AIDS and the City: Exploring the Spatial Characteristics of HIV/AIDS Pandemic in Nairobi, Kenya

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Abstract: Globally, the HIV/AIDS prevalence rates have been higher in the urban areas. The cities, especially in fast urbanizing Sub-Saharan Africa, present conditions that influence the spatial characteristics of health including that of HIV/AIDS. Comprised of migrants from varying socio-cultural backgrounds, and having spatially diverse socio-economic characteristics, the cities are bound to have spatial patterns of the HIV/AIDS epidemic that are as heterogeneous as those at the global, continental, and country levels. This paper reports an endeavour to understand the spatial characteristics of the epidemic through a case study of people living with HIV/AIDS (PLWHA) in Nairobi, Kenya. The study, through a questionnaire survey on PLWHA, established that the AIDS pandemic within the city of Nairobi is spatially heterogeneous. Most of the PLWHA in the study resided in the densely populated administrative locations of the city. These locations are also characterised by high density of people living below the urban poverty line, unhygienic environment, and insecurity. However, the availability of affordable basic living necessities, and the presence of medical, financial and social support, among other reasons, makes these areas the only feasible residential option for most of the PLWHA. Besides these factors, family reunion (and separations due to HIV/AIDS), job-search, HIV/AIDS stigma and discrimination, among other factors, are influencing the spatial distribution of PLWHA through intra-city residential movement and in-migration to Nairobi. The research suggests that addressing economic as well as medical infrastructure would be very important if other mitigation efforts in the spread of HIV are to gain sustainable effects.

Key words: spatial distribution, HIV/AIDS, PLWHA, poverty, Nairobi, Kenya

Introduction

Background

Two and a half decades have passed since the pioneering descriptions and eventual definition of the acquired immune deficiency syndrome (AIDS) in 1982. AIDS is one of the worst epidemics the world has ever experienced. According to the Joint United Nations Programme on AIDS (UNAIDS) over 25 million people have died due to AIDS since the start of the epidemic. An estimated 39.4 million people were living with the human immunodeficiency virus (HIV), 4.9 million were infected, and 2.1 million died of AIDS in 2004 (UNAIDS 2005).

The task of reversing the spread and burdens already wrought by the epidemic is an enormous global challenge that needs input from different disciplines, individuals, and organisations. The numerous factors contributing to the spread of the HIV/AIDS epidemic: migration, lifestyle, culture and behaviour, among others, call for pooling of research explanations and solutions to supplement the mitigation programmes already in place. Moreover, as the geographical patterns and impacts of the epidemic are different across the world, mitigation efforts at all feasible scales, from the global down to the local level, are very important in the control of the spread of this global pandemic.

The problem and objective

HIV/AIDS is a network disease associated with urban nodes and major transportation arteries. The diffusion of HIV, especially in sub-Saharan Africa, is largely the product of the major transportation network. The urban centres are the hubs in the network from where the epidemic

has penetrated into the rural interior. The cities and large urban centres constitute the biggest nodes and reservoirs in the diffusion process of the epidemic from where HIV, the causative agent of AIDS, has spread down the urban population hierarchy to appear in smaller settlements and rural communities (Smallman-Raynor 1995).

Cities are characterised by living conditions that shape the health of their residents in varying ways (Galea et al. 2005). These ways include population characteristics (e.g. socio-economic status and race/ethnicity), the physical urban environment, the social environment (e.g. social networks, community organization), and the service system which either meets or fails to meet the various societal and individual needs. Population concentration and the dynamic nature of the cities present conditions that influence the spatial characteristics of health, including that of HIV/AIDS, both within the cities themselves and at their interacting urban or rural counterparts Comprised of migrants from varying socio-cultural backgrounds and with diverse socio-economic characteristics, the cities are bound to have spatial patterns of the HIV/AIDS epidemic that are as heterogeneous as those displayed at the global, continental and country scales.
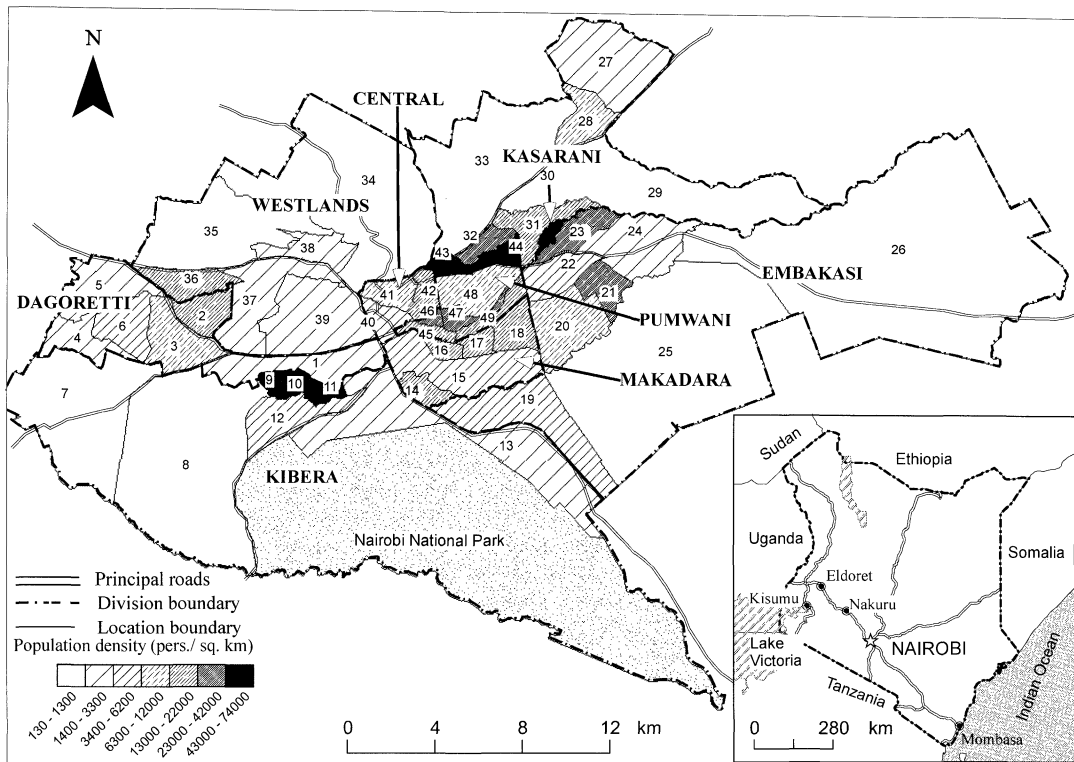
The yearly UNAIDS epidemic updates, surveillance reports, and other health surveys have revealed that HIV prevalence levels are higher in the urban areas (UNAIDS 2004; Dyson 2003). The higher prevalence rates in the urban areas of sub-Saharan Africa, which emerged in the late 1980s, are still persistent, despite the spread of the epidemic into the rural hinterland. Some studies have also found that rural areas with higher connectivity and migration patterns to urban areas have higher prevalence rates as well (Bloom et al. 2002; Tanser et al. 2000; Brockerhoff and Biddlecom 1999). Despite the acknowledgement that HIV/AIDS rates are higher in the urban areas, studies on the urban characteristics of the epidemic, especially in the fast urbanizing cities in sub-Saharan Africa, have been few. Most of the existing investigations are mainly on specific "high" risk groups or on specific risk phenomena (Hargreaves et al. 2002; Zulu et al. 2004), with little or no emphasis on the epi-

