Do Poorer Areas Have Poorer Access to Services in Hong Kong?

A Small-Area Analysis Based on Multiple Spatial Accessibility Indicators

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Abstract

Previous studies have yielded inconsistent findings regarding whether poorer areas have poorer access to health and social services. Using three indicators of service availability and accessibility, we investigated how the spatial accessibility of 28 types of services varied across quintiles of small-area poverty rates in Hong Kong. The results show that the patterns differed by the indicator used and type of services examined. The service-to-population ratio tended to yield a “pro-rich pattern”, i.e. higher service availability in less poor neighborhoods, but the road-network distance indicator tended to yield a “pro-poor pattern”, i.e. a shorter distance by road to the nearest service in poorer neighborhoods; in contrast, the two-step floating catchment area index yielded patterns that were less consistent across different types of services. Consistency in the associations across the three accessibility indicators was found only for a few types of services, e.g. a “pro-poor pattern” for self-study rooms and a “pro-rich pattern” for swimming pools and tennis courts. As the three spatial accessibility indicators tended to generate different results, future research should include careful consideration of the choice of indicators and the context in which these indicators are utilized. Our analysis also indicates that the spatial distribution of services in Hong Kong does not always support the “deprivation amplification theory,” i.e. poorer areas are more deprived of resources, while poorer areas had better, not poorer, access to certain services.

Keywords

Hong Kong; Poverty; Spatial accessibility indicators; Deprivation amplification; Inequality

1. Introduction

Poorer access to services in poorer areas? – findings from past research

A substantial body of research indicates that neighborhood disadvantage is associated with poor health outcomes, independently of individuals' characteristics (Kawakami et al. 2011; Pickett and Pearl 2001). Yet which neighborhood contextual characteristics might be affecting health, and how? Some studies have highlighted the role of neighborhood services and resources in influencing people's life chances and their ability to lead healthy lives (Macintyre et al. 1993; Macintyre 2007; Macintyre et al. 2002; Pearce et al. 2007). To describe the mechanism underlying the association of area deprivation with poor health, Macintyre (2007) put forward the theory of "deprivation amplification" - there is less access to the services or resources that might help a person to lead a healthy life in poorer neighborhoods than in more affluent neighborhoods (Macintyre 2007). However, empirical studies examining "deprivation amplification" across a range of services or resources have produced mixed findings, as is explained in detail below.

Of the neighborhood services / resources studied in relation to health outcomes, health-care services have been the ones most commonly investigated. It has been proposed that the supply of good medical/health care tends to vary inversely with the need for it in the population served; that is to say, good health care is more readily accessible for people, or in neighborhoods, that are better off—a phenomenon known as the "inverse care law" (Hart 1971). However, Adams and White (2005) found that, on the contrary, in England the geographical proximity to general practices was better in poorer areas than in affluent areas. Another type of resource that has received considerable attention is that of food-related services. Some studies from the United States suggest that deprived/poor neighborhoods have poorer access to supermarkets and/or grocery stores that sell healthy food (Alwitt and Donley 1997; Algert et al. 2006; Morland et al. 2002; Zenk et al. 2005). However, some other studies have contradicted this (Macintyre 2007; Pearce et al. 2007). Studies on the spatial distribution of physical activity services have had inconsistent findings. Powell et al. (2006) found that rich neighborhoods had better access to various kinds of physical activity services in the United States. However, Giles-Corti and Donovan (2002) found that some types of physical activity resources/services (such as sport centers, swimming pools, and gyms) were better supplied in deprived neighborhoods of Perth. A study from the Netherlands (Van Lenthe et al. 2005) found that there was no difference between deprived and affluent neighborhoods as regards access to sports services. In a systematic investigation of the access to multiple types of services in Glasgow, Macintyre et al. (2008) found that there was no clear pattern in variations in neighborhood service accessibility by level of neighborhood deprivation; they concluded that academic theories about, and urban policies on, the distribution of services should be based on context-specific empirical evidence. Similarly, basing their recommendations on findings from New Zealand, Pearce et al. (2007) suggested that the association between neighborhood socioeconomic characteristics and community resource access should be context-specific and advised that researchers from other countries should examine this issue locally so as to avoid making unwarranted assumptions and over generalizations (Pearce et al. 2007).

Indicators of spatial accessibility to services

Penchansky and Thomas (1981) have usefully grouped the quality of access into five dimensions: availability, accessibility, affordability, acceptability and accommodation. The last three are essentially non-spatial, while the first two dimensions are spatial in nature. Availability refers to the number of local service points from which a person can choose. Accessibility is travel impedance (distance or time) between user location and service points. In the geography and social sciences literature, the two spatial dimensions are commonly combined and referred to as “spatial accessibility” (Guagliardo 2004). However, most previous studies involved only one single spatial accessibility indicator, either the availability indicator (e.g. service-to-population ratio) (Block et al. 2004; Macintyre et al. 2008; Morland et al. 2002; Powell et al. 2006) or the accessibility indicator (e.g. distance to nearest service) (Giles-Corti and Donovan 2002; Macintyre et al. 2008; Pearce et al. 2007; Zenk et al. 2005). Ottensmann (1994) suggested that capturing only one aspect of spatial accessibility may overgeneralize the spatial distribution of services, leading to misguided policy making. Therefore sensitivity analysis including multiple spatial accessibility indicators is needed. However, few studies have used different spatial accessibility indicators to examine whether the results are sensitive to the choice of indicators (Macintyre et al. 2008; Powell et al. 2006). Moreover, most previous studies examined only one or a few kinds of resources or services (Algert et al. 2006; Alwitt and Donley 1997; Block et al. 2004; Burns and Inglis 2007; Ellaway et al. 2007; Giles-Corti and Donovan 2002; Morland et al. 2002; Powell et al. 2006; Van Lenthe et al. 2005; Winkler et al. 2006; Zenk et al. 2005), except a few that included a comprehensive analysis of various types of services (Kawakami et al. 2011; Macintyre 2007; Pearce et al. 2007). Given the inconsistent findings from previous research, mostly in Western settings, it is neccessiry to conduct more research investigating how resources and/or services are allocated across neighborhoods of different levels of poverty using multiple spatial accessiblity indicators. Hong Kong, a developed city in Asia, is an appropriate setting for this kind of investigation.

The unique context of Hong Kong

Hong Kong is one of the most crowded cities in the world, with its 7.1 million people residing on only 7% of a landmass of 1,104 square kilometers (Planning Department 2014). Although Hong Kong only occupies a comparatively small geographic area, the spatial distribution of its population is complex (Monkkonen 2011). In some areas, rich neighborhoods are immediately next to poor neighborhoods, while in other areas, poor neighborhoods are close to each other and form geographic clusters. With such a high-density context and mixed residential pattern, any single indicator is unlikely to sufficiently capture the complex picture. Past research has suggested that the level of service provision varies spatially in Hong Kong (Poon 2009), while these observations were made at a rather large geographic level (e.g. district) based on simple availability indicators. Studies applying more sophisticated indicators such as accessibility indicator or combined indicator (e.g. combing availability and accessiblity) are rare in Hong Kong. Sensitivity analysis including multiple spatial accessibility indicators is needed to capture a comprehensive picture. Moreover, previous studies from Hong Kong mainly focused on health care facilities (M. Wong et al. 2009; N. S. Wong et al. 2010) and there is a lack of systematic investigations into spatial variations in access to various types of services. To better allocate resources in Hong Kong, it is necessary to conduct a research comprehensively understanding the spatial distribution of services.

