

# Addressing Vitamin D Deficiency as a Modifiable Risk Factor for Increased Maternal Morbidity and Mortality Among Black/African-American Women

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## Purpose

The United States has been called “the most dangerous country in the developed world to give birth in”, with the March of Dimes giving the United States a D+ in preterm birth (Lardieri, 2018; March of Dimes, 2022). Women of Black/African-American (B/AA) ancestry are particularly at risk with a maternal mortality rate roughly 2.5-3 times that of their white counterparts (Fleszar et al., 2023). Research has shown that addressing vitamin D deficiency/insufficiency (VDD/I) among B/AA women by achieving and maintaining 25(OH)D concentrations of  $\geq 40$  ng/ml has the potential to significantly improve maternal health outcomes (McDonnell et al. 2017; Wagner et al., 2017).

This presentation will focus on introducing vitamin D research demonstrating improved prenatal outcomes, including women of B/AA descent, and introduce a toolkit, model, e-tools, and translational resources, as well as suggestions for public health and healthcare policy to move this research into practice faster.

**NHANES Data show 68% of Black/AA women have vitamin D concentrations <20 ng/ml, with 80% of Blacks having vitamin D Levels below 30 ng/ml (75 nmol/L); 95% below the scientific recommendation of 40 ng/ml (100 nmol/L) (GrassrootsHealth, 2022)**



## Background

- Since 2000, significant progress has been made in understanding the physiological impact of VDD/I on prenatal health and maternal outcomes. Several studies have noted circulating 25(OH)D concentrations prior to conception, during the prenatal and postpartum periods of  $\geq 40$  ng/ml are considered “critical” for optimal maternal outcomes, with safely administered doses up to and exceeding 4,400 IU/day without adverse events (Wagner et al., 2017; McDonnell et al., 2017; Hollis & Wagner, 2022; Grant et al., 2023).
- 1,25D is synthesized in greater amounts during pregnancy, up to levels that would be fatal to a non-pregnant individual (Hollis & Wagner, 2022).
- Optimal vitamin D levels prior to conception and early in the first-trimester support placental health, early fetal development, and maternal health by activating vitamin D receptors on hundreds to thousands of genes, impacting genetic expression (Wagner et al., 2017; Ames et al., 2021).
- A recent systematic review found VDD/I in pregnancy is a modifiable risk factor for morbidities such as hypertensive disorders, preeclampsia, preterm birth, gestational diabetes, pulmonary embolism, hemorrhage, low birth weight, and risk for maternal mortality (Suarez-Varela, et al., 2022a & b).
- B/AA women are at increased risk for health disparities related to VDD vs. their Caucasian counterparts due to darker skin tone, requiring increased time in the sun to manufacture similar amounts of vitamin D (Ames et al., 2021; Englesen, 2010).
- Occupation, lifestyle choices, and cultural habits, leading to decreased sun exposure during peak UV index hours (10-2 pm) or covering of the body for personal or religious reasons may be additional individual risk factors for healthcare providers to consider (Sanford et al., 2023).
- Environmental determinants of health (DOH) are an additional consideration for B/AA women living in northern latitudes where they cannot generate Vitamin D from the sun for up to six months of the year or inclement weather (hot or cold) driving women indoors (Sanford et al., 2023).
- Prenatal screening and treatment programs have been found effective in the early detection and treatment of VDD/I in women, demonstrating improved maternal outcomes (Rostami et al., 2023).

