Redefining Modern Maternal Health

A Call for Action and Innovation

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A message from our founder and CEO

Human health is inextricably tied to forces outside the care setting. We are multifaceted and intersectional, yet the way we historically deliver healthcare is not. We react clinically to ailments that require a social component to the remedy. This contrast is particularly stark in the case of maternal care in America.

We find ourselves amid a worsening maternal health crisis, which disproportionately impacts Black, Indigenous, and other women of color. Racial inequality in pregnancy outcomes persists regardless of income level:[1] babies born to the wealthiest Black families still suffer from higher mortality rates than babies born to the lowest income white parents.

Due to structural racism and implicit biases among healthcare professionals,[2] Black patients also often report not being listened to by their doctors.[3] Social Determinants of Health (SDOH), such as racial biases, affect everyone's health. Several SDOH disproportionately impact pregnant people:

- Racism, sexism, and bias at structural, institutional, and individual levels
- Limited access to hospitals, specialized care, and health insurance
- Political, social, and economic limitations to reproductive care access

Addressing health inequities necessitates a thorough examination and proactive measures to rectify the disparities within our healthcare system.

Historically, these disparities were undervalued or considered outside the realm of healthcare professionals, leading to the exclusion of individuals in marginalized communities from initiatives aimed at enhancing healthcare outcomes.

Our nation's global standing in maternal health is troubling. Despite spending $12,000 per capita on healthcare—the highest among high-income nations—the United States still lags in maternal outcomes. It is also among the most expensive countries to deliver a baby in.[4] But what do we gain from this investment?

The simple answer is **not much**. A quick review of the data bears this out:

- Women who don't receive prenatal care are 3-4x more likely to die in childbirth than those who do[5]
- There is a 2-3x higher likelihood of dying from pregnancy-related causes for Black and Indigenous birthing people[6]
- The rate continues to grow, with a 2x increase in maternal deaths between 2018 and 2021[7]

The data also show that—despite evolving care approaches like virtual women's health clinics and pregnancy trackers—maternal health in our country is generally getting worse. We need to start proactively treating the root causes of the maternal health crisis—both clinical and social.

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Employers, payers, and providers wield significant influence that must be brought to bear on this crisis. Together, we can identify the moments of greatest impact in maternal health management and focus our resources in ways that help bring healthcare access and support to pregnant patients and families everywhere—especially in our most in-need communities.

Maternal health tragedies don't happen in a vacuum; we hear about them every day. In 2018, Serena Williams shared her story of experiencing pregnancy care as a Black woman in Vogue magazine.[8] In 2023, the world's fastest female runner, Olympian Tori Bowie, died at eight months pregnant due to complications of a suspected and undiagnosed hypertensive disorder of pregnancy.[9] And, just this year, Kansas City Chiefs cheerleader Krystal Lakeshia Anderson died shortly after giving birth to her daughter, who, sadly, was stillborn.[10]

Research shows that women who hemorrhage at disproportionately Black-serving hospitals are significantly more likely to experience severe complications like birth-related embolisms and emergency hysterectomies.[11]

While the healthcare system acknowledges the issue and has made progress, it's not enough. To confront the challenges birthing individuals encounter daily, we must harness effective models and cutting-edge technologies to establish an inclusive and equitable maternal care system that connects pregnant patients with providers, supplemental benefits, and community resources. We call it our "closed loop" or connected system of care.

At Delfina, we're reshaping maternal healthcare by scaling the application of artificial intelligence (AI) to deliver more inclusive, effective, and efficient care. Our closed-loop care model uniquely centers around connectedness. This puts moms in the driver's seat of their pregnancy while enabling their trusted providers to support them with data to intervene at the right time in the right way.

We have built the most detailed scientific understanding of how health works at an individual level during pregnancy. In doing so, we're opening up new connections and opportunities for transformative change at the community level.

