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## Geographic variation of reproductive health indicators and outcomes in the United States: place matters

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### Abstract

The social determinants of health are the circumstances in which people are born, grow up, live, work, and age and the systems put in place to deal with illness. These circumstances, in turn, are shaped by a wider set of forces: economics, social policies, and politics. Reproductive health indicators and conditions that are germane to obstetricians and gynecologists vary across states and regions in the United States as well as within regions and states. The aim of this article is to illustrate this variation with the use of examples of gynecologic malignancies, sexually transmitted infections, teen birth rates, preterm birth rates, and infant mortality rates. Using the example of infant death, the difficulties in “unpacking” the construct of place will be discussed, and a special emphasis is placed on the interaction of race, place, and disparities in shaping perinatal outcomes. Finally, readily available and easy-to-use online data resources will be provided so that obstetricians and gynecologists will be able to assess geographic variation in health indicators and outcomes in their own localities.

### Keywords

disparity; infant mortality rate; preterm birth; social determinant of health

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The Institute of Medicine has adopted the definition of population health proposed by Stoddart and Kindig<sup>1</sup> as “the health outcomes of a group of individuals, including the distribution of such outcomes within the group.” Implicit in this definition is the understanding that health outcomes at the population level are determined by multiple individual and societal factors. What is measured as population health outcomes is ultimately determined by individual decisions about one’s health, interactions with health care, and the larger social and geopolitical environment across populations. Hence, one defining characteristic of a population is place. Because characteristics of place vary, it stands to reason that health outcomes and indicators of populations will vary.

*Geography* has been defined as “the study of what is where, why there, and why care?”<sup>2</sup> The definition incorporates the phenomenologic “what” to include features that occur in spatial distribution (natural and cultural); the spatial where incorporates elements of location; the

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analytic why there encompasses processes and interrelationships, and the implicational why care accounts for relevance. The definition is at once descriptive and conceptual and incorporates the complex context of what we consider as place. This definition provides a framework for those who are involved in the enterprise of caring for individuals in health care settings to better understand the individual and the population being served.

It is not surprising that the circumstances that people grow up and live in (an aspect of what we call geography) have implications for their health. As posited by Frieden<sup>3</sup> who used the construct of a 5-tiered pyramid that depicts the impact of interventions to effect change in health outcomes, changing the socioeconomic factors and the contexts in which people grow and live is likely to have the greatest ability to effect change. Disparities in health outcomes have been well-described.<sup>4,5</sup> However, quietly accepting that disparities are immutable will guarantee only that they persist. For the obstetrician-gynecologist, understanding the variation in women's and perinatal health indicators and outcomes for populations is a necessary first step in moving toward elimination of disparities, which is one of the overarching goals of the US Department of Health and Human Services' *Healthy People 2020*.<sup>6</sup> Hence, the aim of this article is to show geographic variation in selected health indicators and outcomes that are pertinent to the specific interests of obstetricians and gynecologists by using readily available public data. Most important, the article will provide interactive resources that are updated consistently so that readers can access the information that is most important to them and the women they serve.

## **Examples of geographic variation in outcomes and indicators for obstetricians and gynecologists**

Table 1 shows examples of variation in several outcomes and indicators that are pertinent to the work of obstetricians and gynecologists. Although there are degrees of variation among states for different conditions and indicators, it is also important to note that health varies even within states. For example, although almost all counties in New Mexico (a state with high teen birth rates) have teen birth rates higher than almost all counties in New Hampshire (a state with low teen birth rates), there is some overlap of county level rates, and in each state, there are county pockets with low and high rates relative to other counties.<sup>7</sup> Similarly, states with relatively high rates of gonorrhea and/or syphilis have counties with rates as low as the lowest overall state rates.<sup>8</sup> States with the highest breast cancer incidences do not necessarily have the highest death rates, as would be expected for a disease incidence highly dependent on screening access and practices. Ovarian cancer, with its relatively high case fatality rate, has less difference between incidence and death rates. This can be seen in a more graphic fashion by accessing the Centers for Disease Control and Prevention's interactive cancer atlas.<sup>9</sup> Such variation between and within states suggests a level of complexity of geography and points to the importance of understanding that context on the local level when caring for women as members of a population.

