Geographic Factors Associated with Treatment Participation and Viral Suppression

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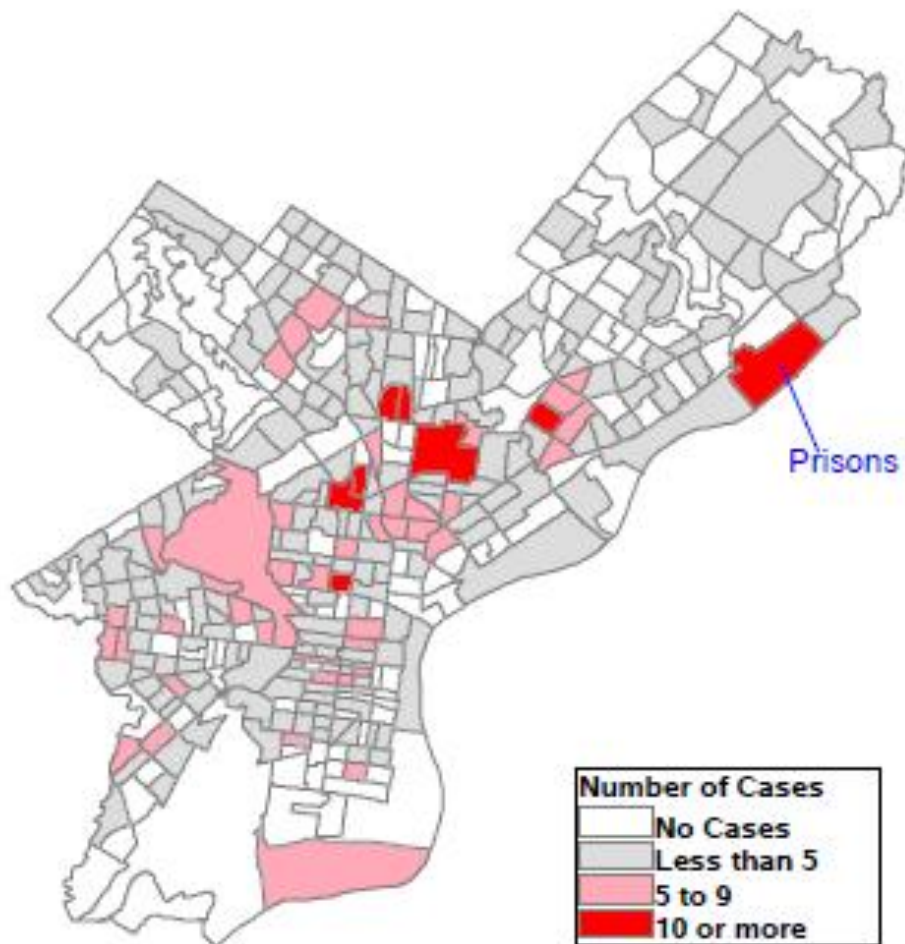
Penn-AACO ECHPP Supplement

- Basic and advanced Geographic Information System (GIS) Training to staff of the AIDS Activities Coordinating Office

- Established ongoing collaboration on GIS in HIV between Penn CFAR and AACO

- Established a permanent Core service to provide GIS support to HIV investigators

People Living With HIV/AIDS in Philadelphia: 2012

Prisons

Number of Cases
- Less than 5
- 5 to 14
- 15 to 34
- 35 or more
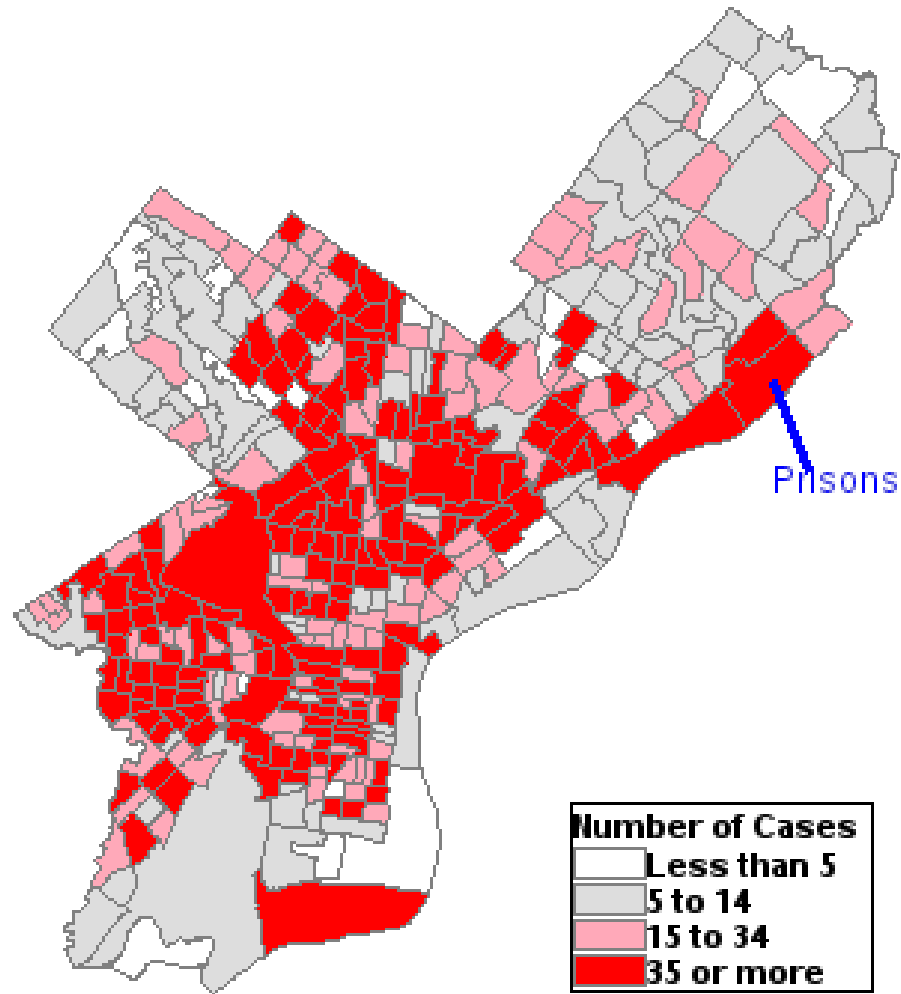
Newly diagnosed HIV cases in Philadelphia: 2012

Prisons

Number of Cases
- No Cases
- Less than 5
- 5 to 9
- 10 or more

Behind the Cascade: Analyzing Spatial Patterns Along the HIV Care Continuum

Using GIS analytic strategies, we sought to identify geographic areas associated with:

- *not* linking to care

- *not* linking to care within 90 days

- *not* retaining in care

- *not* achieving viral suppression after HIV diagnosis

Methods

- Retrospective cohort
- Data extracted from eHARS
- Inclusion/Exclusion criteria:
  - New HIV diagnosis in 2008 and 2009
  - Philadelphia address at the time of diagnosis
  - Persons with an invalid address or with a prison address at the time of their diagnosis were excluded

