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Geographic correlates of primary and secondary syphilis among men who have sex with men in the United States

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ABSTRACT

Purpose: Primary and secondary (P&S) syphilis in men who have sex with men (MSM) has been increasing; however, there is a lack of research on geographic factors associated with MSM P&S syphilis.
Methods: We used multiple data sources to examine associations between social and environmental factors and MSM P&S syphilis rates at the state- and county-level in 2014 and 2015, separately. General linear models were used for state-level analyses, and hurdle models were used for county-level models. Bivariate analyses ($P < .25$) were used to select variables for adjusted models.
Results: In 2014 and 2015 state models, a higher percentage of impoverished persons (2014 $\beta = 1.24$, 95% confidence interval, 0.28–2.20; 2015 $\beta = 1.19$; 95% confidence interval, 0.42–1.97) was significantly associated with higher MSM P&S syphilis rates. In the 2015 county model, policies related to sexual orientation (marriage, housing, hate crimes) were significant correlates of MSM P&S syphilis rates ($P < .05$).
Conclusions: Our state-level findings that poverty is associated with MSM P&S syphilis are consistent with research at the individual level across different subpopulations and various sexually transmitted diseases. Our findings also suggest that more research is needed to further evaluate potential associations between policies and sexually transmitted diseases. Geographic-level interventions to address these determinants may help curtail the rising syphilis rates and their sequelae in MSM.

Introduction

Primary and secondary (P&S) syphilis is a sexually transmitted disease (STD) that has long been recognized as a public health issue in the United States [1]. When not treated appropriately, syphilis can result in serious medical issues including neurologic and cardiovascular complications [2]. In addition, co-infection with syphilis and human immunodeficiency virus (HIV) is not uncommon in some countries and subpopulations [3]. In the United States, reported rates of P&S syphilis have increased from 2.1 per 100,000 in 2001 to 9.5 per 100,000 in 2017 with men who have sex with men (MSM) accounting for the majority of 2017 P&S syphilis cases [4]. Among 2017 P&S syphilis cases in MSM with known HIV status, 46% were HIV-positive [4].

Rather than geographic or community factors, research has largely examined individual-level factors potentially associated with recent increases in STD among MSM. One U.S. study of urban MSM identified a decrease in condom use over time [5]. However, a U.S. national probability survey also found a significant decrease in the average number of recent partners among MSM from 2002 to 2006–2010 [6]. Similarly, a review of studies from high-income countries found a decrease in the number of sex partners reported by MSM over time but also identified an increase in anal sex without a condom [7]. Other research has focused on STD/HIV and individual-level demographics and socioeconomic status. For instance, a U.S. study of urban MSM found that race and lower education levels were associated with testing positive for HIV [8]. Another study demonstrated that black and Hispanic MSM and those aged 20–29 years had the largest increases in P&S syphilis

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from 2005 to 2008 [9]. Finally, studies have also examined access and use of health care by individual-level factors. A review of research found that black and white MSM were equally likely to have ever received an HIV test; however, HIV testing did not occur as frequently in black MSM compared with white MSM [10].

However, there are limitations to an individual-level only approach to STD prevention. Social and environmental factors can also affect health [11]. Research has examined geography and has found that P&S syphilis is more geographically concentrated (i.e., isolated to fewer geographic areas) than bacterial STDs such as chlamydia and gonorrhea [12,13]. In addition, research has suggested that areas with clustering, or a concentration, of STDs may be one way to define core groups, those who are associated with a heightened amount of disease transmission [14]. Therefore, a focus on geographic factors that may be associated with P&S syphilis among MSM may be useful in targeting interventions designed to halt or decrease the rising syphilis rates.

