Feasibility of Universal Screening for Preeclampsia Risk and Aspirin Recommendation in the Ultrasound Unit

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Abstract

Objective To evaluate the feasibility and impact of using the first-trimester ultrasound visit to identify and counsel women at increased risk of preeclampsia about the benefits of low-dose aspirin (LDA) for preventing preeclampsia. We also assessed patient-reported utilization of LDA, perceived risk for preeclampsia, and clinical outcomes.

Study Design Women presenting for routine first-trimester nuchal-translucency (NT) ultrasounds were screened for clinical preeclampsia risks using a self-administered risk assessment. Women at moderate or high risk for preeclampsia were counseled to take LDA, if not already taking it. LDA utilization and perceived risk for preeclampsia were assessed during the second-trimester ultrasound. Factors associated with LDA utilization were analyzed. Pregnancy outcomes were compared between those who used LDA and those who did not.

Results Slightly more than 20% of patients (765/3,669) screened at increased risk for developing preeclampsia. Of those, 67.8% (519/765) had not received LDA recommendations from their referring obstetrician and 97 had not been taking LDA despite being advised to do so. Combined, 94.6% (583/616) of these patients eligible to start LDA prophylaxis received the indicated counseling during the ultrasound visit. A total of 61.4% (358/583) of women completed the follow-up form and of those 77.9% (279/358) reported taking LDA. Screening at increased risk for preeclampsia and perception of increased risk were positively associated with LDA utilization, whereas concerns for LDA safety were negatively associated with use. African American/Black patients and Medicaid recipients were less likely to use LDA. Pregnancy outcomes were similar between those who used LDA and those who did not.

Conclusion Assessing preeclampsia risk and counseling patients about LDA at the time of the NT ultrasound are feasible in the ultrasound unit and led to good LDA utilization among women at increased risk for preeclampsia. This intervention may standardize patient care and help close the disparity in maternal health.

Keywords

- low-dose aspirin
- aspirin utilization
- preeclampsia
- risk assessment
- pregnancy
- ultrasound unit

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Key Points

- A simple intervention captured 2/3 of eligible patients.
- Aspirin utilization rate was good after the intervention.
- Screening high risk for preeclampsia and self-perception of risk correlated with aspirin use.

Preeclampsia is a leading cause of maternal and perinatal morbidity and mortality worldwide.[1] Low-dose aspirin (LDA) reduces the risk or delays the onset of preeclampsia among pregnant individuals at increased risk of preeclampsia.[2–13] LDA use in pregnancy is associated with absolute risk reductions of 2 to 5% for preeclampsia, 1 to 5% for fetal growth restriction, and 2 to 4% for preterm birth.[2] Based on the substantial evidence of the benefits of LDA use, the United States Preventative Services Taskforce (USPSTF) and the American College of Obstetricians and Gynecologists (ACOG) recommend LDA (81 mg) daily for patients at increased risk for preeclampsia beginning at 12 weeks of gestation.[1–4]

Despite the guidelines, information may not be conveyed effectively to women at risk of developing preeclampsia. General LDA use has been reported as low as 29.4%.[14] A recent anonymous survey study assessing patient recollection of LDA recommendation found a higher adherence nearing 80% in the moderate-risk and high-risk groups; however, only 4.8% of moderate-risk participants recalled receiving LDA counseling compared with 57.7% of high-risk participants.[15] Besides patient adherence, other barriers to a successful implementation of the LDA recommendation exist, including providers' awareness of factors that make patients eligible for LDA and communication between patients and providers about the LDA recommendation.[16] Assessing these barriers, Krishnamurti et al found that 46% of patients with at least one high-risk factor for preeclampsia indicated their obstetrical provider recommended LDA.[17] Only 72.6% had evidence of LDA recommendation in their charts, and of these, 36.7% were unaware of the LDA recommendation.[17]