## **Preterm birth, infant death, and place**

Perinatal health outcomes perhaps provide the starkest examples of geographic variation in the United States and are likely most familiar to obstetricians and gynecologists. Figures 1

and 2 show the most recent state-level data that are available for preterm birth and infant mortality rates. Infant death is tied closely to preterm birth; preterm birth is the greatest contributor to infant death, with most preterm-related deaths occurring among infants who were born at <32 weeks' gestation.<sup>10</sup> In addition, both preterm birth and infant mortality rates exhibit long-standing and consistently documented racial and ethnic disparities, most particularly between black and white women.<sup>11,12</sup> Infant mortality rates and variation among geographic locations likely represent a complex interplay that involves place, race, and health care. Figure 3 shows infant mortality rates for black and white women for the aggregate years 2007–2009 in 6 selected states with different population sizes, infant mortality rates, preterm birth rates, and racial compositions. In spite of the variation, the black:white gaps in infant mortality rates are relatively consistent, with black women about twice as likely to have an infant die in the first year of life. Figure 4 shows gestational age-specific mortality rates for black and white women in these same 6 states. The black:white gap is considerably smaller and, in many instances, virtually inconsequential or even reversed at lower gestational ages at which gestational age-specific mortality rates are high. The black:white gap does not begin to reappear until later gestation at which time the contribution to overall infant mortality rates becomes smaller. When taken in light of the proportion of a state population that is black and the variation in preterm birth rates, it becomes clearer that infant death variation in large measure can be explained by variation in preterm birth rates; a black infant born at <32 weeks' gestation in Mississippi (a state with one of the country's highest infant mortality rates) has a survival rate as good or better than states with lower overall infant mortality rates.

Kramer and Hogue<sup>13</sup> explored the relationships among geographic location, race/ethnicity, and very preterm birth (<32 weeks' gestation). They looked at the distribution of very preterm births across metropolitan statistical areas for non-Hispanic black, non-Hispanic white, and Hispanic women. There was little to no overlap in the distributions of very preterm birth for non-Hispanic white and Hispanic women compared with non-Hispanic black women; even metropolitan statistical areas with the lowest very preterm birth rates for non-Hispanic black women had higher rates than nearly all the metropolitan statistical areas with the highest rates for non-Hispanic white and Hispanic women. Interestingly, however, there was less variation among metropolitan statistical areas for non-Hispanic white and Hispanic women where the distributions were narrow and more tightly concentrated about the means. Conversely, the distributions of very preterm birth for non-Hispanic black women were broader and flatter, with considerable more variation about the mean. This suggests that, at least for the outcome of very preterm birth, place may matter more for non-Hispanic black women than it does for non-Hispanic white or Hispanic women.

### **Toward a deeper understanding of place**

As proposed by Gritzner,<sup>2</sup> the context of where we live and practice and where the women we serve live is complex and has implications for health and health care, as seen by a few brief examples here. The concept of geography extends beyond the somewhat arbitrary physical and political boundaries of locality and, in and of itself, can be seen to embrace a variety of social determinants of health that can be applied to populations that are served by physicians. Thus, taking advantage of the opportunity to better understand the context

