

## ORIGINAL RESEARCH

# Multi-morbidity and Highly Effective Contraception in Reproductive-Age Women in the US Intermountain West: a Retrospective Cohort Study

Lori M. Gawron, MD, MPH<sup>1</sup>, Jessica N. Sanders, PhD, MSPH<sup>1</sup>, Katherine Sward, PhD, RN<sup>2,3</sup>, Azadeh E. Poursaid, PhD<sup>4</sup>, Rebecca Simmons, PhD<sup>1</sup>, and David K. Turok, MD, MPH<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, University of Utah School of Medicine, Salt Lake City, UT, USA; <sup>2</sup>College of Nursing, University of Utah, Salt Lake City, UT, USA; <sup>3</sup>Department of Biomedical Informatics, University of Utah, Salt Lake City, UT, USA; <sup>4</sup>School of Medicine, University of Utah, Salt Lake City, UT, USA.



**BACKGROUND:** Women with chronic health conditions benefit from reproductive planning and access to highly effective contraception.

**OBJECTIVE:** To determine the prevalence of and relationship between chronic health conditions and use of highly effective contraception among reproductive-age women.

**DESIGN:** Retrospective cohort study using electronic health records.

**PARTICIPANTS:** We identified all women 16–49 years who accessed care in the two largest health systems in the US Intermountain West between January 2010 and December 2014.

**MAIN MEASURES:** We employed administrative codes to identify highly effective contraception and flag chronic health conditions listed in the US Medical Eligibility Criteria for Contraceptive Use (US MEC) and known to increase risk of adverse pregnancy outcomes. We described use of highly effective contraception by demographics and chronic conditions. We used multinomial logistic regression to relate demographic and disease status to contraceptive use.

**KEY RESULTS:** Of 741,612 women assessed, 32.4% had at least one chronic health condition and 7.3% had two or more chronic conditions. Overall, 7.6% of women with a chronic health condition used highly effective contraception vs. 5.1% of women without a chronic condition. Women with chronic conditions were more likely to rely on public health insurance. The proportion of women using long-acting reversible contraception did not increase with chronic condition number (5.8% with 1 condition vs. 3.2% with 5 or more). In regression models adjusted for age, race, ethnicity, and payer, women with chronic conditions were more likely than those without chronic conditions to use highly effective contraception (aRR 1.4; 95% CI 1.4–1.5). Public insurance coverage was associated with both use of long-acting reversible contraception (aRR 2.2; 95% CI 2.1–2.3) and permanent contraception (aRR 2.9; 95% CI 2.7–3.1).

**CONCLUSIONS:** Nearly a third of reproductive-age women in a regional health system have one or more chronic health condition. Public insurance increases the likelihood that women with a chronic health condition use highly effective contraception.

**KEY WORDS:** contraception; chronic disease; LARC; public insurance; multi-morbidity.

J Gen Intern Med 35(3):637–42

DOI: 10.1007/s11606-019-05425-5

© Society of General Internal Medicine 2019

## INTRODUCTION

In the United States (U.S.), the prevalence of chronic health conditions and multi-morbidity are increasing, in part due to high rates of obesity and increased longevity for individuals with chronic conditions.<sup>1</sup> This change in overall prevalence, along with the increasing age at first childbirth, contributes to maternal morbidity and mortality.<sup>2–5</sup> Even when well controlled, maternal chronic health conditions can increase the risk of adverse outcomes during pregnancy.<sup>4, 6</sup> Nearly half of all pregnancies in the U.S. are unintended.<sup>7</sup> Pregnancy intention is an independent risk factor for preterm birth, low-birth-weight infants, and other adverse physical and mental childhood health outcomes.<sup>8–11</sup> Consistent and correct use of contraception effectively prevents unintended pregnancy and allows women to optimize their health prior to pregnancy.<sup>7</sup> Unfortunately, women with chronic health conditions have greater risk for unintended pregnancy than healthy women,<sup>12</sup> in addition to increased risk of adverse maternal and neonatal outcomes related to their condition.<sup>13</sup> Contraceptive safety is a central concern for women and medical providers. The Centers for Disease Control published valuable practice guidelines called the U.S. Medical Eligibility Criteria for Contraceptive Use (US MEC) to support healthcare providers in making the safest recommendations of contraceptive methods for women with specific medical or reproductive characteristics. The US MEC lists over 200 health condition and ranks the safety of use of estrogen-based methods (pills, patches, or rings), short-acting progestin-only methods (pills or injectable), and long-acting reversible contraceptives

