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RESEARCH LETTER
Prevention in Practice

Disparities in cholesterol screening among a nationally representative sample of pregnant women in the United States

Reed Mszar [1,2], Shiwani Mahajan[2,3], Javier Valero-Elizondo [4,5], Gowtham R. Grandhi [6], César Caraballo[2,3], Dipika J. Gopal[7], Richard L. Nemiroff[8], Daniel E. Soffer[7], Miguel Cainzos-Achirica[4,5], Garima Sharma[9]†, Khurram Nasir [4,5]*†

[1]Department of Chronic Disease Epidemiology, Yale School of Public Health, 60 College Street, New Haven, CT 06510, USA; [2]Center for Outcomes Research and Evaluation, Yale New Haven Health, 1 Church Street, Suite 200, New Haven, CT 06510, USA; [3]Section of Cardiovascular Medicine, Yale School of Medicine, 333 Cedar Street, New Haven, CT 06520, USA; [4]Division of Cardiovascular Prevention and Wellness, Houston Methodist DeBakey Heart and Vascular Center, 6550 Fannin Street, Suite 1801, Houston, TX 77030, USA; [5]Center for Outcomes Research, Houston Methodist Research Institute, Houston, TX, USA; [6]Department of Medicine, MedStar Union Memorial Hospital, 201 E University Pkwy, Baltimore, MD 21218, USA; [7]Division of Cardiology, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA; [8]Department of Obstetrics and Gynecology, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA; and [9]Ciccarone Center for Prevention of Cardiovascular Disease, Johns Hopkins University School of Medicine, Baltimore, MD, USA

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While normal gestation is characterized by an increase in lipid production during the second and third trimesters to support healthy fetal development, maternal dyslipidemia during early gestation is associated with greater risk of preeclampsia, preterm birth, and other adverse pregnancy outcomes, as well as an increased risk of cardiovascular disease later in life.[1–3] Therefore, pregnancy represents a unique period to screen for subclinical dyslipidemia. Despite guidelines recommending routine screening of low-density lipoprotein cholesterol in adults >20 years of age,[4] screening rates remain suboptimal, particularly among non-White individuals and those of a lower socioeconomic status.[5,6] Accordingly, we aimed to assess the prevalence of cholesterol screening and variations based on sociodemographic characteristics in a nationally representative sample of pregnant women in the United States.

We used 7 years of pooled data (2012–2018) from the National Health Interview Survey (NHIS) and included women between 18 and 49 years of age who were pregnant at the time of survey completion. The NHIS is composed of annual, cross-sectional surveys that incorporate complex, multistage sampling to report estimates on noninstitutionalized individuals in the United States. Cholesterol screening status was ascertained by participants' dichotomous response to the question, 'During the past 12 months, have you had your cholesterol checked by a doctor, nurse, or other health professional?' We assessed associations between screening status and the following sociodemographic characteristics: age (18–29 years and 30–49 years), race/ethnicity (i.e. non-Hispanic White or non-White), education level (≥some college or ≤high school), insurance status (insured or uninsured), immigration status (US-born or non-US-born), family income [as a proportion of the federal poverty limit from the US Census Bureau and categorized as high (≥400%), middle (200% to <400%), and low income (<200%)], and usual source of care (yes or no). To provide national estimates, person-level weights were created after adjusting for nonresponse, age, and race/ethnicity (based on population estimates produced by the US Census Bureau). Logistic regression was used to analyze factors associated with an absence of cholesterol screening. Due to NHIS data being publicly available and de-identified, this study was exempt from purview by the institutional review board committee. The datasets were derived from sources in the public domain: National Health Interview Survey, https://www.cdc.gov/nchs/nhis/index.htm, last accessed February 15, 2020.

Among 1517 pregnant women, representing more than 1.8 million women in the United States, 32.4% [95% confidence interval (CI) 29.4–35.6%] had no cholesterol screening during the past 12 months. We found higher rates of lacking screening among women aged 18–29 years compared with women ≥30 years (36.0% vs. 27.8%,

* Corresponding author. Tel: + (713) 441-1100, Email: knasir@houstonmethodist.org
† The last two authorsare co-senior authors.

