advancing science for the health of women depends on intentional alignment of research with community needs. Bidirectional listening and culturally responsive communication are essential for effective community-engaged research. Community members should be engaged in all phases of research, including study design, study implementation or project implementation, analysis, and dissemination of results.

3 *Promote engagement science (e.g., methods, processes) related to implementation, behavior, and health outcomes relevant to improving the health of women.*

Effective community-engaged research and implementation science are essential for ensuring that relevant evidence, interventions, and outcomes are generated to inform clinical and public health practices and policies. By ensuring that outcomes are relevant to community members, community-engaged researchers can make progress toward improving the health of women.

4 *Expand implementation science focused on improving public health practices and health care delivery tailored to the needs of women.*

Support for expanding implementation science is critical for public health practices, policies, and health care delivery that improve the health of women. By conducting implementation science, researchers can ensure that such practices, policies, and delivery methods are tailored to provide individualized, sex- and gender-appropriate, evidence-based health care for women.

5 *Expand implementation science aimed at investigating and intervening on the social, policy, environmental, structural, and systemic factors that influence sex and gender disparities in the health of women.*

Social, policy, environmental, structural, and systemic factors influence sex and gender disparities that affect the health of women. Multilevel interventions addressing these factors should be prioritized to eliminate inequities relevant to the health of women. By carrying out effective implementation science, researchers can better understand social, policy, environmental, structural, and systemic factors and develop interventions that are aimed at improving the health of women.

CROSSCUTTING THEMES AND SPECIFIC TOPICS

NIH has identified six crosscutting themes that span the goals of this strategic plan: comorbidity and multimorbidity, interdisciplinary collaboration, precision medicine, inclusion of women and girls in clinical studies, sex and gender differences research, and preventive care and services (Figure 3). These themes are integral to achieving the strategic goals and advancing research on the health of women.

Figure 3. Strategic Goals and Crosscutting Themes for Research on the Health of Women

Comorbidity and Multimorbidity

To fully understand the factors that affect the health of women, researchers must consider the ways in which comorbidity and multimorbidity influence an individual's overall health. Comorbidity emerged as a topic of interest during Advancing NIH Research on the Health of Women: A 2021 Conference. Examples of comorbid and multimorbid conditions that commonly occur in populations of women include autoimmune disease, cardiovascular disease, diabetes, cancer, and genitourinary disease. Health outcomes associated with the occurrence of two or more chronic conditions can reflect a complex interplay of behavioral, social, structural, and environmental factors. By conducting mechanistic, basic, and translational research focused on comorbidity and multimorbidity, researchers can examine how sex and gender influence biology, disease pathogenesis, therapeutics, and health outcomes. Ultimately, these efforts can lead to better screening for—and prevention, diagnosis, and treatment of—comorbid and multimorbid conditions in women.

Interdisciplinary Collaboration

Research on factors related to sex and gender is relevant to multiple disciplines that span the ICOs and involves increasingly complex, multilevel, and multifactorial dynamics. An interdisciplinary approach engages researchers with scientific expertise from two or more disciplines to advance research on the health of women from different perspectives. Interdisciplinary research can inform methods for studying various aspects of the health of women. Further, these methods can lead to more effective treatments and health outcomes for populations of women than can be achieved through a single discipline. By supporting training for researchers who are pursuing interdisciplinary careers, NIH is fostering interdisciplinary and team science among the next generation of researchers to advance science on the health of women.

Precision Medicine

Precision medicine is a novel approach that accounts for differences in the biological, environmental, and behavioral factors of individuals. The integration of SABV into precision medicine will be critical for the health of women because it recognizes and addresses conditions that are unique, more common, or more debilitating for women. By considering these differences, clinicians can provide tailored treatment approaches for diagnosis and treatment. Precision medicine is applicable to numerous areas, including cancer and various rare diseases, and is highly relevant to improving the health of women. As precision medicine becomes more widespread, researchers focused on the health of women can apply innovative methods and measurements and cutting-edge technologies to improve personalized care by considering the interplays among risk factors, mechanisms, and diagnostic and treatment outcomes that are relevant to women.

Inclusion of Women and Girls in Clinical Studies

Women and girls historically have been underrepresented as participants in clinical studies. For clinical research to be truly useful, it must reflect the populations that it intends to help. ORWH and NIH are committed to addressing this issue by promoting the inclusion of women and girls in preclinical and clinical studies. Including women in research is not just a matter of enrolling women in clinical studies; it is imperative that researchers consider people who are male, female, or intersex when planning, designing, and conducting clinical research. By including women and girls in biomedical research, investigators can work toward characterizing the multiple biological, behavioral, social, structural, and environmental factors that influence the health of women.

Sex and Gender Differences Research

To date, basic, preclinical, and clinical research has often focused on male cells, animals, and human participants. NIH is committed to ensuring that sex and gender are considered across NIH-funded studies. By accounting for sex and gender, researchers can explore the influences of sex on biology, disease pathogenesis, therapeutics, and health outcomes that uniquely affect women. Additionally, researchers can use a variety of models—including cell and animal models, organoids, engineered tissue matrices, in silico models, and related systems—to define the role of sex in biomedicine.

Preventive Care and Services

Prevention is a key aspect of health care and has the potential to improve the health of women. Preventive care and services can help reduce the burden of various diseases that affect women. Understanding the complex behavioral, social, structural, and environmental factors that influence the health of women across the life course is essential to effective prevention. Additionally, innovative research methods and measurements and cutting-edge technologies are essential for progress in this area. Community engagement is also critical to ensuring that preventive care and services are effective and relevant to improving the health of women.

ALIGNMENT OF THE NIH-WIDE STRATEGIC PLAN FOR RESEARCH ON THE HEALTH OF WOMEN WITH THE NIH-WIDE STRATEGIC PLAN

The *NIH-Wide Strategic Plan for Research on the Health of Women* aligns with the three objectives outlined in the *NIH-Wide Strategic Plan for Fiscal Years 2021–2025* (Figure 4). These three NIH-wide objectives are part of a framework that reflects NIH's priorities in biomedical and behavioral research areas, research capacity, and research conduct. This strategic plan further aligns with the five crosscutting themes of the NIH-wide plan: improving minority health and reducing health disparities, enhancing women's health, addressing public health challenges across the life span, promoting collaborative science, and leveraging data science for biomedical discovery.

