Does Location Matter: Effects of Distance & Practice Size on Consumer Preferences for Seeking Primary Healthcare

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ABSTRACT

This article examines distance to healthcare services and physician practice size as factors influencing consumer preference and choice when seeking primary healthcare (PHC) in an urban setting. Data from a multipurpose telephone survey for the Canadian city of Saskatoon, Saskatchewan was analyzed. Using network analyst in ArcGIS and information drawn from this survey, distances to respondents' regular family physicians were compared against distances to the location where healthcare was alternatively received. Statistical analysis demonstrated preferences for larger, more local practices at the expense of continuity of care. These findings suggest erratic utilization of healthcare services that could lead to further healthcare access issues. This paper contributes to a growing body of work that recognizes the complexity of access to healthcare; most importantly it suggests that lower neighbourhood level access can result in health care decisions that might reduce continuity of care.

Categories and Subject Descriptors

H.2.8 [**Models and Principles**]: Database Applications – *Spatial databases and GIS*

General Terms

Measurement, Documentation, and Human Factors

Keywords

GIS, access to healthcare, continuity of care, neighbourhood-level access, distance variables, practice size variables

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1. INTRODUCTION

Primary healthcare services, in the form of pharmacists, family physicians, as well as walk-in, community, and after-hours clinics all provide gateways to secondary healthcare providers that are important for the treatment, diagnosis, and prevention of illness [1]. Access to primary care is vital in decreasing the probability of acute illness [2], thus relieving congestion in secondary healthcare facilities. It is clear that a deficiency in access to primary care can result in negative health outcomes, higher disease rates, and poor healthcare utilization [3]. Accessibility and availability of primary care services are thus essential health determinants in any society. The Canadian healthcare system provides Canadians with medically necessary services free at the point of delivery [4]. While the Canadian healthcare system is often held up as a model of universal health care, research in recent years has shown a lack of satisfaction with accessibility [5]. In addition, in 2003 approximately 15% of Canadians reported difficulties accessing routine care, and nearly 23% reported problems accessing immediate care according to the CCHS (Canadian Community Health Survey) [6]. It should be noted that a decline in accessibility has been reported since the 1990s [7]. Healthcare accessibility, the right and ability for an individual to act as a healthcare consumer, can be defined on several levels related to predisposing, enabling, and need factors that are recognized as key determinants of access [8]; as a result, this ongoing deficiency in access could be attributed to a number of factors including urban development and expansion, distribution of healthcare facilities, and socioeconomic and demographic variables. As well, demand for PHC services has increased in Canada due to an aging population, rising patient expectations, a shift in focus from hospital care to community care, an increase in pressure to contain costs, and a slow supply of physicians [9]. It is important to investigate causes of this reported decline in accessibility if solutions are to be found. From a geographic perspective, distance and distribution of healthcare facilities presents an interesting dynamic in regards to accessibility and associated problems.

Distance to healthcare facilities is an important factor in the health-seeking behaviours of various populations [10-12]. Many studies support the necessity and importance of distance-based analysis of primary-healthcare, as well as the importance of an integrated approach to studying health geography using GIS and other quantitative and census-based measures [13, 14]. While an individual seeking healthcare may have many family physician options within their city or area, he or she may be attracted to nearby options. When nearby care is not available it may contribute to compromised continuity of care as intervening options are used when care is needed [15]. In addition, the urban focus of this paper remains an area of healthcare accessibility research that is historically under-researched. Traditionally, accessibility issues focus on rural populations while urban populations are considered well-served, despite internal accessibility variation [16]. Attributing a city-wide physician count to an entire city suggests that PHC services are distributed evenly, which is rarely the case. Neighbourhood-level accessibility must be considered to account for the uneven distribution of healthcare facilities within the city in question. In this study we consider both neighbourhood level access to PHC services and practice size to better understand such aspects of the PHC landscape that might affect individual healthcare. We hypothesize that larger clinics with more practicing physicians will be seen as more attractive options for those in need of healthcare, due to perceived shorter wait times resulting from more physicians in combination with the likelihood that such practices might offer extended hours. In addition, we considered car-ownership as a proxy for socioeconomic status that may be associated with alternative methods of transport (for example public transport, walking or cycling).

