

Background

Neisseria gonorrhoea is the second most prevalent sexually transmitted infection (STI) in the US with increasing incidence. Untreated, it leads to devastating sequelae for nonpregnant women, pregnant women, and their neonates.

Geographic clustering of gonorrhea coincides with clustering of other risk factors and may help guide interventions. We utilize Geographic Information Systems (GIS) software to map gonorrhea incidence among women in Chicago, and examine factors associated with the spatial distribution of infection.

Methods

Chicago Department of Public Health data sets and shape files were available through the Chicago Data Portal. ArcGIS was utilized for map illustrating and data analysis.

Ordinary Least Squares (OLS) Regression was utilized using the dependent variable of Gonorrhea incidence in women per Chicago Community Area (CCA), with various explanatory variables.

Within the OLS, the Koenker Statistic (KS) was reported and from this a Geographically Weighted Regression (GWR) tool was run for combinations with statistically significant KS.

Maps

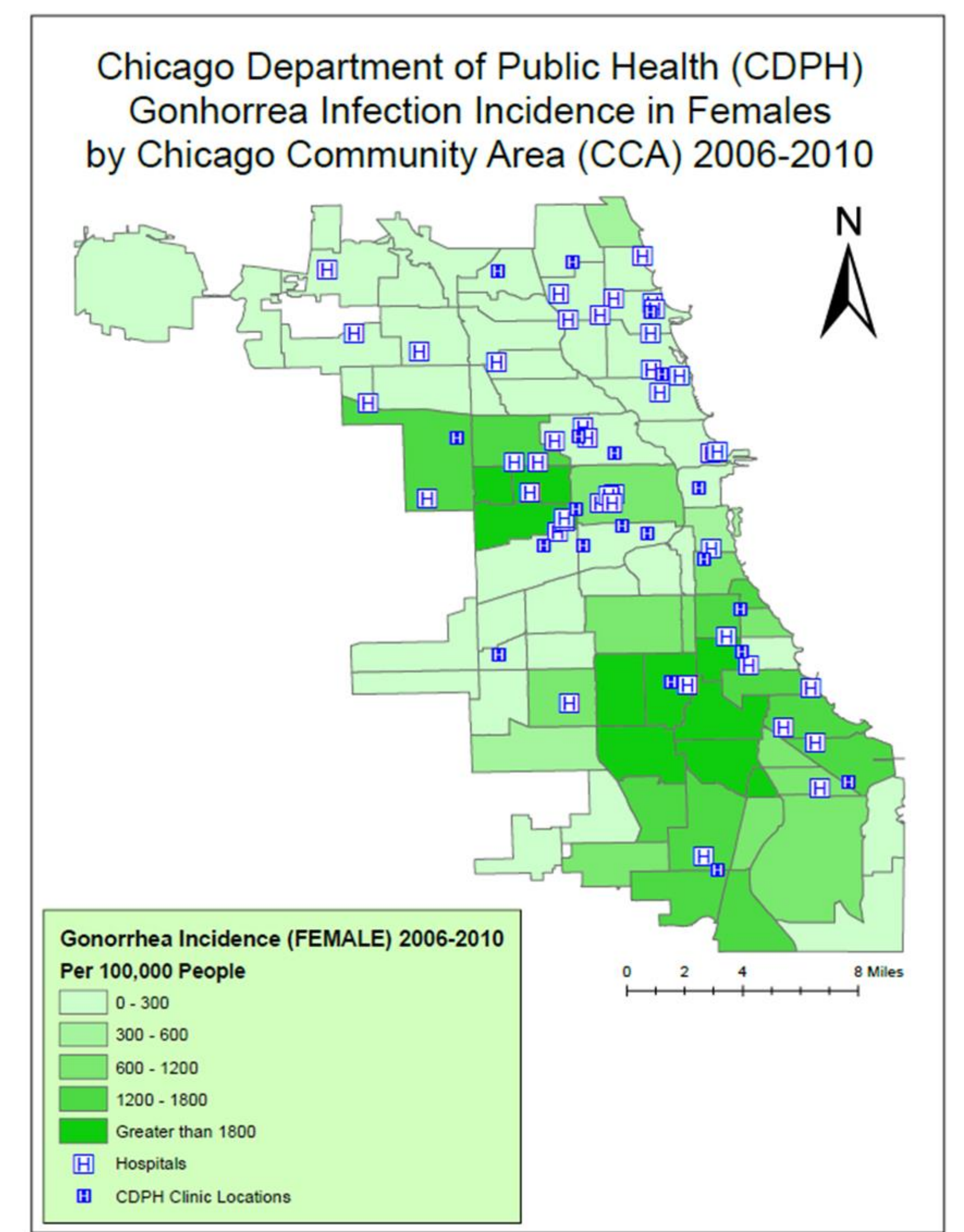


Figure 1: Gonorrhea Incidence among females

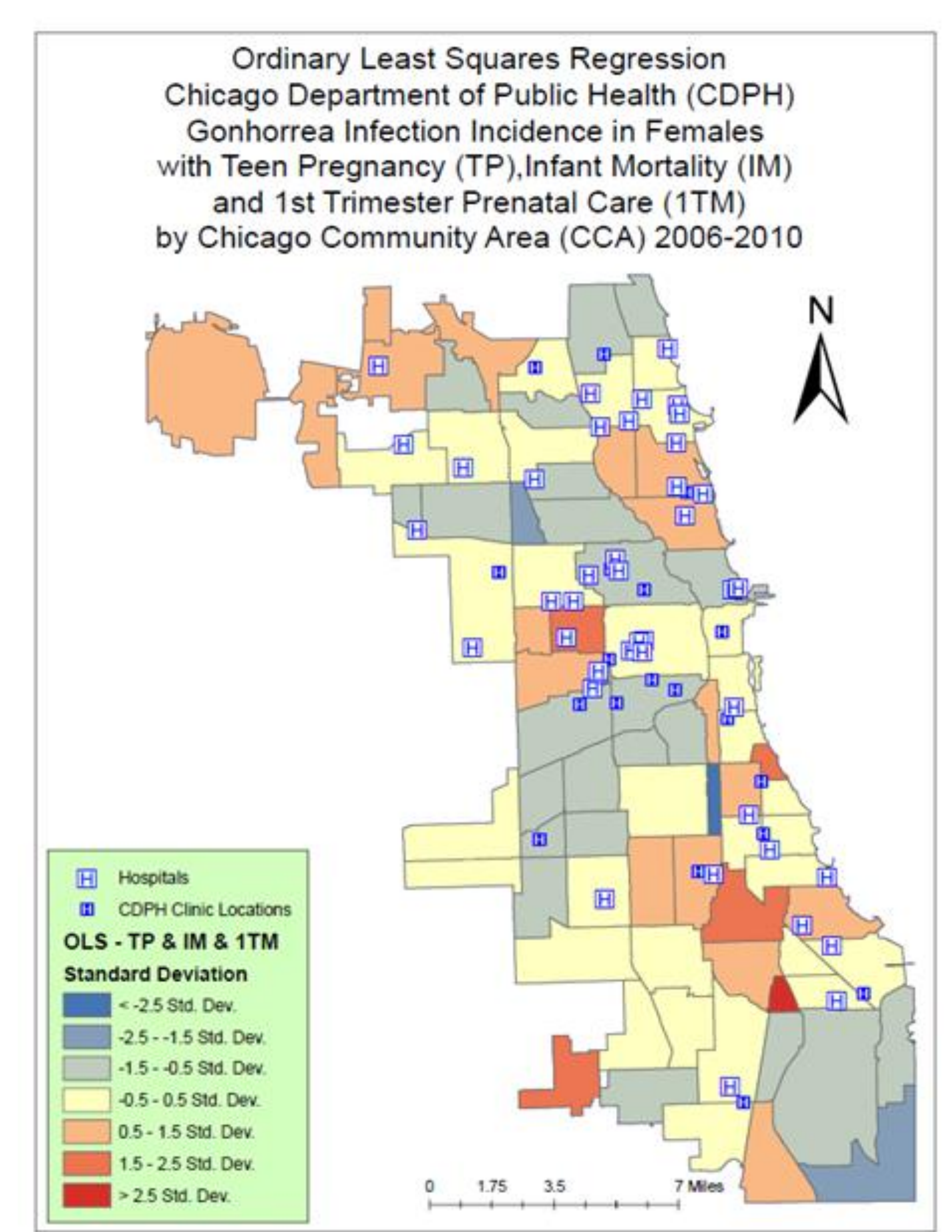


Figure 2: Ordinary Least Squares Regression Map

Ordinary Least Squares Table

Ordinary Least Squares Table									
Grouping	Variable	Coefficient	Probability	R. Prob	VIF	Adj. R ²	AICc	KS (p-value)	JBS (p-value)
	Chlamydia	0.353	<0.001*	<0.001*		0.916	1076.73	<0.001*	<0.001*
Natality	TP	26.6	<0.001*	<0.001*	2.12				
	Preterm	132.99	0.026*	0.06	3.75				
	LBW	119.83	0.016*	0.09	4.31				