Hong Kong is among one of the most affluent cities in the world (per capita GDP in 2014: US$40,170). However, it has experienced a widening gap between the rich and the poor over the past two decades; its Gini coefficient increased from 0.451 in 1981 to 0.537 in 2011. In response to such an expanding disparity, the Hong Kong Government published its first Poverty Report and official poverty line in 2013 (Government of the Hong Kong Special Administrative Region 2013). Recent studies from Hong Kong have shown a strong association of area poverty or deprivation with individuals' wellbeing indicators such as mortality (Kandt 2016), suicide risk (Hsu et al. 2015) and life satisfaction (Hsu et al. 2017). There is thus an urgent need to better understand the services and resources allocation in relation to neighborhood poverty level, to inform strategies to alleviate poverty and its impact in Hong Kong.

The aims of this study were to investigate (i) whether poorer neighborhoods of Hong Kong have poorer access to various services, including health and social services; and (ii) whether the patterns of spatial accessibility vary by type of services and spatial accessibility indicator.

2. Methods

2.1 Data

We used 2011 census data from the Census and Statistics Department of the Government of the Hong Kong SAR to calculate neighborhood poverty rates. To calculate spatial accessibility indicators we used geocoded services location data (2009 Geo-community Database) and road-network data (2009 Geo-Reference Database) from the Lands Department. Large street blocks (LSBs; 2011: n = 1,620, median population = 2,110, interquartile range 1,472–4,456) were used as a proxy for neighborhoods. LSBs are small geographic units that are demarcated by the Planning Department for the purpose of town planning; they are based on geographic features, such as roads, coastlines, and rivers. The Geographic Information System (GIS) software was used to process the spatial analysis data and manage the spatial databases. The ArcGIS (version 10.2) software from the Environmental Systems Research Institute (ESRI) was used for the map creation and spatial analysis.

Neighborhood poverty rate was defined as the percentage of the local population living below the official poverty line which is defined by the Hong Kong Government as 50% of the median household income by household size (categorized as households with one person, two persons, three persons, four persons, five persons, and six persons and above) (Government of the Hong Kong Special Administrative Region 2013). We divided all 1,620 neighborhoods of Hong Kong into quintiles based on their neighborhood poverty rates, with quintile 1 indicating the least poor areas (lowest neighborhood poverty rates) and quintile 5 indicating the poorest areas (highest neighborhood poverty rates). Each quintile contained 324 neighborhoods (i.e. LSBs).

The 2009 Geo-Community Database provided by the Lands Department included a range of various types of services and resources and their geocoded location information. Based on the main types of services examined in previous studies with regard to their accessibility across areas of various poverty/deprivation levels (Kawakami et al. 2011; Macintyre et al. 2008; Pearce et al. 2007), we grouped 28 types of services with information in the Geo-Community Database into eight categories as follows -

A. Health-care services (hospitals, clinics/health centers/dispensaries, homes for the elderly)

B. Food services (supermarkets, "cooked food stalls," convenience stores)

C. Physical activity/sports services (indoor games halls/recreation centers/sports centers, sports grounds, public gardens/parks, swimming pools, bowling greens, tennis courts)

D. Education services (child-care centers, kindergartens, primary schools, secondary schools)

E. Emergency services (fire stations, police stations/police posts)

F. Exchange services (post offices/post boxes, associations/clubs/societies, community centers/community halls/rural committees/youth centers/welfare centers/community services complexes, family service centers)

G. Culture and entertainment services (museums/art galleries/exhibition centers, performing arts centers, libraries, self-study rooms, theatres, cinemas)

H. Transport services (bus termini/Green Minibus termini, light rail stations, car parks)

We built up a topological map of the road networks in Hong Kong based on road-network data in the 2009 Geo-Reference Database supplied by the Lands Department.

2.2 Spatial accessibility indicators

To investigate the distribution of the 28 types of services in relation to neighborhood poverty, we used three indicators: (i) a container indicator (availability); (ii) a road-network indicator (accessibility); and (iii) a demand-supply buffer indicator (combing both availability and accessibility) (Chen and Clark 2013).

The container indicator was used to indicate the availability of services in a targeted area; it was calculated as the supply (the number of services) divided by the demand (the population served) and usually referred to as "service-to-population ratio" (Luo and Qi 2009). We calculated the container indicator for each type of services by quintile of small-area (LSB) poverty rates. For five specific types of services that serve age-specific populations (child-care centers, kindergartens, primary schools, secondary schools, and homes for the elderly), we calculated the number of services per 1,000 people aged 0-4, 5-14, 10-19, and 65 and above, respectively. For the other 23 types of services, we calculated the number of services per 1,000 of the population of all ages. The lower value of service-to-population ratio indicates poorer access to services.

The second indicator was a road-network indicator, which is typically given as the shortest distance along a road network from the center of a targeted area to the location of the closest service, indicating the accessibility of services in a specific area (Luo and Qi 2009). We calculated the road-network distances (in meters) from the centroid of each LSB to the closest services using the network analysis module of the ArcGIS 10.2 software program. We used the median, not the mean, road-network distances because their distribution was highly skewed. The greater this distance, the less accessible is the service.

The third indicator was based on the two-step floating catchment area (2SFCA) method and a demand-supply buffer measure. The 2SFCA index was first proposed by Radke (2000) and later modified by (Luo and Wang 2003b, 2003a); it can take into account both of the two dimensions of spatial accessibility of a service: the service-to-population ratio (availability) and proximity (accessibility). The 2SFCA index is calculated in two steps. First, the estimated population within a given distance from a service location is used to calculate the service-to-population ratio for the service location; this is done (and separate ratios calculated) for each service location (for a particular type of service) within a given area. Second, all the separate service-to-population ratios calculated in the first step are summed to yield an overall service-to-population ratio for those who reside within a given area (Luo and Wang 2003a). In this study, the detailed steps were as follows -

In Step 1, for each service location *j* we identified all LSB centroids *k* that were within a circular area of radius d_0 from location *j* (this was assumed to be the catchment area of the service); we then calculated the service-to-population ratio R_j within the catchment area of the service:

$$\boldsymbol{R_j} = \frac{\boldsymbol{S_j}}{\sum_{\boldsymbol{k}\in\{\boldsymbol{d_{kj}}<\boldsymbol{d_0}\}} \boldsymbol{P_k}}$$

where P_k is the population of LSB *k* (the centroid of which is located within the catchment area of service *j*); S_j is the number of services (equal to 1 in this study) at location *j*; and d_{kj} is the distance between *k* and *j* ($d_{kj} < d_0$).

In Step 2, for each LSB *i* we identified all the services, *j*, that were located within a radius of d_0 from the LSB centroid's location (this was assumed to be the catchment area in this LSB). Finally, we summed the service-to-population ratios derived in step 1:

$$\boldsymbol{A_i^F} = \sum_{\boldsymbol{j}\in\{\boldsymbol{d_{ij}}<\boldsymbol{d_0}\}} \boldsymbol{R_j} = \sum_{\boldsymbol{j}\in\{\boldsymbol{d_{ij}}<\boldsymbol{d_0}\}} \frac{\boldsymbol{S_j}}{\sum_{\boldsymbol{k}\in\{\boldsymbol{d_{kj}}<\boldsymbol{d_0}\}} \boldsymbol{P_k}}$$

where A_i^F stands for the 2SFCA index; R_j is the service-to-population ratio at service location *j* located within the catchment area of LSB *i*; and d_{ij} is the distance between *i* and *j*. The lower the value of the 2SFCA index, the poorer is the access to services for the residents of that LSB. In this study, we used 2,500m as the radius because it is described as being a reasonable walking distance (Donkin (1999); people typically travel by car, public transport, or taxi for distances greater than that (Winkler et al. 2006). In a procedure similar to the one we used with the second indicator, we calculated the 2SFCA index of each service for each LSB; we also calculated the median 2SFCA index for each quintile of area poverty, as the distribution of the 2SFCA indexes was highly skewed.

