

Spatial Analysis of Tuberculosis in an Urban West African Setting: is there Evidence of Clustering?

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Background: TB in Greater Banjul

- Major Public Health Problem
- Mainly in Greater Banjul(79%)
- One key Health centre
- New approaches to TB control required.

GIS and Public Health

- Describe the environment more accurately
- Assist in visualizing problems
- Provides answers to important public health problems:
 - Do unusual clusters of health events exist in an area?
 - Which places have high or low prevalence of disease?
 - Where are known risks of ill health highest or lowest?

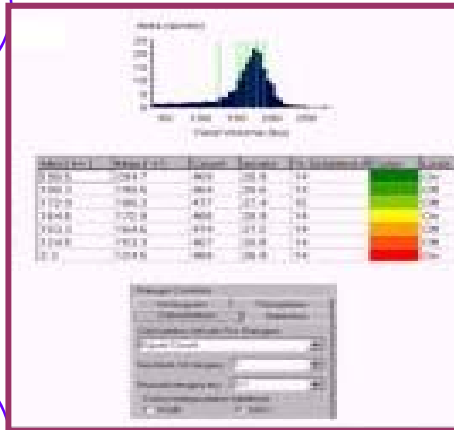
Why Spatial Statistics?

**Better Understand
behaviour of
Geographic phenomena**

**Make decisions with higher
Level of confidence**

**Pinpoint causes of specific
Geographic patterns**

**Summarise the distribution
In a single number**



Objectives

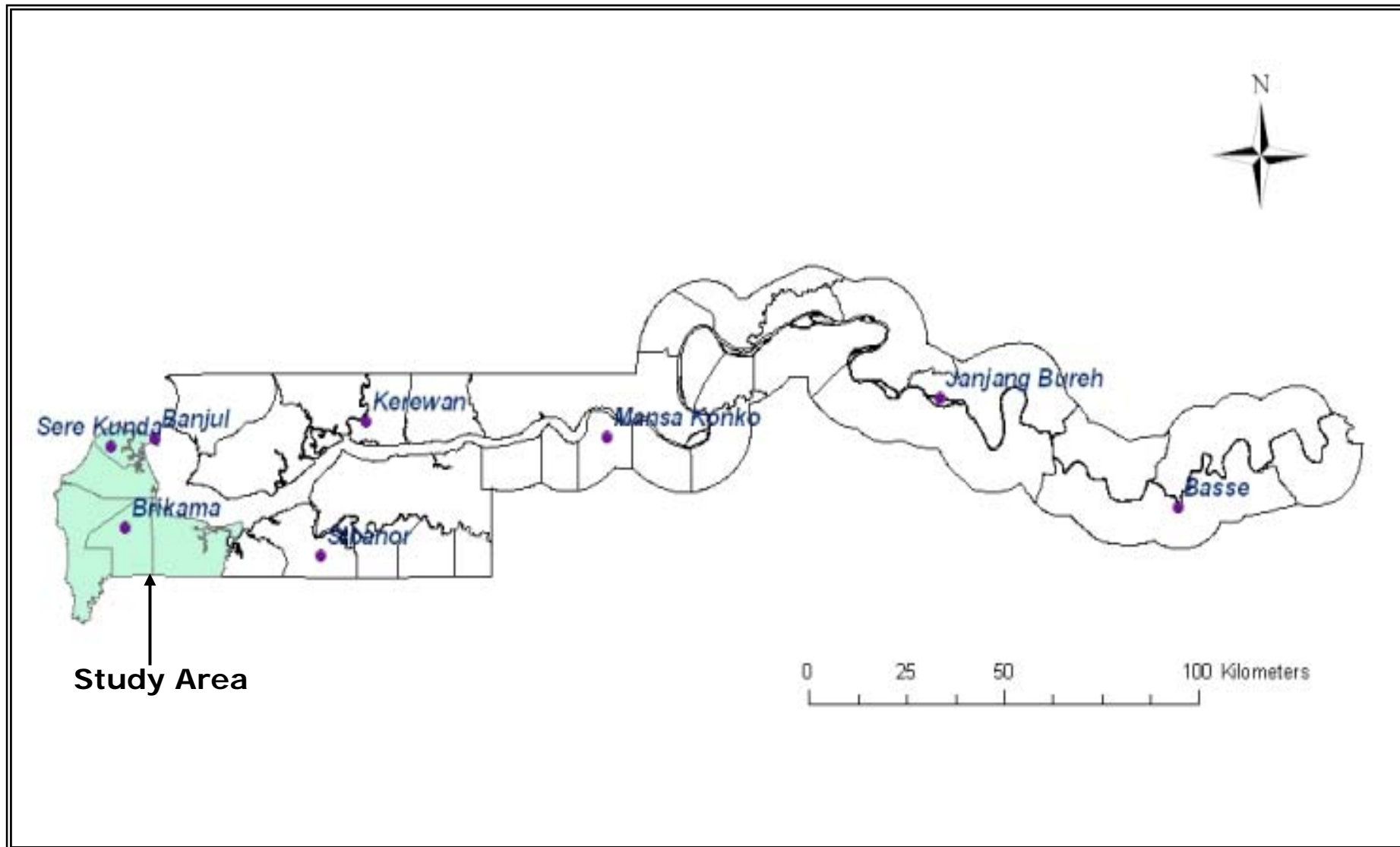
Primary Objective:

