## Geospatial Curve Fitting Methods for Disease Mapping of Tuberculosis in Eastern Cape Province, South Africa

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Abstract : To interpolate scattered or regularly distributed data, there are imprecise or exact methods. However, there are some of these methods that could be used for interpolating data in a regular grid and others in an irregular grid. In spatial epidemiology, it is important to examine how a disease prevalence rates are distributed in space, and how they relate with each other within a defined distance and direction. In this study, for the geographic and graphic representation of the disease prevalence, linear and biharmonic spline methods were implemented in MATLAB, and used to identify, localize and compare for smoothing in the distribution patterns of tuberculosis (TB) in Eastern Cape Province. The aim of this study is to produce a more "smooth" graphical disease map for TB prevalence patterns by a 3-D curve fitting techniques, especially the biharmonic splines that can suppress noise easily, by seeking a least-squares fit rather than exact interpolation. The datasets are represented generally as a 3D or XYZ triplets, where X and Y are the spatial coordinates and Z is the variable of interest and in this case, TB counts in the province. This smoothing spline is a method of fitting a smooth curve to a set of noisy observations using a spline function, and it has also become the conventional method for its high precision, simplicity and flexibility. Surface and contour plots are produced for the TB prevalence at the provincial level for 2012 - 2015. From the results, the general outlook of all the fittings showed a systematic pattern in the distribution of TB cases in the province and this is consistent with some spatial statistical analyses carried out in the province. This new method is rarely used in disease mapping applications, but it has a superior advantage to be assessed at subjective locations rather than only on a rectangular grid as seen in most traditional GIS methods of geospatial analyses.

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