

Progesterone Supplementation for the Prevention of Preterm Birth: Provider Practice in Wisconsin

Kara Hoppe, DO, MS; Renee D. Kramer, MPH; Barbara Ha, MPH; Angela Rohan, PhD; Chelsea Aeschbach, MPH; Deborah B. Ehrenthal, MD, MPH

ABSTRACT

Objective: To assess provider practice patterns on type of progesterone prescribed and barriers specific to 17 α -hydroxyprogesterone caproate utilization for preterm birth prevention.

Study Design: A survey mailed to providers assessed utilization and barriers to long-acting reversible contraception and progesterone for preterm birth prevention. Data analysis included chi-square tests for homogeneity followed by post hoc tests of proportions to detect significant pairwise differences.

Results: Five hundred sixty-three of 1,695 respondents who provide prenatal care were included in the analysis. More obstetric than family medicine and midwife providers (87.4% vs 31.4% and 72.6%, respectively; $P < .001$) prescribed any progesterone for preterm birth prevention. More obstetric providers prescribed 17 α -hydroxyprogesterone caproate (17OHP-C) compared with family medicine and midwife providers (98.1% vs 77.8% and 80.5%, respectively; $P < .0001$). Family medicine and midwife providers prescribed oral progesterone more often than obstetric providers (40.7% and 24.4% vs 13.1%; $P < .05$). System-level barriers to 17OHP-C were reported more often than patient-level barriers at a rate that was highest among family medicine and midwife providers.

Conclusion: 17OHP-C has been demonstrated to be an effective method for prevention of recurrent preterm birth. It is used significantly less—and oral progesterone is used significantly more—by family medicine and midwife providers, emphasizing the need for increased education and decreased treatment barriers for its utilization for preterm birth prevention.

INTRODUCTION

Preterm birth constitutes the leading cause of neonatal morbidity and infant mortality in the United States.¹ In 2016, approximately 1 in 10 infants were born preterm nationwide,² giving the

• • •

Author Affiliations: School of Medicine and Public Health, University of Wisconsin-Madison, Madison, Wis (Hoppe, Kramer, Ha, Aeschbach, Ehrenthal); Wisconsin Department of Health Services, Madison, Wis (Rohan).

Corresponding Author: Kara Hoppe, DO, MS, University of Wisconsin School of Medicine and Public Health, Department of Obstetrics and Gynecology-Division of Maternal Fetal Medicine, McConnell Hall, 1010 Mound St, Madison, Wisconsin 53715; phone 206.471.4014; email khoppe2@wisc.edu.

United States the highest rate of preterm birth among countries in the industrialized world.³

Previous spontaneous preterm birth is the greatest risk factor for subsequent preterm birth, recurring in 35% to 50% of women at similar gestational ages.⁴ Several studies have demonstrated progesterone supplementation to be an effective method for prevention of recurrent preterm birth, with appropriate patient selection, clinical scenario, and route of administration.^{5,6} Currently, 250 mg 17 α -hydroxyprogesterone caproate (17OHP-C) administered intramuscularly on a weekly basis starting at 16 to 20 weeks through 36 weeks gestation or delivery (whichever is achieved first) is the only agent approved by the Food and Drug Administration (FDA) for prevention of recurrent spontaneous preterm birth,⁷ and the American College of Obstetricians and Gynecologists (ACOG)

and the Society for Maternal-Fetal Medicine both endorse its use for prevention of recurrent preterm birth in singleton pregnancies.⁸⁻¹⁰

Makena is an FDA-approved hydroxyprogesterone caproate injection. Prior to FDA approval in 2011, compounded 17OHP-C was used exclusively. Both Makena and compounded 17OHP-C are thought to have equivalent efficacy in prevention of recurrent preterm birth. Both are reimbursable by the state's Medicaid program, are endorsed by ACOG, and were available at the time of this survey.¹¹

However, evidence suggests 17OHP-C may be underutilized,^{12,13} and a variety of barriers have been identified at the patient, provider, and system levels.¹⁴ Patient barriers have

included lack of perception they are at risk of recurrent preterm birth, lack of knowledge regarding this intervention, or concerns regarding the risks or side effects of 17OHP-C. Provider barriers include lack of access or availability of 17OHP-C as well as lack of knowledge regarding its efficacy and recommendations to provide it. System barriers include issues surrounding access to health care, which may include patients presenting late to care, difficulty coordinating administration of the drug, and insurance coverage.¹⁵ Prior literature examining progesterone use has focused on care provided by those working in obstetric (OB) or maternal fetal medicine practices.¹²⁻¹⁷ However, much prenatal care in the United States is provided by those in family medicine and midwifery,¹⁸ where less is known about their practice patterns in this area or the unique barriers they face when prescribing progesterone. This is of particular importance in rural and underserved areas, where the availability of OB providers may be limited.