Table 1 Overall distribution of study variables and weighted proportions of sociodemographic factors associated with an absence of cholesterol screening among pregnant women in the past 12 months, from the National Health Interview Survey, 2012–2018

Study variables	Overall population, *N*	Absence of screening, *N*	Weighted prevalence, %	*P*-value	Adjusted OR[a] (95% CI)
Overall population	1517	513	32.4		
Age category (years)				0.005	
18–29	834	307	36.0		*Reference*
≥30	683	206	27.8		1.23 (0.90–1.69)
Race/Ethnicity				<0.001	
Non-White	685	204	26.6		*Reference*
White	832	309	36.5		1.93 (1.39–2.69)
Immigration status				0.273	
US-born	1193	421	33.4		*Reference*
Non-US-born	322	91	28.9		1.05 (0.66–1.66)
Education level				0.093	
≥Some college	979	314	30.6		*Reference*
≤High school/GED	538	199	36.1		0.94 (0.65–1.36)
Insurance status				<0.001	
Insured	1383	439	30.9		*Reference*
Uninsured	129	74	56.1		2.51 (1.47–4.27)
Family income[b]				0.023	
High	437	120	26.8		*Reference*
Middle	365	134	34.4		1.27 (0.85–1.90)
Low	630	235	36.3		1.56 (1.05–2.32)
Usual source of care				<0.001	
Yes	1366	426	30.0		*Reference*
No	151	87	55.1		2.28 (1.43–3.64)

CI, confidence interval; GED, general education diploma; HS, high school; OR, odds ratio.
[a]Adjusted for age, race/ethnicity, immigration status, education level, insurance status, income level, and usual source of care.
[b]Income classified as high [≥400% of federal poverty level (FPL)], middle (200–400% of FPL), and low (<200% of FPL).

$P = 0.005$), uninsured compared with insured women (56.1% vs. 30.9%, $P < 0.001$), and women without a usual source of care compared to those with a usual source of care (55.1% vs. 30.0%, $P < 0.001$) (*Table 1*). Our results showed a stepwise increase in lacking cholesterol screening based on income status with high-, middle-, and low-income subgroups reporting at 26.8%, 34.4%, and 36.3% without screening, respectively ($P = 0.023$). After adjusting for covariates, uninsured status [OR, 2.51 (95% CI 1.47–4.27)], low-income level [OR 1.56 (95% CI 1.05–2.32)], and no usual source of care [OR 2.28 (95% CI 1.43–3.64)] were independently associated with an increased likelihood of lacking cholesterol screening.

In our nationally representative sample representing approximately 1.8 million pregnant women in the United States annually, we found that nearly one in three women lacked cholesterol screening in the past 12 months. Disparities in screening were observed based on family income, insurance status, and a usual source of care. Prior studies have shown that social determinants of health are associated with factors influencing atherosclerotic cardiovascular disease (ASCVD) risk; however, the extent that these sociodemographic characteristics affect cholesterol screening rates during pregnancy is not well-established. Pregnancy, often referred to as a cardiometabolic 'stress test', provides a unique opportunity to assess women's cardiovascular health and future risk of disease.[7–9] Considering that many women rely on their obstetrician–gynecologist (OB-GYN) for preventive care and that a large proportion of women experience at least one pregnancy, cholesterol screening may be integrated into routine prenatal care services.[10,11]

While studies have ascertained the prevalence of cholesterol screening in the general population and characterized racial/ethnic and socioeconomic disparities in screening access and utilization,[5] this is the first study to the authors' knowledge that has described the proportion of and differences in pregnant women receiving screening specifically. These findings highlight a current gap in the provision of guideline-recommended screening in the period before pregnancy or during early prenatal care. This is further strengthened by the recent Presidential Advisory from the American Heart Association and American College of Obstetricians and Gynecologists, stating that clinicians who provide care to women must take an active role in chronic disease prevention and that coordinated healthcare delivery will foster accurate assessments of patients' needs and improve health outcomes.[11] While lipid panel results may vary over the course of a pregnancy, abnormally high lipids during the first trimester may be an

indicator of increased cardiometabolic risks and underlying familial disorders requiring follow-up care.