Research suggests that the first-trimester nuchal-translucency (NT) ultrasound appointment provides an opportunity to identify, counsel, and advise women who might benefit from LDA prophylaxis due to increased risk for preeclampsia.[18] For example, after implementing a brief risk assessment at the time of the NT ultrasound, Boelig et al found that 95% of high-risk patients were advised to take LDA compared with 74% prior to the initiative.[18]

In this study, we evaluated a similar screening and counseling program initiated on our ultrasound unit between December 1, 2017, and December 31, 2019. The study took place at the ultrasound unit of a single urban hybrid community/academic medical center in the Northeast with a medium-sized obstetrics and gynecology residency program. The ultrasound unit is a regional referral center with an ethnically and financially diverse patient population that attend hospital-based, privately owned, and federally funded prenatal care clinics. The screening program was designed to identify women at moderate and high risk of preeclampsia, document use of LDA, and provide advice regarding LDA from a Maternal–Fetal Medicine (MFM) physician at the time of the NT ultrasound. We evaluated the feasibility of this practice change and its impact on patient screening and counseling in alignment with established guidelines. In addition, we assessed patient LDA use, perceived risk for preeclampsia, primary reasons for taking LDA, concerns about LDA, and clinical outcomes for a subset of patients who delivered at our hospital.

Materials and Methods

Based on our clinical experience, we anticipated many patients at increased risk for developing preeclampsia were not taking LDA at the time of their NT ultrasound. Thus, in our ultrasound unit, we implemented universal screening and counseling for clinical risks of preeclampsia during the NT visit. Our intent was to identify women who were at increased risk for preeclampsia and recommend daily LDA when warranted.

The practice change was rolled out in stages. First, the primary author (V.M.P.) developed a self-administered risk assessment based on established clinical criteria for preeclampsia (►Fig. 1). The draft assessment was then reviewed and approved by the MFM physicians and introduced to staff. The questionnaire asked patients about their history of risk factors for preeclampsia per the 2014 USPSTF guidelines,[19] which were the most up-to-date guidelines available at the time. In addition, patients were asked if a health care provider had recommended LDA, and if the patient was taking LDA. The questionnaire was structured so that questions assessing high-risk factors were presented first and grouped separately from those assessing moderate-risk factors. Black/African American race was used as a proxy for health stressors secondary to racism. Medicare insurance was a proxy for low socioeconomic status. Patients with one or more high-risk factors or those with three or more moderate-risk factors were considered at increased risk for preeclampsia.[19] Together, the MFM physicians and staff determined how to implement the practice change. Referring physicians were informed of the practice change during a departmental business meeting. The program was piloted in November 2017 and implemented between December 1, 2017, and December 31, 2019.

The risk assessment questionnaire was given to patients having a viable pregnancy and presenting for their first trimester NT ultrasound. Patients completed the assessment

Patient sticker

Preeclampsia Risk Assessment Questionnaire (PRAQ)

Patient name: _____ Date of birth: _____ Today's date: _____

1. Have you ever had preeclampsia?	[ ] Yes [ ] No
b) Did you have high blood pressure in your last pregnancy	[ ] Yes [ ] No
2. Are you pregnant with twins?	[ ] Yes [ ] No
3. Do you have chronic hypertension (high blood pressure)?	[ ] Yes [ ] No
4. Do you have diabetes (type 1 or 2)?	[ ] Yes [ ] No
5. Do you have renal (kidney) disease?	[ ] Yes [ ] No
6. Do you have an autoimmune disease (e.g., lupus, antiphospholipid syndrome,	[ ] Yes [ ] No
rheumatoid arthritis, Sjogren's)?	[ ] Yes [ ] No
b) Do you have sickle cell disease	
7. Have you given birth to a baby before?	[ ] yes [ ] NO
8. BMI: a) Your weight? _____ lbs. b) Your height? ____ ft ___ in	_____
9. Did your mother or sister have preeclampsia when they were pregnant?	[ ] Yes [ ] No
10. SOCIODEMOGRAPHICS	
a) Are you African American or Black?	[ ] Yes [ ] No
b) Is your insurance Medicaid or Husky?	[ ] Yes [ ] No
11. Are you 35 years old or older?	[ ] Yes [ ] No
12. PERSONAL FACTORS	
a) Have you given birth to a growth restricted (smaller than expected) baby?	[ ] Yes [ ] No
b) Did you have any complications during your previous pregnancies? (If yes,	[ ] Yes [ ] No
please explain: _____)	
c) Was your last pregnancy more than 10 years ago?	[ ] Yes [ ] No
Is this an IVF pregnancy?	[ ] Yes [ ] No
13. Have you ever taken aspirin while pregnant? (If yes, why? _____)	[ ] Yes [ ] No
14. Are you taking a low-dose aspirin (baby aspirin, 81 mg) in this pregnancy?	[ ] Yes [ ] No
15. Has your doctor recommended you take aspirin during this pregnancy?	[ ] Yes [ ] No
16. Are you allergic to aspirin?	[ ] Yes [ ] No
17. Do you have a bleeding problem? (e.g. Hemophilia, von Willebrand Disease)	[ ] Yes [ ] No