Previous research has examined social factors associated with health and syphilis. A national U.S. study of syphilis from 1941 to 1993 found that violent crime was associated with P&S syphilis in the South [15]. Research has also examined geographic factors, including demographics, socioeconomic status and polices, and STDs among different populations [16–18]. A few studies have examined HIV and geographic factors and have found that geographic measures may provide insight into pre-exposure prophylaxis [19]. Research has also found state-level racial disparities in HIV and syphilis [20]; yet, a review found that individual-level factors could not explain racial disparities in HIV among MSM [10].

Much of this research has not examined associations between geographic level factors and syphilis among MSM. Geographic influences on syphilis may include social and environmental factors that have been repeatedly associated with STD. Given the increasing P&S syphilis rates in the U.S. among MSM [4], it is important to examine social and environmental factors associated with health as potential geographic correlates of P&S syphilis in MSM. Research has also indicated that different geographic levels may have a varied relationship with STD and may be used differently for targeting purposes [21]. Thus, we examined geographic factors and their association with state- and county-level rates of P&S syphilis (prevalence of a new infection) among MSM in 2014 and 2015 to inform the development of interventions to prevent P&S syphilis that function not just at the individual level.

Materials and methods

Data and measures

Our analysis of correlates of MSM P&S syphilis in 2014 and 2015 focused on two different geographic levels: state and county (for a total of four outcome measures). We examined two different geographic levels because policies may be enacted at various geographic levels. Also, the geographic distribution of syphilis has changed over time [22]. Thus, we conducted analyses for 2 years, separately, to see if correlates changed while MSM P&S syphilis was increasing. For the state-level examination, data from all 50 states and the District of Columbia were included (n = 51; hereafter referred to as states). For the county-level examination, data from counties in the 30 largest metropolitan statistical areas (MSA) as defined by the U.S. Census in 2012 were included (Supplemental Material) [23]. Counties from the 30 largest MSAs were selected, given that some of our key correlates were only available for these counties. In 2012, there were 275 counties or county-equivalent areas included in the 30 largest MSAs.

Our four outcome measures—state- and county-level MSM P&S syphilis rates per 100,000 population in 2014 and 2015—were calculated using Centers for Disease Control and Prevention surveillance data and U.S. Census data (MSM population estimates) [24]. P&S syphilis is a notifiable condition in all states, and cases are reported to Centers for Disease Control and Prevention through an electronic surveillance system, the National Notifiable Diseases Surveillance System [4]. Reported P&S syphilis cases are assigned to their county and state of residence not the diagnosing facility or health department. To optimize stability of the estimates of P&S syphilis rates, we limited our analyses to states that included sex of sex partner for at least 70% of male P&S syphilis case reports. The 70% threshold represented the best balance between including male cases of P&S syphilis while gathering the most complete epidemiologic data for those cases [24].

We used data from several different sources and included several social and environmental measures as correlates of P&S syphilis (at the state and county levels). First, we included 2014 drug overdose death data (rate per 100,000), as a proxy measure of drug abuse, from the National Vital Statistics System [25]. We also included the percentage of nonelderly population living below the poverty level (in 2014: $12,071 for family of one; $24,230 for family of four) [26], percentage of nonelderly population that is uninsured, and the percentage of population that was MSM from the American Community Survey: state data were from 2014, and county data were from 2010 to 2014 or 2011 to 2015 [27].

Finally, we included lesbian, gay, bisexual (LGB) policy data collected as of 2013 (policies could have been enacted at any time prior). We limited policies to LGB, given that our outcomes focus on MSM (documentation/data available: http://www.phmcresearch.org/about/projects/199-examination-of-state-and-local-laws-relevant-to-lgbt-populations) [28]. LGB policy measures included same-sex marriage recognition (prohibited or not addressed; recognized); employment protections, either for public or private employers or both (no protections for sexual orientation; some protections for sexual orientation); hate crime policy (includes or excludes sexual orientation); and housing protections (no protections for sexual orientation; some protections for sexual orientation). Policy data were collected before two U.S. Supreme Court decisions that first ruled that same-sex marriages could not be treated differently than heterosexual marriages at the federal level and then legalized same-sex marriage across the country. For this analysis, our focus was on social or environmental context. Thus, we selected policy variables that best represented the local context; therefore, state-level laws before the Supreme Court rulings were included, as they are likely a better measure of local context than a federal court ruling. We used a two-step process for applying legal variables to counties. First, if a state had a relevant law, then all counties in that state were coded per the state law. This was done because the state law applies to all residents of the state, even if a county has a contradictory law, as state laws preempt county laws (i.e., a higher authority of law displaces a lower authority of law). Second, if a state did not have a relevant law, counties were coded per their county law only (or lack thereof).