Figure 4. Research on the Health of women: Alignment of Strategic Goals with NIH-Wide Objectives

	NIH-WIDE OBJECTIVES		
	Advancing Biomedical and Behavioral Sciences	Developing, Maintaining, and Renewing Scientific Research Capacity	Exemplifying and Promoting the Highest Level of Scientific Integrity, Public Accountability, and Social Responsibility in the Conduct of Science
HEALTH OF WOMEN STRATEGIC GOALS	Research Data Science and Management Basic and Translational Science Community Engagement	Data Science and Management Training and Education	Research Data Science and Management Training and Education Community Engagement

ALIGNMENT OF THE NIH-WIDE STRATEGIC PLAN FOR RESEARCH ON THE HEALTH OF WOMEN WITH THE NIH-WIDE STRATEGIC PLAN

NIH-Wide Objective 1: Advancing Biomedical and Behavioral Sciences

The first objective of the *NIH-Wide Strategic Plan* embodies NIH's commitment to driving cutting-edge biomedical and behavioral sciences forward in the areas of foundational science; disease prevention and health promotion; and treatments, interventions, and cures. **Strategic Goals 1, 2, 4, and 5** of the *NIH-Wide Strategic Plan for Research on the Health of Women* align with this NIH-wide objective.

Health of Women Strategic Goal 1: Research

The first goal of this strategic plan supports Objective 1 by promoting research to understand the health of women in different contexts, including among populations and across the life course. An understanding of the biological, behavioral, and social determinants of health, as well as of health disparities experienced by different populations, will be key to these endeavors. This NIH-wide objective also highlights the need to address risks and burdens of disease, which reflect many internal and external factors. Efforts to advance research on the health of women are essential to achievement of NIH's goal to advance research in biomedical and behavioral sciences across all populations.

Health of Women Strategic Goal 2: Data Science and Management

The second goal of this strategic plan supports Objective 1 by promoting development of data science and technology. As emphasized in this NIH-wide objective, foundational science involves building data resources to enable research progress, as well as developing tools and technologies to catalyze discovery and inform decision-making. AI/ML approaches will be harnessed to help NIH-funded scientists analyze large-scale, complex data sets. This NIH-wide objective identifies the need for longitudinal studies that follow participants over time, which is also integral to the second goal of this strategic plan.

Health of Women Strategic Goal 4: Basic and Translational Science

The fourth goal of this strategic plan supports Objective 1 by emphasizing the importance of basic and translational research for biomedical discovery and advancement. This NIH-wide objective supports experimental and observational basic research to understand human health and disease processes, as well as to develop new treatments and cures. Sex and gender are identified within this NIH-wide objective as areas warranting particular attention in research studies. The *NIH-Wide Strategic Plan for Research on the Health of Women* further advances progress in this area by conveying the importance of studying sex and gender in biomedicine through mechanistic, basic, and translational research across biological domains. Additionally, the objective also highlights the need for animal models of disease, which is addressed in the fourth goal of this strategic plan.

Health of Women Strategic Goal 5: Community Engagement

The fifth goal of this strategic plan supports Objective 1 by addressing the need for research centered on community leadership, community engagement, bidirectional listening, and trust-building across the research continuum. This NIH-wide objective highlights the value of pragmatic trials, which are designed to evaluate interventions in community settings. This research approach engages community organizations as key partners and is focused on dissemination, education, and coordination.

NIH-Wide Objective 2: Developing, Maintaining, and Renewing Scientific Research Capacity

The second objective of the *NIH-Wide Strategic Plan* addresses the need for research resources and infrastructure and emphasizes the importance of a well-trained, diverse workforce. **Strategic Goals 2 and 3** of the *NIH-Wide Strategic Plan for Research on the Health of Women* align with this NIH-wide objective.

Health of Women Strategic Goal 2: Data Science and Management

The second goal of this strategic plan supports Objective 2 by identifying the need for cutting-edge tools and technologies for research, as well as approaches for data management. This NIH-wide objective outlines how data repositories help researchers disseminate knowledge and build on existing research to make new discoveries. Advancements in data science can help drive research on prevention and treatments that are relevant to all populations, including women. Additionally, novel medical technologies can lead to improved methods to screen for and prevent, diagnose, and treat diseases, including those affecting women.

Health of Women Strategic Goal 3: Training and Education

The third goal of this strategic plan supports Objective 2 by highlighting the need to foster diversity and training across the biomedical research workforce to advance research on the health of women. This NIH-wide objective recognizes the importance of both supporting early and mid-career researchers and evaluating how policies affect women and individuals from groups that are underrepresented in biomedical and behavioral sciences. The significant role of interdisciplinary science, particularly for research on the health of women, also is highlighted as a component of this objective. Furthermore, this NIH-wide objective addresses the need to identify and remove barriers to the entry, recruitment, retention, and career development of women biomedical and behavioral scientists.

ALIGNMENT OF THE NIH-WIDE STRATEGIC PLAN FOR RESEARCH ON THE HEALTH OF WOMEN WITH THE NIH-WIDE STRATEGIC PLAN

NIH-Wide Objective 3: Exemplifying and Promoting the Highest Level of Scientific Integrity, Public Accountability, and Social Responsibility in the Conduct of Science

The third objective of the *NIH-Wide Strategic Plan* reflects NIH's commitment to fostering a culture of good stewardship, leveraging partnerships, ensuring accountability and confidence in biomedical and behavioral sciences, and optimizing operations. **Strategic Goals 1, 2, 3, and 5** of the *NIH-Wide Strategic Plan for Research on the Health of Women* align with this NIH-wide objective.

Health of Women Strategic Goal 1: Research

The first goal of this strategic plan supports Objective 3 by emphasizing the importance of conducting research and identifying relevant health outcomes for populations of women. NIH recognizes the significance of ensuring that knowledge gained from research is broadly applicable and is committed to including women across the life course, as well as other underrepresented and underserved groups, in clinical research. Including diverse populations is essential to ensuring that the knowledge gained from research is applicable to everyone affected by the disease or condition being studied.

Health of Women Strategic Goal 2: Data Science and Management

The second goal of this strategic plan supports Objective 3 by promoting the application of FAIR data principles in biomedical research. This NIH-wide objective details the value of public data resources and tools to enhance the utility of new and existing data. Transparency in data access and sharing is also essential to maximizing NIH's investment in research. The importance of promoting FAIR data practices, which enhance the utility of new and existing data on the health of women, is emphasized in the second goal of this strategic plan.