**Prior presentations** Some of this information was presented as a poster and published abstract at the North American Forum on Family Planning in Denver, CO, November 2016.

Received September 13, 2018

Revised April 20, 2019

Accepted August 23, 2019

Published online November 7, 2019

**Table 1 Characteristics of Reproductive-Age Women Who Accessed the Intermountain West Healthcare Systems between 2010 and 2014, by Chronic Disease Status**

Variable	Healthy cohort: <i>n</i> (%) <i>n</i> = 501,129 (100%)	Chronic disease cohort: <i>n</i> (%) <i>n</i> = 240,483 (100%)	Pearson chi-2 ( <i>p</i> value)
Age			
16–24	176,528 (35.2)	42,306 (17.6)	< 0.001
25–34	165,042 (32.9)	72,163 (30.0)	
35–44	106,470 (21.2)	71,863 (29.9)	
45–49	53,089 (10.6)	54,151 (22.5)	
Race			
White	387,369 (77.3)	202,670 (84.3)	< 0.001
Black	5,821 (1.7)	2,637 (1.1)	
Asian	6,296 (1.3)	1,174 (0.5)	
AI/AN	3,294 (0.7)	1,958 (0.8)	
Pacific Islander	4,189 (0.8)	1,629 (0.7)	
Other/multi	12,555 (2.5)	6,463 (2.7)	
Hispanic ethnicity	81,605 (16.3)	23,952 (10.0)	
Payer type			
Public	59,224 (11.8)	41,484 (17.4)	< 0.001
Private	317,737 (63.1)	153,317 (64.5)	
Self-pay/none	92,060 (18.3)	35,239 (14.8)	
Missing	34,760 (6.7)	7,791 (3.3)	
Religious payer	11,257 (2.3)	4,394 (1.8)	

AI/AN = American Indian/Alaskan Native; public payer = Medicaid, Medicare, jail/prison contracts; *p* value < 0.05 is significant

(LARC), such as intrauterine devices (IUDs) and contraceptive implants. LARC methods are the most effective (e.g., < 1% failure rate vs. 8% failure with pills) and safest contraceptives for the majority of women, as they are not estrogen-based.<sup>14</sup> The US MEC recommends LARC as first-line reversible contraceptives for women with chronic health conditions in which an unintended pregnancy would pose unacceptable risks.<sup>14</sup> Alternatively, for women who do not desire future fertility, permanent contraceptive (PC) options have included tubal ligation (< 1% failure rate) and hysteroscopic sterilization.

Reproductive-age women are more likely to seek routine care from a general medical provider than from an obstetrician gynecologist.<sup>15</sup> Unfortunately, many women with chronic health conditions receive misinformation regarding contraceptive safety. Limited attention to the reproductive health needs of women with chronic conditions<sup>16</sup> may lead to disease-related disparities in LARC and PC use.<sup>17, 18</sup>

A recent study of commercially insured women estimated that 12.1% of U.S. reproductive-age women had at least one of the chronic conditions listed by the US MEC for which LARC is recommended, yet use of either LARC or PC was low.<sup>18</sup> As contraceptive access can be more challenging for women without commercial insurance, we sought to determine the prevalence of and relationship between chronic health conditions and use of LARC and PC among reproductive-age women in a regional, mixed-payer health system.