Ultimately, we are interested in the degree to which an urban population's tendencies for seeking healthcare are affected by distance to care. This paper examines the physical availability (i.e.: distance from participant's home) and distribution of primary healthcare facilities, as well as practice size (number of physicians in a clinic) as outcomes. In doing so, this study provides a better understanding of access to primary healthcare facilities (encompassing PHC offices, walk-in clinics, and family physicians) as well as the role that distance to care plays in health-seeking behaviour.

2. DATA AND METHODS

This research examines whether distance to healthcare services is a factor in influencing consumers' preferences and priorities for seeking primary care in Saskatoon, Saskatchewan. Saskatoon is a mid-sized, relatively isolated metropolitan area with no large population centers nearby. The data used in this study was extracted from a cross-sectional telephone survey pertaining to multiple aspects of access to PHC (for a more detailed description, see [17]). Participants were asked whether or not they had a family physician, where their family physician was located, whether their family physician was the location at which they were most likely to go when in need of healthcare, as well as the specific location of their last visit with a physician (if it occurred in the last 12 months). This survey was conducted in 2010 across several pre-determined neighbourhoods with mixed income levels (for further information concerning these neighbourhoods, see Table 1 and Figure 1). Neighbourhood selection was based on a city wide assessment of physical availability of PHC services [17]. In terms of physician availability, five well-served neighbourhoods (City Park, Grosvenor Park, King George, Nutana and Pleasant Hill), and four poorly-served neighbourhoods (Fairhaven, Lawson Heights, Meadowgreen and Silverspring) were surveyed, as indicated in Figure 1 [17]. Neighbourhood accessibility was calculated using the 3 Step Floating Catchment Area method. This method involves generation of a neighbourhood level access value for a neighbourhood by using an average of access ratios from the neighbourhood's Dissemination Areas (the smallest unit of population analysis used by Statistics Canada for the national census). This produces an access ratio that is independent of neighbourhood size. From these access ratios, certain neighbourhoods were determined to be comparably well- or poorly-served [17, 18].

Table 1: Summary of participating survey respondents

PHC Accessibility	Neighbourhood	Total participants	Sub-sample
Poorly-served	Fairhaven	103	60 (58.3%)
	Lawson Heights	116	70 (60.3%)
	Meadowgreen	62	39 (62.9%)
	Silverspring	127	75 (59.1%)
Well-served	City Park	111	54 (48.6%)
	Grosvenor Park	113	82 (72.6%)
	King George	33	17 (51.5%)
	Nutana	111	47 (42.3%)
	Pleasant Hill	40	18 (45.0%)
Grand Total		816	462 (56.6%)

We compared the distance traveled by a participant to their family physician (**Path 1**) with the distance traveled to their alternative PHC provider (**Path 2**) when care was last needed. Information pertaining to participants' residence, their family physician, and alternative PHC provider was collected during the survey and were used to compute street network distances. This information was collected in the form of physician and participant postal addresses. In situations where respondents were unable to provide a street address, other location information was recorded in the form of nearest street intersection, doctor name, or clinic name. For situations where a physician address was absent, various data sources were consulted to identify the most suitable address. These resources included PHC Physician lists from the Saskatchewan College of Physicians and Surgeons (SCPR) or other web-based sources such as Google. In situations where physician surname resulted in ambiguity, the nearest physician address to the participant's residence was utilized. Other situations in which only a road intersection was provided, but more than one primary healthcare location was nearby may have resulted in small distance disparities.