The purpose of this study was to assess progesterone use across a broad range of specialties and practice locations providing prenatal care, in order to identify opportunities to improve 17OHP-C utilization and impact rising rates of preterm birth. To accomplish this, we surveyed providers throughout Wisconsin to assess utilization of, and barriers to, the use of progesterone for preterm birth prevention. Specifically, the objectives were: (1) to explore the prescribing/referral patterns of progesterone for preterm birth prevention among prenatal providers; (2) to compare the progesterone formulations prescribed by providers trained in family medicine and midwifery with those trained in obstetrics and gynecology; and (3) to understand the barriers providers face to implementation of current recommendations.

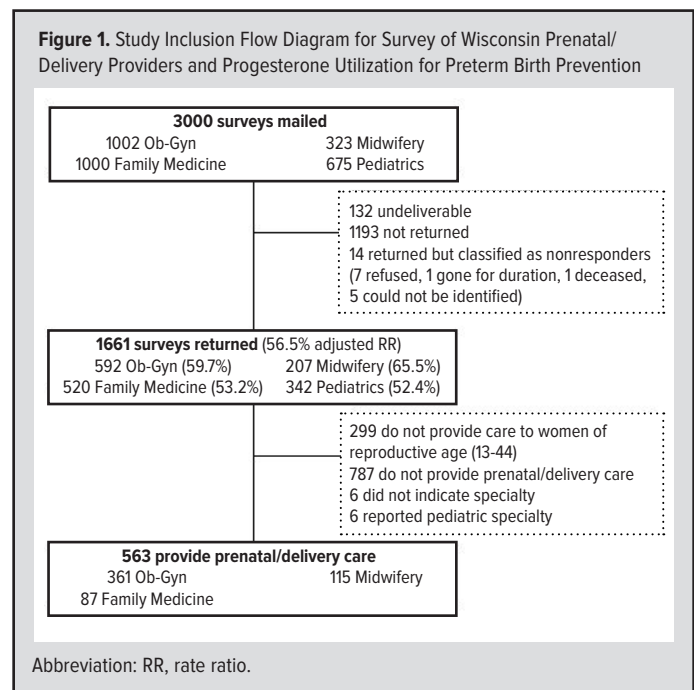
METHODS

Subjects and Setting

We surveyed physicians and advanced-practice providers (APP) in obstetrics, family medicine, and midwifery holding active licenses to practice in Wisconsin. Wisconsin is a state with an urban city as well as large rural areas, and obstetrical care is provided by those trained in obstetrics and gynecology (OB), midwifery, and family medicine.

The study sample was developed from a list of licensed providers obtained from the Wisconsin Department of Safety and Professional Services. This list included information about specialty, subspecialty, licensing, demographic information (age, sex, and ethnicity), and practice or home address. Providers were sampled if they held a license in the specialty or subspecialty of obstetrics, midwifery, family medicine, or pediatrics and had a mailing address in Wisconsin or within 50 miles of the Wisconsin border (n=7,750). ArcGIS 10.2 was used to geocode all mailing addresses, and straight-line buffers were used to identify addresses meeting our 50-mile criteria. The study was deemed exempt by the University of Wisconsin-Madison Institutional Review Board.

Surveys were mailed in the fall of 2015 by the University of



Wisconsin (UW) Survey Center to all OB (n=1,002) and midwife (n=323) providers, 21% of family medicine providers (n=1,000), and 47% of pediatric providers (n=675). The budget allowed for a total sample of 3,000 licensed health care providers, so we included all OB and midwife providers and randomly selected a portion of family medicine and pediatric providers. Because there are more family medicine and pediatric providers in Wisconsin than OB and midwife providers, we determined sampling all OB and midwife providers with similar amounts of family medicine and pediatric providers would provide satisfactory representation of all specialties. To ensure the sampling across specialties was similar, we employed simple random sampling using SAS 9.4 (SAS Institute Inc, Cary, North Carolina). A \$5 incentive was included in the first mailing to increase response rate.