## METHODS

We conducted a retrospective cohort study utilizing the University of Utah Health Care (UUHC) and Intermountain Healthcare (IHC) Data Warehouses. The Utah Population Database (UPDB) served to aggregate all inpatient, outpatient,

and ambulatory surgery billing codes across institutions. UUHC and IHC provide care to > 85% of the state population and are regional, tertiary care centers for the Intermountain West, which accounts for ~ 10% of the U.S. land mass. The UUHC and IHC Institutional Review Boards approved this study.

We included all women, ages 16–49 years, with any encounter type at either UUHC or IHC occurring between January 2010 and December 2014. The study group included women with one or more chronic health condition known to increase the risk of adverse outcomes in the setting of an unintended pregnancy<sup>14</sup> and conditions that are more prevalent among reproductive-age women than in men and can be impacted by pregnancy, such as depression, asthma, obesity, and autoimmune diseases.<sup>5</sup> The investigative team identified chronic health conditions via *International Classification of Diseases, Ninth Revision (ICD-9)* codes. We included chronic condition diagnoses that occurred at any time from 1996 to 2014 (based on data warehouse limitations), but contact with the health system in 2010–2014 was required for study eligibility. No minimum number of visits was required for inclusion, except in defining the study population with chronic disease. Study subjects identified as chronic-condition prevalent cases must have the same diagnosis coded at least twice, with a minimum interval of 30 days, to avoid false positives from coding error. We confirmed first date of diagnosis whenever possible, especially for chronic conditions associated with time (e.g., bariatric surgery or solid organ transplant within the past 2 years). We completed a manual chart review on a random sample of 2% of the study group to narrow or refine specific diagnosis codes for final cohort inclusion. For example, chart reviews found the code listed for bariatric surgery was also used for other, non-weight loss indications. In response, we required both an obesity code and the surgical procedure code to identify the bariatric surgery cohort.

**Table 2 Prevalence of Chronic Health Conditions and Use of Long-Acting Reversible or Permanent Contraception by Women Who Accessed the Intermountain West Healthcare Systems Between 2010 and 2014**

Chronic health condition	Condition prevalence* N = 741,612 n (%)	No long-acting/permanent contraception n (%)	LARC n (%)	Sterilization n (%)	Hysterectomy n (%)
Depression	111,279 (15.0)	100,445 (90.3)	7,103 (6.4)	2,422 (2.2)	1,309 (1.2)
Asthma	56,872 (7.7)	51,942 (91.4)	3,042 (5.4)	1,208 (2.1)	635 (1.1)
Obesity	55,433 (7.5)	48,047 (89.9)	2,981 (5.6)	1,627 (3.0)	778 (1.5)
Thyroid diseases	50,347 (6.8)	46,085 (91.5)	2,426 (4.8)	1,073 (2.1)	763 (1.5)
Hypertension	44,533 (6.0)	41,309 (92.8)	1,532 (3.4)	879 (2.0)	813 (1.8)
Diabetes	23,267 (3.1)	21,778 (93.6)	723 (3.1)	422 (1.8)	344 (1.5)
Solid organ transplant <sup>†</sup>	10,414 (1.4)	9,663 (92.8)	410 (3.9)	204 (2.0)	137 (1.3)
Bariatric surgery <sup>†</sup>	9,350 (1.3)	8,622 (92.2)	374 (0.4)	208 (2.2)	146 (1.6)
Moderate pregnancy risk cardiac disease <sup>‡</sup>	9,305 (1.3)	8,555 (91.9)	398 (4.3)	218 (2.3)	134 (1.4)
Epilepsy	8,936 (1.2)	8,347 (93.4)	340 (3.8)	164 (1.8)	85 (1.0)
High pregnancy risk cardiac disease <sup>§</sup>	6,168 (0.8)	5,786 (93.8)	180 (2.9)	105 (1.7)	97 (1.6)
Severe cirrhosis	6,031 (0.8)	5,689 (94.3)	177 (2.9)	87 (1.4)	78 (1.3)
GYN malignancy	4,557 (0.6)	4,222 (92.7)	212 (4.7)	37 (0.8)	86 (1.9)
Breast malignancy	4,313 (0.6)	4,021 (93.2)	101 (2.3)	55 (1.3)	136 (3.2)
IBD	3,143 (0.4)	2,910 (92.6)	131 (4.2)	72 (2.3)	30 (1.0)
Rheumatoid arthritis	3,195 (0.4)	2,944 (92.1)	125 (3.9)	56 (1.8)	70 (2.2)
Stroke	3,237 (0.4)	3,021 (93.3)	126 (3.9)	55 (1.7)	35 (1.1)
SLE	2,959 (0.4)	2,728 (92.2)	129 (4.4)	63 (2.1)	39 (1.3)
Thrombogenic Mutations	2,583 (0.4)	2,210 (85.6)	245 (9.5)	94 (3.6)	34 (1.3)
HIV/AIDS	1,793 (0.2)	1,631 (91.0)	95 (5.3)	49 (2.7)	18 (1.0)
Malignant liver tumor	767 (0.1)	726 (95.0)	19 (2.5)	4 (0.5)	18 (2.3)
Sickle cell disease	536 (0.1)	480 (89.6)	30 (5.6)	15 (2.8)	11 (2.1)
Malignant GTD	389 (0.1)	344 (88.4)	29 (7.5)	14 (3.6)	2 (0.5)
Tuberculosis	104 (0.0)	98 (94.2)	4 (3.8)	1 (1.0)	1 (1.0)
Schistosomiasis	18 (0.0)	17 (94.4)	1 (5.6)	0 (0)	0 (0)

