

Validating the Accuracy of GIS-Based Accessibility Analysis in Determining Public Primary Health Care Demand in Metropolitan Areas

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Service access planning

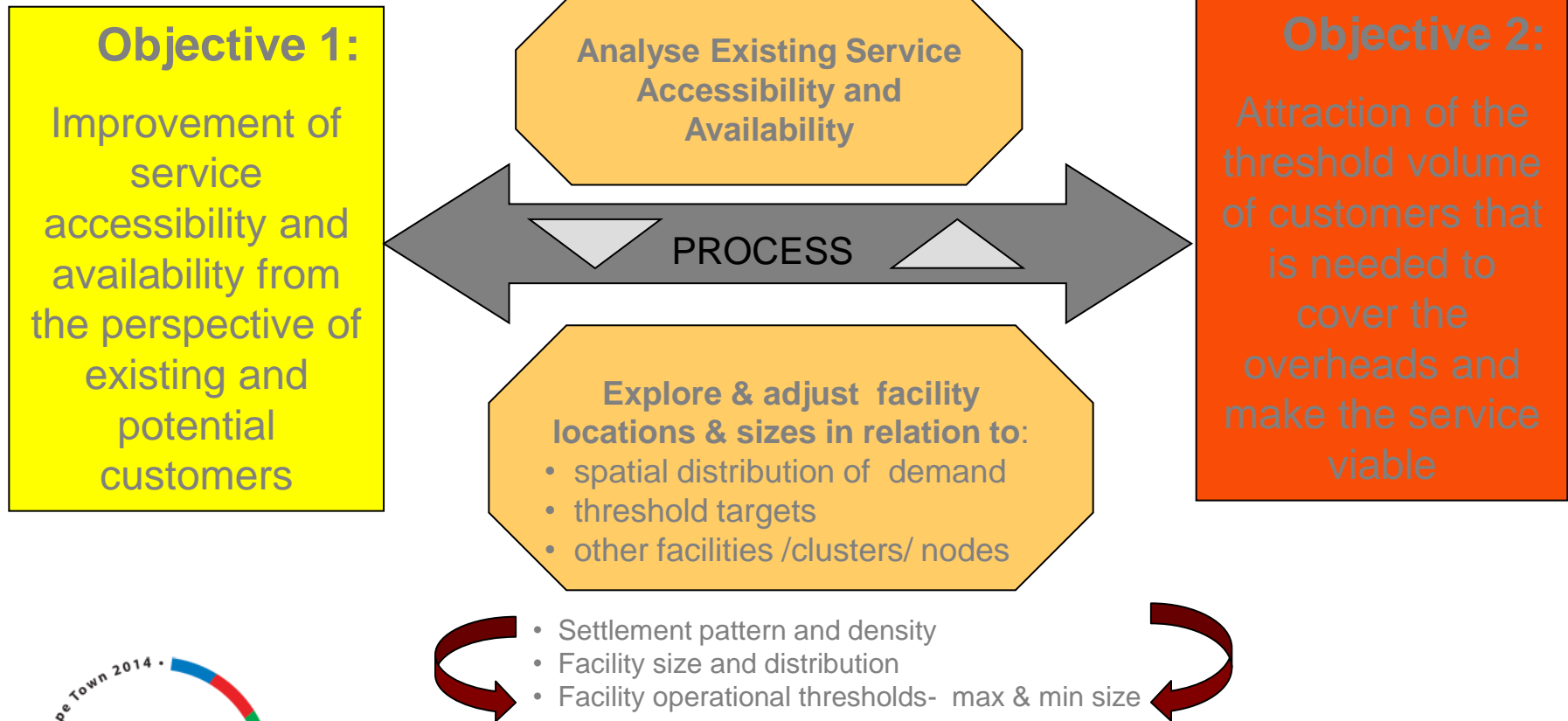
- The demand for services will continue to change:
 - Changing spatial realities of SA
 - Population growth & migration trends
 - Changing human settlement patterns and demographics
- Need for:
 - Spatial planning that is equitably & realistically based
 - More accessible services closer to where people live
 - Determine demand to support planning on nature of service and capacity

GIS-based accessibility analysis

- Accessibility analysis models the access of residents to facilities - assuming people will go to their nearest facility for service
- If an analysis is done for a large area, this will show whether provision is
 - Sufficient and
 - Equitable
 - .. if both capacity (threshold) and distance parameters are included

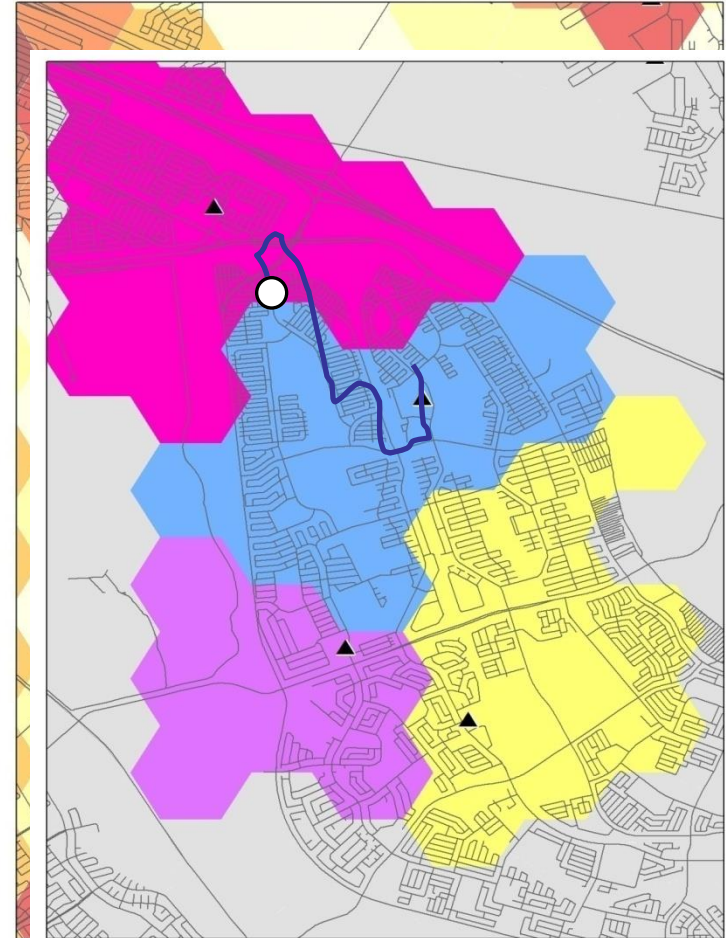


Basic approach and principles of accessibility analysis: WHO gets WHAT, WHERE and HOW MUCH



How does it work?

- Data layers used for accessibility analysis:
 - Road network
 - Facility locations with capacity
 - Population distribution
- All three layers interact based on standards to determine what population travel how far to a facility with capacity.
- Indicate potential catchments.
- Map well and poorly served areas.