	PNC 1T	-31	0.17	0.31	1.65				
	IM	202.55	<0.001*	<0.001*	2.27				
Poverty & Chlamydia	Poverty	52.52	<0.001*	<0.001*		0.46	1220.15	<0.001*	0.004*
	Chlamydia	-0.5	0.89	0.94	2.06	0.92	1078.94	<0.001*	<0.001*
ALL	TP	0.81	0.76	0.76	7.61	0.78	1157.04	0.006*	<0.001*
	Preterm	32.19	0.03*	0.009*	3.82				
	Fertility	-4.97	0.12	0.051	2.88				
	LBW	-44.59	0.06*	0.04*	5.11				
	PNC 1T	-9.43	0.19	0.09	1.87				
	IM	-32.24	0.008*	0.11	3.69				
	Poverty	0.49	0.9	0.93	2.57				
	Chlamydia	0.41	<0.001*	<0.001*	9.94				
Teen Pregnancy & Infant Mortality	TP	13.92	<0.001*	<0.001*	1.64	0.71	1174.17	0.039*	0.06
	IM	99.14	<0.001*	<0.001*	1.64				
Teen Pregnancy, Infant mortality, & Prenatal Care in 1st Trimester	TP	11.2	<0.001*	<0.001*	1.99	0.725	1170.36	0.56	0.12
	IM	92.9	<0.001*	<0.001*	1.69				
	PNC 1T	-30.86	0.016*	0.042*	1.54				

Table 1. R.Prob = Robust Probability, Adj. R² = adjusted R-squared, VIF = variance inflation factor, AICc = Akaike's Information Criterion, KS = Koenker (BP) Statistic, JBS = Jacque-Bera Statistic, TP = Teen Pregnancy incidence, Preterm = percent of live births that were preterm, Fertility = general fertility rate, LBW = fetal low birth percentage, PNC 1T = prenatal care in the 1st Trimester, IM = infant mortality, Poverty = below poverty level. * = statistically significant.

Results

- The highest incidence of Gonorrhea is shown in the southern and western CCA's, with hospitals & clinics clustered in the northern and southeastern, with gaps primarily noted in the southern and northwestern CCA's. (Figure 1)
