A Spatial Investigation of the United States Birth Rate

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Research Question and Literature Review

Over the past decade there has been a significant decrease in birth rate and an increase in infertility in the United States (Tannus & Dahan, 2018). By some projections, Americans are not bearing enough children to replace themselves, which has the potential to lead to a significant drop in the United States' population in the coming decades (Mathews & Hamilton, 2019). This phenomenon provides the basis for the overall research question, "Were reproductive rights spatially associated with the number of total births at the state level in the U.S. in 2014?"

Reproductive rights are defined as the rights of an individual to decide whether to reproduce and maintain their reproductive health including choosing whether or not to terminate a pregnancy or use contraception. Important reproductive factors influencing the birth rate in the United States, as Greeta Nargund notes in her paper, *Declining birth rate in Developed Countries: A radical policy re-think is required,* include access to contraception, abortion rate, and economic factors such as per capita income (Nargund, 2009). In analyzing reproductive rights, these factors will be spatially analyzed.

Before describing the analysis of these factors, it is important to provide additional information about some of them. The percentage of need met by Title X- funded centers may play a role in the birth rate. Title X-funded centers are funded by the Title X family planning program, the only national program that subsidizes contraceptive services to people who are disadvantaged due to age or income (Frost, Frohwirth, and Zolna, 2016). Beyond these factors, infant mortality and sexually transmitted disease rates (STD) were also analyzed. Infant mortality rate was chosen because it is higher in the U.S. than in comparable developed countries in Europe (Chen, Oster, & Williams, 2016) and because lower infant mortality rates are closely

associated with fertility rates and, therefore, the overall birth rate (Nargund, 2009). STD rates were chosen because they are a useful factor in analyzing birth rate. Three major STDs were examined: Chlamydia, Gonorrhea, and Syphilis. These diseases were noteworthy because they have all been shown to cause fertility issues (Danielle, Wiesenfeld, Parks, & Peipert, 2016).

Methods and Analysis

The United States shapefile used came from ESRI and was published by Charlie Fitzpatrick, Co-Manager of Esri Schools Program. It was chosen because the attribute table was clean and had the necessary vector data. The American Community Survey, gathered by the U.S. Census Bureau, was used because it provided the 2014 population for each state, and was used as the normalizing factor for birth rate. Additionally, the U.S. Census Bureau provided information on health insurance coverage and per capita income. The Guttmacher database provided datasets for several factors mapped including the percentage of need covered by Title X-funded centers, access to an abortion provider, and the abortion rate. The data about the number of individuals affected with the three major STDs as well as the number of infant deaths was obtained from the CDC Wonder Online Database, gathered by the U.S. Department of Health and Human Services.

Following data collection, each group member downloaded the group's MXD template and joined their reproductive factor to the US state shapefile (ESRI). The reproductive factors joined were live births per 1,000 people, the percentage of need met by Title X-funded centers, the infant mortality rate, access to an abortion provider, abortion rate, percent of population with health insurance, per capita income, and the rates of the three most common STDs. Everyone then mapped birth rate, defined as the number of live births per 1,000 people, on a choropleth

map. Above each choropleth map, every group member created a graduated symbols map with their reproductive factor as the variable. Each person then used select by attribute to find the quartile of states doing the best for their reproductive factor, exported the layer as a shapefile, and uploaded it to the Team Drive to be included in map 8. Each of the exported shapefiles were joined to the United States shapefile in map 8 (ESRI). Additionally, this map had the STD rate, which was calculated by selecting out the 25% of states with the lowest STD rates from each disease layer and intersecting them. For each of the reproductive factors, a new field was created and each state was assigned a boolean value of '1' if the factor was present in the indexed layer or a '0' if not. A new field called 'index', was then created by adding up all of the 1's and 0's for each state to get an overall reproductive health index for each state ranging from zero to six.

Results

Map 1 looks at the percentage of contraceptive needs being met by specific Title X-funded centers. The map illustrates that a greater percentage of needs are met near the east coast than in other areas of the United States where the percentage of needs being met appear to be more scattered. This is not to say that the remaining percentage of contraceptive needs are not being met, but rather being obtained through another source such as publicly funded care, private doctors, or over-the-counter methods (Frost, Frohwirth, and Zolna, 2016). On the map, no symbol with the largest percentage of need met by Title X-funded centers occur within states having the highest quartile for birth rate, suggesting a negative correlation between birth rate and Title X-funded centers.

In map 2, the number of infant deaths per 1,000 live births was mapped by state. Overall, this map shows little correlation between birth rate and infant mortality rate in the U.S.--most of the states with the highest infant mortality rates seemed to have birth rates in the middle classes of the data. However, there does seem to be a spatial pattern for infant mortality. The majority of states in the highest category of mortality rates are located in the South, whereas the majority of states in the lowest category of mortality rates are located on the East Coast.

In map 3, the percentage of women living in counties without access to an abortion provider is shown. The map portrays strong regional patterns; specifically, with states in the northeastern part of the United States having much higher percentages of access. Additionally, the vast majority of states lack access for over 75% of women, with only about one-fourth of states providing access to over 25% of women. Furthermore, the states with the least access to providers strongly correlate with the states having the highest birth rates.

In map 4, abortion rate per 1,000 women aged 15 to 44 is mapped by state. This map shows a strong regional pattern as the northeastern states and the western states generally have the highest abortion rates, ranging from 15.5 to 32.7 abortions per 1,000 women. Additionally, there does appear to be some correlation between states having low birth rates and these states also having high abortion rates.

