The Impact of Distance to HIV Care on Adherence to Treatment - Adjusting for Population and Geographical Heterogeneity Using Advanced Spatial Analysis

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Poster No. PEC276

Background

Distance to health care services plays an important role in determining access to care and therefore, to an individual's overall health. In the realm of HIV research, distance to care has been shown to directly impact a participant's wellbeing along the HIV prevention and care continuum.

The objective of this study is to examine the relationship between distance to HIV physician facilities (used as a proxy for travel time to care) and adherence to HIV treatment in BC, between 2003 and 2013.

Methods

Data

This analysis was based upon data from BC Centre for Excellence in HIV/AIDS' Drug Treatment Program (DTP) and included the location of the first ever ART prescribing physician for all participants 18 years or older who initiated ART for the first time in BC (i.e. ART naïve). The dataset allows for a study of participants' outcomes of HIV treatment in a setting in which all financial barriers to HIV/AIDS and other medical care are eliminated.

Outcome, Exposure and Confounder variables

Outcome variable: Adherence to treatment, measured by pharmacy refill compliance, dichotomized at <95% versus ≥95%, during the first year of ART.
Exposure variable: Distance from the participant's home address or postal code to the location of the first ever ART prescribing physician.
Potential confounding variables(measured at ART initiation):
  Age (years)
  Gender (male/female)
  CD4 count (cells/µL)
  Viral load (log10 copies/mL)
  History of injection drugs use (IDU) (no/yes/unknown)
  Having had an AIDS-defining illness prior to starting ART (yes/no).
  Number of viral load performed in the first year of follow-up.

Analysis

To assess the impact of distance to first ever ART prescribing physician on ART adherence amongst participants who most likely walked or drove to their physician, two separate analyses were performed.
Walking models
Those living within walking distance of their physician's office. We considered two cut-offs: ≤3 km or ≤5 km.
Driving models
Those living within driving distance of their physician's office. We considered two cut-offs: >3 km or >5 km.

The distances within these four data subsets were further categorized based on the median distance of its participants. Participants residing within the median distance were marked as having "good access" to their physician's office, and those residing outside the median distance were defined as having "limited access". The resulting variable was then used as the primary exposure variable within each analysis.

Bivariable analyses were done to examine the composition of the study's population according to ART adherence (<95% versus ≥95%). Multivariable logistic regression was used to implement a confounder selection technique.
A geographically weighted logistic regression (GWLR) method was then used to examine geographically varying relationships between our outcome and main exposure variable, while adjusting for potential confounders across space.
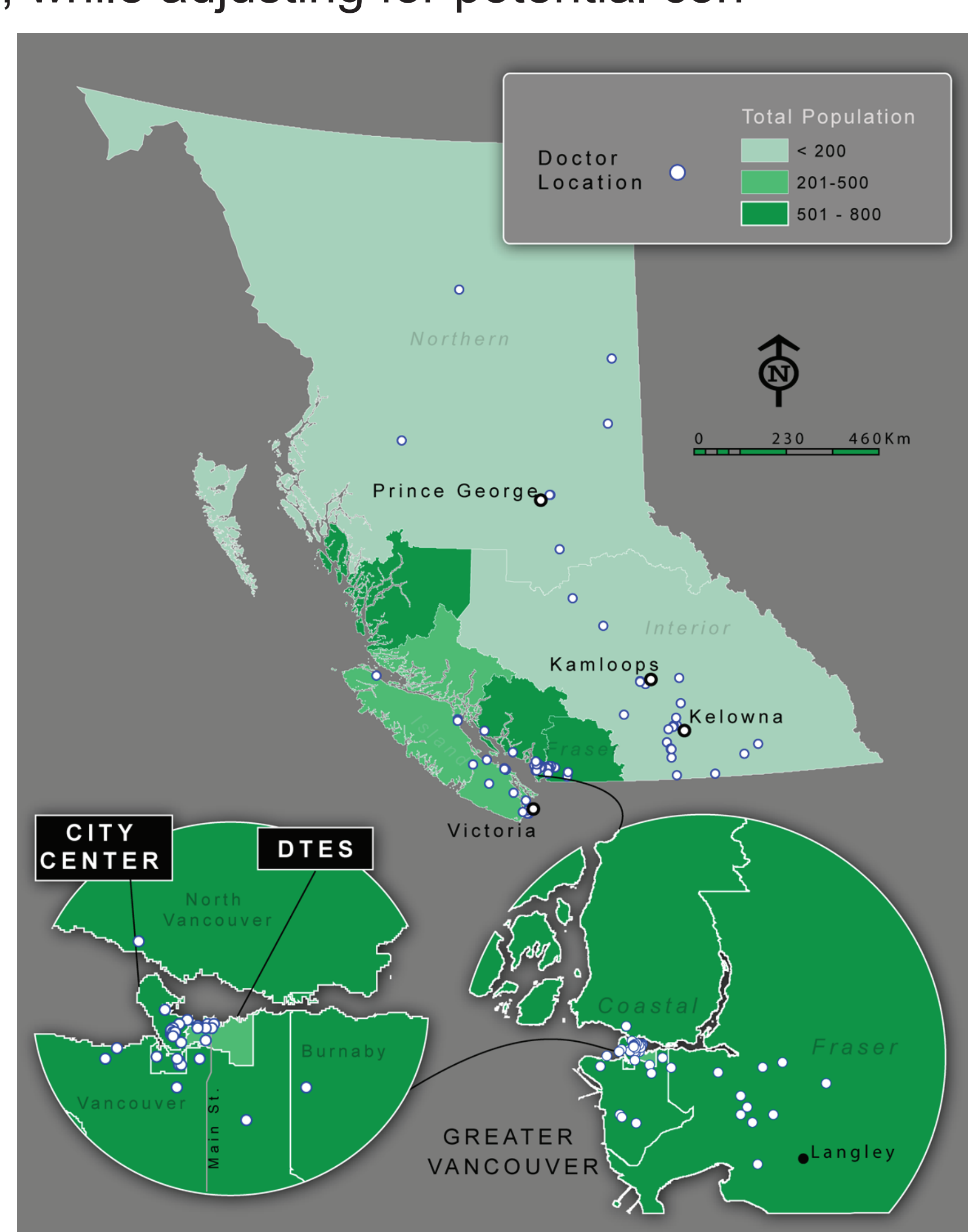
Fig. 1. Count of study participants at Health Authority level (DTES and City center are at Local Health Authority level).
Notes: DTES: Down Town East Side

