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Measuring Female Veterans' Prepregnancy Wellness Using Department of Veterans Affairs' Health Record Data

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Abstract

OBJECTIVE: To estimate the feasibility of using measures developed by the Clinical Workgroup of the National Preconception Health and Health Care Initiative to assess women's prepregnancy wellness in a large health care system.

METHODS: We examined Department of Veterans Affairs' (VA) national administrative data, including inpatient, outpatient, fee-basis, laboratory, pharmacy, and screening data for female veterans aged 18–45 who had at least one pregnancy outcome (ectopic pregnancy, spontaneous abortion, stillbirth, and live birth) during fiscal years 2010–2015 and a VA primary care visit within 1 year before last menstrual period (LMP). LMP was estimated from gestational age at the time of pregnancy outcome, then used as a reference point to assess eight prepregnancy indicators from the Workgroup consensus measures (eg, 3 or 12 months before LMP).

RESULTS: We identified 19,839 pregnancy outcomes from 16,034 female veterans. Most (74.9%) pregnancies ended in live birth; 22.6% resulted in spontaneous abortion or ectopic pregnancy, and 0.5% in stillbirth. More than one third (39.2%) of pregnancies had no documentation of prenatal care within 14 weeks of LMP. Nearly one third (31.2%) of pregnancies occurred in women with obesity. Among pregnancies with a recent relevant screening, 29.2% were positive for smoking and 28.4% for depression. More than half (57.4%) of pregnancies in women with preexisting diabetes did not have documentation of optimal glycemic control. Absence of

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sexually transmitted infection screening in the year before or within 3 months of LMP was high. Documentation of prenatal folic acid use was also high. Exposure in the same timeframe to six classes of teratogenic medications was low.

CONCLUSION: Despite limitations of administrative data, monitoring measures of prepregnancy wellness can provide benchmarks for improving women's health across health care systems and communities. Areas for intervention to improve female veterans' prepregnancy wellness include healthy weight, optimizing control of diabetes before pregnancy, and improved use and documentation of key prepregnancy health screenings.

Despite increased attention to the potential benefits of prepregnancy care, or interventions that aim to promote the health of women of reproductive age before pregnancy to improve pregnancy-related outcomes,[1] clinical implementation has been suboptimal.[2] A lack of consensus in the medical community about how and when to implement such care and how to determine prepregnancy care quality[3] may prevent uptake, as may inconsistent insurance coverage for these services. Preconception care delivery is further complicated because a significant portion of pregnancies in the United States are unintended so women may not initiate prepregnancy conversations or directly seek care.

In 2016, the Clinical Workgroup of the National Preconception Health and Health Care Initiative (hereafter "the Workgroup") proposed nine prepregnancy wellness measures, assessable at a woman's first prenatal care visit and available for evaluation through administrative (ie, health record or claims or both) data, that would serve as a "surrogate but feasible assessment of quality of preconception care"[2] within a health care system and that could provide benchmarks for improving women's prepregnancy wellness across health care systems and communities. These measures include: pregnancy intention, access to care, prepregnancy folic acid use, tobacco avoidance, absence of uncontrolled depression, healthy weight, absence of sexually transmitted infections (STIs), optimal glycemic control in women with pregestational diabetes, and teratogenic medication avoidance.

As the largest integrated health care system in the United States, and with women of childbearing age (18–44) representing 43% of the female veterans accessing Department of Veterans Affairs' (VA) health care,[4] VA is uniquely positioned to lead the way in implementing and evaluating prepregnancy care efforts to improve birth outcomes and women's overall health. The purpose of this article is twofold: first, to offer a guide for VA and other health systems to using administrative data in this context, and second, to present a snapshot of female veteran VA users' prepregnancy wellness using available data on established measures, to inform local and national efforts to optimize access to and delivery of high-quality preventive care for women of reproductive age.