GIS-based accessibility analysis allows

- Accessibility modelling - improved means of measuring facility access and of identifying poorly served areas and backlogs (spatially)
- Inform long term plans
- Measure progress w.r.t. service delivery of services
- Assist in setting service standards and benchmarks

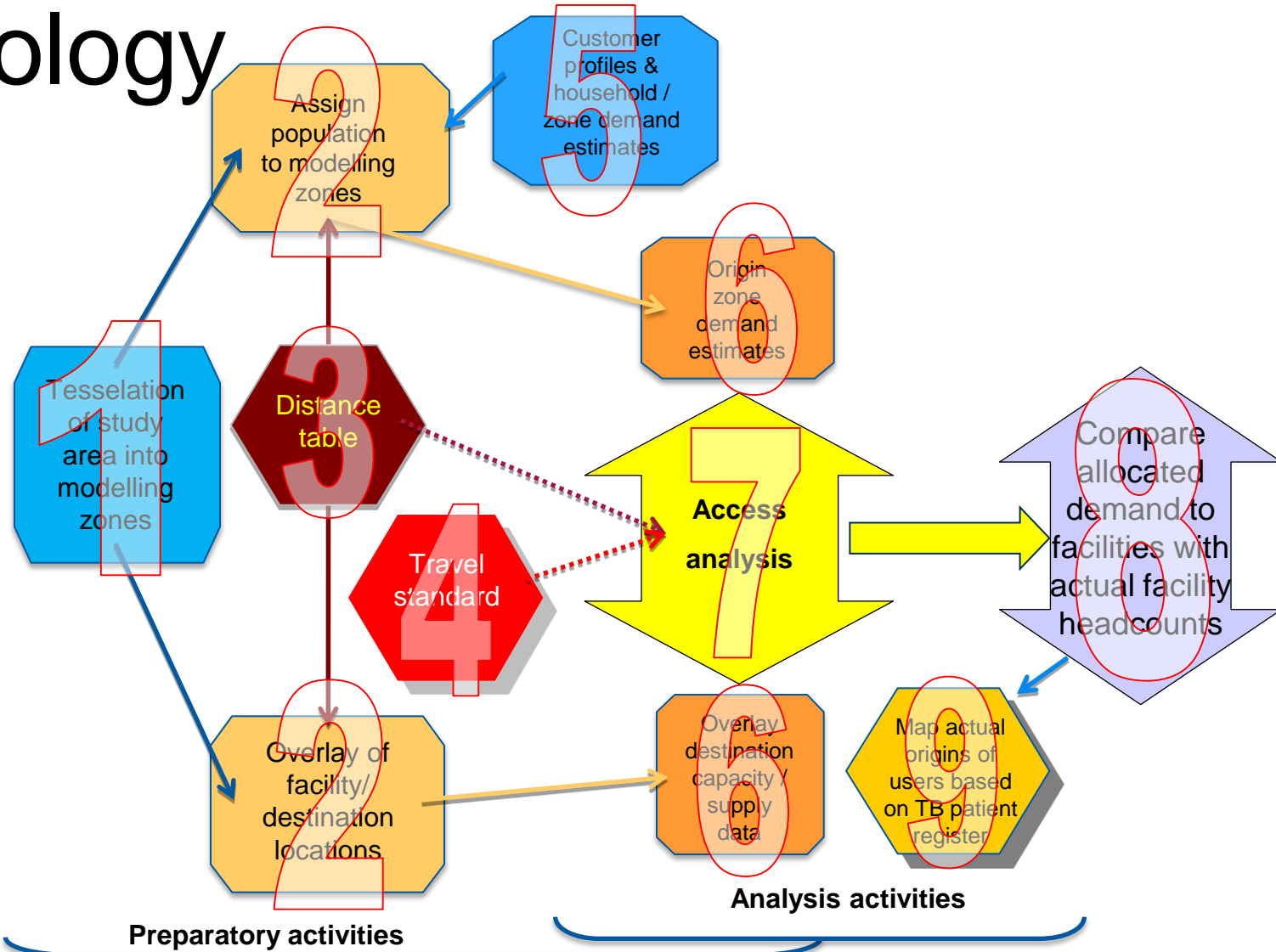


How far is contemporary GIS accessibility analysis applicable in South African **health** planning practice of today?

- Based on rational choice / behaviour
- Lack of data inputs in many developing countries
- **Key challenges to application:**
 - (a) What method is the best in determining demand in the absence of accurate databases indicating public versus private health care usage?
 - (b) How accurate is a rational choice based model regarding people's actual decisions?



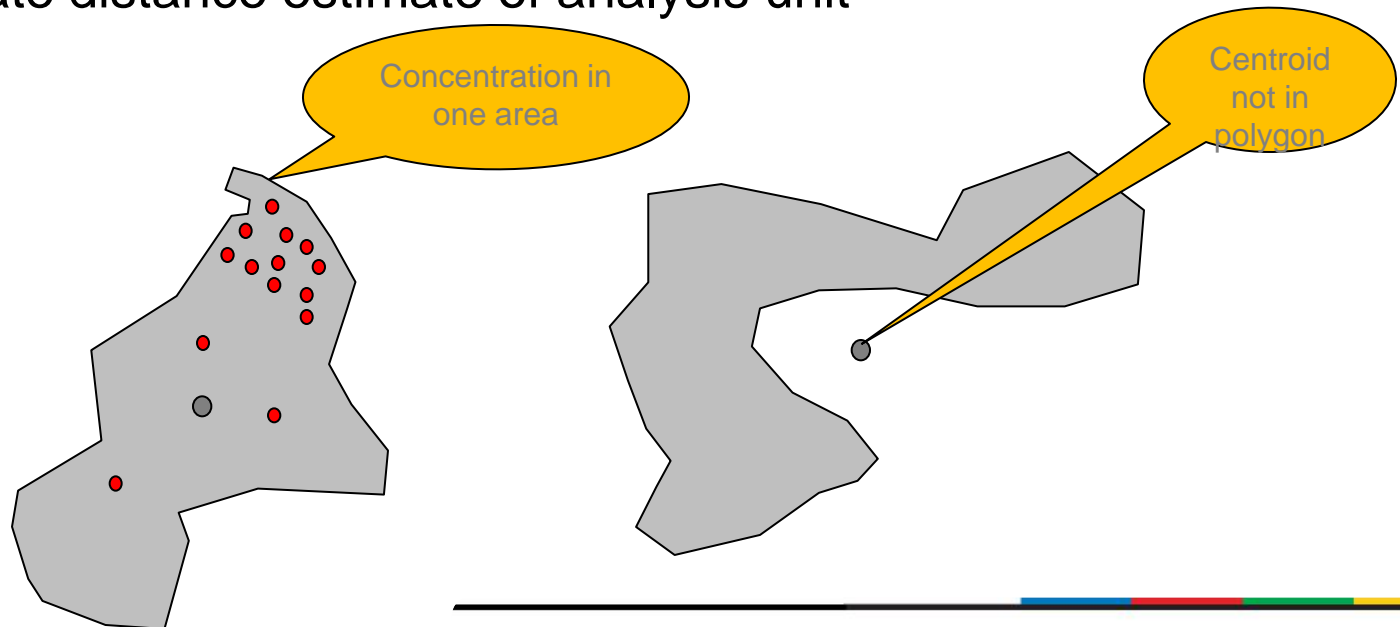
Methodology



Tessellation
of study
area into
modeling
zones

Why tessellation?