Results

Of the four models, the only one to show a significant relationship between adherence and distance was that for participants who travelled at least 5 km to their physician's office.
There were 1,528 participants who travelled at least 5 km to their physician's office; their median distance travelled was 17.85 km (Q1-Q3: 8.8-47.2) (Table 1).

Variables	Adherence to treatment		
	≥95% (N=1090; %)	<95% (N=438; %)	P-value
Median travel distance, n(%)			
≥ 17.85 km	512 (67%)	252 (33%)	0.0002
< 17.85 km	578 (76%)	186 (24%)	
Gender, n(%)			
Female	183 (52%)	168 (48%)	<0.0001
Male	907 (77%)	270 (23%)	
History of IDU, n(%)			
No	596 (75%)	197 (25%)	<0.0001
Yes	252 (58%)	179 (42%)	
Unknown	242 (80%)	62 (20%)	
Having had an AIDS Defining Illness, n(%)			
No	144 (71%)	59 (29%)	0.9336
Yes	946 (71%)	379 (29%)	
Age at ART initiation			
Median	43	40	<0.0001
Q1-Q3	(36 - 50)	(33-48)	
CD4 cell count (Cells/µL)			
Median	390	255	<0.0001
Q1-Q3	(240-560)	(9 - 480)	
Viral load (Log10 Copies/mL)			
Median	4.86	4.77	0.0044
Q1-Q3	(4.30 - 5.00)	(4.12 - 5.00)	
Viral load count			
Median	6	5	<0.0001
Q1-Q3	(5 - 8)	(3 - 7)	

Table 1. Comparison of the potential confounders and main exposure variable according to adherence level for those participants travelling more than 5km to their physician's office.

The final adjusted model showed that participants who travelled more than 17.85km to receive treatment had a significantly higher chance of not adhering to the treatment as their counterparts (adjusted odds ratio 1.34; 95% Confidence Interval 1.06 - 1.70).