LARC = long-acting reversible contraception (IUD = intrauterine devices and implants); IBD = inflammatory bowel diseases; HIV/AIDS = human immunodeficiency virus/acquired immune deficiency syndrome; GYN Cancer = ovarian or endometrial; GTD = malignant gestational trophoblastic disease; SLE = systemic lupus erythematosus

\*Column 1 reports proportion of women with the chronic health condition in the entire cohort (column percent). The remainder of the columns report the proportion of women within each chronic condition who use LARC, PC, or neither (row percent)

<sup>†</sup>Within 2 years of study timeframe

<sup>‡</sup>Moderate pregnancy risk cardiac disease categories as defined by the CDC US MEC: Repaired Tetralogy of Fallot, arrhythmias, mild left ventricular dysfunction, moderate native valve disease, and mild aortic root dissection

<sup>§</sup>High pregnancy risk cardiac disease categories as defined by the CDC US MEC to include both "other" and "pregnancy contraindicated" conditions, including myocardial infarction, coronary artery disease, prosthetic mechanical valve, complex congenital heart diseases, aortic root dissection > 4 cm, peripartum cardiomyopathy, NYHA class III or IV, severe pulmonary hypertension, and severe valvular disease with heart failure

We used ICD-9 and Current Procedural Terminology (CPT®) codes for IUD and contraceptive implant device insertion, surveillance, removal, and exchange, as well as related device orders and current and historical medication records to identify LARC use within the 5-year 2010–2014 capture frame. We considered LARC "use" as an outcome, rather than limiting to "insertion." Differing LARC devices are FDA approved for use for 3–12 years and may be managed at other facilities or family planning clinics; thus, all events related to care may not be captured within a health system, due to insurance changes or lack of coverage. CPT® codes flagged tubal sterilization and hysterectomy procedures, including procedure dates at any time from 1996 to 2014. While recognizing that hysterectomy is not done for contraceptive purposes, we identified these women as no longer at risk for unintended pregnancy.<sup>19</sup> Women with a code for sterilization or hysterectomy were excluded from the LARC cohort when analyzed separately, even if they received a LARC method post-procedure for non-contraceptive benefits.

