

# DIAL-Malawi Use Case



EDA- Health and Sample MNO data

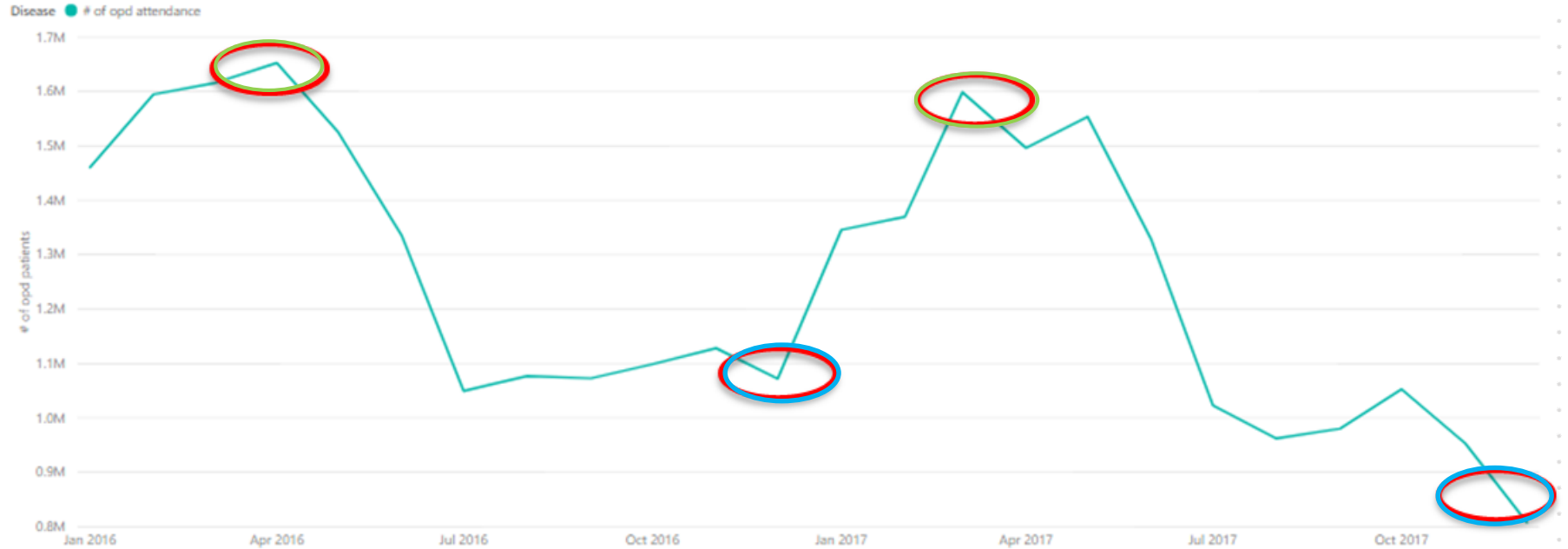
**(Work in progress)**





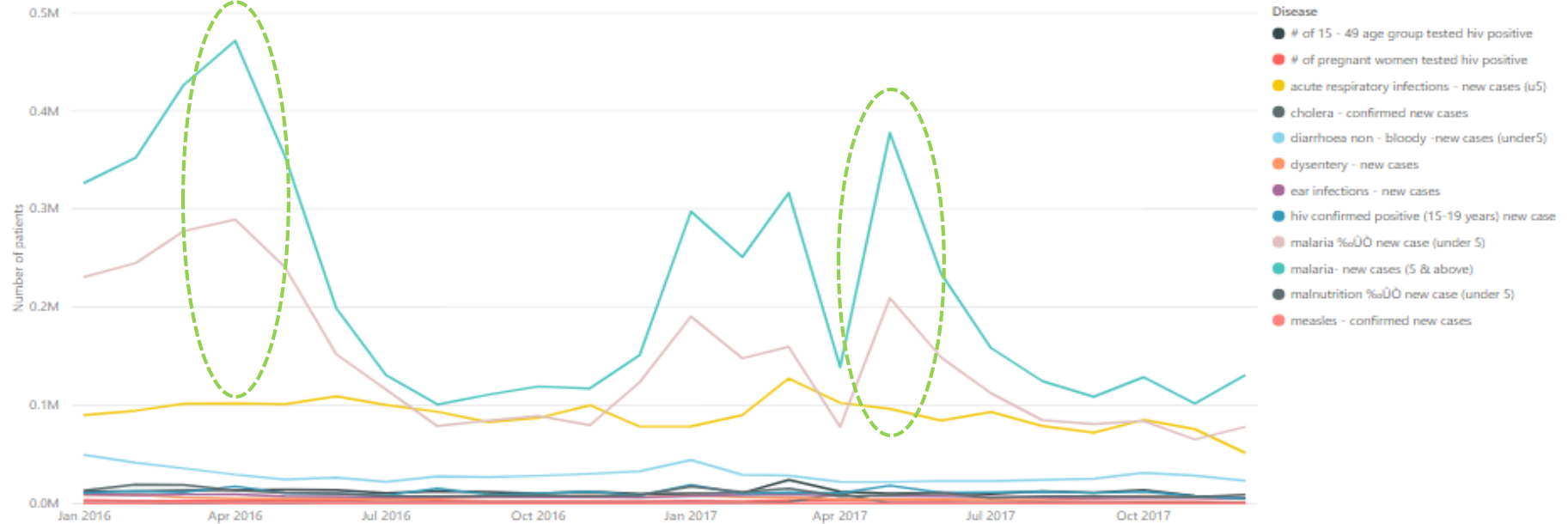
# Health data

# Trend of OPD Patients



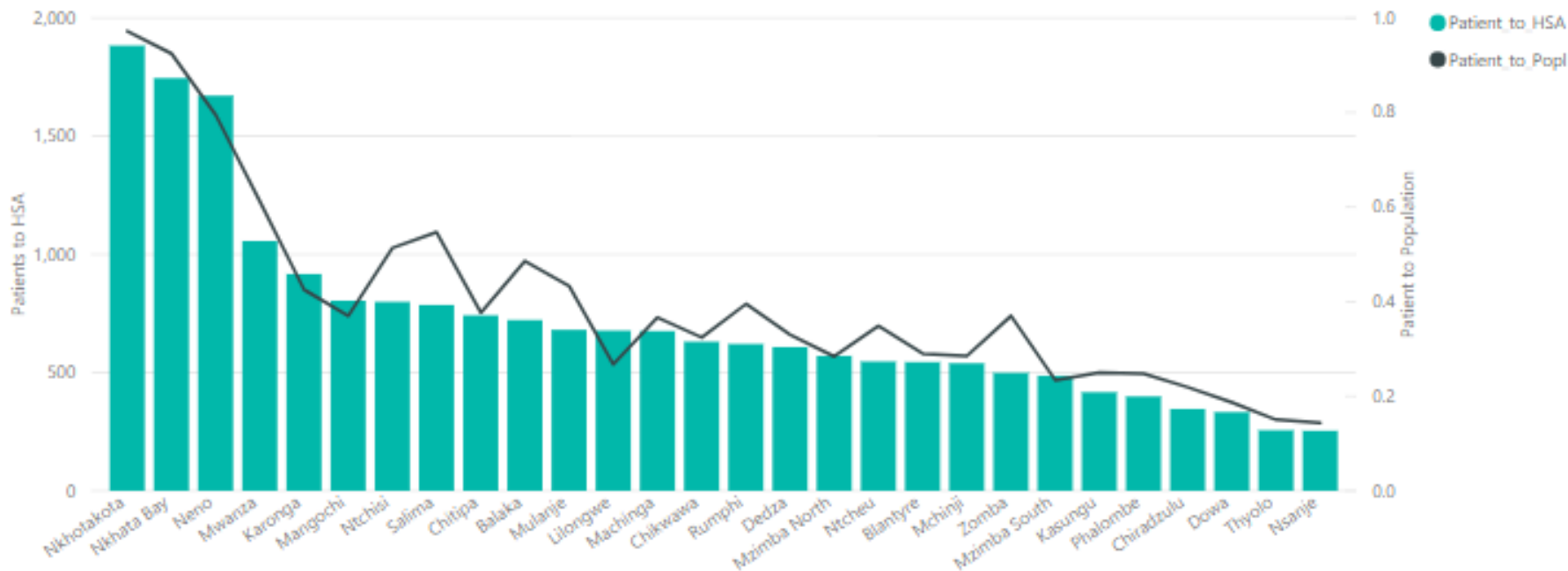
- The trend of OPD patients follows a similar pattern for the years 2016 and 2017.
- The number of OPD patients is **high in the first quarter** of the year followed by a **steep decline**.