Health of Women Strategic Goal 3: Training and Education

The third goal of this strategic plan supports Objective 3 by identifying the need for interventions that address barriers and facilitate recruitment, retention, re-entry, and re-integration to advance the behavioral and biomedical careers of women. This NIH-wide objective emphasizes the importance of fostering a safe and harassment-free work environment. NIH works with its partners to develop policies focused on changing scientific culture; preventing sexual harassment; and promoting a civil, safe, and respectful work environment.

Health of Women Strategic Goal 5: Community Engagement

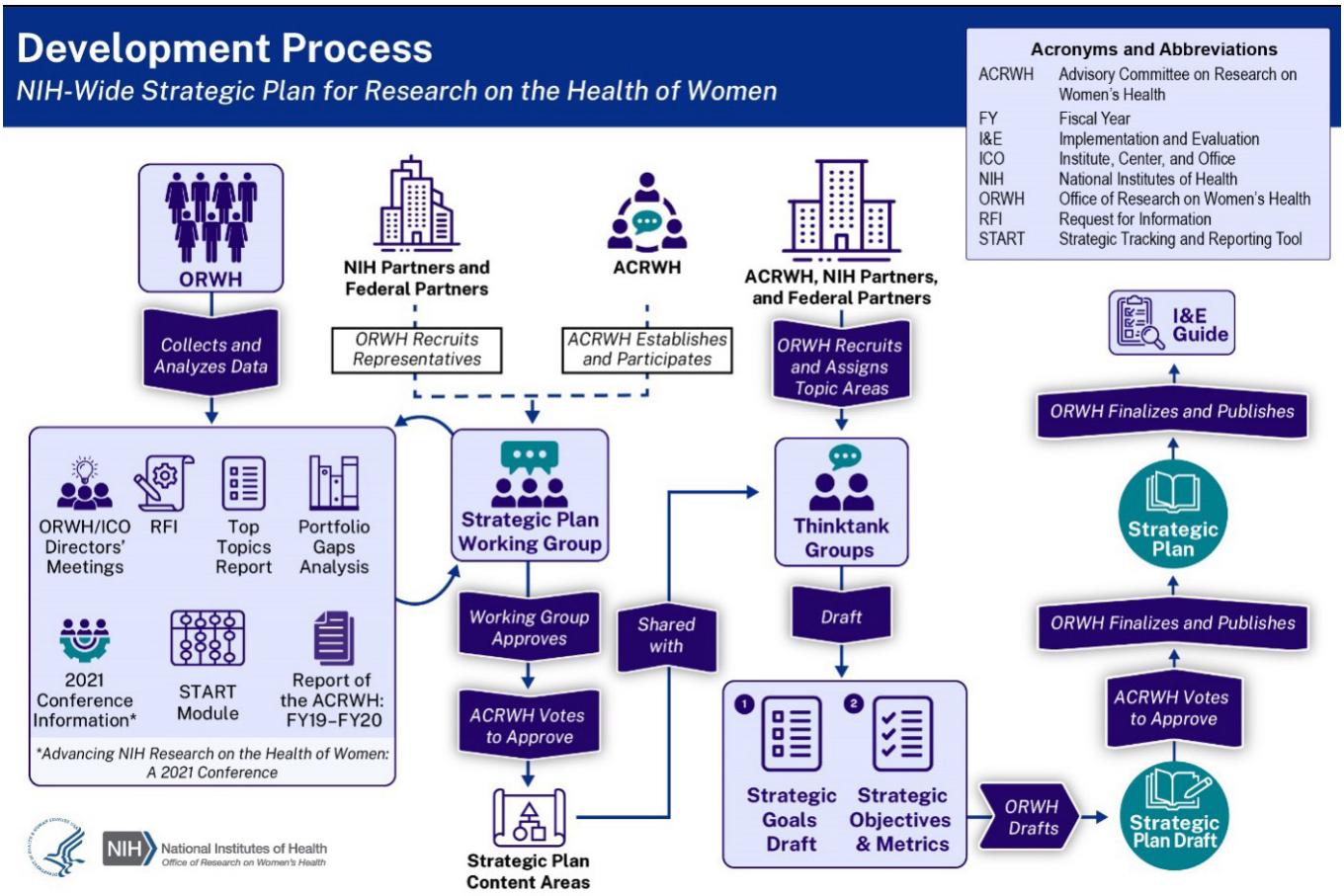
The fifth goal of this strategic plan supports Objective 3 by highlighting the need for research based on public engagement. These activities may involve engaging and coordinating with patients; research participants; disease advocacy organizations; and local, state, and cultural communities. These groups can provide valuable insights into study design and identify knowledge gaps relevant to community-level programs, policies, and practices. In particular, NIH supports community engagement efforts relevant to disparities in maternal health.

APPENDIX A: PROCESS FOR DEVELOPING THE NIH-WIDE STRATEGIC PLAN FOR RESEARCH ON THE HEALTH OF WOMEN

The National Institutes of Health (NIH) Office of Research on Women's Health (ORWH) used a data-driven, iterative approach to develop its strategic plan, with a strong focus on community input (Figure 5). This evidence-based approach included analyzing data obtained from multiple sources, including the Strategic Tracking and Reporting Tool (START); cluster areas that were identified following an ORWH conference on the health of women; the *Report of the Advisory Committee on Research on Women's Health: Office of Research on Women's Health and NIH Support for Research on Women's Health*; discussions among a Strategic Plan Working Group; meetings with directors of institutes, centers, and offices (ICOs); a Request for Information (RFI); and internal ORWH staff meetings. Following the analysis, content areas were developed and presented to five thinktank groups, which were tasked with developing strategic goals and objectives. ICO representatives, federal partners, and other community partners were active participants throughout the development and finalization of the strategic plan and included the following groups:

- Advisory Committee on Research on Women's Health (ACRWH)
- Coordinating Committee on Research on Women's Health (CCRWH)
- Strategic Plan Working Group
- Thinktank Groups

Figure 5. Process for Developing the NIH-Wide Strategic Plan for Research on the Health of Women



ORWH compiled and analyzed ICO submissions that were obtained through the START module to determine past expenditures for research on the health of women, as well as activities associated with the strategic goals of the *2019–2023 Trans-NIH Strategic Plan for Women's Health Research*. ORWH also hosted Advancing NIH Research on the Health of Women: A 2021 Conference, which resulted in working groups focused on four cluster areas: data harmonization; maternal morbidity and mortality; chronic, debilitating conditions; and cervical cancer. Drawing on these discussions, ORWH identified key gaps in and opportunities for research on the health of women. ACRWH ranked the gaps and opportunities by priority, and the top-ranked items were shared publicly.