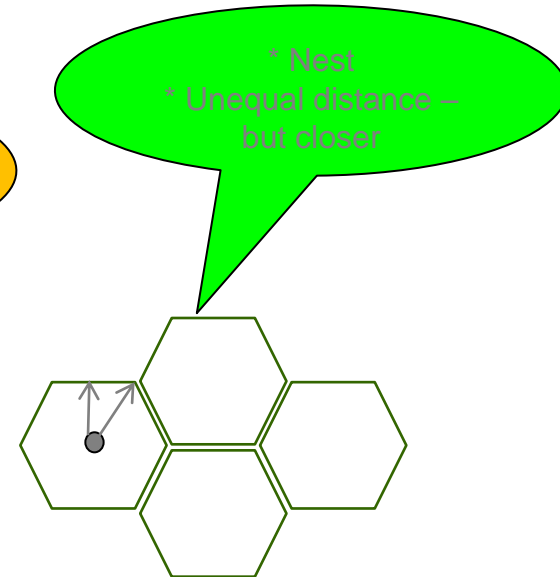
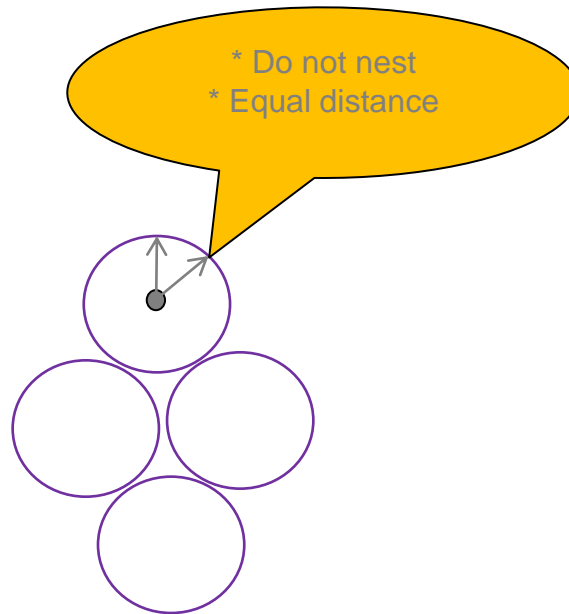
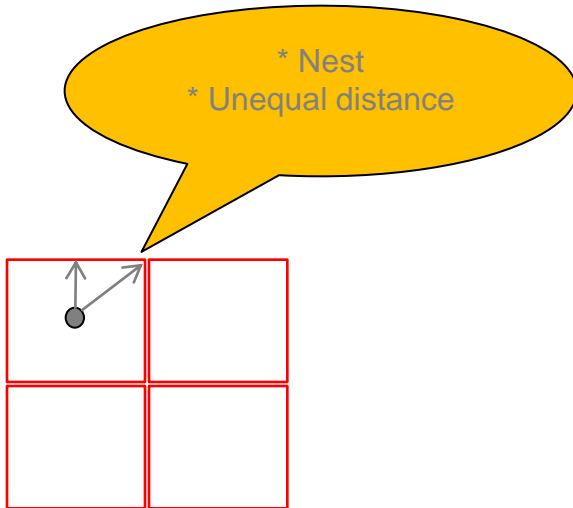
- Can use StatsSA sub-places or EAs
- Problems
 - Modifiable areal unit problem (MAUP)
 - Varying sizes – primary purpose is enumeration
 - Inaccurate distance estimate of analysis unit



Tessellation
of study area
into
modeling
zones

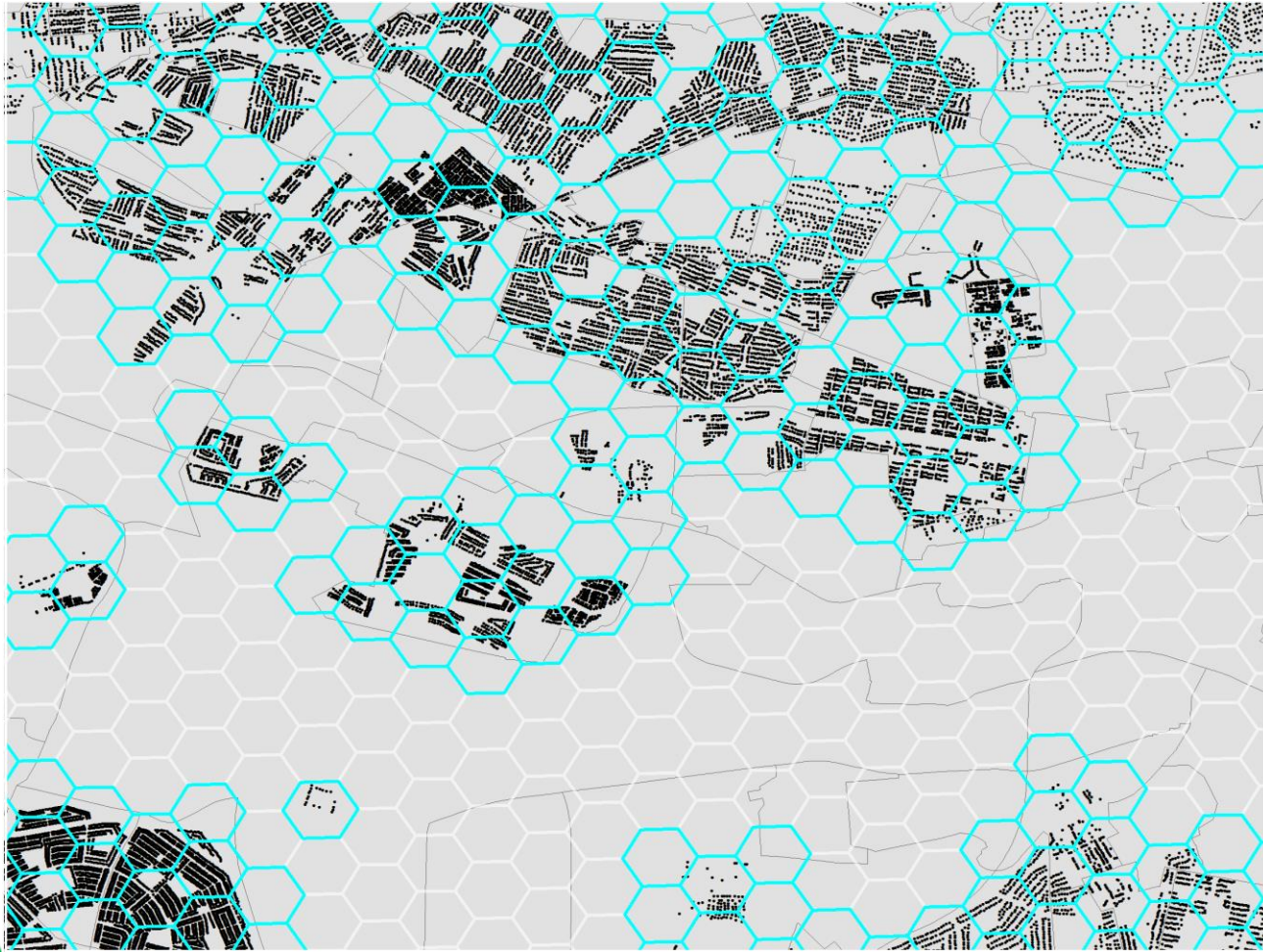
Why hexagons?

