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Not just pretty pictures: geographical information systems (GIS) in tuberculosis control - experience from Malawi.

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Summary

Geographical Information Systems (GIS) is becoming a useful tool in disease control by health planners. However little is known about its potential in tuberculosis (TB) control. In 2000 the National TB Programme (NTP) in Malawi assessed its usefulness. Routinely collected case-finding data from the 3 previous years (1997 to 1999) were entered into a system containing a digital map of Malawi. District performance was mapped. We concluded that GIS may be complementary in monitoring TB programme performance, and may be useful for target setting, advocacy, and research. World Health Organisation (WHO) now provides free GIS software (Health Mapper) and training. However, the use of GIS in TB control still needs further piloting and expansion without constraining the locally available resources or disrupting the present TB data management system.

Introduction

The World Health Organisation (WHO) describes five components that define a good TB programme, one of which is a good monitoring system for programme supervision and evaluation. [1] A Geographical Information System (GIS), because of its ability to map health events in relation to their environment and existing infrastructure, may be a useful monitoring tool in TB control. However, its use in TB control activities especially in Africa is poorly documented. One study from South Africa reported satisfactory results when GIS was used to document and quantify improved access to tuberculosis treatment through a community-based programme. [2]

In Malawi, a country that lies in sub-Saharan Africa where the human immunodeficiency virus (HIV) has its greatest impact on TB [3], GIS is not routinely used in the health service. The National TB Programme (NTP) in the country covers a population of about 9 million people from 3 regions containing a total of 27 districts and 3 cities. Between 1985 and 2003 there was a fivefold increase in new TB cases in the country. TB control activities in Malawi have been based on the recommendations of the WHO and International Union against TB and Lung Disease (IUATLD). [1,4] Recording is generally done on paper by District TB Officers (DTO), who compiles data on case finding and treatment outcome on a quarterly basis. Regional TB Officers (RTO) aggregate district data before sending it to the Central Unit of the NTP where national statistics are computed.

Since 1996 the NTP in Malawi has set itself targets on a yearly basis. These targets cover case finding (including the proportion of each type of TB), quality of diagnosis (mainly the degree to which health workers follow NTP guidelines) and equity in access of patients to TB services. For example, the current target for new smear positive cases is 50% or more of all new cases. Any figure below this is taken as poor performance.

We decided to assess whether GIS would generate useful information from routinely collected programme data.

Application of GIS to Malawi TB Programme data and its result

In August 2000 a short-term consultant was recruited. District based case-finding data collected over a period of 3 years (1997 to 1999) was obtained from all 3 regions of Malawi. At the Central Unit of the NTP data including TB incidence by type, sex and patients' age groups were entered into a spreadsheet. This enabled correction of minor addition errors made in the field. The spreadsheet data was then imported into an ArcView version 3 Geographical Information System containing a digital map of Malawi.

The data were analysed and district performance was colour coded (relative to Programme Targets). An example of the resulting maps is provided below.

The maps show that district performance varied from year to year. For example, one of the districts (Lilongwe) shows poor performance in 1997, improved in 1998 and got worse again in 1999. In another district (Ntcheu) performance remains good over the three-year period. This enabled the NTP to ask relevant questions and look for targeted solutions to the problems.

Discussion

Our experienced has convinced us that GIS may be useful in TB control in several ways. Comparing performance over a large geographical area with the GIS was quick. The NTP in Malawi is a human resource-constrained programme that handles large amounts of data because of increasing TB cases. The NTP needs a mechanism that translates data into useful information in a timely manner. Thus for such a programme, with a well-established and efficient data collection structure, GIS may be useful. The exercise also highlighted changes in performance over time. This might be increasingly useful in a dynamic situation, as future data may be added to the established system. It was noted that GIS maps are as good as the data collected and entered in the software and cannot in themselves explain what is behind the patterns. A program needs to be clear what it wants out of the pictures before taking the labour of entering amounts of data in the system.

Graphical demonstration of the mapping to a wider audience may be a good tool for advocacy. The NTP manager in Malawi has used GIS-generated maps in presentations to the Ministry of Health and Population, to donor groups within Malawi and to international conferences.

As the mapping also incorporated the NTP targets, it may be used to assist target setting. Analysing data against targets also allows us to highlight districts where targets are not being met, and to prioritise the NTP's efforts in these areas. Maps showing performance against NTP targets will have to be presented to

members of District Health Management Teams to highlight their relative performance.

In the example given, the NTP looked for possible reasons for the fluctuating performance in Lilongwe, where up to 20% of national TB cases are reported. In 1998 there was a senior NTP scientist in the district who carried out a smear negative TB study. Patients who were diagnosed as smear negative were re-screened with sputum smears to establish a proper diagnosis. This might have improved diagnostic practice and increased the proportion of smear positive cases.

