



## Health Equity

# Preconception Health Risks Among U.S. Women: Disparities at the Intersection of Disability and Race or Ethnicity



Willi Horner-Johnson, PhD<sup>a,b,\*</sup>, Ilhom Akobirshoev, PhD<sup>c</sup>,  
 Ndidiamaka N. Amutah-Onukagha, PhD<sup>d</sup>, Jaime C. Slaughter-Acey, PhD<sup>e</sup>,  
 Monika Mitra, PhD<sup>c</sup>

<sup>a</sup> Department of Pediatrics, Institute on Development and Disability, School of Medicine, Oregon Health & Science University, Portland, Oregon

<sup>b</sup> Oregon Health & Science University-Portland State University Collaborative School of Public Health, Portland, Oregon

<sup>c</sup> Lurie Institute for Disability Policy, Heller School for Social Policy and Management, Brandeis University, Waltham, Massachusetts

<sup>d</sup> Department of Public Health and Community Medicine, School of Medicine, Tufts University, Boston, Massachusetts

<sup>e</sup> Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis, Minnesota

Article history: Received 13 November 2019; Received in revised form 22 September 2020; Accepted 6 October 2020

## A B S T R A C T

**Introduction:** Prior research has found that some preconception health risks are more prevalent among women in historically minoritized racial and ethnic groups. Preconception health risks are also increased among women with disabilities. Risks could be even greater among women who both have a disability and belong to a minoritized racial or ethnic group. The purpose of this study was to assess preconception health at the intersection of disability and race or ethnicity.

**Methods:** We analyzed data from the 2016 Behavioral Risk Factor Surveillance System to estimate the prevalence of health behaviors, health status indicators, and preventive healthcare receipt among nonpregnant women 18–44 years of age. We used modified Poisson regression to compare non-Hispanic White women with disabilities and women with and without disabilities in three other race/ethnicity groups (non-Hispanic Black, Hispanic, other race) to a reference group of non-Hispanic White women without disabilities. Disability status was defined based on affirmative response to at least one of six questions about difficulty with seeing, hearing, mobility, cognition, personal care, or independent living tasks. Multivariate analyses adjusted for other sociodemographic characteristics such as age and marital status.

**Results:** In every racial and ethnic group, women with disabilities had a significantly higher prevalence of most preconception health risks than their counterparts without disabilities. The disparity in obesity for Black women with disabilities was additive, with the adjusted prevalence ratio (PR, 1.77; 95% confidence interval [CI], 1.57–2.00) equal to the sum of the prevalence ratios for disability alone (PR, 1.29; 95% CI, 1.19–1.41) and Black race alone (PR, 1.47; 95% CI, 1.36–1.58).

**Conclusions:** Women at the intersection of disability and minoritized race or ethnicity may be at especially high risk of adverse outcomes. Targeted efforts are needed to improve the health of women of reproductive age in these doubly marginalized populations.

© 2020 Jacobs Institute of Women's Health. Published by Elsevier Inc.

**Funding:** Research reported in this publication was supported in part by Award Number 90DDUC0039 from the Administration on Community Living, Cooperative Agreement Number NU27DD000014 from the National Center on Birth Defects and Developmental Disabilities of the Centers for Disease Control and Prevention, Award Numbers R01HD074581, R01HD090103, and R01HD082105 from the National Institute of Child Health and Human Development of the National Institutes of Health, and Award Number 90DPGE000 from the National Institute on Disability, Independent Living, and Rehabilitation Research. The contents are solely the responsibility of the authors and do not necessarily represent the official views of the funding sources.

\* Correspondence to: Willi Horner-Johnson, PhD, 707 SW Gaines Street, Portland, OR 97239. Phone: 503 494 9273; fax: 503 494 6868.

E-mail address: [hornerjo@ohsu.edu](mailto:hornerjo@ohsu.edu) (W. Horner-Johnson).

An estimated 12%–18% of reproductive age women in the United States have a disability related to vision, hearing, mobility, cognition, and/or ability to engage in self-care and independent living activities (Horner-Johnson, Darney, Kulkarni-Rajasekhara, Quigley, & Caughey, 2016; Mitra, Clements, Zhang, & Smith, 2016; Okoro, Hollis, Cyrus, & Griffin-Blake, 2018). Research has found higher odds of pregnancy complications and adverse pregnancy outcomes (e.g., gestational diabetes, preterm birth, infants small for gestational age) among women with disabilities than among women without disabilities (Akobirshoev, Parish,

Mitra, & Rosenthal, 2017; Clements, Mitra, Zhang, & Iezzoni, 2016; Darney, Biel, Quigley, Caughey, & Horner-Johnson, 2017; Gavin, Benedict, & Adams, 2006; Mitra, Clements, et al., 2015a; Mitra, Parish, Clements, Cui, & Diop, 2015b; Morton et al., 2013). These complications and adverse outcomes may be due in part to elevated preconception health risks that could be prevented. Preconception health indicators include modifiable risk factors (e.g., smoking, alcohol use, lack of exercise, lack of social support) that are associated with adverse pregnancy outcomes (Broussard, Sappenfield, Fussman, Kroelinger, & Grigorescu, 2011). Addressing these risk factors is an important mechanism for improving maternal and child health.

An earlier study found significant disparities in preconception risk factors between reproductive age women with and without disabilities (Mitra et al., 2016). In contrast with other women, women with disabilities were more likely to report fair or poor health, frequent mental distress, and inadequate emotional support, and were also more likely to have obesity, report lower levels of exercise, smoke in the past month, and report more chronic diseases (Mitra et al., 2016). Relatedly, research on women who already had children and many of whom could potentially become pregnant again found that those with disabilities had higher odds of chronic conditions, adverse health behaviors, poor physical and mental health, and insufficient social and emotional support compared with women without disabilities (Kim, Kim, Hong, & Fredriksen-Goldsen, 2013). Further, multiple studies (e.g., Drew & Short, 2010; Horner-Johnson, Dobbertin, Andresen, & Iezzoni, 2014; Steele, Townsend, Courtney-Long, & Young, 2017) have found that women with disabilities are less likely to receive Pap testing to screen for cervical cancer, an important form of preconception as well as overall preventive health care.

Many of these disparities parallel those that have been found in relation to race and ethnicity. Adverse pregnancy outcomes—including preterm birth, infants small for gestational age, and severe maternal morbidity and mortality—are more common among women in minoritized racial and ethnic groups compared with non-Hispanic White women (Admon et al., 2018; Grobman et al., 2018; Petersen et al., 2019; Ratnasiri et al., 2018; Tangel, White, Nachamie, & Pick, 2019). Preconception risk factors such as physical inactivity, obesity, and diabetes are also more common among Black and Hispanic women of reproductive age than among similarly aged non-Hispanic White women (Arbour, Corwin, Salsberry, & Atkins, 2012; Robbins et al., 2018). Such disparities are rooted in structural racism that drives inequitable access to social determinants of health (Bailey et al., 2017; Williams, Lawrence, & Davis, 2019). Women in these racial and ethnic groups who also have disabilities may experience inequities associated with both racism and ableism, potentially magnifying threats to their health. Moreover, disability is more common across the lifespan in many racial and ethnic groups than it is in the non-Hispanic White population (Centers for Disease Control and Prevention, 2019a). In our specific population of interest, although nearly two-thirds of reproductive age women with disabilities are non-Hispanic White, an estimated 12% are non-Hispanic Black, 15% are Hispanic, and 7% belong to other racial groups or are multiracial (Mitra et al., 2016). Thus, the intersection of disability and race/ethnicity is important to consider in the context of preconception health.