APPENDIX A: PROCESS FOR DEVELOPING THE NIH-WIDE STRATEGIC PLAN FOR RESEARCH ON THE HEALTH OF WOMEN

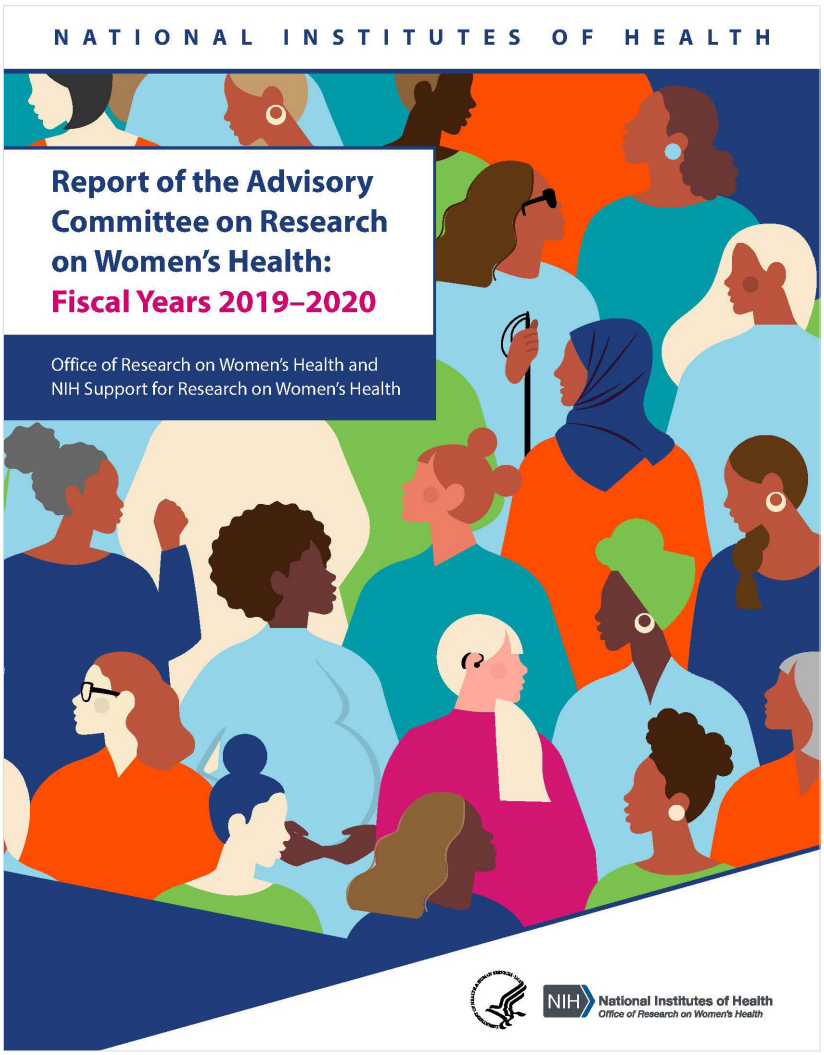
Current and former ACRWH members were also tasked with reviewing the *Report of the Advisory Committee on Research on Women's Health: Fiscal Years 2019–2020—Office of Research on Women's Health and NIH Support for Research on Women's Health* to identify gaps in research on the health of women. ORWH collated and summarized evaluations, focusing on disease agnostic recommendations. Additionally, 10 high priority topic areas were identified regarding research on the health of women.

The Strategic Plan Working Group was tasked with advising ACRWH and the ORWH director on the development of this *NIH-Wide Strategic Plan for Research on the Health of Women*, addressing the current state of science on the health of women to identify research gaps and develop goals and objectives that ORWH should prioritize for the next five years, and reviewing midcourse accomplishments of the prior strategic plan by the ICOs. The Strategic Plan Working Group included representatives from the ACRWH, NIH, and other federal partners (Appendix D).

The ORWH director met with ICO directors to identify high-priority topics on the health of women within the context of each ICO, discuss strategies to facilitate meaningful collaborations across NIH to achieve health equity for women, and explore ways for ORWH to help ICOs implement the NIH policy on sex as a biological variable (SABV).

ORWH issued an RFI in July 2022 (NOT-OD-22-186) to solicit input on topics under consideration for the strategic plan from basic, clinical, and translational scientists; advocacy and patient communities; and the public. A total of 120 responses to the RFI were received. ORWH also held internal staff meetings to identify additional topics of interest for the strategic plan.

Report of the Advisory Committee on Research on Women's Health: Fiscal Years 2019–2020



A content analysis of the input from these collections was performed, and five content areas were identified to inform the development of strategic goals. The Strategic Plan Working Group and ACRWH reviewed and approved the content areas, which were presented to the thinktank groups. The thinktank groups, like the Strategic Plan Working Group, included representation from ACRWH, NIH, and other federal partners (Appendix D). The thinktank groups were tasked with developing strategic goals and objectives that correspond to the content areas.

The draft strategic plan was shared with ACRWH, Strategic Plan Working Group, and thinktank groups. ACRWH voted to approve the draft strategic plan during an open session of the April 2024 ACRWH meeting. The strategic plan then underwent final review and clearance by NIH leadership.

APPENDIX B: NIH-WIDE PARTNERSHIPS SUPPORTING THE HEALTH OF WOMEN AND WOMEN IN BIOMEDICAL CAREERS

Building Interdisciplinary Research Careers in Women's Health (BIRCWH)

BIRCWH, an Office of Research on Women's Health (ORWH) initiative co-sponsored by multiple National Institutes of Health (NIH) institutes, centers, and offices (ICOs), provides mentored research training and career development to prepare junior faculty for independent scientific careers in interdisciplinary science. This K12 program connects BIRCWH scholars to senior faculty with shared interests in interdisciplinary basic, translational, behavioral, clinical, and/or health services research relevant to the health of women, as well as research on the influence of sex as a biological variable (SABV) on health and disease. BIRCWH scholars are provided protected time to pursue career development opportunities, conduct their research, and achieve research independence. The interdisciplinary team approach is applied to the study of the health of women across the life course, bridging basic and clinical science and incorporating new models of collaboration and institutional support. Mentors from collaborating departments provide necessary expertise and resources to BIRCWH scholars' projects.