- To identify settlements with TB clusters in the Greater Banjul Area

Secondary Objectives:

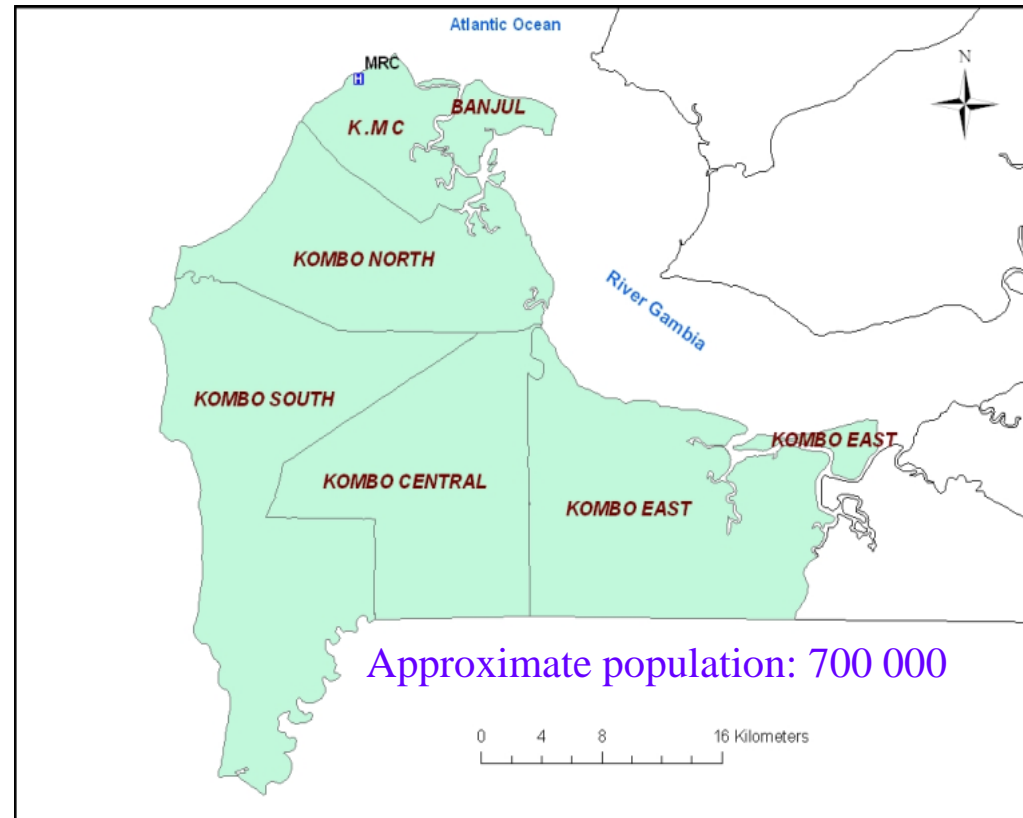
- To identify the differences if any, in the demographic and clinical characteristics of the TB cases in areas with clustering compared to other parts of the study area
- To assess the differences in defaulting rates by settlement