Outcomes

- Linkage to Care – Defined as documentation of ≥ 1 CD4 or viral load test results after the diagnosis
- Linkage to Care in 90 days – Defined as documentation of ≥ 1 CD4 or viral load test results within 90 days of HIV diagnosis
- Retention in Care – Defined by NQF Medical Visit Frequency Measure. completing at least 1 medical visit with a provider with prescribing privileges in each 6-month interval of the 24-month measurement period, with a minimum of 60 days between medical visits.
  - Date of first linkage defined the start of the 24 month measurement period.
  - We used CD4 and/or viral load as a proxy for HIV medical care visits
- Viral Suppression – Defined as evidence of HIV-1 RNA <200 copies closest to the end of the 24 month measurement period

Variables of Interest

○ Age, sex at birth, race/ethnicity, HIV transmission risk, insurance status at the time of diagnosis, imprisonment, multiple care providers, distance to nearest care site

○ Spatial Analyses - K function
  - Analyze a spatial point process
  - Multiple distance scales
    ○ e.g. clustered at small distances yet dispersed at large distances
  - Complete spatial randomness (CSR)
  - Utilizes all points in a given area
  - Compare to multiple simulated random processes

Dot Density Map of New HIV Diagnoses,
Philadelphia, PA 2008-2009
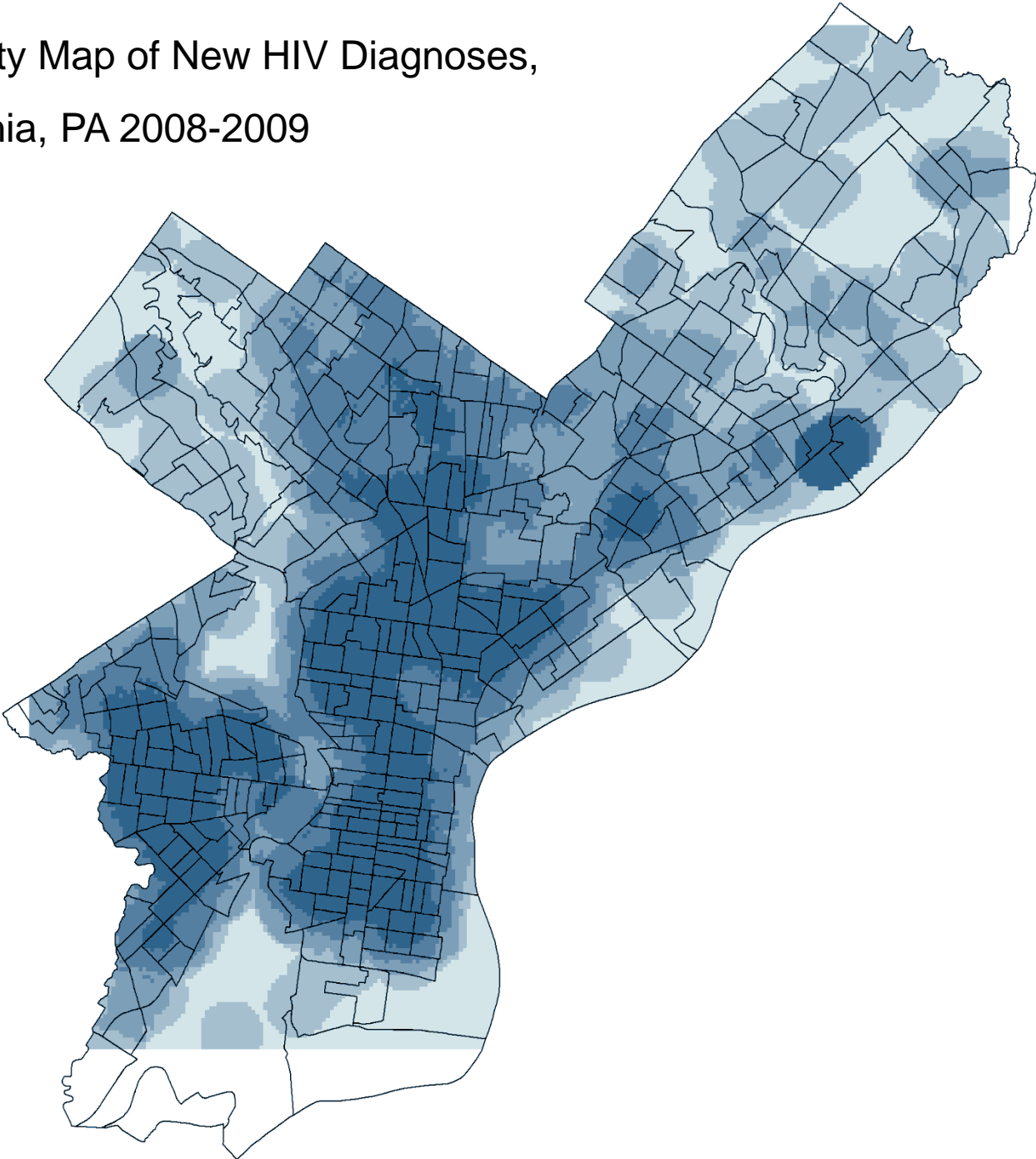
Cross-K functions

- Analyze marked spatial point process
  - 2 patterns within 1 population
- Multiple distance scales
  - e.g. clustered at small distances yet dispersed at large distances
- Spatial Indistinquishability Hypothesis
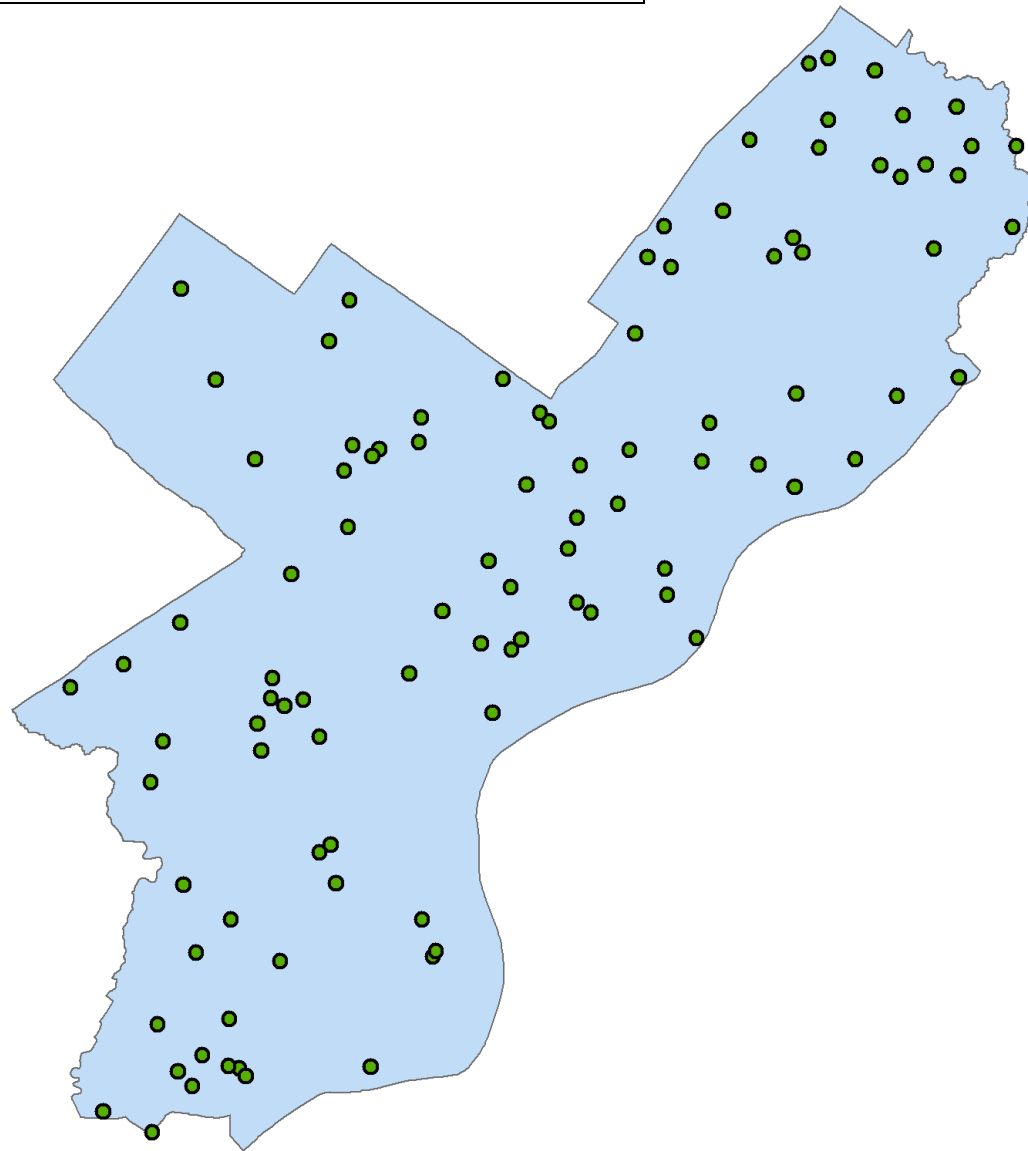- Compares distribution of pop 1 to that of pop1+pop2