Specialized Centers of Research Excellence (SCORE) on Sex Differences

SCORE on Sex Differences, an ORWH program supported by the U54 grant mechanism, is the successor to the ORWH SCOR P50 program, which began in 2002. Since its inception, SCORE has been co-sponsored through partnerships with multiple ICOs. SCORE's objectives are to expedite research and apply new knowledge to human diseases that affect women, to help improve understanding of the etiology of these diseases, and to foster better approaches to treatment and prevention. SCORE is an innovative, interdisciplinary research program that focuses on sex differences and major conditions affecting women in the United States and supports established scientists across the country who conduct groundbreaking studies that integrate basic, clinical, and behavioral approaches to incorporate sex differences in their research. SCORE is the only NIH Center of Excellence program that supports disease-agnostic research on sex differences.

Administrative Supplements

An administrative supplement is a noncompeting award that provides additional funding to a currently funded grant to meet increased costs that are within the scope of the approved project.

Research on Sex and Gender Differences (SAGE)

The ORWH SAGE program provides one year of support to ongoing NIH-funded grants to catalyze exploratory research on sex and gender differences. This program bolsters the research of ICO grantees to encourage sex and/or gender comparisons in preclinical and clinical studies and encourages researchers to study females and males as a catalyst for considering sex as a fundamental biological variable in research.

The supplement supports three types of research approaches:

- Adding the opposite sex and/or gender (i.e., adding animal or human subjects, tissues, or cells of the sex opposite to those used in the parent grant to enable sex and/or gender comparisons)
- Increasing sample size (i.e., adding more animal or human subjects, tissues, or cells to a sample that already includes both males and females to increase the power of a study to analyze for sex and/or gender differences)
- Analyzing existing data (i.e., comparative analyses of existing samples, data sets, and databases and/or data mining to investigate the role of sex and/or gender)

Research on the Health of Women of Understudied, Underrepresented, and Underreported (U3) Populations

The ORWH U3 Administrative Supplement Program provides supplements for interdisciplinary research focused on the effects of sex and gender at the intersection of social determinants of health—including race and ethnicity, socioeconomic status, education, health literacy, gender identity, and urban or rural residence. These administrative supplements are available for one year to active NIH grants that are supporting preclinical, clinical, or behavioral studies. The purpose of the supplements is to address health disparities among populations of women in the United States who are understudied, underrepresented, and underreported in biomedical research. Projects must focus on one or more NIH-designated populations experiencing health disparities, which include people who are from racial and ethnic minority groups, people with lower socioeconomic status, underserved rural populations, sexual and gender minority groups, and people with disabilities. Combining two or more populations in the research design is encouraged.

Promotion of Re-entry, Re-integration Into, and Re-training in Health-Related Research Careers

ORWH and participating ICOs provide administrative supplements to research grants to support individuals with high potential to re-enter, remain, or advance in an active research career despite impediments and other special circumstances. The aim of the **Re-entry** supplement program is to encourage individuals who needed to take time off for family responsibilities to re-enter research careers within the missions of all NIH program areas. The **Re-integration** supplements provide individuals adversely affected by unsafe work or research environments to transition into new safer and more supportive ones, without need to discontinue their

research career. The **Re-training** supplement program affords individuals in early or mid-career to pursue a new research direction, facilitating cross-sector and interdisciplinary collaborations that would enhance their skills and augment their chances of promotion and advancement. Most applicants and awardees over the years have been women.

The Intersection of Sex and Gender Influences on Health and Disease

ORWH is leading NIH's first investigator-initiated, disease-agnostic R01 funding opportunity (RFA-OD-19-029) focused on sex and gender. This announcement solicits research to address gaps in knowledge regarding the influence and intersection of sex and gender on disease conditions to improve understanding of the factors and mechanisms underlying sex and gender differences in health. Eligible projects include (1) research applications that examine sex and gender factors and their intersection in understanding health and disease and (2) research that addresses one of the five objectives from Strategic Goal 1 of the *2019–2023 Trans-NIH Strategic Plan for Women's Health Research*.

Implementing a Maternal Health and Pregnancy Outcomes Vision for Everyone (IMPROVE)

NIH launched the IMPROVE initiative in 2019 in response to high rates of pregnancy-related complications and deaths in the United States. ORWH co-leads this initiative and co-funds multiple IMPROVE research efforts. The IMPROVE initiative supports research to reduce preventable causes of maternal deaths and improve health for women before, during, and after delivery. It includes a special emphasis on health disparities and populations that are disproportionately affected, such as racial and ethnic minorities, very young women and women of advanced maternal age, and people with disabilities. Through IMPROVE and other efforts, ORWH plays an important role and collaborates with other ICOs to create and implement NIH-wide efforts to improve maternal health outcomes.