Prior research in the overall adult population has found that individuals in minoritized racial and ethnic groups who also have a disability experience greater disparities than those who belong to just one of these population groups, on indicators including

severe depression and receipt of dental care (Horner-Johnson, Dobbertin, & Beilstein-Wedel, 2015; Jones & Sinclair, 2008). Similarly elevated disparities may exist in preconception health. However, the preconception health of women with disabilities has not yet been examined in conjunction with race and ethnicity. To address this gap, we conducted analyses of nationally representative population-based survey data to compare the prevalence of selected potentially modifiable preconception health risk factors among women with and without disabilities in different racial and ethnic groups.

## Methods

### Data Source

We analyzed data from the 2016 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an ongoing random digit dial telephone survey of the noninstitutionalized population 18 years of age and older. The survey is conducted by each U.S. state and participating territory in collaboration with the Centers for Disease Control and Prevention to provide population-level data on health risk behaviors and preventive health practices. We analyzed data from all 50 states, the District of Columbia, and three territories. Response rates in 2016 ranged from 30.7% to 65.0%, with a median of 47.1% (Centers for Disease Control and Prevention, 2017a). Because this was a secondary analysis of publicly available data that do not include identifying information, institutional review board approval was not required.

Our analyses were limited to women ages 18–44 years ( $n = 67,790$ ). We excluded women who were pregnant at the time of their interview ( $n = 2,497$ ) or who had had a hysterectomy ( $n = 3,214$ ). We also excluded women with unknown race or ethnicity or missing values for disability status ( $n = 2,762$ ). Our final analytic sample included 59,317 women ages 18–44 years, including 37,942 (64.0%) White women, 6,662 (11.2%) Black women, 9,162 (15.5%) Hispanic women, and 5,551 (9.4%) women from other races and ethnicities.

### Measures

We categorized women as having a disability if they answered yes to any of the following questions (Centers for Disease Control and Prevention, 2019b): 1) Are you deaf or do you have serious difficulty hearing? 2) Are you blind or do you have serious difficulty seeing, even when wearing glasses? 3) Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions? 4) Do you have serious difficulty walking or climbing stairs? 5) Do you have difficulty dressing or bathing? 6) Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?

We grouped race and ethnicity into the following categories: non-Hispanic White, non-Hispanic Black, Hispanic of any race, and other race (including Asians, Native Hawaiians and other Pacific Islanders, American Indians and Alaska Natives, and multiracial individuals). We also created a new variable combining disability status and race/ethnicity. This variable included the following eight categories: 1) non-Hispanic White without disability, 2) non-Hispanic White with disability, 3) non-Hispanic Black without disability, 4) non-Hispanic Black with disability, 5) Hispanic without disability, 6) Hispanic with

disability, 7) other race without disability, 8) other race with disability.

The preconception health indicators we analyzed were drawn from a list of 45 variables as defined by the Core State Preconception Health Indicators Working Group as key preconception health indicators (Broussard et al., 2011). The indicators identified by the Working Group cover multiple domains, including general health status, social determinants of health, health care, substance use, nutrition and physical activity, mental health, emotional and social support, chronic conditions, and infections (Broussard et al., 2011). We examined the 17 indicators for which data were available in the 2016 BRFSS, as described elsewhere in this article.

The dataset included one variable per domain in the general health status and social determinants of health domains. To assess general health status, we classified women as having fair or poor health based on their response to the question: “In general, would you say your health is excellent, very good, good, fair, or poor?” In the social determinants of health domain, we utilized data on highest level of educational attainment to identify women with less than a high school degree or GED.

The health care indicators established by the Working Group and available in the BRFSS data included presence of health insurance, receipt of routine checkup within the past year, dental visit within the past year, and receipt of a Pap test within the past 3 years. We categorized women as having no health insurance if they indicated that they did not have any type of health care coverage. We created dichotomous variables for these three indicators based on how recently women reported having received each type of care.

The available substance use indicators were current smoking, heavy drinking in the past month, and binge drinking in the past month, as coded within the BRFSS (Centers for Disease Control and Prevention, 2017b). Women were classified as current smokers if they had smoked at least 100 cigarettes in their lifetime and were currently smoking every day or some days. Heavy drinking for women was defined as consuming on average more than one drink per day during the past 30 days. Binge drinking for women was defined as consuming four or more drinks on a single occasion within the past 30 days.

Nutrition and physical activity indicators included obesity and engaging in exercise or physical activity. Obesity was defined as having a body mass index of 30 or above. Lack of physical activity in the past month was determined based on no reported participation in any physical activity or exercise other than as part of their job during the past month.

BRFSS data provided one indicator each in the mental health and emotional and social support domains. The mental health indicator of frequent mental distress was defined by the respondent's self-report of having 14 or more days in the past 30 days when their mental health was not good. We categorized women as having inadequate social support if they indicated never, rarely, or sometimes (as opposed to always or usually) receiving the social and emotional support they needed.

Chronic conditions indicators included diabetes and current asthma. Women who had ever have been told by a health professional that they had diabetes—excluding women who were only told they had diabetes during pregnancy—were categorized as having diabetes. Women were considered to have current asthma if they indicated they had ever been told by a health professional that they had asthma and subsequently responded that they still had asthma.

Indicators available in the infections domain included receipt of human immunodeficiency virus (HIV) testing and influenza vaccine. We coded women as not having received HIV testing if they reported never having been tested for HIV. We categorized women as not having been vaccinated for influenza if they had not received a flu shot within the past year.

We included the following sociodemographic characteristics as covariates in all of our multivariate analyses: age (18–24 years, 25–34 years, 34–44 years); marital status (married or part of an unmarried couple, divorced/separated/widowed, never married); employment status (employed, unemployed, student/homemaker/retired, unable to work); and household income (<\$15,000; \$15,000–<\$25,000; \$25,000–<\$35,000; \$35,000–<\$50,000; ≥\$50,000). Additionally, we included education (less than high school, high school, some college, college degree or higher) as a covariate in analyses for all preconception health indicators other than education itself. Similarly, we include health insurance status (yes or no) as a covariate for analyses of all other preconception health indicators.

### Statistical Analysis

We compared the demographic and socioeconomic characteristics of women with and without disabilities in each racial and ethnic group. Differences between women with and without disabilities were evaluated using  $\chi^2$  tests. All the available preconception health indicators were analyzed as binary (yes/no) variables, coded such that a higher prevalence indicated a greater risk to preconception health. We calculated the prevalence for each of the risk indicators among women with and without disabilities in each racial and ethnic group. We conducted modified Poisson regressions to estimate the unadjusted and adjusted prevalence ratios (with 95% confidence intervals) for each preconception risk factor in each disability by race-ethnicity category, using non-Hispanic White women without disabilities as the reference group. Multivariable models adjusted for the covariates described above. Because a number of model covariates had missing values (household income: 14.6%; employment: 1.0%), consistent with best practices (Royston & White, 2011; Schenker et al., 2006), we conducted multiple imputation by chained equations to impute values for the variables with missing data. This imputation method, suitable for large datasets with many variables, uses a series of regression models wherein each variable with missing data is sequentially modeled conditional upon the other variables in the data (Azar, Stuart, Frangakis, & Leaf, 2011). We used Stata version 16 for all analyses, applying *svy* commands to account for the complex sampling design of the BRFSS.