**Vitamin D is the only substance associated with decreased preeclampsia rates and subsequent preterm birth (Hollis & Wagner, 2022).**

## Significant Literature Highlights

Since the mid-2000s, researchers at the Medical University of South Carolina in collaboration with GrassrootsHealth Nutrient Institute, have had success improving prenatal outcomes among urban women using an evidence-based protocol, a three-step testing method testing serum 25(OH)D concentrations at 3 timepoints during pregnancy: baseline, 1st trimester (<16 weeks); 2nd trimester (16–26 weeks); and 3rd trimester ( $\geq 27$  weeks) and preterm birth), focusing on achieving and maintaining circulating 25(OH)D concentrations of  $\geq 40$  ng/ml. Women were also given free bottles of 5000 IU of vitamin D3 (Wagner et al., 2017)

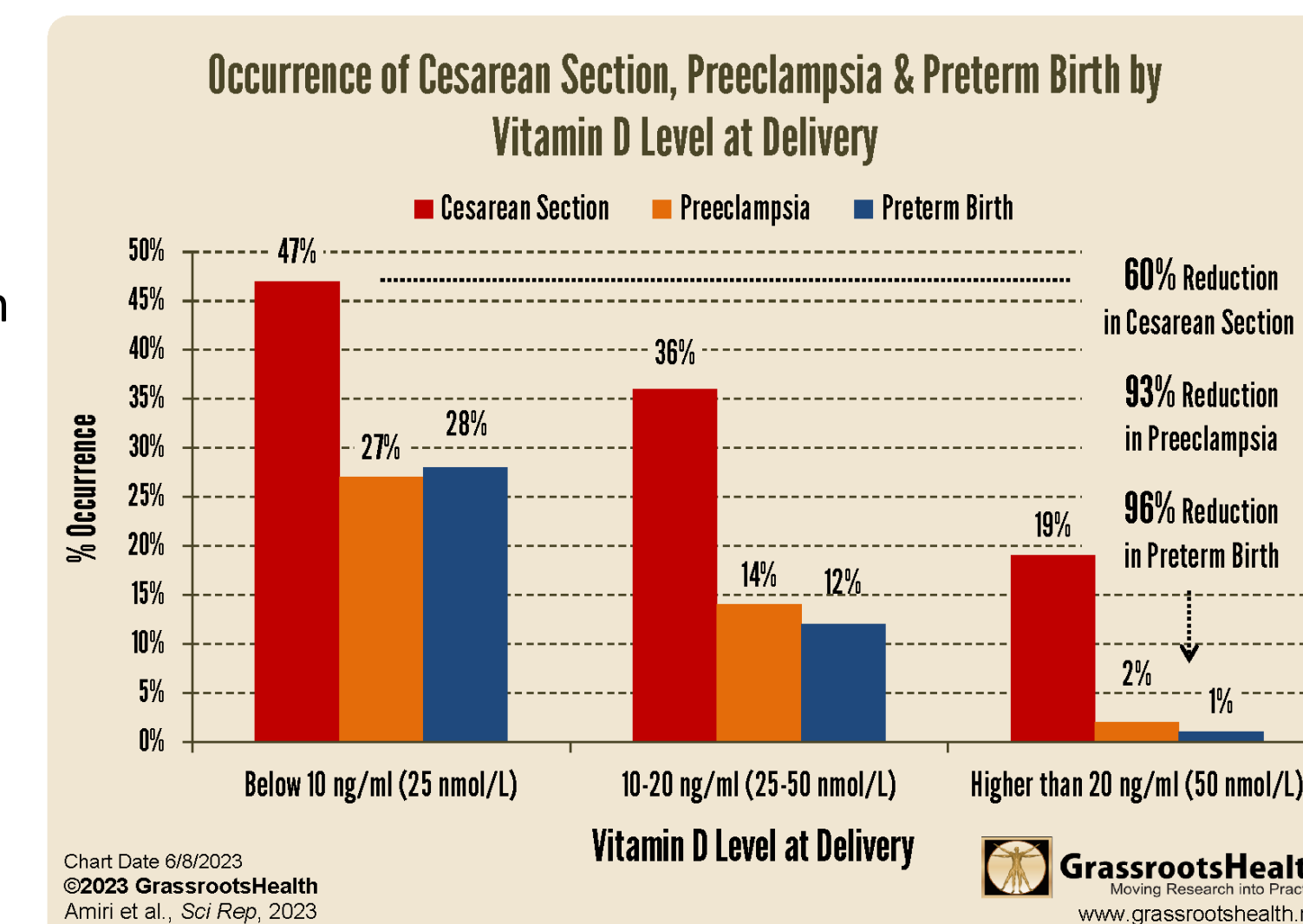
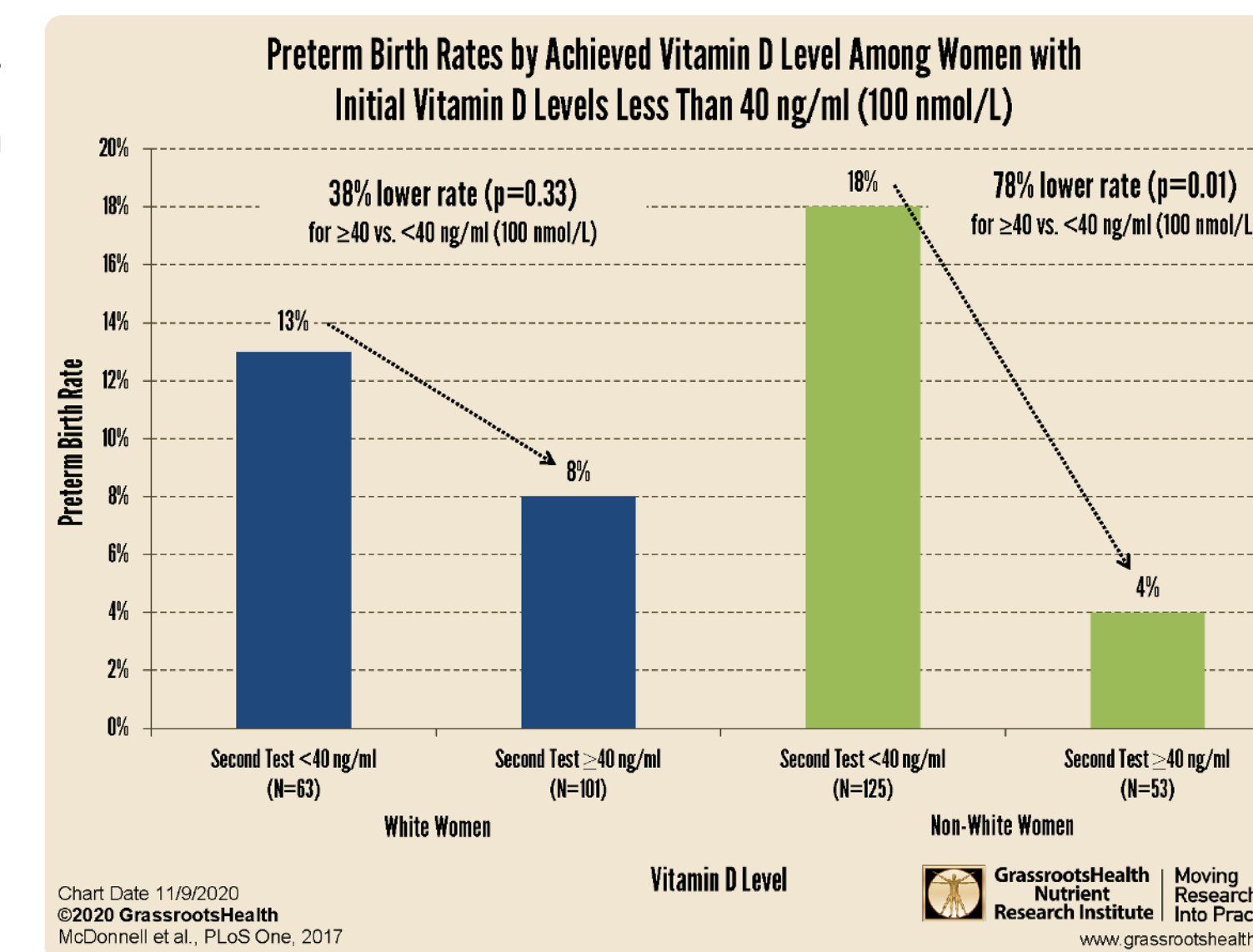
## Significant Research Findings (cont.)

