ORIGINAL RESEARCH

Associations Between Modifiable Preconception Care Indicators and Pregnancy Outcomes

Ashwini Kamath Mulki, MD, MBBS, MPH, Melanie B. Johnson, MPA, Nicole M. Burgess, BS, Kyle Shaak, MPH, Katie Nisbett, PharmD, Katarzyna Jabbour, PharmD, BCPS, Roya Hamadani, MPH, and Beth Careyva, MD

Purpose: **This study explored gaps and opportunities in preconception care with a focus on determining whether modifiable preconception care indicators are associated with preterm births.**

Methods: **This retrospective case-control study explored prepregnancy data of patients ≥18 years old who delivered preterm (cases) versus full term (controls) between June 1, 2018, and May 31, 2019, at a health care network in Pennsylvania. Cases were matched 1:2 with controls based on age, parity, and history of preterm delivery. A literature review yielded 11 key indicators of quality preconception care. Documentation of counseling on these indicators were extracted from patient charts from their most recent primary care visit before pregnancy (preconception care) and their pregnancy intake visit (prenatal care). Bivariate analyses were used to assess whether any of the 11 preconception indicators were associated with preterm birth. All analyses were conducted using SPSS statistical software.**

Results: **Our sample included 663 patient charts: 221 preterm births and 442 term births. Elevated blood pressure (>120/80) in the preconception period (Odds Ratio [OR] = 1.84) and at the prenatal intake visit (OR = 1.68) was significantly associated with preterm birth. In addition, patients with Body Mass Index (BMI) ≤18 or ≥30 at their prenatal visit were nearly twice as likely (OR = 1.85) to have pregnancies resulting in preterm birth.**

Conclusions: **Our study highlights BMI and Blood Pressure (BP) as key focus points for preconception counseling. Additional studies are needed to determine whether pregnancy outcomes other than preterm birth may be influenced by these and other preconception care indicators. (J Am Board Fam Med 2025;00:000–000.)**

Keywords: **Case-Control Studies, Counseling, Pennsylvania, Preconception Care, Pregnancy, Pregnancy Outcome, Preterm Birth, Primary Health Care, Retrospective Studies**

Introduction

The United States ranks low among developed nations when it comes to maternal and infant mortality, with poor maternal outcomes continuing to rise.[1,2] The preterm birth rate is rising, with 1 in 10 babies in the United States born prematurely.[3] It is the second leading cause of infant mortality,[3] and it is a major cause of infant morbidity in the United States.[4]

Preterm birth also presents risks to mothers. Individuals who deliver preterm are at twice the risk for future cardiovascular disease as their counterparts who deliver at term.[5] They also are likely to experience high blood pressure (BP) patterns throughout their reproductive years, which further increases the risk for subsequent cardiovascular

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Corresponding author: Ashwini Kamath Mulki, MD, MBBS, MPH, VHP Family Health Center, 400 N 17th St., Suite 300, Allentown PA 18104 (E-mail: ashwini.kamathmulki@lvhn.org).

disease.[6] Improving health before conception may help reduce preterm births and improve both maternal and infant outcomes.[7,8]

Preconception care helps identify and modify biomedical, behavioral, environmental, and social risks before pregnancy occurs.[1] There continues to be an opportunity to improve access to and awareness of preconception care. A 2015 nationally representative sample study of 383 million women of reproductive age found that only about 14% received preconception care.[9] Healthy People 2020,[10] an initiative of the US Office of Disease Prevention and Health Promotion, included "increase the proportion of women delivering a live birth who receive preconception care services and practice key recommended preconception health behaviors" as one of its objectives for improving health in the nation. The Healthy People 2030 agenda[11] includes indicators related to preconception care among its Family Planning and Pregnancy and Childbirth objectives.

National recommendations[12–15] also highlight preconception care as a crucial factor in decreasing the risk of preterm birth and improving maternal and infant outcomes. Since the 2004 initiation of the Preconception Health and Health Care Initiative (PCHHC),[12] a public-private partnership of more than 70 organizations across the United States, many studies have explored health care for individuals of reproductive age. After reviewing the evidence and considering the feasibility of data collection, the PCHHC suggested 9 indicators defining quality preconception care: 1) pregnancy intention, 2) access to care, 3) preconception multivitamin with folic acid use, 4) tobacco avoidance, 5) absence of uncontrolled depression, 6) healthy weight, 7) absence of sexually transmitted infection (STI), 8) optimal glycemic control in individuals with pregestational diabetes, and 9) teratogenic medication avoidance.[12]

In their 2018 cross-sectional study, Hitti et al. found that one-third of preterm births with severe maternal morbidity were associated with maternal hypertension.[16] The American College of Obstetricians and Gynecologists identified increased rates of substance use (tobacco, alcohol, and/or harmful substances) in pregnancy as a significant risk factor for maternal and infant morbidity and mortality.[2] Like the PCHHC's 9 preconception care indicators, maternal chronic hypertension, and substance use in pregnancy are modifiable factors.