Our findings should be interpreted considering several limitations. First, the cross-sectional design of the NHIS limits the ability to establish associations between screening patterns and pregnancy outcomes. Even after adjusting for covariates, the risk of residual confounding cannot be discounted. Second, the presence of a screening in the year preceding survey completion was ascertained via self-report, thus the prevalence of screening may be subject to recall bias. Third, the lack of data on family history of premature ASCVD precludes our ability to assess the proportion of women at greater cardiovascular risk who may derive increased benefit from screening. In addition to capturing screening data specific to trimester of pregnancy, future studies should aim to more comprehensively characterize the observed racial/ethnic variations in screening that may be attributed to racial bias along with differences in healthcare access and utilization. Specifically, non-Hispanic White women may be more likely to receive preventive health services including cholesterol screening well before pregnancy.

In our study, one in three pregnant women lacked cholesterol screening in the past 12 months. Despite recommendations for cholesterol screening among young adults and the risks associated with maternal dyslipidemia, more than half of uninsured pregnant women and those without a usual source of care lacked screening. Our findings underscore the need for integrating preventive screenings into routine prenatal care, particularly among underserved populations with unmet cardiovascular needs.

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References

1. Catov JM, Bodnar LM, Kip KE, Hubel C, Ness RB, Harger G, Roberts JM. Early pregnancy lipid concentrations and spontaneous preterm birth. *Am J Obstet Gynecol* 2007;**197**:610.e1–7.
2. Maymunah AO, Kehinde O, Abidoye G, Oluwatosin A. Hypercholesterolaemia in pregnancy as a predictor of adverse pregnancy outcome. *Afr Health Sci* 2015; **14**:967–973.
3. Spracklen CN, Smith CJ, Saftlas AF, Robinson JG, Ryckman KK. Maternal hyperlipidemia and the risk of preeclampsia: a meta-analysis. *Am J Epidemiol* 2014;**180**: 346–358.
4. Grundy SM, Stone NJ, Bailey AL, Beam C, Birtcher KK, Blumenthal RS, Braun LT, de Ferranti S, Faiella-Tommasino J, Forman DE, Goldberg R, Heidenreich PA, Hlatky MA, Jones DW, Lloyd-Jones D, Lopez-Pajares N, Ndumele CE, Orringer CE, Peralta CA, Saseen JJ, Smith SC, Sperling L, Virani SS, Yeboah J. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the management of blood cholesterol: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2019;**73**:3168–3209.
5. Toth PP, Potter D, Ming EE. Prevalence of lipid abnormalities in the United States: the National Health and Nutrition Examination Survey 2003-2006. *J Clin Lipidol* 2012;**6**:325–330.
6. Kenik J, Jean-Jacques M, Feinglass J. Explaining racial and ethnic disparities in cholesterol screening. *Prev Med* 2014;**65**:65–69.
7. Sharma G, Lindley K, Grodzinsky A. Cardio-obstetrics. *J Am Coll Cardiol* 2020;**75**: 1355–1359.
8. Park K, Wu P, Gulati M. Obstetrics and gynecological history. *JACC Case Rep* 2020;**2**:161–163.
9. Moe K, Sugulle M, Dechend R, Staff AC. Risk prediction of maternal cardiovascular disease one year after hypertensive pregnancy complications or gestational diabetes mellitus. *Eur J Prev Cardiol* 2020;**27**:1273–1283.
10. Stormo AR, Saraiya M, Hing E, Henderson JT, Sawaya GF. Women's clinical preventive services in the United States. *JAMA Intern Med* 2014;**174**:1512.
11. Brown HL, Warner JJ, Gianos E, Gulati M, Hill AJ, Hollier LM, Rosen SE, Rosser ML, Wenger NK, et al. Promoting risk identification and reduction of cardiovascular disease in women through collaboration with obstetricians and gynecologists: a presidential advisory from the American Heart Association and the American College of Obstetricians and Gynecologists. *Circulation* 2018;**137**:e843–e852.