

Mapping HIV prevalence in Africa for a better understanding of epidemics: example from Burkina Faso using 2003 Demographic and Health Survey data



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Backgrounds

Since 2001, several Demographic and Health Surveys (DHS) include HIV testing. For many countries, in particular in sub-Saharan Africa, DHS are the only national source of data in general population. Several DHS collect latitude and longitude of surveyed clusters but the sampling method is not appropriate to derive local estimates: sample size is not large enough for a direct spatial interpolation.

We developed a generic approach to map spatial regional trends of HIV prevalence from DHS. We present how our results from Burkina Faso 2003 DHS shed new light on HIV epidemics.

DHS simulation and model country

To test our methodology, we elaborated a model country where it was possible to simulate DHS and to compare epidemic of the model and reconstituted epidemic.

In addition, 14 000 DHS were simulated in order to determine the best smoothing parameters depending on the total number of tested persons and national prevalence.

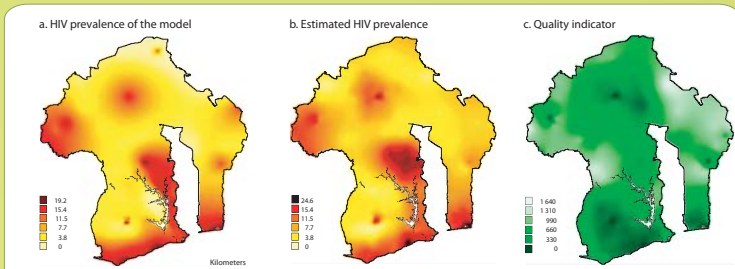


Figure 1 represents HIV prevalence in the model before DHS simulation. In this example, national prevalence was fixed to 10%. Figure b shows estimated prevalence using our approach on data from a DHS simulation (8000 tested persons). Figure c represents a quality indicator calculated for the estimation on figure b. A smaller value of this indicator corresponds to a better estimation (more precise and more accurate).

Results

The map produced by applying our method on Burkina Faso 2003 DHS is coherent with the knowledge we had of HIV epidemic in this country. Prevalence is higher in main cities and small cities along main roads (similar results were observed in the beginning of 90's).

The region around Diebouyou and Gaoua was particularly affected, data not shown by antenatal surveillance. In addition to its proximity to Ivory Coast and Ghana, it is a major gold-washing zone which also has lot of migrant men and sex workers. The map showed similarities with migration areas in the 80's and 90's and with repatriate returns from Ivory Coast at the end of 2002 and beginning of 2003.

Lastly, our results diverge from antenatal surveillance around Kaya. The high prevalence observed in this rural antenatal clinic was not representative of the low prevalence observed at a regional level in the DHS.

Conclusion

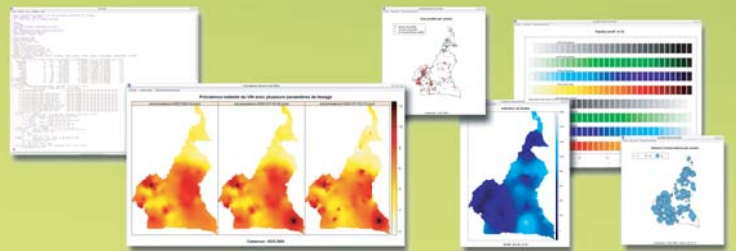
Rings of the same number of observations make possible to realise a spatial interpolation to extract regional trends from DHS data.

Mapping these regional trends of HIV prevalence offers a new vision of spatial variations of epidemics. Our results highlight differences that were not visible using only antenatal surveillance data. Our approach supplements other surveillance systems, allows identifying most prevalent areas and constitutes a monitoring and evaluation tool. Lastly, it suggests new research fields to investigate.

Methods

Our approach is inspired by techniques used for calculating regional trends and based on smoothing rings. An estimation is made of regional spatial trends of HIV prevalence for each surveyed cluster by aggregating data from neighbouring clusters, using rings of the same number of tested persons and taking into account main urban agglomerations. The map is then generated by spatial interpolation using kriging method.

Globally, this methodology estimates national, regional and sub-regional variations, with a more or less important smoothing according to the accuracy of the data of each zone, although a precise estimation of levels of each point is not possible.

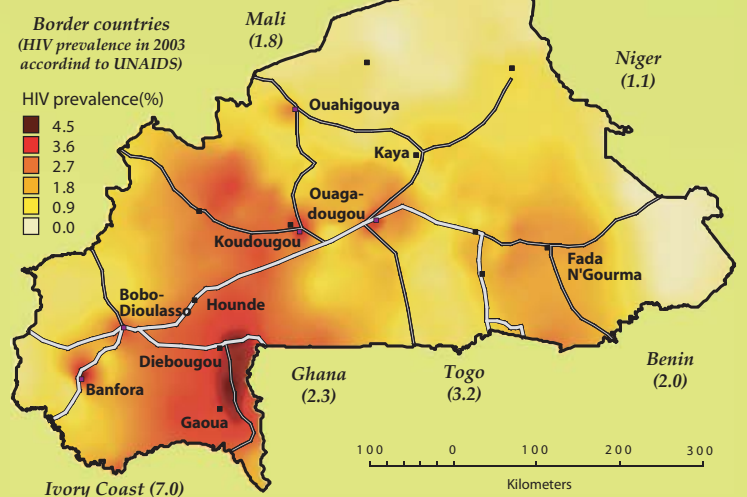


prevR: an open-source and free tool

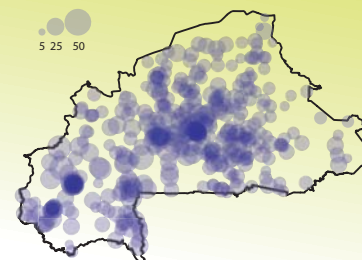
We conduct all these analyses using the free and open-source statistical software R. A specific package called prevR was written and can be downloaded free of charge at <http://www.ceped.org/prevR/>.

Regional trends of HIV prevalence

(in % among 15-49 years old)



Number of tested persons by surveyed clusters (undetermined results excluded)



Quality indicator