# Number of Patients by Disease



- The total number of patients registered for each disease follows a similar pattern as OPD patient trend
- **Malaria** (new cases 5 and above, new cases under 5) and **acute respiratory** diseases are among the top 3 diseases (~ 84% of total # of patients)

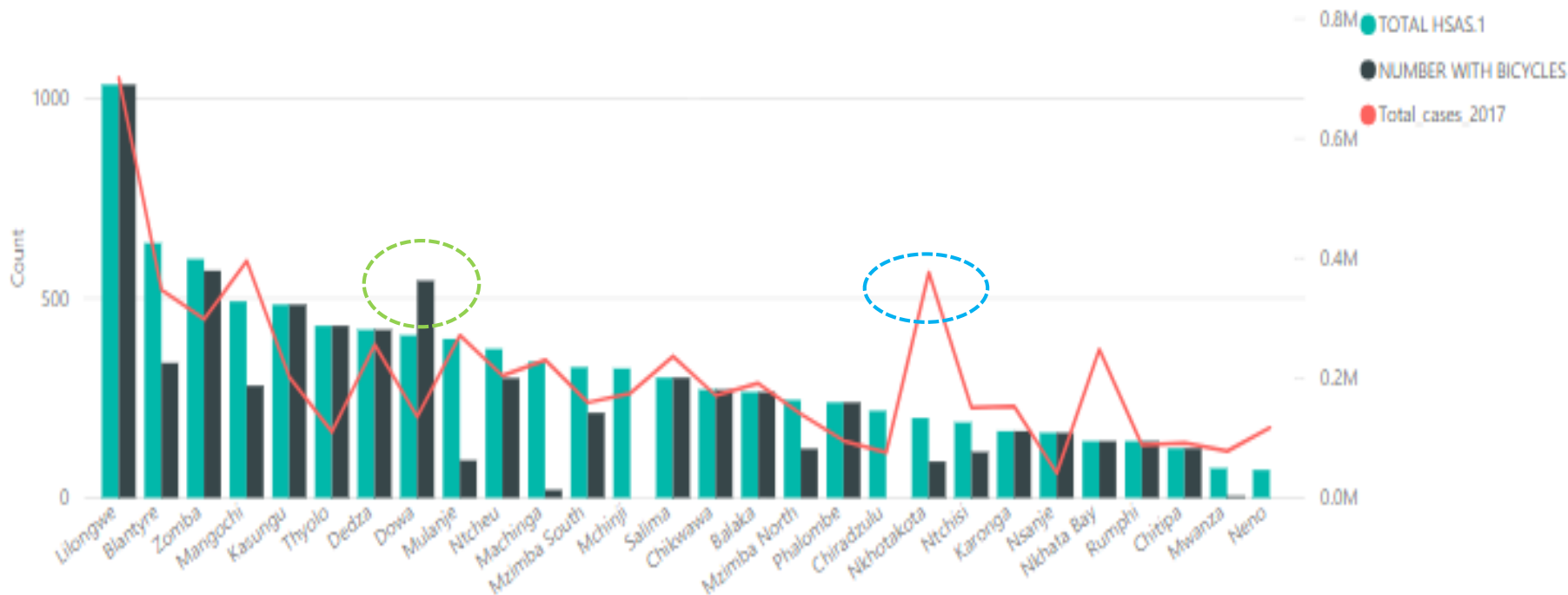
# Proportion of Patients to HSA and Patients to Population in Districts



\*Data represented for the year 2017

- **Nkhotakota**, **Nkhata Bay** and **Neno** districts have the highest burden on HSA
- **Salima**, **Balaka** and **Zomba** districts have high proportion of patients to population

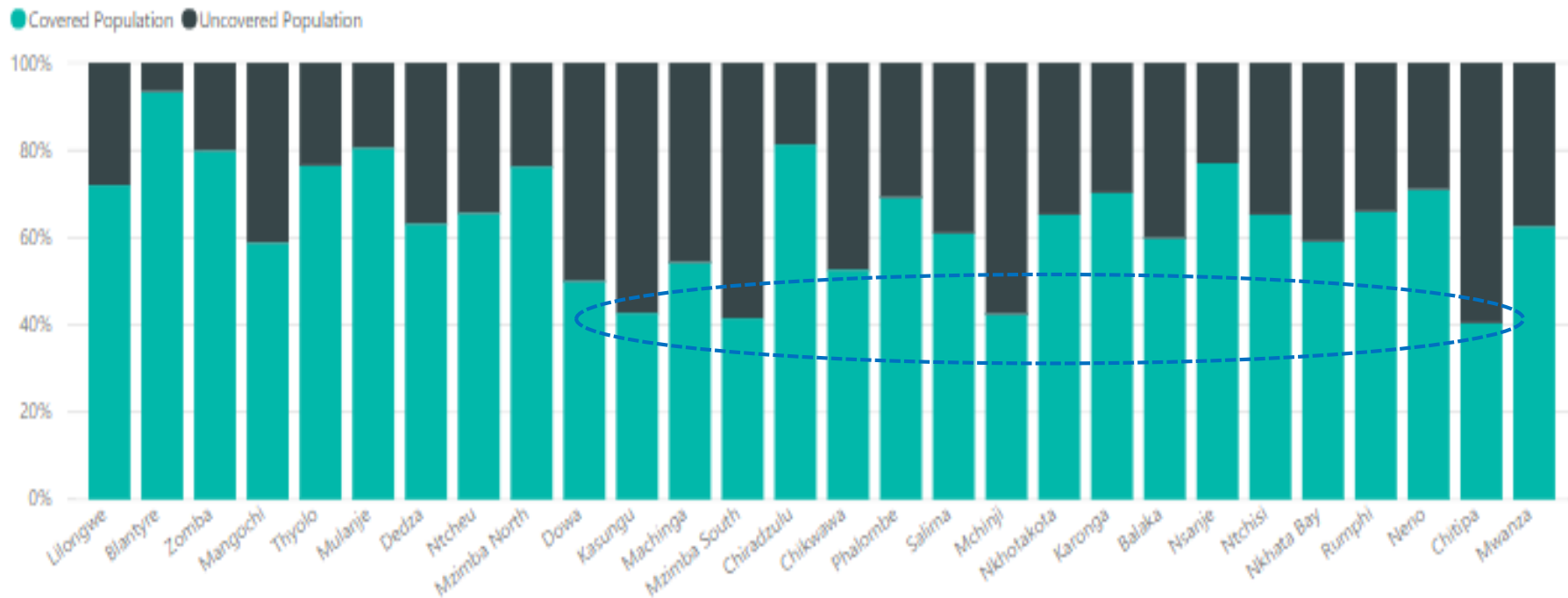
# HSAs and Total # of Patients



\*Data represented for the year 2017

- The number of patients registered in **Nkhatakota** district is comparatively higher than other districts
- In Dowa district, abundance of bicycles provided whereas in **Mchinji** and **Chiradzulu** districts none of the HSAs are provided bicycles

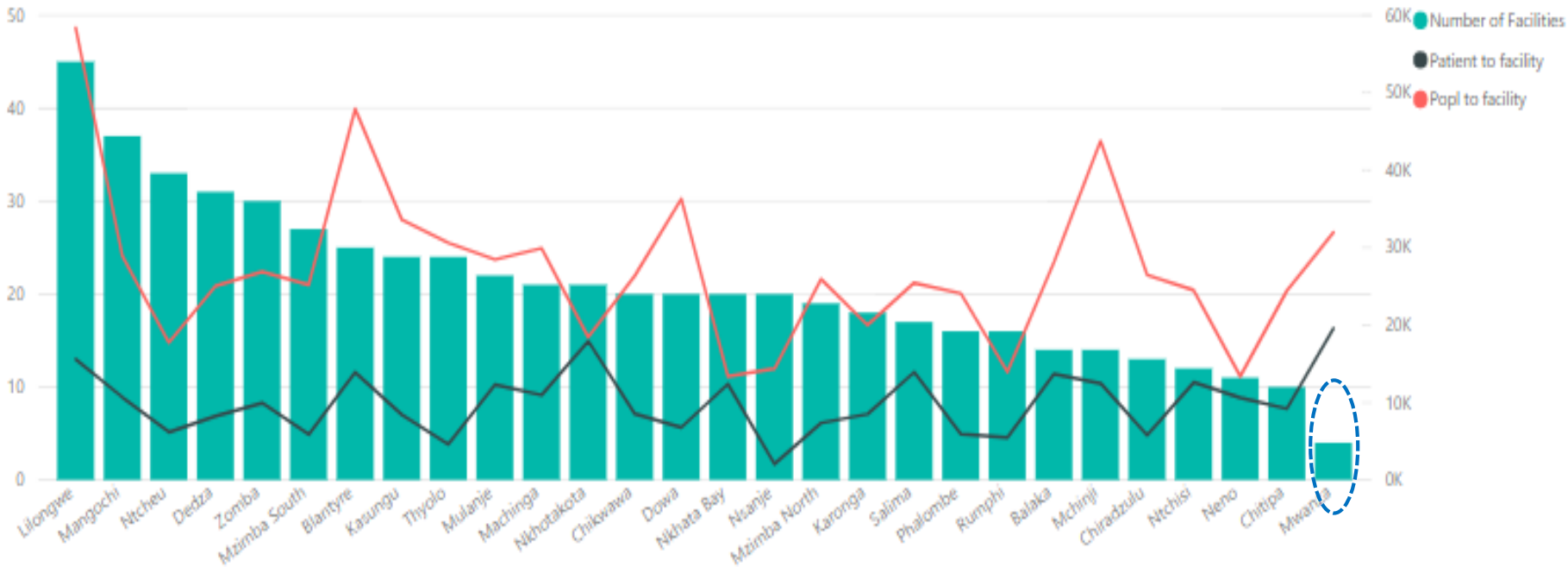
# Population coverage by facilities in Districts



\*Data represented for the year 2017

- ~ 60 % of population in **Chitipa, Mchinji, Mzimba South** and **Kasungu** districts live outside **5km radius** of a health facility.