Primary care clinicians play a key role in the wellness of individuals of reproductive age and can be pivotal in addressing preconception care. Unfortunately, significant gaps exist in preconception care implementation, specifically around systems change, training, and education for clinicians delivering this care.[17] The Pregnancy Risk Assessment Monitoring System (PRAMS) data for 2013 to 2015 showed that less than 50% of patients took oral multivitamins (defined as ≥ 4 days a week in the month before pregnancy), less than 45% of patients had normal weight before pregnancy, and nearly 34% reported that their pregnancy was mistimed or unwanted.[18] Another study showed that fewer than 20% of primary care clinicians offered contraceptive counseling for women of reproductive age taking teratogenic drugs.[19]

Local evaluations show similar gaps in care. A study conducted at our health network explored preconception counseling for women 18 to 35 years old with diabetes mellitus.[20] That study revealed that fewer than 20% of primary care clinicians (those in internal medicine, family medicine, or obstetrics and gynecology) had discussed preconception care during nonacute, nonprenatal visits with patients in the previous 3 years.[20]

The purpose of this study is to further explore gaps and opportunities in preconception care among individuals of reproductive age with a uterus, with a focus on determining whether the 11 modifiable preconception indicators (PCHHC's 9 wellness measures, maternal hypertension, and substance use in pregnancy) are associated with preterm births. Secondary aims included evaluating pregnancy risk and receipt of counseling during prenatal intake visits.

Methods

Population and Sample Selection

This retrospective case-control study compared charts of eligible patients who delivered preterm (case) or at term (control) at our health network between June 1, 2018, and May 31, 2019. Preterm delivery includes any birth occurring before 37 completed weeks of gestation. Inclusion criteria were delivery date, singleton birth, patient age ≥18 at delivery, primary care clinician specified in chart, and prior pregnancy data (parity, gravidity). Any delivery before 20 weeks of gestation was excluded.

The health network sees about 4000 births per year. All preterm deliveries that met study inclusion and exclusion criteria were included as cases. Controls (term deliveries) were matched with cases at a ratio of 2:1 based on age, parity, and history of preterm delivery. In instances where exact matches were

not possible, preference was given to closely matching preterm history followed by parity and then age.

The institutional review board of the health network where the research occurred granted approval for this study.

Data Collection

Manual chart review comprised the patient's prenatal intake visit as well as the most recent primary care well visit in the 2 years prior. Prenatal intake visit was identified as the patient's first visit for obstetric care in their current pregnancy. Primary care visits included annual physicals or well encounters with Family Medicine, Obstetrics and Gynecology, or Internal Medicine clinicians that were documented in the electronic medical record. If none existed, then notes for the most recent acute or nonacute visit were audited. The patient charts were stratified by high-risk versus low-risk indicators as documented at their pregnancy intake visit. Pregnancies were classified as high risk if factors or medical concerns existed for mother or fetus that made them more likely to experience complications in the gestational period or during birth than would be expected in a typical pregnancy.[21] Low-risk pregnancies were those with no known factors placing the patient or fetus at increased risk of complications.[22] Patient charts were queried for notes related to any of the 11 key preconception care indicators,[12,16,18] as defined in Table 1.

Data Management and Statistical Analysis

Patient data were imported into a secure Excel workbook by a member of the study team. The data were stored in a secure folder and accessed only by the study team until uploaded into a database created specifically for this study. The database was created with REDCap (Research Electronic Data Capture),[23,24] a secure web platform for building and managing databases, hosted by the health network. Manual chart review data were entered into the same REDCap database. Only necessary study personnel had access to the database.