Maternal Health Research Centers for Excellence

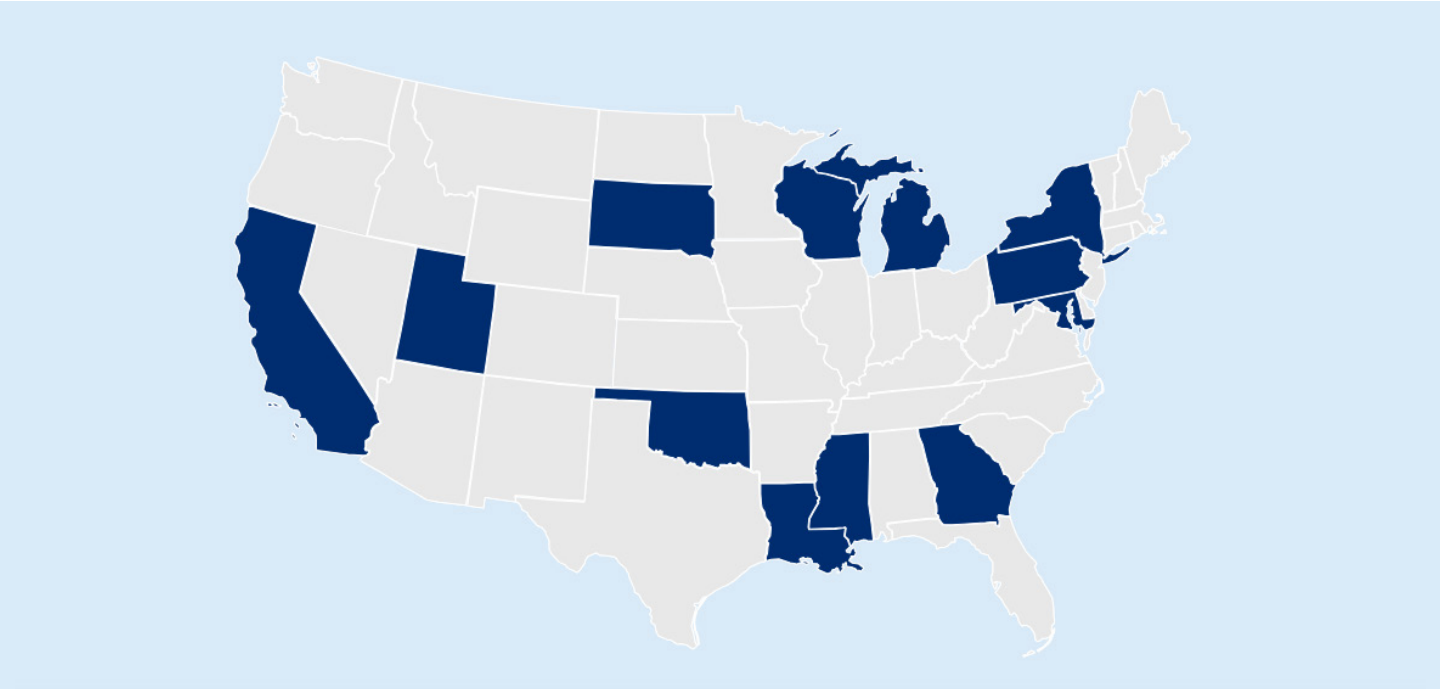


Image Credit: IMPROVE Maternal Health Hub, Johns Hopkins University

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APPENDIX D: STRATEGIC PLAN WORKING GROUP AND THINKTANK GROUPS

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APPENDIX D: STRATEGIC PLAN WORKING GROUP AND THINKTANK GROUPS

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APPENDIX D: STRATEGIC PLAN WORKING GROUP AND THINKTANK GROUPS

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APPENDIX E: REFERENCES

Ahn, R., Gonzalez, G. P., Anderson, B., Vladutiu, C. J., Fowler, E. R., & Manning, L. (2020). Initiatives to reduce maternal mortality and severe maternal morbidity in the United States: A narrative review. *Annals of Internal Medicine, 173*(11 Suppl), S3–S10. https://doi.org/10.7326/M19-3258

Arnegard, M. E., Whitten, L. A., Hunter, C., & Clayton, J. A. (2020). Sex as a biological variable: A 5-year progress report and call to action. *Journal of Women's Health (Larchmont), 29*(6), 858–864. https://doi.org/10.1089/jwh.2019.8247

Barr, E., Popkin, R., Roodzant, E., Jaworski, B., & Temkin, S. M. (2024). Gender as a social and structural variable: Research perspectives from the National Institutes of Health (NIH). *Translational Behavioral Medicine, 14*(1), 13–22. https://doi.org/10.1093/tbm/ibad014

Chellappa, S. L., Qian, J., Vujovic, N., Morris, C. J., Nedeltcheva, A., Nguyen, H., Rahman, N., Heng, S. W., Kelly, L., Kerlin-Monteiro, K., Srivastav, S., Wang, W., Aeschbach, D., Czeisler, C. A., Shea, S. A., Adler, G. K., Garaulet, M., & Scheer, F. A. J. L. (2021). Daytime eating prevents internal circadian misalignment and glucose intolerance in night work. *Science Advances, 7*(49), eabg9910. https://doi.org/10.1126/sciadv.abg9910

Chinn, J. J., Eisenberg, E., Dickerson, S. A., King, R. B., Chakhtoura, N., Lim, I. A. L., Grantz, K. L., Lamar, C., & Bianchi, D. W. (2020). Maternal mortality in the United States: Research gaps, opportunities, and priorities. *American Journal of Obstetrics and Gynecology, 223*(4), 486–492.e6. https://doi.org/10.1016/j.ajog.2020.07.021

Collin, L. J., Gaglioti, A. H., Beyer, K. M., Zhou, Y., Moore, M. A., Nash, R., Switchenko, J. M., Miller-Kleinhenz, J. M., Ward, K. C., McCullough, L. E. (2021). Neighborhood-level redlining and lending bias are associated with breast cancer mortality in a large and diverse metropolitan area. *Cancer Epidemiology, Biomarkers & Prevention 30*(1), 53–60. https://doi.org/10.1158/1055-9965.EPI-20-1038

GBD 2015 Maternal Mortality Collaborators (2016). Global, regional, and national levels of maternal mortality, 1990-2015: A systematic analysis for the Global Burden of Disease Study 2015. *Lancet (London, England), 388*(10053), 1775–1812. https://doi.org/10.1016/S0140-6736(16)31470-2

Gogineni (2016). Brain showing hallmarks of Alzheimer's disease [photo]. https://www.flickr.com/photos/nihgov/26709211161/

Goldberg, M., Chang, C. J., Ogunsina, K., O'Brien, K. M., Taylor, K. W., White, A. J., Sandler, D. P. (2024). Personal care product use during puberty and incident breast cancer among Black, Hispanic/Latina, and White women in a prospective US-wide cohort. *Environmental Health Perspectives, 132*(2), 27001. https://doi.org/10.1289/EHP13882

Greeson, K. W., Crow, K. M. S., Edenfield, R. C., & Easley, C. A. 4th. (2023). Inheritance of paternal lifestyles and exposures through sperm DNA methylation. *Nature Reviews Urology, 20*(6), 356–370. https://doi.org/10.1038/s41585-022-00708-9

Hall, K. L., Vogel, A. L., & Croyle, R. T. (2019). *Strategies for team science success: Handbook of evidence-based principles for cross-disciplinary science and practical lessons learned from health researchers*. Springer Nature Switzerland.