Other potential applications and problems of GIS in TB control have been documented. [5]We acknowledge such observations and would therefore recommend GIS only to programmes that may have extra benefit from it without disrupting core programme activities. The cost of GIS is becoming a less important issue as WHO can now freely provide a GIS software (Health Mapper) and its training.

In this study we observed that GIS has potential to complement the standard monitoring systems in TB control. It may be a useful advocacy tool and has a role to play in research. We recommend further piloting of GIS by other TB programmes. This recommendation needs to be implemented with care not to disrupt core program activities in resource-poor settings. Having a consultant dedicated to the task of using GIS for program monitoring may provide a temporary solution. For sustainable implementation bigger organisations like WHO should consider funding for training and supporting manpower with the TB programs to carry out this activity.

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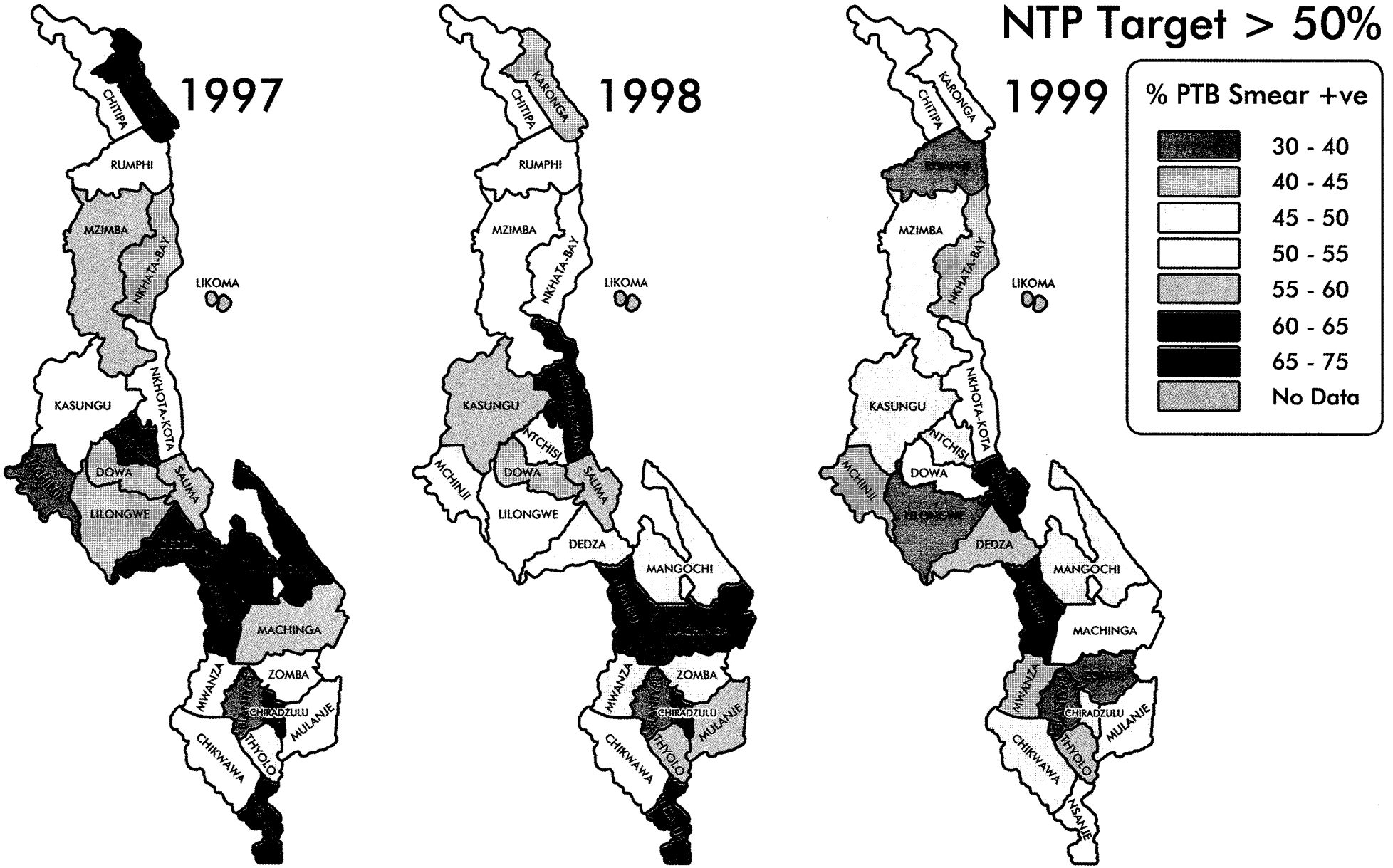
DISTRICT PERFOMANCE IN TB CASE FINDING IN MALAWI



Colours indicate different proportions of smear positive cases among all cases diagnosed annually in each district. Green colours represent better performance and red colours represent poorer performance