Cases were matched to controls at a rate of 1:2. Bivariate analyses were used to assess any patient

Table 1. Operationalization of Preconception Care Indicators for Data Collection

Preconception Care Indicators	Definition for Preconception Visits (Yes/No Response)	Definition for Prenatal Intake Visit (Yes/No Response)[12,28]
Pregnancy intention	Contraception counseling	Planned pregnancy
Access to care	Any primary care visit w/in 2 years	Prenatal intake visit <12 weeks gestational age (first trimester)
Preconception multivitamin with folic acid use	Education on use before conception	Use of a daily multivitamin with folic acid for at least 3 months before conception
Tobacco avoidance	Counseling on avoidance	Tobacco avoidance
Absence of uncontrolled depression	Depression screening negative (Negative PHQ-2 or PHQ-9 <10)	Depression screening negative (Negative PHQ-2 or PHQ-9 <10)
Healthy weight	BMI >18 and <30	BMI >18 and <30
Absence of STIs*	STI screening low risk**	STI screening negative
Optimal glycemic (if have pre-existing diabetes diagnosis)	Counseling on goal A1c <6.5%	A1c <6.5%
Teratogenic medication avoidance	Counseling on pregnancy risk with teratogenic drugs in pregnancy (previously, category X with mention of teratogenicity as the reason for being pregnancy category X)	No use of teratogenic drugs in pregnancy
Controlled chronic HTN	BP value ≤120/80	BP value ≤120/80
Harmful substance use avoidance	Counseling on avoidance of harmful substances (eg, marijuana, alcohol)	Avoidance of harmful substances (eg, marijuana, alcohol)

*STI screening included testing for gonorrhea, chlamydia, HIV, hepatitis B and syphilis.
**STI low risk included a no response to all these patient-related questions: 1) Sexually active and >25 years old, 2) a new sex partner, 3) more than 1 sex partner, 4) a sex partner who has concurrent partners, 5) a sex partner who has an STI, 6) inconsistent condom use among persons who are not in mutually monogamous relationships, 7) personal history of STIs, 8) exchanging sex for money or drugs, 9) patient asks for STI screening, or simply agrees if offered by clinician.
Abbreviations: W/in, Within; PHQ-2, 2-item Patient Health Questionnaire; PHQ-9, 9-item Patient Health Questionnaire; BMI, body mass index; STI, sexually transmitted infection; HTN, hypertension; BP, blood pressure.

demographic differences (ie, age, race, primary language, etc.) across cases and controls. The outcome of preterm birth was compared with documented receipt of counseling on the 11 preconception care indicators (for both preconception visits and pregnancy intake visit) by bivariate analysis. Additional bivariate analyses were utilized to compare receipt of the 11 preconception care indicators with the outcome of low- and high-risk pregnancy classification. To complete these analyses, the χ^2 and Fisher's exact tests of independence were used as appropriate. Pairwise deletion was used to handle missing values.

All statistical tests were two-sided, and a *P*-value <0.05 was used for significance. All analyses were conducted using SPSS statistical software (Version 29.0. Armonk, NY: IBM Corp).

Results

A total of 4,735 births were identified, 593 of which were preterm deliveries. Of those, 221 preterm births met inclusion criteria. Charts were excluded for unspecified primary care clinician (n = 315), nonsingleton births (n = 56), and missing parity count (n = 1). After case-control matching, the study sample comprised 663 patient records, including the 221 cases (preterm births) and 442 controls (term births).

The average age of patients in both groups was 29.2 years. The study sample was majority White (67.1%) and non-Hispanic (71.0%). The majority of patients received their primary care from a family medicine (70.9%) clinician. Table 2

Preconception Care and Preterm Birth

Our study's primary aim was to determine whether any association existed between incidence of preterm birth and documented receipt of counseling for any of the 11 modifiable preconception care indicators. A statistically significant association was found for one indicator: BP >120/80 (Odds Ratio [OR] = 1.84; 95% CI, 1.26-2.68; *P* = .002). Several other indicators were found to increase the odds of having a preterm birth—not receiving contraceptive counseling (OR 1.29), a positive depression screening (OR 1.64), BMI ≤18 and ≥30 (OR 1.43), and absence of harmful substance use counseling (OR 1.54). However, none of these achieved statistical significance. Table 3