- Reason being
 - Nesting
 - Approximation of distance for analysis unit

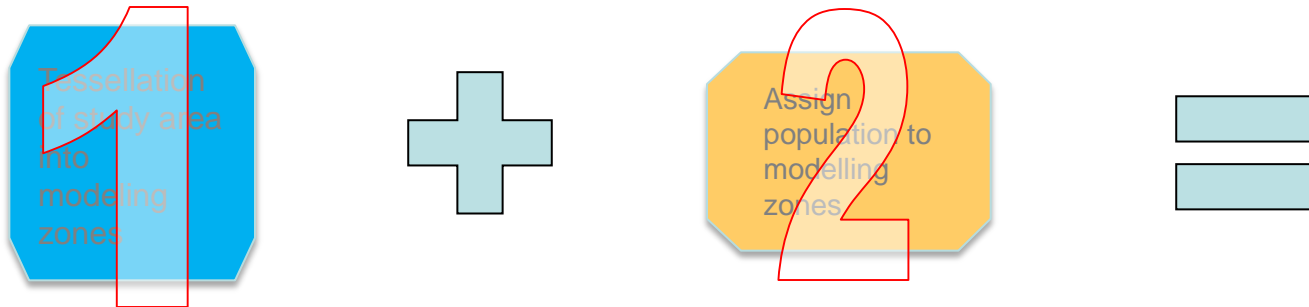


Assign
population to
modelling
zones

Principles of dasymetric mapping



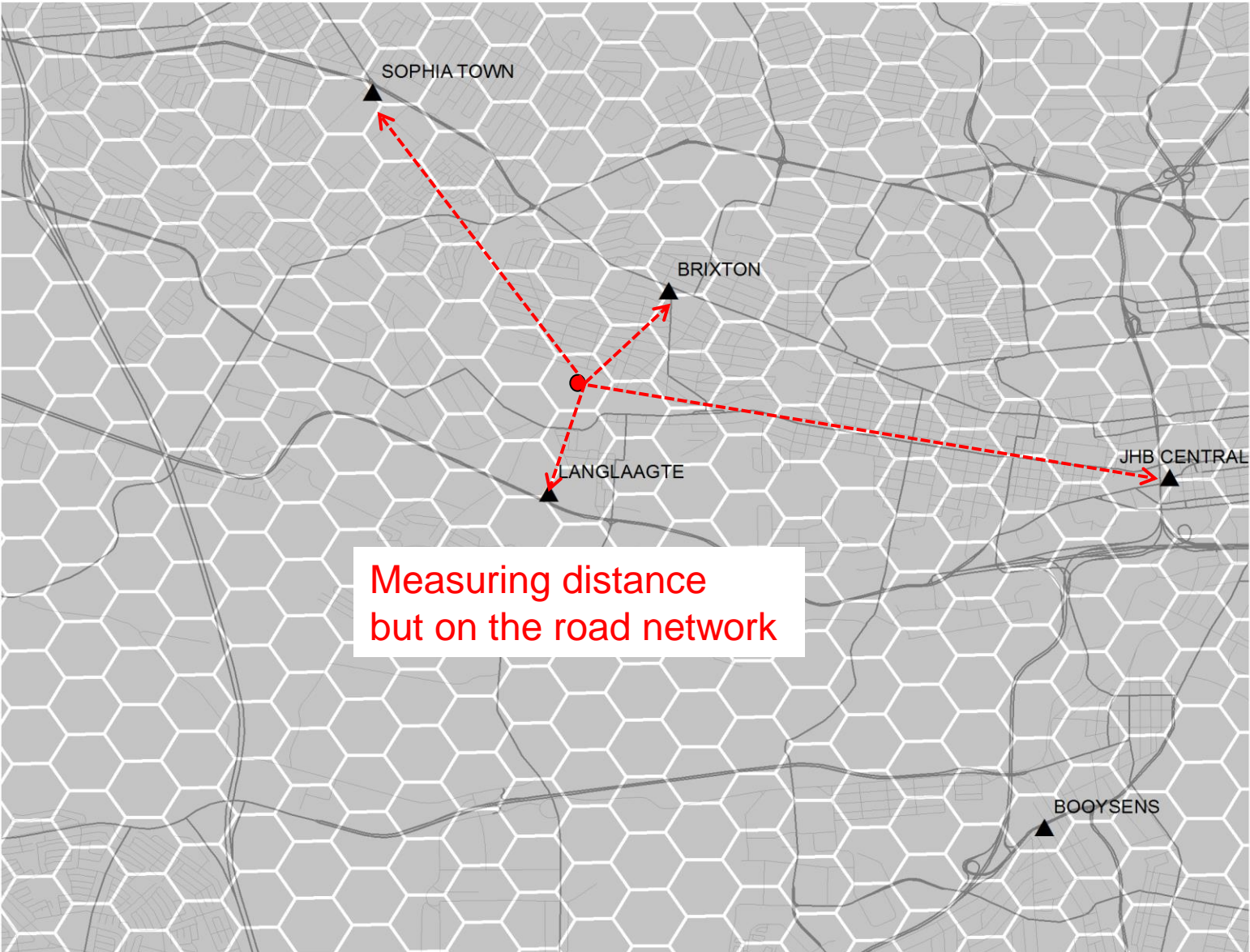
Conclusion on 1 & 2



- More accurate
 - Demand distribution
 - Better measurements of access
 - time
 - distance