Map 5 looks at the number of people infected with Chlamydia, Gonorrhea, and Syphilis per 1,000 people. This map shows that all states within the bottom 25th percentile of STD rates are located in the north. It also shows that Oregon and the northeastern states, which have relatively lower birth rates, also have a lower number of people infected. However, states located

in the Midwest and the West, which have relatively higher birth rates, also have a lower number of people infected. Thus, there does not appear to be a correlation between STDs and birth rate.

In map 6, the per capita income, or the average income per person, in each state is mapped. This map shows that per capita income tends to be higher in the New England area, where birth rates are lower. However, there are a significant number of exceptions throughout the country that make it difficult to determine any significant correlation between the two factors.

In map 7, the percentage of the population with health insurance in each state is mapped. Health insurance coverage has a fairly steady trend of being higher in northern states and lower in southern states; however, this trend does not appear to correlate with birth rate.

In map 8, each of the previous seven factors were joined into one table to create a "reproductive rights index", ranging from zero - seven (although no states had a value of seven, so the actual range is zero - six). In this map, there does seem to be a relationship between the index and birth rate--the majority of states with the highest birth rate, which are concentrated in the middle of the country, either have a zero index or fall into the lowest category of indexes. On the other hand, the majority of states with the highest birth rates, which are concentrated largely in the Northeast, fall into the middle or highest index category for reproductive rights.

Conclusions and Next Steps

On their own, only several factors relating to reproductive rights appeared to be correlated with state-level birth rate. These factors were Title X centers, access to abortion

clinics, and abortion rates. However, there does seem to be a spatial relationship between the overall statewide birth rates and the reproductive rights index--states with lower indices tended to have higher birth rates, and states with higher indices tended to have lower birth rates. However, due to the limited scope of this project no concrete conclusions can be drawn on this relationship.

For our next steps, we would need to look at a wider scope of data, including data from multiple time periods and different geographical scales. Observing these factors only at the state level may be too broad to find connections, and looking at trends on smaller scales may reveal stronger trends. Had their have been more time, mapping additional factors provided by Guttmacher may have helped strengthen the conclusions about possible correlations.

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NV+NH+NJ+NM+NY+NC+ND+OH+OK+OR+PA+RI+SC+SD+TN+TX+UT+VT+VA+WA+WV+WI+WY&topics=59&dataset=data