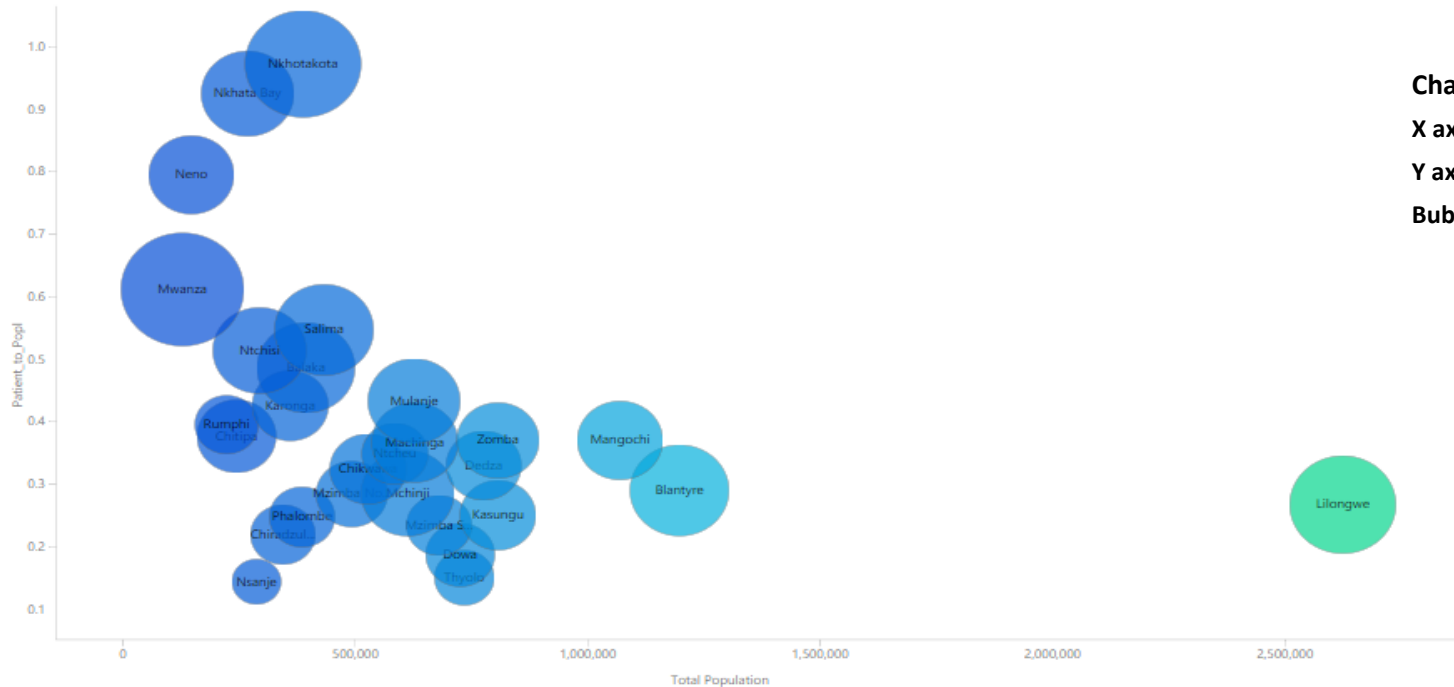
# Proportion of Patients to Facility and Population to Facility



- **Mwanza** district has the least number of health facilities with high burden on facilities



# District-wise Patient Burden



## Chart details:

X axis : Total # of population

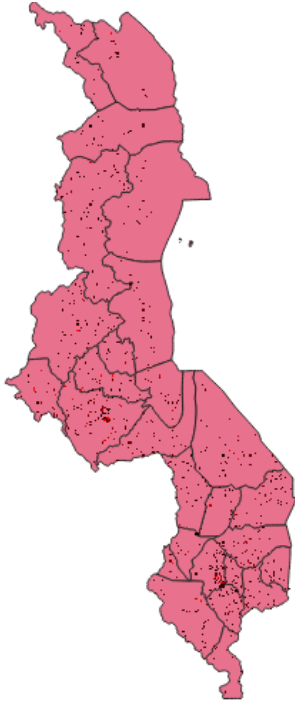
Y axis : # of patients/population

Bubble size : # of patients/# of facilities

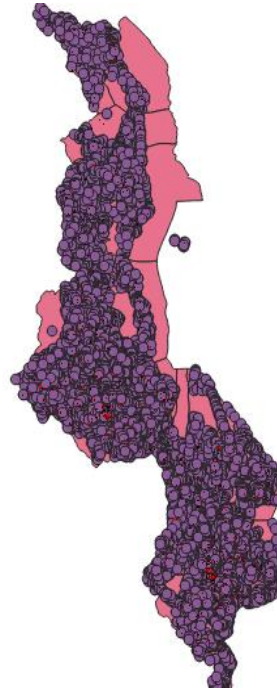
- **Nkhatakota** and **Nkhata Bay** districts reported **high proportion of patients** and significant **burden on facility** but relatively **low population**
- **Mwanza** district has least population with the highest burden on facilities

# Population Density and Distribution of Health Posts

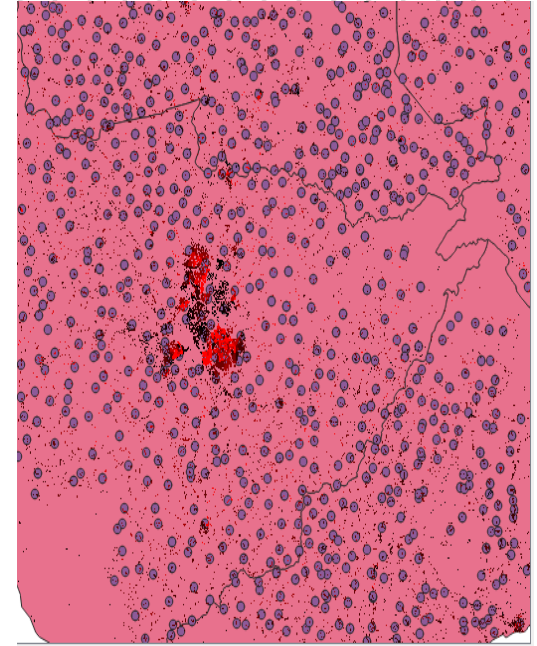
Population density



# of health posts



Normal



Zoomed version

\* **Blue dots** on the map signifies the **location of health posts** and **black dots** signifies the **population presence**