demic's geographical patterns within the urban set-up. This owes much to the adoption of the UNAIDS-recommended surveillance system, targeted for measuring HIV infection trends in countries with generalised AIDS epidemics, in which all but the most rudimentary geographical markers are stripped off from HIV/AIDS surveillance data, leaving it unsuitable for local area analysis such as within a city.

The city of Nairobi, located on the main highway connecting the port city of Mombasa to western Kenya, Uganda, Rwanda, and Burundi, constitutes a very important node in the diffusion network of HIV/AIDS within Kenya and in East Africa. Understanding the spatial characteristics and dynamics of the epidemic within Nairobi would play an important step in the mitigation efforts. The objective of the research was to explore the spatial characteristics of the HIV/AIDS epidemic within the city of Nairobi, Kenya. Faced with the problem that geographical origins of the antenatal clinics (ANC) surveillance site clients are classified as either urban or rural, the research used a survey on people living with HIV/AIDS (here after referred as PLWHA) to investigate the spatial manifestation of the epidemic. The paper begins by presenting a background on the study area Nairobi highlighting the HIV/AIDS prevalence in the city in comparison with the rest of the country. Subsequently, the survey methodology adopted for the study is followed by results and analysis of the spatial distribution of PLWHA against the structure of the city. The final section gives a brief summary and conclusions drawn from the research.

Study Area

Nairobi is Kenya's principal economic and cultural centre and one of the largest and fastest growing cities in Africa. It is located at the heart of the country, mid-way along the main road and railway line linking the port city of Mombasa to the lakeside city of Kisumu (Figure 1). Nairobi has a population of about three million (2006 estimate) with population density varying from as low as 500 people per square kilometre in the high-income administrative locations to as high as 74,000 people per square kilometre in the low-

Figure 1. Map of the city of Nairobi. The map shows the eight administrative divisions and population density at the location administrative level. The inset shows the location of the city within Kenya.

Location names

1: Kenyatta/GolfCourse	2:Kawangware	3:Riruta	4:Mutuini	5:Uthiru/Ruthimitu	6:Waithaka	7:Karen
8: Langata	9: Sera Ngombe	10: Kibera	11:Laini Saba	12: Mugumoini	13: Nairobi West	14: Mukuru Nyayo
15: Viwandani	16: Makongeni	17:Maringo	18:Makadara	19:Mukuru Nyayo	20:Umoja	21:Kayole
22:Kariobangi South	23:Dandora	24:Njiru	25:Embakasi	26:Ruai	27:Kahawa	28:Githurai
29:Kasarani	30:Korogocho	31:Kariobangi	32:Ruaraka	33:Roysambu	34:Highridge	35:Kitsuru
36:Kangemi	37:Lavington	38:Parklands	39:Kilimani	40:Starehe	41:Ngara	42:Kariokor
43:Mathare	44:Huruma	45:Kamukunji	46:Pumwani	47:Eastleigh South	48:Eastleigh North	49: Bahati

The history of HIV/AIDS epidemic in Nairobi is as old as the epidemic itself in Kenya. The first case of AIDS in Kenya, diagnosed in 1984, was a Nairobi resident. Seroprevalence tests soon after confirmed that HIV had already spread in the prostitute community in the city (Kreiss et al. 1986). Systematic surveillance of HIV prevalence in the country through testing of pregnant women attending selected antenatal clinics since 1990 indicates a persistent epidemic despite the mitigation efforts in Kenya being coordinated from the city (see Figure 2). In 2003, Nairobi had an estimated 130,000 HIV-infected adults (National AIDS and STD Control Programme (NASCOP)/Ministry of Health 2005). This was the third highest among eight provinces, and a third of the total estimated urban HIV-positive persons in the country. With Nairobi being the smallest among the provinces, it has the highest concentration of people living with HIV/AIDS. However, their spatial distribution and living conditions within the city remain unknown.

Nairobi is the leading destination of migrants in Kenya (Figure 3). It attracts migrant labourers, job seekers and sexually active adults from across the whole country, as well as a considerable number of international migrants (Obudho 1997). According to the 1999 population census, nearly 70% of Nairobi residents were born out-
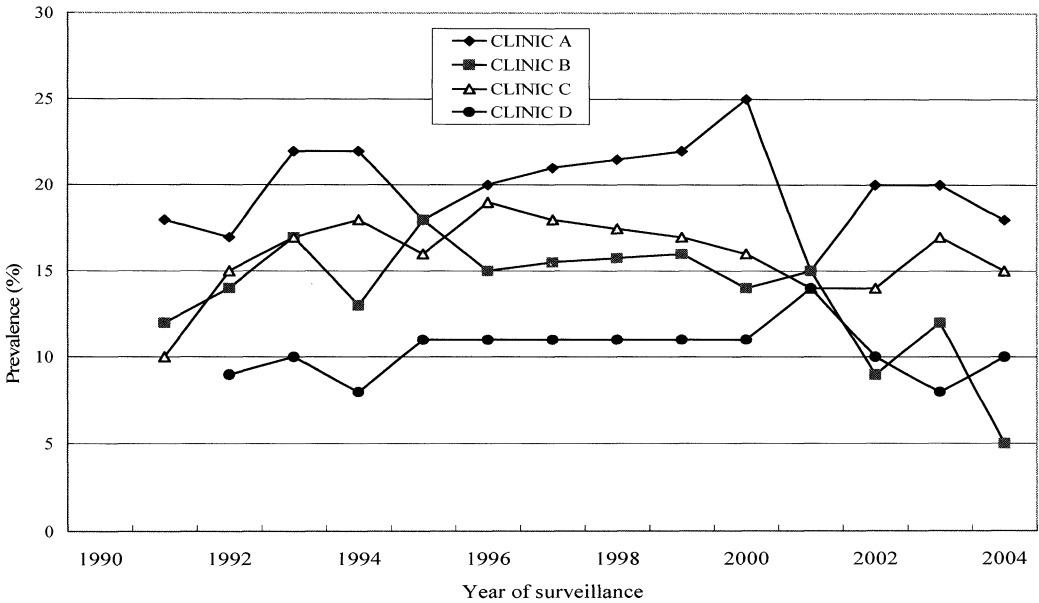
income locations.