For physician use *Gestational age:* _____

Preeclampsia risk : ***[ ] HIGH*** ***[ ] Medium*** *[ ] Low*

Was pt offered ASA? [ ] Yes [ ] No *Pt accepts ASA? [ ] Yes [ ] No [ ] Thinking about it*

Fig. 1 Preeclampsia risk assessment questionnaire.

in the waiting room with their intake paperwork. The MFM physician reviewing the NT scan also reviewed the patient questionnaire and assessed risk. If a patient at increased risk was not taking LDA, the MFM physician counseled the patient, recommended a daily dose of aspirin (81 mg), and inserted a brief follow-up form in the patient's chart to be completed at the second-trimester anatomy ultrasound (6–10 weeks after initial screening). The MFM physician addressed patient questions or concerns. The referring primary obstetrical team received notice in writing in the ultrasound report of the assessment and recommendation. All patients received an educational handout on preeclampsia.

To evaluate the program, we audited records of patients presenting to the ultrasound unit during the 25-month implementation period. We first set out to document LDA use and preexisting recommendations for LDA at the time patients presented for their first-trimester NT ultrasound. Our goal was to counsel all women at increased risk of preeclampsia who were not taking LDA at that time. Subsequently, we assessed aspirin use among patients returning for their second-trimester anatomy ultrasound. Secondary objectives were to determine the patient's perception of her own risk for developing preeclampsia, identify factors associated with aspirin utilization, and assess pregnancy outcomes (gestational age at delivery, delivery method, estimated blood loss, Apgar scores, preeclampsia, and gestational hypertension). Our institution uses the ACOG diagnostic criteria to define preeclampsia.[20] Documentation of counseling by the MFM staff, patient demographics, and clinical outcomes were extracted from the electronic medical record. Patient-reported outcomes were recorded by the patient on the follow-up form at the time of the anatomy ultrasound visit. This form assessed if the patient was taking LDA; reasons for taking or not taking LDA; and the patient's perceived personal risk for developing preeclampsia. This study was approved by our Institutional Review Board.

Statistical analysis was performed using SAS statistical software (SAS Institute, Cary, NC), version 9.4. Descriptive statistics included mean and standard deviation for continuous variables (estimated blood loss, gestational age at delivery) and frequencies (n, %) for categorical variables. Chi square, Fisher's exact test, and t-tests were performed when appropriate. All statistical tests were two-sided and $p < 0.05$ was considered statistically significant.

Results

Screening Program

►Fig. 2 shows the screening and eligibility of our cohort. A total of 3,669 patients presenting for their first-trimester anatomy ultrasound were screened between December 1, 2017 and December 31, 2019. Slightly more than 20% (765/3,669) of patients screened at high ($n = 402$) or moderate risk ($n = 363$) for preeclampsia. Among the 765 high- and moderate-risk patients, 242 (31.6%) patients reported they had been advised to take LDA by their obstetrics provider. However, only 149 of the 242 patients (61.6%) were taking LDA. Thus, the screening program identified 616 patients eligible for counseling by the MFM physicians. Following screening, 95% of these patients (583/616) had a documented recommendation for LDA by the MFM team.