METHODS

A major challenge for researchers using administrative data to identify pregnancy outcomes has been the accurate detection of the beginning of pregnancy.[5–7] A recent review found that in the absence of reliable data, most prior studies have assessed only live-birth outcomes and assumed the same broad estimates of gestational age for all pregnancies.[5] Previous work on pregnancy within VA[8,9] has likewise focused primarily on live births; this study expands

on this literature by considering pregnancies resulting in other outcomes (ectopic pregnancy, spontaneous abortion, and stillbirth) in addition to live birth. This work was conducted as a quality improvement project in partnership with VA's Office of Women's Health Services; as such, it did not require VA institutional review board approval.

As a primary goal of this work was to inform programmatic strategies for female veterans receiving VA primary care, we sought to capture any pregnancy outcome during fiscal years 2010–2015 among female veterans aged 18–45 who were actively engaged in VA care in the year before pregnancy, as evidenced by at least one visit to VA primary care in that time period. To capture pregnancy outcomes, we used data from the VA Corporate Data Warehouse, including International Classification of Diseases, Ninth Revision (ICD-9) diagnosis and procedure codes, Current Procedural Terminology (CPT) codes, and diagnosis related group codes for inpatient, outpatient, and fee-based services (visits to non-VA clinicians that are paid for by VA). Following a previously published algorithm[10] that we tailored for VA data, we first identified all claims that mapped to any diagnosis, procedure, CPT or diagnosis related group code indicative of a pregnancy outcome (including ectopic pregnancy, induced or spontaneous abortion, stillbirth, and live birth). Next, to adapt the algorithm for VA data, we removed all codes associated with elective abortion because abortions are not provided in VA and such codes, when present, had strong indications that they were miscoded (eg, predominantly assigned to men or to women who were not of childbearing age (older than 65 years). To distinguish between visits associated with separate pregnancies and multiple visits for the same pregnancy, we grouped together all codes associated with each pregnancy outcome. Within an outcome group, codes were considered part of the same pregnancy if they were less than 210 days apart (for live birth and stillbirth outcomes) or 60 days apart (for spontaneous abortion or ectopic pregnancy outcomes); these timeframes mirror prior research using administrative data to identify pregnancy outcomes.[10,11]

If a pregnancy diagnosis code has no indication of preterm or postterm delivery, that pregnancy is assigned an estimated gestational age of 40 weeks. Pregnancies coded with an indication of preterm delivery are assigned an estimated gestational age less than 40 weeks (estimated age varies on the specific preterm indication). Pregnancies coded with an indication of postterm delivery are assigned an estimated gestational age of more than 40–42 weeks (again, estimated age varies on the specific postterm indication). For most pregnancies, we had multiple estimates of gestational age; to avoid overestimating pregnancy duration we used the minimum gestational age for further analyses, except in cases with conflicting codes. When a single delivery had multiple conflicting codes, one indicative of a preterm or postterm delivery and one with no timing indication (default estimation: 40 weeks of gestation), priority was given to the code with a specific indication of the pregnancy term. For a few cases (n = 10) with conflicting term-specific codes (eg, one code for preterm delivery and one code for postterm delivery), we conducted a manual review of the data and found that the preterm indication was generally the most accurate.

Following the example set by Ailes et al,[11] we estimated the last menstrual period (LMP) date for each pregnancy outcome by subtracting the estimated or assigned gestational age from the date of discharge (for inpatient visits) or service (for outpatient visits). We then

used a hierarchical coding scheme of 1) both live birth and stillbirth from a multiple birth pregnancy, 2) live birth (using standard ICD practices for priority coding related to obstetrics), 3) stillbirth, and 4) spontaneous termination to resolve conflicting indications of the final outcome for each pregnancy.[10,11] For VA data, we modified previously published decision rules, developed using other administrative data sources, to prioritize particular live-birth codes found to be specific for identifying live births in VA administrative data when conflicting codes were present regarding pregnancy outcome. For example, if one pregnancy outcome was coded in multiple ways, such as stillbirth or miscarriage and live birth using one of the prioritized codes, we found that the live-birth code tended to be accurate, rather than the stillbirth or miscarriage. We were able to refine these methods in a subset of the data by confirming live births using available data on the newborns for whom VA provides care.