## Results

### Sample Characteristics

Table 1 presents the demographic and socioeconomic characteristics of women with and without disabilities, stratified by race and ethnicity. In each racial and ethnic group, women with disabilities had significantly less education, were less likely to be married, and were less likely to be employed than their counterparts without disabilities. Compared with women without disabilities, women with disabilities were over-represented in the lowest income categories and under-represented in the highest income categories in every racial and ethnic group.

**Table 1**  
Sample Characteristics of Women 18–44 Years Old With and Without Disability Stratified by Race/Ethnicity (Weighted Percentages, BRFSS, 2016)

Characteristic	Non-Hispanic White (n = 37,942) <sup>†</sup>		Non-Hispanic Black (n = 6,662)		Hispanic (n = 9,162)		Other Race <sup>‡</sup> (n = 5,551)	
	Disability Status		Disability Status		Disability Status		Disability Status	
	No (n = 32,002)	Yes (n = 5,940)	No (n = 5,477)	Yes (n = 1,185)	No (n = 7,520)	Yes (n = 1,642)	No (n = 4,618)	Yes (n = 933)
Age (y)								
18–24	26.9	29.7	28.9	25.1	26.3	27.9	31.8	33.5
25–34	37.6	36.4	38.6	33.7	39.7	35.7	33	33.6
35–44	35.5	33.9	32.5	41.2	34	36.4	35.1	32.9
Age, mean (SD)	32.6 (7.4)	32.3 (7.7)	31.9 (7.4)	32.8 (7.5)	31.8 (7.4)	32.3 (7.6)	31.2 (7.6)	32.3 (7.8)
Education								
Less than high school	4.8	15.5	6.2	17.8	30.5	35.7	3.3	13.8
High school graduate	19.9	31.7	28.7	35.2	29.3	26.6	17.8	31.2
Some college	36.4	37.9	39.0	34.9	25.8	27.7	30.6	35.4
≥College graduate	39.0	15.0	26.2	12.1	14.4	9.9	48.3	19.5
Marital status								
Married/coupled	49.3	33.7	23.0	17.0	41.6	29.4	44.0	27.7
Previously married <sup>†</sup>	8.0	16.7	9.8	14.6	11.0	14.9	6.5	11.5
Never married	42.7	49.6	67.2	68.4	47.5	55.7	49.4	60.8
Employment								
Employed	68.6	45.6	69.4	45.9	52.2	43.0	58.3	44.5
Unemployed	26.6	25.5	20.7	17.9	37.0	31.2	35.3	24.9
Out of workforce <sup>§</sup>	3.8	11.6	8.1	14.5	8.3	14.7	5.1	10.8
Unable to work	0.9	17.2	1.8	21.8	2.5	11.1	1.4	19.8
Health coverage								
Insured	7.5	13.3	12.8	18.0	32.9	31.7	8.8	14.2
Uninsured	92.5	86.7	87.2	82.0	67.1	68.3	91.2	85.8
Income								
Less than \$15,000	6.1	23.0	15.3	32.8	20.8	30.3	8.6	19.9
\$15,000 to <\$25,000	11.8	26.9	23.8	29.7	31.5	34.6	12.1	33.2
\$25,000 to <\$35,000	8.4	10.9	13.3	10.0	13.3	11.3	9.6	11.5
\$35,000 to <\$50,000	13.7	12.2	14.6	13.8	12.1	10.6	11.0	9.0
≥\$50,000	60.0	27.0	33.0	13.7	22.3	13.2	58.7	26.3

Abbreviation: BRFSS, Behavioral Risk Factor Surveillance System.

<sup>§</sup> Includes students, homemakers, and retired persons.

\* Sample sizes are unweighted counts.

<sup>†</sup> Includes Asian, Native Hawaiian and other Pacific Islander, American Indian and Alaska Native, and multiple races.

<sup>‡</sup> Includes divorced, separated, or widowed.

### *Differences in Preconception Risk Factors Between Women with and without Disabilities within Racial and Ethnic Groups*

The proportions and 95% confidence intervals of the preconception risk factors for women with and without disabilities are shown in [Table 2](#), stratified by race and ethnicity. In every racial and ethnic group, women with disabilities were significantly more likely to report fair or poor health, less than a high school education, no dental visit in the past year, current smoking, binge drinking in the past month, obesity, lack of exercise, frequent mental distress, diabetes, and current asthma compared with women without disabilities in the same racial or ethnic group. For the remaining risk factors (no health insurance, no checkup in past year, no Pap test in past 3 years, heavy drinking, inadequate social support, never tested for HIV, and no influenza vaccination in the past year), women with disabilities were generally at greater risk than their counterparts without disabilities, but the differences were not statistically significant in all racial and ethnic groups. The exception to this overall pattern was HIV testing, which women with disabilities were approximately as or more likely to have received compared with women without disabilities of the same race or ethnicity.

### *Preconception Risks at the Intersection of Race/Ethnicity and Disability*

When comparing all groups to non-Hispanic White women without disabilities, prevalence ratios for women with disabilities in each racial and ethnic group were significantly elevated in our unadjusted analyses for the majority of the risk factors we examined ([Table 3](#)). Of the variables on which women with disabilities in minoritized racial and ethnic groups did not differ significantly from non-Hispanic White women without disabilities, most were ones for which women without disabilities in the same racial and ethnic groups had significantly lower prevalence ratios compared with the reference group (i.e., less prevalence of risk than among their non-Hispanic White counterparts). There were two factors on which we found significantly lower prevalence ratios for women with disabilities compared with the reference group: 1) never tested for HIV (for all disability groups) and 2) no checkup in past year (Black women with disabilities only). There were also two factors (obesity and physical inactivity) on which Black women with disabilities had elevated prevalence ratios with confidence intervals that did not overlap with those of Black women without disabilities or White women with disabilities, indicating greater disparity for women with the combination of Black race and disability status than for women with only one of these characteristics.

With the addition of covariates to the models ([Table 4](#)), prevalence ratios were somewhat attenuated. The prevalence ratios for women with disabilities in certain racial and ethnic groups that were significant in unadjusted analyses no longer significantly differed from the reference group for the following indicators: no health insurance (other race only), no dental visit in the past year (Hispanic and other race only), no Pap test in past 3 years (Hispanic only), current smoking (Black only), and no flu vaccine in past year (Black and other race only). Other indicators shifted from insignificant to significantly lower prevalence ratios for some groups. These variables included no checkup in past year (Hispanic only), no Pap test in the past 3 years (Black only), and current smoking (Hispanic only). Despite these changes, women with disabilities in each racial and ethnic group

continued to have significantly elevated prevalence ratios compared with the reference group for the majority (ranging from 9 to 13) of the 17 preconception health risk indicators. Black women with disabilities continued to have a higher prevalence ratio for obesity, not only compared with the reference group but also compared with White women with disabilities and Black women without disabilities.