2.3 Statistical analysis

We compared the container indicators across the poverty quintiles using a chi-squared test. The comparisons of median road-network distances and 2SFCA indices across the quintiles were conducted using a nonparametric test (Mood's median test) as the data did not follow a normal distribution. A p value of Chi-squared test/Mood's median test lower than 0.05 refers to a significant difference of spatial accessibility of services across the poverty quintiles. Furthermore, we investigated whether poverty quintiles were associated with spatial accessibility to services using Spearman's correlation coefficients.

Based on the results of chi-squared test / Mood's median test and Spearman's correlation coefficient, we classified the association of the service spatial accessibility with the poverty quintiles into three groups: a "pro-rich pattern", a "pro-poor pattern", or "no clear pattern". "Pro-rich pattern" refers to the situation that richer areas have better access to services compared to poorer areas. While, "pro-poor pattern" refers to the situation that poorer areas have better access to services compared to richer areas. Specifically, a pattern of spatial accessibility with (i) a significant positive correlation (coefficient > 0; $p < 0.05$) or (ii) a non-significant positive correlation (coefficient > 0; $p > 0.05$) but with a significant difference ($p < 0.05$) across the poverty quintiles was defined as a “pro-rich pattern” for the road-network indicator and as a “pro-poor pattern” for the container indicator and the demand-supply buffer indicator. A pattern of spatial accessibility with (i) a significant negative correlation (coefficient < 0; $p < 0.05$) or (ii) a non-significant negative correlation (coefficient < 0; $p > 0.05$) but with a significant difference ($p < 0.05$) across the poverty quintiles was defined as a “pro-rich pattern” for the container indicator and demand-supply buffer indicator and as a “pro-poor pattern” for the road-network indicator. The others were defined as “no clear pattern.”

All analyses were performed using the ArcGIS 10.2 and StataMP 13 software programs.

3. Results

Figure 1 shows the distribution of neighborhood poverty in Hong Kong. Table 1 shows population sizes, number of neighborhoods, and neighborhood poverty rates by poverty quintile in Hong Kong in 2011. The poverty rates of neighborhoods in the least poor quintile ranged from 0.0% to 5.1%, while those in the poorest quintile ranged from 23.7% to 55.7%.

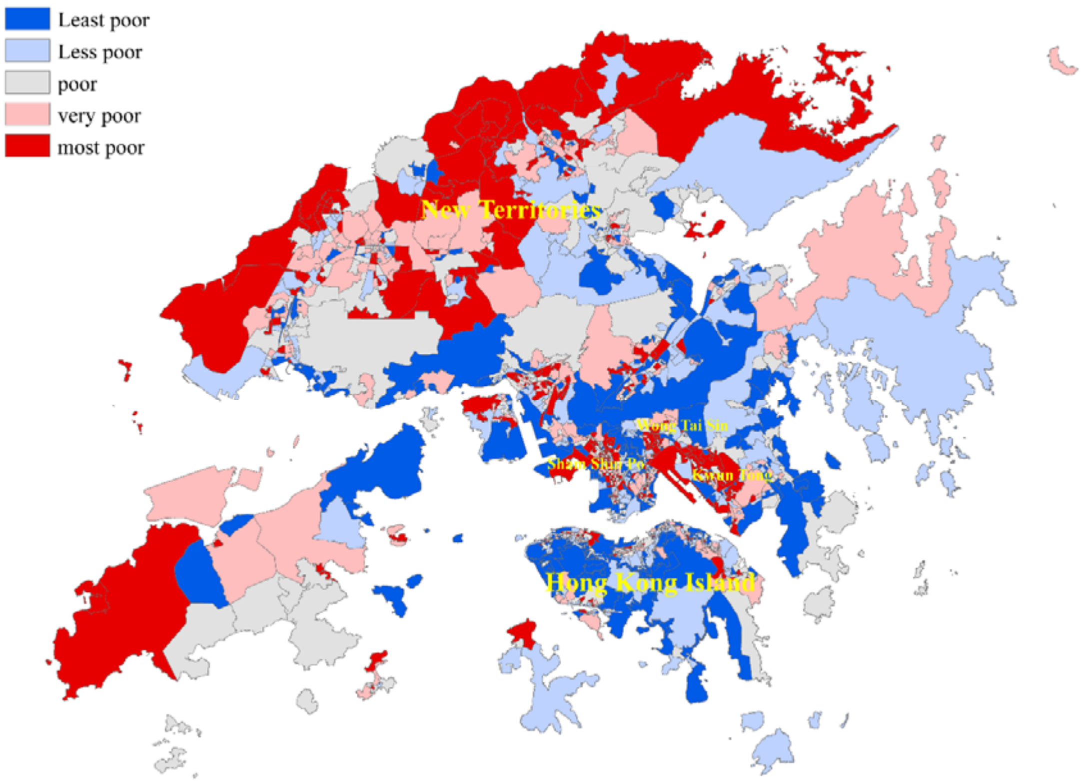


Fig.1 Spatial distribution of neighborhood poverty in Hong Kong by quintile (based on 2011 census data)

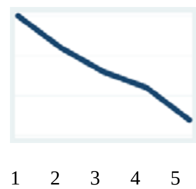
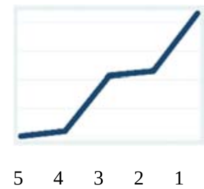
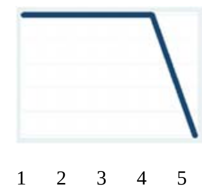
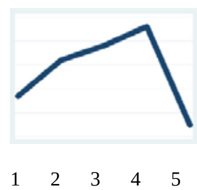
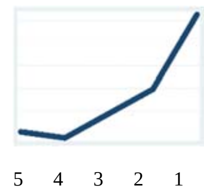
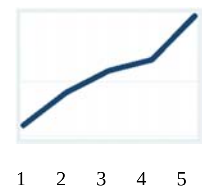
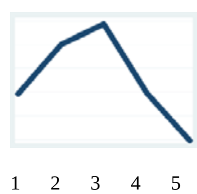
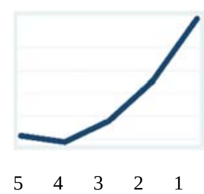
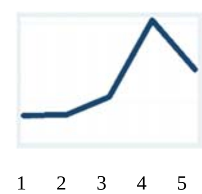
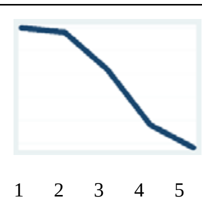
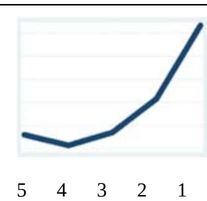
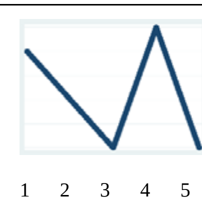
Table 1 Descriptive data of the quintiles of neighborhood poverty