The Workgroup, first convened in 2006, comprises clinicians with varying clinical expertise, including public health, family medicine, maternal-fetal medicine, obstetrics and gynecology, nurse midwifery, and nursing. Their goal in identifying measures of preconception wellness was “to define the smallest number of metrics that would capture the greatest proportion of a woman’s preconception wellness”; more than 20 measures were considered for inclusion, with nine meeting the Workgroup’s consensus criteria.[2] These measures include indicators for 1) pregnancy intention, 2) access to care, 3) prepregnancy folic acid use, 4) tobacco avoidance, 5) absence of uncontrolled depression, 6) healthy weight, 7) absence of STIs, 8) optimal glycemic control in women with pregestational diabetes, and 9) teratogenic medication avoidance. For each measure, the Workgroup suggest sample data for reporting and recommend a target response for demonstrating optimal prepregnancy wellness. Of note, although the Workgroup used the term “preconception,” we use the term “prepregnancy” in this manuscript in line with ACOG’s current recommendations.[12]

Each of the measures detailed above is intended to be assessed at a woman’s first prenatal care visit; together they can provide an aggregate assessment of the quality of prepregnancy care within a health system. Because most female veterans’ prenatal care is purchased in the community through the VA fee-basis care program, rather than provided by VA, we were unable to assess each measure at a woman’s first prenatal care visit. Instead, we used estimated LMP as a reference point to approximate eight of the nine prepregnancy indicators within a range of time (eg, within 12 months before to 3 months after LMP for screenings and within 3 months before to 3 months after LMP for prescriptions) and chose the assessment of pregnancy wellness closest to the LMP. Our selection of these timeframes reflects our understanding that LMP in our data is a best estimate, so these timeframes are our best capture of the prepregnancy period. For each measure, we present the VA-specific data sources used to assess this measure in our analyses. Data cleaning and descriptive analyses were completed using SAS Enterprise Guide 7.1.[13]

1. Pregnancy intention. Pregnancy intention is not a currently reported measure in VA administrative data; therefore we are unable to report on this recommended indicator.

2. Prenatal care within the first trimester. To identify prenatal care visits, we followed decision rule and subsequent code selection guidelines outlined by the National Committee for Quality Assurance.[14] Based on these criteria, a visit was classified as a prenatal visit if 1) it contained any diagnosis or procedure code specific to standalone prenatal visits; 2) any visit to an obstetrics practitioner or midwife with at least one of the following markers to indicate that the visit was for prenatal care—obstetric panel, TORCH (toxoplasmosis, other viruses, rubella, cytomegalovirus, herpes simplex viruses) antibody panel, rubella antibody titer with Rh incompatibility, ultrasonogram of pregnant uterus, or pregnancy-related diagnosis code; or 3) any visit to a family practitioner or other primary care provider with a pregnancy-related diagnosis code and at least one of the above-mentioned markers. Using the VA Corporate Data Warehouse, we searched ICD-9 diagnosis and procedure codes and CPT codes from inpatient and outpatient workload and fee basis files and retained any record with a visit or service date within 14 weeks of LMP (for all pregnancies that continued for 20 weeks or longer).

3. Preconception folic acid use. Using VA outpatient prescription data from Corporate Data Warehouse, we searched five fields of medication names for the key words “folic,” “prenat,” and “multivitamin.” We then removed any classified as vitamin B plus folic acid–leucovorin, which is not indicated for prenatal use, and multivitamin classes (identified through the VA formulary) that do not include folic acid. All active prescriptions for prenatal vitamins or folic acid in the period 3 months before to 3 months after LMP were included, acknowledging a range of error for the LMP date. An important limitation of this measure is that over-the-counter (OTC) (as opposed to prescription) folic acid use is common, and OTC medicines are under-documented in the medical record.