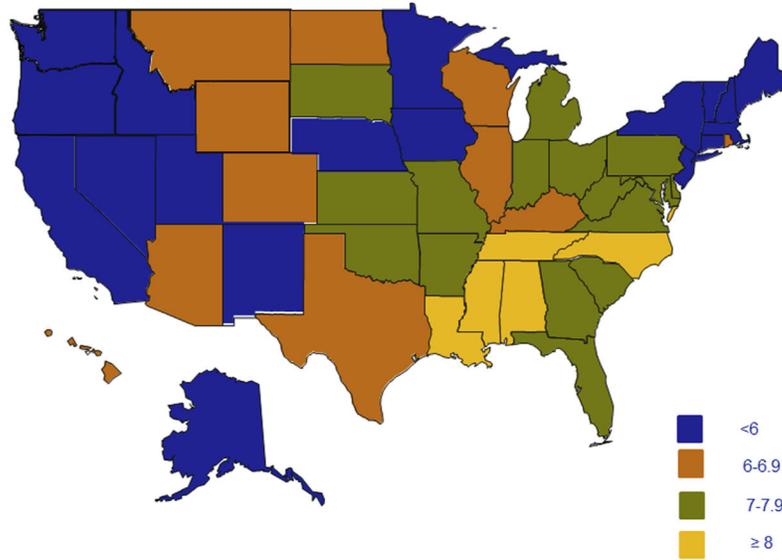
allows for an opportunity to improve the lives of the women who are our patients by understanding their social context as well as advocating for change that can improve their lives. Fortunately, there are tools available to explore geographic variation and a variety of social determinants embedded in the construct of geography. The examples provided herein are but a small sample of the available health outcomes and contextual variables available to aid in a deeper understanding of the variation in health and health care experienced by women across the United States. All of the examples of geographic variability in this article came from readily accessible materials. Table 2 presents a list of web-based resources that are readily available for use. Many are interactive and able to be customized for specific inquiries. The resources range from state and county-level queries of vital statistics data to more complex queries that address the socioeconomic milieu in which patients live. Clinical care occurs in a place; knowing something about place and that all places are not equal has the potential for clinical care and public health to become increasingly connected. Place does matter, and geography is more than dirt.

## Acknowledgments

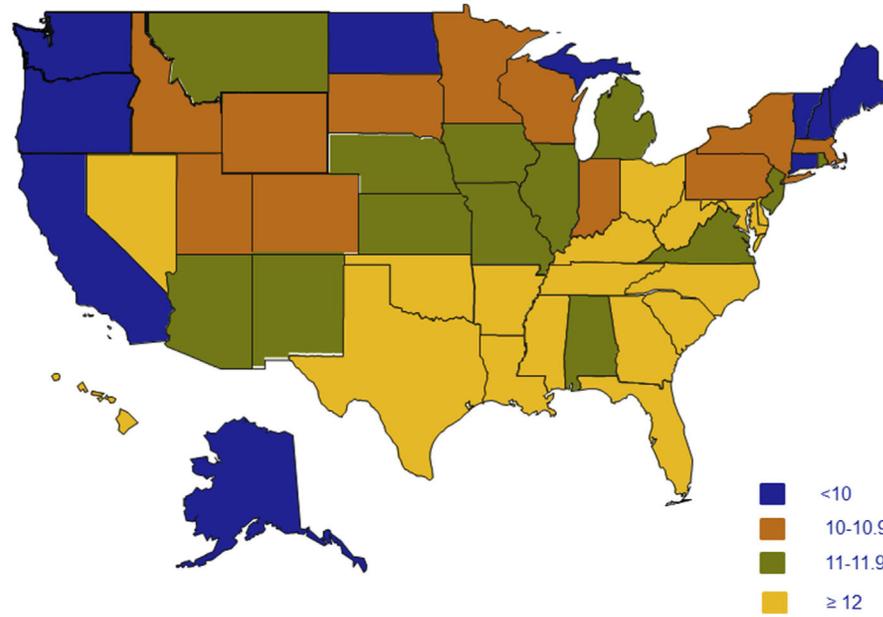
The findings and conclusions in this report are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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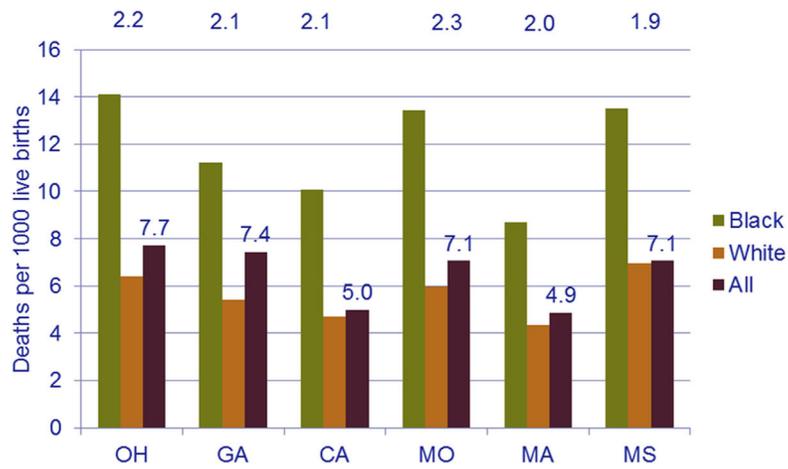


**FIGURE 1. Infant mortality rates (deaths per 1000 live births) for the United States, each state, and the District of Columbia, 2010**  
CDC WONDER. Available at: <http://wonder.cdc.gov/lbd.html>. Accessed May 27, 2014.