The Gambia map



Methods

- Registered TB patients from 8 treatment centres (2007-2008).
- Demographic, clinical characteristics and GPS coordinates recorded
- Purely spatial and space-time analysis on permanent residents



Results

- 1145 TB patients were recruited and almost all located with GPS
- The treatment status of all subjects at three and six months categorised as:
 - Cured and Treatment completed
 - On treatment
 - Failure
 - Transferred out
 - Defaulted
 - Died

Results

- Spatial analysis and mapping on permanent residents
 - Spatial Scan Statistics (SaTScan)
 - ArcGIS version 9.3
- Two significant clusters (purely spatial analysis)
- One significant cluster (space-time analysis)
- Mapping and visualisation in ArcGIS 9.3

Recruitment by treatment centre

Treatment Centre	Recruited n(%)
Gunjur Health Centre	5 (0.4%)
Tujereng CCF	8 (0.8%)
Banjulnding Health Centre	12 (1%)
JFP Hospital	41 (3.6%)
Banjul Poly Clinic	58 (5.1%)
Fajikunda Health Centre	211 (18.4%)
Brikama Health Centre	226 (19.7%)
Serekunda Health Centre	584 (51.0%)
Total	1145

Demographic and clinical characteristics

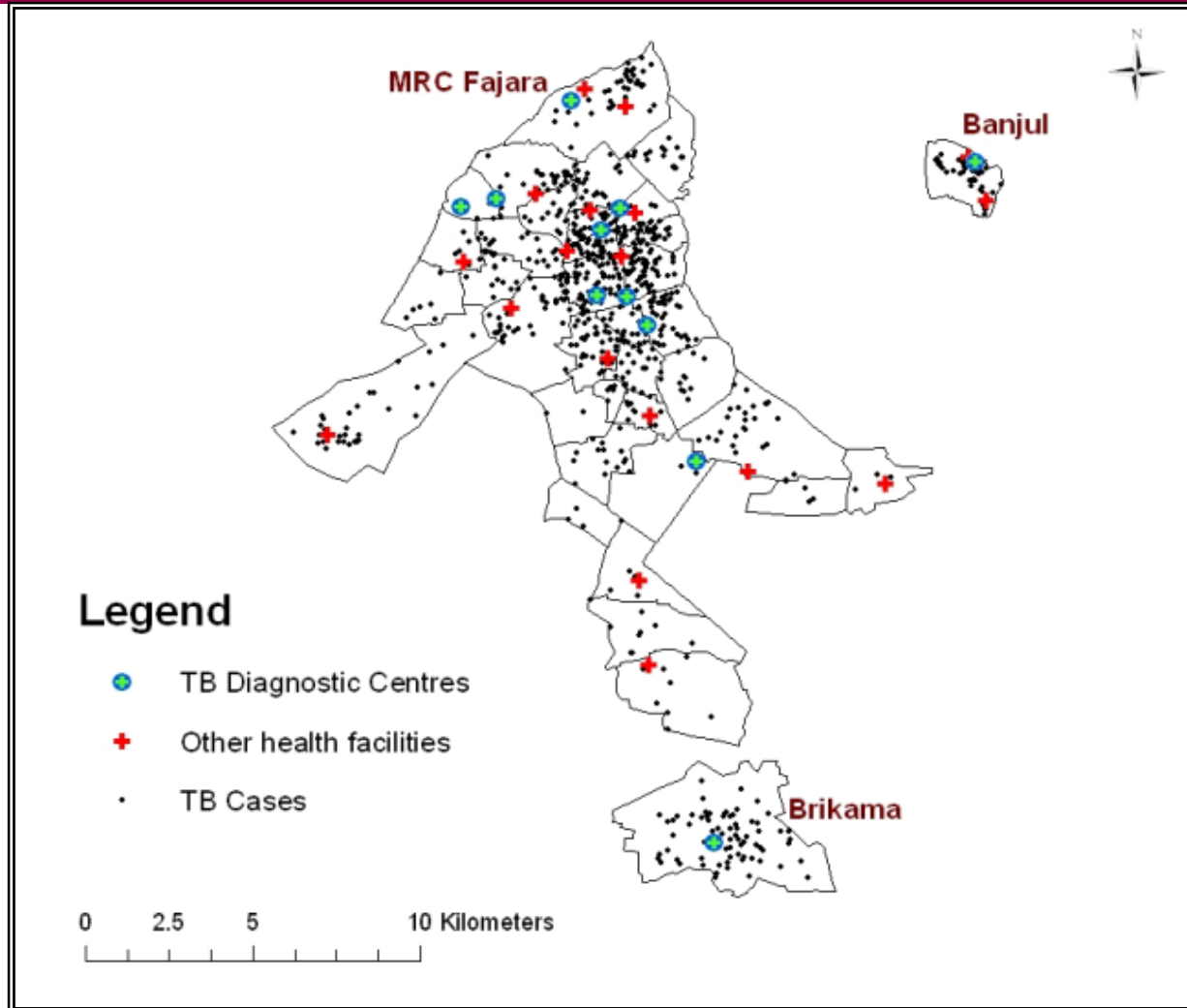
Characteristics

	n (%)		
	Permanent residents	Non-permanent residents	Total
Sex			
Male	646(67.3)	102(55.1)	748(65.3)
Female	314(32.7)	83(44.9)	397(34.7)
Age, Years			
Median age	31	33	31
0-14	95(9.9)	11(5.9)	106(9.3)
15-25	229(23.8)	37(20.0)	266(23.2)
26-40	351(36.6)	71(38.4)	422(36.9)
>40	285(29.7)	66(35.7)	351(30.6)
Type of TB			
Smear Positive	623(64.9)	108(58.4)	731(63.8)
Smear Negative	288(30.0)	70(37.8)	358(31.3)
Extra-pulmonary	49(5.1)	7(3.8)	56(4.9)
Ethnicity			
Mandinka	372(38.8)	66(35.7)	438(38.2)
Wolof	152(15.8)	23(12.4)	175(15.3)
Fula	130(13.5)	38(20.5)	168(14.7)
Jola	163(17.0)	33(17.8)	196(17.1)
Other	143(14.9)	25(13.5)	168(14.7)
Total	960(83.8)	185(16.2)	1145(100)

Treatment outcome at six months

Outcome	n(%)
Cured & treatment completed	891 (77.8%)
On treatment	6 (0.5%)
Failed treatment	19(1.7%)
Transferred out	62 (5.4%)
Defaulted	42(3.7%)
Died	113(9.9%)
Unknown	12 (1.0%)