4. Tobacco avoidance. Using Corporate Data Warehouse Health Factors data, we identified the most recent smoking status assessed within 12 months before to 3 months after LMP, choosing the closest value to LMP (smoking status was originally coded in text format; we manually reviewed and hard-coded smoking status for inclusion in our analysis). If more than one smoking status was listed for the same date, we used a hierarchical coding scheme of smoking, non-smoking, or unknown.

5. Absence of uncontrolled depression. Using Corporate Data Warehouse Mental Health surveys, we identified the most recent depression screening within 12 months before to 3 months after LMP, again selecting the value closest to LMP. We used the PHQ-2 (Patient Health Questionnaire-2) (scores higher than 0), PHQ-9 (Patient Health Questionnaire-9) (scores of 10 or higher),[15] and the BDI-II (Beck Depression Inventory-II) (scores of 20 or higher)[16] to denote a positive depression screen. We prioritized PHQ-9 scores as the most complete screening for depression but report PHQ-2 or BDI-II scores when PHQ-9 scores are not available.

6. Healthy weight. Using the VA Vital Status file, which contains both height and weight data, we identified weight measurement within 12 months before to 3 months after LMP, choosing the value closest to LMP, and computed body mass index (BMI, calculated as weight in kilograms divided by height in meters squared) after making the following assumptions: based on the broadest guidelines found for military women, we limited height to between 58 and 80 inches (if more than one height was reported, we took the median height value); we limited weight between the arbitrary values of 90 and 500 pounds. If multiple weight measurements were available for the same pregnancy in the selected timeframe, we chose the measurement nearest in time to LMP.

7. Absence of STIs. Standardized laboratory data were provided by the VA New England Healthcare System. These data were standardized to aid in test identification and to qualitatively and quantitatively code most character results fields into useable numeric or qualitative (eg, positive, normal) results. Because we could not obtain laboratory results from the first prenatal visit, which is paid for but not provided within VA and generally includes screening for human immunodeficiency virus (HIV), syphilis and hepatitis B, we identified any evidence of active chronic infection within 12 months before to 3 months after LMP for hepatitis B, HIV, and syphilis, choosing the value closest to LMP; we also identified test type and laboratory test results (positive, negative, or inconclusive). We did not include screening for chlamydia or gonorrhea, though they were included in the original measure, because these screenings are only universally recommended for women under age 25 (a small subset of our total population); screening for older women is based on their status as “high risk,” which we could not assess in our data.

8. Optimal glycemic control in women with pregestational diabetes. We first identified pregnancies for which the woman had a diagnosis of pregestational diabetes within 2 years before LMP. Using Corporate Data Warehouse laboratory data, we next identified hemoglobin A_{1c} (Hb A_{1c}) measurements in the 12 months before to 3 months after LMP for each of these pregnancies, choosing the value closest to LMP. We excluded values less than 3 and greater than 18. Similar to healthy weight, if multiple Hb A_{1c} measurements were available in the selected timeframe, we used the measurement closest in time to LMP.

9. Teratogenic medication avoidance. Using VA outpatient prescription data from Corporate Data Warehouse, we searched five fields of medication names for key words related to a list of medications under each of the Workgroup’s six classes of teratogenic medications (ace inhibitors, angiotensin receptor blockers, statins, Valproic acid, lithium, or warfarin) at any time from 3 months before to 3 months after LMP.

RESULTS

We identified 26,556 pregnancy outcomes from 21,234 female veterans aged 18–45 at LMP during fiscal years 2010–2015. After excluding 6,717 pregnancies (25.3%) in women

with no record of a VA primary care visit within 1 year before LMP, our final sample includes 19,839 pregnancy outcomes from 16,034 female veterans. The majority of women (74.7%) had one pregnancy outcome during the study timeframe; 20.4% had two pregnancy outcomes, and 4.9% had three or more pregnancy outcomes. Details of the sample are reported at the pregnancy level in Table 1. Just more than half of pregnancies (57.2%) were in non-Hispanic White women, 23.6% in non-Hispanic Black women, and 10.5% in Hispanic women; the mean age at LMP was 30.3. The majority (74.9%) of pregnancies ended in a live birth; 22.6% resulted in spontaneous abortion or ectopic pregnancy, and 0.5% in a stillbirth.