In a 2017 study (N=1,064), researchers found optimizing vitamin D levels to  $\geq 40$  ng/ml prior to birth vs. <20 ng/ml improved preterm birth risk among both white women and \*non-white women, with 65% (p=0.03) and 68% (p=0.008) lower risk, respectively (McDonnell et al., 2017).

The most notable improvement in the study was among non-white women whose initial vitamin D levels were <40 ng/ml who raised their level to  $\geq 40$  ng/ml—their preterm birth rate was 78% lower than those who did not raise their level (see top chart).

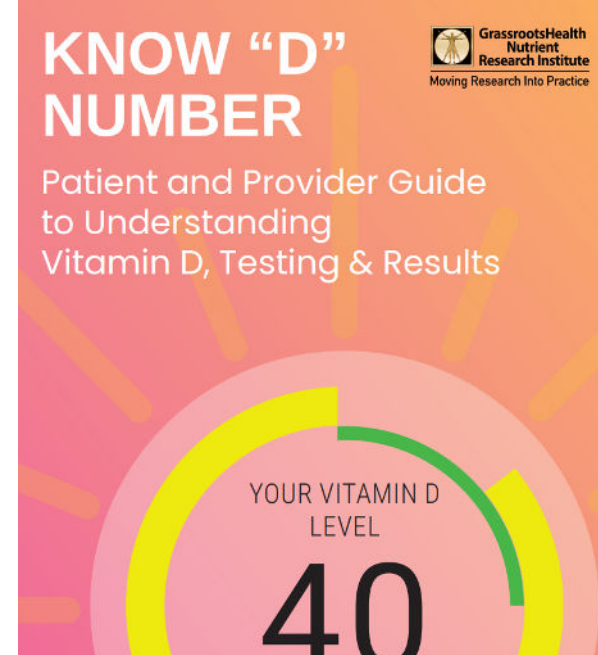
\*Of the non-white women enrolled in the study, 69% were B/AA women.

A recently published randomized controlled trial by Amiri et al. (2023) found a 60% reduction in cesarean section, 93% reduction in pre-eclampsia, and 96% reduction in preterm birth in women with levels of 20 ng/mL or higher vs. women with severe VDD of less than 10 ng/mL. The study also found significantly higher rates of gestational diabetes, low birth weight, and other pregnancy complications.



## Evidence-Based Tools to Increase Translation of Research to Practice

- Vitamin D Best Practices Toolkit—Moving Vitamin D Research into Practice: Addressing Vitamin D Deficiency to Improve Patient Outcomes, Population Health, & Reduce Costs. Of the 86 participants who completed the follow-up survey, confidence scores increased significantly from 2.0 to 3.3 on a scale of 1-5 (p<0.0001) (Sanford et al., 2023).
- The Cycle of Best Practices for Addressing Vitamin D Deficiency addresses VDD from primary prevention, early detection, and tertiary prevention aspects. 100% of participants (reported using at least one component of the model of best practices, with the top four components being: referred (54%), assess (50%), educate (46%), and screen (25%) (Sanford et al. 2023).
- The 2022 evidence-based Vitamin D Deficiency Risk Assessment Quiz (beta) guides providers and patients in identifying risk factors and points for individualized education (GrassrootsHealth, 2022).
- The 2015 evidence-based Vitamin D\*Calculator aids providers in calculating individualized vitamin D doses with options to target specific 25(OH)D concentrations (GrassrootsHealth, 2022).
- The Everyone Responds Differently to Vitamin D Handout guides providers in identifying patient risk factors and providing Individualized patient education (GrassrootsHealth, 2022)
- KNOW “D” NUMBER: Patient and Provider Guide to Understanding Vitamin D, Testing & Results, was found to be the preferred single resource for education among nurses & dietitians (GrassrootsHealth, 2022; Sanford et al., 2023).