Figure 2.   HIV prevalence trends for the four surveillance clinics in Nairobi.
            Note: Data values for 1997 and 1998 are by linear-interpolation.
            Source: National AIDS and STD Control Programme (NASCOP)/ Ministry of Health (2005).
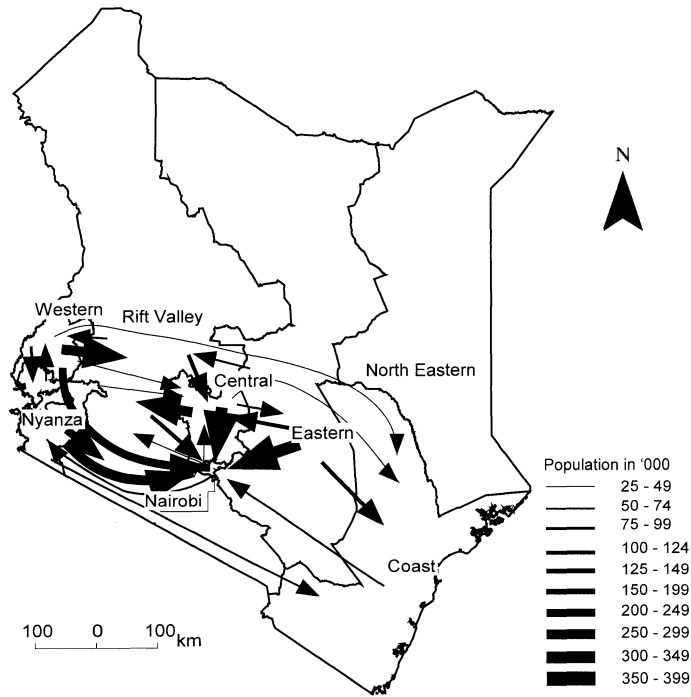

Figure 3.   Inter-province migration in Kenya, 1999. Nairobi is the leading migrant destination.
            Note: The map shows migration of 25,000 people and above.
            Source: Kenya, Central Bureau of Statistics (2004).

side the city, 17% of whom had migrated within the previous year. Circular and split migration, a unique characteristic of the urban-rural migration in Kenya, where migrants maintain two households (one urban and the other rural), dominates in Nairobi. Uncertainties associated with urban employment and earnings drive the household heads (usually husbands) to move first to the urban areas while the wife and family remain in the rural areas (Agesa 2004). The husband then occasionally visits the rural home, or the family visits the husband. When economically better off, the family may eventually move to the urban home. The family separation and the endless rural-urban link have serious implications in the diffusion of HIV/AIDS in the city as well as in the rural counterparts (Brockerhoff and Biddlecom 1999).

The link between urbanization, mobility, and exposure to commercial sex and partners from a variety of origins mean that Nairobi's population is very susceptible to HIV infection (Konde-Lule 1991). Understanding the dynamics of the HIV/AIDS epidemic in Nairobi is not only important for the health of the city but also for the interacting urban and rural areas. Spatial characteristic analysis is useful in identifying location-based factors, important in the mitigation of the epidemic in the city.

Methodology

This research utilized two data sources, a survey of persons living with HIV/AIDS as the primary source and the 1999 population census and poverty mapping data as the secondary source. The secondary data was used to describe the urban structure of the city, and as a background in discussing the spatial distribution characteristics of the PLWHA and other findings of the survey.

The survey method on PLWHA

The primary data used in this study were collected through a questionnaire survey in January 2005. The population of the survey are members of PLWHA groups in the city of Nairobi that had full membership status in the National Empowerment Network of People Living with HIV and AIDS in Kenya (NEPHAK), an umbrella network

of PLWHA groups in Kenya. Out of the sixteen associations within the city of Nairobi, thirteen facilitated access to 230 people living with HIV/AIDS, 88% of whom resided within the city limits.

The decision to adopt a survey on PLWHA was due to several reasons. First, the existing systematically collected prevalence data had most of its attributive information stripped off. Spatially, residential origins of the surveillance site clients are categorised very broadly as either rural or urban, rendering the data unsuitable for small area analysis. The second reason was on the assumption that the PLWHA groups drew membership from across the city, and therefore a survey of the PLWHA in these groups would form a good representation of the spatial characteristics of the HIV/AIDS epidemic. The groups also provided the best avenue for accessing the people already infected with HIV, and who could readily volunteer information.

Besides the demographic and socio-economic characteristics of the PLWHA interviewed, the research delved into factors relating to their HIV infection. The factors included the number of sexual partners, mode through which one may have contracted HIV, the 'suspected' infector (if transmission was sexual), and duration elapsed since knowledge of one's HIV positive status. Aiming to characterise the HIV/AIDS pandemic spatially, the study sought the residence of the respondents at the time of the survey and at infection, whether there had been any shift in residence, and if there was any shift, the factors influencing it. The study also sought for environmental, socio-economic as well as sociological factors characterizing the current residence of the interviewees.

Describing the spatial structure of Nairobi

Using the 1999 population census and welfare monitoring survey of 1997, the Central Bureau of Statistics of Kenya made small-area estimates for population living below the poverty line. This data, mapped at lower administrative units, are useful in depicting the heterogeneity of the population of the city of Nairobi in terms of socio-economic characteristic. Together with the 1999 population census data, the data were used to describe the spatial structure of the city at the
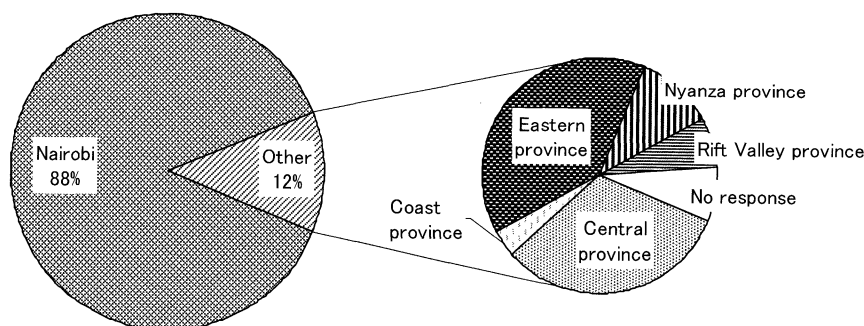
Figure 4.   Characteristic of the total respondents by province of residence (n=230).
Note: See Figure 2 for the location of the provinces.
Source: Questionnaire survey in January 2005.

location administrative boundary level.