Radial Distances

○ Determined by research

○ Avg nearest neighbor

○ Direct observation

○ Some combination

- Avg of 5 nn distances for each cases
  ○ Mean = 990 (1000)
  ○ Max nn dist for 99% cases 5000 ft
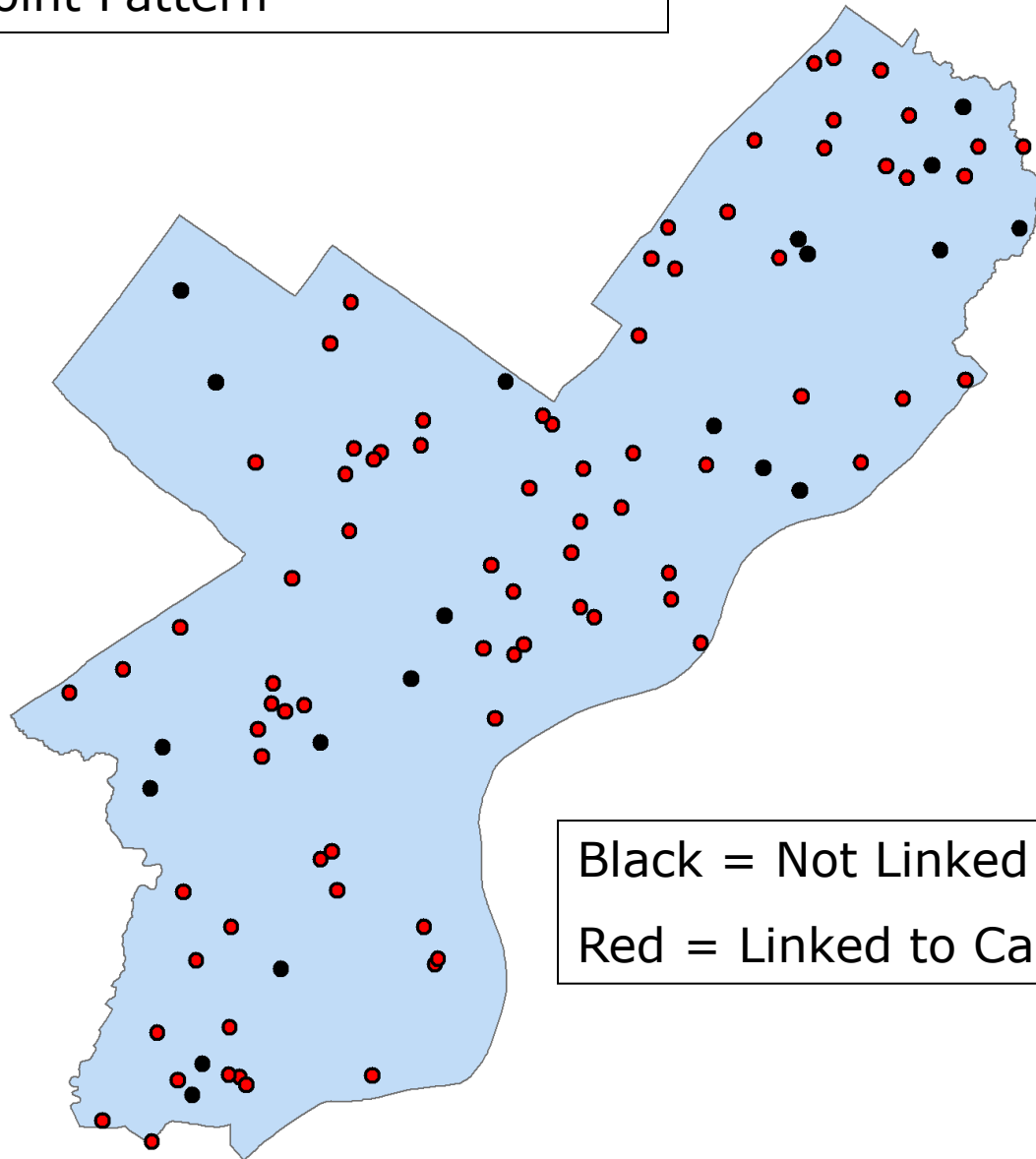 ○ 2500 for 3rd distance
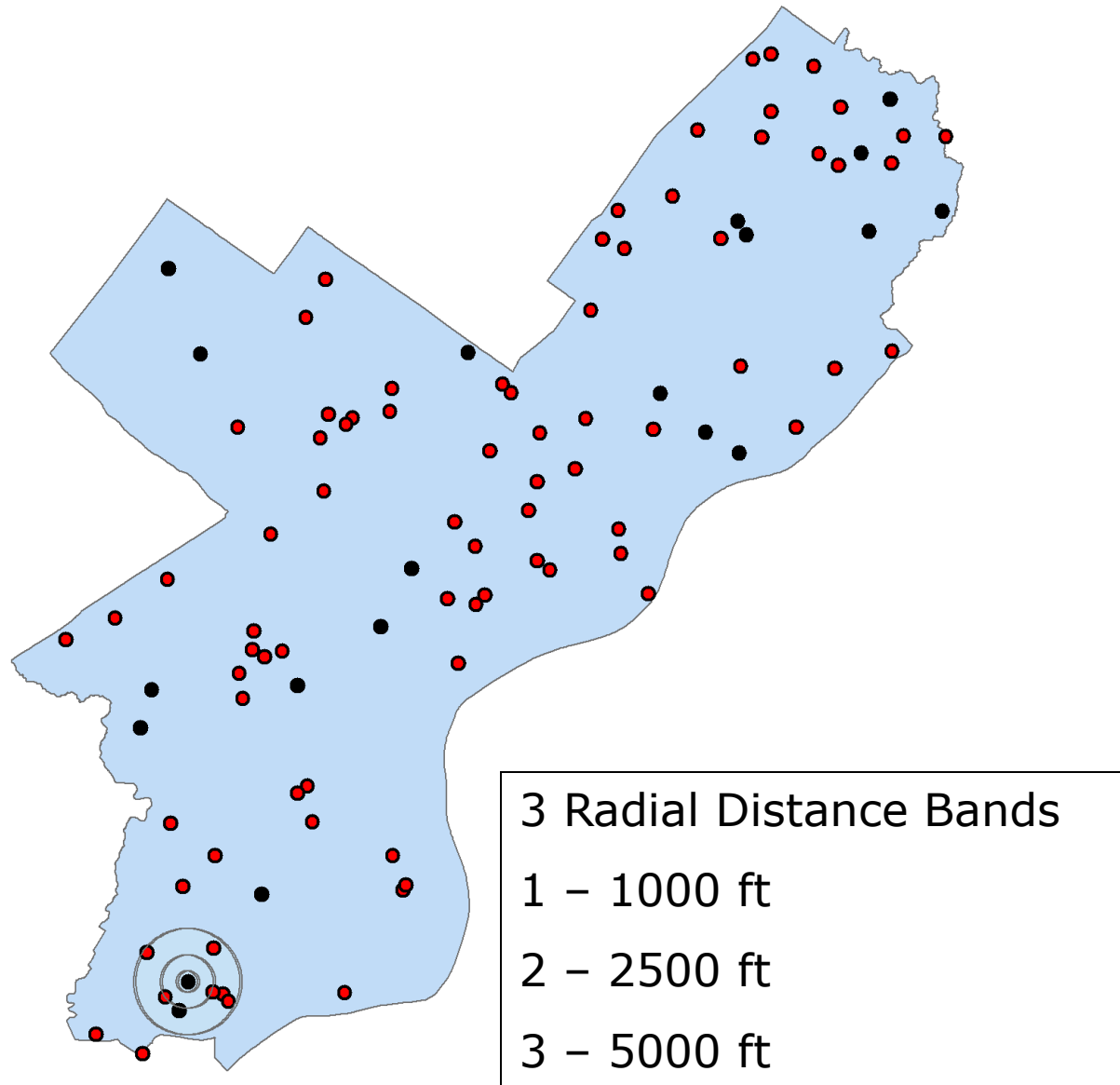
Region - R