Creating an OD matrix





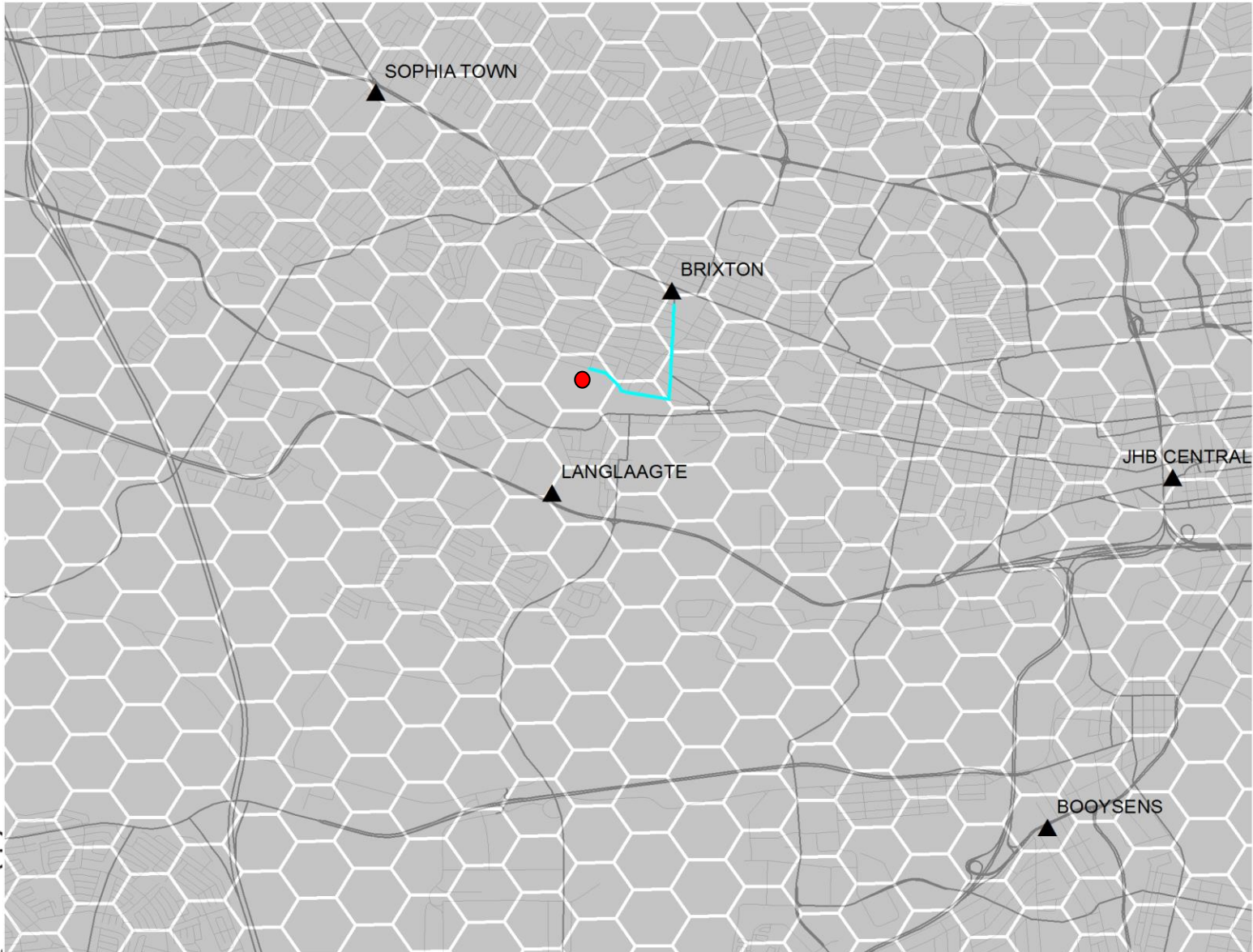
Creating an OD matrix

	Sophia Town	Brixton	Langlaagte	Booyens	Jhb Cnt
Hex1	200	400	300	250	50
Hex2	100	500	600	200	100
Hex3	200	300	100	700	200
Hex4	50	800	900	200	300
Hex5	200	100	300	500	600
Hex6	100	50	100	700	800



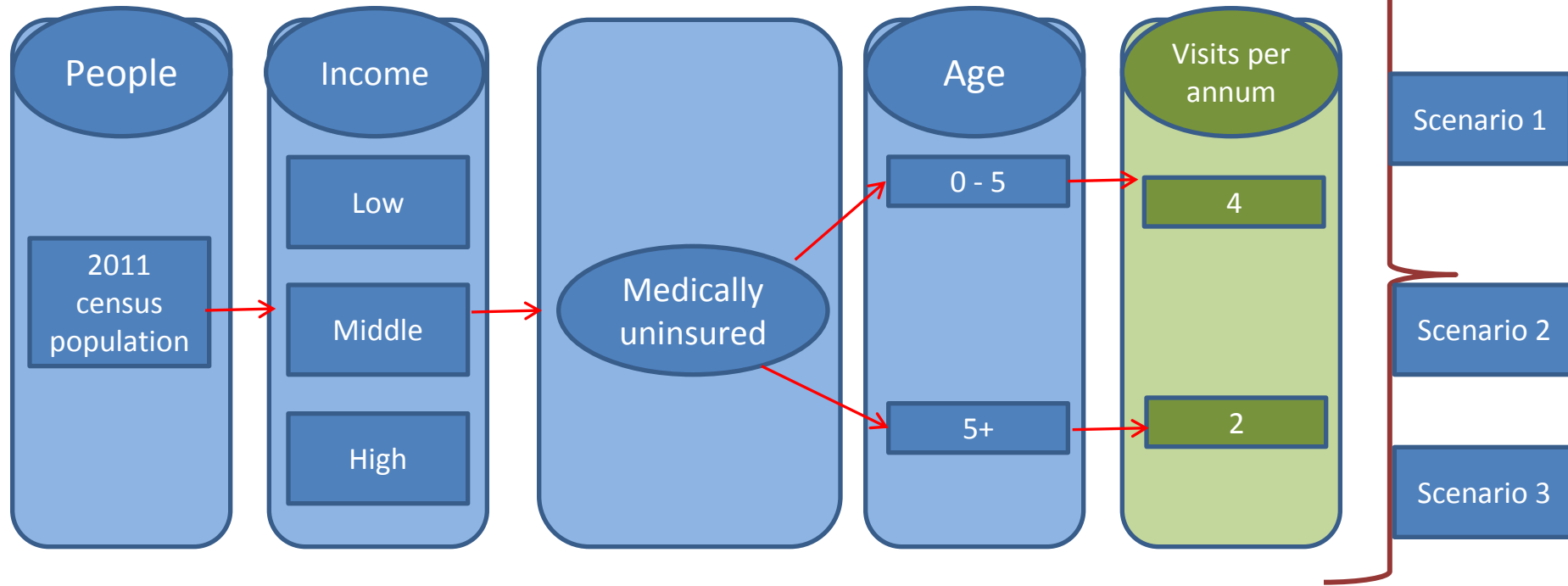


Use of OD matrix



Customer profiles & household / zone demand estimates

Demand profiling for public primary health care



SCENARIO 1

7 124 518 visits

the status of uninsured is proportionally allocated to the population in each income category using the uninsured population global total for the study area as the control variable. Uninsured population global total as published by StatsSA from the General Household Survey for 2011.

SCENARIO 2

7 149 055 visits

all persons in the low income group and 50% of persons in the middle income group are assigned the status of uninsured.