We summarized descriptive characteristics with frequencies and proportions and conducted chi-square tests for comparisons within groups, stratifying by presence or absence of

chronic health conditions. We used multinomial logistic regression to relate demographic and disease status to LARC use, sterilization, and hysterectomy. We report relative-risk ratios with robust standard errors in the adjusted models, controlling for age, insurance, race, and ethnicity. We set the significance threshold at  $p < 0.05$ , flagged the level of on each variable, and defined them in the table footnote. We used Stata 15 to conduct all analyses.

## RESULTS

A total of 741,612 reproductive-age women accessed care at UUHC and/or IHC between 2010 and 2014. Of these women, 32.4% ( $n = 240,483$ ) had at least one chronic health condition (Table 1). Women with chronic conditions had greater likelihood of being older, non-Hispanic, and White and having public insurance. Women with chronic health conditions had greater likelihood of having a hysterectomy (1.2 vs. 0.4%,  $p < 0.001$ ) or tubal sterilization (2.2 vs. 1.1%,  $p < 0.001$ ), compared to healthy women. Women with a chronic condition were more likely to use an IUD (4.9% vs 3.7%,  $p < 0.001$ ) and

**Table 3 Effect of Number of Chronic Conditions on Use of Highly Effective Contraception Among Reproductive-Age Women in the Intermountain West Healthcare Systems Between 2010 and 2014**

Number of chronic conditions						
Total cohort = 741,612						
n (%)						
Variable	0	≥ 1	≥ 2	≥ 3	≥ 4	≥ 5
Age						
16–34	341,570 (68.2)	79,941 (55.6)	22,917 (42.6)	7,268 (31.8)	2,586 (24.3)	1,757 (18.5)
35–49	159,559 (31.8)	63,735 (44.4)	30,907 (57.4)	15,590 (68.2)	8,049 (75.7)	7,733 (81.5)
Payer type						
Public	14,124 (11.6)	6,609 (15.1)	3,728 (19.6)	2,087 (23.7)	1,297 (28.4)	1,873 (40.8)
Private	78,611 (64.4)	28,863 (65.8)	12,103 (63.5)	5,290 (60.2)	2,565 (56.2)	2,143 (46.4)
Self/none	29,323 (24.0)	8,387 (19.1)	3,216 (16.9)	1,412 (16.1)	700 (15.3)	587 (12.8)
Contraceptive method						
No LARC/PC	474,021 (94.6)	131,182 (91.3)	48,794 (90.7)	20,799 (91.0)	9,794 (92.1)	8,827 (93.0)
LARC	20,076 (4.0)	8,284 (5.8)	2,963 (5.5)	1,094 (4.8)	423 (4.0)	307 (3.2)
Sterilization	5,346 (1.1)	2,908 (2.0)	1,326 (2.5)	577 (2.5)	213 (2.0)	178 (1.9)
Hysterectomy	1,686 (0.3)	1,302 (0.9)	741 (1.4)	388 (1.7)	205 (1.9)	178 (1.9)
Multivariable model* assessing probability of highly effective contraceptive use by number of chronic conditions aRR (95% CI)						
Contraceptive method						
LARC	Ref	1.48 (1.44,1.52)	1.47 (1.41,1.54)	1.35 (1.26,1.44)	1.09 (0.99,1.21)	0.88 (0.78,0.99)
Sterilization	Ref	1.75 (1.66,1.83)	1.94 (1.81,2.07)	1.80 (1.64,1.98)	1.30 (1.12,1.51)	1.00 (0.85,1.18)
Hysterectomy	Ref	1.93 (1.78,2.08)	2.34 (2.13,2.57)	2.39 (2.12,2.70)	2.30 (1.96,2.69)	2.14 (1.81,2.53)

Public payer = Medicaid and Medicare and jail/prison contracts; LARC = long-acting reversible contraceptives (intrauterine devices and contraceptive implants); PC = permanent contraception; aRR = adjusted relative risk; CI = confidence interval; Ref = referent  
 \*Model controlling for age, race, ethnicity, and payer type by number of chronic conditions

contraceptive implant (0.5% vs 0.3%,  $p < 0.001$ ) than women without chronic conditions.