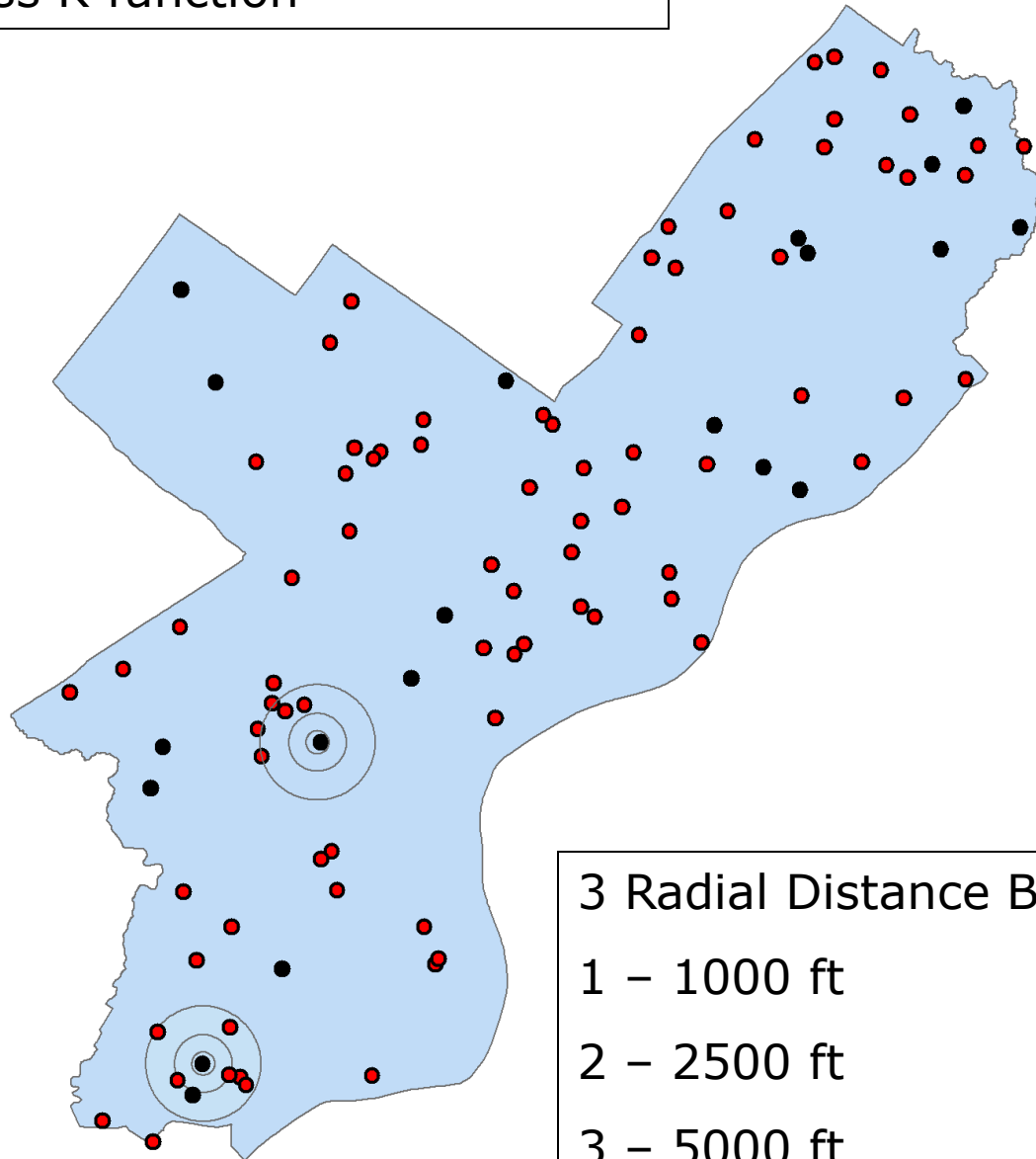Point Process – HIV Cases

Marked Point Pattern

Black = Not Linked to Care

Red = Linked to Care

Local Cross K function

3 Radial Distance Bands

1 – 1000 ft

2 – 2500 ft

3 – 5000 ft

Local Cross K function

3 Radial Distance Bands
1 – 1000 ft
2 – 2500 ft
3 – 5000 ft

Local Cross K function
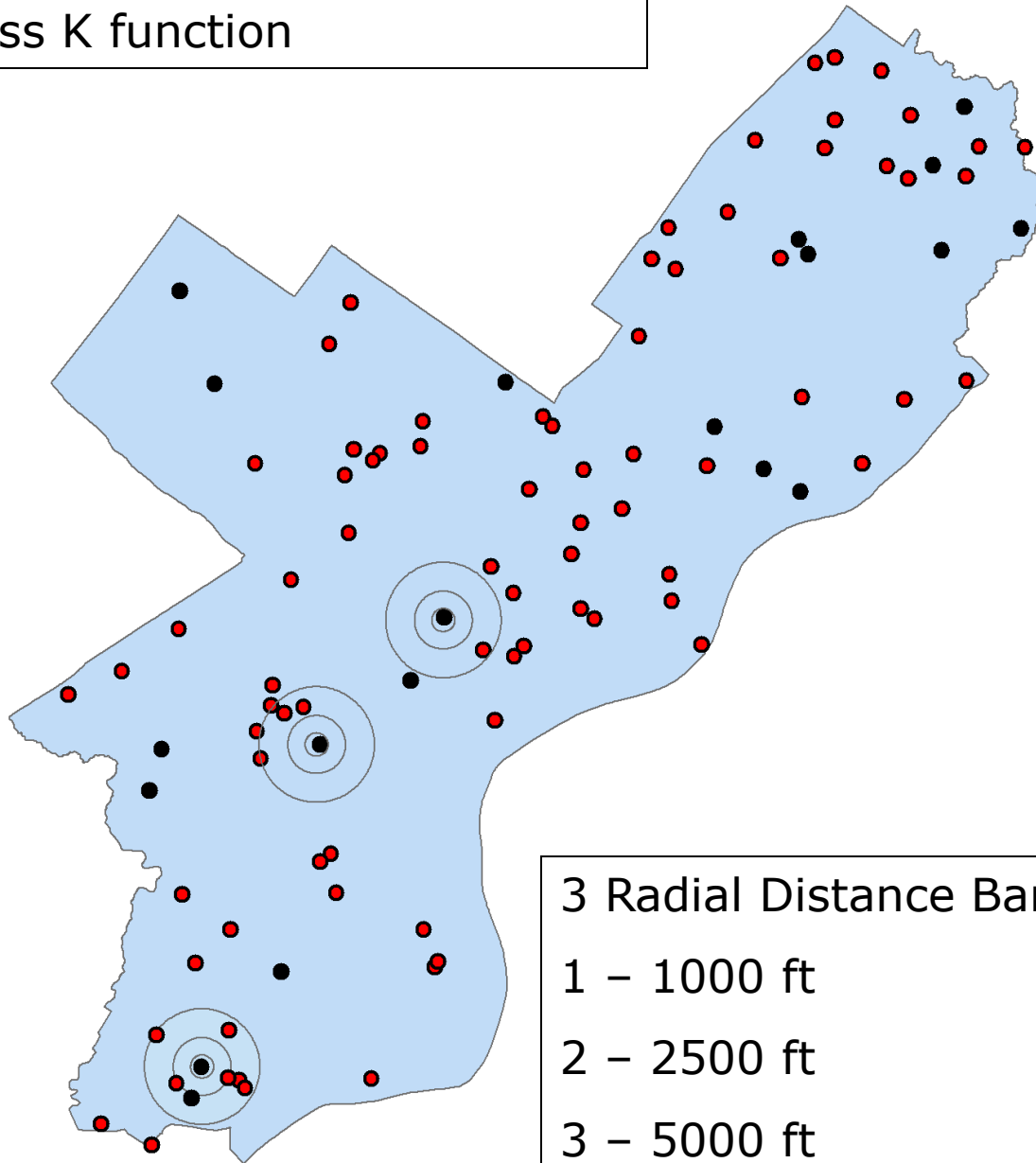
3 Radial Distance Bands