Respondents who indicated that they did not provide care to women of reproductive age (13-44 years) (n=299) or did not provide prenatal care to patients (n=787) were excluded from this analysis (Figure 1). We also excluded providers who did not indicate their specialty (n=6) and pediatricians (n=6) due to the very small sample who reported providing prenatal care (n=6).

Survey Design

In collaboration with the UW Survey Center, public health professionals, and women's health physicians, an 8-page, self-administered questionnaire was developed consisting of 39 questions focused on provision of long-acting reversible contraceptives (LARC) and progesterone use for preterm birth prevention. The intention was to analyze the questions regarding use of LARC vs progesterone separately. The first portion of the survey was applicable to all respondents and asked questions pertinent to general

Table 1. Personal and Practice Characteristics of Wisconsin Prenatal/Delivery Providers, by Provider Specialty (n=563)^a

	Obstetrics N=361 No. (%)	Family Medicine N=87 No. (%)	Midwifery N=115 No. (%)	P-value ^b
Sex				
Female	245 (67.9)	57 (65.5)	113 (98.3)	<0.0001
Age				
Under 35	56 (15.5)	21 (24.1)	18 (15.7)	0.006
35-44	98 (27.1)	31 (35.6)	38 (33.0)	
45-54	96 (26.6)	21 (24.1)	17 (14.8)	
55+	111 (30.7)	14 (16.1)	42 (36.5)	
Race/ethnicity				
Non-Hispanic white	302 (83.7)	78 (89.7)	103 (89.6)	0.21
Other ^c	52 (14.4)	8 (9.2)	11 (9.6)	
Provider level				
Physician	310 (85.9)	73 (83.9)	N/A	<0.0001
APP	51 (14.1)	14 (16.1)	115 (100.0)	
Earned license				
1994 or earlier	122 (33.8)	11 (12.6)	18 (15.7)	<0.0001
1995-2004	103 (28.5)	24 (27.6)	38 (33.0)	
2005 or later	136 (37.7)	52 (59.8)	59 (51.3)	
Practice setting ^d				
Group/solo practice	259 (71.7)	50 (57.5)	59 (51.3)	<0.0001
Hospital	116 (32.1)	18 (20.7)	34 (29.6)	0.11
Academic	59 (16.3)	22 (25.3)	19 (16.5)	0.14
Other ^e	58 (16.1)	23 (26.4)	49 (42.6)	<0.0001
% Medicaid patients				
Up to half	197 (54.6)	42 (48.3)	34 (29.6)	<0.0001
Half or more	160 (44.3)	45 (51.7)	81 (70.4)	
Urban/rural location				
Large metro	131 (36.3)	20 (23.0)	40 (34.8)	0.008
Small metro	164 (45.4)	36 (41.4)	52 (45.2)	
Micropolitan or rural	62 (17.2)	29 (33.3)	20 (17.4)	

Abbreviations: APP, advanced practice provider; N/A, not applicable.

^aMany columns do not add to 100% due to data missingness.

^bFrom chi-square test of homogeneity.

^cIncludes Hispanic, non-Hispanic black, non-Hispanic Asian, non-Hispanic American Indian/Alaska native, non-Hispanic Hawaiian /Pacific Islander, non-Hispanic "other."

^dBecause this was a "check all that apply" item, multiple chi-square values and percentages exceed 100. "Other" includes Planned Parenthood, other family planning clinic, health maintenance organization or managed care organization (HMO), federally qualified health centers, and "other."

^eIncludes Planned Parenthood, other family planning clinic, HMO/managed care, federally qualified health centers, and "other."

^fOnly accounts for the first of up to 2 counties listed (N=103 listed a second county of practice).

contraception, specifically the utilization of LARC. Only those who answered "Yes" to the following specific questions were asked the final questions regarding progesterone supplementation, which generated the data analyzed for this study:

- "During the past 12 months, have you either provided prenatal care to patients or delivered babies?"
- "During the past 12 months, have you personally prescribed or made a referral for any of your pregnant patients to receive any type of progesterone supplementation to prevent preterm birth?"