## **Discussion**

To our knowledge, this study is the first to examine the preconception health of women with disabilities by racial and ethnic group. Our findings regarding overall patterns of disparities in preconception risk factors between women with and without disabilities largely confirm those reported previously (e.g., [Mitra et al., 2016](#); [Kim et al., 2013](#); [Drew & Short, 2010](#); [Horner-Johnson et al., 2014](#); [Steele et al., 2017](#)). Further, we found that most of these disparities were apparent in each racial and ethnic group; that is, they were not driven exclusively by non-Hispanic White women.

In addition to the increased prevalence of health risks in comparison to the reference group, there were some preconception health risk indicators on which prevalence ratios for minoritized women with disabilities were either higher than the prevalence ratios for their counterparts without disabilities or higher than those for non-Hispanic White women with disabilities, but not both simultaneously. In our adjusted analyses, obesity was the only risk factor on which minoritized women (specifically Black women) with disabilities seemed to experience compounded disparity. The effect was additive, with the prevalence ratio for the combination of Black race and disability status equal to the sum of each of the individual effects. Although obesity is known to be prevalent among Black women ([Fryar, Carroll, & Ogden, 2018](#)) and among women with disabilities ([Mitra, et al., 2016](#); [Kim et al., 2013](#)), ours is the first study to show an additive effect for women living at the intersection of race and disability.

Our findings emphasize the need for increased attention to the preconception health of women with disabilities, particularly women with disabilities in marginalized racial and ethnic groups who may encounter biases related to both race/ethnicity and disability. Given long-standing societal beliefs that women with disabilities are asexual and cannot or should have children ([Stevens, 2011](#); [National Council on Disability, 2012](#)), clinicians may assume that supporting preconception health is less relevant for this population. Similarly, the United States has a long history of stratified reproduction, in which the fertility of White women is valued over that of women of color ([Ginsburg & Rapp, 1995](#)). Unaddressed, such biases can lead to discriminatory care, which in turn may cause women to distrust clinicians and avoid future health care encounters. Training clinicians to recognize and counter their implicit biases is a crucial component of developing more equitable systems of care, including comprehensive and respectful preconception care.

Unfortunately, few clinicians receive instruction in addressing biases or knowledge gaps about disability. A recent survey of U.S. obstetrician-gynecologists found that only 17% had received any information or training on provision of care to women with disabilities ([Taouk, Fialkow, & Schulkin, 2018](#)). The [Alliance for Disability in Health Care Education \(2019\)](#) has developed a minimum set of disability competencies clinicians should be expected to demonstrate. The competencies emphasize grounding in conceptual models of disability and the history of

**Table 2**  
Frequencies (With 95% Confidence Intervals) for Preconception Risk Factors Among Women 18–44 Years Old With and Without Disability, Stratified by Race/Ethnicity (BRFSS, 2016)

Indicator	NH White (n = 37,942)					p Value	NH Black (n = 6,662)					Hispanic (n = 9,162)					p Value	Other Race (n = 5,551)						
	Disability Status				p Value		Disability Status				p Value	Disability Status				p Value		Disability Status						
	No		Yes				No		Yes			No		Yes				No		Yes				
	% <sup>*</sup>	95% CI	%	95% CI			%	95% CI	%	95% CI		%	95% CI	%	95% CI			%	95% CI	%	95% CI			
General health status																								
Fair/poor health	4.5	4.1–5.0	34.8	32.7–36.9	<.001	8.7	7.6–9.9	38.4	33.8–43.2	<.001	14.3	12.9–15.7	38.8	34.8–42.9	<.001	5.7	4.6–7.0	35.6	30.1–41.6	<.001				
Social determinants																								
<High school education	4.8	4.2–5.3	15.5	13.7–17.4	<.001	6.2	5.1–7.5	17.8	14.3–22.0	<.001	30.5	28.6–32.5	35.7	31.8–39.9	.02	3.3	2.5–4.3	13.8	10.2–18.4	<.001				
Health care																								
No health insurance	7.5	7.0–8.0	13.3	11.9–14.9	<.001	12.8	11.3–14.3	18.0	14.5–22.2	.006	32.9	31.0–34.8	31.7	27.8–35.8	.598	8.8	7.4–10.5	14.2	10.3–19.2	.010				
No checkup in past year	34.5	33.6–35.5	36.3	34.1–38.5	.143	21.4	19.5–23.4	25.3	21.0–30.1	.112	36.3	34.4–38.3	35.7	31.9–39.8	.792	30.0	27.5–32.6	37.7	31.9–43.8	.016				
No dental visit in past year	25.8	24.9–26.6	45.0	42.8–47.3	<.001	33.6	31.5–35.7	48.6	43.7–53.5	<.001	37.4	35.6–39.4	44.6	40.5–48.8	.002	28.3	25.8–30.9	38.2	32.5–44.2	.001				
No Pap test in past 3 years	9.8	9.2–10.5	16.0	14.3–17.8	<.001	6.0	4.8–7.5	7.6	5.6–10.2	.222	8.5	7.4–9.7	12.7	10.1–15.9	.003	10.0	8.2–12.1	11.3	8.4–15.1	.497				
Substance use																								
Current smoking	15.3	14.7–16.0	39.6	37.5–41.8	<.001	11.4	10.1–12.8	26.5	22.5–30.9	<.001	5.4	4.7–6.2	16.7	13.9–19.9	<.001	6.7	5.7–7.7	29.7	24.8–35.1	<.001				
Heavy drinking	8.0	7.4–8.5	7.7	6.6–8.9	.663	4.2	3.3–5.5	8.5	5.5–12.9	.006	2.6	2.1–3.2	6.7	4.8–9.2	<.001	3.5	2.8–4.4	8.4	5.4–12.9	<.001				
Binge drinking	3.5	3.2–4.0	5.6	4.6–6.8	<.001	2.8	2.2–3.6	5.4	3.1–9.3	.035	1.5	1.2–1.9	4.5	3.0–6.9	<.001	1.5	1.1–2.1	6.3	4.0–10.0	<.001				
Nutrition and physical activity																								
Obesity	22.0	21.2–22.8	34.9	32.7–37.2	<.001	36.4	34.2–38.6	52.1	47.2–57.0	<.001	29.0	27.0–31.0	39.1	34.9–43.5	<.001	12.9	11.3–14.7	38.6	32.5–45.1	<.001				
No exercise in past month	12.6	12.0–13.3	28.8	26.8–30.8	<.001	25.4	23.5–27.3	38.1	33.6–43.0	<.001	28.4	26.6–30.2	34.5	30.7–38.5	.004	18.5	16.3–20.9	26.2	21.5–31.5	.003				
Mental health																								
Frequent mental distress	10.2	9.6–10.8	49.2	46.9–51.5	<.001	8.0	6.8–9.3	36.8	32.2–41.6	<.001	7.1	6.1–8.2	26.4	22.7–30.5	<.001	6.6	5.5–8.0	43.8	37.7–50.2	<.001				
Inadequate social support <sup>†</sup>	11.0	9.1–13.3	38.4	31.2–46.1	<.001	26.0	19.6–33.5	62.8	48.2–75.4	<.001	23.6	14.5–36.1	31.9	13.7–58.1	.51	17.1	10.8–25.9							
Chronic conditions																								
Diabetes	1.4	1.2–1.6	6.0	5.0–7.2	<.001	3.0	2.4–3.7	9.5	7.2–12.5	<.001	2.6	2.0–3.3	4.9	3.6–6.7	.001	2.6	1.8–3.7	6.6	4.0–10.7	.002				
Current asthma	10.4	9.8–11.0	22.3	20.5–24.2	<.001	12.3	10.6–14.2	23.2	19.6–27.2	<.001	6.1	5.3–7.0	17.2	14.4–20.3	<.001	6.6	5.4–7.9	20.9	16.3–26.5	<.001				
Infections																								
Never tested for HIV	52.9	51.9–53.9	40.1	37.8–42.4	<.001	25.2	23.0–27.7	25.2	20.9–30.0	.978	47.0	44.9–49.0	42.8	38.5–47.3	.097	62.8	59.8–65.6	37.0	31.3–43.1	<.001				
No flu vaccine in past year	64.0	63.0–64.9	70.7	68.5–72.8	<.001	72.2	70.2–74.1	69.9	65.1–74.3	.367	71.8	70.0–73.5	75.4	71.8–78.6	.074	58.2	55.2–61.2	70.5	64.7–75.7	<.001				

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval.

