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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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 facility (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 naive). 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.

Bivariate 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.

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).

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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.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N=1090</th>
<th>N=438</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>36-50</td>
<td>33-48</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>CD4 cell count</td>
<td>≤36</td>
<td>&gt;36</td>
</tr>
<tr>
<td>Viral load</td>
<td>≤4.12</td>
<td>&gt;4.12</td>
</tr>
<tr>
<td>HIV status</td>
<td>Unknown</td>
<td>Yes</td>
</tr>
<tr>
<td>History of IDU</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Age at ART initiation</td>
<td>≤17.85</td>
<td>&gt;17.85</td>
</tr>
<tr>
<td>Median travel distance</td>
<td>≤3km</td>
<td>&gt;3km</td>
</tr>
</tbody>
</table>

The use of the GWLR method to adjust for spatial dependency provided a slightly better model, as indicated by a lower AICc (Figure 2).

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.

Discussion
We would like to thank the patients enrolled in the BC Centre for Excellence in HIV/AIDS and the physicians, nurses, social workers and volunteers who support them.

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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

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