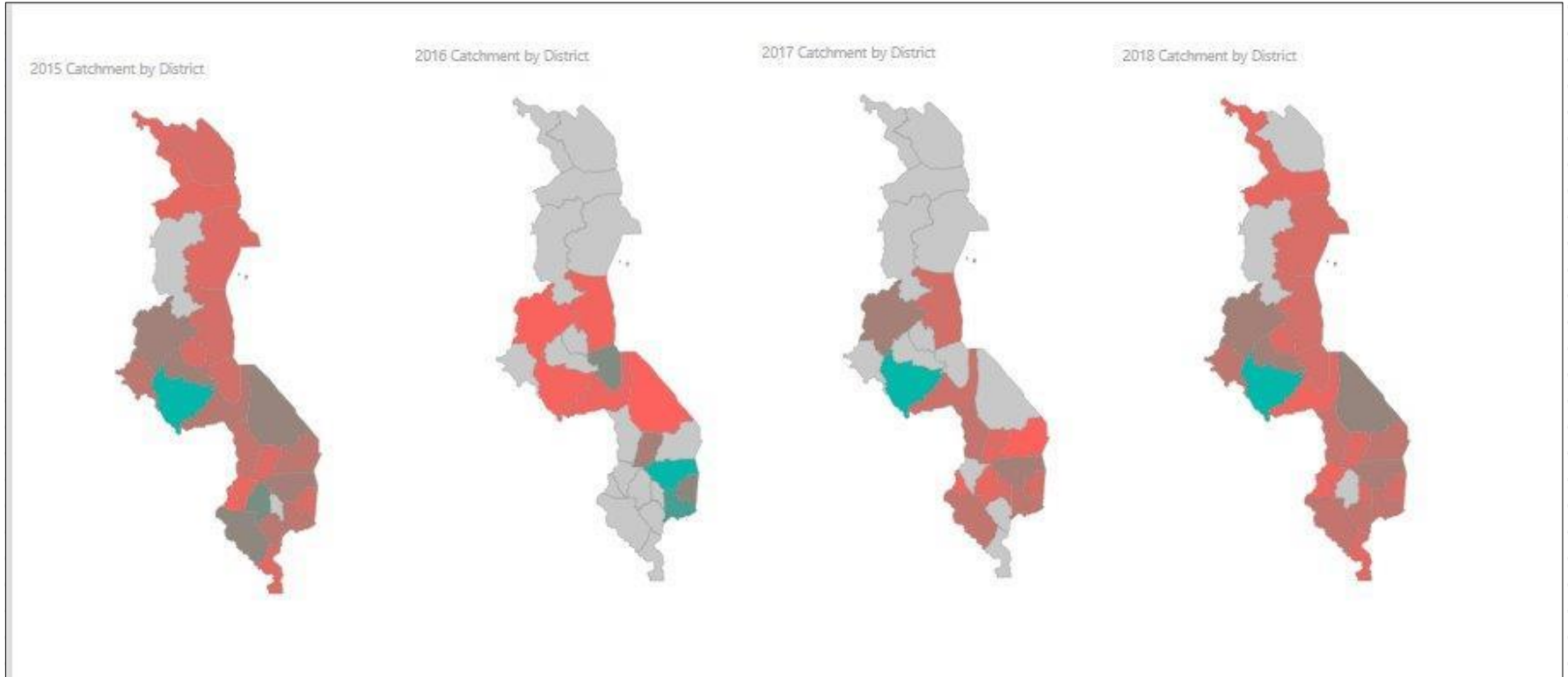


# Catchment Population Data

# Catchment Population - Data Details

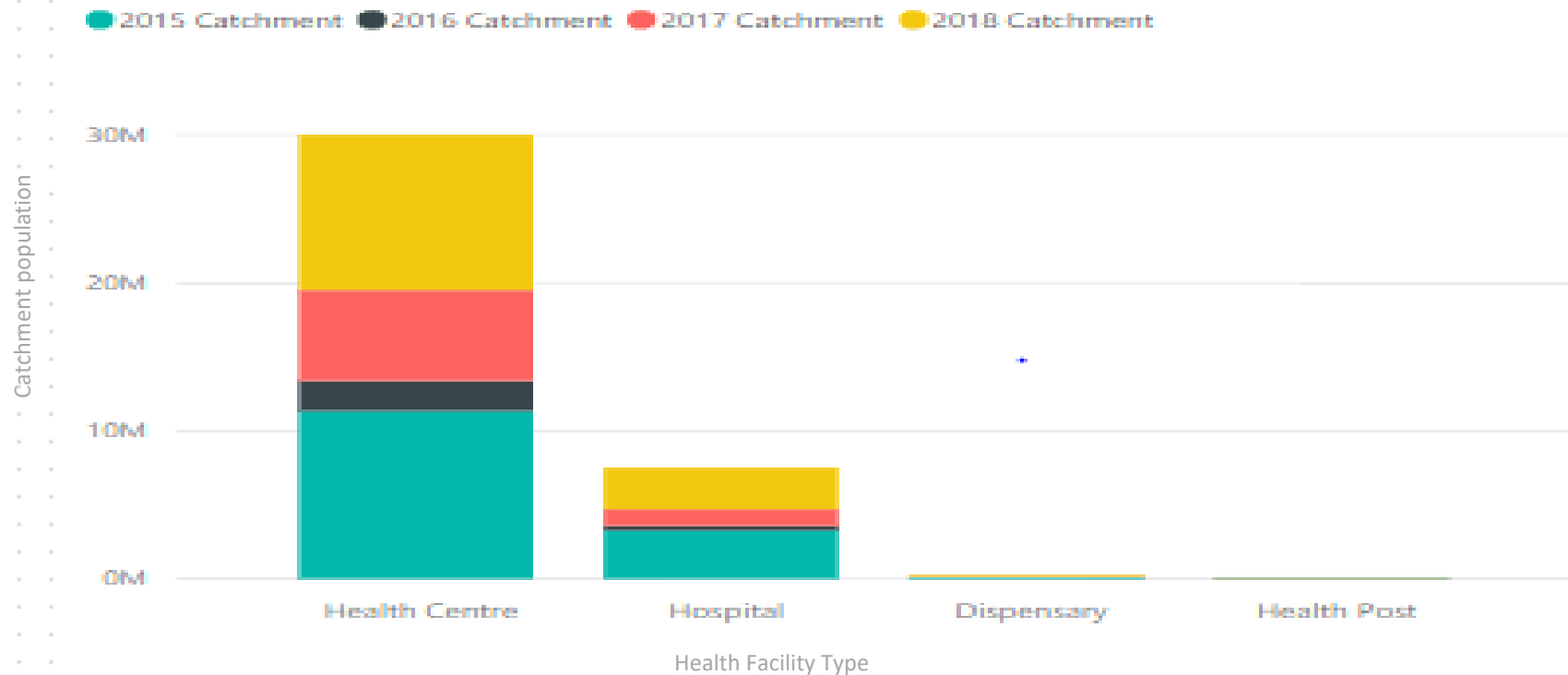
Summary Statistic	2018 Catchment	2017 Catchment	2016 Catchment	2015 Catchment
Count	537	278	107	568
Mean	27039	28402	23762	27316
Std	24001	26715	12929	31805
min	1129	1096	2179	2064
25% quantile	13035	14319	14193	12327
50% quantile	21189	22635	22844	20184
75% quantile	34514	34361	31413	32870
max	312657	301098	64375	518287

# Catchment Population by year



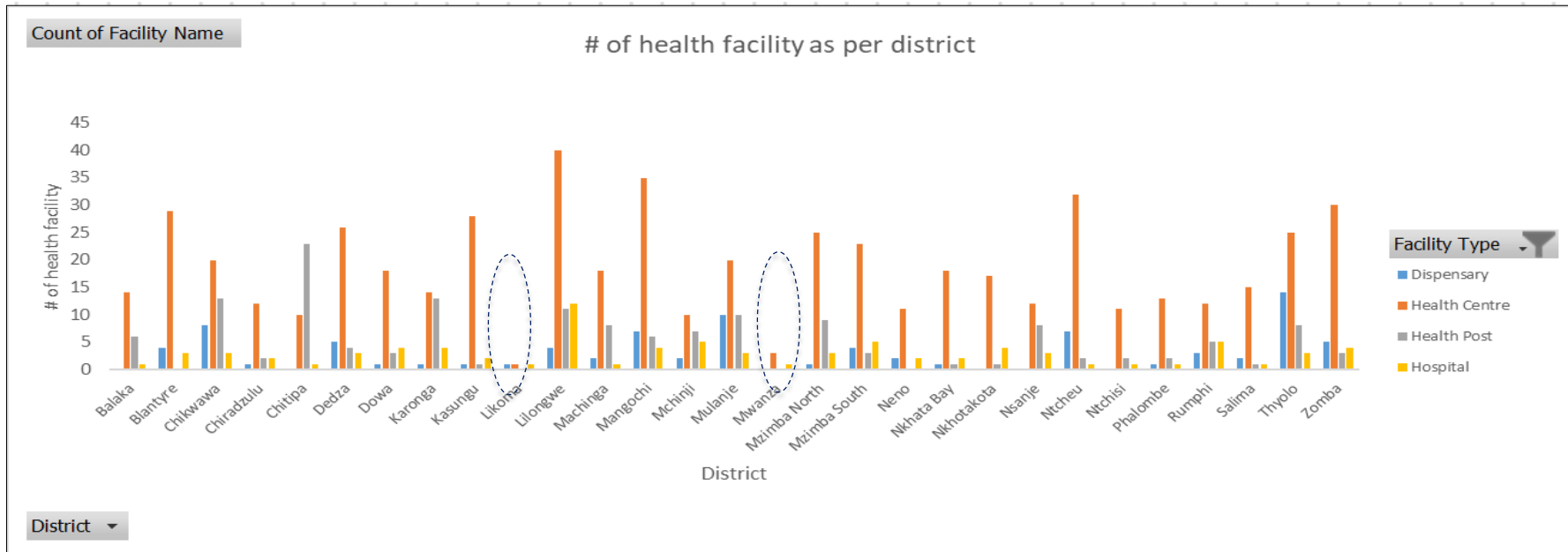
- Catchment population variation across 4 years (grey color on map signifies population not present)