The distribution of the PLWHA by residence at the time of the interview was overlaid onto the population density and density of population living below the urban poverty line in order to visually analyse the spatial characteristics of the HIV/AIDS epidemic in the city. Subsequently, bivariate correlation analysis facilitated to discuss further the relationship of the selected socio-economic population characteristics and the residential distribution of the PLWHA. The location, the second smallest administrative unit, was employed as the level of analysis because responses for residential addresses of the respondents could only be resolved to this unit.

Results and Discussion

General characteristics of the PLWHA

Responses from the interviewees revealed that the PLWHA support groups in Nairobi drew their membership not just from within the city extents but also from the other provinces. Out of 230 respondents interviewed, the majority (88%) were from Nairobi. However, 12% lived outside the city, in Central, Eastern, Nyanza, Rift Valley and the Coast province (Figure 4). As the focus of the research was on the spatial characteristics of the HIV/AIDS epidemic within Nairobi, the results and discussion that follow refer only to the respondents who resided within the administrative borders of the city.

Women formed the majority of the respondents (Table 1). Among those who resided within

the city borders, 145 were women while men were 57. This could be because women initiated several of the PLWHA groups and organizations contacted for the research. Sufferings brought about by stigma and discrimination, separation, and widowhood were heavier on women, and majority of them moved to the city as dependents on their husbands. The groups were a good forum for the women to cope with the stigma and sufferings, and for the advocacy and lobbying for the rights of the PLWHA in general.

The HIV/AIDS epidemic is affecting all regardless of marital status. Of the respondents, only 19% were single. Over fifty percent of the men and 25% of the women were married (Table 1). Among the women respondents, 30% were widowed in comparison to only 12% of the men. A notable percentage (22%) of the interviewed was divorced or separated, a situation that many attributed to disagreements and blame on the source of the HIV infection.

In terms of age, there were more women (28%) in lower ages (below thirty years) as compared with the men (9%). As women entered into sexual activity at an earlier age than men did, their exposure to HIV was also earlier. The majority of the PLWHA were between 30 and 39 years old, while only 7% of the group was fifty and over, an indication that HIV/AIDS affected the young and active population, and/or those infected in their late twenties and thirties never lived for long (Table 1).

The PLWHA were from a range of socio-economic backgrounds (Table 1). The majority (72%) had at least some primary or secondary-

Table 1.   General characteristics of the respondent PLWHA

| Characteristic | Category | Gender | | | | | |
| | | Male | | Female | | TOTAL | |
		Count	%	Count	%	Count	%
Marital status	single	10	17.5	28	19.3	38	18.8
	married–monogamy	29	50.9	34	23.4	63	31.2
	–polygamy	4	7.0	2	1.4	6	3.0
	divorced/separated	7	12.3	37	25.5	44	21.8
	widow/widower	7	12.3	44	30.3	51	25.2
	TOTAL	57	100.0	145	100.0	202	100.0
Age group	15–20			4	2.8	4	2.0
	21–29	5	8.8	37	25.5	42	20.8
	30–39	30	52.6	73	50.3	103	51.0
	40–49	18	31.6	21	14.5	39	19.3
	50 and over	4	7.0	10	6.9	14	6.9
	TOTAL	57	100.0	145	100.0	202	100.0
[a] Education Level	none	1	1.8	6	4.1	7	3.5
	primary school	9	15.8	67	46.2	76	37.6
	secondary/high school	24	42.1	46	31.7	70	34.7
	College	21	36.8	23	15.9	44	21.8
	University	2	3.5	3	2.1	5	2.5
	TOTAL	57	100.0	145	100.0	202	100.0
[b] Current occupation	none	6	11.1	35	25.0	41	21.1
	farming			1	0.7	1	0.5
	unskilled/semi-skilled	7	13.0	32	22.9	39	20.1
	commerce services	15	27.8	38	27.1	53	27.3
	skilled/clerical/semi-professional	16	29.6	16	11.4	32	16.5
	professional	4	7.4	3	2.1	7	3.6
	HIV/AIDS social work	6	11.1	15	10.7	21	10.8
	TOTAL	54	100.0	140	100.0	194	100.0
[c] Monthly income in Kenya shillings	None	6	11.3	35	25.0	41	21.2
	less than 5,000	18	34.0	66	47.1	84	43.5
	5,000–10,000	18	34.0	32	22.9	50	25.9
	11,000–15,000	3	5.7	3	2.1	6	3.1
	16,000–20,000	5	9.4	3	2.1	8	4.1
	more than 20,000	3	5.7	1	0.7	4	2.1
	TOTAL	53	100.0	140	100.0	193	100.0

Note:
[a] Education categories refer to the highest level of education attended.
[b] Non-respondents are excluded in the percentages.
[c] 1 USD is approximately Kenya Shillings 75.00.

level education. Fifty percent of the women had only primary and lower level of education, which implied that they could only find low-paying occupations within the city, or just live as dependents. The occupations reflected a similar pattern with 21% reporting no occupation, 20% engaged in unskilled/semi-skilled activities, 27% were in commercial activities, while only 4% were in professional careers. A notable percentage (11%) was engaged in occupations directly involving the HIV/AIDS epidemic. The HIV/AIDS-related occupations were mainly care of the

Table 2.   Mode by which the respondents contracted HIV

Marital Status	Mode by which HIV contracted						
	Heterosexual		Blood transfusion		Do not know		
		%		%		%	TOTAL
single	36	(97.3)			1	(2.7)	37
married–monogamy	60	(98.4)	1	(1.6)			61
–polygamy	5	(83.3)			1	(16.7)	6
divorced/separated	41	(93.2)			3	(6.8)	44
widow/widower	46	(92.0)	1	(2.0)	3	(6.0)	50
	188	(95.0)	2	(1.0)	8	(4.0)	198

Source: Questionnaire survey in January 2005.

affected families and orphans left by deceased parents and counselling of other PLWHA.

Asked about their monthly income, nearly two-thirds (64%) of the respondents earned less than five thousand Kenya shillings (US$ 68) per month (Table 1). The low incomes were barely enough to afford decent housing, medication, and support dependants. Most of the employed PLWHA were in very low-paid jobs, while most of those engaged in commercial activities were in petty trading that brought erratic and usually minimal returns. This implied higher vulnerability to HIV infection among low-income earners and the unemployed as compared to those with self-sufficient incomes.

