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A Mathematical Concept of Assessing the Social Class Basis of Transmission of HIV Segregation

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Abstract: The purpose of this study is to describe a conceptual approach suitable for spatially analysing the spread of an infectious disease. This study focuses on the development of an index to measures HIV segregation as the degree of departure from an even residential distribution of population of HIV carriers/AIDS sufferers as a minority and non HIV carriers/AIDS sufferer's population as a majority in a city or country. The study concludes that the method of indirect standardisation examines the relationship between D and E (D) to determine the degree to which HIV/AIDS group segregation can be attributed to social class, by correlation expected and actual numbers of HIV/AIDS members across tracts.

Key words: Mathemetical, concept of assessing, social class, transmission, segrigation, AIDS, HIV

INTRODUCTION

The common scientific approaches to the reasoning of problems are mathematical reasoning or statistical reasoning. Mathematical or formal reasoning is mostly deductive, in that one reasons from general assumptions to specifics using mathematical logic and axioms for multi criteria decision-making (Oluwoye, 1997, 2001). Thus, this study will be based on the principles of applied research which attempt to use existing knowledge as an aid to the solution of some given problem or sets of problems. When considering the problem of predicting the rates of HIV infection, it is important to factor in the geographic dimensions that have been totally ignored due to ignorance and an undue concern for confidentiality (Oluwoye, 2001, 2006). Furthermore, the HIV/AIDS epidemic jumps from city to city in hierarchical diffusion and then spreads out by spatially contagious diffusion from regional epicentres into the surrounding country side (Oluwoye, 2007).

The purpose of this study is to describe a conceptual approach suitable for spatially analysing the spread of an infectious disease. The description is focused on the study of spread of HIV/AIDS. For the purposes of this paper the expression "infected persons" will refer to persons either HIV positive or suffering AIDS symptoms (Oluwoye, 2002). The application of the conceptual approach to specific studies will require closer definition of what constitutes an infected person, but this is not the focus of the current work.

This study focus on the development of an index to measures HIV segregation as the degree of departure from an even residential distribution of population of infected persons versus the majority non-infected population by city or country.

CONCEPTUAL FRAMEWORK

Local mal-distribution of infected persons may be quantified as the difference between the numbers of infected persons in a given locality, given the total population of infected in the whole population.

Conceptually, the proportion of infected persons to non-infected persons in a city, represents the relative proportion of HIV/AIDS that would have to exchange tracts with non-carriers and sufferers to achieve evenness For example, if infected population was evenly distributed throughout the census tracts of a city the expected numbers of infected persons in any of locality j =1 to m tracts, would be:

$$E(I_j) = qP_j$$

Where

$E(I_j)$: Is the expected number of infected persons in locality j,
q : Is the city-wide proportion of the population already infected,
P_j : Is population of locality j

The number of infected persons from within the locality required to exchange residences with non-infected

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persons from outside of the locality in order to achieve evenness would thus equal:

$$I^*\text{-}qP^*$$

Where

I^* : Is total populations of infected persons in a locality

P^* : Is total population in the locality

However, $I_j > E(I_j)$ i.e., those in which infected carriers are overrepresented. When Segregation is at a maximum,

$I^*\text{-}qP^*$ reduces to (I. NI)/P

Where, NI is Non-infected persons

The index of dissimilarity represents the ratio of these two values

$$D = \frac{I^* - qP^*}{(I \cdot NI/P)} \quad (1)$$

Where

D = Index of dissimilarity

In practice, the index is usually obtained from the following computational formula:

$$D = \frac{1}{2}\sum_{i=1}^{m}\left|\frac{I_j}{I} - \frac{NI_j}{NI}\right| \quad (2)$$

However, even if there were no discrimination in urban housing markets, an even residential distribution on infected and non-infected persons would not be expected. These groups of people obviously differ with respect to socioeconomic status.

If infected and non-infected persons are cross-tabulated by socioeconomic status within census tracts, the effect of social context (social behaviour) can be controlled directly by computing the index of dissimilarity within socioeconomic strata:

$$D_1 = \left(I_i^* - q_i P_i^*\right) \Big/ \left(\frac{I_i . NI}{P_i}\right) \quad (3)$$

Where $q_i = \sum_{j-1}^{m} I_{ij}^* \Big/ \sum_{j=1}^{m} P_{ij}$

I_i^* and P_i are the infected persons and total populations in stratum I within those tracts

Where

$$E(I_i) = \sum_{j=1}^{n} q_i P_{ij}$$

This direct standardisation procedure provides an appropriate test of the assimilation hypothesis that HIV/AIDS segregation varies inversely with increasing social class.

Specifically, by assuming an even distribution of infected and non-infected persons within social classes, but allowing segregation between classes, the expected number of infected persons in track j becomes

$$E(I_i) = \sum_{j=1}^{n} q_i P_{ij}$$

for I = 1 to n social class.

This expectation yields an index of dissimilarity conditioned by social class

$$D^1 = \left(I^* - \sum_{i=1}^{n} q_i P_j^*\right) \Big/ \left(\frac{I \cdot NI}{P}\right) \quad (4)$$

Where HA* and P* again refer to number of HIV/AIDS carriers and total populations in those tracts where

$$I_j > E(I_j)$$

This index states the degree of segregation not attributable to social class. The degree of segregation expected on the basis of social class alone can be computed as a residual

$$E(D) = D - D^1 \quad (5)$$

or it can be calculated directly from the expected distributions of infected and non-infected persons among tracts:

$$E(D) = \frac{1}{2}\sum_{j=i}^{M}\left|\frac{\sum_{j=1}^{a} q_i P_{ij}}{I} - \frac{\sum_{j=1}^{n}(1-q_i)P_{ij}}{NI}\right| \quad (6)$$

RECOMMENDATIONS

It is recommended that the development of an index to measures HIV segregation would serve as basis for designing housing for people with AIDS with all amenities including rooms for nursing and treatment for the purpose of minimize their impact on the local area.

CONCLUSION

The method of indirect standardisation discussed in this study examines the relationship between D and E (D)

to determine the degree to which HIV/AIDS group segregation can be attributed to social class, either by correlation expected and actual numbers of infected persons across tracts.

REFERENCES

Oluwoye, J., 2002. Managing AIDS-Mapping can mitigate the scourge of Africa. Au. Geographic Infor. Sys. Applied J., IS User, 49: 54-55.

Oluwoye, J., 2007. Land Transport and HIV Vulnerability: A Conceptual Framework of Vulnerability of Road Users, Road and Environment, Published in Res. J. Med. Sci., 1: 9-12.

Oluwoye, J., 1997. 'Seldom-Do' models approach for multiple criteria decision-making in environmental design management. 13th International Conference on Multiple Criteria Decision Making (MCDM), pp: 43.

Oluwoye, J.O., 2001. Spatial interaction and social-behaviour of HIV transmission. In Applicable Mathematics- Its Perspective's and Challenges, Part V, Edited by JC Misra, Narosa Publishing House New Delhi, India, pp: 399-406.

Oluwoye, J.O., 2006. Application of Statistical Methodology and Model Design to Socio-Behaviour of HIV Transmission". Chapter in Biomathematics (Eds.) J.C. Misra Published by World Scientific.