# Facility Type wise Catchment Population



- **Health Centre facility** has the **highest catchment** population in comparison to other facility types (i.e. hospital, dispensary and health post)

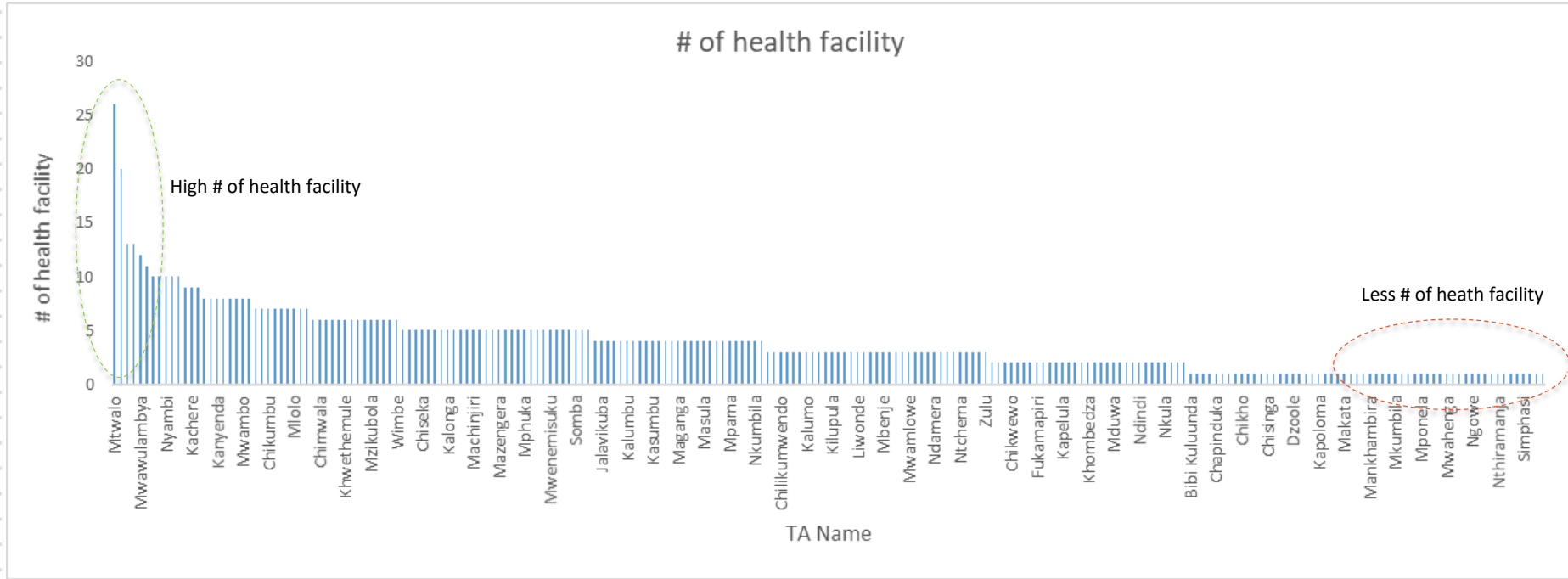
# Major Controlling health agency excluding Outreach and Village Clinic



\* Health agencies Outreach and Village Clinic are not in the current scope

- **Likoma** and **Mwanza** districts have very less # of Health Centre, Health Post, Hospital and Dispensary (*aligned to slide # 10 of this deck*)

# Major Controlling health agency excluding Outreach and Village Clinic



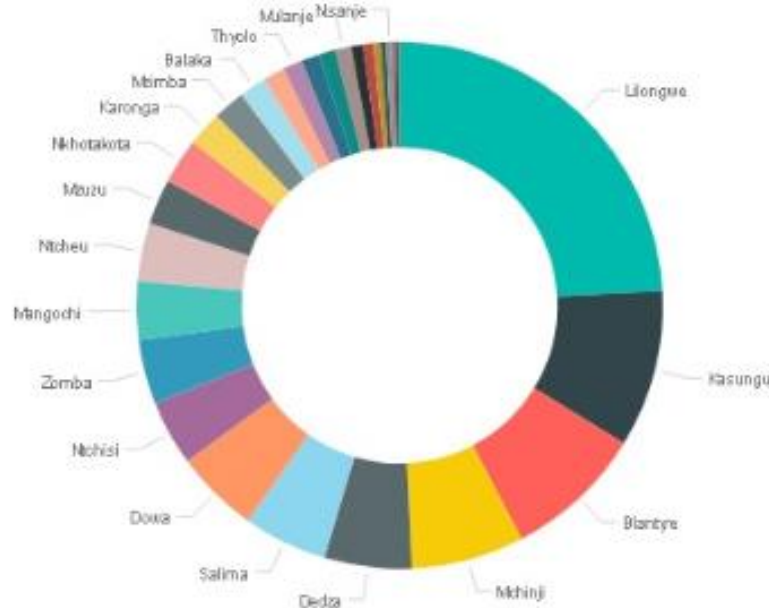
\* Health agencies Outreach and Village Clinic are not in the current scope





# 7 Days-MNO Sample Data

# Overview of # of SMS sent from Districts



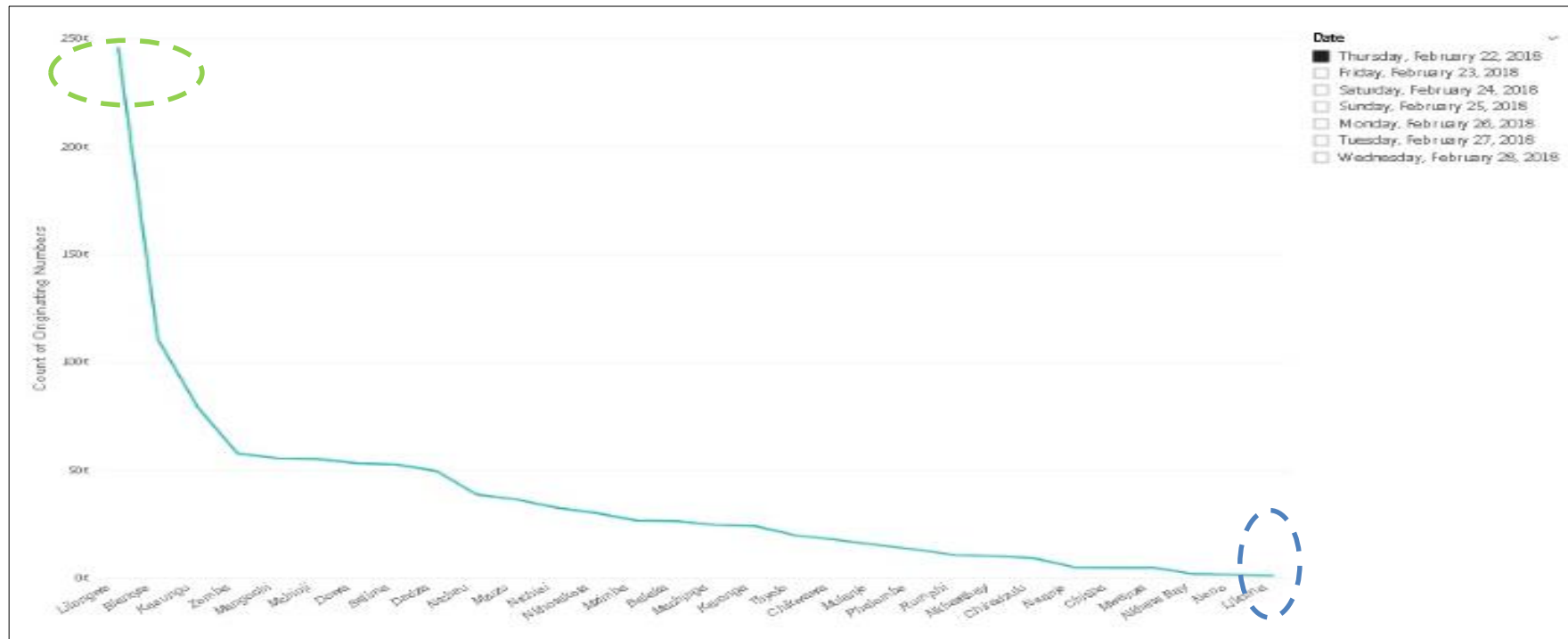
- **Maximum** # of sms sent from **Lilongwe** district
- **Lowest** # of sms sent from **Nakhata Bay** district