Statistical analyses

Analyses consisted of bivariate and multivariable models for the four outcomes. Natural log transformations were conducted on all variables except the policy variables before analysis. For state-level bivariate analyses, analysis of variance was used for the policy variables, and general liner modeling (GLM) was used for the remaining correlates. Variables $P < .25$ in bivariate analyses were included in the corresponding multivariable model using GLM. For county-level analyses, given the large number of counties that did not have any MSM syphilis (0 cells), GLM could not be used. Thus, bivariate and multivariable hurdle models were conducted where logistic regression models examined the odds of a county having any MSM P&S syphilis. Next, for counties with any cases of MSM P&S syphilis, negative binomial models were used to examine MSM P&S syphilis rate ratios. This allowed an examination of correlates of higher rates of MSM P&S syphilis. All analyses were conducted in SAS 9.3 (Cary, NC), R 3.4.1 (Vienna, Austria), and RStudio 1.0.153 (Boston, MA). Models were adjusted for the percentage of the population that was black, Hispanic, and aged 15–24 years, as these demographic factors have been consistently associated with STD. Variance inflation factors were calculated for all variables and, in all models, collinearity was not an issue.

Results

State-level correlates

The number of states where 70% or more of sex of sex partner data for P&S syphilis cases was reported was 40 in 2014 and 44 in 2015. These states represented 87.6% and 83.4% of the total reported P&S syphilis cases in 2014 and 2015, respectively.

Bivariate analyses

Significant geographic correlates of 2014 P&S syphilis rates among MSM included percent living below poverty ($P = .004$) and percent of nonelderly population uninsured ($P = .030$) (Table 1). For these correlates, an increase in the percentages was associated with an increase in 2014 MSM syphilis rates. Additional correlates meeting the inclusion criteria ($P < .25$) for the 2014 model were same-sex marriage policies ($P = .188$) and MSM population ($P = .081$). Also, in bivariate analyses, significant geographic correlates of 2015 P&S syphilis rates among MSM included percent living below poverty ($P < .001$), percent of nonelderly population uninsured ($P = .046$), and employment protections for sexual orientation ($P = .039$) (Table 2). States that had no public or private employment protections for sexual orientation had significantly higher rates of P&S syphilis in MSM in 2015. Other variables meeting the inclusion criteria for the 2015 model were same-sex marriage recognition ($P = .054$), and hate crime policy includes sexual orientation ($P = .171$).

Adjusted analyses

For the 2014 model, a higher percentage of those living in poverty (β = 1.24, 95% confidence interval, 0.28–2.20) was significantly associated with higher rates of MSM P&S syphilis in 2014 (Table 1). The 2015 model also identified higher percentages for persons living in poverty (β = 1.19, 95% confidence interval, 0.42–1.97) as significantly associated with higher MSM P&S syphilis rates (Table 2).

County-level correlates

The number of counties from the 30 MSAs that had data for all variables and where 70% or more of sex of sex partner data for P&S syphilis cases was reported was 197 in 2014 and 190 in 2015. These counties represented 38.9% and 38.8% of the total reported P&S syphilis cases in 2014 and 2015, respectively.

