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County-Level Chlamydia and Gonorrhea Rates by Social Vulnerability, United States, 2014–2018

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Abstract

We examined mean chlamydia and gonorrhea case rates from 2014 to 2018 by categorizing US counties by social vulnerability. Overall, these rates were approximately 1.0 to 2.4 times higher in high vulnerability counties than low vulnerability counties. Percentage change in case rates from low to high social vulnerability counties varied by sex, geographic region, and urbanicity.

At the community level, social vulnerability refers to the ability to prepare for and respond to events that exert undue stress on people and systems. To measure community characteristics associated with resilience in response to hazardous events, the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry created the Social Vulnerability Index (SVI).[1] Although initial uses were confined to environmental and natural disasters, use of the SVI has evolved over time. More recently, higher social vulnerability as measured by the SVI has been linked to higher levels of COVID-19–related mortality[2] and lower levels of COVID-19 vaccination coverage.[3] In addition, research has extended use of the SVI to other epidemics in the United States, including drug overdose deaths[4] and chronic diseases, such as diabetes, obstructive pulmonary disease, heart disease, and kidney disease.[5]

The SVI is divided into 4 domains that can affect health and health outcomes: (1) socioeconomic status, (2) household composition and disability, (3) minority status and language, and (4) housing and transportation.[1] The prevalence of research on the impact of neighborhood factors,[6] social determinants of health,[7] and local infrastructure[8] on health outcomes has grown exponentially in recent years. This work recognizes that the interaction between an individual and where they live influences their risk or resilience to disease. However, because of the complexity of assessing and analyzing community-level factors,

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much of this work is specific to smaller-scale geographic areas or a strictly defined subpopulation. Using the SVI, we extend prior work focused on the social determinants of health to examine disparities in sexually transmitted disease (STD) rates in the United States.

There is a well-established link between social and environmental factors and sexual behavior.[9] In a meta-analysis exploring disparities between black and white men who have sex with men (MSM), Millett et al[10] found no differences by race for HIV risk-related behaviors, such as unprotected anal intercourse or sex with a known HIV-positive partner, despite substantially higher rates of HIV infection among black MSM. The authors concluded that behavioral risks were not the primary driver of the stark disparity between HIV rates in black as compared with white MSM. Later work using the SVI and National HIV Surveillance System data found that black adults living in places with the highest SVI were 1.5 times as likely to be diagnosed with HIV compared with those living in places with the lowest SVI.[11] The latter association, drawn between racial/ethnic disparities in HIV rates and the SVI, introduces the question of how social vulnerability influences STD rates.

METHODS

To address this question, we used 3 data sources from CDC for statistical analysis: (1) county-level annual chlamydia and gonorrhea case rates (cases per 100,000 population) in 2014 to 2018 in all 50 states and the District of Columbia from the National Notifiable Disease Surveillance System[12]; (2) county-level sociodemographic variables from the 2018 SVI[13]; and (3) 2013 rural-urban codes to identify metropolitan and nonmetropolitan counties.[14] Overall, the SVI includes 15 indicators from the 2014 to 2018 American Community Survey (ACS).[1] The SVI percentile rankings range from 0 to 1, with higher numbers indicating higher vulnerability. For this analysis, SVI rankings were grouped into tertiles (low, 0.00–0.33; medium, 0.34–0.66; high, 0.67–1.00). We matched these 3 data sources based on county Federal Information Processing Standard codes, which provided us with 3132 counties for chlamydia and 3079 counties for gonorrhea available for analysis.

We summarized multiple years of STD rates by adding the cases from 2014 to 2018, dividing by the sum of the population estimates for each year, and multiplying the result by 100,000 to produce a 5-year estimated mean for each county. The time frame for a 5-year county-level estimate of mean STD rates is consistent with 5-year county-level demographic and socioeconomic estimates from ACS.[15] For all US counties for which SVI data were matched, we present means and standard deviations (SDs) for chlamydia and gonorrhea rates by SVI tertile for men and women separately, and by US Census region (Northeast, Midwest, South, West) and urbanicity (metropolitan/nonmetropolitan). Relative percentage change by SVI was calculated as the case rates for high SVI counties subtracted from the case rates for low SVI counties, divided by low SVI county case rates.

RESULTS

Overall, the mean chlamydia case rate by county in 2014 to 2018 was 213.3 per 100,000 (SD, 167.7) for men and 531.2 per 100,000 (SD, 365.4) for women (Table 1). For men, the

mean chlamydia case rate was 151.1 per 100,000 in low vulnerability counties and 291.9 per 100,000 in high vulnerability counties (percentage change, 93%). Comparatively, women had a larger percentage change in mean chlamydia case rates from low to high SVI than men (347.6–780.7 per 100,000; 125%).