● ● ●



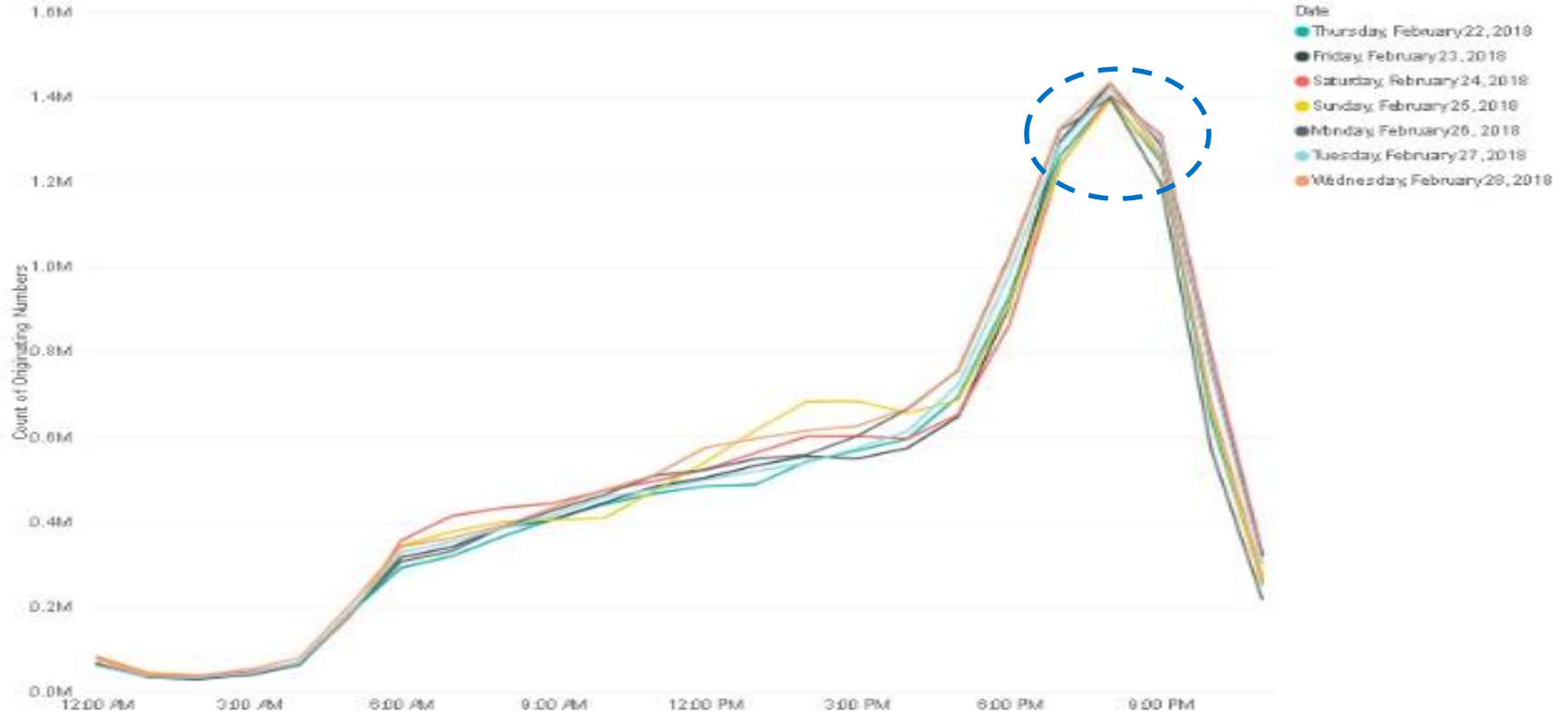
- 2<sup>nd</sup> highest # of sms sent from **Kasungu** for all 7 days

# # SMS sent from unique Originating number from Districts

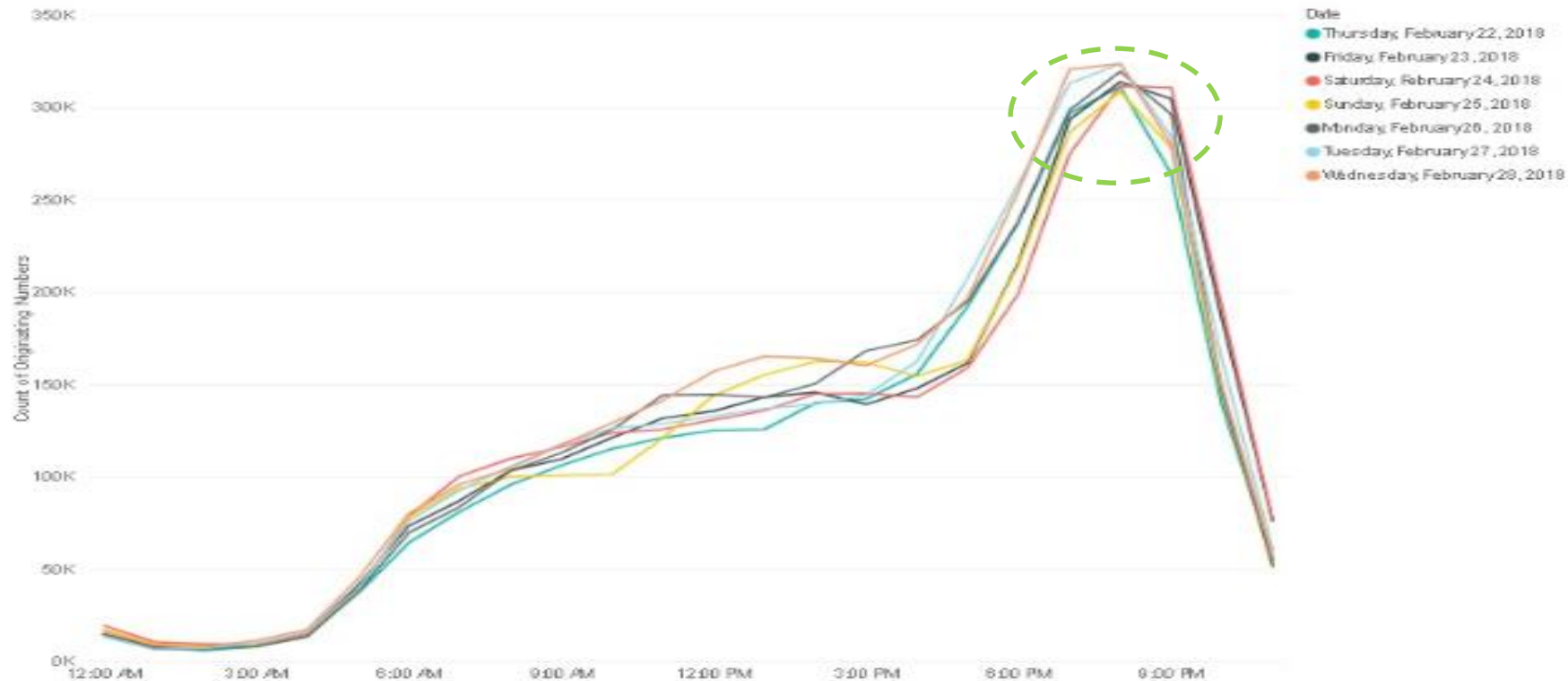


- Maximum # of sms sent from **Lilongwe** ; 2<sup>nd</sup> highest # of sms sent from Blantyre district
- Lowest # of sms sent from **Likoma** district