Regardless of marital status, heterosexual intercourse was the major mode of HIV transmission among the respondents (Table 2). Over 90% attributed their infection to heterosexual intercourse, 2% attributed it to blood transfusion, while 8 % did not know the how they contracted HIV. Most of the respondents claimed to have obtained HIV from their spouses or close friends, with only a few claiming to have become infected from commercial sex work and casual encounters. However, 40% had had more than one partner, shedding doubt on the certainty of the infection source claims. Additionally, in a population as dynamic as that of Nairobi city, even low activity of risky behaviour is capable of maintaining a high level of HIV transmission, as noted in the stably high HIV prevalence in the city's ANC surveillance sites.

The distribution of PLWHA and the spatial structure of Nairobi

The spatial structure as defined by population density pattern, described by Kahimbaara (1986), is still dominant in Nairobi. The historical origin of Nairobi as a racially segregated urban centre continues to affect the city's population distribution structure even today (Figure 5). Divisions according to class and income replaced the old racial divisions of the city after the country's independence in 1963. The former African areas remain as low-income areas with high population densities, while new ones have grown. These former African areas include planned workers residential estates close to the industrial area and east of the central business district, and unplanned satellite townships of Kawangware, Kangemi and Riruta on the western side of the city (refer to Figure 1 for location names). Other African areas, originally squatter settlements on the periphery of the city but included in the city boundary extensions, developed unplanned along flood plains and river valleys to become large uncontrolled slums. Prominent examples are Kibera and Mathare (see Figure 1), which have grown to become some of the largest informal settlements in Nairobi. Most of the migrant job seekers, low-income workers, and informal traders, who form the majority of the city's population, are concentrated in these former African sectors (Lee-Smith and Lamba 1998).

The middle and high-income earners mainly reside in the former Asian and European sectors. These areas constitute parts of Central, West-
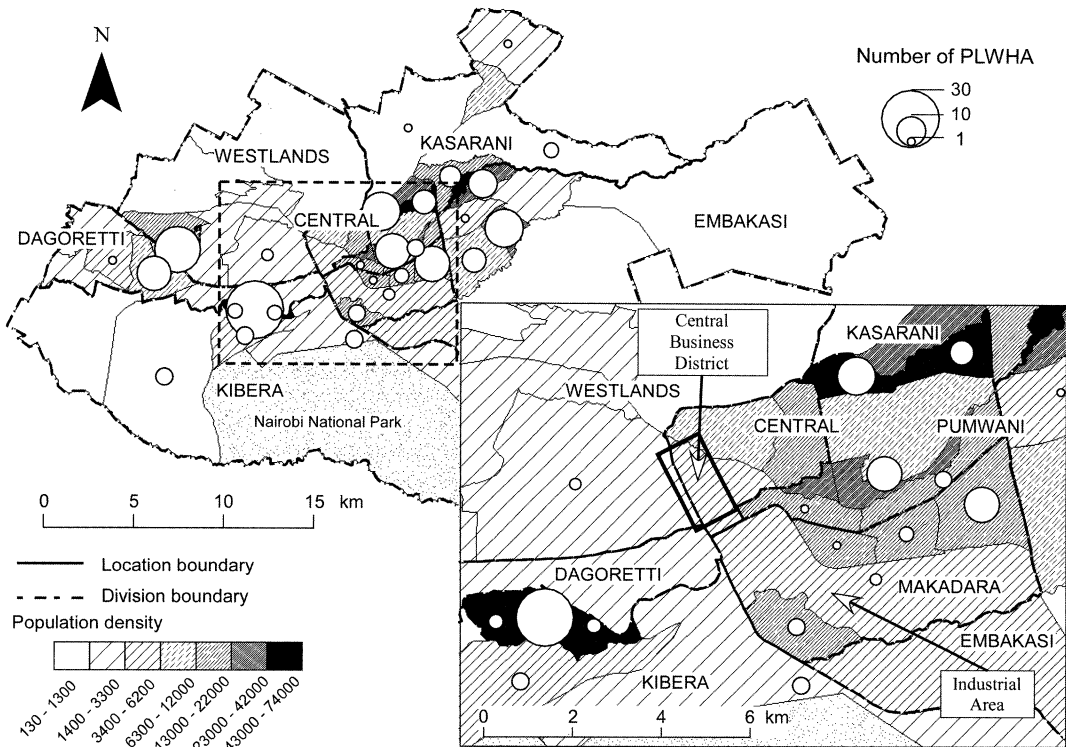
Figure 5.   Spatial distribution of the respondent PLWHA with population density.
Source: Questionnaire survey in January 2005.

lands and Dagoretti divisions. A characteristic of these areas is low population density, with a mixture of middle and high-income residential estates. Post-independent development in addition created new middle-income residential estates in the eastern part of the city in Embakasi division. While some are located in the low to medium densely populated locations such as Umoja and Embakasi locations, others are in the more-densely populated areas such as Kayole (refer to Figure 1 and Figure 5).

The residential distribution of the PLWHA at a lower and the best achievable scale from the survey responses show that the HIV/AIDS spatial pattern follows the population density structure of the city (Figure 5). Nearly 70% of the respondents resided in just eight locations. Kibera location had the highest (17%), followed by Kawangware (11%), Kayole (8%), Mathare (8%), Eastleigh South (7%), Makadara (7%), Riruta (7%) and Dandora (5%) locations (refer to Figure 1 for the location names). These locations

are not only characterised by high population density, but also by large, overcrowded informal settlements (slums) juxtaposed to well-planned residential estates.