This ebook provides context and insights for organizations dedicated to health equity and addressing the maternal health crisis. We aim to explain how Delfina contributes to scaling care responsibly to improve health equity. While change is gradual, we are committed to listening, learning, championing, and implementing small changes to bring about broader improvements across our communities and care systems.

That's what we're doing at Delfina. Let me show you how.

Senan Ebrahim, MD, PhD
CEO and founder
Delfina

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The intersectional nature of maternal health

Our society talks a lot about the value of family and children. Yet our healthcare policy and practice repeatedly fail these very people. While the current state of maternal healthcare lets down many birthing people across race and economic status, people of color bear the brunt of this broken system. This indicates that the differences in care and outcomes aren't simply disparities—they are inequities, unjust realities produced by social and environmental conditions.

Healthcare professionals have tried to overcome harmful social determinants of health (SDOH) since they were first chronicled in a 1961 article in the American Journal of Public Health. The thing holding us back from making real progress is that the current approach to SDOH doesn't address the root causes that create and maintain inequalities—and it needs to. We need to look at the bigger picture and consider the whole system to build a fairer and more effective network of care.

"People often ask me 'why is maternal mortality increasing?' and my answer is typically, 'There are a lot of contributing factors, and most of them are getting worse,' says Isabel Fulcher, PhD, Delfina's Chief Science Officer.

"Racial, ethnic, and geographic disparities have grown. However, nearly 85% of these pregnancy-related deaths are preventable. We have the power to change outcomes for pregnant patients—we need to employ these known solutions for the patients that need them most."

We know what works. However, multiple factors obstruct our ability to provide care in a scalable and effective way.

> **"We have the power to change outcomes for pregnant patients—we need to employ these known solutions for the patients who need them most.**
>
> **Dr. Isabel Fulcher, PhD**
> CSO

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Systemic racism, sexism, and bias

Among the social and cultural factors impacting pregnant people are wage suppression, unequal employment opportunities, low housing security related to economic conditions and red-lining, medical gaslighting, and the research gap. Medical bias has also led women, especially Black and Hispanic women,[12] to distrust the medical system, which negatively influences behaviors like engagement and treatment adherence.[13]

Because of these dynamics, "Pregnancy is riskier and costlier for Black, Hispanic and American Indian and Alaska Native (AIAN) communities," according to a report from members of the U.S. Senate's Joint Economic Committee.[14] For example, one study found that the rate of severe maternal morbidity and mortality for Indigenous women was almost twice that of white women.[15] Among rural residents, the rate is even higher. About 40% of Indigenous people live outside metro areas.[16] Many of these communities are low-income, exacerbating the economic burden of quality maternal healthcare.

Unequal employment opportunities hinder obtaining affordable health insurance, especially employer-provided benefits. One two-year study found that while three-quarters of white non-Hispanic women were continuously covered from preconception to postpartum, only around half of Black non-Hispanic women (55.4%) and indigenous women (49.9%) were.[17]

Inadequate coverage intensifies racial inequalities and financial strain. Severe pregnancy complications are not only traumatizing but incredibly expensive: data shows that severe pregnancy complications are associated with higher maternity-related costs for people with commercial insurance (111%) and people on Medicaid (175%).[18]

Challenges are exacerbated for the 7.9 million women of childbearing age lacking health coverage. Uninsured women face obstacles accessing and receiving adequate care, resulting in reduced prenatal and perinatal services and heightened risks during pregnancy and delivery compared to their insured counterparts. Their infants are also adversely affected, with uninsured newborns at higher risk of low birth weight and mortality.