- Teen pregnancy incidence, infant mortality rate, and first trimester prenatal care (PNC 1T), had statistical significance of the robust probability for all of their explanatory variables, and variance inflation factor (VIF) less than 2 for all explanatory variables, Jacque-Bera Statistic (JBS) were not statistically significant, and Akaike's Information Criterion (AICc) were approximately 1170 demonstrating stable Ordinary Least Squares (OLS.) (Table 1, Figure 2)

Results (continued)

- Teen pregnancy incidence (TP) & infant mortality rate (IM) did have a statistically significant Koenker Statistic and Geographic weighted regression was run demonstrating random spatial pattern.
- This confirms TP & IM as predictors for gonorrhea incidence had variable predictability throughout the CCA's and GWR improves the model outcome.
- Both combinations of TP/IM/PNC1T & TP/IM spatially explain gonorrhea incidence.

Conclusion

- Teen pregnancy rates, infant mortality rates, and prenatal care in the first trimester explain some of the spatial patterns of gonorrhea incidence of females in Chicago.
- Identification of these factors identified should prompt providers to ensure enhanced testing of gonorrhea and other STI's to reduce burden in areas of high incidence.
- Further expansion of sexual wellness clinics may focus in southern and western Chicago CCA's which report higher *Gonorrhea* incidence with more widely distributed facilities.

References

- Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance, 2018. Atlanta, GA: US Department of Health and Human Services; 2019.
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