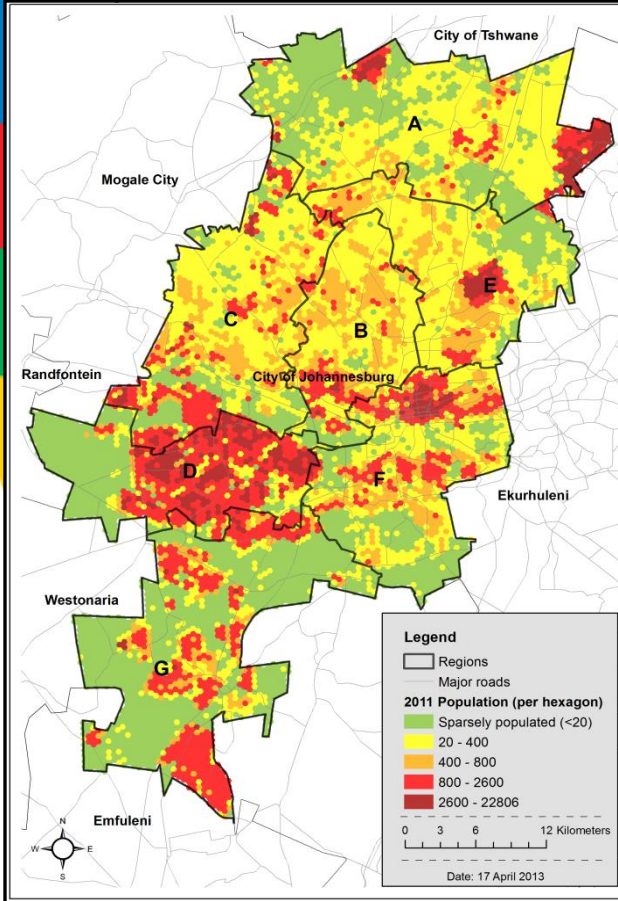
SCENARIO 3

7 416 886 visits

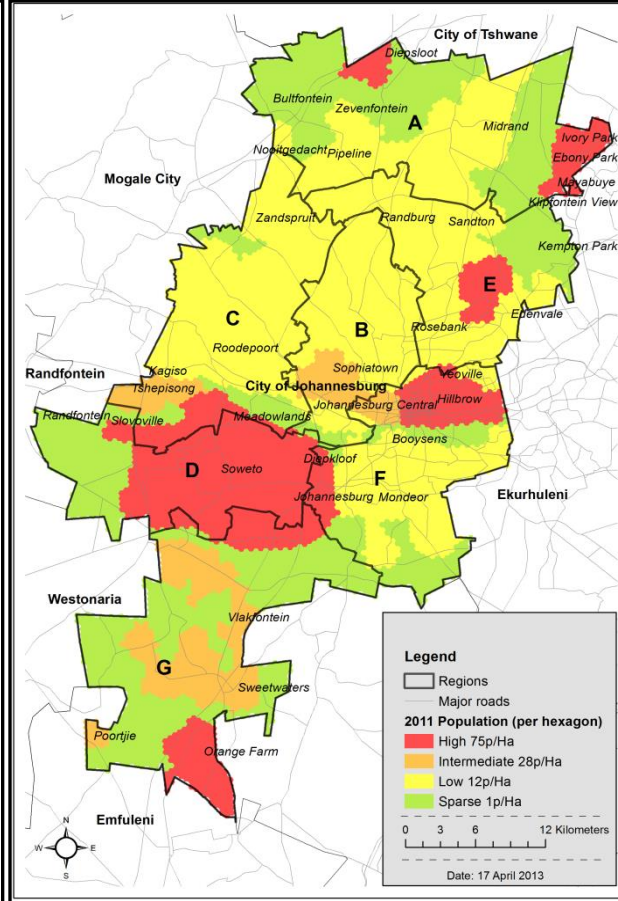
persons from the highest income category are first assigned the status of “insured” (insured population estimates as published by the Council for Medical Schemes for 2011), and then people from the next highest income category and so on until the total insured population has been assigned. Once the total number of insured population is reached, the remainder of the population is assigned the status as uninsured..

Study area

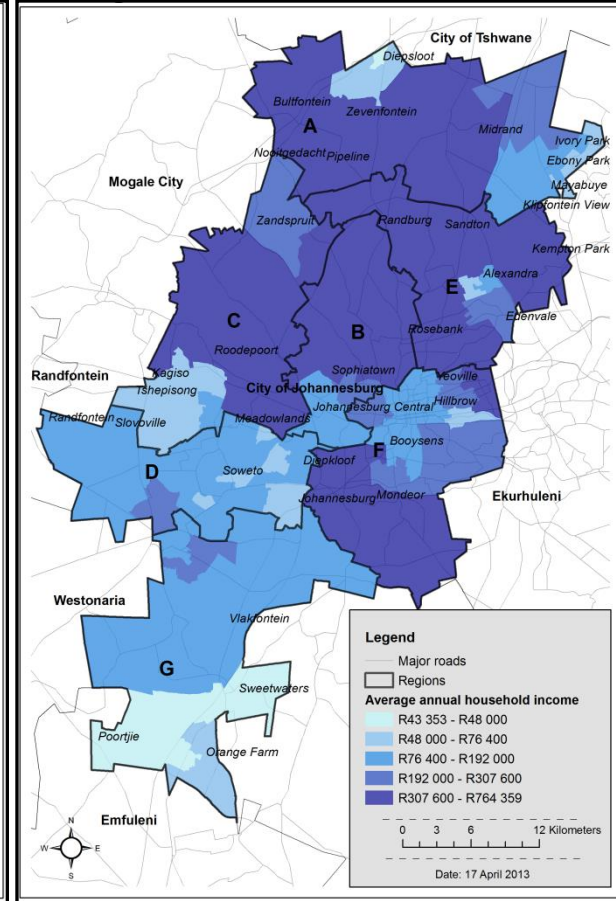
2011 Population



Density zones



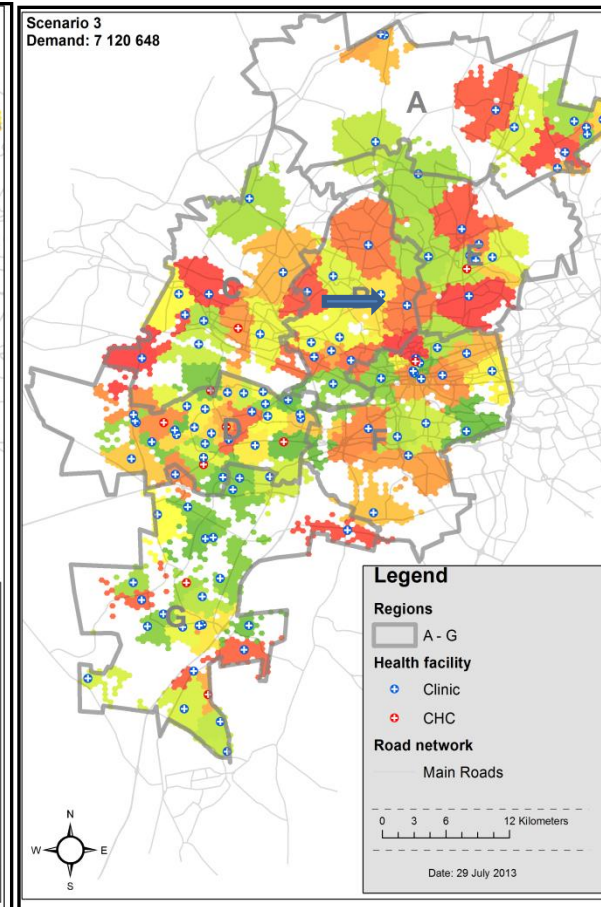
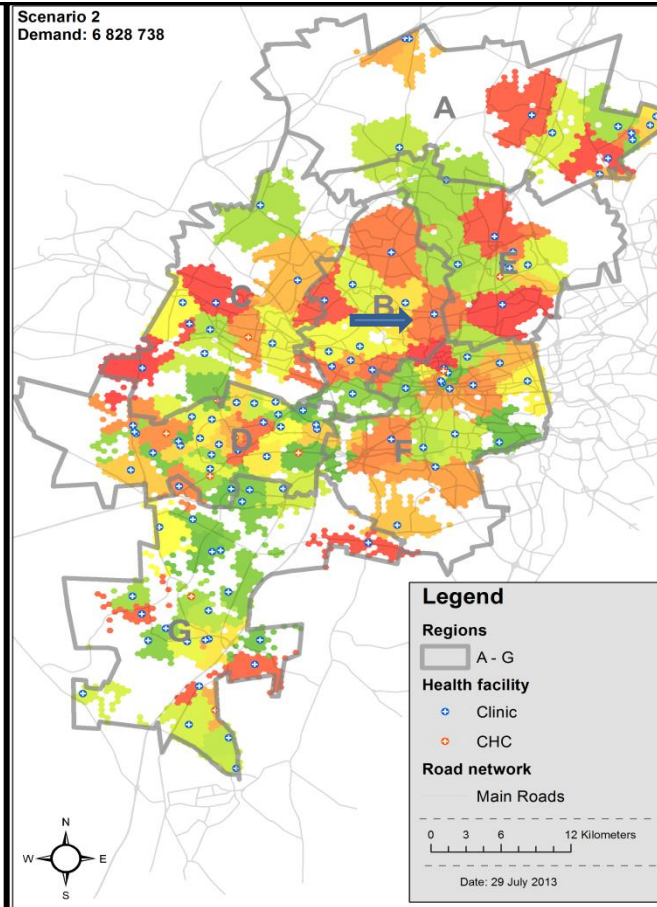
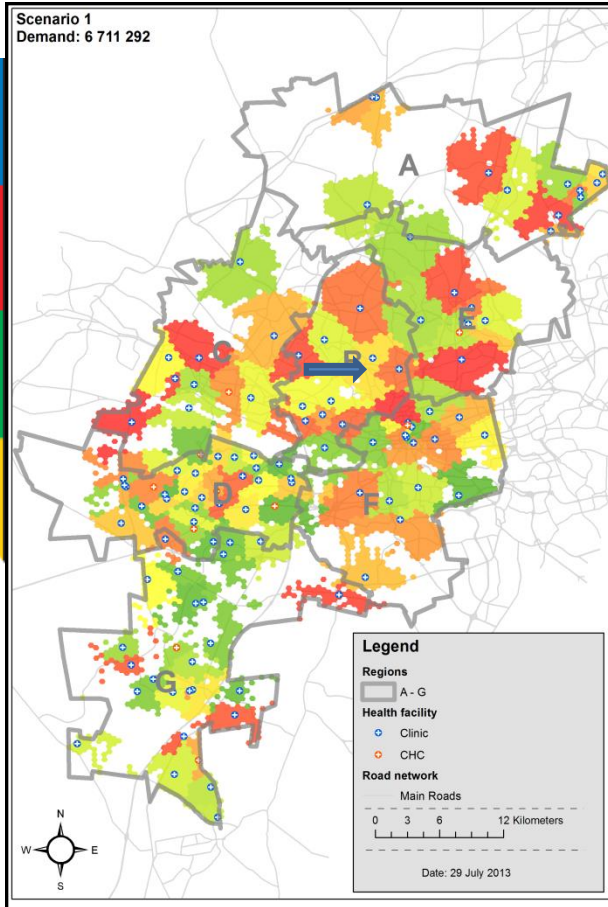
Average income