The survey revealed the contrasting nature of the residential environs in the city of Nairobi. Clean and secure neighbourhoods are located next to dirty and insecure ones within the same administrative locations. From an open-ended inquiry, it became evident that the cost of basic Living necessitres such as rent and food was the main factor considered in describing the positive aspect of the residential neighbourhoods, followed by presence of HIV/AIDS support groups, and subsequently by presence of family and good neighbours (Figure 6). As many of the respondents had very low income, and were at various levels of HIV/AIDS infection, low cost of basic Living necessitres and availability and easy access to antiretroviral drugs were of great importance. In negative descriptions of the residential locations, environment, and security topped the
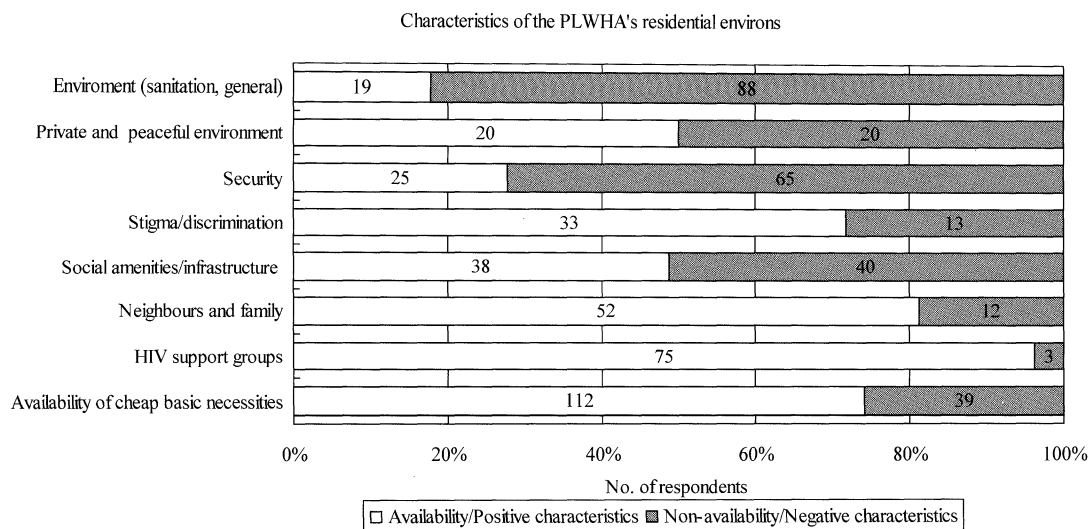
Characteristics of the PLWHA's residential environs

Enviroment (sanitation, general)	19		88		
Private and peaceful environment	20		20		
Security	25		65		
Stigma/discrimination	33			13	
Social amenities/infrastructure	38		40		
Neighbours and family	52			12	
HIV support groups	75				3
Availability of cheap basic necessities	112			39	

0%   20%   40%   60%   80%   100%

No. of respondents

☐ Availability/Positive characteristics ■ Non-availability/Negative characteristics

Figure 6. Residential characteristics of the city of Nairobi from the respondents' viewpoint and experiences.
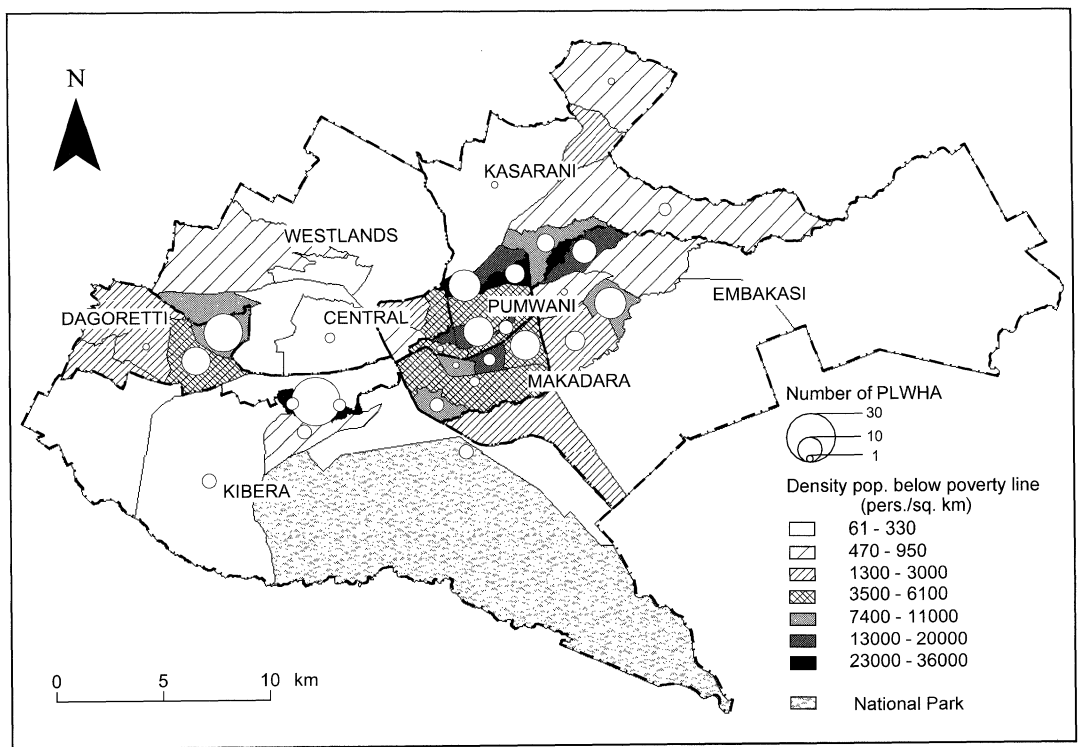Source: Questionnaire survey in January 2005.

Figure 7. Distribution of the respondent PLWHA by residential location against density of population living below the urban poverty line.
Source: Questionnaire survey in January; Poverty density data: derived from Kenya, Central Bureau of Statistics (2003).

list. For many who resided in the slum environ-
ments such as in Kibera, Mathare and Kawang-
ware locations, the presence of many non-gov-
ernmental organizations and PLWHA support
groups was a great boost to the numerous neg-
ative disadvantages of these residential areas.
Among 117 respondents, 82% described their
residential environs to be dirty and unsanitary
while only 25% of those who responded on se-
curity (90) regarded their residential locality to
be safe (Figure 6).

Poverty estimate data for 1999 from the Kenya
Central Bureau of Statistics provides another
perspective in depicting the spatial structure of
Nairobi. The density of persons living below the
urban poverty line (Ksh 2,648) follows that of
the population density. It is visually evident that
the there were more of PLWHA residing in loca-
tions characterised by high density of the urban
population living below the poverty line (Figure
7). Correlation between the residential distribu-
tion of the PLWHA and the density of population
below urban poverty line suggests that areas
with higher densities of population living below
the poverty line have higher concentration of
persons infected with HIV/AIDS (Figure 8). How-
ever, the correlation is not strong and therefore
should be interpreted in context of the method
employed to access the interviewed population.