1 – 1000 ft

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Local Cross K function

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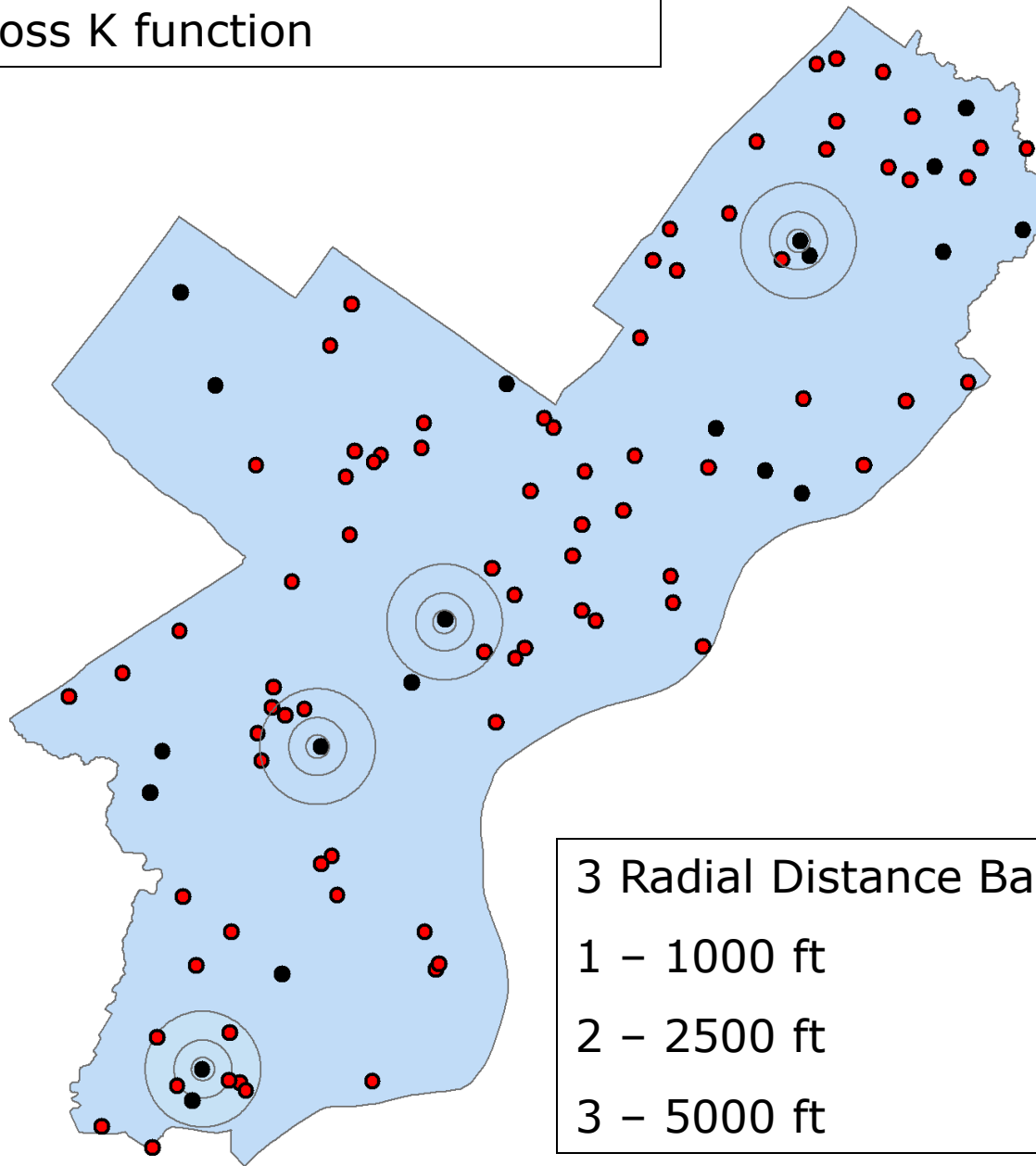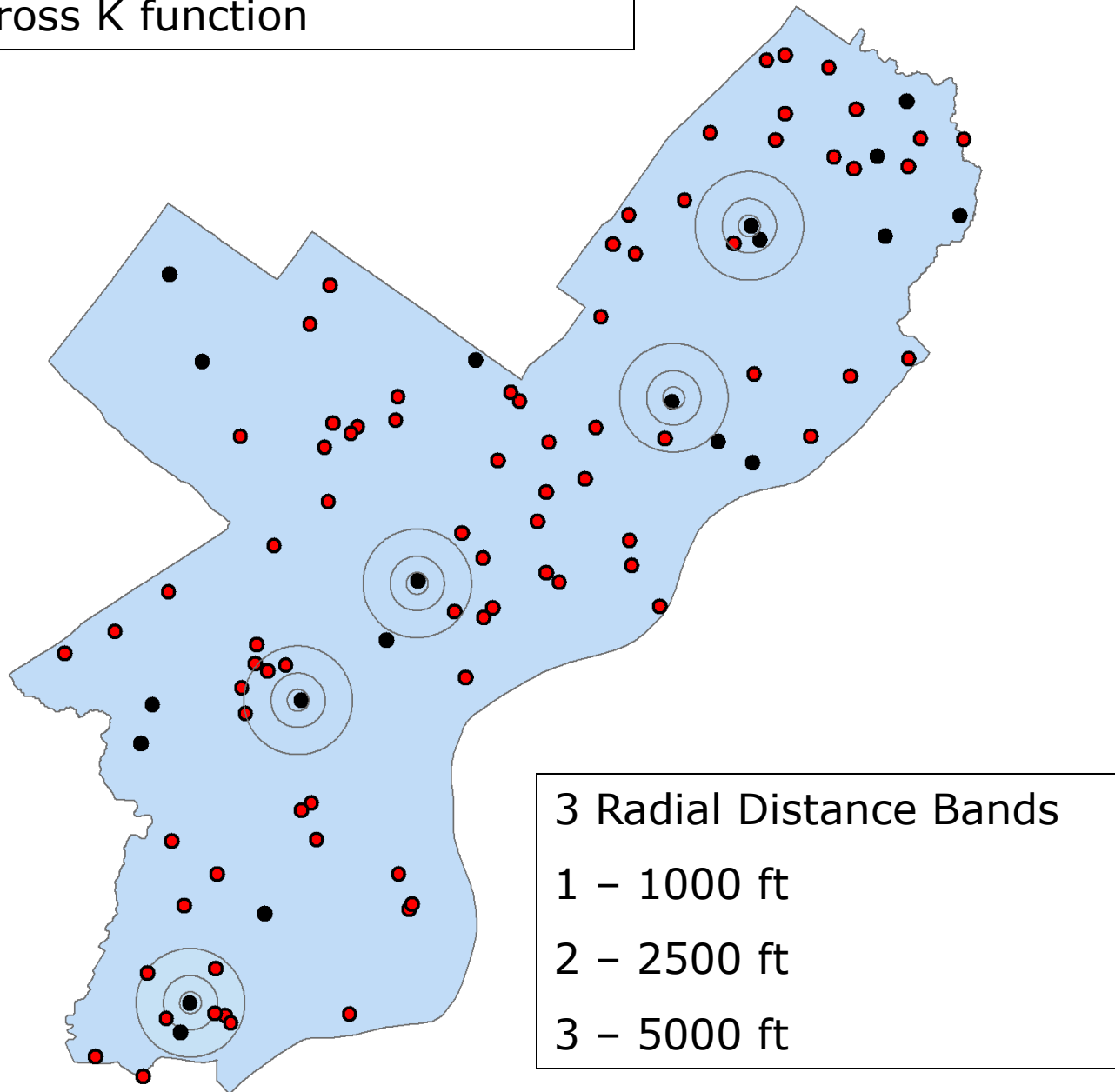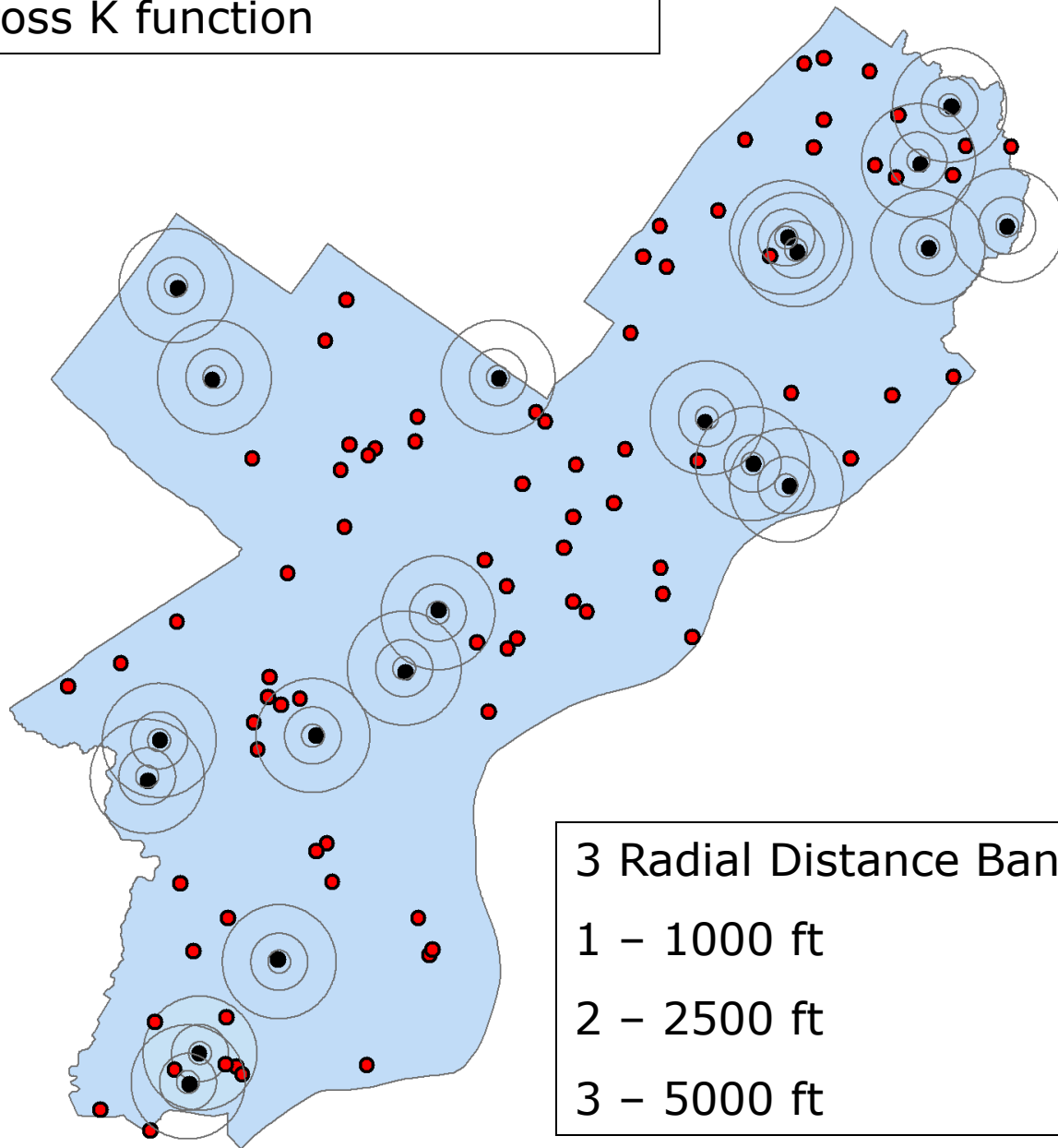
Local Cross K function