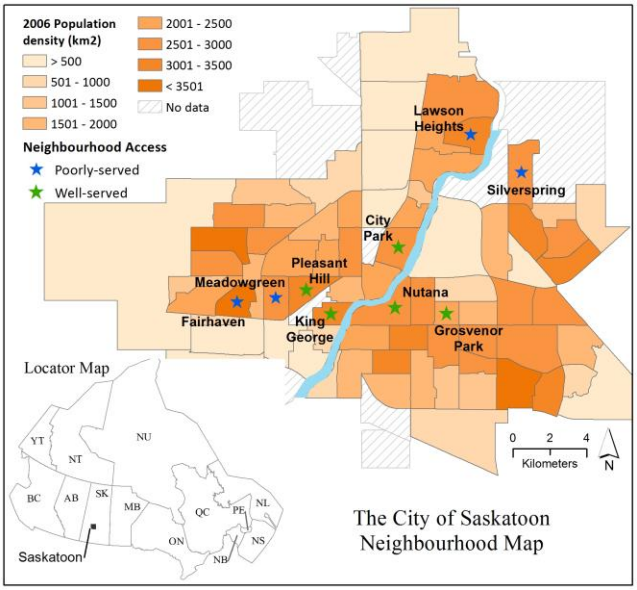

Figure 1: Map of study area

An integrated geocoding approach was applied, including street and postal code geocoding methods using DMTI datasets [19, 20] as well as manual identification; this generated the geographic coordinates for the participants' residence, practice locations of family physicians, and alternative PHC providers reported in the aforementioned survey. Finally, the road distances from each participant's residence to the practice locations of their family physicians and to their alternative PHC providers were calculated. This was achieved via the CANMap Streetfile [20] and the Network Analyst extension of ArcGIS software. Geocoding matchrates were at or near 100% for both regular physician and alternative physician locations. Given the purpose of the research, the main criteria for inclusion in our analysis is that the participant must have a family physician located within the city limits of Saskatoon, SK, must have visited a doctor in the last 12 months, as well as attend a healthcare facility with classifiable characteristics necessary for our analysis (for example, number of physicians practicing at a clinic, as well as type of clinic (primary vs. emergency)). We elected to remove records involving out-of-city physicians, as they all represent substantial distance outliers and would have biased our final distance results to inaccurately represent the urban focus of our study. In addition, if a proper street address could not be identified for a physician the record was removed from the analysis. We began with 816 total survey participants, of which 699 had a family physician and 514 provided a Path 2 location (where care was sought when needed in the past 12 months). Of the 514 records with both Path 1 and Path 2 information, we were left with 462 that could be considered primary clinics with a geocodable address. Of these 462 participants, 301 were female and 161 were male. Of the 462 participants, 319 visited their regular doctor when they needed care (in the previous 12 months) and 143 visited an alternate care provider (for whom we have an address). As is common with telephone surveys, our sample had a high proportion of older respondents and was mostly associated with average to high socioeconomic status [17]. The neighbourhoods surveyed were represented equally in terms of well- and poorly-served neighbourhoods. Of the PHC providers identified, 25 were single physician practices and 11 were group physician practices (3 attending physicians or more). At the time the survey was conducted, Saskatoon had 264 practicing physicians city-wide with a total of 67 practicing in our well-served neighbourhoods and none within our poorly-served neighbourhoods.

2.1. Data Analysis

Two variables were selected to examine the distance variations at city and neighbourhood levels: 1) Path distance to regular family physician; and 2) path distance to alternate physician location, if different from regular family physician. To incorporate the role of neighbourhood we included our well- and poorly-served neighbourhood variable. In addition, we considered practice size according to number of attending physicians (Single, 2 to 3, 4 to 5, 6 to 9 and 10+ physician practices), as well as vehicle ownership. We coded our dependent variable in a way that segregated survey data into participants remaining at the same healthcare facility when in need of healthcare, versus those that switched healthcare facilities from their regular family physicians (Same vs. Different). It should be noted that while some participants (n = 41) do attend the same healthcare facility that their family doctor is located at, they utilize a different healthcare practitioner located at the same clinic. These records were considered in the 'Same' category as that care provider would have access to and be expected to add to the patient's core health record, with their regular doctor being highly likely to notice the care received. The data analysis procedure for this study is as follows.