\* Weighted percentages.

† Only four states (Louisiana, Minnesota, Rhode Island, and Tennessee) collected data on social support and total sample size for this item was 3,473; the sample size for women with disabilities in the other race group was insufficient for reporting estimates on this indicator.

**Table 3**  
Unadjusted PRs (With 95% CIs) for Preconception Risk Factors Among Women 18–44 Years Old (BRFSS, 2016) (*n* = 59,317)

Indicator	NH White		NH Black		NH Black		Hispanic		Hispanic		Other Race		Other Race	
	Disability		No Disability		Disability		No Disability		Disability		No Disability		Disability	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
General health status														
Fair/poor health	7.69*	6.88–8.58	1.92*	1.63–2.26	8.47*	7.27–9.88	3.15*	2.76–3.61	8.56*	7.44–9.84	1.25	0.99–1.57	7.87*	6.53–9.48
Social determinants														
<High school education	3.25*	2.76–3.83	1.30 <sup>†</sup>	1.04–1.63	3.75*	2.94–4.78	6.42*	5.64–7.32	7.52*	6.41–8.83	0.70 <sup>†</sup>	0.52–0.94	2.91*	2.11–3.99
Health care														
No health insurance	1.79*	1.57–2.04	1.71*	1.50–1.96	2.42*	1.93–3.02	4.41*	4.03–4.82	4.25*	3.68–4.90	1.19	0.99–1.43	1.90*	1.38–2.62
No checkup in past year	1.05	0.98–1.12	0.62*	0.56–0.68	0.73*	0.61–0.88	1.05	0.99–1.12	1.03	0.92–1.16	0.87 <sup>†</sup>	0.80–0.95	1.09	0.93–1.28
No dental visit in past year	1.75*	1.65–1.86	1.30*	1.21–1.40	1.89*	1.70–2.10	1.45*	1.37–1.54	1.73*	1.57–1.91	1.10	1.00–1.21	1.48*	1.27–1.74
No Pap test in past 3 years	1.63*	1.43–1.85	0.61*	0.49–0.77	0.77	0.57–1.05	0.86	0.74–1.00	1.29 <sup>†</sup>	1.02–1.64	1.02	0.83–1.25	1.15	0.85–1.56
Substance use														
Current smoking	2.59*	2.41–2.78	0.74*	0.66–0.84	1.73*	1.46–2.04	0.35*	0.30–0.41	1.09	0.90–1.31	0.43*	0.37–0.51	1.94*	1.62–2.32
Heavy drinking	0.96	0.82–1.13	0.53*	0.41–0.70	1.07	0.69–1.65	0.33*	0.26–0.41	0.84	0.61–1.17	0.44*	0.35–0.56	1.06	0.68–1.65
Binge drinking	1.58*	1.25–1.99	0.79	0.60–1.04	1.52	0.86–2.70	0.42*	0.32–0.56	1.28	0.83–2.00	0.43*	0.31–0.59	1.79 <sup>†</sup>	1.11–2.88
Nutrition and physical activity														
Obesity	1.59*	1.47–1.71	1.66*	1.54–1.78	2.37*	2.14–2.63	1.32*	1.22–1.43	1.78*	1.59–2.00	0.59*	0.51–0.68	1.76*	1.49–2.08
No exercise in past month	2.28*	2.09–2.49	2.01*	1.84–2.20	3.02*	2.65–3.46	2.25*	2.08–2.44	2.74*	2.42–3.10	1.47*	1.28–1.68	2.08*	1.70–2.53
Mental health														
Frequent mental distress	4.82*	4.47–5.19	0.78 <sup>†</sup>	0.66–0.93	3.60*	3.12–4.15	0.70*	0.60–0.82	2.59*	2.21–3.04	0.65*	0.53–0.79	4.29*	3.68–5.01
Inadequate social support <sup>§</sup>	3.47*	2.64–4.56	2.35*	1.69–3.27	5.69*	4.25–7.62	2.14 <sup>‡</sup>	1.30–3.52	2.89 <sup>†</sup>	1.35–6.20	1.54	0.96–2.49		
Chronic conditions														
Diabetes	4.36*	3.48–5.47	2.18*	1.68–2.83	6.91*	5.06–9.44	1.88*	1.42–2.48	3.58*	2.55–5.03	1.89 <sup>†</sup>	1.29–2.76	4.76*	2.85–7.97
Current asthma	2.14*	1.93–2.36	1.18 <sup>†</sup>	1.01–1.37	2.23*	1.87–2.65	0.58*	0.50–0.68	1.65*	1.38–1.97	0.63*	0.52–0.76	2.01*	1.56–2.58
Infections														
Never tested for HIV	0.76*	0.71–0.81	0.48*	0.43–0.52	0.48*	0.40–0.57	0.89*	0.85–0.93	0.81*	0.73–0.90	1.19*	1.13–1.25	0.70*	0.59–0.82
No flu vaccine in past year	1.11*	1.07–1.14	1.13*	1.09–1.16	1.09 <sup>†</sup>	1.02–1.17	1.12*	1.09–1.15	1.18*	1.12–1.24	0.91*	0.86–0.96	1.10 <sup>†</sup>	1.02–1.19

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; NH, non-Hispanic; PR, prevalence ratio.

Note: Non-Hispanic White women with no disabilities served as the reference group.

\*  $p < .001$ .

<sup>†</sup>  $p < .05$ .

<sup>‡</sup>  $p < .01$ .

<sup>§</sup> Only four states (Louisiana, Minnesota, Rhode Island, and Tennessee) collected data on social support and total sample size for this item was 3,473; the sample size for women with disabilities in the other race group was insufficient for reporting estimates on this indicator.