Depression was the most common chronic condition, impacting 15% of women of reproductive age. LARC and PC use varied by chronic health condition. Of all chronic health conditions, women with malignant liver tumors had the lowest proportion of either LARC or PC use (3.0% combined). Those with thrombogenic mutations had the highest proportion of LARC use (9.5%) and PC (3.6%). Women with

breast cancer had the lowest proportion of LARC use (2.3%) (Table 2).

Multi-morbidity impacted 7.3% of the cohort and prevalence increased with age: 5.0% of those under 35 years had two or more health conditions, compared to 10.8% of those aged 35–49 years. As the number of chronic health conditions increased, public payer reliance increased. As the number of chronic conditions increased, the proportion of women using LARC decreased, from 5.8% of women with one condition down to 3.2% of women with five or more conditions. LARC use, sterilization, and hysterectomy were all associated with one or more chronic condition, compared to healthy women in models controlling for age, race, ethnicity, and payer, but the strength of association did not increase with multi-morbidity burden. (Table 3)

After adjusting for age, race, ethnicity, and payer type, we found women with a chronic health condition were more likely to use LARC (aRR 1.4; 95% CI 1.4–1.5), or have had a hysterectomy (aRR 2.1; 95% CI 2.0–2.3) or permanent contraception (aRR 1.7; 95% CI 1.7–1.8) compared to women without a chronic condition. Women without insurance were less likely to use highly effective contraception, whether or not they had a chronic condition (Table 4).

**Table 4 Multivariable Logistic Regression Models Assessing Probability of Use of Highly Effective Contraception by Reproductive-Age Women Who Accessed the Intermountain West Healthcare Systems Between 2010 and 2014**

Variable	LAR (aRR, 95% CI)	Sterilization (aRR, 95% CI)
Any chronic health condition*		
Healthy	Ref	Ref
Chronic diagnosis	1.44 (1.40, 1.47)	1.74 (1.66, 1.82)
Insurance payer type		
None	Ref	Ref
Public	2.17 (2.07, 2.27)	2.90 (2.69, 3.13)
Private	1.79 (1.72, 1.86)	1.55 (1.44, 1.65)
Age (years)	0.98 (0.97, 0.98)	1.02 (1.01, 1.02)
Race		
White	Ref	Ref
Black	0.84 (0.76, 0.94)	0.83 (0.64, 1.00)
Asian	1.09 (0.98, 1.23)	0.58 (0.44, 0.77)
AI/AN	0.91 (0.80, 1.23)	0.96 (0.77, 1.18)
Pacific Islander	0.79 (0.69, 0.91)	1.37 (1.29, 1.65)
Other/multiracial	0.99 (0.93, 1.07)	0.51 (0.44, 0.59)
Ethnicity		
Non-Hispanic	Ref	Ref
Hispanic	1.30 (1.25, 1.36)	1.81 (1.69, 1.93)

aRR: adjusted relative risk; CI: confidence interval; Ref: referent; AI/AN = American Indian/Alaskan Native

\*Chronic health conditions either those identified by the CDC U.S. Medical Eligibility Criteria for Contraceptive Use (US MEC) or prevalent conditions in reproductive-age women that increase risk of adverse outcomes in pregnancy

**DISCUSSION**

This 5-year cross-sectional study of two large health systems found that nearly 1/3 of reproductive-age female patients had one or more chronic health conditions that could increase risk of adverse pregnancy outcomes, especially in the setting of an unintended pregnancy. Potentially further increasing health

and pregnancy risks,<sup>20</sup> 7.3% of reproductive-age women had multiple chronic conditions. However, only 7.6% of women with a chronic health condition were using highly effective contraception. These findings are similar to a prior study of commercially insured US women, which reported that 12.1% of women of reproductive age had one or more chronic condition, and that few were using LARC and PC.<sup>18</sup>