James, P., Hart, J. E., Banay, R. F., & Laden, F. (2016). Exposure to greenness and mortality in a nationwide prospective cohort study of women. *Environmental Health Perspectives, 124*(9), 1344–1352. https://doi.org/10.1289/ehp.1510363

Jiang, H. (2016). Illustration of advanced contact lens for presbyopia [photo]. https://www.flickr.com/photos/nihgov/25161992434

Krieger, N., Van Wye, G., Huynh, M., Waterman, P. D., Maduro, G., Li, W., Gwynn, R. C., Barbot, O., Bassett, M. T. (2020a). Structural racism, historical redlining, and risk of preterm birth in New York City, 2013-2017. *American Journal of Public Health, 110*(7), 1046–1053. https://doi.org/10.2105/AJPH.2020.305656

Krieger, N., Wright, E., Chen, J. T., Waterman, P. D., Huntley, E. R., Arcaya, M. (2020b). Cancer stage at diagnosis, historical redlining, and current neighborhood characteristics: Breast, cervical, lung, and colorectal cancers, Massachusetts, 2001-2015. *American Journal of Epidemiology, 189*(10), 1065–1075. https://doi.org/10.1093/aje/kwaa045

Martz, C. D., Wang, Y., Chung, K. W., Jiakponnah, N. N., Danila, M. I., Webb-Detiege, T., Allen, A. M., & Chae, D. H. (2023). Incident racial discrimination predicts elevated C-Reactive protein in the Black Women's experiences Living with Lupus (BeWELL) study. *Brain, Behavior, and Immunity, 112*, 77–84. https://doi.org/10.1016/j.bbi.2023.06.004

Mauvais-Jarvis, F., Merz, N. B., Barnes, P. J., Brinton, R. A., Carrero, J. J., DeMeo, D. L., De Vries, G. J., Epperson, C. N., Govindan, R., Klein, S. L., Lonardo, A., Maki, P. M., McCullough, L. D., Regitz-Zagrosek, V., Regensteiner, J. G., Rubin, J. B., Sandberg, K., & Suzuki, A. (2020). Sex and gender: Modifiers of health, disease, and medicine. *The Lancet, 396*(10250), 565–582. https://doi.org/10.1016/S0140-6736(20)31561-0

Nardone, A., Casey, J. A., Morello-Frosch, R., Mujahid, M., Balmes, J. R., Thakur, N. (2020a). Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. *The Lancet Planetary Health, 4*(1), e24–e31. https://doi.org/10.1016/S2542-5196(19)30241-4

Nardone, A. L., Casey, J. A., Rudolph, K. E., Karasek, D., Mujahid, M., Morello-Frosch, R. (2020b). Associations between historical redlining and birth outcomes from 2006 through 2015 in California. *PloS One, 15*(8), e0237241. https://doi.org/10.1371/journal.pone.0237241

Nelson, B. D., Moniz, H. M., & Davis, M. D. (2018). Population-level factors associated with maternal mortality in the United States, 1997-2012. *BMC Public Health, 18*, 1007. https://doi.org/10.1186/s12889-018-5935-2

APPENDIX E: REFERENCES

NIH (National Institutes of Health). (2022). *Perspectives on advancing NIH research to inform and improve the health of women*. https://orwh.od.nih.gov/sites/orwh/files/docs/ORWH-WHC-Report-508C.pdf

Nordhues, H. C., Bhagra, A., Stroud, N. N., Vencill, J. A., & Kuhle, C. L. (2021). COVID-19 gender disparities and mitigation recommendations: A narrative review. *Mayo Clinic Proceedings, 96*(7), 1907–1920. https://doi.org/10.1016/j.mayocp.2021.04.009

Patel, I., & West, S. (2009). Gender differences in presbyopia. *Community Eye Health, 22*(70), 27.

Schweinhart, A., & Clayton, J. A. (2018). Reversing the trends toward shorter lives and poorer health for U.S. women: A call for innovative interdisciplinary research. *International Journal of Environmental Research and Public Health, 15*(9), 1796. https://doi.org/10.3390/ijerph15091796

Spagnolo, P. A., Manson, J. E., & Joffe, H. (2020). Sex and gender differences in health: What the COVID19 pandemic can teach us. *Annals of Internal Medicine, 173*(5), 385–386. https://doi.org/10.7326/M20-1941

Stuart, J. J., Tanz, L. J., Missmer, S. A., Rimm, E. B., Spiegelman, D., James-Todd, T. M., & Rich-Edwards, J. W. (2018). Hypertensive disorders of pregnancy and maternal cardiovascular disease risk factor development: An observational cohort study. *Annals of Internal Medicine, 169*(4), 224–232. https://doi.org/10.7326/M17-2740

Tawakol, A., Osborne, M. T., Wang, Y., Hammed, B., Tung, B., Patrich, T., Oberfeld, B., Ishai, A., Shin, L. M., Nahrendorf, M., Warner, E. T., Wasfy, J., Fayad, Z. A., Koenen, K., Ridker, P. M., Pitman, R. K., & Armstrong, K. A. (2019). Stress-associated neurobiological pathway linking socioeconomic disparities to cardiovascular disease. *Journal of the American College of Cardiology, 73*(25), 3243–3255. https://doi.org/10.1016/j.jacc.2019.04.042

Temkin, S. M., Noursi, S., Regensteiner, J. G., Stratton, P., & Clayton, J. A. (2022). Perspectives from advancing National Institutes of Health Research to inform and improve the health of women: A conference summary. *Obstetrics and Gynecology, 140*(1), 10–19. https://doi.org/10.1097/AOG.0000000000004821

Thiele, L., Thompson, J., Pruszynski, J., & Spong, C. Y. (2022). Gaps in evidence-based medicine: Underrepresented populations still excluded from research trials following 2018 recommendations from the Health and Human Services Task Force on Research Specific to Pregnant Women and Lactating Women. *American Journal of Obstetrics and Gynecology, 227*(6), 908–909. https://doi.org/10.1016/j.ajog.2022.07.009