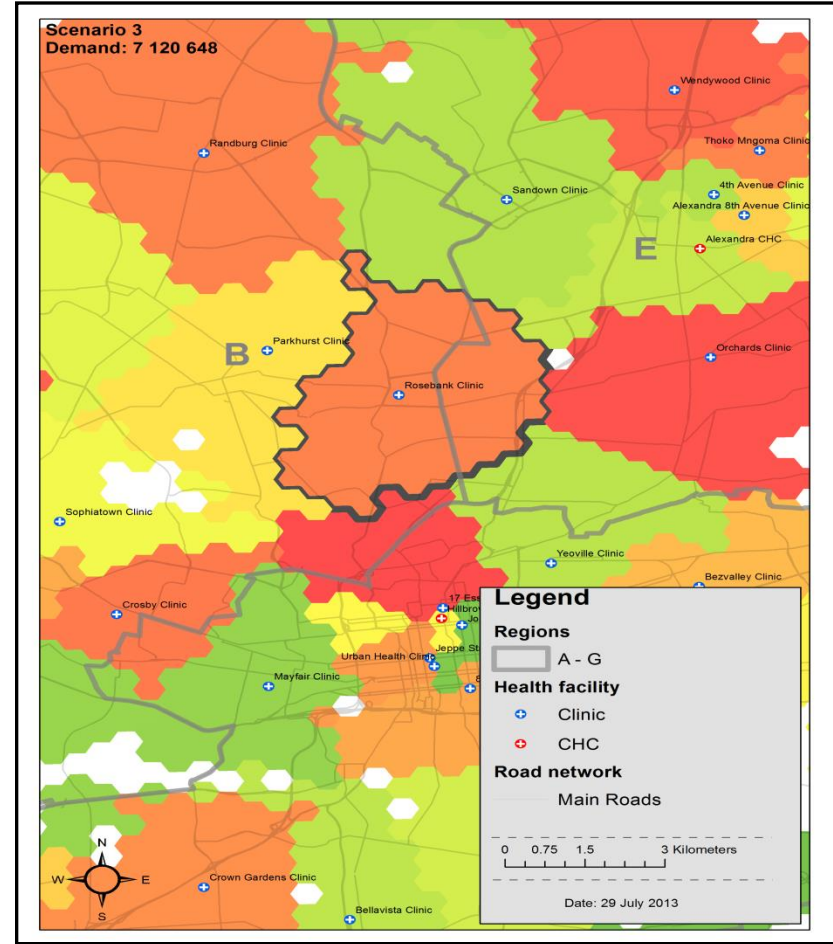
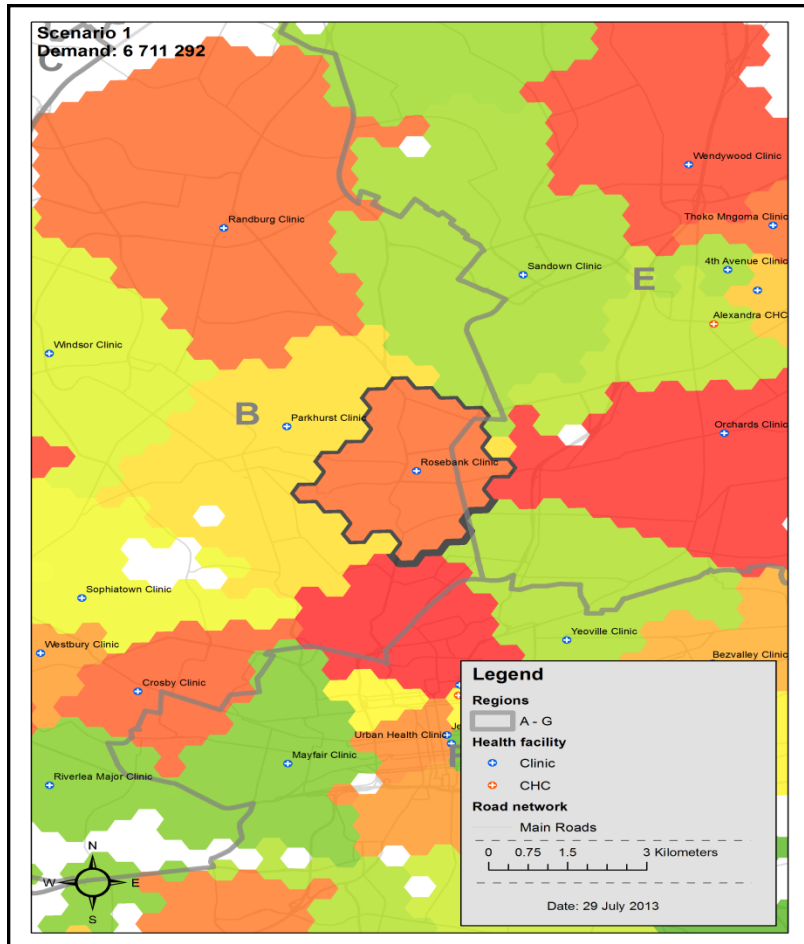
Criteria and processes for primary health care analyses