Results from our assessment of eight of the recommended measures of prepregnancy wellness are presented at the pregnancy level in Table 2. Results are drawn from the total study sample (n = 19,839 pregnancy outcomes from 16,034 women). Slightly more than half (60.8%) of pregnancies with duration of 20 weeks or longer had documentation of prenatal care within 14 weeks from LMP, and 48.7% of pregnancies had at least one active prescription for vitamins with folic acid or prescription folic acid supplements within 3 months before to 3 months after LMP.

Any tobacco use screening within 1 year before to 3 months after LMP was present in 78.1% of pregnancies; among pregnancies with a screening, 70.4% were nonsmokers and 29.2% smokers. Any depression screening was reported in 75.7% of pregnancies; among those with a screening, 71.2% of pregnancies had only negative screens and 28.4% had only positive screens. We prioritized PHQ-9 results when available as the most complete screening for depression; however, among pregnancies with a positive screen, 77.3% only had a PHQ-2 or BDI-II result with no documented follow-up PHQ-9 result. For 0.4% of pregnancies, conflicting screens are reported when a patient had more than one screen on the same test (ie, two PHQ-2s or two PHQ-9s) in the same day; it was not possible to discern from the data the order in which the conflicting tests occurred.

Body mass index was documented at some point 12 months before to 3 months after LMP in 98.2% of pregnancies; 34.4% of pregnancies had a documented BMI in the healthy range (18.5–25), 64.3% fell in the overweight (25–29.9, 33.1%) or obese (30 or higher, 31.2%) range, and 1.3% fell in the underweight range (below 18.5).

In the 12 months before to 3 months after LMP, 21.6% of pregnancies had a screening test for hepatitis B surface antigen; 34.4% of pregnancies had an HIV antibody test; and 24.3% of pregnancies had a screening test for syphilis. Of these tests, 96.5% had only negative test results for hepatitis B, 97.6% had only negative results for HIV, and 94.0% had only negative results for syphilis.

Among the 1.4% of pregnancies (n = 274) for which the woman had a prior diabetes diagnosis within 2 years before LMP, 9.8% (n = 27) had no reported Hb A_{1c} measurement in the 12 months before to 3 months after LMP, and only 42.6% of pregnancies (n = 118) reported an optimal Hb A_{1c} measurement of less than 6.5% in the same timeframe. More than one fifth of pregnancies (20.9%, n = 58) had an Hb A_{1c} measurement of 8% or higher.

Finally, only 4.4% of pregnancies had documentation of a prescription for one of the Workgroup's selected teratogens in the 3 months before to 3 months after LMP (a complete list of included medication names can be found in Box 1).

DISCUSSION

Understanding women's health and wellness before and during early pregnancy may be a key component in health care system efforts to improve both pregnancy outcomes and women's overall health. In this national study of prepregnancy wellness within VA, we gained insights about the process of using health care system administrative data to describe prepregnancy health. We also identified multiple areas for possible intervention to improve female veterans' health before, during, and after a pregnancy.