A. Distance comparison- City level analysis
   1) Between distance variables; Path 1 (P1) and Path 2 (P2)
      a. Path 1: distance to regular family physician
      b. Path 2: distance to alternative physician (location where care was sought when necessary, if different from regular family physician)
B. Distance comparison- Neighbourhood analysis
   1) Within distance variables P1 and P2 based on poorly- and well-served neighbourhoods
   2) Between P1 and P2 for poorly-served neighbourhoods
   3) Between P1 and P2 for well-served neighbourhoods
C. Distance comparison- Physician practice size
D. Distance comparison- Vehicle ownership

A Multivariate ANOVA was run on Path 1 and Path 2 for confirmation of effects. All statistical analysis was performed with SPSS software (Version 19). We used a cut off significance value of p = 0.05 for all tests.

3. RESULTS

Descriptive statistics for the distance traveled by a participant to their family physician (P1) and the distance traveled to their alternative PHC provider when care was last needed (P2) are

given in Table 2, along with the corresponding accessibility classification (well- or poorly-served).

Table 2: Average Distances for Path 1 and Path 2 Segregated According to Accessibility and Same/Different Variable

P1 / P2	Access	Same vs. Different PHC	Mean (meters)	Std. Dev.	N
P1	Poorly-served	Same FP	6293	3270	163
		Alt. Provider	7308	2964	81
		Total	6630	3202	244
	Well-served	Same FP	3918	2528	156
		Alt. Provider	3328	2528	61
		Total	3752	2536	217
	Total	Same FP	5132	3158	319
		Alt. Provider	5598	3407	142
		Total	5275	3241	461
P2	Poorly-served	Same FP	6293	3270	163
		Alt. Provider	3412	2499	81
		Total	5336	3322	244
	Well-served	Same FP	3918	2528	156
		Alt. Provider	2721	2013	61
		Total	3582	2450	217
	Total	Same FP	5132	3158	319
		Alt. Provider	3115	2320	142
		Total	4510	3068	461

The distance to a respondents' regular physician did not differ between people seeking care at an alternate location and those remaining with their regular physician (p = 0.562), in a comparison between distance to the regular family physicians of those participants who did not switch care facilities (5132m) and the distance to the regular family physicians of those participants who did switch (5598m). However, for respondents who did switch to a different provider when they needed care, the distance to that provider was much shorter than to the regular family physician of their comparators (those who sought care at their regular family physician). The difference was significant (p < 0.001) between the distance to the family physicians of those participants who did not switch care facilities (5132m), and those who did select an alternative healthcare facility when care was needed (3115m). These results indicate no interaction between distance to regular care and propensity towards switching care facilities, despite approximately one third of our sample seeking alternative care at a significantly decreased distance (n = 142).

Descriptive statistics for distance variables for well- and poorly-served survey neighbourhoods for both Path 1 and 2 are given in Table 2. ANOVA tests for Path 1 and Path 2 revealed significant distance disparity (p < 0.001 for both) for our neighbourhood access variable (well- versus poorly-served neighbourhoods). A significant main effect was found in Path 1 (p < 0.001) and Path 2 (p = 0.001) for the neighbourhoods in our analysis resulting in much higher distance means corresponding with respondents from a poorly-served neighbourhood. Analysis within the well- and poorly-served neighbourhoods demonstrates significant variance (p < 0.001) between Path 1 (6630m) and Path 2 (5336m) for the poorly-served neighbourhoods only. This indicates that respondents from a poorly-served neighbourhood have a much more dramatic decrease in distance from Path 1 to Path 2 than those respondents from a well-served neighbourhood. Analysis within Path 1 for the well- and poorly-served neighbourhoods between those participants who choose to switch care providers and those who don't does not reveal any significant results, again indicating that distance to regular family physician is not a factor in the decision to switch care providers. Within the Path 2 data set, the same comparison indicates an interaction (p = 0.012) between neighbourhood accessibility and a decrease in travel distance in accordance with an alternative care practitioner (ie. poorly-served neighbourhoods have a much more dramatic difference in distance between those attending the same PHC practitioner and those who chose an alternative care facility).