**FIGURE 2. Preterm birth rates (births <37 weeks' gestation) for the United States, each state, and the District of Columbia, 2012**

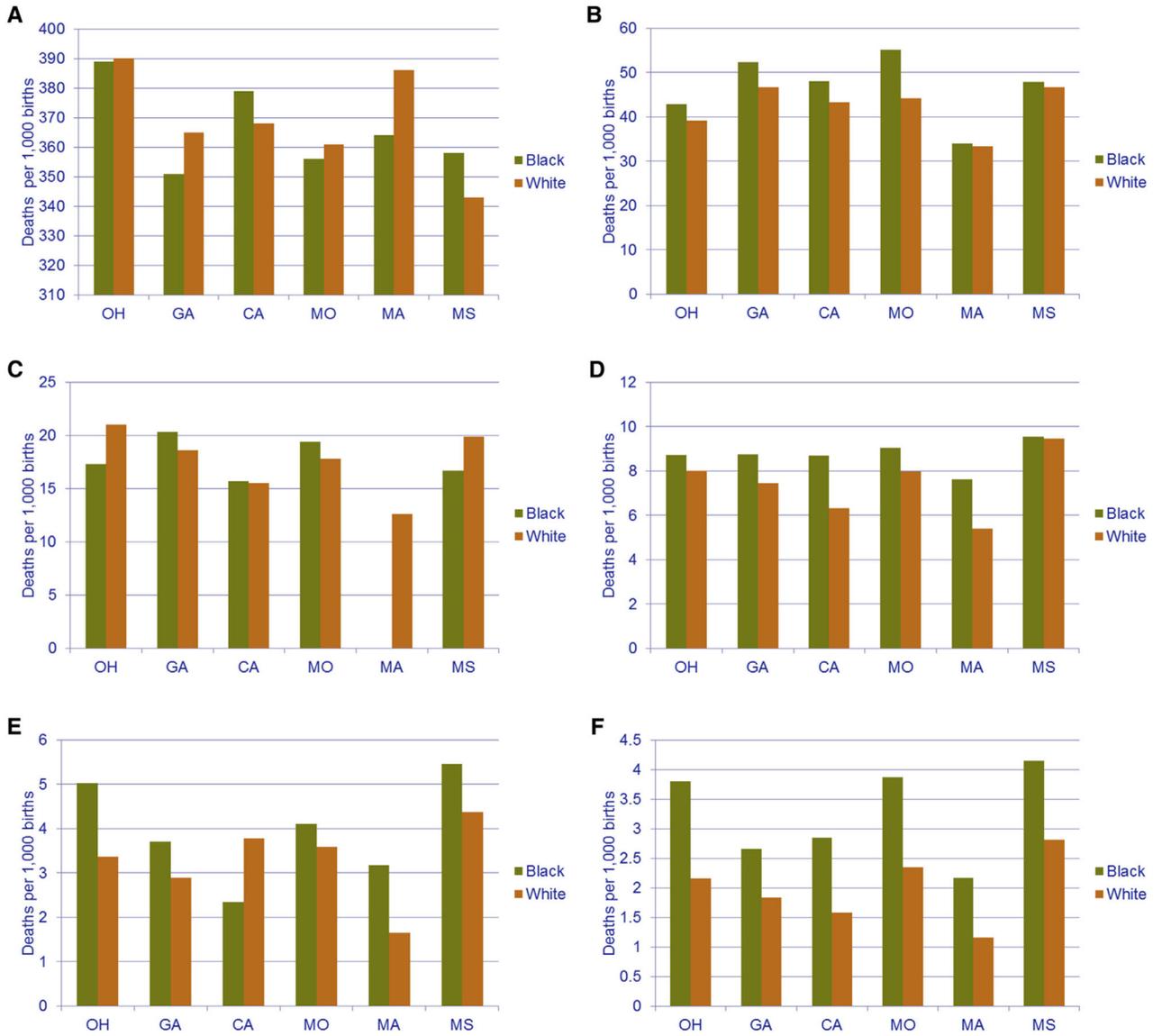
Available at: [http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62\\_09.pdf#table01](http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_09.pdf#table01). Accessed May 27, 2014.