- P value calculated for each point in marked pattern 1
- Exact because all points are known, and no simulation is required
- P-values imported to ArcMAP, plotted at x,y coordinates and spline interpolated to raster surface
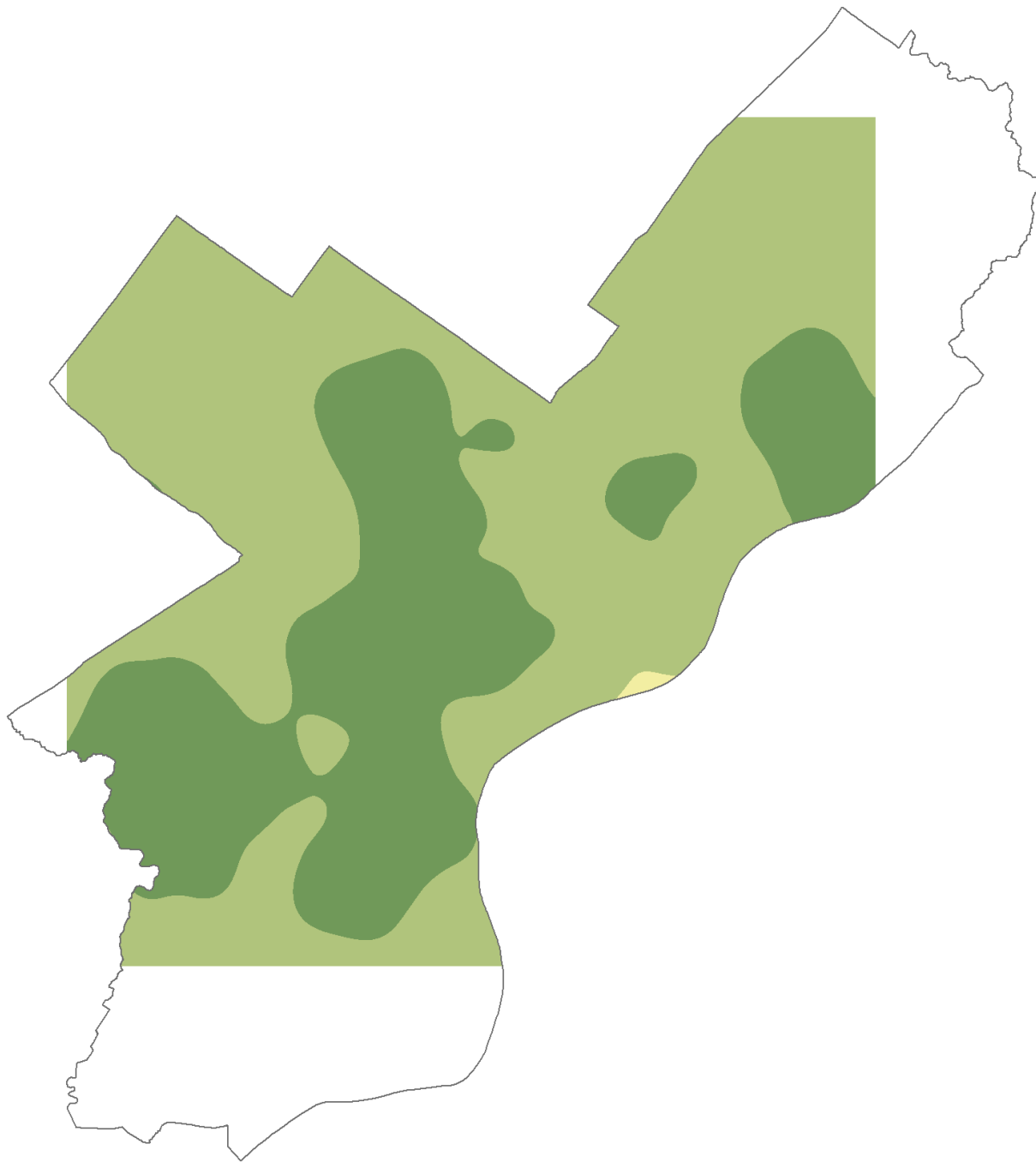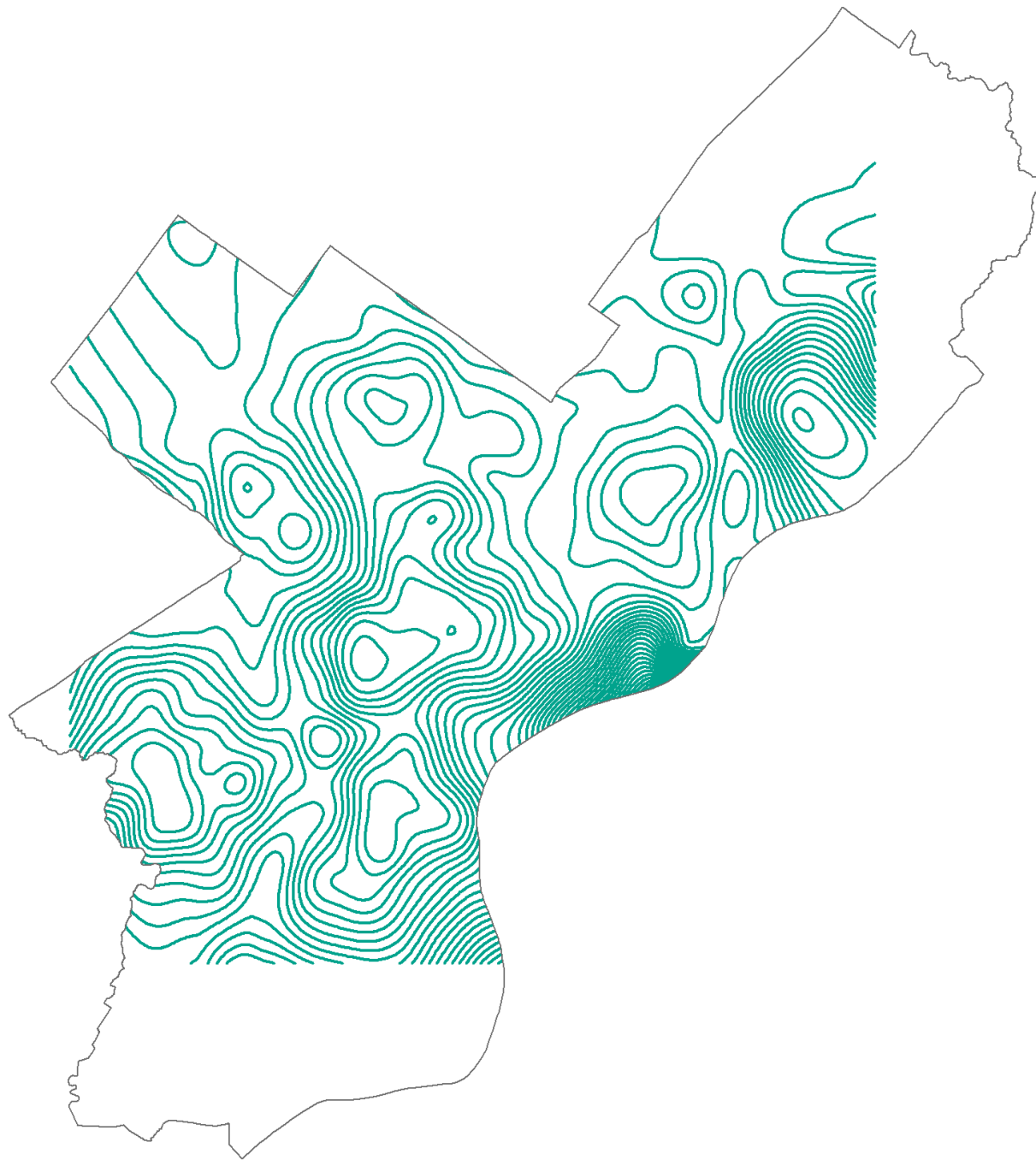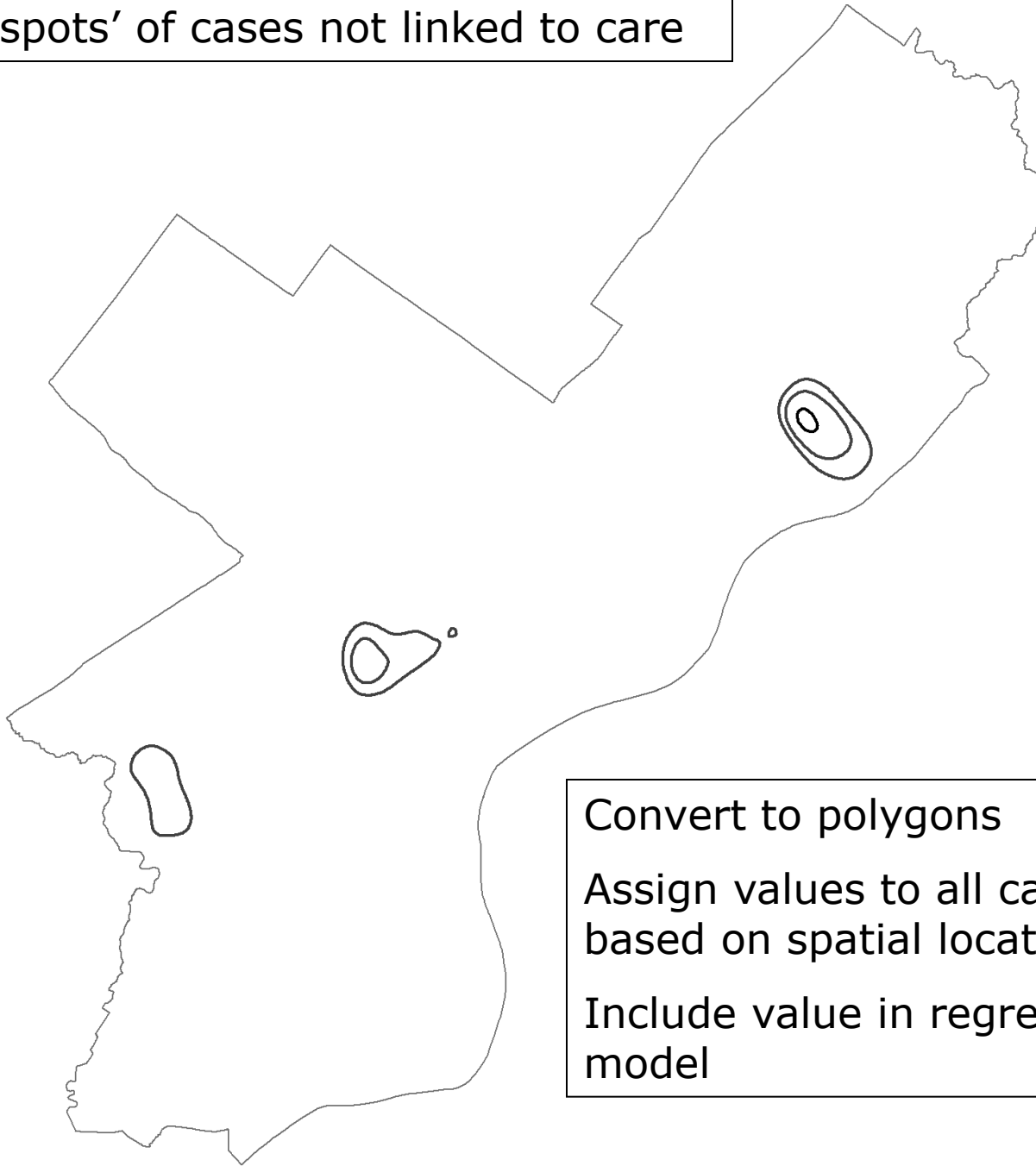
'Hots spots' of cases not linked to care