# Time - wise SMS sent from Towns/Districts

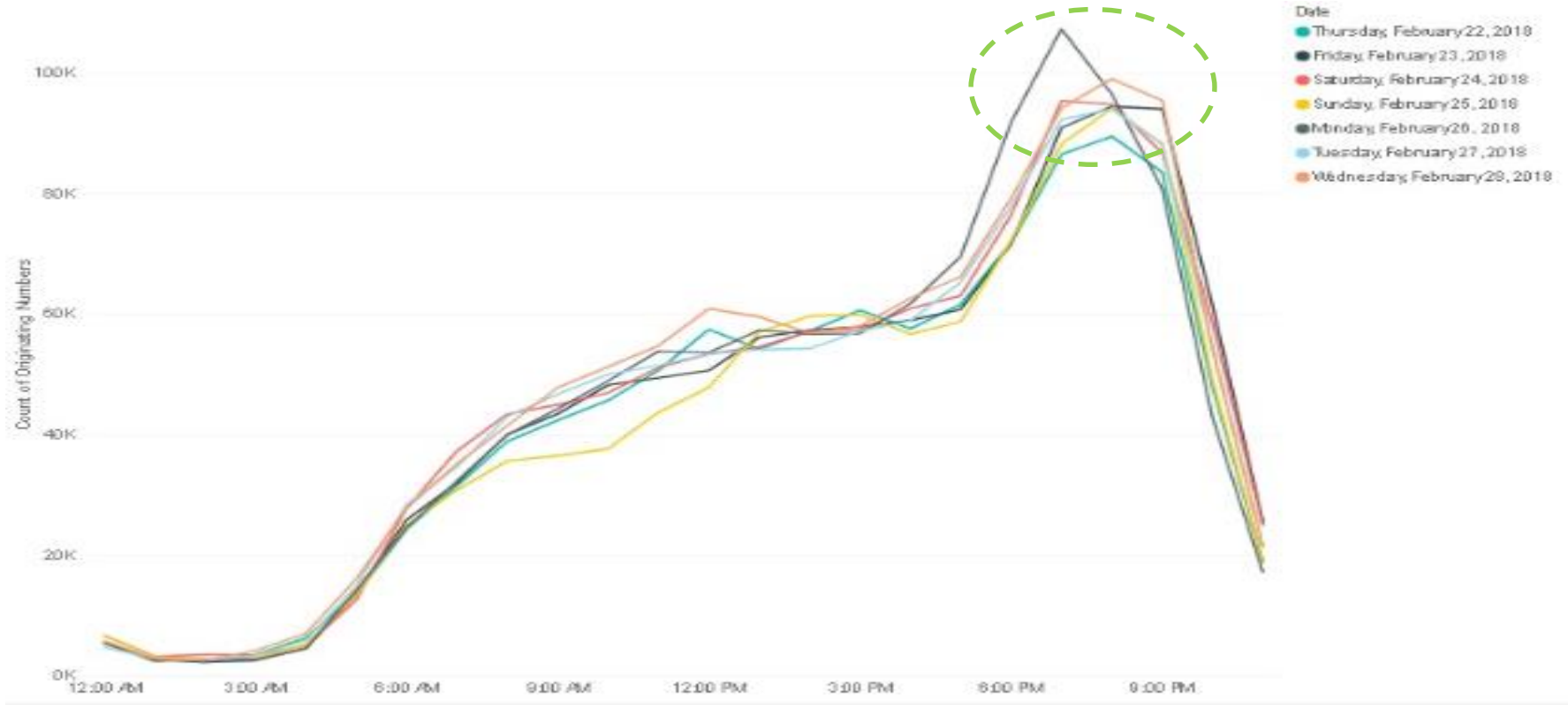


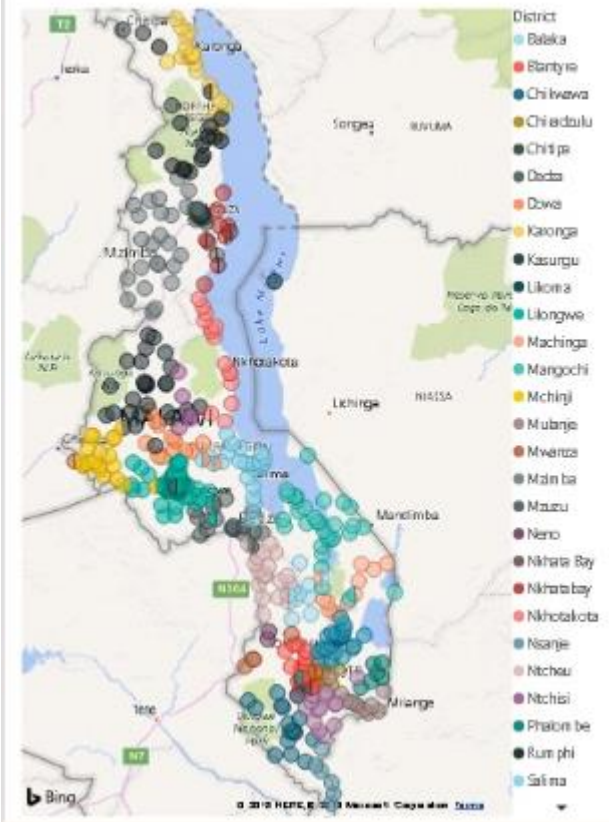
# Time-wise SMS sent in Lilongwe Town/District



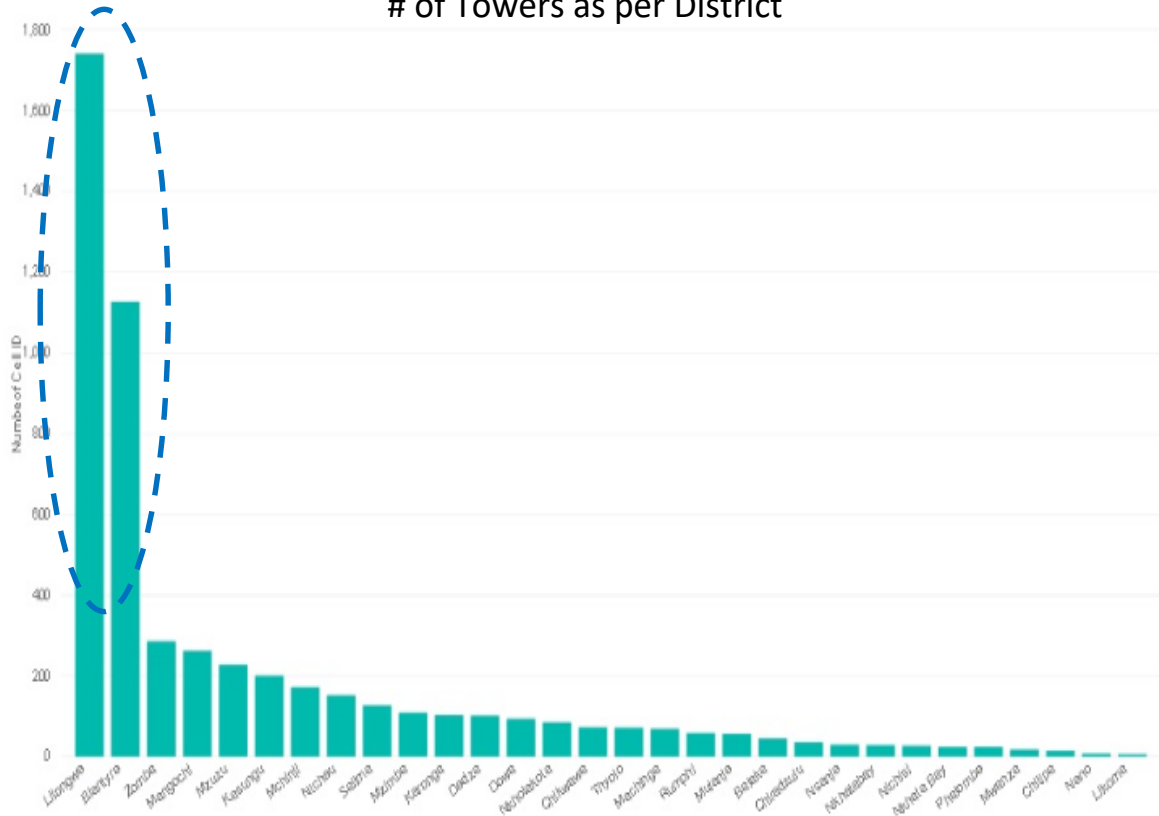
- Overall Maximum # of sms is sent between **19:00 to 21:00** in **Lilongwe**