Preconception Care and Pregnancy Risk

Our secondary aim was to determine whether any associations existed between pregnancy risk (high/low) at prenatal intake visit and any of the 11 modifiable preconception indicators. Once again, BP >120/80 had a statistically significant association with a poor outcome. Elevated BP at the prenatal visit increased the odds of having a high-risk pregnancy (OR = 1.61; 95% CI, 1.09-2.38; *P* = .02). However, for patients at high risk of STIs during the preconception period, there was a statistically significant reduction in odds of having a high-risk pregnancy (OR = 0.60; 95% CI, 0.39-0.92; *P* = .02). Many other preconception care indicators elevated the odds of a high-risk pregnancy, but none reached statistical significance. These included not receiving contraceptive counseling (OR 1.22), not having a primary care visit 2 years before pregnancy intake visit (OR 1.14), not having multivitamin use education (OR 1.09), not receiving tobacco avoidance counseling (OR 1.46), a positive depression screen (OR 1.74), BMI ≤18 and ≥30 (OR 1.26), absence of A1c goal counseling (OR 4.75), and harmful substance use counseling (OR 1.55). Table 4.

Prenatal Care and Preterm Birth

Our third aim was to determine whether any modifiable prenatal care indicators were correlated with preterm birth. Both blood pressure >120/80 (OR = 1.68; 95% CI,1.20-2.35; *P* = .002) and a BMI ≤18 and ≥30 (OR = 1.85; 95% CI, 1.33-2.58; *P* < .001) had statistically significant associations with increased odds of preterm birth. No other indicators reached statistical significance, however, several had elevated odds ratios when compared with increased risk of preterm birth: no prenatal care by 12 weeks gestation (OR 1.13), multivitamin use <3 months prenatal (OR 1.54), a positive STI screening (OR 2.32), and A1c ≥6.5 (OR 3.14). Table 5

Discussion

Our study found that patients with a BMI ≤18 and ≥30 at prenatal intake visit were associated with having a preterm birth while there was no such significant association with BMI ≤18 and ≥30 in the preconception period. This may suggest that those with BMI ≤18 and ≥30 in the preconception period who make therapeutic lifestyle changes and enter prenatal care with a BMI >18 and <30 may improve pregnancy-related outcomes. A secondary

Table 2. Patient Demographics (N = 663) Stratified by Delivery Status

	Entire Sample (N = 663)	Term Delivery (n = 442)	Preterm Delivery (n = 221)	*P* value
Age mean ± standard deviation	29.22±5.6	29.14±5.4	29.36±5.8	0.64*
Race, n (%)				0.23†
Amer Indian/Alaska Native	1 (0.2)	1 (0.2)	0 (0.0)	
Asian	18 (2.7)	12 (2.7)	6 (2.7)	
Black or African American	52 (7.8)	29 (6.6)	23 (10.4)	
Multiracial	59 (8.9)	35 (7.9)	24 (10.9)	
Native Hawaiian or Other Pacific Islander	1 (0.2)	0 (0.0)	1 (0.5)	
White	445 (67.1)	304 (68.8)	141 (63.8)	
Other	70 (10.6)	51 (11.5)	19 (8.6)	
Refused/NA/Unknown	17 (2.6)	10 (2.3)	7 (3.2)	
Ethnicity, n (%)				0.67†
Hispanic or Latino	187 (28.2)	121 (27.4)	66 (29.9)	
Not Hispanic or Latino	471 (71.0)	318 (71.9)	153 (69.2)	
Declined/Unknown	5 (0.8)	3 (0.7)	2 (0.9)	
Language n (%)				**0.04**‡
English	609 (91.9)	404 (91.4)	205 (92.8)	
Spanish	42 (6.3)	26 (5.9)	16 (7.2)	
Other	12 (1.8)	12 (2.7)	0 (0.0)	
Patient PCP Specialty				0.11†
Critical care medicine	1 (0.2)	1 (0.2)	0 (0.0)	
Diagnostic radiology	1 (0.2)	1 (0.2)	0 (0.0)	
Family medicine	470 (70.9)	321 (72.6)	149 (67.4)	
Geriatric medicine	1 (0.2)	0 (0.0)	1 (0.5)	
Gerontology	2 (0.3)	2 (0.5)	0 (0.0)	
Infectious disease	1 (0.2)	1 (0.2)	0 (0.0)	
Internal medicine	174 (26.2)	105 (23.8)	69 (31.2)	
Obstetrics and gynecology	7 (1.1)	7 (1.6)	0 (0.0)	
Pediatrics	6 (0.9)	4 (0.9)	2 (0.9)	
Pre-gravid BMI, median (IQR)§	27.5 (23.4-32.6)	26.5 (23.1-31.4)	29.0 (24.5-33.9)	**<0.001**‖