Table 3: Basic statistics for Practice Size variable (n =462)

P1/P2		Physician practice size (P2)					
		Single	2 to 3	4 to 5	6 to 9	10+	**Total**
Physician practice size (P1)	**n**	Number of Participants					
	Single	28	1	6	3	11	49
	2 to 3	2	32	4	4	11	53
	4 to 5	1	2	100	5	19	127
	6 to 9			4	38	7	49
	10+	1	2	19	2	157	181
	Dist. P1	Average road network distance (in meters)					
	Single	4,929	5,069	6,907	4,154	5,566	5,270
	2 to 3	4,814	5,270	3,224	4,385	3,936	4,754
	4 to 5	3,497	11,054	5,344	7,362	5,396	5,508
	6 to 9			7,325	6,067	4,448	5,938
	10+	3,774	7,389	4,782	4,351	5,157	5,126
	Dist. P2	Average road network distance (in meters)					
	Single	4,941	2,323	3,336	2,187	3,741	4,253
	2 to 3	5,635	4,861	562	2,413	4,037	4,210
	4 to 5	3,314	984	4,633	3,125	2,959	4,256
	6 to 9			3,994	5,807	2,976	5,255
	10+	548	4,001	3,394	8,189	4,847	4,698
	N	32	37	133	52	205	459
	Ave. P1	4,841	5,691	5,330	5,886	5,111	5,290
	Ave. P2	4,797	4,537	4,256	5,171	4,505	4,531

Descriptive statistics for distribution of participants by physician practice size for both P1 and P2 are shown in Table 3. Our analysis revealed high proportions (50% of all those that switched care providers from Path 1 to Path 2) of participants who chose an alternative healthcare facility that was larger (more physicians) than that of their regular family physician's. Just over a quarter of those who visited a different practice chose a same-size facility. Just under a quarter visited a practice smaller in size, although approximately 76% of these visited a facility still classified as a large group practice. Concerning distance information in Table 3 for Path 1 and Path 2, it should be noted that Path 1 distances are larger than those for Path 2.

Whether or not the participant in question owned a vehicle was considered an important variable in our analysis. The confidence intervals and distance disparities resulting from this variable are presented in Figure 2 and Table 4. Participants who owned a vehicle, traveled further on average between Path 1 and Path 2

(5369m in Path 1, 4604m in Path 2) than those who did not own a vehicle (4199m for Path 1, 3575m for Path 2). There were no significant differences in the average distance traveled to an alternative healthcare location between those who owned and did not own a car in the Path 2 data set (p = 0.894 and 0.982 for Path 1 and Path 2, respectively).

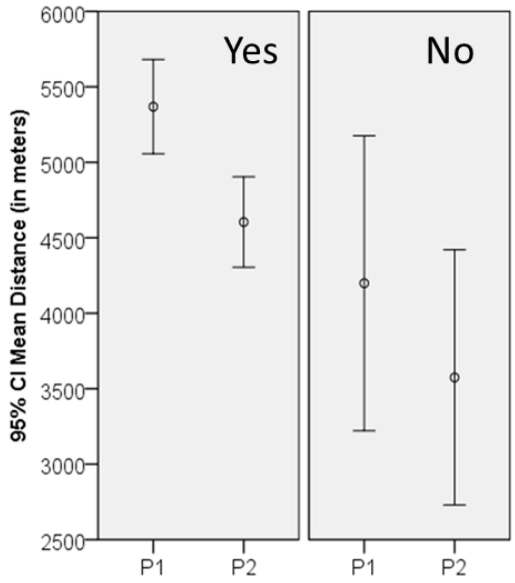

Figure 2. Distance Means at 95% CI for Path 1 and Path 2 Segregated According to Car-Ownership (Yes vs. No)