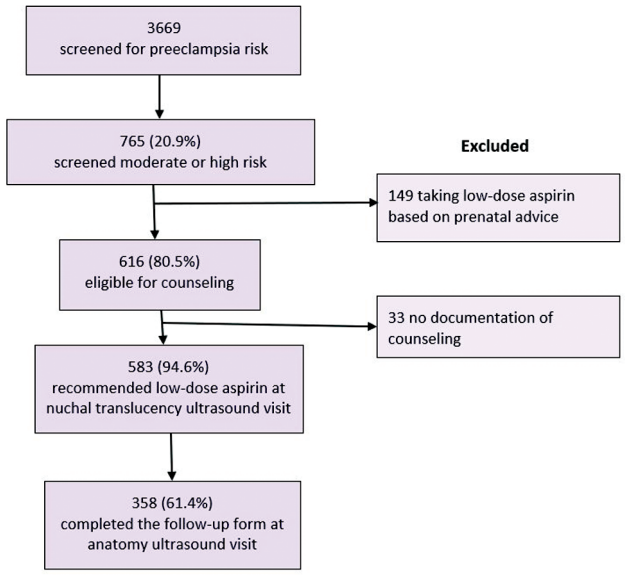

Fig. 2 Cohort flow diagram.

Follow-up

The follow-up form was given at the anatomy ultrasound visit to ascertain if patients had followed the recommendation to take LDA. The form was completed by 358 (61.4%) of the 583 patients. There were no differences with respect to demographics and risk factors between those with and without follow-up questionnaires (data not shown). ►Table 1 shows the baseline characteristics of patients who completed the follow-up form. Patients who completed the follow-up form were evenly divided between high and moderate risk (50.6 vs. 49.4%). The mean age was 31.5 ± 5.9 years and one-third ($n = 120$, 33.6%) were older than 35 years old. Most had body mass index $> 30\ kg/m^2$ ($n = 229$, 64.7%) and were multiparous ($n = 209$, 61.5%). Approximately half were Medicaid recipients ($n = 162$, 52.3%), attended private clinics or offices ($n = 186$, 52.7%), and identified as Black/African American ($n = 168$, 46.9%).

At follow-up, most of the 358 patients ($n = 279$, 77.9%) reported they were taking LDA. More high-risk patients were taking LDA compared with moderate-risk patients (153/181 = 84.5 vs. 126/177 = 71.2%, $p = 0.002$). Most patients taking LDA indicated their primary reason was to lower their risk of preeclampsia or hypertension ($n = 172$, 61.7%). Approximately one-fifth ($n = 51$, 18.3%) indicated the primary reason was a recommendation from a physician. A subset of patients taking LDA gave primary reasons unrelated to aspirin use ($n = 45$, 16.1%) or did not provide a reason ($n = 11$, 3.9%). Approximately 13.5% of patients (47/348; 10 did not respond) expressed concerns about the LDA safety (►Table 1).

Patients who screened high risk were more likely to use LDA (153/181, 84.5%) compared with moderate-risk patients (126/177, 71.2%; $p < 0.01$). ►Table 2 shows the relationship

Table 1 Baseline characteristics of patients who screening at increased risk for preeclampsia and completed the follow-up form

Participant characteristics	$N = 358$ *n* (%)
Age, mean (SD), $n = 349$	31.5 (5.9)
Age ≥ 35 y old, $n = 357$ (from survey)	120 (33.6)
BMI, mean (SD), $n = 354$	33.5 (8.6)
BMI > 30 kg/m^2	229 (64.7)
Parity, $n = 340$	
0	131 (38.5)
1	102 (30.0)
2	61 (17.9)
3	30 (8.8)
4	11 (3.2)
5 or more	5 (1.5)
Race	
Asian	16 (4.5)
African American/Black	168 (46.9)
White	101 (28.2)
Other/unknown	73 (20.4)
Hispanic ethnicity, $n = 352$	84 (23.9)
Prenatal clinic, $n = 354$	
Clinic	130 (36.8)
Private	186 (52.7)
Health center	37 (10.5)
Insurance, $n = 310$	
Medicaid	162 (52.3)
Other	148 (47.7)
Screened risk	
High	181 (50.6)
Moderate	177 (49.4)
Patient perceived risk, $n = 335$	
No risk	57 (17.0)
Low risk	126 (37.6)
Moderate risk	112 (33.4)
High risk	40 (11.9)
Concerns about LDA, $n = 348$	
Yes	47 (13.5)
No	301 (86.5)