*Independent-samples t-test.
†Fisher's Exact test.
‡Chi-square test of independence.
§47 records (23 term, 24 preterm) missing pre-gravid BMI.
‖Mann-Whitney U test. Highlighted bold values indicate statistical significance.
Abbreviations: Amer, American; BMI, Body mass index; NA, Not Available; PCP, primary care physician.

analysis of our current results would help further evaluate this hypothesis. Daly et al.'s systematic review highlights that BMI ≤18 and ≥30 in preconception and pregnancy is associated with increased pregnancy risks and poor birth outcomes, which further supports our interpretation of our study results.[25]

Maternal infection with gonorrhea, chlamydia, or syphilis has been shown to be associated with greater odds of preterm birth.[26] In our study, however, Sexually Transmitted Infection (STI) risk was associated with decreased odds of high-risk pregnancy on prenatal intake—although preconception counseling on STI risks and absence of STI at prenatal intake visit did not have a statistically significant association with preterm birth. We included HIV and hepatitis screening in our STI counseling definition and documentation of this counseling was inconsistent in the charts we reviewed, which may have affected these results.

Blood pressure control in pregnancy is known to improve perinatal outcomes. The CHAP study[27] informs that tighter BP control (BP <140/90) in pregnancy is associated with improved pregnancy outcomes, including lowering preterm birth risk. Our study found that patients with BP <120/80 in preconception period and during prenatal intake

Table 3. Associations Between Preconception Care Indicators and Preterm Delivery

	Entire Sample	Term Delivery	Preterm Delivery	*P* value	Preterm OR	95% CI
Contraception counseling (n = 652)				0.16*		
Yes (REF)	233	164 (70.4)	69 (29.6)		—	—
No	419	272 (64.9)	147 (35.1)		1.29	0.91-1.82
Prim care encounter ≤2 Years (n = 663)				0.50*		
Yes (REF)	481	317 (65.9)	164 (34.1)		—	—
No	182	125 (68.7)	57 (31.3)		0.88	0.61-1.27
Multivitamin education (n = 620)				0.28*		
Yes (REF)	73	45 (61.6)	28 (38.4)		—	—
No	547	372 (68.0)	175 (32.0)		0.76	0.46-1.25
Tobacco avoidance counseling (n = 657)				0.40*		
Yes (REF)	75	47 (62.7)	28 (37.3)		—	—
No	582	393 (67.5)	189 (32.5)		0.81	0.49-1.33
Depression screening (n = 161)				0.30*		
Negative (REF)	140	96 (68.6)	44 (31.4)		—	—
Positive	21	12 (57.1)	9 (42.9)		1.64	0.64-4.17
BMI (n = 475)				0.07*		
BMI >18 and <30 (REF)	298	206 (69.1)	92 (30.9)		—	—
BMI ≤18 and ≥30	177	108 (61.0)	69 (39.0)		1.43	0.97-2.11
STI Risk (n = 663)				0.51*		
Low risk (REF)	518	342 (66.0)	176 (34.0)		—	—
High risk	145	100 (69.0)	45 (31.0)		0.87	0.59-1.30
A1c goal counseling (n = 27)				0.53†		
Yes (REF)	3	0 (0.0)	3 (100.0)		—	—
No	24	9 (37.5)	15 (62.5)		n/a	n/a
Teratogenic med counseling (n = 658)				0.72*		
Yes (REF)	16	10 (62.5)	6 (37.5)		—	—
No	642	429 (66.8)	213 (33.2)		0.83	0.30-2.31
Blood pressure (n = 488)				**0.002***		
<120/80 (REF)	287	204 (71.1)	83 (28.9)		—	—
≥120/80	201	115 (57.2)	86 (42.8)		**1.84**	1.26-2.68
Substance use counseling (n = 659)				0.16*		
Yes (REF)	60	45 (75.0)	15 (25.0)		—	—
No	599	396 (66.1)	203 (33.9)		1.54	0.84-2.83

*Chi-square test-of-independence.
†Fisher's Exact test. Highlighted values indicate statistical significance.
Abbreviations: OR, Odds ratio; REF, Reference; Prim, Primary; BMI, Body mass index; STI, Sexually transmitted infection; Med, Medication.

visit were positively associated with term births. We did not measure how many patients had a history of hypertension or developed preeclampsia and related complications that may have led to preterm birth. The potential harms and benefits of tighter BP control in preconception period—for example, reducing systolic BP from 140 to 120 and diastolic BP from 90 to 80 — will have to be further evaluated.