**FIGURE 3. Aggregated infant mortality rates (deaths per 1000 live births) for the years 2007–2010 by black and white race**

The black:white ratios are displayed across the top of the chart. (CDC WONDER; Available at: <http://wonder.cdc.gov/lbd.html>. Accessed May 29, 2010.)

CA, California; GA, Georgia; MA, Massachusetts; MO, Missouri; MS, Mississippi; OH, Ohio.



**FIGURE 4. Aggregated gestational age-specific infant mortality rates (deaths per 1000 live births) for the years 2007–2010 by black and white race**  
**A**, 20–27 weeks of gestation; **B**, 28–31 weeks of gestation; **C**, 32–33 weeks of gestation (Deaths in Massachusetts are too rare to calculate accurate rates.); **D**, 34–36 weeks of gestation; **E**, 37–38 weeks of gestation; **F**, 39 weeks of gestation. (CDC WONDER; Available at: <http://wonder.cdc.gov/lbd.html>. Accessed May 29, 2010.)  
 CA, California; GA, Georgia; MA, Massachusetts; MO, Missouri; MS, Mississippi; OH, Ohio.

**TABLE 1**

Selected reproductive health outcomes and indicators by state

State	Breast cancer <sup>d</sup>		Ovarian cancer <sup>d</sup>		Gonorrhea rate for 2012 <sup>b</sup>	Primary and secondary syphilis rate for 2012 <sup>b</sup>	Teen birth rate for 2012 <sup>c</sup>	Infant mortality rate for 2010 <sup>d</sup>
	Incidence	Death rate	Incidence	Death rate				
Alabama	116.2	23.5	11.3	8.8	193	4.5	39.2	8.73
Alaska	124.5	21.8	10.2	5.2	101	1.5	34.5	3.57
Arizona	108.3	19.4	11.6	7.6	90	3.1	37.4	5.94
Arkansas	—	22.7	—	7.5	146	5.9	45.7	7.24
California	117.9	20.7	11.7	7.7	89	7.8	26.5	4.74
Colorado	124.0	20.0	11.7	9.3	55	4.1	25.4	5.91
Connecticut	138.5	20.9	13.0	7.4	60	1.5	15.1	5.30
Delaware	130.9	22.7	8.2	7.1	99	4.2	25.0	7.48
District of Columbia	142.9	30.4	8.1	6.2	389	26.7	38.6	7.64
Florida	111.2	21.3	11.4	6.9	102	7.2	28.0	6.51
Georgia	117.2	23.6	11.7	8.4	156	9.5	33.8	6.34
Hawaii	130.7	14.8	10.0	7.0	59	1.7	28.1	6.21
Idaho	116.9	21.3	11.6	5.4	11	1.6	28.3	4.78
Illinois	125.4	22.6	12.0	7.8	141	6.2	27.9	6.84
Indiana	114.0	22.8	10.4	8.4	113	3.4	33.0	7.62
Iowa	126.5	19.4	12.3	8.8	66	2.3	24.1	4.86
Kansas	118.1	20.4	10.7	7.7	78	0.8	34.1	6.20
Kentucky	118.5	21.8	10.4	7.8	98	3.4	41.5	6.81