In addition, we found that public insurance was an important predictor of use of highly effective contraception, particularly among women with multiple chronic conditions. As implementation of the Patient Protection and Affordable Care Act (ACA) of 2010 and subsequent Medicaid expansion vary by state, opportunities remain in many states to improve consistent public funding for comprehensive contraceptive services. As it is estimated that 45% of all U.S. births are publicly funded,<sup>21</sup> national efforts to improve preconception health and reduce maternal mortality need to remain focused on health insurance coverage that allows access to the full range of contraception for U.S. women of reproductive age.

Limitations of this study include our inability to control for number of visits or provider type or standardize the period of observation for each individual. Further, we relied on structured billing data to identify chronic conditions and LARC use or PC procedures. Although we focused on LARC and PC because they are typically more effective than short-acting contraceptives, we recognize that with many chronic conditions these are safe and reasonable options. We attempted to minimize false positives through manual chart reviews to validate codes and requiring recurrent codes > 30 days apart to meet criteria for a condition, but it is possible that some women identified as having no chronic conditions received care for a chronic condition in other settings. In particular, diagnoses with relapsing and remitting courses, such as asthma, may have been missed. We also could not capture disease severity. Although this 5-year study captured all healthcare visits at two large institutions, we lack data from free-standing family planning clinics where contraceptive services may have occurred. We opted to define our outcome as LARC “use,” rather than limiting to insertions, which precludes direct comparison with studies using LARC insertion as an outcome.

In conclusion, many women of reproductive age are burdened by chronic health conditions, yet relatively few are using highly effective contraception. As primary care providers care for many women with chronic conditions, efforts to ensure effective reproductive planning and prompt access to contraceptive services are needed. Our findings also highlight the importance of public insurance that allows women with chronic conditions to access comprehensive reproductive health services.

---

**Contributors:** Ware Branch, MD; Reed Barney, BA; Vickie Baer, Alison Frasier and Jeff Bennion

**Corresponding Author:** Lori M. Gawron, MD, MPH; Department of Obstetrics and Gynecology University of Utah School of Medicine, Salt Lake City, UT, USA (e-mail: lori.gawron@hsc.utah.edu).

**Funding information** This project is funded by the University of Utah Center for Clinical and Translational Science and the Program in Personalized Health Collaborative Pilot Project Grant. Team members receive support from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and the Office of Research on Women's Health of the National Institute of Health, LMG via K12HD085816, JNS via K12HD085852, and DKT via K24HD087436.

#### Compliance with Ethical Standards:

The UUHC and IHC Institutional Review Boards approved this study.

**Conflict of Interest:** The authors declare that they do not have a conflict of interest. The University of Utah Department of Obstetrics and Gynecology receives industry funding from Sebela, Femasys, and Medicines360. No industry supported trial data or relationships influenced the collection or analysis of these data.

**Prior presentations:** Some of this information was presented as a poster and published abstract at the North American Forum on Family Planning in Denver, CO, November 2016.