The general survey questions included provider demographic characteristics (ie, sex, age, and race) practice location, and provider specialty. Questions were asked regarding scope of practice around contraception and prenatal care, including provision of progesterone supplementation for preterm birth prevention. In addition, providers were asked to indicate the setting(s) in which they practice (eg, hospital, academic medical center, private practice). The 6 geographic categories from the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties were collapsed into 3 groups: large metropolitan, small metropolitan, and rural/micropolitan.¹⁹

The prenatal and/or obstetrical care providers who responded "yes" to prescribing or referring pregnant patients for any type of progesterone supplementation to prevent preterm birth were asked about the specific formulations of progesterone (Makena, compounded, vaginal progesterone, or oral progesterone) prescribed to prevent preterm birth. They also were asked to indicate any patient- or system-level barriers they encountered specifically regarding the use of compounded 17OHP-C or Makena, such as late presentation to care, lack of patient interest, medication cost, preauthorization requirements, and on-site availability of medication.

Those with APP credentials were grouped with physicians in their specialty (OB and family medicine) when their practice was similar. Midwives constituted their own group because of their independent practice. For analysis of barriers to use, we grouped Makena and compounded 17OHP-C together as "any 17OHP-C." Barriers to 17OHP-C provision were assessed on a Likert scale, with the responses "not at all," "a little," "somewhat," "quite a bit," and "a great deal." The responses were dichotomized, with "quite a bit" and "a great deal" representing a substantial barrier.

Data Analysis

Because providers' likelihood of being sampled varied by their specialty, most results were stratified by specialty. The percentage of providers reporting referral or prescribing of progesterone in their practice for the prevention of preterm birth, the type of progesterone prescribed, and barriers specific to prescribing any 17OHP-C are described. Differences in group responses were assessed using chi-square tests for homogeneity followed by post hoc tests of proportions to detect significant pairwise differences. Where noted, analyses were restricted to prescribers of any progesterone due to substantial missing data on key items among nonprescribers. A P-value of <0.05 was considered statistically significant. All analyses were performed with STATA version 15.0 (College Station, Texas).

RESULTS

The overall survey response rate was 56.5% (n=1,661), with 59.7% of OB providers, 53.2% of family medicine, and 65.5% of midwife providers responding. Of the 563 providers who reported providing prenatal or obstetrical care, 64.1% practiced in OB

(n=361), 15.5% (n=87) in family medicine, and 20.4% (n=115) as midwives.

Table 1 shows demographic and other characteristics of survey respondents by specialty. Age, provider level, year of licensure, urban-rural classification of practice location, and percentage of Medicaid patients varied by specialty (all $P < .01$). Family medicine providers tended to be younger and were more likely to practice in micropolitan/rural areas than OB or midwife providers. OB providers were more likely to have been licensed in 1994 or earlier compared with family medicine and midwife providers, who were more likely to have been licensed in 2005 or later.

As shown in Table 2, 87.4% of OB providers (92.5% of physicians and 56.0% of APPs), 31.4% of family medicine providers, and 72.6% of midwife providers (all pairwise specialty differences $P < .001$) report prescribing at least 1 type of progesterone within the past 12 months for the prevention of preterm birth. An additional 4.9% of providers (n=27) reported having referred patients for progesterone for preterm birth prevention in the past year but did not personally prescribe it, with no differences by specialty. A greater proportion of midwife providers (10.6%) compared with those in OB (2.8%) referred patients for progesterone supplementation but did not prescribe it themselves ($P = .0006$). The total sample size among provider types is slightly lower than in Table 1 because 7 providers (4 OB, 1 family medicine, and 2 midwife) did not answer the question pertinent to the data in this table.

Among providers who reported prescribing at least 1 type of progesterone, the type prescribed differed by specialty. Most OB providers reported personally prescribing any 17OHP-C, versus family medicine and midwife providers (98.1% vs 77.8% and 80.5%, respectively; both $P < .0001$). In contrast, a greater proportion of family medicine and midwife providers reported prescribing oral progesterone than OB providers (40.7% and 24.4%, respectively, vs 13.1%; both $P < .05$). Overall, 62.5% of providers prescribed vaginal progesterone, with no differences by specialty ($P = .61$). (See Table 2.)

Makena was more commonly prescribed by OB providers than by family medicine and midwife providers (76.9% vs 51.9% and 52.4%; both $P < .01$); and the compounded formulation was prescribed more often by OB providers and midwives than by family medicine providers (64.4% and 63.4% vs 37.0%, respectively; both $P < .05$). Among providers who prescribed any 17OHP-C, about 90% of those in OB and family medicine reported that “most” or “almost all” of their patients completed the full course of therapy, compared to 77.3% of midwife prescribers.