Hurdle model, 2014

First, an adjusted logistic regression model found that counties with a higher percentage of nonelderly population in poverty (adjusted odds ratio = 0.13, $P = .010$) were less likely to have any MSM P&S syphilis (Table 3). The final model (negative binomial model) examined correlates of a higher level of MSM P&S syphilis in 2014 (our outcome of interest) among counties who had any MSM P&S syphilis. In adjusted analyses, no variables were significantly associated with county-level MSM P&S syphilis in 2014.

Hurdle model, 2015

Findings from the hurdle model for MSM P&S syphilis in 2015 identified additional correlates of MSM syphilis at the county-level (Table 4). First, the logistic model for 2015 found that the percentage of MSM (adjusted odds ratio, 0.16; $P < .001$) was associated with whether a county had any MSM P&S syphilis. The negative binomial model examined correlates of higher rates of MSM P&S syphilis in 2015 (our outcome of interest) among counties who had any MSM P&S syphilis. In adjusted analyses, a few correlates were significant. Counties who had policies that recognized same-sex marriage (expected change in counts based on a unit of change in the predictor, exp(B) = 1.74, $P = .008$) and had housing protections

Table 1
Bivariate and adjusted analyses: state-level correlates of MSM P&S Syphilis, 2014 (n = 40)

State-level correlates (y)	Bivariate analyses			Adjusted analyses		
	Mean	SD	*P*	β	95% CI	*P*
Same-sex marriage recognition (2013)			.188			
Recognition not addressed or prohibited	260.2	141.5		Referent		
Marriage recognized	162.5	92.7		0.05	−0.49, 0.60	.841
Employment protections, public or private (2013)			.345	—	—	—
None for sexual orientation	270.4	164.9		—	—	—
Some for sexual orientation	228.3	105.1		—	—	—
Hate crime policy (2013)			.613	—	—	—
Sexual orientation not included	257.0	159.2		—	—	—
Sexual orientation included	230.7	48.0		—	—	—
Housing protections for sexual orientation (2013)			.969	—	—	—
No housing protections for sexual orientation	251.1	159.7		—	—	—
Some housing protections for sexual orientation	249.3	102.8		—	—	—
	β	SE	*P*			
Percent living below poverty level (2014)[*,†]	1.49	0.49	.004	1.24	0.28, 2.20	.013
Percent of population uninsured (2014)[*,†]	0.75	0.33	.030	−0.29	−0.97, 0.39	.388
Percent MSM population (2014)[†]	0.52	0.29	.081	−0.08	−0.63, 0.46	.756
Drug overdose death rate per 100,000 (2014)[†]	0.27	0.30	.388	—	—	—
R^2	—			0.64		

Means tests and general linear models were used. Models were adjusted for percentage Hispanic, black, and aged 15–24 y.
β = standardized beta; SE = standard error; — = did not meet inclusion criteria for adjusted models ($P < .25$).
[*] Estimates are for the nonelderly population from the American Community Survey.
[†] Natural log.

Table 2
Bivariate and adjusted analyses: state-level correlates of MSM P&S Syphilis, 2015 (n = 44)

State-level correlates (y)	Bivariate analyses			Adjusted analyses		
	Mean	SD	*P*	β	95% CI	*P*
Same-sex marriage recognition (2013)			.054			
Recognition not addressed or prohibited	306.3	145.2		Referent		
Marriage recognized	173.9	89.7		−0.05	−.052, 0.43	.840
Employment protections, public or private (2013)			.039			
None for sexual orientation	334.2	168.7		Referent		
Some for sexual orientation	244.2	99.2		0.13	−0.22, 0.48	.458
Hate crime policy (2013)			.171			
Sexual orientation not included	305.5	153.5		Referent		
Sexual orientation included	227.2	81.2		0.07	−0.27, 0.42	.665
Housing protections for sexual orientation (2013)			.311	—	—	—
No housing protections for sexual orientation	309.1	167.3		—	—	—
Some housing protections for sexual orientation	262.9	100.6		—	—	—
	β	SE	*P*			
Percent living below poverty level (2014)[*,†]	1.22	0.31	<.001	1.19	0.42, 1.97	.004
Percent of population uninsured (2014)[*,†]	0.42	0.21	.046	−0.24	−0.74, 0.25	.328
Percent MSM population (2014)[†]	0.04	0.21	.839	—	—	—
Drug overdose death rate per 100,000 (2014)[†]	−0.14	0.22	.541	—	—	—
R^2				0.49		