State	Breast cancer <sup>d</sup>		Ovarian cancer <sup>d</sup>		Gonorrhea rate for 2012 <sup>b</sup>	Primary and secondary syphilis rate for 2012 <sup>b</sup>	Teen birth rate for 2012 <sup>c</sup>	Infant mortality rate for 2010 <sup>d</sup>
	Incidence	Death rate	Incidence	Death rate				
Louisiana	121.6	24.6	9.5	7.0	194	7.4	43.1	7.55
Maine	125.1	20.1	10.6	9.1	34	1.3	19.4	5.40
Maryland	128.7	24.1	10.0	8.2	98	7.4	22.1	6.83
Massachusetts	125.1	19.1	10.0	7.0	40	4.8	14.1	4.39
Michigan	115.6	23.7	12.6	8.4	127	3.0	26.3	7.12
Minnesota	—	20.1	—	7.9	58	2.2	18.5	4.55
Mississippi	112.9	24.9	8.0	6.8	231	5.0	46.1	9.62
Missouri	117.4	23.4	10.2	7.4	146	2.6	32.2	6.58
Montana	128.0	21.1	11.1	8.6	11	0.2	28.8	5.97
Nebraska	116.3	19.2	10.4	7.3	78	0.4	26.8	5.25
Nevada	108.1	23.6	8.5	7.0	83	5.1	33.4	5.51
New Hampshire	127.8	21.7	10.3	7.7	11	2.7	13.8	3.88
New Jersey	124.7	23.2	13.4	8.5	85	2.6	16.7	4.80
New Mexico	106.3	22.1	10.3	7.5	90	4.9	47.5	5.60
New York	123.6	21.6	12.4	7.7	116	6.3	19.7	5.08
North Carolina	125.0	23.3	11.0	7.5	148	3.6	31.8	7.09
North Dakota	121.2	22.8	11.1	6.7	49	0.6	26.5	6.81
Ohio	112.3	24.0	10.4	8.2	143	3.7	29.8	7.72
Oklahoma	119.3	24.8	10.5	8.3	117	2.2	47.3	7.49
Oregon	124.4	22.9	11.0	9.1	38	5.5	23.8	4.96

State	Breast cancer <sup>d</sup>		Ovarian cancer <sup>d</sup>		Gonorrhea rate for 2012 <sup>b</sup>	Primary and secondary syphilis rate for 2012 <sup>b</sup>	Teen birth rate for 2012 <sup>b</sup>	Infant mortality rate for 2010 <sup>d</sup>
	Incidence	Death rate	Incidence	Death rate				
Pennsylvania	124.7	23.3	12.9	8.2	121	3.9	23.7	7.23
Rhode Island	110.4	19.0	7.7	6.5	48	4.2	19.9	7.16
South Carolina	119.4	22.5	9.4	8.0	163	4.8	36.6	7.34
South Dakota	109.1	19.5	10.0	6.1	86	2.2	33.3	7.11
Tennessee	115.7	22.4	11.8	7.9	142	4.2	38.5	7.87
Texas	109.8	20.8	10.6	7.5	127	6.3	44.4	6.15
Utah	110.7	22.2	11.9	7.9	17	1.5	23.3	4.86
Vermont	131.9	19.1	14.2	8.9	16	1.0	16.3	4.18
Virginia	118.6	22.2	11.3	8.1	85	3.5	22.9	6.83
Washington	129.0	20.9	13.3	8.4	47	4.4	23.4	4.48
West Virginia	111.1	20.5	12.8	7.5	49	0.4	44.1	7.33
Wisconsin	116.9	21.3	11.9	8.0	82	1.6	21.9	5.84
Wyoming	107.4	22.3	13.1	9.3	8	0.7	34.7	6.88

<sup>a</sup>Rates are per 100,000 persons and age adjusted to the 2000 US standard population: US Cancer Statistics: an interactive atlas. Available at: [http://apps.nccd.cdc.gov/DCPC\\_INCA/DCPC\\_INCA.aspx](http://apps.nccd.cdc.gov/DCPC_INCA/DCPC_INCA.aspx). Accessed May 27, 2014;

<sup>b</sup>Reported cases per 100,000 population: 2012 Sexually transmitted diseases surveillance. Available at: <http://www.cdc.gov/std/stats12/slides.htm>. Accessed May 27, 2014;

<sup>c</sup>Births for teenagers 15–19 years old per 1000 estimated female population 15–19 years old. Available at: [http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62\\_09.pdf#table01](http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_09.pdf#table01). Accessed May 27, 2014;

<sup>d</sup>Linked birth/infant death records; deaths for infants <1 year old per 1000 live births. CDC WONDER. Available at: <http://wonder.cdc.gov/lbd.html>. Accessed May 27, 2014.