Convert to polygons

Assign values to all cases based on spatial location

Include value in regression model

Results

- 1,861 cases, 157 excluded (8%) due to an invalid address or imprisoned at the time of diagnosis
  - Excluded persons less likely to be black/Hispanic, more likely to be >45 years of age, IDU and privately insured
- Among 1,704 person included:
  - 70% male, 63% black, 30% 45 years or older
  - 40% heterosexuals, 36% MSM
- 82% linked to care
- Among those linked, 75% linked in 90 days and 37% were retained in care
- Among those retained, 72% achieved viral suppression

K-function mapping of four outcomes

A3. Persons Not Linked to Care

n=300
N=1,704

A4. Persons Not Linked to Care w/in 90 Days

n=345
N=1,404

A5. Persons Not Retained in Care

n=878
N=1,404

A6. Persons Not Virally Suppressed

n=147
N=526

Multivariate Regression Models for Involvement in Continuum of Care

Characteristic	Not Linked to Care	Not Linked <90 Days	Not Retained in Care	Not Virally Suppressed
Age at Dx			**<25**	
Sex at birth	**Male**			
Race/ ethnicity	**Black**		**Black Hispanic**	
Risk Group	**IDU**			
Insurance	**Medicare Uninsured**	**Uninsured**		
Geographic Area	**Yes**	**Yes**	**Yes**	**Yes**
Prison stay				
Proximity to care				**Yes**
Multiple care sites			**Yes**	

Summary

- Geographic clustering was independently associated with poor outcomes at each step along the HIV Care Continuum

- Geographic clusters identified were unique with no geographic overlap between steps in the Continuum

- Geographic clusters identified have a greater burden of HIV disease compared to other neighborhoods

- Proximity to HIV medical care was associated with suppression, but not associated with linkage to care, linkage in <90 days or retention in care

Conclusions

- Community factors related to poverty and community socioeconomic status may impact HIV treatment outcomes for individuals in living in geographic clusters
- We hypothesize:
  - Community norms and social disorder may have a greater effect on linkage to care;
  - Access to public transportation and social services may have a greater effect on retention in care;
  - And access to pharmacies may have a greater effect on viral suppression.
- Differences in community factors that influence each step of the cascade may explain the lack of overlap in hot spots.

Next Steps

- Better understanding of the **characteristics of places** that influence access to HIV medical care and treatment outcomes—mixed methods research

- Consistent with CDC's High Impact Prevention program, identification of geographic clusters could help to specifically **target separate linkage, retention, and adherence interventions** in the areas identified with the greatest need
  - Philadelphia's CDC CoRECT application – selected medical providers in the geographic cluster identified for retention

- **Develop new strategies for intervention** based upon ecological factors of the distinct clusters

Acknowledgments

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