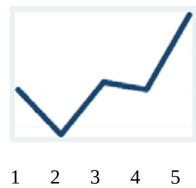
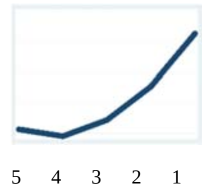
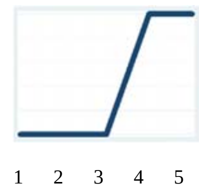
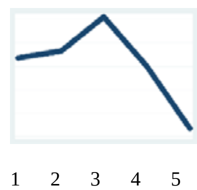
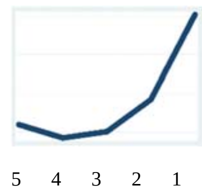
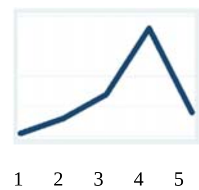
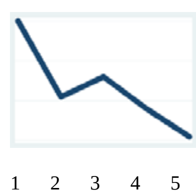
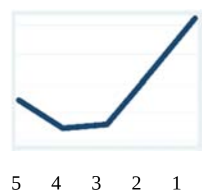
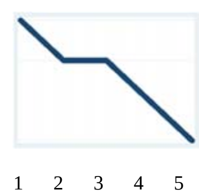
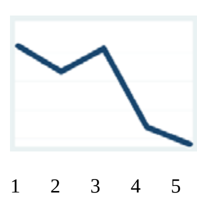
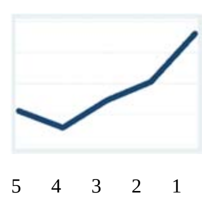
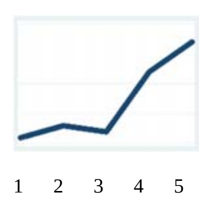
	Quintiles of neighborhood poverty				
	1 (least poor)	**2**	**3**	**4**	**5 (poorest)**
Number of people	1,027,591	1,133,959	1,186,917	1,573,051	1,894,644
Number of neighborhoods	324	324	324	324	324
Neighborhood poverty rates (range)	0.00%-5.13%	5.14%-10.22%	10.23%-15.75%	15.76%-23.72%	23.73%-55.70%

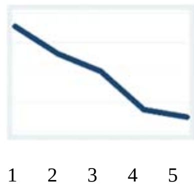
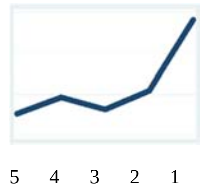
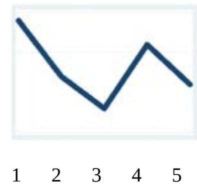
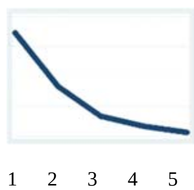
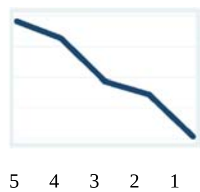
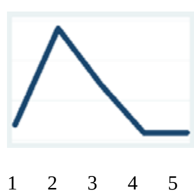
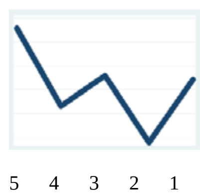
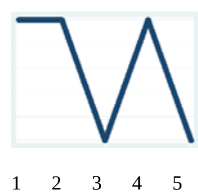
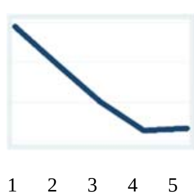
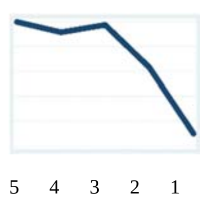
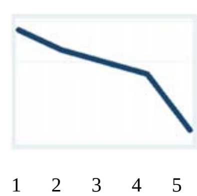
Table 2 shows detailed results of the various associations between poverty quntiles and each of the three accessibility indicators by type of services and indicator. Table 3 summarizes the patterns of associations (i.e. pro-rich, pro-poor, or no clear patterns) based on results shown in Table 2. As shown in Table 3, the patterns differed by the indicator used and type of services examined. In terms of the indicator used, for service-to-population ratio, 20 out of 28 types of services showed a pro-rich pattern, i.e. higher service availability in less poor neighborhoods. By contrast, 24 types of services showed a pro-poor pattern based on the road-network distance indicator, i.e. a shorter distance by road to the nearest service in poorer neighborhoods. The 2SFCA index tended to show no strong evidence for an association between spatial accessibility and poverty quintiles – 14 out of 28 types of services yielded "no clear pattern". In terms of the type of services examined, consistency in the associations across the three spatial accessibility indicators was found only for three types of services - a pro-poor pattern for self-study rooms (in the culture and entertainment services category) and a pro-rich pattern for swimming pools and tennis courts (both in the physical activity and sports services category). Some weak consistency, i.e. two indicators showing the same direction of associations with the third indicator showing no clear association, was found for the following seven types of services – two of the three indicators showed a "pro-poor pattern" for five types of services, i.e. clinics/health centers/dispensaries in the health-care services category, cooked food stalls in the food services category, kindergartens in the education services category, family service centers in the exchange services, and libraries in the culture and entertainment services category; two of the three indicators showed a "pro-rich pattern" for two types of services, i.e. bowling greens in the physical activity and sports services category and car parks in the transport services category. For other types of services a contradictory pattern was commonly found, mainly a pro-rich pattern based on service-to-population ratio and a pro-poor pattern according to the road-network distance indicator.

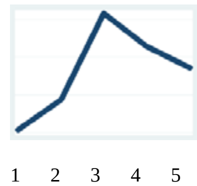
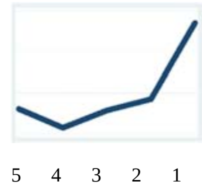
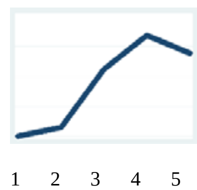
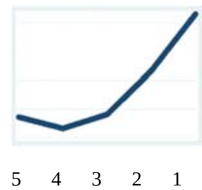
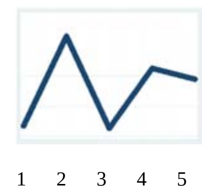
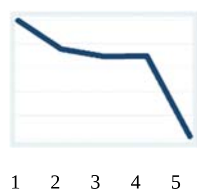
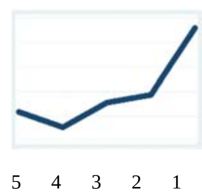
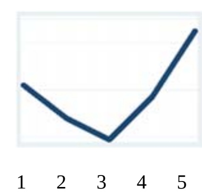
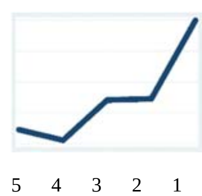
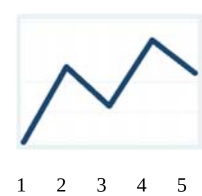
Table 2 Quintiles of neighborhood poverty: number of each service (N); percentage of total services (%); number of each service per 1,000 of the population (higher values indicate better access); median road-network distance (in meters) to the nearest service (higher values indicate poorer access; the x axis of the graphs was reversed for ease of comparison with the other two spatial accessibility indicators); median 2SFCA index (higher values indicate better access)

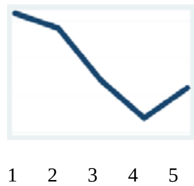
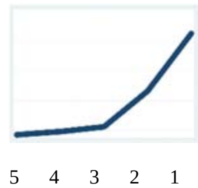
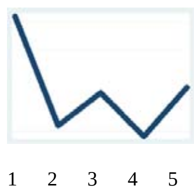
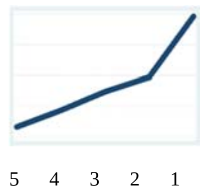
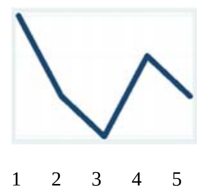
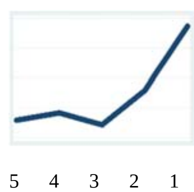
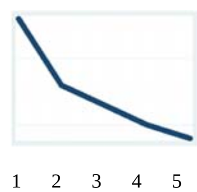
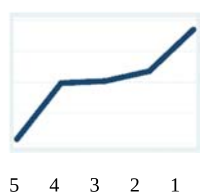
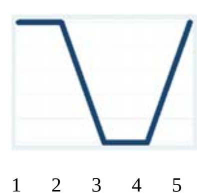
Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population	Median road-network distance (meters to nearest service)	Median 2SFCA index
A.						
Hospitals	**1 – Least poor**	15	30.0	0.015	2,013	0.007