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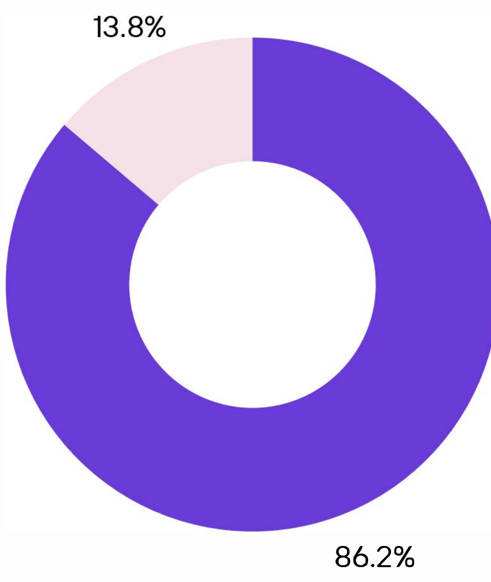
Access to hospitals, specialty care, and health insurance

Affordable prenatal care is vital to preventing and addressing complications throughout pregnancy.[19] Getting that care, however, is increasingly difficult. Many hospitals and clinics are closing. According to the March of Dimes, 1,119 U.S. counties have less maternity access than just two years ago—and that number is rising. These areas with low or no access are home to almost seven million women and 500,000 births.[20]

Pregnant people in these “maternity care deserts” are forced to travel long distances for care. That can be a hardship for those with limited transportation or conflicting obligations and may increase their risk of complications and chronic illness later.

The lasting impacts of maternal morbidity on adults and children cost around $32.3 billion from conception through the age of five. About three-quarters of that was attributed to children’s long-term health issues, and the rest was for maternal outcomes, including hospital expenses.[21]

Maternity Care Access 2022



March of Dimes, 2022

The politicization of reproductive health

Despite significant wins in various levels of the legislative and judicial systems, women and individuals of color continue to face challenges due to government actions. Recent decisions have had a detrimental impact on access to care, financial stability, and overall well-being:

- The Dobbs v. Jackson Women's Health Supreme Court decision has restricted providers from effectively managing miscarriages and other pregnancy-related emergencies in states with existing abortion bans. This limitation has raised concerns among healthcare professionals and advocates.
- The recent IVF ruling by the Alabama Supreme Court has led to the suspension of IVF treatments in several fertility clinics across the state.
- Furthermore, legislators in four states persist in enforcing laws that inhibit pregnant individuals from seeking divorce, highlighting ongoing challenges in legal frameworks.[22]

As we anticipate further legislative and judicial actions, the trajectory appears to restrict agency and impede access to essential reproductive health services, underscoring the need for continued advocacy and awareness.

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Creating connections to make meaningful progress

Dismantling the inequities that prevent pregnant individuals and infants from achieving optimal health is not only morally right but also crucial for making substantial advancements in maternal health across our nation. Recognizing and addressing the interconnected factors influencing maternal and fetal health paves the way for a comprehensive and practical approach to improving outcomes in this critical area.

"Things are very fragmented," observes Delfina Chief Medical Officer Bonnie Zell, MD, MPH. "There are a lot of ideas for programs or products that broaden the scope to providers and patients. And that's great. But a disaggregated approach isn't going to have the impact we need. The big opportunity is using technology to connect all the dots."

A major roadblock for innovators is data standardization. "Without data standardization, we can't efficiently connect the dots," says Zak King, Delfina's Vice President of Engineering. "More time and resources are required for every new implementation, which ultimately impacts the speed at which you can get your solution into the hands of end users and the cost associated with serving those individuals."

We can leverage advanced technology to connect:

- Birthing people to interventions, information, and wrap-around specialty care via the tech (mobile and stationary) they already use
- Clinical practices to stores of big data and analytics that drive patient care and education
- Payers and health tech solutions to population health data that inform benefits design and utilization management

We know it's possible because it's what we're doing at Delfina. However, the path of progress is bumpy. While technology is advanced, the healthcare system and the healthcare industry continue to hit barriers to interoperability.

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Improving health equity in rural Minnesota

Nestled in the heart of the American Midwest, Minnesota stands as a testament to nature's extraordinary beauty and resilience, interwoven with the rich tapestry of the American experience.