Most of the associations drew most of their
members from residential areas close to the ven-
ues where the groups held their regular meet-
ings. Residential areas with similar risk poten-
tials and socio-economic characteristics could
have equally high number of PLWHA, but the dis-
tance to the groups' meeting venues influenced
the low membership. For example, several of the
contacted PLWHA had their regular meeting
places in Kibera, Mathare, Kawangware, and
Kayole, which explains the higher number from
these localities. However, some neighbouring lo-
cations with similar or worse socio-economic
conditions were also likely to have higher
HIV/AIDS presence, but the distance to the
PLWHA meeting venue and the interview loca-
tions could have influenced the number that
joined the association meetings and/or member-
ship. Examples are Laini Saba, and Sera Ngombe
locations that neighbour Kibera; both are char-
acterised by slums, and very high density of poor
population, but had fewer number of PLWHA
among the interviewed population. The social
networking extent could also have had an influ-
ence on the results of the survey. Persons
residing in close proximity of each other were
more likely to join the same associations, and
with most associations operating in the regions
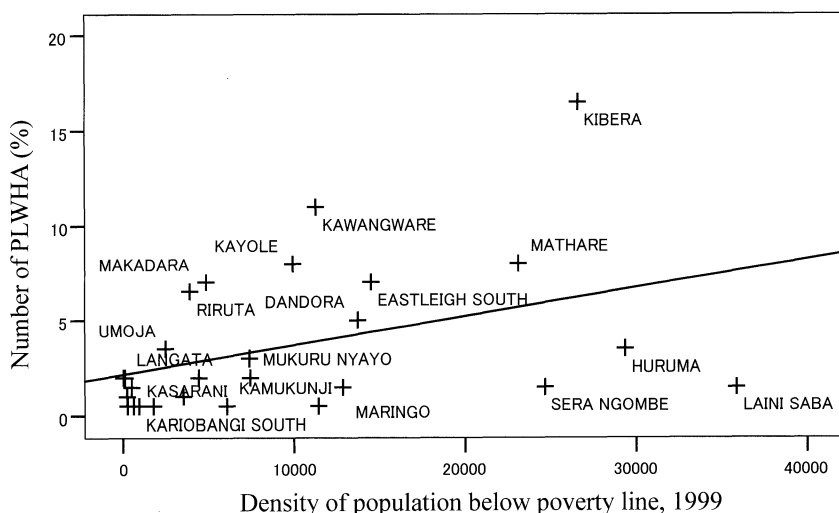with slum characteristics, Kibera, Kawangware,

Figure 8.   Number of PLWHA against density of population living below poverty line 1999 ($R^2=0.16$).
            Note: Refer to Figure 1 for the map showing the administrative locations of Nairobi.
            Source: PLWHA: Questionnaire survey in January 2005; Poverty density: derived from Kenya, Central
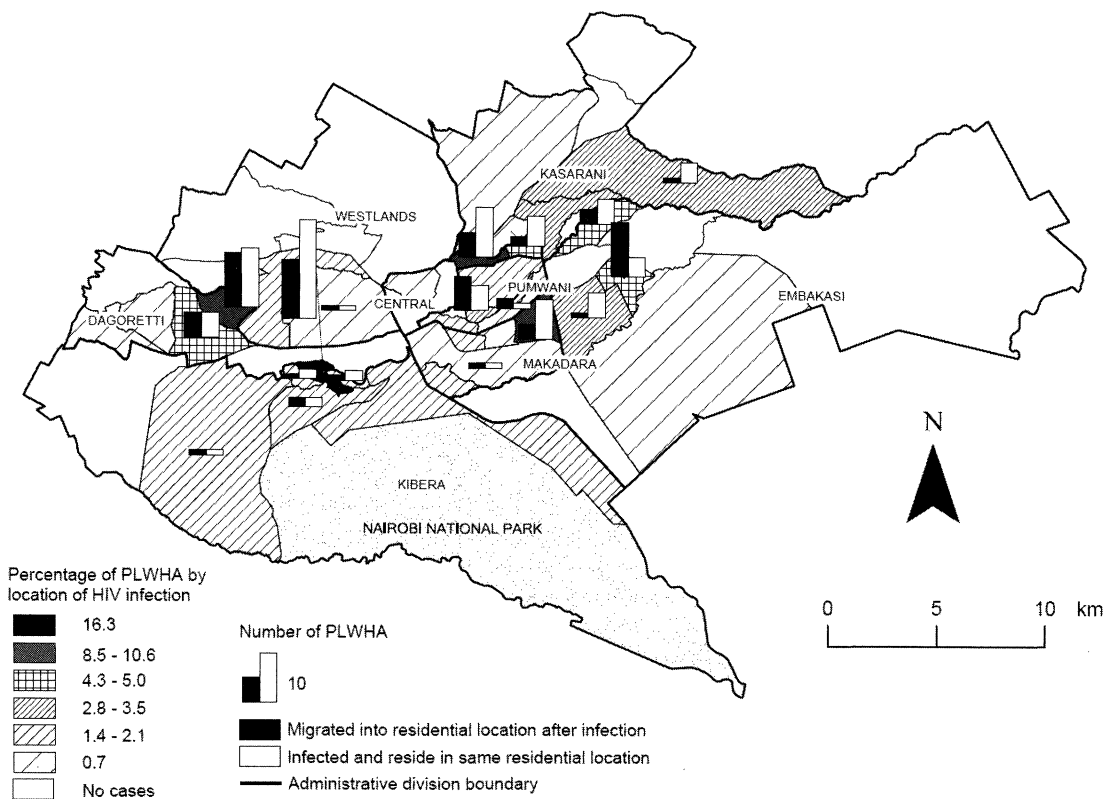   Bureau of Statistics (2003).

Figure 9. Spatial pattern of location of residence at the time of HIV infection and residential migration des-
tination of the PLWHA. Locations characterised by high infection rates are also the main resi-
dential choices for the infected in-migrants.

Note: Refer to Figure 1 for map showing the administrative locations.

Source: Questionnaire survey in January 2005.

and Mathare, the largest slums within Nairobi, were the most likely targets. However, with thirteen associations of PLWHA contacted in the survey, the manifested spatial pattern does shed light on the pattern of the epidemic within the city.

Residential migration and HIV/AIDS diffusion in Nairobi

Seeking to track the diffusion characteristic of the HIV/AIDS epidemic in the city of Nairobi, the research established that 23% of the PLWHA migrated into the city from various origins within Kenya after HIV infection. Out of 192 respondents, 60% indicated that they still resided in the same locations as at the time of HIV infection. There had been very little intra-city migra-

tions reported by the PLWHA. As Figure 9 shows, there was hardly any difference between the number of those infected in each of the locations and those infected and still resided in the same locations. However, locations exhibiting higher infection rates continued to attract higher numbers of the infected who originated mainly from outside the city.