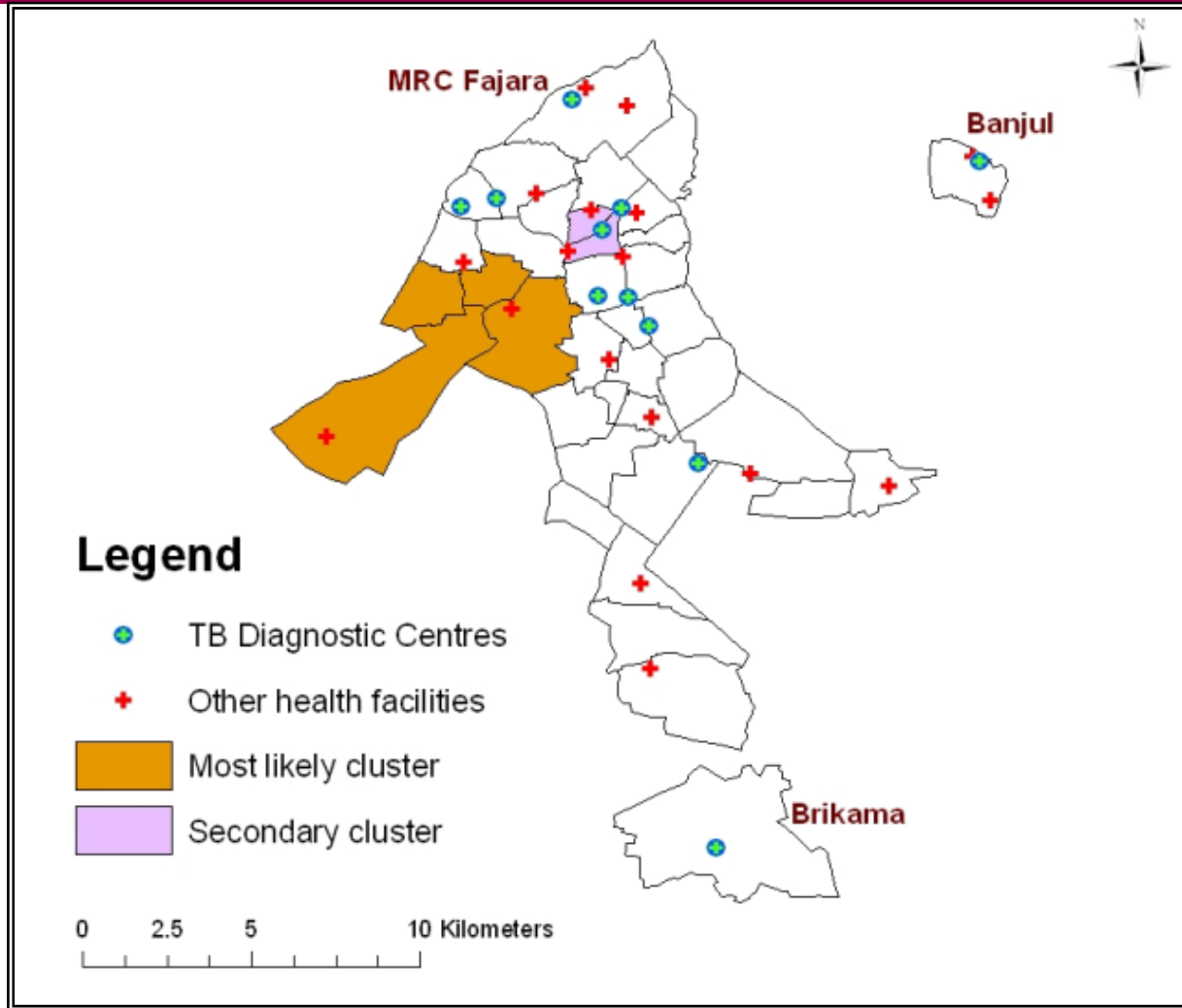
Spatial distribution of TB cases



Spatial clustering

Cluster ID	Cases	Expected	RR	LLR	P-value
Most Likely Cluster: Brufut, Sukuta, Sukuta Sanchaba, Bijilo	99	62	6.328	9.937	0.001
Secondary Cluster: Serekunda and Dippakunda	61	38	3.204	5.874	0.038