**Table 4**  
Adjusted PRs (With 95% CIs) for Preconception Risk Factors Among Women 18–44 Years Old (BRFSS, 2016),  $n = 59,317$

Indicator*	NH White		NH Black		NH Black		Hispanic		Hispanic		Other Race		Other Race		
	Disability		No Disability		Disability		No Disability		Disability		No Disability		Disability		
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	
General health status															
Fair/poor health	4.68 <sup>†</sup>	4.12–5.31	1.49 <sup>†</sup>	1.26–1.76	4.39 <sup>†</sup>	3.71–5.19	1.99 <sup>†</sup>	1.71–2.30	4.52 <sup>†</sup>	3.87–5.28	1.32 <sup>‡</sup>	1.05–1.67	4.79 <sup>†</sup>	4.01–5.72	
Social determinants															
<High school education <sup>§</sup>	1.74 <sup>†</sup>	1.46–2.08	0.94	0.75–1.18	1.75 <sup>†</sup>	1.37–2.25	2.93 <sup>†</sup>	2.54–3.37	3.05 <sup>†</sup>	2.57–3.61	0.62 <sup>¶</sup>	0.46–0.84	1.57 <sup>¶</sup>	1.15–2.13	
Health care															
No health insurance <sup>  </sup>	1.10	0.96–1.27	1.23 <sup>¶</sup>	1.07–1.42	1.34 <sup>‡</sup>	1.07–1.68	2.21 <sup>†</sup>	2.00–2.44	1.96 <sup>†</sup>	1.69–2.28	1.20 <sup>‡</sup>	1.00–1.44	1.21	0.89–1.64	
No checkup in past year	1.00	0.93–1.07	0.57 <sup>†</sup>	0.52–0.63	0.68 <sup>†</sup>	0.57–0.81	0.84 <sup>†</sup>	0.79–0.89	0.84 <sup>¶</sup>	0.75–0.95	0.87 <sup>¶</sup>	0.80–0.95	1.04	0.89–1.22	
No dental visit in past year	1.34 <sup>†</sup>	1.26–1.43	1.08 <sup>†</sup>	1.01–1.16	1.32 <sup>†</sup>	1.18–1.48	0.97	0.91–1.04	1.10	1.00–1.22	1.11 <sup>†</sup>	1.01–1.22	1.14	1.00–1.32	
No Pap test in past 3 years	1.26 <sup>¶</sup>	1.09–1.46	0.51 <sup>†</sup>	0.40–0.64	0.51 <sup>†</sup>	0.37–0.71	0.56 <sup>†</sup>	0.46–0.67	0.79	0.61–1.03	1.07	0.87–1.31	0.90	0.66–1.22	
Substance use															
Current smoking	1.62 <sup>†</sup>	1.50–1.76	0.52 <sup>†</sup>	0.46–0.59	0.88	0.75–1.04	0.22 <sup>†</sup>	0.18–0.25	0.58 <sup>†</sup>	0.48–0.70	0.50 <sup>†</sup>	0.43–0.58	1.26 <sup>‡</sup>	1.04–1.52	
Heavy drinking	1.18	0.99–1.40	0.49 <sup>†</sup>	0.37–0.65	1.23	0.78–1.93	0.41 <sup>†</sup>	0.32–0.53	1.09	0.79–1.51	0.44 <sup>†</sup>	0.35–0.56	1.27	0.80–2.01	
Binge drinking	1.53 <sup>†</sup>	1.20–1.94	0.66 <sup>¶</sup>	0.49–0.87	1.42	0.79–2.56	0.44 <sup>†</sup>	0.32–0.60	1.27	0.82–1.96	0.43 <sup>†</sup>	0.31–0.60	1.62	0.99–2.67	
Nutrition and physical activity															
Obesity	1.29 <sup>†</sup>	1.19–1.41	1.47 <sup>†</sup>	1.36–1.58	1.77 <sup>†</sup>	1.57–2.00	1.10 <sup>‡</sup>	1.01–1.19	1.37 <sup>†</sup>	1.22–1.54	0.63 <sup>‡</sup>	0.55–0.72	1.46 <sup>†</sup>	1.23–1.75	
No exercise in past month	1.53 <sup>†</sup>	1.40–1.68	1.66 <sup>†</sup>	1.51–1.82	1.79 <sup>†</sup>	1.55–2.07	1.45 <sup>†</sup>	1.33–1.58	1.59 <sup>†</sup>	1.40–1.80	1.53 <sup>†</sup>	1.34–1.75	1.38 <sup>¶</sup>	1.12–1.70	
Mental health															
Frequent mental distress	3.92 <sup>†</sup>	3.60–4.27	0.68 <sup>†</sup>	0.57–0.80	2.73 <sup>†</sup>	2.35–3.16	0.62 <sup>†</sup>	0.52–0.73	2.11 <sup>†</sup>	1.78–2.49	0.66 <sup>†</sup>	0.54–0.81	3.51 <sup>†</sup>	3.00–4.12	
Inadequate social support <sup>#</sup>	2.55 <sup>†</sup>	1.93–3.37	1.78 <sup>†</sup>	1.27–2.50	3.19 <sup>†</sup>	2.17–4.70	1.58	0.96–2.62	1.73	0.81–3.69	1.42	0.90–2.25			
Chronic conditions															
Diabetes	2.52 <sup>†</sup>	1.96–3.23	1.86 <sup>†</sup>	1.41–2.44	3.29 <sup>†</sup>	2.37–4.58	1.39 <sup>‡</sup>	1.05–1.84	2.03 <sup>†</sup>	1.40–2.94	1.94 <sup>†</sup>	1.33–2.84	2.61 <sup>†</sup>	1.63–4.18	
Current asthma	1.83 <sup>†</sup>	1.64–2.04	1.10	0.94–1.28	1.83 <sup>†</sup>	1.52–2.20	0.60 <sup>†</sup>	0.51–0.71	1.51 <sup>†</sup>	1.25–1.82	0.62 <sup>†</sup>	0.51–0.75	1.69 <sup>†</sup>	1.31–2.17	
Infections															
Never tested for HIV	0.76 <sup>†</sup>	0.71–0.80	0.48 <sup>†</sup>	0.44–0.53	0.49 <sup>†</sup>	0.41–0.59	0.86 <sup>†</sup>	0.82–0.90	0.79 <sup>†</sup>	0.72–0.88	1.13 <sup>†</sup>	1.08–1.19	0.67 <sup>†</sup>	0.57–0.79	
No flu vaccine in past year	1.05 <sup>‡</sup>	1.01–1.08	1.06 <sup>†</sup>	1.03–1.10	1.00	0.94–1.07	1.03	1.00–1.06	1.07 <sup>‡</sup>	1.02–1.12	0.91 <sup>†</sup>	0.86–0.96	1.03	0.95–1.12	

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; NH, non-Hispanic; PR, prevalence ratio.

Note: Non-Hispanic White women with no disabilities served as the reference group.

\* Models are adjusted for age, education, marital status, employment, health insurance, and income unless otherwise noted.

<sup>†</sup>  $p < .001$ .

<sup>‡</sup>  $p < .05$ .

<sup>§</sup> Models are adjusted for age, marital status, employment, health insurance, and income.

<sup>||</sup> Models are adjusted for age, education, marital status, employment, and income.

<sup>¶</sup>  $p < .01$ .

<sup>#</sup> Only four states (Louisiana, Minnesota, Rhode Island, and Tennessee) collected data on social support and total sample size for this item was 3,473; the sample size for women with disabilities in the other race group was insufficient for reporting estimates on this indicator.



discrimination that compounds disability; consideration of social determinants of health; and recognition of disability as a dimension of human diversity similar to and intersecting with age, gender, sexual identity, race, ethnicity, and language (Alliance for Disability in Health Care Education, 2019). Integration of these competencies into health education curricula and evaluation standards would be an important step toward expanding best practices, improving the quality of care available to women with disabilities, and decreasing preconception health disparities.