Associations between urban-rural classification and prescription of vaginal and oral progesterone varied by specialty. Among

Table 2. Types of Progesterone Prescribed by Wisconsin Prenatal/Delivery Providers Reporting Prescribing 1 or More Type, by Provider Specialty, n (%), 2015

Among All Prenatal Delivery Providers	Obstetrics N=357	Family Medicine N=86	Midwifery N=113	P-value ^a
Any progesterone	312 (87.4%)	27 (31.4%)	82 (72.6%)	<.0001
Refer only	10 (2.8%)	5 (5.8%)	12 (10.6%)	.003
Among Providers Who Prescribe at Least 1 Form of Progesterone	Obstetrics N=312	Family Medicine N=27	Midwifery N=82	P-value ^a
Any 17OHP-C	306 (98.1%)	21 (77.8%)	66 (80.5%)	<.0001
Makena	240 (76.9%)	14 (51.9%)	43 (52.4%)	<.0001
Compounded 17OHP-C	201 (64.4%)	10 (37.0%)	52 (63.4%)	<.0001
Vaginal Progesterone	192 (61.5%)	16 (59.3%)	55 (67.1%)	.61
Oral Progesterone	41 (13.1%)	11 (40.7%)	20 (24.4%)	<.0001

^aFrom chi-square test of homogeneity.

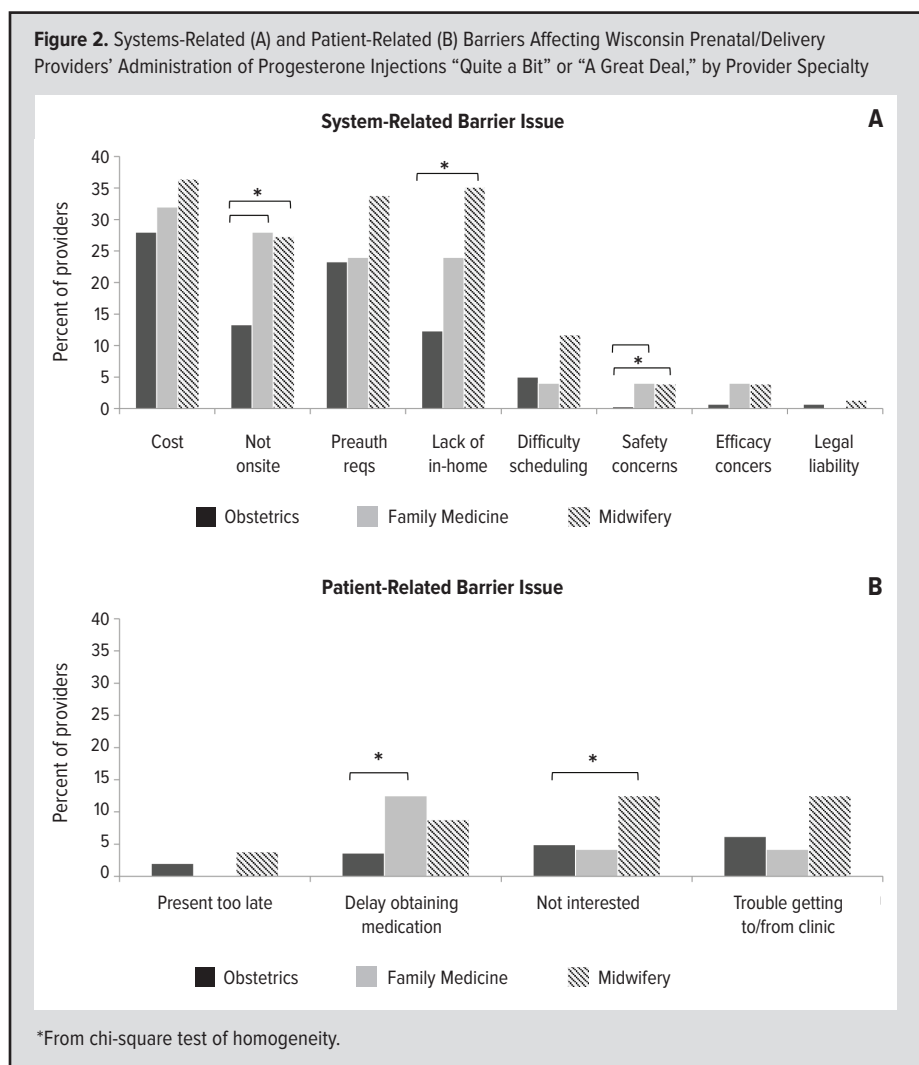
OB and midwife providers, a greater proportion practicing in micropolitan/rural areas prescribed oral progesterone (29.6% and 53.3%) than those in small metropolitan areas (10.0% and 12.1%) and large metropolitan areas (9.5% and 24.2%; all $P < .05$). Among OB providers only, prescription of vaginal progesterone was more common in large metro areas than micropolitan/rural areas (70.7% vs 46.3%, $P = .002$).