Abbreviations: BMI, body mass index; LDA, low-dose aspirin; SD, standard deviation.
Note: Data are depicted as number and % or mean ± SD.

between LDA utilization and risk factors for preeclampsia. Patients ages 35 years or older were more likely to use LDA compared with younger women (84.2 vs. 74.7%, $p = 0.04$). In contrast, Black/African American women and patients on Medicaid were less likely to use LDA compared with non--Black/African American (70.2 vs. 84.3%, $p < 0.01$) and non-Medicaid (73.5 vs. 83.8%, $p = 0.03$) patients, respectively. Patients who expressed concern about the LDA safety were less likely to report taking LDA compared with those with no concerns (24/47, 51.1 vs. 251/301, 83.4%, $p < 0.01$). In fact, 31.5% (23/73) of patients not taking LDA expressed concern about the LDA safety. No other risk factors were associated with LDA utilization.

Patient Perceived Risk

►**Fig. 3** depicts perceived preeclampsia risk by actual risk for the 335 patients who answered the perceived risk question. Although all 335 were at moderate (49.6%, 166) or high risk (50.4%, 169), more than half (54.6%, 183/335) perceived themselves to have low or no risk of preeclampsia. Of the 169 patients in the high-risk group, only 17.2% (29/169) accurately estimated their preeclampsia risk compared with 32.5% (54/166) in the moderate-risk group ($p < 0.01$). Of the 152 patients who correctly perceived themselves as high or moderate risk for developing preeclampsia, 87.5% (133/152) used LDA compared with 73.2% (134/183) of those who perceived their risk as low and no risk ($p < 0.01$).

We found no statistically significant differences in pregnancy outcomes based on self-reported aspirin use (►**Table 3**).

Discussion

Principal Finding

This study assessed universal screening for preeclampsia and patient LDA utilization using a brief, self-administered questionnaire during the NT visit. Our intent was to address a clinical need and coordinate care, without overburdening a busy ultrasound unit. The program allowed us to either advise patients early or reinforce advice provided by the obstetrics providers. During the ideal gestational window of 12 to 14 weeks, screening in the unit captured 80.5% of patients who screened at increased risk for preeclampsia but reported not taking LDA. The MFM physicians provided the appropriate LDA recommendation to 94.6% of these eligible patients. Most had not yet been advised to take LDA by their obstetric providers. Although the patients' obstetrics provider may have identified and counseled these patients at a later appointment, the screening program took the burden of identification off the providers, allowing them to reiterate the recommendation and concentrate on other important prenatal issues. For the women who had been advised to take LDA but were not, counseling on the ultrasound unit provided an opportunity to reinforce the message and inform the obstetric providers.

Not surprisingly, women who perceived themselves to be at increased risk for preeclampsia were more likely to report taking LDA, whereas women with concerns about LDA safety were less likely. Risk perception is a complex process involving many factors including personal experience, motivation, and emotions.[21] Often individuals believe they are at lower risk for outcomes than they are.[22] This phenomenon, referred to as "unrealistic optimism" is linked to lower motivation to accept protective behaviors to lower risk. Interventions that

Table 2 Preeclampsia risk factors by low-dose aspirin use of patients who completed the follow-up form