Known affectionately as the "Land of 10,000 Lakes," Minnesota's landscape is perhaps its most defining feature. However, the state's most enduring quality is its people's resilience and warmth. Rooted in the values of hard work, community, and kindness, Minnesotans exemplify strength and compassion.

The overall maternal mortality rate in Minnesota is below the national average,[23] but state leaders want to reduce persistent racial disparities. According to the state Health Department, Indigenous women in Minnesota are eight times and Black women are one-and-a-half times more likely to die from pregnancy complications than white women.[24] To change the trends, the South Country Health Alliance (South Country) partnered with Delfina to extend a community-led maternal health model to eight rural counties.

Most of the areas served by South Country are rural, with 25% having limited or moderate OBGYN access. South Country utilizes Delfina in their CareConnect program to support local pregnant people. The Community Care Connectors of South Country operate within county public health or human service departments, bridging the gap between healthcare, public health, social services, and other community resources.

“Through this alliance, we are setting a standard for responsive and culturally sensitive maternal health services,” said Brenna Toquam, manager of South Country’s clinical care management, in a news release. “It is our collective mission to reduce the disparities in healthcare outcomes by making personalized care a reality for all mothers, regardless of geographic location or background."

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The next level: a new system of care

Delfina was built with the unique needs of pregnant people in mind: *If I am a Latina woman pregnant with twins—what specific issues should I be mindful of?* We're dedicated to bridging the maternal health gap through a comprehensive system of care that not only standardizes access but also facilitates better outcomes while reducing overall costs. We do this via three product pillars that sit on a foundation of an AI-powered machine learning engine:

Product inclusivity: Delfina is inclusive by design. We tailor the member's experience to their unique needs with diversity, equity, inclusion, and belonging at the core. Our approach provides highly personalized experiences. Our members' needs are assessed through a health questionnaire, self-reported data, and insights from the Delfina Doula. Delfina Care offers personalized support in English and Spanish.

Human and community relationships: Non-clinical Doulas support members in addressing everyday challenges. In addition to the required professional certifications and designations, Delfina Doulas, who are bilingual and from the communities they serve, undergo training on culturally competent care.

Closing the loop: Our closed-loop care model connects members to their providers and payers to help ensure essential information and tools reach the care team.

By leveraging these pillars and a strong tech foundation, we're transforming the landscape of maternal health, ensuring that every individual receives the personalized care and support they deserve.

> **"…a disaggregated approach isn't going to have the impact we need. The big opportunity is using technology to connect all the dots.**
>
> **Dr. Bonnie Zell, MD, MPH**
> CMO

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Facilitating advanced machine learning

Our machine-learning algorithms rely on patient data collected from multiple different sources. We gather inputs from electronic health records, member surveys, and remote patient monitoring to create a rich source of real-world evidence and data that generates a clearer, more accurate picture of maternal health. This data enables:

- Early detection of complication risk factors
- Personalized care based on medical history, lifestyle factors, and past pregnancies
- Monitoring pregnancy progression to ensure both mom and baby meet appropriate milestones
- Chronic condition management during pregnancy and postpartum
- Postpartum care and monitoring to identify and address potential postpartum complications
- Research and evidence-based activities aimed at improving maternal health outcomes
- Member engagement and education give pregnant individuals the insights they need to participate actively in prenatal care

At Delfina, we analyze data from diverse populations to identify trends and risk factors and support effective provider interventions. This leads to the development of our evidence-based maternal health program.

This kind of data-gathering is the first step toward spanning the research gap, reducing bias, and raising the quality of care, especially for Black and Indigenous birthing people.

Machine learning has the potential to mitigate issues of racism, sexism, and bias in maternal care. However, machine learning models can also perpetuate biases if not carefully developed, validated, and deployed.