Limitations

Some of the variables in this study had to be extracted manually from patient records due to the variability of how the information was entered into the electronic medical record. These included receipt of counseling, harmful substance use, multivitamin use, teratogenic medication use, screening for depression, and STI risk. Since there were multiple chart reviewers who conducted the manual audits and data entry into REDCap, there may have been some interobserver variability in which data were extracted. We aimed to limit this by not only distributing a mix of case and control charts to each reviewer, but also having the principal investigator review a small sample of all other reviewers' charts

Table 4. Associations Between Preconception Care Indicators and Pregnancy Risk at Intake Visit

	Entire Sample	Low-Risk Preg	High-Risk Preg	*P* value	High-Risk Preg OR	95% CI
Contraception counseling (n = 630)				0.27*		
Yes (REF)	228	159 (69.7)	69 (30.3)		—	—
No	402	263 (65.4)	139 (34.6)		1.22	0.86-1.73
Prim care encounter ≤2 Years (n = 640)				0.48*		
Yes (REF)	470	318 (67.7)	152 (32.3)			
No	170	110 (64.7)	60 (35.3)		1.14	0.79-1.65
Multivitamin education (n = 598)				0.75*		
Yes (REF)	72	49 (68.1)	23 (31.9)			
No	526	348 (66.2)	178 (33.8)		1.09	0.64-1.85
Tobacco avoidance counseling (n = 635)				0.17*		
Yes (REF)	73	54 (74.0)	19 (26.0)			
No	562	371 (66.0)	191 (34.0)		1.46	0.84-2.54
Depression screening (n = 157)				0.26*		
Negative (REF)	137	99 (73.2)	38 (27.7)			
Positive	20	12 (60.0)	8 (40.0)		1.74	0.66-4.58
BMI (n = 462)				0.25*		
BMI >18 and <30 (REF)	287	200 (69.7)	87 (30.3)			
BMI ≤18 and ≥30	175	113 (64.6)	62 (35.4)		1.26	0.85-1.88
STI Risk (n = 640)				**0.02***		
Low risk (REF)	499	322 (64.5)	177 (35.5)			
High risk	141	106 (75.2)	35 (24.8)		**0.60**	0.39-0.92
A1c goal couns (n = 24)				0.34†		
Yes (REF)	3	1 (33.3)	2 (66.7)			
No	21	2 (9.5)	19 (90.5)		4.75	0.29-78.74
Teratogenic med counseling (n = 635)				0.71*		
Yes (REF)	16	10 (62.5)	6 (37.5)			
No	619	414 (66.9)	205 (33.1)		0.83	0.30-2.30
Blood pressure (n = 474)				**0.02***		
<120/80 (REF)	276	199 (72.1)	77 (27.9)			
≥120/80	198	122 (61.6)	76 (38.4)		**1.61**	1.09-2.38
Substance use counseling (n = 636)				0.16*		
Yes (REF)	60	45 (75.0)	15 (25.0)			
No	576	380 (66.0)	196 (34.0)		1.55	0.84-2.85

*Chi-square test-of-independence.
†Fisher's Exact test. Highlighted values indicate statistical significance.
Abbreviations: Preg, Pregnancy; OR, Odds ratio; CI, Confidence interval; REF, Reference; Prim, Primary; STI, Sexually transmitted infection; Med, Medication; BMI, Body Mass Index.

and provide feedback to encourage consistent data entry. The COVID-19 pandemic hit just as the project began, which delayed the project's progress, thus the dataset utilized for analysis is dated. The access to care indicator was available only for patients empaneled with physicians in our health network, so any encounters occurring at other locations were missing this data point. Counseling for BP was operationalized as documentation of a BP reading for the visit, with the assumption that primary care clinicians review vital signs at every visit and address those outside normal range with patients. This may overemphasize the impact of counseling about BP control versus the actual BP control itself, irrespective of counseling.