Description	The facilities selected for the analysis are mainly those that offered public primary health care services and acted as first point of contact with the health service delivery system. Attached to the facility data are attribute data indicating the capacity of the facility.
Facilities analysed	116 primary health care facilities with fixed locations (Clinics and Community Health Centres)
Demand	A. Scenario 1 B. Scenario 2 C. Scenario 3
Supply	Each facility was separately specified a capacity, i.e. translated into the potential to accommodate visits (visits to a professional nurse in a facility).
Travel mode and access distance	Transport via existing road network, with a distance travel standard: <ul style="list-style-type: none"> Facilities must be accessed within 5km (National Health Standard)
Analyses undertaken	<ul style="list-style-type: none"> Model catchment areas of facilities for each scenario based on capacity and maximum travel distance standard Compare utilisation data (in the form of headcounts) with the current capacity or threshold and also with the demand that has been allocated in terms of the catchment area analysis Map the actual origins of facility users based on patient register

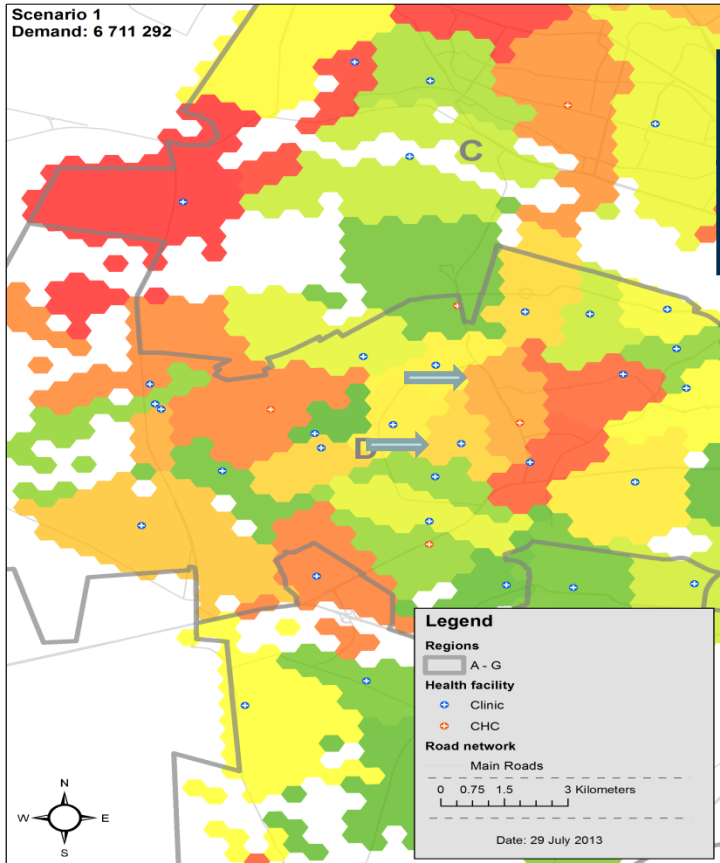
Results: Modelled catchments



Results: Modelled catchments



Results: Modelled catchments

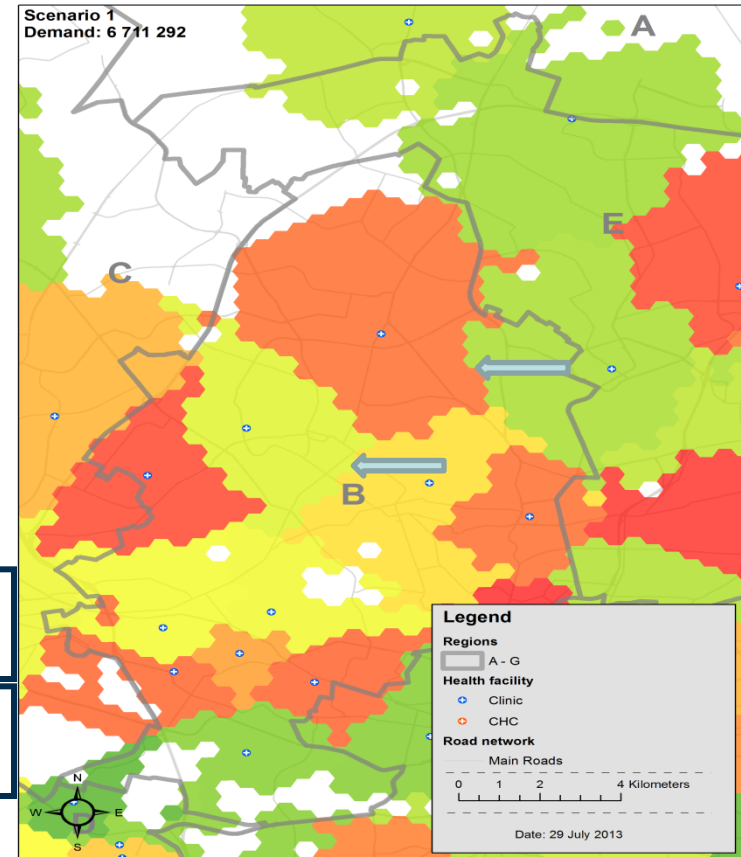


77 831 allocated demand

70 792 allocated demand

36 135 allocated demand

23 473 allocated demand



Findings

- **Headcounts:**
 - Total headcounts from the city exceed the totals from each of the 3 demand scenarios
 - Allocated demand from Scenario 3 more in line with facility headcounts – positive correlation
- **Patient register:**
 - 1% residing outside the city boundary
 - 44% not residing in catchment areas of the facility they visited
 - Significant flows in the direction of Johannesburg CBD
 - Model under-predicts the use of facilities that are further away

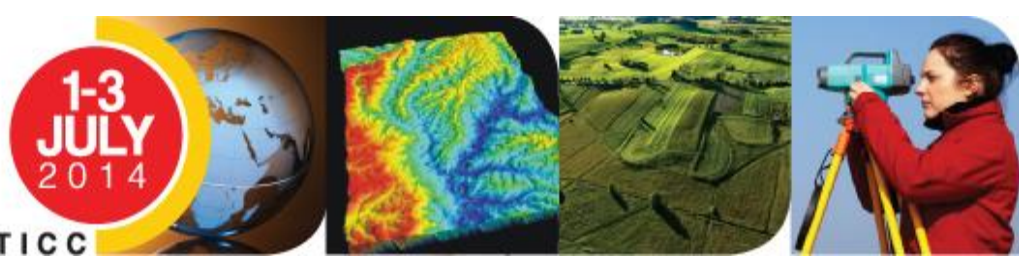
Concluding remarks

- **Implications for this project:**
 - Calculate the probability variance of rational choice vs. actual choice based on a distance measure to further enhance the model's capabilities
- **Steps to improved demand estimate:**
 - Improved algorithm to estimate demand
 - Detailed patient registers
 - Availability of spatially linked population employment data so that measures can be constructed by computing the measure separately for different trip purposes; from workplace and place of residence.



Cape Town 2014
Developing Geomatics for Africa

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Thank You