## Recommendations for Reducing Barriers to Translate Research into Practice & Healthcare Policy

Research has found three main barriers to the movement of vitamin D science into practice: lack of patient interest/knowledge, lack of healthcare professional knowledge/resistance, and financial barriers to testing (Sanford et al. 2023). Recommendations to address barriers include:

- Cultural competency education:** Educating providers on regional DOH and individual risk factors that impact vitamin D status as well as skin-tone-specific safe sun exposure recommendations may assist to eliminate preventable VDD/I, reducing health disparities among B/AA pregnant women (Ames et al., 2021; Sanford et al., 2023).
- Higher Education:** Integrating current vitamin D science, properly designed research, and best practices throughout the curriculum, research initiatives, and practical experiences (Heaney, 2014; Sanford et al., 2023).
- Licensed Healthcare Professionals:** Increasing access to continuing education from the vitamin D scientific communities through professional healthcare associations, conferences, webinars, professional learning communities, and dissemination of scientific literature, best practices, and resources (Sanford et al., 2023).
- Community-Based Educational Initiatives for At-Risk Populations:** Leveraging key community stakeholders, focused education initiatives in community centers, community organizations, & places of worship as well as social media to disseminate information.
- Institutional Initiatives:** Incorporating continuing education as well as decision-making processes such as order-set, properly designed research & quality improvement initiatives using the Heaney criteria of nutrient design (pre- and post-intervention blood work targeting optimal 25(OH)D concentrations of 40-60 ng/ml), and change champions (Heaney, 2014; Sanford et al., 2023; Uko & Utley, 2020).
- Healthcare Policy:** Initiatives should focus on local or regional determinants of health and utilize a primary prevention model for addressing VDD/I in prenatal health. Recommendations include public education campaigns, increasing funding for vitamin D screening & testing three times during pregnancy in government programs for low-income women, decreasing overall testing costs for all pregnant women, and increasing insurance reimbursement (Sanford et al., 2023).

**Vitamin D researchers agree—obtaining and maintaining vitamin D levels at a target goal of 40-60ng/ml is cost-effective, reducing direct costs of healthcare and preserving public health resources (Baggerly et al., 2015)**

## CONCLUSIONS

Although there are many needs to be addressed to improve the overall health of pregnant B/AA women, addressing VDD/I as a modifiable risk factor is a safe and effective way to improve maternal outcomes. It is imperative to increase healthcare professionals’ knowledge of local or regional determinants of health that increase the risk for VDD/I among all women, especially in darker-skinned women who live at higher latitudes or individual risk factors such as decreased sun exposure for occupational, lifestyle, or cultural/religious reasons, or take medications which disrupt vitamin D levels (Sanford et al., 2023).

Priority should be given to increasing healthcare professionals’ knowledge of vitamin D physiology, optimal 25(OH)D concentrations, and best practices for the translation of knowledge into practice while reducing financial barriers to testing is a cost-effective way to decrease overall maternal morbidity and mortality; thus, improving maternal health outcomes among B/AA women and decreasing overall healthcare costs. Providing evidence-based resources and processes to increase translation to practice among healthcare professionals is critical to improving their confidence and satisfaction while providing prenatal care to B/AA women (Sanford et al., 2023).

Implementing an evidence-based toolkit and applying a translational model with easily accessible resources along with a primary prevention model for addressing VDD/I should be part of research, practice, and public health initiatives to address VDD/I as a modifiable risk factor for health disparities among child-bearing age B/AA women. Research efforts should include longitudinal studies in diverse prenatal practice settings, such as hospitals and community-based birth centers, WIC, and track improvement in prenatal, staff, and financial outcomes.

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