The research team also acknowledges that preterm birth is not the only adverse pregnancy outcome that may be impacted by preconception care. For example, short interval pregnancies are associated with preterm births, but our study did not explore this for multiparous patients, making it a potential confounder. Multiple factors—biological, societal,

Table 5. Associations Between Prenatal Care Indicators and Preterm Delivery

	Entire Sample	Term Delivery	Preterm Delivery	*P* value	Preterm OR	95% CI
Pregnancy intention (n = 549)				0.72*		
Intended (REF)	331	229 (69.2)	102 (30.8)		—	—
Unintended	218	154 (70.6)	64 (29.4)		0.93	0.64-1.36
Prenatal intake visit (n = 660)				0.61*		
Intake visit <12 wks gestation (REF)	567	381 (67.2)	186 (32.8)		—	—
No intake visit <12 wks gestation	93	60 (64.5)	33 (35.5)		1.13	0.71-1.78
Multivitamin use (n = 169)				0.17*		
≥3 Months of prenatal use (REF)	96	51 (53.1)	45 (46.9)		—	—
<3 Months of prenatal use	73	31 (42.5)	42 (57.5)		1.54	0.83-2.84
Tobacco avoidance (n = 653)				0.80*		
Yes (REF)	583	391 (67.1)	192 (32.9)		—	—
No	70	48 (68.6)	22 (31.4)		0.93	0.55-1.59
Depression screening (n = 542)				0.68*		
Negative (REF)	482	341 (70.7)	141 (29.3)		—	—
Positive	60	44 (73.3)	16 (26.7)		0.88	0.48-1.61
BMI (n = 647)				**<0.001***		
BMI >18 and <30 (REF)	374	274 (73.3)	100 (26.7)		—	—
BMI ≤18 and ≥30	273	163 (59.7)	110 (40.3)		1.85	1.33-2.58
STI screening (n = 622)				0.07*		
Negative (REF)	604	422 (69.9)	182 (30.1)		—	—
Positive	18	9 (50.0)	9 (50.0)		2.32	0.91-5.94
A1c goal (n = 59)				0.07*		
<6.5 (REF)	43	22 (51.2)	21 (48.8)		—	—
≥6.5	16	4 (25.0)	12 (75.0)		3.14	0.87-11.30
Teratogenic medication use (n = 661)				0.33†		
No (REF)	660	440 (66.7)	220 (33.3)		—	—
Yes	1	0 (0.0)	1 (100.0)		n/a	n/a
Blood pressure (n = 634)				**0.002***		
<120/80 (REF)	364	264 (72.5)	100 (27.5)		—	—
≥120/80	270	165 (61.1)	105 (38.9)		**1.68**	1.20-2.35
Harmful drug use (n = 653)				0.69*		
Avoided harmful substances (REF)	604	402 (66.6)	202 (33.4)		—	—
Use of harmful substances	49	34 (69.4)	15 (30.6)		0.88	0.47-1.65

*Chi-square test-of-independence.
†Fisher's Exact test. Highlighted values indicate statistical significance.
Abbreviations: OR, Odds ratio; CI, Confidence interval; REF, Reference; Wks, Weeks; BMI, Body mass index; STI, Sexually transmitted infection.

and other social determinants of health—also could influence the listed preconception indicators, and none was evaluated in our study. It is well evidenced that Black women are disproportionately affected by poor pregnancy outcomes, including preterm birth, and our study had a very small representation of Black women (7.8% of total sample). We also could not explore outcomes for the LGBTQIA+ population, which also has been reported as disproportionately affected by poor pregnancy outcomes, as our study was done before our health network collecting sexual orientation and gender identity information from patients. Future studies focusing on preconception care in these populations are essential to address these gaps.

Implications for Practice

Primary care clinicians can play an important role in preconception care counseling to help improve future pregnancy, maternal and neonatal outcomes. While there are many guidelines that discuss the importance of preconception care, little evidence exists to help determine which modifiable preconception indicators should be prioritized when addressed by

primary care clinicians. This study illuminated the need for consistency in documentation of point-of-care counseling. There is a need for more structured prompts for those with a uterus of childbearing age to determine whether technology-based supports would improve rates of preconception counseling and subsequently impact outcomes. Primary care clinicians address many health and wellness topics with patients, so actively addressing all preconception care indicators at every visit might be challenging. Based on our study results, focusing patient counseling on BMI and BP control might be the highest-yield intervention points for primary care clinicians to address to help reduce the risk of preterm births.

Conclusion

Primary care clinicians have an important role in promoting maternal and neonatal health. Preconception care should be seen as primary prevention for preterm birth. Our study highlights BMI >18 and <30 and BP <120/80 as key focus points for preconception counseling. Additional studies are needed to focus on other preconception care indicators and their impact on pregnancy outcomes in diverse populations.

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