Mean chlamydia case rates increased from low to high SVI among men and women in all US regions, with the largest percentage change from low to high SVI among women in the Midwest (328.7 to 813.4 per 100,000; 147%). By urbanicity, the largest percentage change from low to high vulnerability counties in mean chlamydia case rates was among women and men in rural counties compared with urban counties. For women in rural counties, mean chlamydia case rates increased from 273.4 per 100,000 in low vulnerability counties to 748.2 per 100,000 in high vulnerability counties (percentage change, 174%), whereas for men in these counties, mean chlamydia case rates increased from 108.3 per 100,000 to 261.8 per 100,000 (percentage change, 142%), with smaller percentage changes for women (100%) and men (74%) in urban counties.

Overall, the mean gonorrhea case rate in 2014 to 2018 was 95.2 per 100,000 (SD, 106.7) for men and 100.7 per 100,000 for women (SD, 112.7) (Table 2). By sex, mean gonorrhea case rates for women were higher in high vulnerability counties (170.2 per 100,000) than for men in these counties (148.6 per 100,000), but little difference was seen for these case rates by sex in low vulnerability counties (women, 50.4; men, 53.7 per 100,000).

In all US regions, mean gonorrhea case rates increased as SVI increased. By region, the Midwest had the largest percentage change in mean gonorrhea rates from low to high SVI (women, 332%; men, 242%). By urbanicity, the percentage change in mean gonorrhea rates from low to high SVI was largest among women in rural counties (45.7–160.2 per 100,000; 250%), and smallest among men in urban counties (64.2–169.1 per 100,000; 163%).

DISCUSSION

During 2014 to 2018, mean chlamydia and gonorrhea case rates were higher in high vulnerability counties than in low vulnerability counties. Variation in STD case rates by SVI is due to a combination of increased screening efforts, higher disease burden and social and economic SVI characteristics. The CDC's recommendation for annual screening of chlamydia and gonorrhea among women younger than 24 years and older women at risk of STDs,[16] expansion of health insurance,[17] and declines in STD clinic funding[18] have influenced STD screening practices. Geographic variation in STD rates by SVI could be because of screening differentials affected by the availability of healthcare plans that include STD screening, and state-level policies that affect access to sexual health services.[19] Geographic areas with high social vulnerability may also have a higher rate of STDs because of a higher proportion of residents who are at higher risk for acquiring STDs, or a higher rate of transmission among those already infected.[20] In addition, variation in STD rates by SVI could reflect multiple social determinants of health within counties or census tracts that could further exacerbate disparities in STD rates in disproportionately affected groups (eg, <25 years, racial/ethnic minorities).[21]

These results should be interpreted in light of several limitations. Approximately 1% of chlamydia cases (97,478/8,034,038) and gonorrhea cases (26,332/2,352,805) in 2014 to 2018 were omitted from analysis because the Federal Information Processing Standard codes could not be matched across data sources due to incomplete information on county of residence. The smallest geographic unit available describing chlamydia and gonorrhea is county of report; thus, we cannot examine heterogeneity within counties. Our analyses of chlamydia and gonorrhea rates, represented as a mean during 2014 to 2018, occurred during a period when cases were increasing nationwide and may seem larger than if the rates had remained constant or decreased. Furthermore, the mean chlamydia and gonorrhea rates presented are accompanied by large SDs, which indicate that STD rates vary widely within US regions.

Despite its origin in disaster preparedness, the SVI has been used to examine the association between social vulnerability and a broad range of health outcomes; however, its use thus far has not included an exploration of STD disparities. Our finding that higher STD rates occur in the most vulnerable counties may help public health practitioners allocate the appropriate resources to address the multiple dimensions of social vulnerability that can affect sexual health care.[22] Future research is needed to examine how specific aspects of social vulnerability (eg, housing insecurity, lack of transportation) affect STD rates across population subgroups. The use of tools like the SVI can also help tailor interventions to the local population so that the behavioral changes enacted by these programs are supported by, or at least not confounded by, the social, environmental, and economic conditions surrounding populations of interest.

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TABLE 1.

Mean Chlamydia Case Rates (SD) by Social Vulnerability Index Tertiles, by Sex, Region, and Urbanicity, 2014–2018

