The Integration of Geospatial Data Into the Surveillance and Management of HIV/AIDS in Cameroon

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ABSTRACT

In Cameroon, as in other Sub-Saharan African countries, HIV/AIDS is a leading cause of morbidity and mortality, with an estimated 1,000,000 HIV infections and an increasing seroprevalence. There is no coordinated approach to HIV/AIDS interventions in Cameroon, which tend to be unevenly distributed, and often localised and isolated. Integrating spatial data is central to a coordinated and targeted response to combating the epidemic.

In Part One of this thesis, the current situation of HIV/AIDS in Cameroon is examined. Issues including the genesis and amplification of the virus amongst humans, as well as over space and time, are examined. Within the context of HIV/AIDS, the thesis also discussed the adequacy of health service provision and access in Cameroon. The concepts of equity and equality in accessibility are examined within the prevailing socio-economic and cultural factors in Cameroon. Current HIV/AIDS intervention policies in Cameroon are examined, including the creation of the National Committee to Fight AIDS, information campaigns and the development and adoption of a National HIV/AIDS Strategic Plan. The weaknesses inherent in the current intervention approach strongly support the case for the integration of a geospatial approach into the surveillance and management of HIV/AIDS in Cameroon.

The benefits of spatial data in the surveillance of HIV/AIDS are demonstrated in three case studies. First, Geographic Information System (GIS) analytical techniques are used to investigate geographic patterns of HIV-1 infection among 8,452 pregnant women screened at 24 health clinics in the Northwest Province of Cameroon between February 2000 and June 2002. Individual-level HIV-1 infection and community of residence data from the Cameroon
Baptist Convention Health Board Program for the Prevention of Mother-to-Child HIV Transmission (PMTCT) were geoconferenced with the corresponding spatial data. ESRI ArcView 3.2, ArcGIS, and TerraSeer’s SpaceStat software were used. Empirical Bayesian (EB) smoothing techniques were used to stabilize small-area estimates.

Spatial analysis by 24 subdivisions showed HIV-1 prevalence rates between 3.5% and 16.8% in the Northwest Province. Using EB smoothing methods, 55% of the subdivisions fell within 2% of the smoothed mean (±0.3%). A broad arc-shaped geographic pattern of relatively high HIV-1 prevalence was found, adjoinning the most important ring road and trading centers in the Province. Small-area analysis by village showed a number of ‘hot-spots’ with HIV-1 prevalence at 20% or higher. Incorporation of geospatial analysis into the PMTCT program demonstrated residential areas in need of enhanced prevention and HIV clinical care services.

In the second case study, GIS techniques are used to examine the concordance between the location of HIV/AIDS preventive and care services and the population. There are significant variations in the geographic accessibility of HIV/AIDS preventive and care services in the Northwest Province of Cameroon, with over 60% of the population being located more than 5 km from preventive and care services in the Northwest Province. Finally, the Mindistance model within GIS is used to optimise health service location in order to maximise health service coverage of the population in the Northwest Province of Cameroon. This analysis shows a significant difference in population coverage between the existing and optimized facilities, with an increase of 17,000 people located within 5 km of preventive and care services under the optimized model. In addition, to identifying potential location sites, the
optimal location of PMTCT facilities has also reduced the cost (distance) of accessibility to preventive and care services in the study area by 25%.

In mostly rural Sub-Saharan Africa, spatial HIV/AIDS analysis is an innovative and useful approach to identifying high-risk areas of HIV transmission among the population attending health clinics. Integration of spatial HIV data and small-area PMTCT service data allows for targeted allocation of scarce prevention and care resources to those communities in greatest need. In addition to improved research and data analysis, micro-level analysis makes it possible to track seropositives and their networks for prevention and care.