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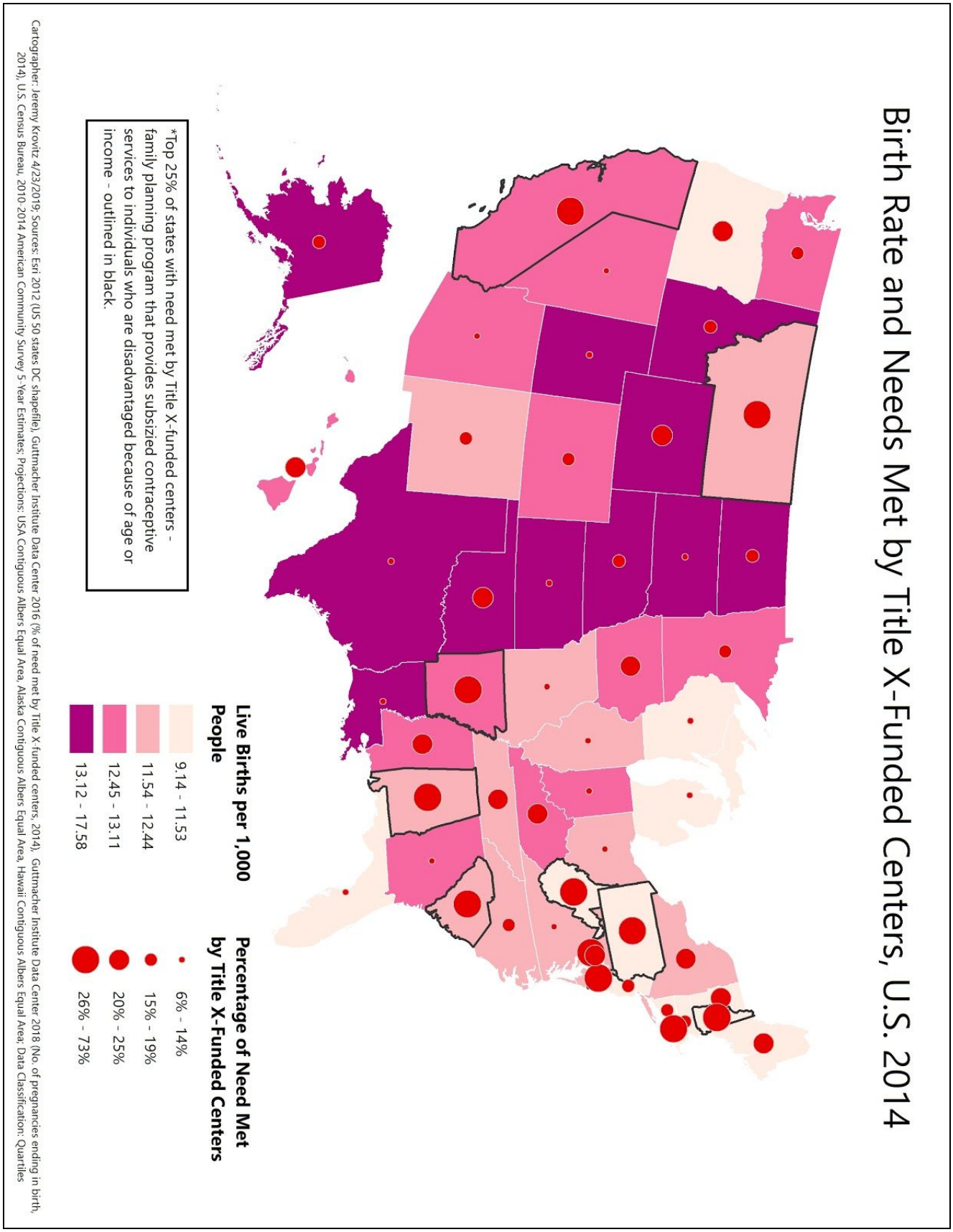