Delfina's predictive models—focused on identifying the risk of crucial pregnancy complications—are nationally recognized for their effectiveness in pinpointing at-risk patients and addressing racial disparities. We intentionally designed them to reduce bias by:

- Excluding race and ethnicity from the inputs used to train the models while assessing model performance by subgroup
- Oversampling selectively for non-Hispanic Black people to improve model performance in that population

When the models identify people who would benefit from intervention, providers get immediate notification, insights, and suggestions for evidence-based actions. Telemedicine and app-based education expand access to appropriate and potentially more affordable care—and can help members avoid unnecessary and expensive hospital visits.

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Empowered Engagement

Digital health tools like phones, apps, and remote monitoring devices, alongside behavioral change theory, empower pregnant people to advocate for themselves and actively engage in their pre- and post-natal care.

“It's important to meet people where they are. Fitting our program within their typical daily routine and using technology they're familiar with increases chances of success,” explains Jess Barra, FNP-C, Delfina’s Vice President of Product. “Behavior is multifaceted, and it’s important to consider the individual, social, and environmental factors at play in the lives of our members when promoting positive health behaviors.” Automated reminders, telemedicine check-ins, surveys, and educational content help members feel more supported by and connected to providers. Providers can also ask about non-medical and intersectional drivers during these between-visit interactions.[25] A more informed and empathetic approach can begin to rebuild trust, too.

“We also need to remove as many barriers as possible to ensure patients of all types can participate and find benefit,” she adds. Mobile-enabled engagement eases the challenge of getting to a care site, especially in areas affected by care deserts, government-initiated interruptions in care availability, or disruptions from climate change-related extreme conditions.

“In meeting people where they are, we also recognize the digital divide's impact on those we serve. While Delfina is a mobile-first program, we’ve also developed a desktop UI for those who prefer to engage on a computer or for those who don’t own a smartphone,” Barra said.

Empowering pregnant individuals through familiar technology and personalized engagement reflects a commitment to breaking down barriers and fostering positive health behaviors.

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Connected care

People aren't 1s and 0s—technology can only go so far in creating a more supportive system of care for pregnant people. Delfina's system connects patients to their providers and other non-clinical supports, from educational materials to personalized doula care.

In an attempt to improve pregnancy outcomes, more and more people have been incorporating doula care into their pregnancy journeys—and insurance plans and employer benefits are catching on.[26] Delfina seamlessly integrates doulas into our system as Delfina Doulas. The Delfina Doulas meet virtually with patients between appointments, help them navigate the platform, and provide personalized support at the member's fingertips.

Delfina also deepens the relationship between provider and patient by enabling more productive prenatal appointments. When people are more engaged in their care between appointments, they can arrive prepared, knowing what's going on with their bodies and what they need from their doctor. This also serves providers: instead of relying on patients' memory to try and understand a new symptom, they can look at the Delfina app and see a more comprehensive picture of a patient's health. By getting the formalities out of the way, Delfina frees up pregnant people and their doctors to ask critical questions.

Pregnancy care must be grounded in personal relationships, whether in the hospital or at home. Providing accessible, holistic support across the continuum of care keeps patients from falling through the cracks.

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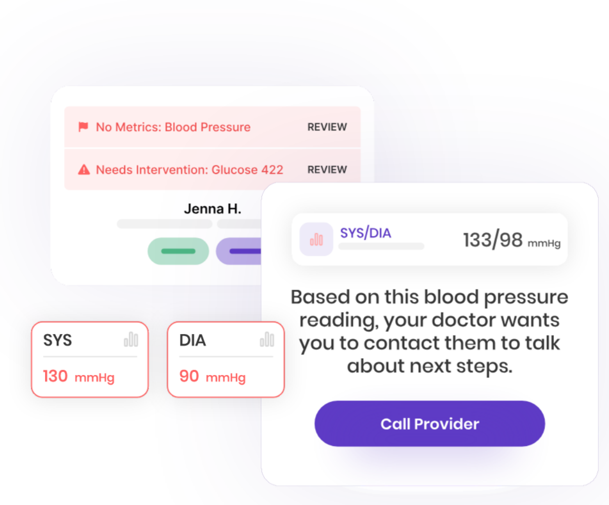
Deploying advanced technology to tackle costly complications