Means tests and general linear models were used. Models were adjusted for percentage Hispanic, black, and aged 15–24 years.
β = standardized beta; SE = standard error; — = did not meet inclusion criteria for adjusted models (*P* < .25).
* Estimates are for the nonelderly population from the American Community Survey.
† Natural log.

by sexual orientation (exp(B) = 1.43, *P* = .010) had higher levels of MSM P&S syphilis. Counties with hate crime policies that included sexual orientation had lower rates of MSM P&S syphilis (exp(B) = 0.67, *P* = .007).

Discussion

Among state-level geographic factors, we found that higher percentages of persons living below the poverty level were associated with MSM P&S syphilis rates in 2014 and 2015. However, at the county-level, the percentage of persons living in poverty was not significantly associated with MSM P&S syphilis in multivariable analyses. This result may be partly a function of the large number of counties with no MSM P&S syphilis. Our state-level findings generally support previous findings at the geographic or individual level for various subpopulations. At the individual level, low income was significantly associated with HIV among urban Latino MSM [29]. In addition, a longitudinal U.S. survey of adolescents and young adults found that lower family income was associated with an STD diagnosis [30]. At the geographic level, in the 1990s, states with higher levels of P&S syphilis overall tended to have higher levels of poverty [31]. A more recent study found that counties with higher percentages of persons living below the poverty level had higher chlamydia and gonorrhea rates [32].

We identified three other correlates of MSM P&S syphilis at the county level. Counties that had policies that recognized same-sex marriage and had housing policies that included protections by sexual orientation tended to have higher rates of P&S syphilis. Conversely, counties whose states had hate crime policies that included sexual orientation tended to have lower rates of MSM P&S syphilis. However, these correlates were only identified in one county-level model (2015) that included only the largest MSAs and accounted for fewer than 40% of syphilis cases. Our study does not provide insight into our somewhat contradictory findings for the policy variables, and the relationship between social policy and STDs may be complex. More MSM may migrate to places with

Table 3
Hurdle model: county-level correlates of MSM P&S Syphilis, 2014

Variable	Logistic model (odds of any MSM syphilis) n = 197				Negative binomial model (MSM syphilis rate ratios) n = 106					
	Bivariate		Adjusted		Bivariate			Adjusted		
	OR	*P*	aOR	*P*	β	Exp(B)	*P*	β	Exp(B)	*P*
Same-sex marriage recognized (2013)	6.34	.021	4.14	.118	0.18	1.19	.403	—	—	—
Has employment protections (2013)[‡]	0.31	.001	0.40	.192	−0.13	0.88	.405	—	—	—
Hate crime policy includes sexual orientation (2013)	0.33	.004	0.66	.378	−0.16	0.85	.357	—	—	—
Has housing protections (2013)[‡]	0.19	<.001	0.51	.380	0.05	1.05	.776	—	—	—
Percent nonelderly population in poverty (2010–2014)[*,†]	0.30	.006	0.13	.010	0.69	1.99	<.001	0.22	1.25	.345
Percent nonelderly population uninsured (2010–2014)[*,†]	0.45	.080	1.19	.858	0.71	2.04	<.001	−0.01	1.00	.995
Percent MSM population (2010–2014)[†]	0.11	<.001	1.11	.101	0.05	1.05	.650	—	—	—
Drug overdose death rate per 100,000 (2014)[†]	1.09	.539	—	—	0.12	1.13	.319	—	—	—