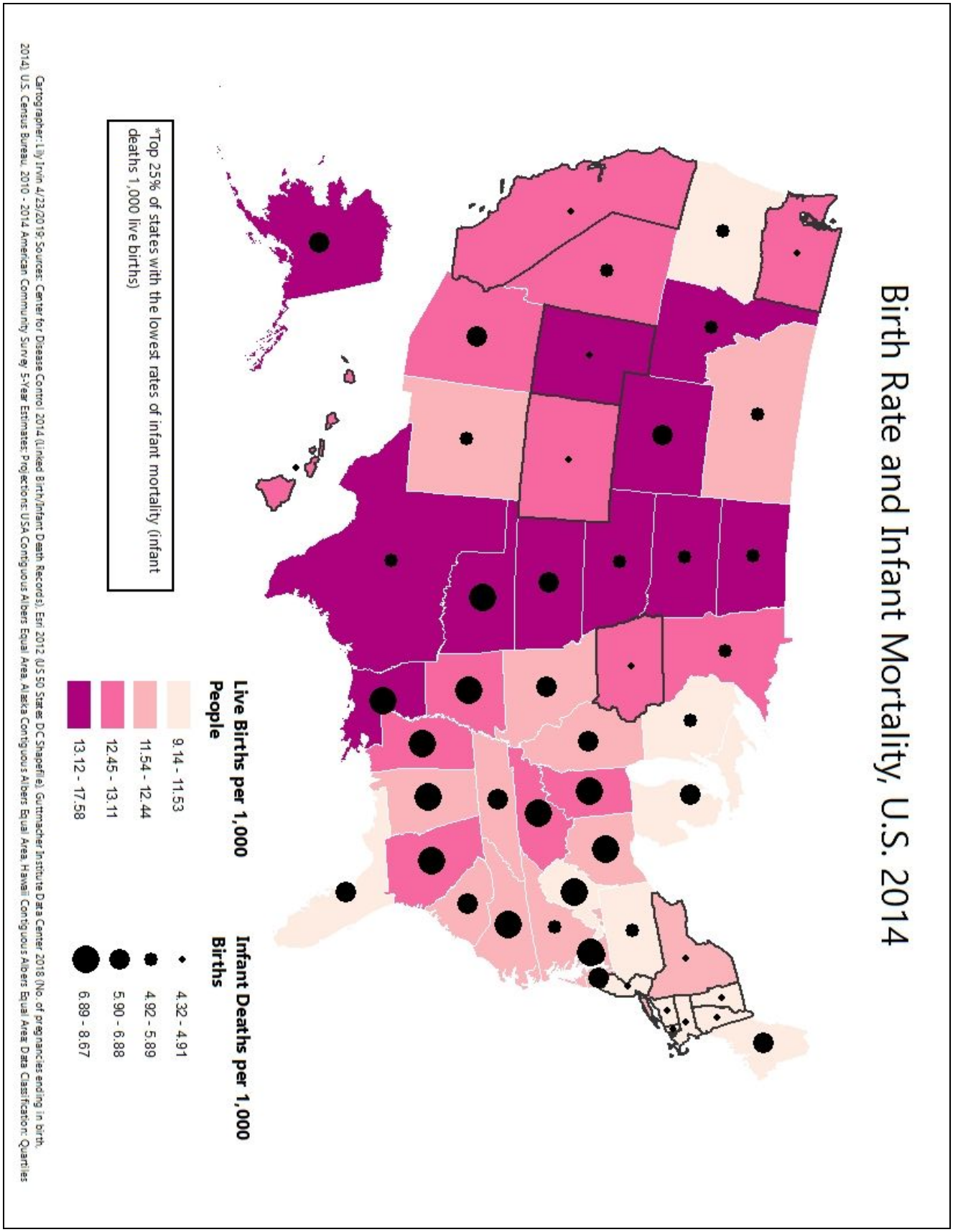
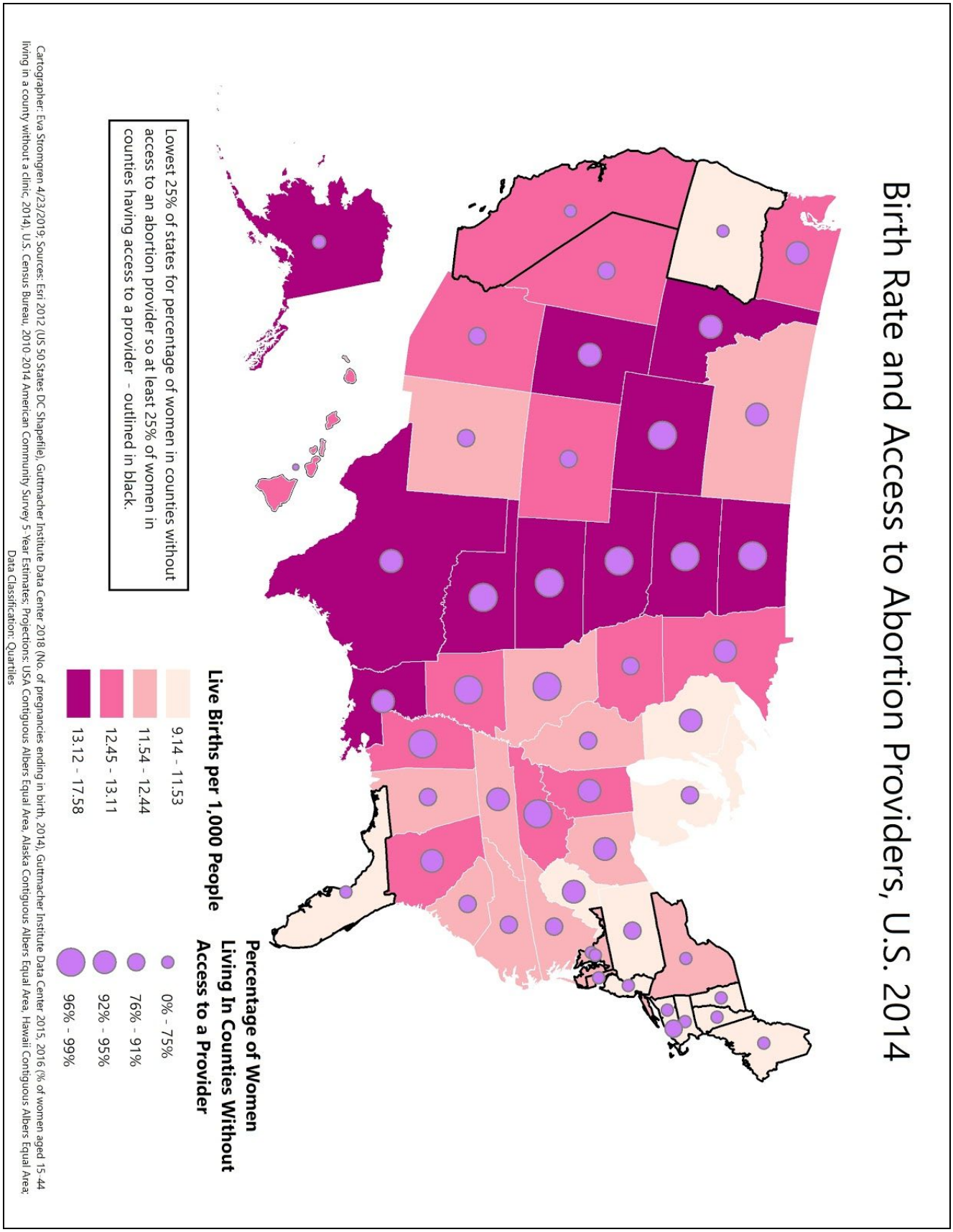
Map 1