Table 4: Distances for Vehicle Ownership between P1 and P2

Vehicle Ownership		Mean	N	Std. Dev.	Std. Error Mean
Yes	Path 1	5,369	409	3,212	159
	Path 2	4,604	409	3,083	152
No	Path 1	4,199	45	3,252	485
	Path 2	3,575	45	2,815	420

4. CONCLUSION

Our research objective was to determine the extent to which the location of PHC facilities and their relative distance to individuals' residences affect a population's tendencies for seeking healthcare in an urban setting. We were also interested in the physician practice size of certain PHC facilities and the effect this has on participant's health seeking behaviours. In addition we examined neighbourhood-level access and vehicle ownership as other variables pertinent to healthcare access at the primary level.

Significant variation exists (p < 0.001) in distance to PHC providers between participants visiting their regular family doctor (5132m) and those utilizing an alternative facility when care was needed (3115m); however this significance cannot be attributed to distance to family physician alone. Our neighbourhood-level analysis revealed key accessibility issues regarding well- and poorly-served neighbourhoods, with individuals residing in poorly-served areas traveling significantly greater distances than those individuals in well-served neighbourhoods. This indicates poor distribution of healthcare services on a city-wide level, notably in terms of practices with available family physicians. It is true that urban areas are traditionally viewed as having better accessibility to health care than rural communities [21, 22]; however, our research reveals disparities in access across neighbourhoods in an urban environment. Negative health outcomes attributed to a lack of nearby primary care have the potential to severely affect other facets of the healthcare system. Furthermore, the simple act of seeking an alternate care location can compromise continuity of care. For example, ineffective communication between various doctors for one patient presents an inefficient use of the healthcare system. Practice size, in terms of number of attending physicians also had an effect on participant's health-seeking behaviours. Our sample tended to gravitate towards larger practices, notably in a Path 2 situation where healthcare was needed but not obtained from one's regular family physician. Our vehicle ownership variable can be viewed as a loose socioeconomic factor that indicates the necessity of well-distributed primary healthcare facilities, notably in areas of low socioeconomic status where alternative methods of transportation (for example, public transit, walking or cycling) could be considered a necessary means of travel. Despite our analysis not showing a significant correlation with our car variable, past research has indicated a significant correlation between vehicle ownership and healthcare utilization rates, suggesting that distance plays a key role in health-seeking behaviour [11].

A few research limitations deserve mention. In some cases, our distance estimation process was flawed and identification of PHC locations was not possible. This resulted in both a lower sample number than might have been possible, as well as some ambiguity and small distance error for some street network pathways. In addition, distance calculation and geocoding errors may also have been present. Due to the nature of the data collected, we were unable to identify specific reasons for selecting nearer health care facilities over a regular family doctor. Our survey included an open-ended question on this topic, however, a set of choices might yield interesting results. As such, this represents an important area of future investigation. As well, our research did not include emergency room or hospital service and utilization. We did not include these records as our focus was on primary care. Situations in which emergency healthcare is required deserves similar attention as this secondary form of healthcare is also a good indicator of public health. Our research was further limited by the ambiguity of hospital visits, as some may have been associated with an appointment-based specialist or surgeon.

The literature in this field is nascent [10-14]. Our study presents a large-scale distance analysis that is patient-based in nature, rather than relying on readily available physician-based statistics. We consider the concept of alternative healthcare locations and patient choice in terms of their local geography. In addition, we consider neighbourhoods in a larger urban setting instead of considering the city as a single health region. Through the course of this work, we identified several areas of investigation that may be worth examining. Analysis with a more continuous measure of

accessibility may prove interesting, and more valuable than a harsh binary classification (poorly-served versus well-served). Specific, qualitative reasons on why certain individuals feel motivated to compromise continuity of care for convenience would certainly shed some light on this area of health services research.

5. ACKNOWLEDGMENTS

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