Our findings confirm prior work suggesting that administrative health record data can be used successfully for health services research related to pregnancy.[7,8,17] Use of VA administrative data for identifying pregnancy outcomes and assessing prepregnancy wellness presented several challenges, some that are common to administrative claims data and others unique to VA data. The single greatest challenge was the lack of information regarding patient pregnancy status and the availability of data on the patient's LMP or gestational age. For the sake of feasibility, we were limited to the use of pregnancies with a coded outcome. In general, pregnancies with an outcome other than live birth may be less likely to be coded in claims data. This issue is further exacerbated in VA claims data, because most pregnancy care and all deliveries are paid through contracted care outside of VA and contain more limited data than care provided within VA. In addition, care that is not covered by VA (such as abortion or care through other insurance including Medicaid) cannot be assessed with the VA administrative data. However, the methods we used maximized all available data by including pregnancy outcomes other than deliveries with live births. We also had additional data available in VA that may not be standardly available in other claims-based data sources, such as pregnancy test results and claims for newborn care that allowed us to tailor the methods for resolving issues with conflicting pregnancy outcomes or gestational ages. Future work may be able to expand on and refine these methods with the use of ICD-10 codes, which contain more detailed information about gestational age.

Our study data may also be limited by our restriction of the cohort only to pregnancies with evidence of a VA primary care visit in the past year, as the excluded pregnancies to women without a recent primary care visit may represent a healthier group overall. We applied this inclusion criteria, however, because unlike in the private sector, many female veterans enrolled in VA, especially those who are not accessing VA primary care, have multiple sources of insurance and do not rely solely on VA care. If included, pregnancies among these women may appear to be missing care metrics in the prepregnancy period when in fact they simply received care that was paid for by alternate insurance.

Another limitation of administrative data for evaluating prepregnancy wellness, not specific to the VA, is that disease status or prevalence can only be assessed for those who were screened and had documentation of that screening, leading to possible underestimation of true occurrence or prevalence rates. Our findings rely on measures documented in the

electronic health record (EHR), all of which are subject to measurement bias[18] and which have been shown in prior studies often to be inaccurate or incomplete when compared with clinical notes,[19–22] and on the accuracy of ICD codes as entered into billing claims. For example, our finding that only 60.8% of pregnancies 20 weeks or longer had evidence of prenatal care in the 14 weeks after LMP may simply reflect that documentation of a prenatal visit is not being captured in VA records. Similarly, our finding that only 56.3% of pregnancies had a recorded prescription for prenatal vitamins with folic acid or prescription folic acid supplements within our prepregnancy timeframe is likely an underestimate. Many women purchase OTC prenatal or other multivitamins rather than receiving prescriptions, and OTC medications are not consistently documented in the VA EHR. The complicated process of assigning ICD codes further complicates data accuracy. In VA, clinicians enter all codes themselves, which may result in under-coding, particularly for patients with complicated multimorbidity. Research on system-level efforts to improve physician documentation suggest multiple promising strategies, including the use of templates and automatic reminders. More complete documentation will be essential for health systems to more accurately describe and then improve women's prepregnancy health.

We also identified broad areas for possible intervention to improve female veterans' health before, during, and after a pregnancy. One demonstrated area in need of clinical intervention is in the management of chronic health conditions among female veterans, specifically obesity and pregestational diabetes, which are important potential risk factors for poor pregnancy outcomes. Nearly two-thirds of pregnancies occurred in women who were overweight or obese; this finding, though similar to results in the general population,[23] is concerning as women with obesity face significantly increased risks of pregnancy complications (eg, postpartum hemorrhage, hypertensive disorders) and fetal and neonatal risks.[24] Fewer than half of female veterans with preexisting diabetes had a documented Hb A_{1c} measurement in the optimal range (less than 6.5%) in the year before pregnancy. Maternal glucose control should be maintained before and throughout pregnancy to decrease the likelihood of complications of hyperglycemia, including spontaneous abortion, fetal malformation, fetal death, and neonatal morbidity.[24] Because the recommended Hb A_{1c} for women with diabetes is lower for pregnancy than at other times, and glycemic management changes frequently throughout pregnancy owing to hormonal fluctuations,[24] targeted prepregnancy counseling is critical for women with diabetes. Here, establishing system-level guidelines for primary care clinicians to routinely assess women's reproductive goals and intentions would increase opportunities for targeted prepregnancy counseling that might significantly affect future health behaviors or disease treatment plans. Research suggests that these conversations may also motivate behavior change in women who desire a future pregnancy.[25,26] Similar to other routine screenings, women's reproductive goals assessment could begin with a prompt in the EHR. Patient-facing decision support tools that promote patient-centered discussions with health care professionals offer another promising opportunity to improve the quality of patient communication with health care professionals around reproductive health (Callegari L, Magnusson S, Nelson K. Integrating reproductive goals assessment with contraceptive decision support in primary care: a pilot test of the MyPath tool [abstract]. Contraception 2019;100.).[27,28]