Birth Rate and Needs Met by Title X-Funded Centers, U.S. 2014
*Top 25% of states with need met by Title X-funded centers - family planning program that provides subsizied contraceptive services to individuals who are disadvantaged because of age or income - outlined in black.
Live Births per 1,000 People
9.14 - 11.53
11.54 - 12.44
12.45 - 13.11
13.12 - 17.58
Percentage of Need Met by Title X-Funded Centers
6% - 14%
15% - 19%
20% - 25%
26% - 73%
Cartographer: Jeremy Krovitz 4/23/2019; Sources: Esri 2012 (US 50 states DC shapefile), Guttmacher Institute Data Center 2016 (% of need met by Title X-funded centers, 2014), Guttmacher Institute Data Center 2018 (No. of pregnancies ending in birth, 2014), U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quartiles

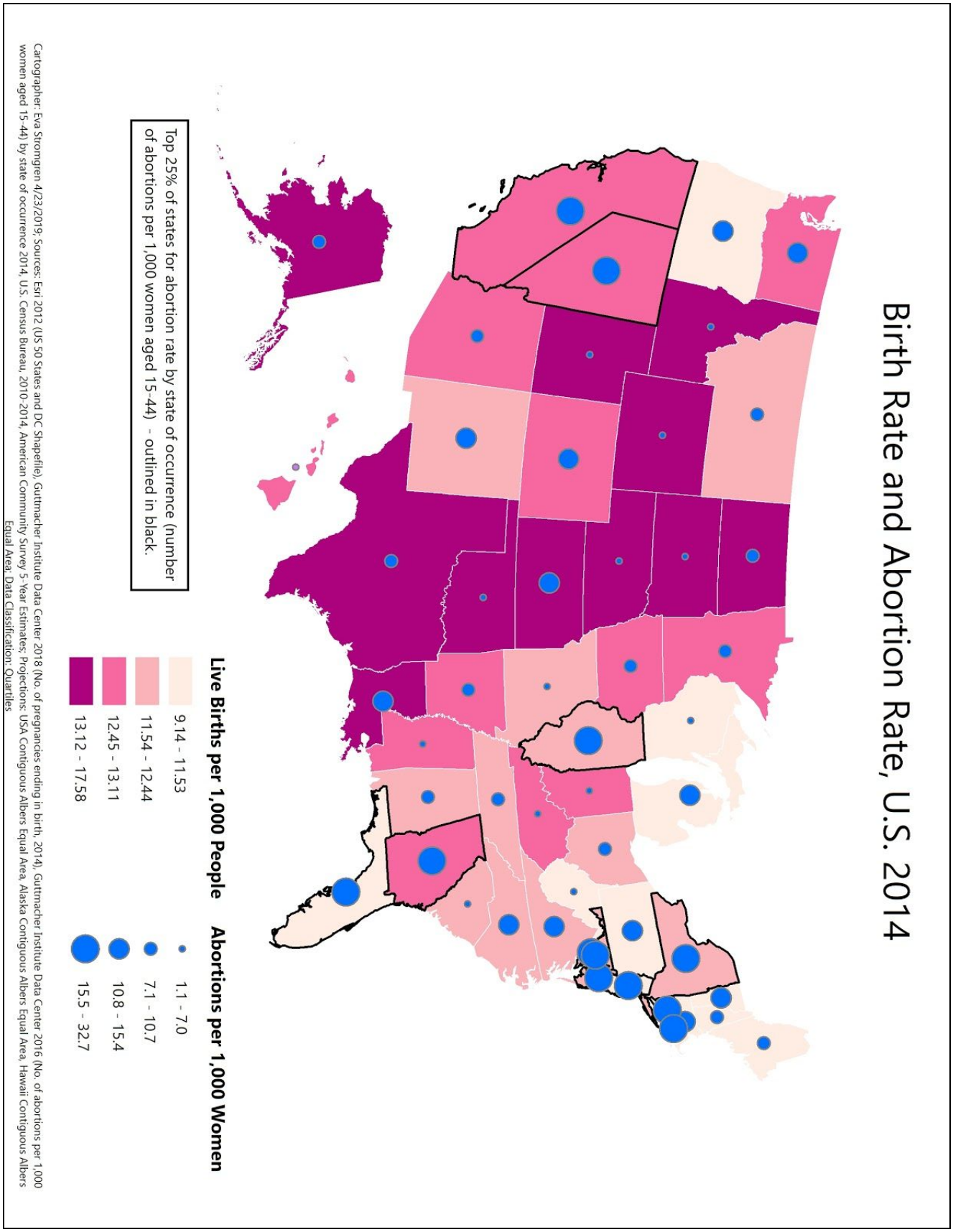
Map 2


Birth Rate and Infant Mortality, U.S. 2014
*Top 25% of states with the lowest rates of infant mortality (infant deaths 1,000 live births)
Live Births per 1,000 People
9.14 - 11.53
11.54 - 12.44
12.45 - 13.11
13.12 - 17.58
Infant Deaths per 1,000 Births
4.32 - 4.91
4.92 - 5.89
5.90 - 6.88
6.89 - 8.67
Cartographer: Lily Irvin 4/23/2019; Sources: Center for Disease Control 2014 (Linked Birth/Infant Death Records), Esri 2012 (US 50 States DC Shapefile), Guttmacher Institute Data Center 2018 (No. of pregnancies ending in birth, 2014), U.S. Census Bureau, 2010 - 2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quantiles