Hypertensive disorders of pregnancy (HDP)

About 8% of birthing people experience complications related to high blood pressure, which causes 6.5% of maternal deaths. Non-Hispanic Black, American Indian, and Alaska Native birthing people and their babies are most likely to experience these conditions before and immediately after birth and to develop chronic conditions later.[27]

Preeclampsia is one of the most prevalent HDPs, and its incidence has doubled since 2007.[28] However, early intervention in the first trimester can prevent preeclampsia and related complications. Delfina's AI-powered preeclampsia predictive model is externally validated to outperform the American Academy of Obstetricians and Gynecologists (ACOG) and the United States Preventive Services Task Force (USPSTF) guidelines for aspirin initiation for first-time pregnancies. That means care teams get an even earlier opportunity to initiate preventive care.



Delfina addresses several preventable conditions that disproportionately impact pregnant people of color and are leading drivers of costs from preterm deliveries and hospitalizations.

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Gestational diabetes (GDM)

GDM is one of the most frequent medical complications of pregnancy, and cases have increased by 30% since 2016, currently affecting 8% of births.[29] The condition elevates the risk of high birth weight and the need for c-sections. It also raises the lifetime risk of metabolic outcomes for both birthing people and their babies; half of pregnant people who develop GDM develop type 2 diabetes later.[30]

There are no clinical guidelines for identifying GDM risk or preventing it among the highest-risk people. So, based on data collected from our patient app and EHR information, we developed our own. Our patent-pending machine learning models show high accuracy in predicting GDM risk as early as the first trimester. We can identify pregnant people who would benefit from evidence-based risk-reduction interventions.[31] For birthing people with pre-GDM or who develop it, we support remote monitoring with glucometers, reminders, materials encouraging adherence, and nutritional guidance via online group classes, digital content, and virtual visits with Delfina Medical Group nutritionists.

As we tackle the digital divide, Delfina's dedication to inclusivity remains at the forefront of our efforts—reaching out to people where they're at, understanding our members' needs, and ensuring everyone can access our services. By doing this, we're not just improving maternal care quality; we're paving the way for a healthcare journey that's more understanding, caring, and fair.

Learn more

- Predicting the risk of gestational diabetes using clinical data with machine learning: a predictive model study: doi.org/10.1016/j.ajogmf.2023.100965
- Remote blood pressure monitoring during pregnancy: Comparing patient engagement between connected and unconnected device users: doi.org/10.1016/j.ajog.2023.11.374

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The path forward

We're at a critical point for maternal health in America. Forces from all directions are testing our commitment to and efforts at improving pregnancy and the health of birthing people and their children.

Collectively, we know what works. We have the technology, from big data to tiny wearable devices.

We have better science and practice.

We have a better understanding of the interconnected drivers of health and the historical barriers that exacerbate them.

We have the power to change these outcomes by employing known solutions and addressing the root causes of inequities.

What we lack is an effective system of care that connects these advancements to move the field of maternal health forward and improve the lives of pregnant people and their babies.

At Delfina, we are committed to bridging the maternal health gap through a comprehensive system of care that leverages advanced technology, data-driven insights, and empowered engagement strategies. Our focus on longitudinal patient data, machine learning, and personalized interventions enables us to provide tailored and proactive care to pregnant individuals, particularly those at higher risk of complications.

We are extending our reach through partnerships and community-led initiatives and making personalized care accessible to all mothers, regardless of geographic location or background. By leveraging technology to connect the dots in the healthcare system, we are transforming the landscape of maternal health and ensuring everyone receives the care and support they deserve.

At Delfina, that's our mission. Delfina remains dedicated to inclusivity, understanding, and compassion in maternal care. Together, we can build a healthcare journey that is more understanding, caring, and fair for each person we serve. **This is our commitment.**

Learn more at Delfina.com

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