## REFERENCES

1. **Ward BW, Schiller JS.** Prevalence of Multiple Chronic Conditions Among US Adults: Estimates From the National Health Interview Survey, 2010. *Preventing Chronic Disease.* 2013;10:E65.
2. **Kim SY, Dietz PM, England L, Morrow B, Callaghan WM.** Trends in pre-pregnancy obesity in nine states, 1993-2003. *Obesity.* 2007;15(4):986-93.
3. **Martin JA, Hamilton BE, Sutton PD, Osterman MJK, Driscoll AK, Drake P.** Births: final data for 2016. *Natl Vital Stat Rep.* 2018;67(1):1-55.
4. **Berg CJ, Mackay AP, Qin C, Callaghan WM.** Overview of maternal morbidity during hospitalization for labor and delivery in the United States: 1993-1997 and 2001-2005. *Obstet Gynecol.* 2009;113(5):1075-81.
5. **Rocca WA, Boyd CM, Grossardt BR, et al.** Prevalence of multimorbidity in a geographically defined American population: patterns by age, sex, and race/ethnicity. *Mayo Clin Proc.* 2014;89(10):1336-49.
6. **Howland RE, Angley M, Won SH, Wilcox W, Searing H, Tsao TY.** Estimating the Hospital Delivery Costs Associated With Severe Maternal Morbidity in New York City, 2008-2012. *Obstet Gynecol.* 2018;131(2):242-52.
7. **Finer LB, Zolna MR.** Declines in Unintended Pregnancy in the United States, 2008-2011. *N Engl J Med.* 2016;374(9):843-52.
8. **Hellerstedt WL, Pirie PL, Lando HA, et al.** Differences in preconceptional and prenatal behaviors in women with intended and unintended pregnancies. *Am J Pub Health.* 1998;88(4):663-6.
9. **Kost K, Lindberg L.** Pregnancy intentions, maternal behaviors, and infant health: investigating relationships with new measures and propensity score analysis. *Demography.* 2015;52(1):83-111.
10. **Axinn WG, Barber JS, Thornton A.** The long-term impact of parents' childbearing decisions on children's self-esteem. *Demography.* 1998;35(4):435-43.
11. **Barber JS, Axinn WG, Thornton A.** Unwanted childbearing, health, and mother-child relationships. *J Health Soc Behav.* 1999;40(3):231-57.
12. **Chor J, Rankin K, Harwood B, Handler A.** Unintended pregnancy and postpartum contraceptive use in women with and without chronic medical disease who experienced a live birth. *Contraception.* 2011;84(1):57-63.
13. **Chuang CH, Velott DL, Weisman CS.** Exploring knowledge and attitudes related to pregnancy and preconception health in women with chronic medical conditions. *Mat Child Health J.* 2010;14(5):713-9.
14. **Centers for Disease Control U.S. Medically Eligibility Criteria for Contraceptive Use.** 2016. Available at: <http://www.cdc.gov/mmwr/pdf/rr/rr5904.pdf>. Accessed November 8, 2016.
15. **Simon AE, Uddin SFG.** Trends in Seeing an Obstetrician-Gynecologist Compared With a General Physician Among U.S. Women, 2000-2015. *Obstet Gynecol.* 2017;130(4):677-683.

16. **Gawron LM, Goldberger AR, Gawron AJ, Hammond C, Keefer L.** Disease-related pregnancy concerns and reproductive planning in women with inflammatory bowel diseases. *J Fam Plann Reprod Health Care.* 2015;41(4):272-7.
17. **Gawron LM, Redd A, Suo Y, Pettey W, Turok DK, Gundlapalli AV.** Long-acting Reversible Contraception Among Homeless Women Veterans With Chronic Health Conditions: A Retrospective Cohort Study. *Med Care.* 2017;55(S9):S111-S120.
18. **Champaloux SW, Tepper NK, Curtis KM, et al.** Contraceptive Use Among Women With Medical Conditions in a Nationwide Privately Insured Population. *Obstet Gynecol.* 2015;126(6):1151-1159.
19. **Callegari LS, Gray KE, Zephyrin LC, et al.** Hysterectomy and Bilateral Salpingo-Oophorectomy: Variations by History of Military Service and Birth Cohort. *Gerontologist.* 2016;56(S1):S67-77.
20. **Farr A, Lenz-Gebhart A, Einig S, et al.** Outcomes and trends of peripartum maternal admission to the intensive care unit. *Wien Klin Wochenschr.* 2017;129(17-18):605-611.
21. **Markus AR, Andres E, West KD, Garro N, Pellegrini C.** Medicaid covered births, 2008 through 2010, in the context of the implementation of health reform. *Womens Health Issues.* 2013;23(5):e273-280.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.