TABLE 2

Resource list for geographic variation and social determinants of health

<p>The <i>County Health Rankings &amp; Roadmaps</i> program is a collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute. State-specific county-level measures for health outcomes, health behaviors, social and economic factors are available Available at: <a href="http://www.countyhealthrankings.org/#app/massachusetts/2012/measures/factors/14/map">http://www.countyhealthrankings.org/#app/massachusetts/2012/measures/factors/14/map</a></p>
<p><i>Measure of America</i> is a project of the Social Science Research Council. It provides easy-to-use interactive tool tools for understanding the distribution of well-being, including health outcomes, and opportunity in the United States. Available at: <a href="http://www.measureofamerica.org">www.measureofamerica.org</a></p>
<p><i>CDC Wide-ranging Online Data for Epidemiologic Research (WONDER)</i> is a set of online databases that use a rich ad-hoc query system for the analysis of public health data. It is an easy-to-use, menu-driven system that makes the information resources of the Centers for Disease Control and Prevention (CDC) available to public health professionals and the public at large. The site is particularly useful for state-level birth and infant death data. Available at: <a href="http://wonder.cdc.gov/">http://wonder.cdc.gov/</a></p>
<p><i>Sortable Stats</i> is an interactive data set comprised of behavioral risk factors and health indicators. This data set compiles state level data for the 50 states, the District of Columbia, and the US territories from various published CDC and federal sources into a format that allows users to view, sort, and analyze data at state, regional, and national levels. Available at: <a href="http://wwwn.cdc.gov/sortablestats/">http://wwwn.cdc.gov/sortablestats/</a></p>
<p><i>Cancer Rates by State</i> is an interactive atlas that depicts state-specific incidence and death rates for major types of cancer. Most pertinent to obstetricians and gynecologists are rates for breast, cervical, ovarian, and uterine cancers. Available at: <a href="http://apps.nccd.cdc.gov/DCPC_INCA/DCPC_INCA.aspx">http://apps.nccd.cdc.gov/DCPC_INCA/DCPC_INCA.aspx</a></p>
<p><i>Sexually Transmitted Diseases Surveillance</i> is slide sets for US sexually transmitted disease surveillance that includes maps with state-specific rates. The most recent year available is 2012. As subsequent years become available, the “stats12” portion of the URL changes to the most recent available year (eg, when 2013 data are available, stats12 will need to be replaced by stats13). Available at: <a href="http://www.cdc.gov/std/stats12/slides.htm">http://www.cdc.gov/std/stats12/slides.htm</a></p>
<p>The <i>Equality of Opportunity Project</i> presents geographic trends and variation in upward economic mobility. Available at: <a href="http://www.equality-of-opportunity.org/">http://www.equality-of-opportunity.org/</a></p>
<p><i>CDC’s Pregnancy Risk Assessment Monitoring System (PRAMS) Online Data for Epidemiologic Research (CPONDER)</i> is an interactive data base that indexes 195 variables by topic for selection as outcome variables. Analyses may be for a single state and year, for a single state and all available years, or for all available states and a single year. Available at: <a href="http://www.cdc.gov/prams/cponder.htm">http://www.cdc.gov/prams/cponder.htm</a></p>
<p><i>VitalStats</i> is a collection of vital statistics products that allow users to access prebuilt tables and reports or to build their own tables with the vital statistics data. Data are available at state, national, and large county (population &gt; 100,000) levels. Available at: <a href="http://www.cdc.gov/nchs/VitalStats.htm">http://www.cdc.gov/nchs/VitalStats.htm</a></p>
<p><i>PeriStats</i> is an interactive site that was developed by the March of Dimes Perinatal Data Center. PeriStats provides free access to maternal and infant health-related data at the United States, state, county, and city level. Available at: <a href="http://www.marchofdimes.com/peristats/Peristats.aspx">http://www.marchofdimes.com/peristats/Peristats.aspx</a></p>
<p><i>CDC Social Determinants of Health</i> provides resources, publications, and definitions that address opportunities and barriers to promote and attain health equity. Available at: <a href="http://www.cdc.gov/socialdeterminants/Index.html">http://www.cdc.gov/socialdeterminants/Index.html</a></p>

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