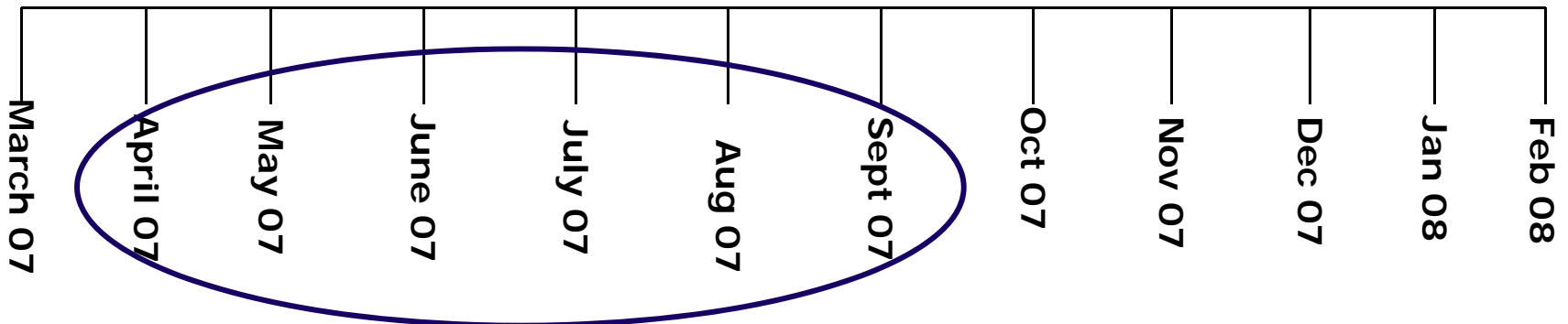
Spatial cluster map



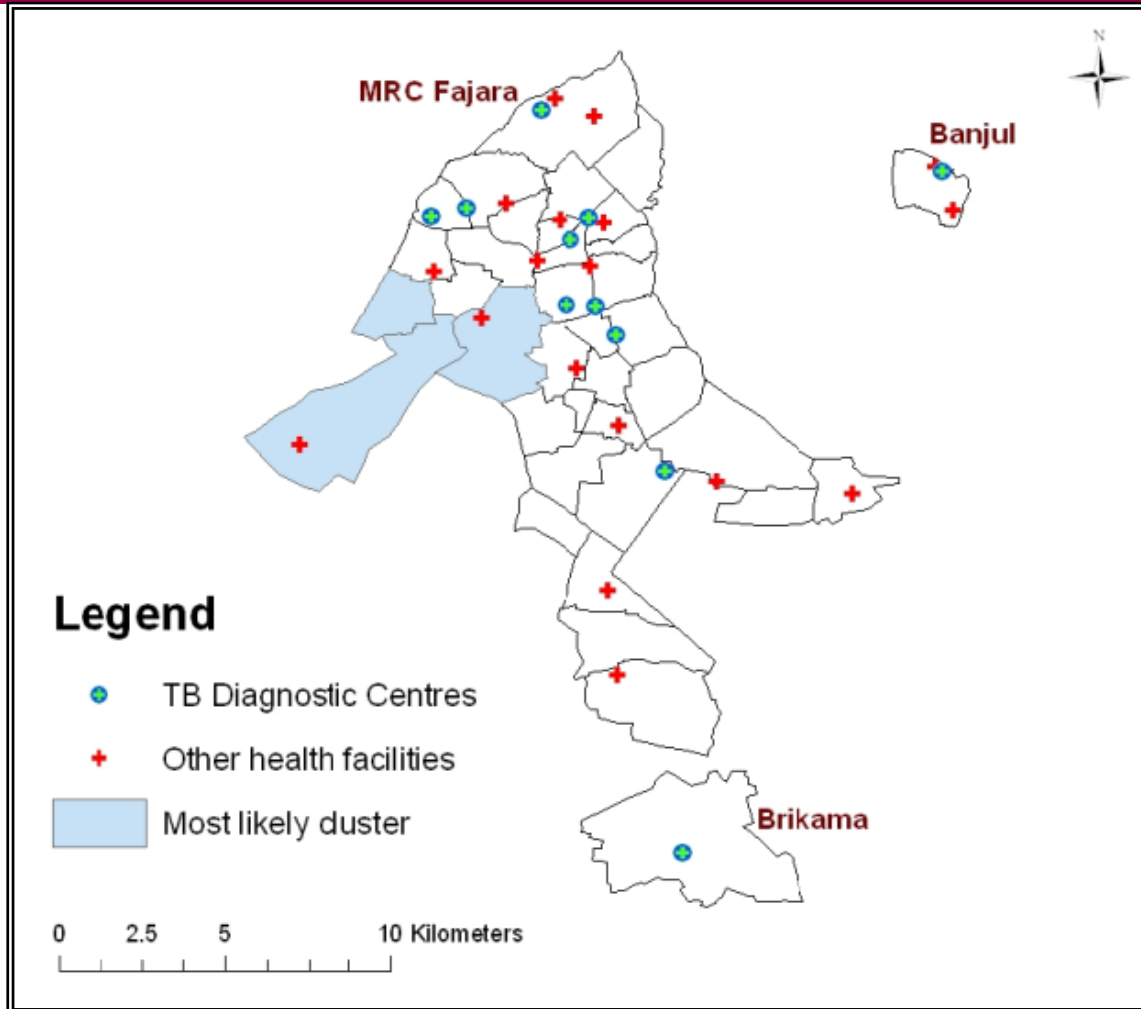
Space-time clustering

Cluster ID	Cases	Expected	RR	LLR	P-value
Most Likely Cluster: Brufut, Sukuta, Bijilo	54	24	4.905	14.476	0.002