U.S. Department of Health and Human Services. (2013). *Report on activities related to "improving women's health" as required by the Affordable Care Act*. Office on Women's Health, Office of the Assistant Secretary for Health. U.S. Department of Health and Human Services. https://owh-wh-d9-dev.s3.amazonaws.com/s3fs-public/documents/aca-full-report.pdf

van Daalen, K., Jung, L., Dhatt, R., & Phelan, A. L. (2020). Climate change and gender-based health disparities. *The Lancet Planetary Health, 4*(2), e44–e45. https://doi.org/10.1016/S2542-5196(20)30001-2

Van Horne, Y. O., Alcala, C. S., Peltier, R. E., Quintana, P. J. E., Seto, E., Gonzales, M., Johnston, J. E., Montoya, L. D., Quirós-Alcalá, L., & Beamer, P. I. (2023). An applied environmental justice framework for exposure science. *Journal of Exposure Science & Environmental Epidemiology, 33*(1), 1–11. https://doi.org/10.1038/s41370-022-00422-z

Wallace, M., Dyer, L., Felker-Kantor, E., Benno, J., Vilda, D., Harville, E., & Theall, K. (2021). Maternity care deserts and pregnancy-associated mortality in Louisiana. *Women's Health Issues, 31*(2), 122–129. https://doi.org/10.1016/j.whi.2020.09.004

Wiley, Z., Hanna, J., Kobaidze, K., & Franks, N. (2023). Team science: Advancing women and Black, Indigenous, and other People of Color on the pathway of conducting clinical research. *Therapeutic Advances in Infectious Disease, 10*, 20499361231159501. https://doi.org/10.1177/20499361231159501

Williams, K., & Finch, B. K. (2019). Adverse childhood experiences, early and nonmarital fertility, and women's health at midlife. *Journal of Health and Social Behavior, 60*(3), 309–325. https://doi.org/10.1177/0022146519868842

WHO. (2019). *Global health estimates: Life expectancy and leading causes of death and disability*. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates

WHO. (2023). *World health statistics 2023: Monitoring health for the SDGs, sustainable development goals*. https://www.who.int/publications/i/item/9789240074323

Xu, J., Murphy, S. L., Kochanek, K. D., & Arias, E. (2022). Mortality in the United States, 2021. *NCHS Data Brief, 456*, 1–8. https://dx.doi.org/10.15620/cdc:122516

Yang, Y., Tian, T. Y., Woodruff, T. K., Jones, B. F., & Uzzi, B. (2022). Gender-diverse teams produce more novel and higher-impact scientific ideas. *Proceedings of the National Academy of Sciences of the United States of America, 119*(36), e2200841119. https://doi.org/10.1073/pnas.2200841119

Yang, Y. C., Walsh, C. E., Johnson, M. P., Belsky, D. W., Reason, M., Curran, P., Aiello, A. E., Chanti-Ketterl, M., & Harris, K. M. (2021). Life-course trajectories of body mass index from adolescence to old age: Racial and educational disparities. *Proceedings of the National Academy of Sciences of the United States of America, 118*(17), e2020167118. https://doi.org/10.1073/pnas.2020167118

Zhu, D., Montagne, A., Zhao, Z. (2021). Alzheimer's pathogenic mechanisms and underlying sex difference. *Cellular and Molecular Life Sciences, 78*(11), 4907–4920. https://doi.org/10.1007/s00018-021-03830-w

APPENDIX F: ABBREVIATIONS

ACRWH	Advisory Committee on Research on Women's Health
AI	artificial intelligence
ALL	*All of Us* Research Program
BSSR	behavioral and social sciences research
CC	Clinical Center
CCRWH	Coordinating Committee on Research on Women's Health
CIT	Center for Information Technology
CSR	Center for Scientific Review
DPCPSI	Division of Program Coordination, Planning, and Strategic Initiatives
ECHO	Environmental Influences on Child Health Outcomes
ENRICH	Early Intervention to Promote Cardiovascular Health of Mothers and Children
FAIR	Findability, Accessibility, Interoperability, and Reusability
FIC	Fogarty International Center
HIV	Human Immunodeficiency Virus
ICO	institutes, centers, and offices
IMPROVE	Implementing a Maternal health and Pregnancy Outcomes Vision for Everyone
ML	machine learning
NASEM	National Academies of Sciences, Engineering, and Medicine
NCATS	National Center for Advancing Translational Sciences
NCCIH	National Center for Complementary and Integrative Health
NCI	National Cancer Institute
NEI	National Eye Institute
NHGRI	National Human Genome Research Institute
NHLBI	National Heart, Lung, and Blood Institute
NIA	National Institute on Aging
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIAID	National Institute of Allergy and Infectious Diseases
NIAMS	National Institute of Arthritis and Musculoskeletal and Skin Diseases

APPENDIX F: ABBREVIATIONS

NIBIB	National Institute of Biomedical Imaging and Bioengineering
NICHD	*Eunice Kennedy Shriver* National Institute of Child Health and Human Development
NIDA	National Institute on Drug Abuse
NIDCD	National Institute on Deafness and Other Communication Disorders
NIDCR	National Institute of Dental and Craniofacial Research
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
NIEHS	National Institute of Environmental Health Sciences
NIGMS	National Institute of General Medical Sciences
NIH	National Institutes of Health
NIMH	National Institute of Mental Health
NIMHD	National Institute on Minority Health and Health Disparities
NINDS	National Institute of Neurological Disorders and Stroke
NINR	National Institute of Nursing Research
NLM	National Library of Medicine
NOSI	Notice of Special Interest
OADR	Office of Autoimmune Disease Research
OAR	Office of AIDS Research
OBSSR	Office of Behavioral and Social Sciences Research
ODP	Office of Disease Prevention
ODS	Office of Dietary Supplements
OEPR	Office of Evaluation, Performance, and Reporting
OER	Office of Extramural Research
ONR	Office of Nutrition Research
ORIP	Office of Research Infrastructure Programs
ORWH	Office of Research on Women's Health
RFI	Request for Information
RPPR	Research Performance Progress Report
SABV	sex as a biological variable

APPENDIX F: ABBREVIATIONS

SAGE	Administrative Supplements for Research on Sex & Gender Differences
SCORE	Specialized Centers of Research Excellence
SGMRO	Sexual & Gender Minority Research Office
START	Strategic Tracking and Reporting Tool
WHISH	Women's Health Initiative Strong and Healthy

National Institutes of Health
Office of Research on Women's Health

https://orwh.od.nih.gov/about/strategic-plan

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