Figure 2 shows reported system- and patient-related barriers to the provision of 17OHP-C injections by provider specialty, among prescribers who responded (either positively or negatively) to at least 1 patient-related barriers item (97.4%) or 1 systems-related barriers item (95.5%). Medication cost was the most common systems-related barrier, reported by 29.9% of providers with no differences by specialty ($P = .35$). About one-quarter of OB (23.3%) and family medicine (24.0%) providers and one third of midwives (33.8%) reported challenges with preauthorization requirements. Though uncommon, safety concerns were more common among family medicine and midwife providers than OB providers (3% each vs 0.05%). Fewer than 5% of providers in every specialty group reported legal or efficacy concerns. Patient-level barriers were less common than system-level barriers. Overall, OB providers tended to report fewer patient-related barriers than family medicine and midwife providers.

DISCUSSION

We aimed to explore utilization and barriers to 17OHP-C amongst prenatal care providers in Wisconsin to identify opportunities to improve its utilization and impact rising preterm birth rates. Through a statewide survey of prenatal care providers, we found most OB and midwife providers report having prescribed or referred patients for progesterone to prevent preterm birth during the prior year, while family medicine providers were significantly less likely to have done so. Furthermore, there were significant differences in the both the formulation of 17OHP-C prescribed by the type of provider practice and their reliance on referral by provider specialty.¹⁰ In general, prescribing injectable progesterone was more common among OB and midwife providers than fam-

Figure 2. Systems-Related (A) and Patient-Related (B) Barriers Affecting Wisconsin Prenatal/Delivery Providers' Administration of Progesterone Injections "Quite a Bit" or "A Great Deal," by Provider Specialty



ily medicine; OB providers also prescribed Makena more often. In contrast, more family medicine providers and midwives prescribed oral progesterone, a difference potentially explained by a micropolitan or rural practice location. System-level barriers were reported most often among midwives, and few providers surveyed reported safety concerns.

The high rate of prescribing progesterone among OB providers in our survey is similar to the findings of other previous studies, in which 67% of board-certified maternal-fetal medicine specialists¹³ and 80% of obstetricians recommended progesterone use.¹⁶ Our study adds to this literature, providing estimates of use among prenatal care providers from other specialties. Most importantly, APPs from any specialty (56%) and family medicine (31.4%) were significantly less likely to prescribe progesterone for preterm birth prevention. This finding could be related to a perception that women with a prior preterm birth are “high risk” and elect to see or are referred to an OB provider to receive 17OHP-C, due to the typical practice pattern wherein most midwife and family medicine providers take “low-risk patients” in their practice.

To our knowledge, this is the first survey to assess choice of

progesterone preparation by specialty. In general, injectable progesterone was prescribed more commonly by OB and midwife providers than family medicine; OB providers also prescribed Makena more often. A prior survey assessed types of progesterone prescribed by OB providers and, similar to our study, most were more comfortable prescribing Makena due to the FDA approval.¹² We did not detect a difference in the reported prescription of vaginal progesterone across specialties; however, the prescription patterns suggest providers in large metropolitan areas were more likely to prescribe vaginal progesterone over other types. We did not assess the reasons providers prescribed vaginal progesterone or injectable progesterone. However, we speculate providers in large metropolitan areas may be more likely to prescribe vaginal progesterone due to underlying differences in the patient demographics, when patients present to care, differences in cervical length surveillance protocols and/or identification of a short cervix by ultrasound, lower health care costs, and ease of patient self-administration. The OB providers in our survey reported much less oral progesterone prescription, however family medicine providers were twice as likely to utilize oral progesterone. The efficacy of

oral progesterone has not been well established and is considered inferior to the use of either intramuscular injections or vaginal formulations.^{20,21}