Models were adjusted for percentage Hispanic, black, and aged 15–24 y.
For the hurdle model, first logistic regression was used to predict the odds of any MSM P&S syphilis in a county.
Next, a negative binomial model was used to predict higher MSM P&S syphilis among counties with any MSM P&S syphilis.
β = standardized beta; aOR = adjusted odds ratio; Exp(B) = expected change in counts based on a unit of change in the predictor; OR = odds ratio; — = did not meet inclusion criteria for adjusted models (*P* < .25).
* Estimates are for the nonelderly population from the American Community Survey.
† Natural log.
‡ Related to sexual orientation.

Table 4
Hurdle model: county-level correlates of MSM P&S Syphilis, 2015

Variable	Logistic model (odds of any MSM syphilis) n = 190				Negative binomial model (MSM syphilis rate ratios) n = 104					
	Bivariate		Adjusted		Bivariate			Adjusted		
	OR	*P*	aOR	*P*	β	Exp(B)	*P*	β	Exp(B)	*P*
Same-sex marriage recognized (2013)	2.26	.260	—	—	0.46	1.58	.013	0.56	1.74	.008
Has employment protections (2013)‡	0.17	<.001	1.14	.843	0.14	1.15	.295	—	—	—
Hate crime policy includes sexual orientation (2013)	0.18	<.001	0.52	.156	−0.19	0.83	.196	−0.40	0.67	.007
Has housing protections (2013)‡	0.09	<.001	0.34	.136	0.30	1.35	.021	0.35	1.43	.010
Percent nonelderly population in poverty (2011−2015)*,†	0.79	.591	—	—	0.32	1.38	.026	0.31	1.36	.066
Percent nonelderly population uninsured (2011−2015)*,†	0.90	.821	—	—	0.01	1.01	.974	—	—	—
Percent MSM population (2011−2015)†	0.09	<.001	0.16	<.001	−0.10	0.91	.367	—	—	—
Drug overdose death rate per 100,000 (2014)†	1.16	.320	—	—	0.17	1.19	.131	0.19	1.22	.114

Models were adjusted for percentage Hispanic, black, and aged 15−24 y.
For the hurdle model, first, logistic regression was used to predict the odds of any MSM P&S syphilis in a county.
Next, a negative binomial model was used to predict higher MSM P&S syphilis among counties with any MSM P&S syphilis.
β = standardized beta; aOR = adjusted odds ratio; Exp(B) = expected change in counts based on a unit of change in the predictor; OR = odds ratio; — = did not meet inclusion criteria for adjusted models ($P < .25$).
* Estimates are for the nonelderly population from the American Community Survey.
† Natural log.
‡ Related to sexual orientation.

supportive social contexts, including places that were early to recognize same-sex marriage. Such places may also have better access to STD services (e.g., for regular STD testing), they may increase disclosure of sexual orientation during health care visits, and they may have enhanced services provided by health departments (e.g., contact tracing). Yet, migration can also lead to loneliness and self-esteem issues that can result in sexual risk taking in an effort to fit into the new community [33]. In addition, more MSM in an area and more opportunities for sex partners may result in a sexual network that can facilitate transmission of STDs.

Although our finding for poverty was consistent at the state-level across 2014 and 2015, none of our findings were the same for different geographic levels. Future research may want to examine trends over time and further examine differences at various geographic levels to identify the best level for similar research. The best geographic level for analysis may vary for different types of correlates (e.g., different policies are enacted at various geographic levels). The ideal level to deliver a given intervention may also help to determine the best geographic level for STD disparities research. Also, our county-level finding for same-sex marriage recognition at one point in time is in contrast to previous research in the United States and Europe that examined trends over time and found lower levels of syphilis in areas that recognized same-sex marriage or civil unions [17,34]. In addition, a study that examined P&S syphilis among women and men from 1985 to 2007 indicated that even when rates were nearly identical over time, there can be changes in how syphilis is geographically distributed [22]. Specifically, although U.S. syphilis rates for men were nearly identical in 1995 (6.7 per 100,000) and 2007 (6.6 per 100,000), syphilis became more concentrated over time, that is, the number of geographic areas where men had syphilis declined over time [22]. Furthermore, the degree to which different subpopulations may be impacted by syphilis may depend on the phase of the epidemic. One study found disparities in syphilis between demographic groups during an epidemic; however, the disparities lessened outside of an epidemic [35]. Thus, it is possible that the factors associated with MSM P&S syphilis may change over time.