Improving clinicians' use and documentation of recommended routine health screenings (eg, screenings for tobacco use, depression)[29,30] using the HER will both create more opportunities for early intervention and contribute to a more complete picture of women's health and prepregnancy wellness within a health system. In addition, ensuring that primary care clinicians have the necessary resources to connect women with available behavioral and health services (at VA, for example, the MOVE! Weight Management Program[31] and Primary Care-Mental Health Integration services[32]) is another way for health systems to improve women's overall health and therefore their prepregnancy wellness. Encouraging patient-centered care collaboration across disciplines, particularly for chronic disease management, provides additional avenues for appropriate counseling and intervention.[33–35]

This study represents the first comprehensive assessment of female veterans' prepregnancy wellness using health system administrative data on recommended measures conceptualized by the Clinical Workgroup of the National Preconception Health and Health Care Initiative. Our findings highlight challenges to accurately assessing prepregnancy wellness with existing administrative data and identify multiple areas for possible intervention to improve female veterans' overall health that may also improve subsequent pregnancy outcomes. Specifically, our findings related to female veterans' prepregnancy management of chronic health conditions such as obesity and pregestational diabetes suggest the need for a health systems approach that integrates reproductive health care services with other aspects of care across VA. Encouraging this approach will be essential for improving female veterans' health before, during, and after pregnancy[36,37] and honoring VA's commitment to ensuring timely, high quality comprehensive health care for all female veterans.

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Box 1.

Full Search List of Teratogenic Medications

ACE

- Benazepril
- Captopril
- Enalapril
- Enalaprilat
- Fosinopril
- Lisinopril
- Moexipril
- Perindopril
- Quinapril
- Ramipril
- Trandolapril

ARB

- Aliskiren
- Azilsartan
- Candesartan
- Eprosartan
- Irbesartan
- Losartan
- Olmesartan
- Telmisartan
- Valsartan

Statins

- Atorvastatin
- Rosuvastatin
- Simvastatin
- Pravastatin
- Lovastatin
- Fluvastatin
- Pitavastatin

Valproic acid

- Valproic acid
- Valproate sodium

Lithium

- Lithium
- Lithium carbonate
- Lithium citrate

Warfarin

- Warfarin

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker.

Table 1.

Distribution of Pregnancy Outcomes (Unique at Pregnancy Level) (N = 19,839)

Outcome	Value
Age at LMP (y)	30.3±4.8
	30 (27, 33)
18–19	12 (0.1)
20–29	9,348 (47.1)
30–39	9,577 (48.3)
40–45	902 (4.5)
Race-ethnicity *	
Non-Hispanic White	11,339 (57.2)
Non-Hispanic Black	4,672 (23.6)
Hispanic	2,090 (10.5)
Other †	1,020 (5.1)
Missing	718 (3.6)
LMP year	
2009	1,304 (6.6)
2010	2,446 (12.3)
2011	2,876 (14.5)
2012	3,326 (16.8)
2013	3,776 (19.0)
2014	4,260 (21.5)
2015	1,851 (9.3)
Pregnancy outcome	
Live birth and stillbirth (multiples)	7 (0.04)
Live birth	14,849 (74.9)
Stillbirth	105 (0.5)
Spontaneous abortion or ectopic pregnancy	4,878 (22.6)

LMP, last menstrual period.

Data are mean±SD, median (quartile 1, quartile 3), or n (%).

* Race–ethnicity based on self-report.