Our survey also aimed to understand the barriers providers face to implementing current recommendations for recurrent preterm birth prevention specifically associated with prescribing 17OHP-C. Patient- and system-related barriers were reported more frequently by family medicine and midwife providers than OB providers. Furthermore, providers practicing in rural areas, where there may be fewer health care resources, appear to choose alternative progesterone formulations. Together, these factors may lead providers to navigate the barriers as best as possible, despite being unable to follow best practice guidelines.

Similar to our findings, the most common reasons for failure to prescribe and/or administer progesterone reported in the literature are financial and logistical barriers, such as lack of insurance and/or medication cost.^{16,17} In addition, patient-level barriers, such as women presenting late to care, declining progesterone treatment, or compliance failure also may contribute to decreased utilization of 17OHP-C.¹²

This study has important limitations. The subset of providers who responded to the survey may not be representative of those surveyed, and recall or desirability bias among providers may influence their reporting of perceived instead of actual practice. We were unable to survey all family medicine providers in Wisconsin due to budget constraints; however, we feel we had an adequate sampling of all provider groups to provide representation of the provider types and practice patterns. Furthermore, generalizability outside of Wisconsin may be limited by the differences in provider, practice, and patient populations. Finally, though we sampled providers across specialties, we cannot estimate the impact of these differences in actual practice, the percentage of inappropriately treated women, or the percentage of eligible women who were not receiving progesterone for the prevention of preterm birth according to the recommendations of ACOG and others.

CONCLUSION

Our findings have important implications in identifying opportunities to improve 17OHP-C utilization for prevention of preterm birth, as we believe this is the first survey to compare the differences amongst OB, family medicine, and midwife prenatal care providers and the types of progesterone they prescribe. Despite prior studies and guidelines,¹⁰ adequate translation of 17OHP-C administration to all women at risk of recurrent preterm birth into clinical practice requires provider knowledge of recommendations as well as the reduction of provider-level, patient-level, and system-level barriers.

Our study suggests that further studies are needed to better understand decision-making patterns for prevention of preterm birth and to develop tools to assist providers in adhering to evidence-based guidelines when selecting treatment for women with a history of preterm birth. Educational initiatives to improve the translation of clinical evidence into practice with the support of clear guidelines and decision-support tools are essential in providing equitable and effective preterm birth prevention to all women.

Acknowledgements: We would like to acknowledge Emma Davis for her editing and revision work on the manuscript and Wisconsin providers for their contribution to the data.

Funding/Support: Funding for this project was provided by the Wisconsin Department of Health Services, and the University of Wisconsin School of Medicine and Public Health from the Wisconsin Partnership Program and the Department of Obstetrics and Gynecology.

Financial Disclosures: None declared.

REFERENCES

1. Hamilton BE, Minino AM, Martin JA, Kochanek KD, Strobino DM, Guyer B. Annual summary of vital statistics: 2005. *Pediatrics*. 2007;119(2):345-360. doi:10.1542/peds.2006-3226