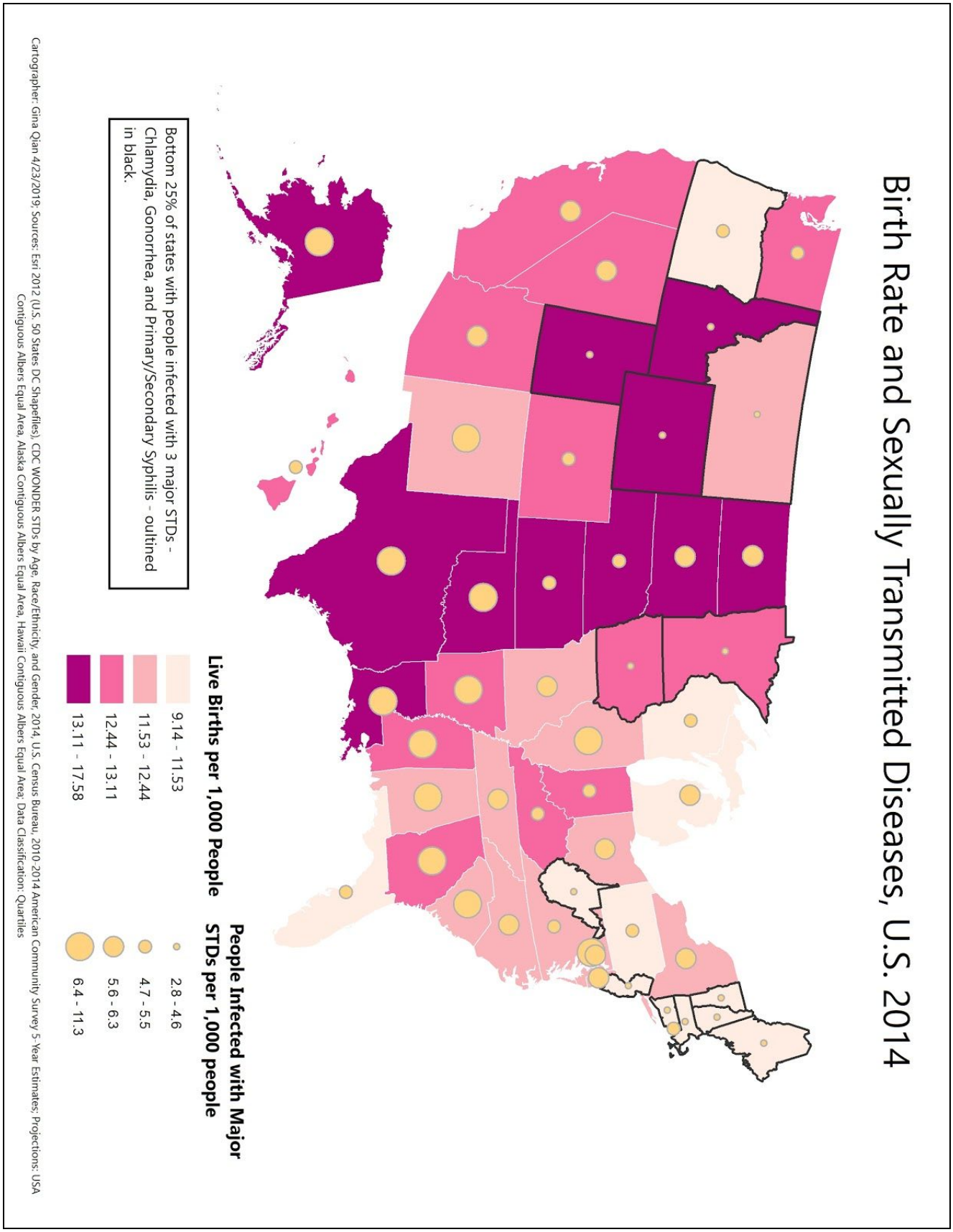
Map 3


Birth Rate and Access to Abortion Providers, U.S. 2014
Lowest 25% of states for percentage of women in counties without access to an abortion provider so at least 25% of women in counties having access to a provider - outlined in black.
Live Births per 1,000 People
9.14 - 11.53
11.54 - 12.44
12.45 - 13.11
13.12 - 17.58
Percentage of Women Living In Counties Without Access to a Provider
0% - 75%
76% - 91%
92% - 95%
96% - 99%
Cartographer: Eva Stromgren 4/23/2019; Sources: Esri 2012 (US 50 States DC Shapefile), Guttmacher Institute Data Center 2018 (No. of pregnancies ending in birth, 2014), Guttmacher Institute Data Center 2015, 2016 (% of women aged 15-44 living in a county without a clinic, 2014), U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quartiles