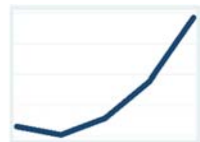
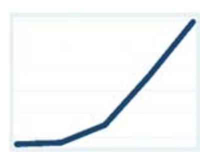
Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population		Median road-network distance (meters to nearest service)		Median 2SFCA index	
	2	13	26.0	0.011		1,829		0.007	
	3	9	18.0	0.008		1,814		0.007	
	4	10	20.0	0.006		1,621		0.007	
	5 – Poorest	3	6.0	0.002		1,603		0.006	
	Total	50	100.0	0.007		1,771		0.007	
	***p* value of chi²/median test**[a]			$p = 0.001$		$p = 0.024$		$p = 0.066$	
	Correlation coefficient[b]			-1.000		-1.000		-0.707	
	(*p* value)			($p< 0.001$)		($p < 0.001$)		($p = 0.182$)	
Clinics/health centers/dispensaries	**1 – Least poor**	48	126.5	0.047		1,028		0.051	
	2	70	18.2	0.062		697		0.054	
	3	81	21.0	0.068		589		0.056	
	4	119	30.9	0.076		480		0.057	
	5 – Poorest	67	17.4	0.035		507		0.061	
	Total	385	100.0	0.056		644		0.056	
	***p* value of chi²/median test**[a]			$p < 0.001$		$p < 0.001$		$p = 0.057$	
	Correlation coefficient[b]			0.000		-0.900		1.000	
	(*p* value)			($p = 1.000$)		($p = 0.037$)		($p< 0.001$)	
Homes for the elderly	**1 – Least poor**	71	9.3	0.793		828		0.882	
	2	137	18.0	1.000		557		0.883	
	3	176	23.2	1.086		381		0.906	
	4	187	24.6	0.796		289		1.004	
	5 – Poorest	189	24.9	0.595		316		0.941	
	Total	760	100.0	0.808		454		0.922	
	***p* value of chi²/median test**[a]			$p < 0.001$		$p < 0.001$		$p = 0.005$	
	Correlation coefficient[b]			-0.300		-0.900		0.900	
	(*p* value)			($p = 0.624$)		($p = 0.037$)		($p = 0.037$)	
B.									
Supermarkets	**1 – Least poor**	108	17.4	0.105		516		0.103	
	2	118	19.0	0.104		358		0.101	
	3	114	18.4	0.096		286		0.099	
	4	132	21.3	0.084		258		0.104	
	5 – Poorest	149	24.0	0.079		281		0.099	
	Total	621	100.0	0.091		323		0.102	
	***p* value of chi²/median test**[a]			$p = 0.068$		$p < 0.001$		$p = 0.619$	
	Correlation coefficient[b]			-1.000		-0.900		-0.308	
	(P value)			($p < 0.001$)		($p = 0.037$)		($p = 0.614$)	
Cooked food stalls	**1 – Least poor**	15	12.9	0.015		1,260		0.017	
	2	10	8.6	0.009		911		0.017	
	3	19	16.4	0.016		689		0.017	

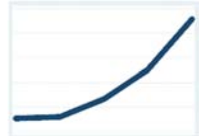
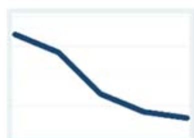
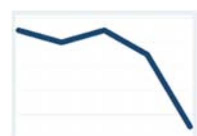
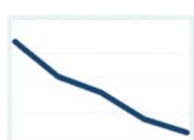
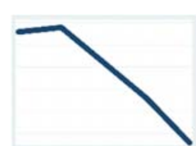
Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population	Median road-network distance (meters to nearest service)	Median 2SFCA index
	4	24	20.7	0.015 	582 	0.018 
	5 – Poorest	48	41.4	0.025	626	0.018
	Total	116	100.0	0.017	814	0.017
	p **value of chi²/median test**[a]			$p = 0.012$	$p < 0.001$	$p = 0.210$
	Correlation coefficient[b]			0.667	-0.900	0.866
	(*p* value)			($p = 0.219$)	($p = 0.037$)	($p = 0.058$)
Convenience stores	**1 – Least poor**	213	16.0	0.207 	503 	0.181 
	2	241	18.1	0.213	285	0.186
	3	287	21.5	0.242	202	0.194
	4	315	23.6	0.200	186	0.216
	5 – Poorest	278	20.8	0.147	220	0.188
	Total	1,334	100.0	0.196	263	0.193
	p **value of chi²/median test**[a]			$p < 0.001$	$p < 0.001$	$p = 0.278$
	Correlation coefficient[b]			-0.600	-0.700	0.700
	(*p* value)			($p = 0.285$)	($p = 0.188$)	($p = 0.188$)
C.						
Indoor games halls/recreation centers/sports centers	**1 – Least poor**	41	28.3	0.040 	1,024 	0.022 
	2	24	16.6	0.021	840	0.021
	3	31	21.4	0.026	661	0.021
	4	28	19.3	0.018	648	0.020
	5 – Poorest	21	14.5	0.011	745	0.019
	Total	145	100.0	0.021	762	0.020
	p **value of chi²/median test**[a]			$p < 0.001$	$p < 0.001$	$p = 0.006$
	Correlation coefficient[b]			-0.900	-0.700	-0.975
	(*p* value)			($p = 0.037$)	($p = 0.188$)	($p = 0.005$)
Sports grounds	**1 – Least poor**	272	17.4	0.265 	481 	0.091 
	2	280	17.9	0.247	403	0.093
	3	312	20.0	0.263	373	0.092
	4	327	20.9	0.208	329	0.102
	5 – Poorest	372	23.8	0.196	356	0.107
	Total	1,563	100.0	0.229	379	0.097
	p **value of chi²/median test**[a]			$p < 0.001$	$p < 0.001$	$p = 0.023$
	Correlation coefficient[b]			-0.900	-0.900	0.900
	(*p* value)			($p = 0.037$)	($p = 0.037$)	($p = 0.037$)
	1 – Least poor	285	22.9	0.277	391	0.194

Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population	Median road-network distance (meters to nearest service)	Median 2SFCA index
Public gardens/parks	**2**	262	21.1	0.231 	305 	0.187 
	3	240	19.3	0.202	282	0.183
	4	217	17.5	0.138	297	0.191
	5 – Poorest	238	19.2	0.126	277	0.186
	Total	1,242	100.0	0.182	305	0.187
	***p* value of chi²/median test[a]**			$p < 0.001$	$p = 0.005$	$p = 0.550$
	Correlation coefficient[b]			-1.000	-0.900	-0.500
	(*p* value)			($p < 0.001$)	($p = 0.037$)	($p = 0.391$)
Swimming pools	**1 – Least poor**	356	50.6	0.346 	410 	0.103 
	2	188	26.7	0.166	547	0.094
	3	81	11.5	0.068	589	0.095
	4	53	7.5	0.034	728	0.087
	5 – Poorest	25	3.6	0.013	783	0.072
	Total	703	100.0	0.103	613	0.087
	***p* value of chi²/median test[a]**			$p< 0.001$	$p< 0.001$	$p < 0.001$
	Correlation coefficient[b]			-1.000	1.000	-0.900
	(*p* value)			($p < 0.001$)	($p < 0.001$)	($p= 0.038$)
Bowling greens	**1 – Least poor**	2	7.1	0.002 	3,485 	0.001 
	2	16	57.1	0.014	2,957	0.001
	3	8	28.6	0.007	3,517	0.000
	4	1	3.6	0.001	3,261	0.001
	5 – Poorest	1	3.6	0.001	3,916	0.000
	Total	28	100.0	0.004	3,470	0.001
	***p* value of chi²/median test[a]**			$p < 0.001$	$p= 0.125$	$p< 0.001$
	Correlation coefficient[b]			-0.667	0.500	-0.577
	(*p* value)			($p = 0.219$)	($p = 0.391$)	($p= 0.308$)
Tennis courts	**1 – Least poor**	297	39.9	0.289 	675 	0.108 
	2	219	29.4	0.193	808	0.103
	3	119	16.0	0.100	894	0.100
	4	46	6.2	0.029	879	0.097
	5 – Poorest	64	8.6	0.034	900	0.083
	Total	745	100.0	0.109	833	0.098
	***p* value of chi²/median test[a]**			$p < 0.001$	$p = 0.013$	$p < 0.001$
	Correlation coefficient[b]			-0.900	0.900	-1.000
	(*p* value)			($p = 0.037$)	($p = 0.037$)	($p < 0.001$)
D.						
Child-care centers	**1 – Least poor**	71	21.1	1.208	771	1.463
	2	66	19.6	1.287	586	1.554

Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population	Median road-network distance (meters to nearest service)	Median 2SFCA index
	3	60	17.9	1.515 	558 	1.465 
	4	64	19.0	1.427	516	1.482
	5 – Poorest	75	22.3	1.371	562	1.438
	Total	336	100.0	1.348	582	1.473
	***p* value of chi²/median test[a]**			$p = 0.727$	$p < 0.001$	$p = 0.137$
	Correlation coefficient[b]			0.600	-0.700	-0.300
	(*p* value)			(p= 0.284)	(p = 0.188)	(p = 0.624)
Kindergartens	**1 – Least poor**	177	18.6	3.011 	465 	3.835 
	2	162	17.0	3.158	366	4.132
	3	163	17.1	4.117	291	3.827
	4	210	22.1	4.683	266	4.026
	5 – Poorest	240	25.2	4.388	286	3.990
	Total	952	100.0	3.820	318	3.963
	***p* value of chi²/median test[a]**			$p < 0.001$	$p < 0.001$	$p = 0.236$
	Correlation coefficient[b]			0.900	-0.900	0.100
	(*p* value)			(p = 0.037)	(p = 0.037)	(p = 0.873)
Primary schools	**1 – Least poor**	113	19.9	1.098 	579 	1.082 
	2	100	17.6	1.039	444	1.068
	3	90	15.8	1.023	428	1.059
	4	116	20.4	1.024	378	1.077
	5 – Poorest	149	26.2	0.857	409	1.105
	Total	568	100.0	0.989	440	1.075
	***p* value of chi²/median test[a]**			$p = 0.312$	$p < 0.001$	$p = 0.747$
	Correlation coefficient[b]			-0.900	-0.900	0.300
	(*p* value)			(p = 0.037)	(p = 0.037)	(p = 0.624)
Secondary schools	**1 – Least poor**	119	21.1	1.060 	650 	0.770 
	2	98	17.4	0.831	523	0.795
	3	105	18.7	0.867	521	0.782
	4	101	17.9	0.597	456	0.804
	5 – Poorest	140	24.9	0.598	473	0.793
	Total	563	100.0	0.746	518	0.791
	***p* value of chi²/median test[a]**			$p < 0.001$	$p = 0.003$	$p = 0.973$
	Correlation coefficient[b]			-0.800	-0.900	0.500
	(*p* value)			(p = 0.104)	(p = 0.037)	(p = 0.391)
E.						
Fire stations	**1 – Least poor**	27	22.0	0.026	1,229	0.018
	2	27	22.0	0.024	1,034	0.017
	3	20	16.3	0.017	913	0.017

Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population		Median road-network distance (meters to nearest service)		Median 2SFCA index	
	4	19	15.4	0.012		897		0.017	
	5 – Poorest	30	24.4	0.016		886		0.016	
	Total	123	100.0	0.018		976		0.017	
	***p* value of chi²/median test[a]**			$p = 0.047$		$p < 0.001$		$p = 0.351$	
	Correlation coefficient[b]			-0.900		-1.000		-0.894	
	(*p* value)			($p = 0.037$)		($p < 0.001$)		($p = 0.041$)	
Police stations/police posts	**1 – Least poor**	37	25.3	0.036		1,393		0.017	
	2	18	12.3	0.016		1,196		0.015	
	3	26	17.8	0.022		1,150		0.014	
	4	22	25.1	0.014		1,089		0.016	
	5 – Poorest	43	29.5	0.023		1,035		0.015	
	Total	146	100.0	0.021		1,152		0.015	
	***p* value of chi²/median test[a]**			$p = 0.003$		$p = 0.015$		$p = 0.344$	
	Correlation coefficient[b]			-0.300		-1.000		-0.359	
	(*p* value)			($p = 0.624$)		($p < 0.001$)		($p = 0.553$)	
F.									
Post offices/post boxes	**1 – Least poor**	258	23.7	0.251		295		0.171	
	2	190	17.5	0.168		252		0.161	
	3	201	18.5	0.169		229		0.158	
	4	201	18.5	0.128		237		0.155	
	5 – Poorest	237	21.8	0.125		232		0..153	
	Total	1,087	100.0	0.159		251		0.158	
	***p* value of chi²/median test[a]**			$p < 0.001$		$p = 0.001$		$p = 0.015$	
	Correlation coefficient[b]			-0.900		-0.700		-1.000	
	(*p* value)			($p = 0.037$)		($p = 0.188$)		($p < 0.001$)	
Associations/clubs/societies	**1 – Least poor**	22	22.7	0.021		1,941		0.010	
	2	16	16.5	0.014		1,673		0.010	
	3	17	17.5	0.014		1,609		0.009	
	4	19	19.6	0.012		1,596		0.009	
	5 – Poorest	23	23.7	0.012		1,233		0.010	
	Total	97	100.0	0.014		1,622		0.010	
	***p* value of chi²/median test[a]**			$p = 0.307$		$p = 0.016$		$p = 0.642$	
	Correlation coefficient[b]			-0.949		-1.000		-0.289	
	(*p* value)			($p = 0.014$)		($p < 0.001$)		($p = 0.638$)	
Community	**1 – Least poor**	53	10.2	0.052		756		0.070	
	2	53	10.2	0.047		579		0.071	

Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population		Median road-network distance (meters to nearest service)		Median 2SFCA index	
centers/rur	**3**	80	15.4	0.067		463		0.071	
al	**4**	153	29.4	0.097		364		0.071	
committees	**5 – Poorest**	181	34.8	0.096		380		0.067	
/youth	**Total**	520	100.0	0.076		481		0.070	
/welfare					1 2 3 4 5		5 4 3 2 1		1 2 3 4 5
centers/co	***p* value of chi^2/median test[a]**			$p < 0.001$		$p < 0.001$		$p = 0.049$	
mmunity	**Correlation coefficient[b]**			0.800		-0.900		-0.224	
services	**(*p* value)**			($p = 0.104$)		($p = 0.037$)		($p = 0.718$)	
Family	**1 – Least poor**	5	7.9	0.005		1,571		0.009	
service	**2**	5	7.9	0.004		1,158		0.009	
centers	**3**	10	15.9	0.008		921		0.009	
	4	19	30.2	0.012		813		0.009	
	5 – Poorest	24	38.1	0.013	1 2 3 4 5	866	5 4 3 2 1	0.009	1 2 3 4 5
	Total	63	100.0	0.009		1,052		0.009	
	***p* value of chi^2/median test[a]**			$p = 0.065$		$p < 0.001$		$p = 0.363$	
	Correlation coefficient[b]			0.900		-0.900		0.000	
	(*p* value)			($p = 0.037$)		($p = 0.037$)		($p = 0.742$)	
G.									
Museums,	**1 – Least poor**	84	38.9	0.082		1,304		0.022	
art	**2**	43	19.9	0.038		1,033		0.022	
galleries/ex	**3**	41	19.0	0.035		939		0.021	
hibition	**4**	20	9.3	0.013		1,069		0.017	
centers,	**5 – Poorest**	28	13.0	0.015	1 2 3 4 5	1,140	5 4 3 2 1	0.016	1 2 3 4 5
performin	**Total**	216	100.0	0.032		1,091		0.018	
g arts	***p* value of chi^2/median test[a]**			$p < 0.001$		$p = 0.001$		$p < 0.001$	
centers	**Correlation coefficient[b]**			-0.900		-0.100		-0.975	
	(*p* value)			($p = 0.035$)		($p = 0.873$)		($p = 0.005$)	
Libraries	**1 – Least poor**	19	10.7	0.018		897		0.021	
	2	21	11.9	0.019		781		0.022	
	3	33	18.6	0.028		677		0.022	
	4	49	27.7	0.031		639		0.021	
	5 – Poorest	55	31.1	0.029	1 2 3 4 5	636	5 4 3 2 1	0.022	1 2 3 4 5
	Total	177	100.0	0.026		722		0.021	
	***p* value of chi^2/median test[a]**			$p = 0.131$		$p < 0.001$		$p = 0.960$	
	Correlation coefficient[b]			0.900		-1.000		0.289	
	(*p* value)			($p = 0.037$)		($p = 0.019$)		($p = 0.638$)	
Self-study	**1 – Least poor**	25	10.9	0.024		958		0.027	
rooms	**2**	23	10.0	0.020		754		0.028	
	3	28	12.2	0.024		635		0.028	

Services	Quintiles of neighborhood poverty	n	%	Number of services per 1,000 of the population		Median road-network distance (meters to nearest service)		Median 2SFCA index	
	4	74	32.3	0.047		562		0.030	
	5 – Poorest	79	34.5	0.042		556		0.030	
					1 2 3 4 5		5 4 3 2 1		1 2 3 4 5
	Total	229	100.0	0.034		649		0.029	
	***p* value of chi²/median test**[a]			$p < 0.001$		$p < 0.001$		$p = 0.124$	
	Correlation coefficient[b]			0.718		-1.000		0.949	
	(*p* value)			($p = 0.172$)		($p < 0.001$)		($p = 0.014$)	
Theatres and cinemas	**1 – Least poor**	17	32.1	0.017		2,077		0.007	
	2	16	30.2	0.014		1,829		0.007	
	3	8	15.1	0.007		1,737		0.007	
	4	6	11.3	0.004		1,761		0.008	
	5 – Poorest	6	11.3	0.003	1 2 3 4 5	1,755	5 4 3 2 1	0.008	1 2 3 4 5
	Total	53	100.0	0.008		1,853		0.007	
	***p* value of chi²/median test**[a]			$p < 0.001$		$p = 0.029$		$p = 0.125$	
	Correlation coefficient[b]			-1.000		-0.700		0.867	
	(*p* value)			($p < 0.001$)		($p = 0.188$)		($p = 0.058$)	
H.									
Bus termini/Green Minibus termini/light rail stations	**1 – Least poor**	232	23.2	0.226		495		0.135	
	2	170	17.0	0.150		410		0.134	
	3	173	17.3	0.146		361		0.135	
	4	193	19.3	0.123		381		0.133	
	5 – Poorest	233	23.3	0.123	1 2 3 4 5	386	5 4 3 2 1	0.127	1 2 3 4 5
	Total	1,001	100.0	0.147		403		0.132	
	***p* value of chi²/median test**[a]			*p*		$p = 0.002$		$p = 0.032$	
	Correlation coefficient[b]			-0.975		-0.600		-0.821	
	(*p* value)			($p = 0.005$)		($p = 0.285$)		($p = 0.089$)	
Car parks	**1 – Least poor**	451	26.9	0.439		263		0.253	
	2	365	21.8	0.322		257		0.254	
	3	320	19.1	0.270		225		0.246	
	4	283	16.9	0.180		256		0.238	
	5 – Poorest	258	15.4	0.136	1 2 3 4 5	279	5 4 3 2 1	0.228	1 2 3 4 5
	Total	1,677	100.0	0.246		259		0.241	
	***p* value of chi²/median test**[a]			$p < 0.001$		$p = 0.189$		$p < 0.001$	
	Correlation coefficient[b]			-1.000		0.100		-0.900	
	(*p* value)			($p < 0.001$)		($p = 0.873$)		($p = 0.037$)	

[a] Chi-square or median test with the null hypothesis that there is no difference in the values of the spatial accessibility indicators across the quintiles of neighborhood poverty.

[b] Spearman's correlation coefficient for the correlation between neighborhood poverty quintile and spatial accessibility indicator.

Table 3 Pro-rich, pro-poor, or no clear patterns in the spatial accessibility of 28 types of services across the quintiles of neighborhood poverty according to three spatial accessibility indicators (number of services per 1,000 of the population, median road-network distance, and median 2SFCA index). 2SFCA index: two-step floating catchment area method index.

Services	Pattern based on number of service locations per 1,000 of the population	Pattern based on median road network distance (shortest distance by road to nearest service)	Pattern based on median 2SFCA index
A. Health-care services			
Hospitals	pro-rich	pro-poor	no clear pattern
Clinics/health centers/dispensaries	no clear pattern	pro-poor	pro-poor
Homes for the elderly	pro-rich	pro-poor	pro-poor
B. Food services			
Supermarkets	pro-rich	pro-poor	no clear pattern
Cooked food stalls	pro-poor	pro-poor	no clear pattern
Convenience stores	pro-rich	pro-poor	no clear pattern
C. Physical activity and sports services			
Indoor games halls/recreation centers/sports centers	pro-rich	pro-poor	pro-rich
Sports grounds	pro-rich	pro-poor	pro-poor
Public gardens/parks	pro-rich	pro-poor	no clear pattern
Swimming pools	**pro-rich**	**pro-rich**	**pro-rich**
Bowling greens	pro-rich	no clear pattern	pro-rich
Tennis courts	**pro-rich**	**pro-rich**	**pro-rich**
D. Education services			
Child-care centers	no clear pattern	pro-poor	no clear pattern
Kindergartens	pro-poor	pro-poor	no clear pattern
Primary schools	pro-rich	pro-poor	no clear pattern
Secondary schools	pro-rich	pro-poor	no clear pattern
E. Emergency services			
Fire stations	pro-rich	pro-poor	pro-rich
Police stations/police posts	pro-rich	pro-poor	no clear pattern
F. Exchange services			
Post offices/post boxes	pro-rich	pro-poor	pro-rich
Associations/clubs/societies	pro-rich	pro-poor	no clear pattern
Community centers/rural committees/youth /welfare centers/community services	pro-poor	pro-poor	pro-rich

Services	Pattern based on number of service locations per 1,000 of the population	Pattern based on median road network distance (shortest distance by road to nearest service)	Pattern based on median 2SFCA index
Family service centers	pro-poor	pro-poor	no clear pattern
G. Culture and entertainment services			
Museums/art galleries/exhibition centers/performing arts centers	pro-rich	pro-poor	pro-rich
Libraries	pro-poor	pro-poor	no clear pattern
Self-study rooms	**pro-poor**	**pro-poor**	**pro-poor**
Theatre and cinemas	pro-rich	pro-poor	no clear pattern
H. Transport services			
Bus termini/Green Minibus termini/light rail stations	pro-rich	pro-poor	pro-rich
Car parks	pro-rich	no clear pattern	pro-rich

4. Discussion

4.1 Main findings

In this study, we investigated whether poorer areas had poorer access to a wide range of services, including health and social services, in Hong Kong. We used three different spatial accessibility indicators to examine the access to 28 different types of services across 1,620 neighborhoods grouped into poverty quintiles based on local poverty rates. The results show that the patterns differed by the indicator used and type of services examined. The service-to-population ratio tended to yield a “pro-rich pattern”, i.e. higher service availability in less poor neighborhoods, but the road-network distance indicator tended to yield a “pro-poor pattern”, i.e. a shorter distance by road to the nearest service in poorer neighborhoods; in contrast, the 2SFCA index yielded patterns that were less consistent across different types of services. Consistency in the associations across the three accessibility indicators was found only for a few types of services, e.g. a “pro-poor pattern” for self-study rooms and a “pro-rich pattern” for swimming pools and tennis courts. The distribution of services in Hong Kong did not always supports the deprivation amplification theory, i.e. poorer areas are more deprived of resources.