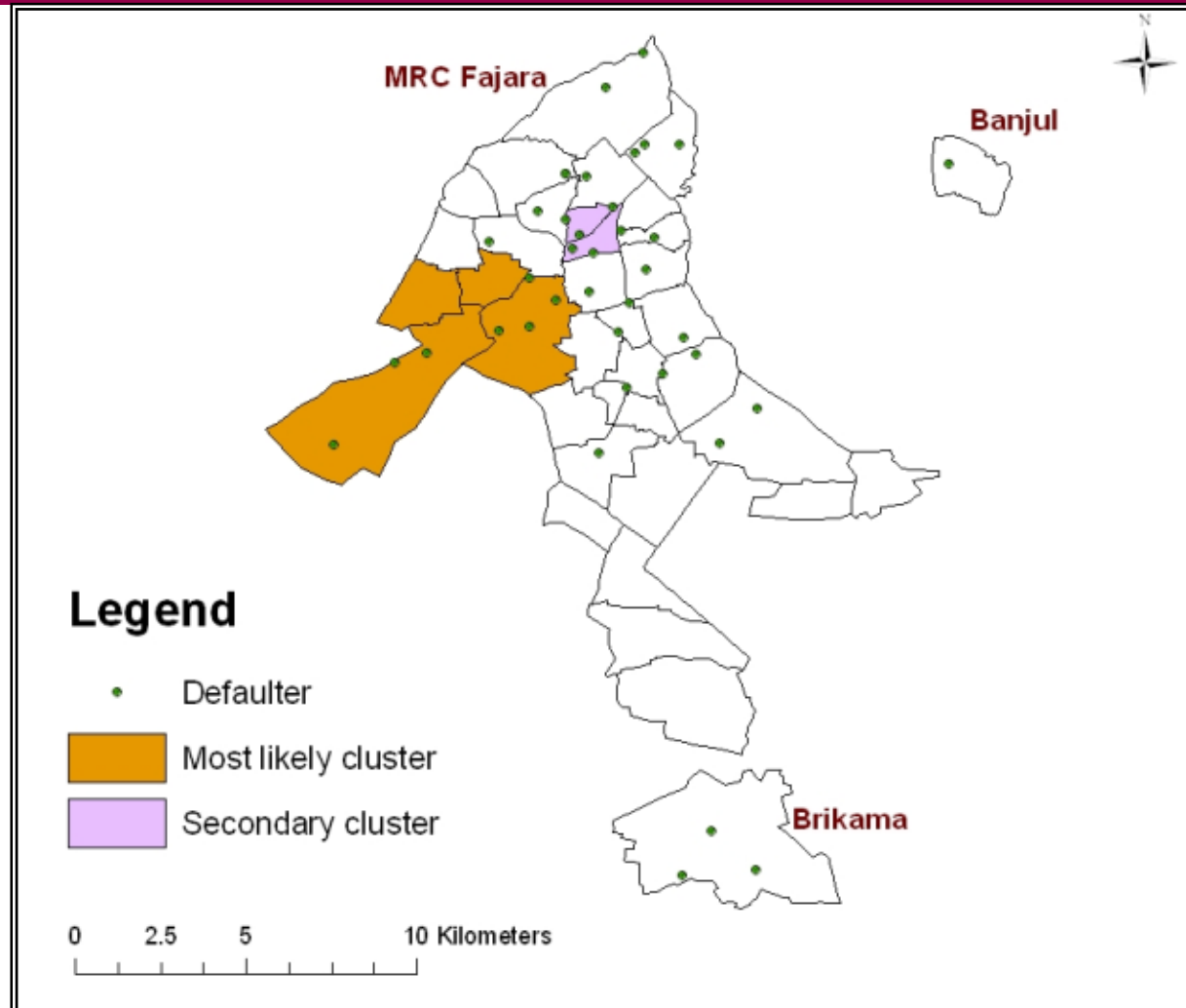
Time frame



Space-time cluster map



Distribution of TB defaulters is random



Discussion

- Hotspots of TB identified in some settlements
- The clusters are from the same geographical area
- The time frame for the space-time clusters- April and September 2007
- Limitations:
 - Data aggregated to settlement level
 - No assessment of risk factors associated with clustering

Conclusions

- Significant clustering of TB cases
- Cluster analysis may help inform public health policy
- Assist in identifying populations at risk
- Aid in resource allocation
- Help in designing and implementing interventions
- A need to conduct community-based active case detection

Thank you



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