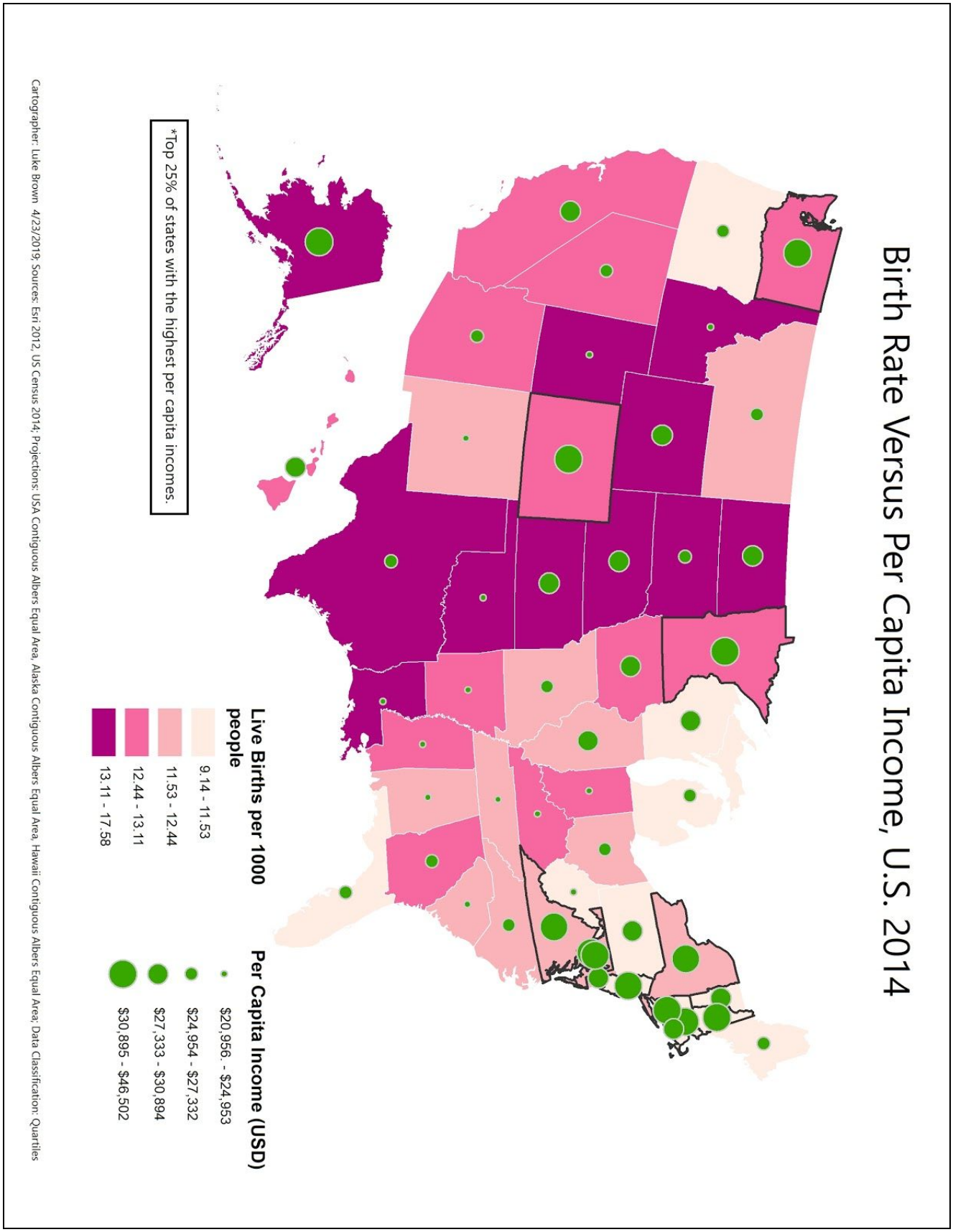
Map 4


Birth Rate and Abortion Rate, U.S. 2014
Top 25% of states for abortion rate by state of occurrence (number of abortions per 1,000 women aged 15-44) - outlined in black.
Live Births per 1,000 People
9.14 - 11.53
11.54 - 12.44
12.45 - 13.11
13.12 - 17.58
Abortions per 1,000 Women
1.1 - 7.0
7.1 - 10.7
10.8 - 15.4
15.5 - 32.7
Cartographer: Eva Stromgren 4/23/2019; Sources: Esri 2012 (US 50 States and DC Shapefile), Guttmacher Institute Data Center 2018 (No. of pregnancies ending in birth, 2014), Guttmacher Institute Data Center 2016 (No. of abortions per 1,000 women aged 15-44) by state of occurrence 2014, U.S. Census Bureau, 2010-2014, American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area, Data Classification: Quartiles

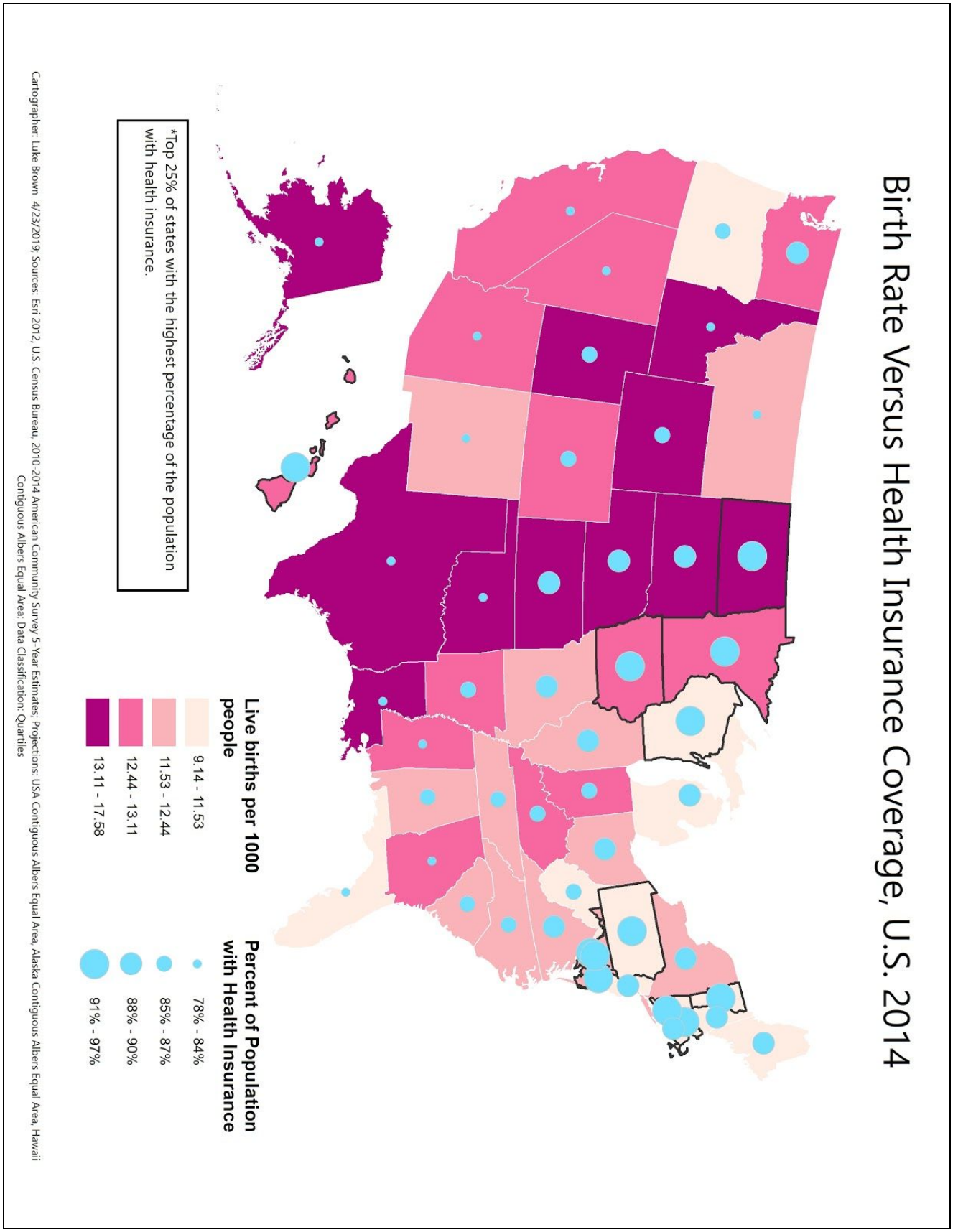
Map 5


Birth Rate and Sexually Transmitted Diseases, U.S. 2014
Bottom 25% of states with people infected with 3 major STDs - Chlamydia, Gonorrhea, and Primary/Secondary Syphilis - outlined in black.
Live Births per 1,000 People
9.14 - 11.53
11.53 - 12.44
12.44 - 13.11
13.11 - 17.58
People Infected with Major STDs per 1,000 people
2.8 - 4.6
4.7 - 5.5
5.6 - 6.3
6.4 - 11.3
Cartographer: Gina Qian 4/23/2019; Sources: Esri 2012 (U.S. 50 States DC Shapefiles), CDC WONDER STDs by Age, Race/Ethnicity, and Gender, 2014, U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quartiles