† Includes American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and multiracial.

Table 2.

Measures of Preconception Wellness (Unique at Pregnancy Level) (N = 19,839)

PCW Measure Outcome (FY 2010–FY 2015)		Level of Measurement	n (%)
1	Pregnancy intention	Not captured in VA administrative data	
2	Access to prenatal care [*]	Within 14 wk from LMP	9,368 (60.8)
3	Preconception folic acid use [†]	At least 1 active prescription for prenatal vitamin or vitamin-folic acid	9,668 (48.7)
4	Tobacco avoidance [‡]	Not screened	4,339 (21.9)
		Any screening	15,500 (78.1)
		Nonsmoker	10,908 (70.4)
		Smoker	4,520 (29.2)
5	Absence of uncontrolled depression [‡]	Not screened	4,815 (24.3)
		Any screening	15,024 (75.7)
		Negative screening	10,692 (71.2)
		Positive screening	4,268 (28.4)
		PHQ-9 only	549 (12.9)
		PHQ-2 or BDI-II+PHQ-9	421 (9.9)
		PHQ-2 or BDI-II only	3,298 (77.3)
		Both positive and negative screens	64 (0.42)
6	Healthy weight [‡§]	Not measured	363 (1.8)
		Measured	
		Underweight (BMI lower than 18.5)	250 (1.3)
		Normal weight (BMI 18.5–24.9)	6,690 (34.4)
		Overweight (BMI 25–29.9)	6,454 (33.1)
		Obesity class I (BMI 30–34.9)	3,916 (20.1)
		Obesity class II (BMI 35–39.9)	1,622 (8.3)
		Extreme obesity class III (BMI 40 or higher)	544 (2.8)
7	Absence of STIs [‡]	Hepatitis B surface antigen [‡]	
		Not screened	15,554 (78.4)
		Any screening	4,285 (21.6)
		Any positive screening	11 (0.25)

PCW Measure Outcome (FY 2010–FY 2015)		Level of Measurement	n (%)
		Negative screening with no positive	4,134 (96.5)
		Only indeterminate or other result	140 (3.3)
		HIV antibody results[‡]	
		Not screened	13,011 (65.6)
		Any screening	6,828 (34.4)
		Negative screening with no positive	6,664 (97.6)
		Any positive, only indeterminate, or other result[//]	164 (2.4)
		Syphilis[‡]	
		Not screened	15,017 (75.7)
		Any screening	4,822 (24.3)
		Any positive screening	11 (0.002)
		Only negative screening	4,533 (94.0)
		Negative and indeterminate or other	268 (5.6)
		Only indeterminate or other result	10 (0.002)
8	Optimal glycemic control	Prior diabetes diagnosis (24 mo before LMP)	277 (1.4)
		Hb A_{1c} measurement[‡]	
		No Hb A_{1c}	27 (9.8)
		Hb A_{1c} less than 6.5%	118 (42.6)
		Hb A_{1c} 6.5% to less than 8%	74 (26.7)
		8% or higher	58 (20.9)
9	Teratogen avoidance[†]	Absence of any active prescription	2,246 (11.3)
		Evidence of teratogenic medication use	872 (4.4)

PCW, Preconception Wellness; FY, fiscal year; VA, Department of Veterans Affairs; LMP, last menstrual period; PHQ-9, Patient Health Questionnaire-9; PHQ-2, Patient Health Questionnaire-2; BDI-II, Beck Depression Inventory-II; BMI, body mass index; STIs, sexually transmitted infections; HIV, human immunodeficiency virus; Hb A_{1c}, hemoglobin A_{1c}.

[*] n = 15,403 (pregnancies 20 weeks or longer).

[†] We used the result or value closest to the LMP, among those measured in the 3 months before to 3 months after LMP.

[‡] We used the result or value closest to the LMP. among those measured in the12 months before to 3 months after LMP.

[§] n = 19,476.

// Categories combined owing to low number of any positive screenings.