2. Preterm Birth. Centers for Disease Control and Prevention website. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>. Reviewed July 23, 2019. Accessed October 1, 2019.
3. Martin JA, Hamilton BE, Osterman MJ. Births in the United States, 2013. *NCHS Data Brief*. 2014;(175):1-8.
4. Adams MM, Elam-Evans LD, Wilson HG, Gilbertz DA. Rates of and factors associated with recurrence of preterm delivery. *JAMA*. 2000;283(12):1591-1596. doi:10.1001/jama.283.12.1591
5. Meis PJ, Klebanoff M, Thom E, et al. Prevention of recurrent preterm delivery by 17 alpha-hydroxyprogesterone caproate. *N Engl J Med*. 2003;348(24):2379-2385. doi:10.1056/NEJMoa035140
6. da Fonseca EB, Bittar RE, Carvalho MH, Zugai M. Prophylactic administration of progesterone by vaginal suppository to reduce the incidence of spontaneous preterm birth in women at increased risk: a randomized placebo-controlled double-blind study. *Am J Obstet Gynecol*. 2003;188(2):419-424. doi:10.1067/mob.2003.41
7. Romero R, Nicolaides KH, Conde-Agudelo A, et al. Vaginal progesterone decreases preterm birth \leq 34 weeks of gestation in women with a singleton pregnancy and a short cervix: an updated meta-analysis including data from the OPPTMUM study. *Ultrasound Obstet Gynecol*. 2016;48(3):308-317. doi:10.1002/uog.15953
8. American College of Obstetricians and Gynecologists. Practice bulletin no. 130: prediction and prevention of preterm birth. *Obstet Gynecol*. 2012;120(4):964-973. doi:10.1097/AOG.0b013e3182723b1b
9. Society for Maternal-Fetal Medicine Publications Committee. Progesterone and preterm birth prevention: translating clinical trials data into clinical practice. *Am J Obstet Gynecol*. 2012;206(5):376-386. doi:10.1016/j.ajog.2012.03.010
10. Society for Maternal-Fetal Medicine Publications Committee. The choice of progesterone for the prevention of preterm birth in women with singleton pregnancy and prior preterm birth. *Am J Obstet Gynecol*. 2017;216(3):B11-B13. doi:10.1016/j.ajog.2017.01.022
11. Reichmann JP. Makena or Compounded 17P? *P T*. 2012;37(9):487.
12. Rebarber A, Fox N, Klausner CK, Saltzman D, Roman AS. A national survey examining obstetrician perspectives on use of 17-alpha hydroxyprogesterone caproate post-US FDA approval. *Clin Drug Invest*. 2013;33(8):571-577. doi:10.1007/s40261-013-0099-4
13. Stringer EM, Vladutiu CJ, Manuck T, et al. 17-Hydroxyprogesterone caproate (17OHP-C) coverage among eligible women delivering at 2 North Carolina hospitals in 2012 and 2013: a retrospective cohort study. *Am J Obstet Gynecol*. 2016;215(1):105.e1-e12. doi:10.1016/j.ajog.2016.01.180
14. Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. *Ultrasound Obstet Gynecol*. 2008;31(5):579-587. doi:10.1002/uog.5323
15. Turitz AL, Bastek JA, Purisch SE, Elovitz MA, Levine LD. Patient characteristics associated with 17-alpha-hydroxyprogesterone caproate use among a high-risk cohort. *Am J Obstet Gynecol*. 2015;214(4):536.e1-e5. doi:10.1016/j.ajog.2015.10.148
16. Ness A, Dias T, Damus K, Burd I, Berghella V. Impact of the recent randomized trials on the use of progesterone to prevent preterm birth: a 2005 follow-up survey. *Am J Obstet Gyn*. 2006;195(4):1174-1179. doi:10.1016/j.ajog.2006.06.034
17. Sibai BM, Istwan NB, Palmer B, Stanziano GJ. Pregnancy outcomes of women receiving compounded 17 alpha-hydroxyprogesterone caproate for prophylactic prevention of preterm birth 2004 to 2011. *Am J Perinatol*. 2012;29(8):635-642. doi:10.1055/s-0032-1311979
18. Kozhimannil KB, Fontaine P. Care from family physicians reported by pregnant women in the United States. *Ann Fam Med*. 2013;11(4):350-354. doi:10.1370/afm.1510
19. Ingram DD, Franco SJ. 2013 NCHS Urban-Rural Classification Scheme for Counties. *Vital Health Stat 2*. 2014;(166):1-73.
20. How HY, Sibai BM. Progesterone for the prevention of preterm birth: indications, when to initiate, efficacy and safety. *Ther Clin Risk Manag*. 2009;5(1):55-64.
21. Glover MM, McKenna DS, Downing CM, Smith DB, Croom CS, Sonek JD. A randomized trial of micronized progesterone for the prevention of recurrent preterm birth. *Am J Perinatol*. 2011;28(5):377-381. doi:10.1055/s-0031-1274509

advancing the art & science of medicine in the midwest

WMJ

WMJ (ISSN 1098-1861) is published through a collaboration between The Medical College of Wisconsin and The University of Wisconsin School of Medicine and Public Health. The mission of *WMJ* is to provide an opportunity to publish original research, case reports, review articles, and essays about current medical and public health issues.

© 2019 Board of Regents of the University of Wisconsin System and The Medical College of Wisconsin, Inc.

Visit www.wmjonline.org to learn more.