Without separating in-migration and intra-city migration, there were several reasons that influenced residential shift (Figure 10). The costs of basic living, composed mainly of housing, food and transport, was the most notably cited factor. Family related factors such as separation and reunion influenced migration. Reunion mainly resulted when a separately living partner moved into the city, while many of the family separations were due to disagreements related to the
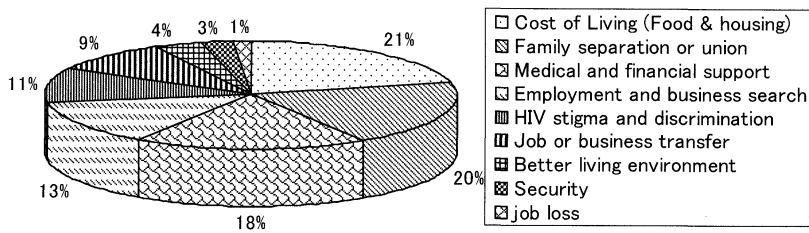
Figure 10. Factors influencing residential migration of the respondent PLWHA into and within Nairobi (n=6).
Source: Questionnaire survey in January 2005.

Table 3. Number of respondent PLWHA by frequency of visits between Nairobi and their home province

| Home province | Percentage visiting 'rural' home by number of times in an year | | | | | | | | | | | | | |
| | >12 | | 6–12 | | 2–5 | | 1 | | never | | N/A | | TOTAL | |
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
Nairobi	–	–	–	–	–	–	–	–	–	–	18	(9.1)	18	9.1
Central	3	(1.5)	2	(1.0)	9	(4.6)	19	(9.6)	7	(3.6)	–	–	40	20.3
Coast	–	–	–	–	1	(5)	3	(1.5)	2	(1.0)	–	–	6	3.0
Eastern	4	(2.0)	2	(1.0)	8	(4.1)	5	(2.5)	9	(4.6)	–	–	28	14.2
North Eastern	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nyanza	1	(0.5)	1	(0.5)	33	(16.8)	19	(9.6)	8	(4.1)	–	–	62	31.5
Rift Valley	1	(0.5)	–	–	5	(2.5)	2	(1.0)	2	(1.0)	–	–	10	5.1
Western	1	(0.5)	1	(0.5)	15	(7.6)	9	(4.6)	5	(2.5)	–	–	31	15.7
Outside Kenya	–	–	–	–	1	(0.5)	–	–	1	(0.5)	–	–	2	1.0
Total	10	(5.1)	6	(3.0)	72	(36.5)	57	(28.9)	34	(17.3)	18	(9.1)	197	100

Note: Values in brackets are percentage of the total respondents.
Source: Questionnaire survey in January 2005.

origin of HIV/AIDS among the couples. Seeking medical and financial assistance, job-hunting, and running from HIV/AIDS-related stigma and discrimination constituted other important factors compelling residential shift, and thus influencing the spatial pattern of the HIV/AIDS within the city.

Though the rate of migration within the city was low, and the main influence on the spatial patterns of the PLWHA was mainly from in-migrants from outside the city, circular migration characterised by frequent visits to the 'rural' home provinces was also reported. Out of 197 respondents, 90% had a second home besides the residence in the city (Table 1), with 80% of them making home visits at least once in a year. Split households, where the wife and children resided in the rural homes, increased the necessity of the visits between the urban and rural areas. Most of the visits were during the festive seasons in April and December; periods usually marked with revelry and increased risks of HIV infection and other sexually transmitted infections. The phenomenon of circular migration was likely to influence the spatial patterns in the country as well as in the city depending on the frequency of migration and the HIV prevalence at the ends of the migration chain. For example out of 62 of the respondents whose 'rural' home was in Nyanza province, which has had the highest HIV prevalence level in Kenya, 33 of them visited the rural home between 2 to 5 times in a year (Table 3).

Conclusion

This paper began by noting that there is notable geographical disparity in the HIV/AIDS epidemic at all scales, from the global, regional, and country levels. The lack of detailed data in the existing surveillance system used for countries with generalised HIV/AIDS epidemic limits its applicability in spatial analysis, especially within small areas such as the cities in Sub-Saharan Africa. The cities, characterised by heterogeneous spatial structure are bound to influence the geographical characteristics of health including that of the HIV/AIDS epidemic. With the aim of understanding the spatial pattern of the HIV/AIDS epidemic, the study revealed that there is notable spatial heterogeneity in the distribution of PLWHA in the city of Nairobi, Kenya.

Except for factors such as stigma and discrimination, and presence of HIV/AIDS support groups that may be specific to the PLWHA respordents, other factors such as costs of basic living and job search are major driving forces influencing migration to the city. With migration to the city still high, and factors leading to infection of HIV not checked, the epidemic in the city of Nairobi may continue to be as high as it has been since the 1990s. The positive correlation of the PLWHA distribution with population density and poverty incidence indicates a relationship between poverty and population concentration in which there are higher risks of infection in the poor densely- populated regions of the city than in the richer areas.

The research, by utilizing a survey methodology on people with HIV/AIDS registered in self-help groups, assumed that the PLWHA form a good spatial representation of the HIV/AIDS epidemic in the city of Nairobi. However, there may be bias in the membership of the associations as most are mainly forums for financial assistance; therefore, there is likelihood of the well-off PLWHA not seeking membership. The concentration of the PLWHA associations in the deprived sections of the city may also influence the membership patterns. Nonetheless, as it is widely accepted that there is a link between HIV/AIDS and poverty (Agyei-Mensah 2006), the membership to the PLWHA associations forms a good starting point in analysing the spatial characteristics of the HIV/AIDS epidemic in regions with no detailed HIV surveillance data such as in the city of Nairobi.

With 70% of the respondent PLWHA residing in just eight locations, this implies that though factors influencing HIV infections may be present across the city, some neighbourhoods have higher risks due to the concentration of vulnerable populations. In highlighting the spatial distribution characteristics of the PLWHA against Nairobi's urban structure, the research brings to light the various factors such as overcrowding, unemployment, and poverty that need to be addressded in order for other mitigation efforts such as abstinence and use of condoms to bear sustainable results.

Improvements in economic resources of the city residents could reduce the concentration of vulnerable populations in poor neighbourhoods, which could in turn have an effect in reducing the risks of HIV infection. Improvements in medical infrastructure as well, especially in the rural areas, can reduce also the migration of PLWHA into the city as they search for medical and financial support. Improved incomes among the urban migrants will help to reduce split households as the incomes can support whole household in the city. This will lower the risks of infections among couples and reduce the necessity and frequency of 'rural' visits, which in turn will reduce the rate of HIV diffusion between the urban and rural areas.

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