### Limitations

Our study shares several limitations inherent in analyses of survey data. Data in the BRFSS are self-reported and may be influenced by social desirability biases. Responses may also be influenced by selection bias if associations between preconception risk factors and disability and/or race and ethnicity differ in survey responders versus non-responders. Owing to limitations of the BRFSS survey methodology, women with sensory or intellectual disability may not be well-represented in the dataset. The level of detail possible in our analyses was limited by the sample sizes of women with disabilities and women in less prevalent racial and ethnic groups. Because of these limitations, we were unable to analyze differences by specific disability type. The population of people with disabilities is heterogeneous and includes multiple types of disabilities. Future research should consider the type of disability, because women with certain disabilities may be more vulnerable to preconception risk factors. Additional research is needed on ways in which each disability type may intersect with race and ethnicity in association with preconception health risks. Similarly, we grouped together Asian, Native Hawaiian and other Pacific Islander, American Indian and Alaska Native, and multiracial women for analyses. Disability prevalence and preconception risk factors may differ across these groups and warrant more detailed examination with larger datasets. Further, although using non-Hispanic White women without disabilities as the reference group in regression analyses is standard practice, it risks incorrectly implying that other groups constitute a departure from the norm. There is an ongoing need for research centered on the experiences of marginalized women and addressing resilience as well as disparities, particularly in Black women.

### Implications for Practice and/or Policy

As the diversity of the U.S. continues to increase (Vespa, Armstrong, & Medina, 2018), we can expect the racial and ethnic diversity of the disability population to grow as well. Addressing the preconception health needs of a diverse population of women with disabilities will therefore become increasingly relevant as a strategy to optimize pregnancy outcomes and maximize health of women and infants. Clinicians providing preconception care to women with disabilities in minoritized racial and ethnic groups should be attentive to the potentially compounded health risks these women may face. Although several of the increased risks we observed were related to health behaviors, it is important to recognize that these behaviors do not occur in a vacuum. Women with disabilities in our study population had much lower incomes than their counterparts without disabilities. Income was especially low among Black women and Hispanic women with disabilities. Thus, women in these groups may have less access to healthy foods

and safe spaces in which to exercise. Policies are urgently needed to address structural inequities in distributions of wealth and other social determinants of health, which drive disparities in health outcomes.

### Conclusions

The existing literature has found that women with disabilities and women in minoritized racial and ethnic groups are each at high risk of adverse pregnancy outcomes. Our findings of even greater disparities on some preconception health indicators for women at the intersection of race or ethnicity and disability—particularly for non-Hispanic Black women with disabilities—suggest that these women may be at especially high risk of adverse pregnancy outcomes. Targeted efforts are needed to improve the health of women of reproductive age in these doubly marginalized populations.

### References

- Admon, L. K., Winkelman, T. N. A., Zivin, K., Terplan, M., Mhyre, J. M., & Dalton, V. K. (2018). Racial and ethnic disparities in the incidence of severe maternal morbidity in the United States, 2012–2015. *Obstetrics and Gynecology*, 132(5), 1158–1166.
- Akibirshoev, I., Parish, S. L., Mitra, M., & Rosenthal, E. (2017). Birth outcomes among US women with intellectual and developmental disabilities. *Disability and Health Journal*, 10(3), 406–412.
- Alliance for Disability in Health Care Education. (2019). *Core Competencies on Disability for Health Care Education*. Peapack, NJ: Alliance for Disability in Health Care Education.
- Arbour, M. W., Corwin, E. J., Salsberry, P. J., & Atkins, M. (2012). Racial differences in the health of childbearing-aged women. *MCN American Journal of Maternal and Child Nursing*, 37(4), 262–268.
- Azar, M. J., Stuart, E. A., Frangakis, C., & Leaf, P. J. (2011). Multiple imputation by chained equations: What is it and how does it work? *International Journal of Methods in Psychiatric Research*, 20(1), 40–49.
- Bailey, Z. D., Krieger, N., Agénor, M., Graves, J., Linos, N., & Bassett, M. T. (2017). Structural racism and health inequities in the USA: Evidence and interventions. *Lancet*, 389, 1453–1463.
- Broussard, D. L., Sappenfield, W. B., Fussman, C., Kroelinger, C. D., & Grigorescu, V. (2011). Core state preconception health indicators: A voluntary, multi-state selection process. *Maternal and Child Health Journal*, 15, 158–168.
- Centers for Disease Control and Prevention. (2017a). Behavioral Risk Factor Surveillance System 2016 Summary Data Quality Report. Available: [www.cdc.gov/brfss/annual\\_data/2016/pdf/2016-sdqr.pdf](http://www.cdc.gov/brfss/annual_data/2016/pdf/2016-sdqr.pdf). Accessed: August 11, 2020.
- Centers for Disease Control and Prevention. (2017b). Calculated variables in the 2016 data file of the Behavioral Risk Factor Surveillance System. Available: [www.cdc.gov/brfss/annual\\_data/2016/pdf/2016\\_calculated\\_variables\\_version4.pdf](http://www.cdc.gov/brfss/annual_data/2016/pdf/2016_calculated_variables_version4.pdf). Accessed: August 11, 2020.
- Centers for Disease Control and Prevention National Center on Birth Defects and Developmental Disabilities, & Division of Human Development and Disability. (2019a). Disability and Health Data System (DHDS) data. Available: <https://dhds.cdc.gov>. Accessed: August 11, 2020.
- Centers for Disease Control and Prevention National Center on Birth Defects and Developmental Disabilities, & Division of Human Development and Disability. (2019b). Disability and Health Data System (DHDS) frequently asked questions. Available: [www.cdc.gov/ncbddd/disabilityandhealth/dhds/faqs.html#anchor\\_data-source](http://www.cdc.gov/ncbddd/disabilityandhealth/dhds/faqs.html#anchor_data-source). Accessed: August 11, 2020.
- Clements, K. M., Mitra, M., Zhang, J., & Iezzoni, L. I. (2016). Pregnancy characteristics and outcomes among women at risk for disability from health conditions identified in medical claims. *Womens Health Issues*, 26(5), 504–510.
- Darney, B. G., Biel, F. M., Quigley, B. P., Caughey, A. B., & Horner-Johnson, W. (2017). Primary cesarean delivery patterns among women with physical, sensory, or intellectual disabilities. *Womens Health Issues*, 27(3), 336–344.
- Drew, J. A., & Short, S. E. (2010). Disability and Pap smear receipt among U.S. women, 2000 and 2005. *Perspectives on Sexual and Reproductive Health*, 42(4), 258–266.
- Fryar, C. D., Carroll, M. D., & Ogden, C. L. (2018). Prevalence of overweight, obesity, and severe obesity among adults aged 20 and over: United States, 1960–1962 through 2015–2016. NCHS Health E-Stats. Available: [www.cdc.gov/nchs/data/hestat/obesity\\_adult\\_15\\_16/obesity\\_adult\\_15\\_16.pdf](http://www.cdc.gov/nchs/data/hestat/obesity_adult_15_16/obesity_adult_15_16.pdf).
- Gavin, N. I., Benedict, M. B., & Adams, E. K. (2006). Health service use and outcomes among disabled Medicaid pregnant women. *Womens Health Issues*, 16(6), 313–322.