Limitations

Our study is an ecological analysis, which is correlational and not causal. Thus, we cannot state that any of our correlates cause higher rates of P&S syphilis among MSM. Also, our analyses focused on the geographic level rather than the individual level. Thus, the findings may not apply to all individuals in this subpopulation. Although we included geographic correlates from similar periods, some of the correlates may have existed for years where others may have been initiated or changed more recently. Future research could examine the timing of various geographic correlates in relation to disease morbidity. Our sample size for the state-level analysis is relatively small. As we focused only on counties in large MSAs, our county-level findings may not be representative of all U.S. counties. We did not have a measure of availability of STD services. In some areas, MSM may have to travel for testing and treatment. Our study was not able to include a measure of use of social networking sites and traveling for sex. If a high proportion of MSM travel across county or state lines to have sex, this may impact our findings.

Conclusion

P&S syphilis has continued to increase among MSM in the United States, and syphilis can result in severe complications. Our findings identified poverty as a consistent state-level correlate of syphilis across different years. This finding is consistent with research focusing on various STDs at the individual level across different subpopulations; thus, interventions to address poverty may help to curtail the rising syphilis rates and their sequelae in MSM. However, we also found that LGB policies, specifically policies focusing on marriage, housing, and hate crimes, were associated with county-level MSM syphilis in 1 year only. Some of the policy findings were somewhat contradictory. Qualitative research may be able to better examine the intricacies of how social context, including social policies, play a role in STD acquisition. Research is also needed to confirm our findings and further evaluate the best level for geographic analyses of STDs and STD disparities.

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Appendix

Supplemental Material

List of 30 most populous metropolitan statistical areas (MSAs) in 2012

MSAs included in the county-level analyses
1. New York-Newark-Jersey City, NY-NJ-PA
2. Los Angeles-Long Beach-Anaheim, CA
3. Chicago-Naperville-Elgin, IL-IN-WI
4. Dallas-Fort Worth-Arlington, TX
5. Houston-The Woodlands-Sugar Land, TX
6. Philadelphia-Camden-Wilmington, PA
7. Washington-Arlington-Alexandria, DC-VA-MD-WV
8. Miami-Fort Lauderdale-West Palm Beach, FL
9. Atlanta-Sandy Springs-Roswell, GA
10. Boston-Cambridge-Newton, MA-NH
11. San Francisco-Oakland-Fremont, CA
12. Riverside-San Bernardino-Ontario, CA
13. Phoenix-Mesa-Scottsdale, AZ
14. Detroit-Warren-Dearborn, MI
15. Seattle-Tacoma-Bellevue, WA
16. Minneapolis-St. Paul-Bloomington, MN-WI
17. San Diego-Carlsbad, CA
18. Tampa-St. Petersburg-Clearwater, FL
19. St. Louis, MO-IL
20. Baltimore-Columbia-Towson, MD
21. Denver-Aurora-Lakewood, CO
22. Pittsburgh, PA
23. Charlotte-Concord-Gastonia, NC-SC
24. Portland-Vancouver-Hillsboro, OR-WA
25. San Antonio-New Braunfels, TX
26. Orlando-Kissimmee-Sanford, FL
27. Sacramento-Roseville-Arden-Arcade, CA
28. Cincinnati, OH-KY-IN
29. Cleveland-Elyria, OH
30. Kansas City, MO-KS