4.2 Difference in findings by spatial accessibility indicator

Most of previous studies (Block et al. 2004; Giles-Corti and Donovan 2002; Morland et al. 2002; Pearce et al. 2007; Zenk et al. 2005) focused on only one aspect of spatial accessibility, either the availability indicator (e.g. service-to-population ratio) or the accessibility indicator (e.g. distance to nearest service), but this may be insufficient within the high-density context and complex residential pattern of Hong Kong. Ottensmann (1994) suggested that capturing only one aspect of spatial accessibility may overgeneralize the spatial distribution of services, leading to misguided policy making, as different indicator captures different aspect of spatial accessibility. In our study, the container indicator (availability) tended to show a “pro-rich pattern” across the neighborhoods of different poverty quintiles, yet the road-network indicator (accessibility) tended to show a “pro-poor pattern”; in contrast, the demand-supply buffer indicator (combining availability and accessibility) yielded less-consistent patterns and weaker evidence of a difference in spatial accessibility between neighborhoods of different poverty levels. One possible explanation for this finding is related to the unique context of Hong Kong: the services examined may tend to be located in richer areas, contributing to the “pro-rich pattern” according to the container indicator; however the highly densely populated poorer areas (e.g., those with public housing) are immediately adjacent to these richer areas and therefore geographically close to the services located therein (Fujita 2016), and this may have contributed to the “pro-poor pattern” according to the road-network indicator. At the same time, the demand-supply buffer indicator is a rather mixed indicator and produces a mixed picture, showing only weak associations between spatial accessibility and the poverty quintiles. In a recent study from Hong Kong, Kandt et al. (Kandt 2016) showed that an area factor, “centrality” (shorter distances to facilities), was associated with increased mortality, in accordance with our finding of a "pro-poor pattern" of spatial accessibility based on the road-network indicator if poverty would be associated with mortality. In our study, a consistent pattern across the three spatial accessibility indicators was found only for three types of services. The inconsistent findings across different indicators suggest that, in future research into spatial accessibility and poverty, the choice of spatial accessibility indicators should be carefully considered, as should the context in which these indicators are utilized and being understood. Moreover, future studies should investigate residents' service use patterns and attempts should be made to better understand how to properly determine spatial accessibility.

4.3 Difference in findings by type of services

Our results also suggest that the spatial accessibility patterns varied by the type of services studied; this tallies with the differentiated model of Macintyre et al. (2008), according to which some resources are equally accessible to the rich and the poor, some are easier to access in deprived areas, and some are easier to access in richer areas. For health-care services, our results do not support the "inverse care law" (Hart 1971; Fiscella 2005). This may be related to the fact that the Government has played an important role in the provision of health services in Hong Kong and the market is not completely determined by the private sector. Over 85% of the hospital services are provided by the Government owned Hospital Authority. The provision of the medical and health services are very much related to the number of residents in the district with no consideration to their income level. Hence, some kinds of health-care services—namely, clinics/health centers/dispensaries—are better supplied in poorer populated areas. With regard to food-related services, we found—as have some Western studies (Block et al. 2004; Burns and Inglis 2007; Holsten 2009)—that cooked food stalls are easier to access in poorer, densely populated areas. However, no clear patterns in the spatial accessibility of supermarkets and convenience stores were identified. For physical activity and sports services, the trend toward a “pro-rich pattern” is clearer than other types of services. Some sports facilities such as swimming pools and tennis courts are usually available in private building blocks in Hong Kong, and such services are commonly lacking in poorer areas. For certain types of services supplied by the government such as family service centers, libraries, and self-study rooms, they are not lacking in poorer areas, and this may be contributable to the effort of the Hong Kong Government to provide additional support for disadvantaged areas. However, current governmental policies concerning the allocation of services in Hong Kong are generally based on distribution of population, while the demographic/socioeconomic characteristics of a district’s population are not commonly considered.

4.4 Strengths and limitations

To the best of our knowledge, this study is among the first to systematically examine, in a non-Western setting, access to a variety of services—including health and social services—across neighborhoods with different poverty levels. Three spatial accessibility indicators were used to enable us to conduct a more comprehensive analysis of the spatial accessibility of services than only one or two indicators would have allowed. However, the study has several limitations. First, we have focused on spatial accessibility of services and did not measure non-spatial aspects of access to services, such as affordability, acceptability and accommodation. Second, we focus on “potential” access to services and did not measure “realized” access to services. For example, people might not use the services within or close to their residential area: they may more frequently use services that are near their place of work or their children’s schools. There is evidence that, for some types of services, people more often use those closer to their place of residence (for example, when purchasing food, engaging in educational activities, and using health services); for other types of services (for example, when purchasing nonfood items and using social support services) most people use services farther away from their place of residence (Matthews 2005). Third, although we tried to use an advanced demand-supply buffer indicator to avoid the “container problem” (which stems from assuming that all services are contained in a target area), there still remains the geographic-scale issue: the choice of geographic scale may influence the research findings. In our analysis, we used the LSB as our basic geographic unit and assumed that all the residents in one target LSB are concentrated at the centroid. Moreover, following previous studies, we used 2,500m as the radius when calculating the demand-supply buffer indicator (Donkin 1999; Winkler et al. 2006); however, although a radius of 2,500m may be appropriate in some Western cities, it may not be appropriate for Hong Kong, it being a very densely populated city that is well-served by public transport. A longer radius might be more appropriate as Hong Kong residents are willing to, or often do, travel farther to make use of services than their Western counterparts.

4.5 Implications

Access to services plays a significant role in ensuring well-being of community (Sallis 2016; Larson et al. 2009; Kaczynski and Henderson 2008; Papas et al. 2007; Ford and Dzewaltowski 2008; Moore et al. 2008; Powell et al. 2007; Wang et al. 2007). Providing service based on residential location is essential and a matter of public policy. It has been widely adopted by some researchers, activists and policy makers that poorer neighborhoods were more likely to lack services. However, policies simply based on the deprivation amplification model may be misguided if based on poor empirical information (Macintyre 2007). Our data from Hong Kong suggest that it may not always be true that poorer neighborhoods have poorer access to services. The associations of spatial accessibility with the poverty quintiles varied by the type of services and spatial accessibility indicator. The findings support Lineberry's ecological hypothesis that the spatial distribution of services is complex (Lineberry 1977). Urban policies should be based on service-specific and indicator-specific empirical evidence for the distribution of neighborhood services.

4.6 Conclusion

Out data did not yield poverty-spatial accessibility patterns consistent with the deprivation amplification hypothesis: in Hong Kong, spatial accessibility of services is not always poorer in poorer areas. Although our study has some limitations, our results have clear implications concerning the formulation of new, evidence-based, context-specific, and service-specific theories upon which urban policymaking should be based. Future studies should further investigate spatial accessibility of specific types of services, using various spatial accessibility indicators, and should relate such spatial accessibility of various wellbeing outcomes across different contexts.

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