Risk factors	Accepted LDA $N=279$ *n* (%)	Did not accept LDA $N=79$ *n* (%)	*p*-Value
High risk			
Autoimmune disease	18 (6.5)	1 (1.3)	0.088
Chronic hypertension	30 (10.9)	7 (9.2)	0.670
Pregestational diabetes mellitus	29 (10.5)	2 (2.6)	0.038
Preeclampsia in prior pregnancy	50 (18.2)	9 (11.4)	0.154
Multiple gestation	29 (10.4)	7 (9.0)	0.713
Renal disease	5 (1.8)	1 (1.3)	1.000
Hypertension in prior pregnancy	36 (15.4)	6 (9.1)	0.193
Moderate risk			
Age $\geq$ 35 y old	101 (36.3)	19 (24.1)	0.042
African American/Black	118 (42.3)	50 (63.3)	0.001
Medicaid insurance	119 (49.0)	43 (64.2)	0.027
Family history of preeclampsia	34 (12.9)	6 (8.2)	0.272
Nulliparity	114 (41.0)	25 (32.1)	0.152
Prior history of fetal growth restriction	9 (4.4, $n=203$)	3 (4.5, $n=67$)	1.000
Last pregnancy >10 y ago	30 (14.8, $n=203$)	9 (13.4, $n=67$)	0.786
BMI > 30	173 (62.7)	56 (71.8)	0.137

Abbreviations: BMI, body mass index; LDA, low-dose aspirin.
Note: Data are depicted as number and %.

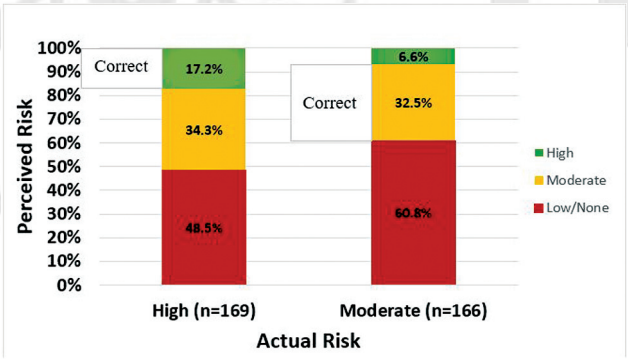

Fig. 3 Preeclampsia perceived risk in patients at moderate and high risk for preeclampsia.

successfully increase risk perception have been shown to produce behavioral change.[22] Counseling by the MFM team may have increased patient perception of preeclampsia risk and motivation to remain healthy and thus improve aspirin utilization.

Additional Findings

Our study adds to the literature about universal screening for preeclampsia risk in an ultrasound unit. Boelig et al found an increase in the aspirin utilization for preeclampsia prevention among high-risk women after the implementation of a screening tool.[18] We found that this approach is well suited to identifying patients with moderate- as well as high-risk factors for preeclampsia. The proportion of patients who identified their level of risk as high or moderate in our study is consistent with recently published data.[23] We found that this approach to screening aligned with the clinical workflow. By coinciding with the NT ultrasound visit, the screening process provided an opportunity to identify and counsel patients at increased risk of preeclampsia about LDA early in pregnancy. Our study shows that it is feasible to sustain this practice change for years and optimize care among patients from diverse clinical and sociodemographic backgrounds.

We found that more than half of the patients underestimated their preeclampsia risk even though they had been counseled on their risk and on what increased their risk for this condition. We are not aware of any published studies that evaluated both the patient's self-assessment of their risk for developing preeclampsia and the accuracy of their risk assessment. Studies have shown that patients do not accurately perceive their risk of certain conditions like gestational diabetes.[24,25] Nevertheless, patients in our study followed the physicians' LDA recommendation despite downgrading their preeclampsia risk. Nearly one in five patients utilized LDA because it was recommended by their health care providers, underscoring the importance of physician counseling in promoting adherence. We observed no differences in pregnancy outcomes based on acceptance of the LDA recommendation. However, these results should be interpreted with caution due to the observational design of the study.