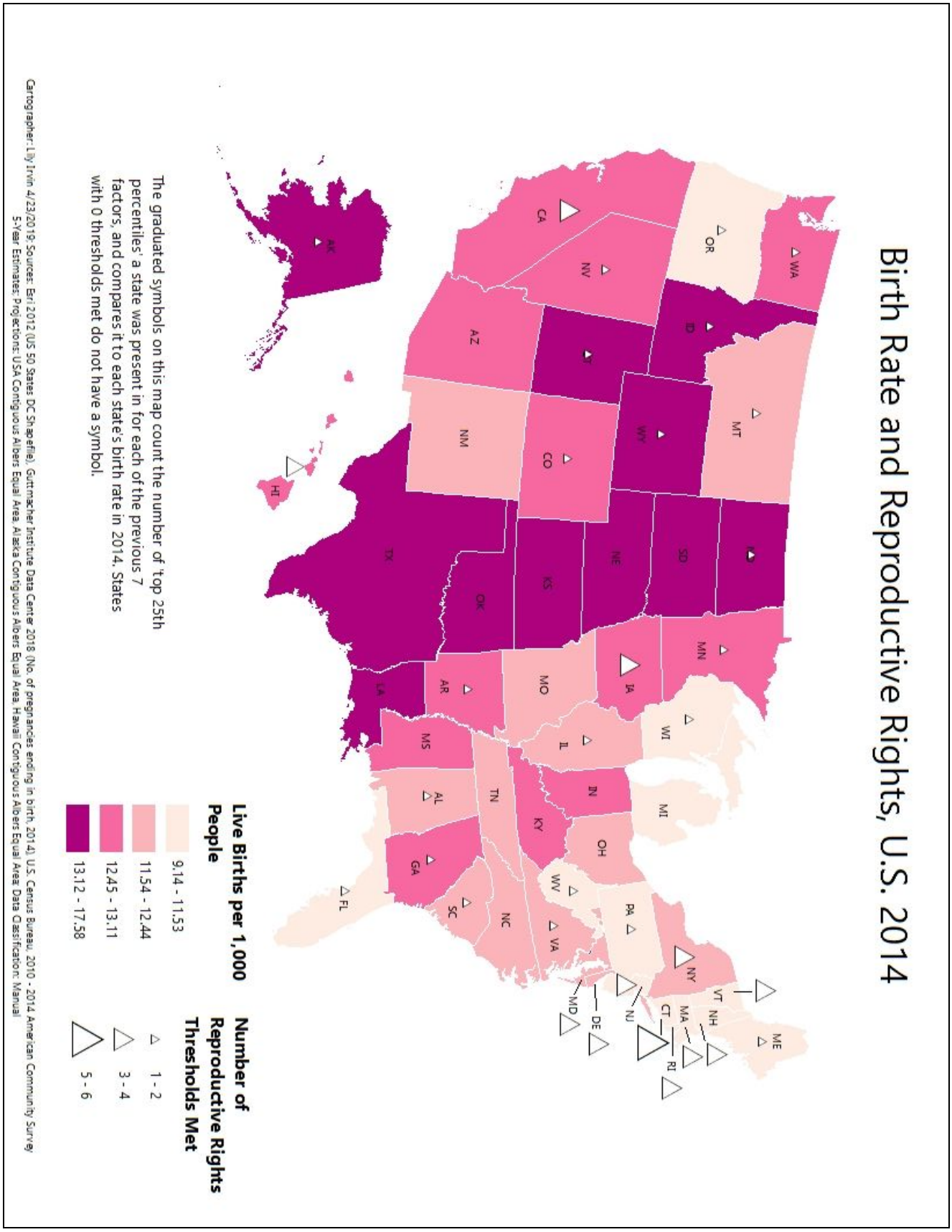
Map 6


Birth Rate Versus Per Capita Income, U.S. 2014
*Top 25% of states with the highest per capita incomes.
Live Births per 1000 people
9.14 - 11.53
11.53 - 12.44
12.44 - 13.11
13.11 - 17.58
Per Capita Income (USD)
$20,956. - $24,953
$24,954 - $27,332
$27,333 - $30,894
$30,895 - $46,502
Cartographer: Luke Brown 4/23/2019; Sources: Esri 2012, US Census 2014; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quartiles

Map 7


Birth Rate Versus Health Insurance Coverage, U.S. 2014
*Top 25% of states with the highest percentage of the population with health insurance.
Live births per 1000 people
9.14 - 11.53
11.53 - 12.44
12.44 - 13.11
13.11 - 17.58
Percent of Population with Health Insurance
78% - 84%
85% - 87%
88% - 90%
91% - 97%
Cartographer: Luke Brown 4/23/2019; Sources: Esri 2012, U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Quartiles

Map 8


Birth Rate and Reproductive Rights, U.S. 2014
The graduated symbols on this map count the number of 'top 25th percentiles' a state was present in for each of the previous 7 factors, and compares it to each state's birth rate in 2014. States with 0 thresholds met do not have a symbol.
Live Births per 1,000 People
9.14 - 11.53
11.54 - 12.44
12.45 - 13.11
13.12 - 17.58
Number of Reproductive Rights Thresholds Met
1 - 2
3 - 4
5 - 6
Cartographer: Lily Irvin 4/23/2019; Sources: Esri 2012 (US 50 States DC Shapefile), Guttmacher Institute Data Center 2018 (No. of pregnancies ending in birth, 2014), U.S. Census Bureau, 2010 - 2014 American Community Survey 5-Year Estimates; Projections: USA Contiguous Albers Equal Area, Alaska Contiguous Albers Equal Area, Hawaii Contiguous Albers Equal Area; Data Classification: Manual