		Mean Chlamydia Case Rates (Per 100,000), by SVI		
	Mean Chlamydia Case Rates for All Counties	**Low Social Vulnerability**	**Medium Social Vulnerability**	**High Social Vulnerability**
Total	3132	1066	1032	1034
Men	213.3 (167.7)	151.4 (128.4)	198.6 (138.5)	291.9 (196.8)
Women	531.2 (365.4)	347.6 (229.6)	471.0 (218.4)	780.7 (449.6)
US regions				
Northeast	217	101	98	18
Men	201.2 (136.6)	157.4 (65.1)	218.1 (138.6)	354.9 (254.1)
Women	411.9 (186.5)	333.9 (99.3)	439.3 (152.8)	700.1 (349.7)
Midwest	1055	606	333	116
Men	166.5 (130.8)	133.9 (81.9)	176.8 (119.4)	306.8 (233.4)
Women	420.2 (300.5)	328.7 (147.9)	449.9 (210.3)	813.4 (618.2)
South	1420	203	460	757
Men	248.3 (173.7)	184.4 (167.6)	208.0 (144.0)	289.8 (180.9)
Women	637.5 (367.2)	419.3 (324.6)	495.7 (228.0)	782.1 (384.0)
West	440	156	141	143
Men	219.0 (208.2)	172.3 (211.1)	205.6 (156.0)	283.0 (234.0)
Women	513.5 (457.4)	337.0 (198.0)	461.9 (236.5)	756.9 (599.1)
Urbanicity				
Urban	1804	611	632	561
Men	244.3 (164.8)	183.5 (148.2)	238.3 (140.1)	317.3 (178.9)
Women	577.1 (328.7)	403.0 (267.7)	540.3 (215.3)	808.1 (359.7)
Rural	1328	455	400	473
Men	171.2 (162.3)	108.3 (76.8)	135.7 (109.6)	261.8 (212.4)
Women	469.0 (402.0)	273.4 (133.2)	361.5 (174.0)	748.2 (535.6)

TABLE 2.

Mean Gonorrhea Case Rates (SD) by Social Vulnerability Index Tertiles, by Sex, Region, and Urbanicity, 2014–2018

		Mean Gonorrhea Case Rates (Per 100,000), by SVI		
	Mean Gonorrhea Case Rates for All Counties	**Low Social Vulnerability**	**Medium Social Vulnerability**	**High Social Vulnerability**
Total	3079	1023	1025	1031
Men	95.2 (106.8)	53.7 (93.6)	82.8 (84.3)	148.6 (116.8)
Women	100.7 (112.7)	50.4 (63.2)	80.9 (70.7)	170.2 (146.0)
US regions				
Northeast	217	101	98	18
Men	64.1 (82.8)	42.4 (33.5)	68.6 (89.1)	161.3 (149.1)
Women	43.7 (45.2)	28.6 (24.6)	48.8 (44.4)	101.0 (78.0)
Midwest	1025	578	331	116
Men	64.2 (79.0)	44.8 (41.9)	66.9 (67.4)	153.0 (154.6)
Women	75.0 (117.3)	48.2 (50.4)	75.0 (70.5)	208.6 (272.2)
South	1414	200	459	755
Men	124.0 (104.7)	76.5 (92.8)	97.7 (82.9)	152.6 (110.7)
Women	133.9 (107.4)	74.0 (99.0)	96.0 (65.9)	172.8 (114.1)
West	423	144	137	142
Men	90.3 (148.8)	67.4 (203.7)	81.6 (109.9)	122.0 (104.5)
Women	81.0 (110.7)	41.8 (54.9)	67.9 (87.9)	133.3 (147.3)
Urbanicity				
Urban	1798	606	632	560
Men	110.3 (117.2)	64.2 (115.8)	102.4 (92.9)	169.1 (118.8)
Women	107.0 (100.7)	53.7 (60.1)	94.7 (69.8)	178.5 (121.6)
Rural	1281	417	393	471
Men	74.1 (85.8)	39.1 (41.1)	51.4 (55.1)	124.1 (109.5)
Women	91.8 (127.3)	45.7 (67.2)	58.9 (66.3)	160.2 (170.2)

SVI ranks counties according to 15 social factors (indicators): (1) percentage of persons with incomes below poverty threshold, (2) percentage of civilian population (age, ≥16 years) that is unemployed, (3) per capita income, (4) percentage of persons 25 years or older with no high school diploma, (5) percentage of persons 65 years or older, (6) percentage of persons 17 years or younger, (7) percentage of civilian noninstitutionalized population with a disability, (8) percentage of single-parent households with children younger than 18 years, (9) percentage of persons who are racial/ethnic minorities (ie, all persons except those who are non-Hispanic white), (10) percentage of persons 5 years or older who speak English “less than well,” (11) percentage of housing in structures with ≥10 units (multiunit housing), (12) percentage of housing structures that are mobile homes, (13) percentage households with more persons than rooms (crowding), (14) percentage of households with no vehicle available, and

(15) percentage of persons in group quarters. Estimates are created using 2014 to 2018 (5 years) data from the ACS. Social Vulnerability Index scores represent percentile rankings by county, ranging from 0 to 1, with higher scores indicating more vulnerability. Scores were categorized into tertiles (low, 0.00–0.33; medium, 0.34–0.66; high, 0.67–1.00).