Clinical Implications

Our findings highlight the potential benefit of utilizing the ultrasound unit to perform universal screening for preeclampsia followed by physician counseling and recommendation for LDA

Table 3 Pregnancy outcomes of those who used low-dose aspirin compared with those who did not

Outcomes	LDA use *n* (%)	No LDA use *n* (%)	*p*-Value
Preeclampsia, $n = 358$	17 (6.1)	5 (6.3)	0.939
Gestational HTN, $n = 358$	9 (3.2)	2 (2.5)	0.752
Any HTN disorder, $n = 358$	47 (16.9)	11 (13.9)	0.534
Delivery method, $n = 303$			
Vaginal delivery	116 (49.6)	35 (50.7)	0.866
Cesarean delivery	118 (50.4)	34 (49.3)	
Apgar < 7, $n = 302$			
1 min	20 (8.6)	5 (7.2)	0.723
5 min	4 (1.7)	0 (0)	0.273
EBL (mean), $n = 288$	692.8 (±633.3)	629.3 (±537.5)	0.461
Gestational age at delivery, $n = 303$	38.0 (±2.5)	38.3 (±2.3)	0.291
Gestational age < 37 wk, $n = 303$	52 (22.2)	13 (18.8)	0.548
Gestational age < 37 wk and preeclampsia, $n = 303$	8 (3.4)	1 (1.5)	0.690

Abbreviations: EBL, estimated blood loss; HTN, hypertension; LDA, low dose aspirin.
Note: Data are depicted as number and %.

for those at increased risk for this condition. LDA has been shown to decrease preeclampsia and preterm birth.[7,26] Our study focuses on the implementation of the USPSTF and the ACOG guidelines pertaining to screening for preeclampsia using established risk factors.[1,2,19] As per the USPSTF and the ACOG guidelines, we used the recommended 81-mg dose.[1,2,19] Research suggests that a higher dose of aspirin may be more effective in reducing the risk of this condition.[7] A study by Guy et al, published after the completion of our study, showed that first-trimester combined screening for preeclampsia with the use of 150 mg of aspirin improves preeclampsia detection rate while reducing the prevalence of this condition.[27]

Since preeclampsia is responsible for 1 in 7 global maternal deaths and 1.5 to 2 million neonatal deaths annually,[10] aspirin use may save maternal and neonatal lives. A study by the California Maternal Quality Care Collaborative showed that 62% of preeclampsia-related deaths are preventable.[28] Undoubtedly, preeclampsia prevention is key to decreasing both maternal and neonatal mortality and morbidity. Additionally, preeclampsia prevention and its associated risk of preterm birth can lead to tremendous cost savings. It is estimated that compared with no aspirin prophylaxis, the implementation of the USPTF guidelines for LDA saves $377.4 million per year.[9]

The United States has tremendous racial disparities in maternal mortality with Black non-Hispanic women being three times more likely to die from pregnancy complications than their White counterparts.[29] Hypertensive disorders of pregnancy cause 6.8% of pregnancy-related deaths in the U.S. and Black women have a higher prevalence of preeclampsia than Hispanic or White women.[30,31] Preeclampsia is a major risk factor for cardiovascular disease, which is the major cause of maternal mortality.[30] In addition to underlying chronic conditions and structural racism, variations in quality health care contribute to racial disparities in pregnancy-related deaths.[32] Our intervention in the ultrasound unit minimizes variation in quality of counseling and recommendation and is likely one positive systemic step toward closing the maternal health disparity gap.

Research Implications

Studies have found a correlation between poor adherence rates and poor obstetric outcomes.[9] The ASpirin for evidence-based PREeclampsia prevention (ASPRE) trial suggested that adherence was influential over the degree of risk reduction that aspirin could yield for high-risk patients, determining that >90% adherence allowed aspirin prophylaxis to be most effective.[33] Due to the retrospective nature of our study, we were unable to evaluate adherence and instead assessed LDA utilization. For those who did not follow the LDA recommendation, we do not know which factors influenced their decision. Future studies are needed to understand the patient's decision making, which will allow us to develop interventions to improve compliance with recommendations.