- Ginsburg, F. D., & Rapp, R. (1995). Introduction: Conceiving the new world order. In Ginsburg, F. D., & Rapp, R. (Eds.), *Conceiving the new world order: The global politics of reproduction* (pp. 1–17). Berkeley: University of California Press.
- Grobman, W. A., Parker, C. B., Willinger, M., Wing, D. A., Silver, R. M., Wapner, R. J., ... Reddy, U. M. (2018). Racial disparities in adverse pregnancy outcomes and psychosocial stress. *Obstetrics and Gynecology*, 131(2), 328–335.
- Horner-Johnson, W., Darney, B. G., Kulkarni-Rajasekhara, S., Quigley, B., & Caughey, A. B. (2016). Pregnancy among US women: Differences by presence, type, and complexity of disability. *American Journal of Obstetrics and Gynecology*, 214(4), 529.e521–529.e529.
- Horner-Johnson, W., Dobbertin, K., Andresen, E. M., & Iezzoni, L. I. (2014). Breast and cervical cancer screening disparities associated with disability severity. *Women's Health Issues*, 24(1), e147–e153.
- Horner-Johnson, W., Dobbertin, K., & Beilstein-Wedel, E. (2015). Disparities in dental care associated with disability and race and ethnicity. *Journal of the American Dental Association*, 146(6), 366–374.
- Jones, G. C., & Sinclair, L. B. (2008). Multiple health disparities among minority adults with mobility limitations: An application of the ICF framework and codes. *Disability and Rehabilitation*, 30(12–13), 901–915.
- Kim, M., Kim, H. J., Hong, S., & Fredriksen-Goldsen, K. I. (2013). Health disparities among childbearing women with disabilities. *Maternal and Child Health Journal*, 17, 1260–1268.
- Mitra, M., Clements, K. M., Zhang, J., Iezzoni, L. I., Smeltzer, S. C., & Long-Bellil, L. M. (2015a). Maternal characteristics, pregnancy complications, and adverse birth outcomes among women with disabilities. *Medical Care*, 53(12), 1027–1032.
- Mitra, M., Clements, K. M., Zhang, J., & Smith, L. D. (2016). Disparities in adverse preconception risk factors between women with and without disabilities. *Maternal and Child Health Journal*, 20(3), 507–515.
- Mitra, M., Parish, S. L., Clements, K. M., Cui, X., & Diop, H. (2015b). Pregnancy outcomes among women with intellectual and developmental disabilities. *American Journal of Preventive Medicine*, 48(3), 300–308.
- Morton, C., Le, J. T., Shahbandar, L., Hammond, C., Murphy, E. A., & Kirschner, K. L. (2013). Pregnancy outcomes of women with physical disabilities: A matched cohort study. *PM & R: The Journal of Injury, Function, and Rehabilitation*, 5(2), 90–98.
- National Council on Disability. (2012). *Rocking the cradle: Ensuring the rights of parents with disabilities and their children*. Washington, DC: National Council on Disability.
- Okoro, C. A., Hollis, N. D., Cyrus, A. C., & Griffin-Blake, S. (2018). Prevalence of disabilities and health care access by disability status and type among adults - United States, 2016. *MMWR Morbidity and Mortality Weekly Report*, 67(32), 882–887.
- Petersen, E. E., Davis, N. L., Goodman, D., Cox, S., Mayes, N., Johnston, E., ... Barfield, W. (2019). Vital Signs: Pregnancy-related deaths, United States, 2011–2015, and strategies for prevention, 13 states, 2013–2017. *MMWR Morbidity and Mortality Weekly Report*, 68, 423–429.
- Ratnasiri, A. W. G., Parry, S. S., Arief, V. N., DeLacy, I. H., Lakshminrusimha, S., Halliday, L. A., ... Basford, K. E. (2018). Temporal trends, patterns, and predictors of preterm birth in California from 2007 to 2016, based on the obstetric estimate of gestational age. *Maternal Health, Neonatology, and Perinatology*, 4, 25.
- Robbins, C., Boulet, S. L., Morgan, I., D'Angelo, D. V., Zapata, L. B., Morrow, B., ... Kroelinger, C. D. (2018). Disparities in preconception health indicators - Behavioral Risk Factor Surveillance System, 2013–2015, and Pregnancy Risk Assessment Monitoring System, 2013–2014. *MMWR Surveillance Summaries*, 67(1), 1–16.
- Royston, P., & White, I. R. (2011). Multiple imputation by chained equations (MICE): Implementation in Stata. *Journal of Statistical Software*, 45(4), 20.
- Schenker, N., Raghunathan, T. E., Chiu, P.-L., Makuc, D. M., Zhang, G., & Cohen, A. J. (2006). Multiple imputation of missing income data in the National Health Interview Survey. *Journal of the American Statistical Association*, 101(475), 924–933.
- Steele, C. B., Townsend, J. S., Courtney-Long, E. A., & Young, M. (2017). Prevalence of cancer screening among adults with disabilities, United States, 2013. *Preventing Chronic Disease*, 14, E09.
- Stevens, B. (2011). Politicizing sexual pleasure, oppression and disability: Recognizing and undoing the impacts of ableism on sexual and reproductive health. In *Barbara Faye Waxman Fiduccia Papers on Women and Girls with Disabilities* (pp. 1–23). Washington, DC: Center for Women Policy Studies.
- Tangel, V., White, R. S., Nachamie, A. S., & Pick, J. S. (2019). Racial and ethnic disparities in maternal outcomes and the disadvantage of peripartum Black women: A multistate analysis, 2007–2014. *American Journal of Perinatology*, 36, 835–848.
- Taouk, L. H., Fialkow, M. F., & Schulkin, J. A. (2018). Provision of reproductive healthcare to women with disabilities: A survey of obstetrician-gynecologists' training, practices, and perceived barriers. *Health Equity*, 2(1), 207–215.
- Vespa, J., Armstrong, D. M., & Medina, L. (2018). *Demographic turning points for the United States: Population projections for 2020–2060*. Washington, DC: U.S. Census Bureau.
- Williams, D. R., Lawrence, J. A., & Davis, B. A. (2019). Racism and health: Evidence and needed research. *Annual Review of Public Health*, 40, 105–125.

---

## Author Descriptions

Willi Horner-Johnson, PhD, is an Associate Professor in the Institute on Development and Disability at Oregon Health & Science University. Her research focuses on health and healthcare disparities impacting individuals with disabilities, particularly those who also belong to other marginalized groups.

Ihrom Akobirshoev, PhD, is a Research Scientist at the Lurie Institute for Disability Policy in the Heller School for Social Policy and Management, Brandeis University. His research examines contributions of contextual environments to health disparities in vulnerable populations.

Nndiamaka N. Amutah-Onukagha, PhD, is an Associate Professor of Public Health and Community Medicine at Tufts University. Her research interests include health disparities, reproductive health, infant mortality, and HIV/AIDS in ethnic minority populations.

Jaime C. Slaughter-Acey, PhD, is an Assistant Professor in the Division of Epidemiology and Community Health, School of Public Health, University of Minnesota. Her research focuses on environmental and psychosocial factors that contribute to women's health across the life course.

Monika Mitra, PhD, is the Nancy Lurie Marks Associate Professor of Disability Policy and Director of the Lurie Institute for Disability Policy. Her areas of research expertise include health and disability research, reproductive healthcare access, and perinatal health of women with disabilities.