The use of the GWLR method to adjust for spatial dependency provided a slightly better model, as indicated by a lower AICc (Figure 2).
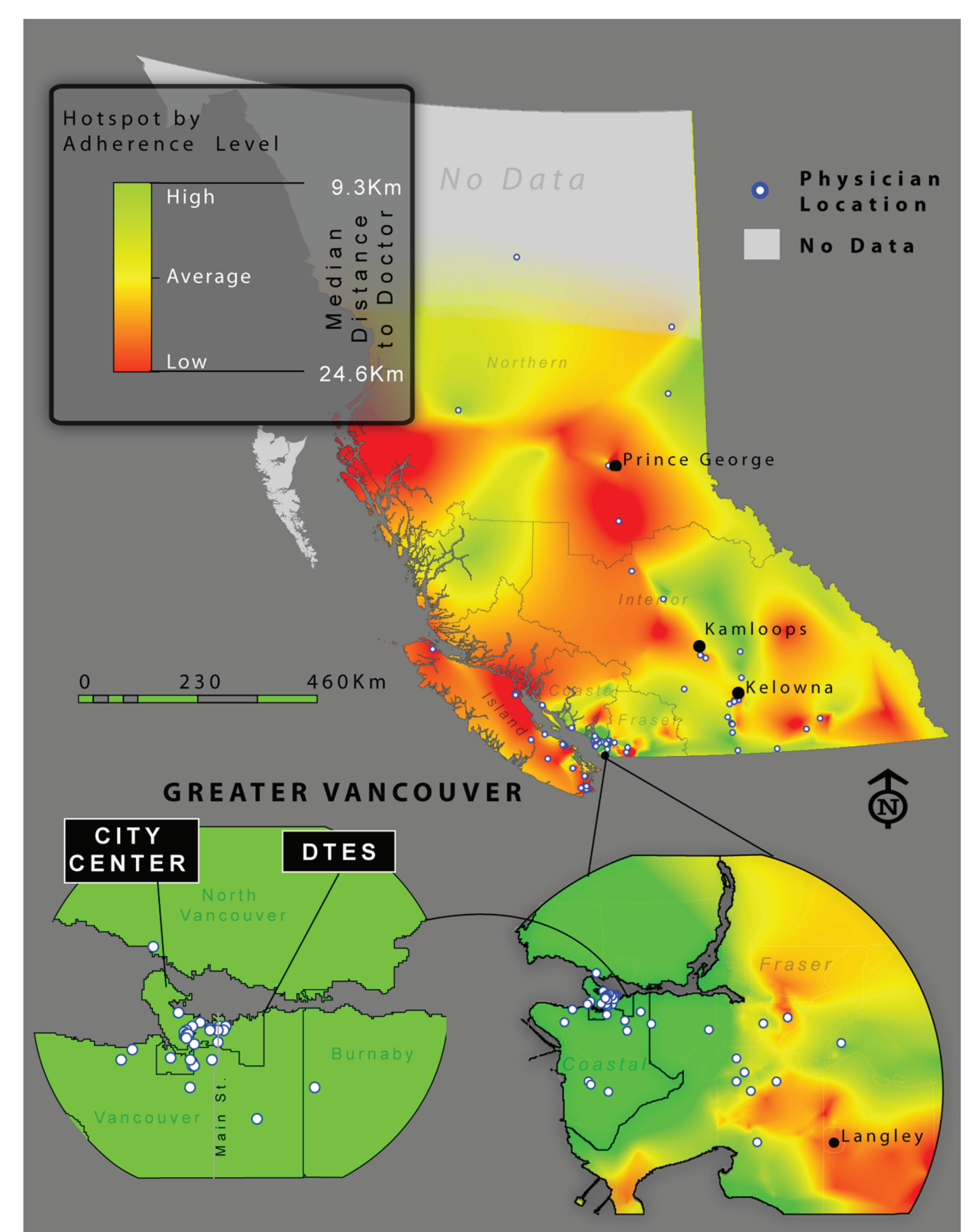
Fig. 2. Interpolation of clustering of high and low levels of adherence based on the predicted value of the GWLR model. The green areas are locations where participants with a high level of adherence are geographically clustered, while the red are locations with low levels of adherence. Notes: DTES: Down Town East Side

Discussion

The primary findings of this study highlight the impact of spatial access (depicted as distance to physician's office) on adherence to HIV treatment. The results clearly show that those who travelled further to receive HIV treatment were less likely to adhere to the treatment. Using mapping technology, we highlighted the locations of clusters where participants did not adhere to treatment as a result of long travel times. Similar to other studies, our maps showed that participants residing in urban areas were more likely to have a high level of adherence to treatment.

Acknowledgments

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