Strength and Weakness

Our study has several strengths. Our findings are generalizable to many clinical settings since it captures a real ultrasound practice in an urban setting with both a deep-rooted community representation and a strong academic affiliation. Our study is one of the largest published in this subject, and participants were selected from a sizable racially, ethnically, and financially diverse population referred from diverse clinical settings.

Another major strength of our study is the use of a quick self-administered risk assessment reviewed by MFM physicians, which allowed us to standardize patient evaluation of preeclampsia risk. Although this risk assessment was not validated or piloted, it is a straightforward checklist based on the USPSTF's guidelines and comparable to the checklist

published by the Society for Maternal-Fetal Medicine (SMFM) in 2020.[34] Similar to our risk assessment checklist, the SMFM tool is a yes-or-no checklist based on the USPSTF's definition of high and moderate risk.[34] Years before the SMFM publication, our checklist ensured patients were screened and counseled appropriately.

Performing the screening in the ultrasound unit was another major strength of our study. It allowed all patients regardless of insurance status or type of prenatal clinic to be screened. Patients received counseling from one of only four physicians. Subsequently, they had the opportunity to receive additional counseling from their primary care team during their regular prenatal visits. However, we do not know which patients received additional counseling and how this counseling impacted LDA utilization. Regardless, all patients had access to quality counseling in the ultrasound unit and received the same educational material about preeclampsia to reinforce the counseling and minimize disparity in quality of care.

An additional strength of our study is our excellent physician compliance rate with LDA recommendation, nearing 95%. In contrast, other studies utilizing similar clinical risk factors as ours have demonstrated much lower provider compliance with LDA recommendation.[17,18] However, similar to our study, Boelig et al showed that the implementation of a clinical checklist improved provider LDA recommendation to 95%.[18]

Our study has some limitations. We do not know how the counseling style differed among physicians and whether patients responded differently to different counseling styles. Response to a counseling style may impact patients' decision to take LDA. We also do not know how other potential barriers, such as the opinion of patient's family and other health care personnel, experience with health care, or overall outlook, may have impacted the patient's decision to use or decline the LDA recommendation. Additionally, at the time of this study, the ACOG had not yet published its preeclampsia screening recommendations establishing that more than one moderate-risk factor was sufficient to meet the criteria for aspirin prophylaxis.[3] The use of more than two risk factors likely lowered the screen-positive rate in our study. Furthermore, our study was not designed to assess the accuracy of our screening protocol. Our protocol is based on current clinical guidelines in the United States, which do not incorporate biomarkers.[1,2,19] Research suggests that the use of biomarkers improves preeclampsia screening performance.[35] O'Gorman et al showed that the detection rate using ACOG recommendation versus the Fetal Medicine Foundation algorithm, which incorporates both biophysical and biochemical measurements to maternal risk factors, was, respectively, 94 versus 100% for preeclampsia at less than 32 weeks, 90 versus 75% for less than 37 weeks, and 89 versus 43% for 37 weeks or greater, with a false positive rate of 64.2 versus 10%.[36]

Another limitation of our study is the assessment of LDA utilization during the anatomy ultrasound and not in later gestations. However, we expect that patients who take a recommended medication in the mid-trimester will continue with the recommended treatment later in pregnancy unless otherwise advised by another qualified health care professional. We do not know the degree of LDA adherence and thus could not assess the relationship between LDA adherence and pregnancy outcomes. Finally, this was an observational study; therefore, it is not designed to assess causality.

In conclusion, our study shows that screening for preeclampsia using a quick questionnaire based on the USPSTF guidelines, followed by appropriate LDA counseling, is feasible in an ultrasound unit. This intervention captured 80.5% of patients eligible for preeclampsia counseling and LDA recommendation. It shows that subsequent patient LDA utilization is good. This intervention may improve patient LDA utilization and standardize patient care, which may help close the maternal health disparity gap.

Note

Some of the data were presented virtually at the Society for Maternal-Fetal Medicine 41st Annual Pregnancy Meeting, Poster #281, January 28, 2021.

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Conflict of Interest

None declared.

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