# Time-wise SMS sent in Blantyre town/district





## # of Towers as per District

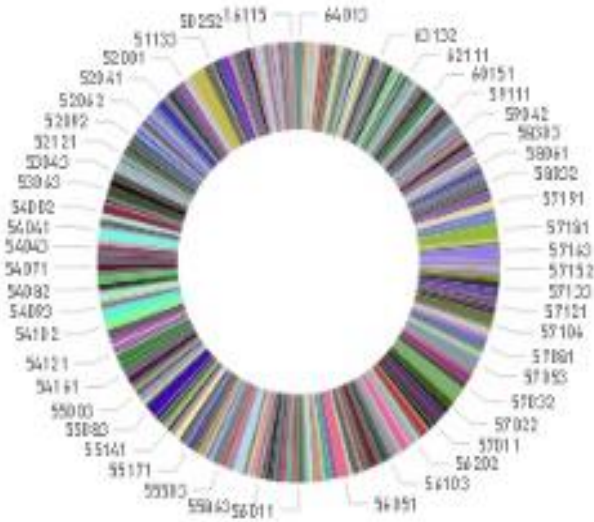


- **Lilongwe** and **Blantyre** have the maximum # of towers



# Usage of Cell ID

Count of Originating by CELL\_ID



Top 10 used Cell ID

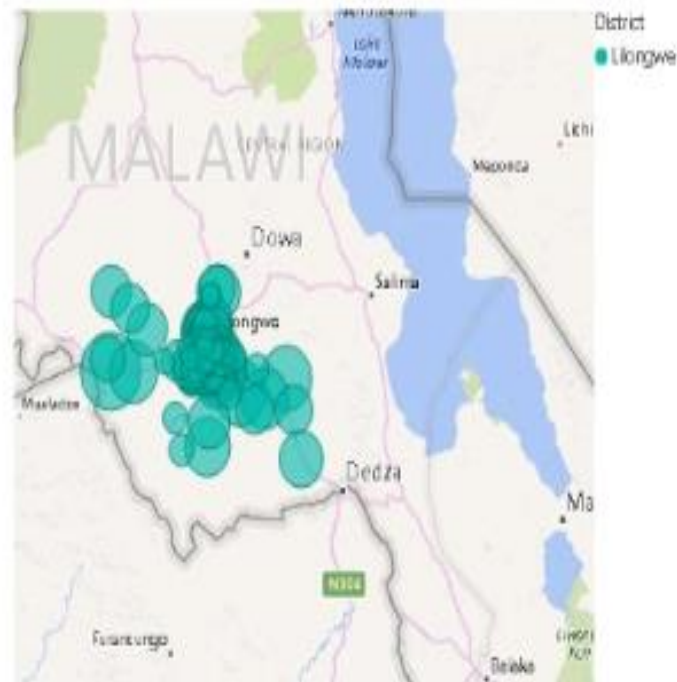
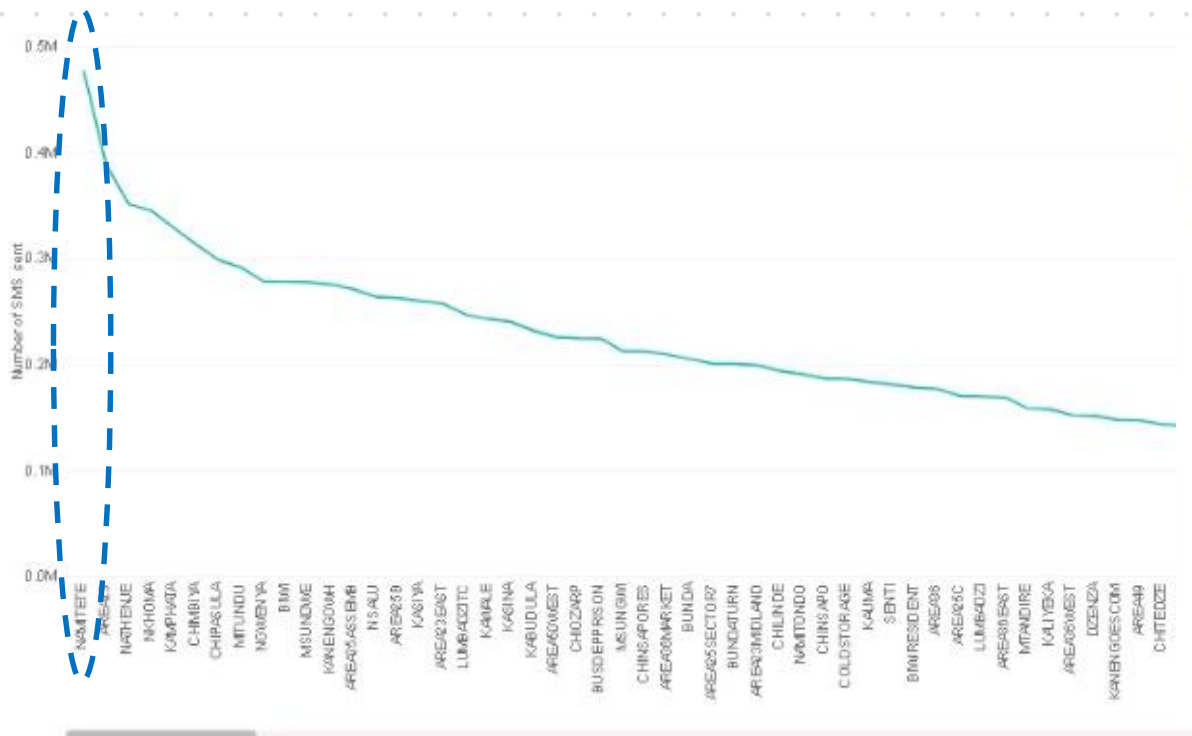


Bottom 10 used Cell ID



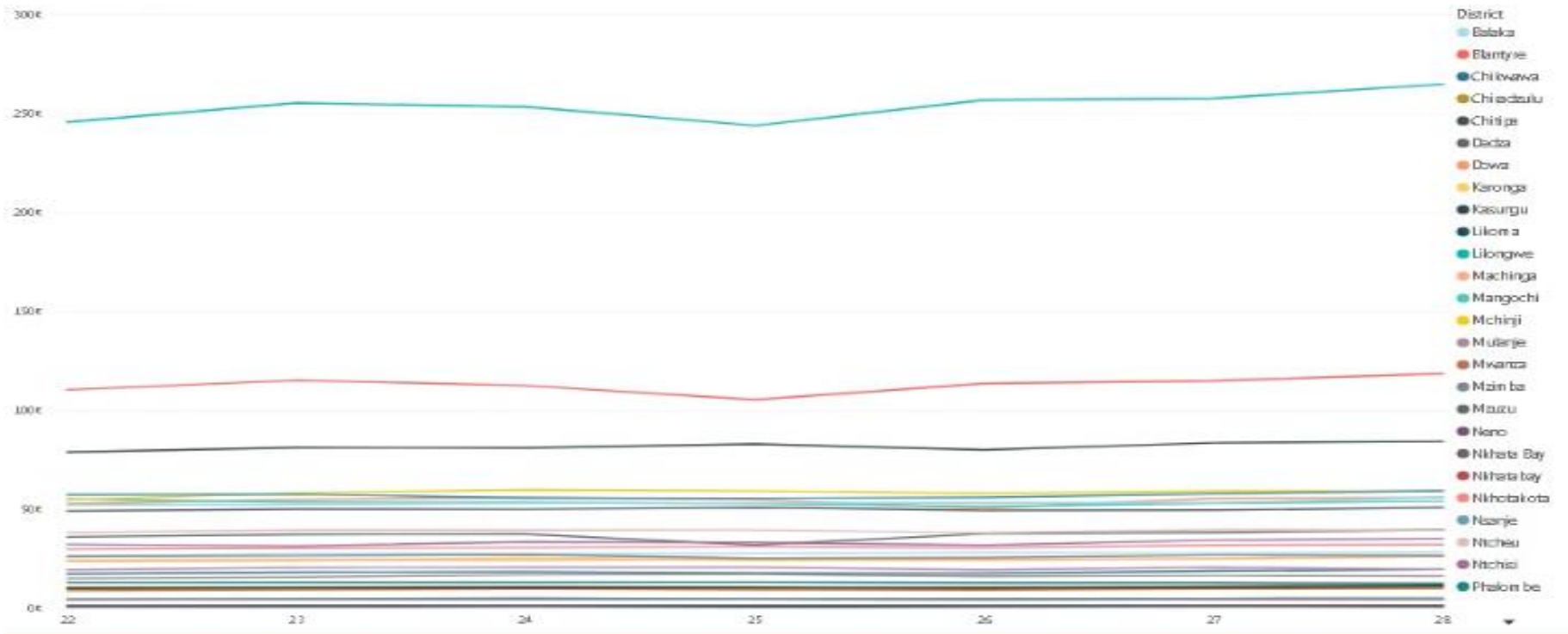
- **Dowa** district has the **busiest** Cell towers
- **Thyolo** district has the **least** used Cell towers

# Busiest Cell id across Lilongwe City town/district



- Namitete in Lilongwe district is the busiest site

# # of unique sender Id as per days



- # of unique sender id was reduced for 25<sup>th</sup> Feb, 2018 (Sunday)
- # of unique sender id was maximum on 28<sup>th</sup> Feb, 2018 (Wednesday)

# Population distribution at administrative areas

Population at administrative levels were obtained using administrative areas shape file and HRSL (Facebook) file.

Top 5 highly populated Administrative levels

ID_0	ISO	NAME_0	ID_1	NAME_1-District Name	ID_2	NAME_2-TA level	ID_3	NAME_3-One level down from TA level	TYPE_3	ENGTYPE_3	Population
135	MWI	Malawi	23	Ntchisi	206	TA Kalumo	2511	n.a. (544)	Unknown	Unknown	1052495.712
135	MWI	Malawi	7	Dowa	50	SC Chakhaza	646	n.a. (579)	Unknown	Unknown	834736.9758
135	MWI	Malawi	13	Mangochi	116	SC Chowe	1467	n.a. (1496)	Unknown	Unknown	199094.3244
135	MWI	Malawi	3	Chikwawa	23	TA Ngabu	296	n.a. (3014)	Unknown	Unknown	118994.6578
135	MWI	Malawi	12	Machinga	109	TA Kawinga	1378	n.a. (1790)	Unknown	Unknown	111125.2361

Complete population file:-



Microsoft Excel  
Worksheet

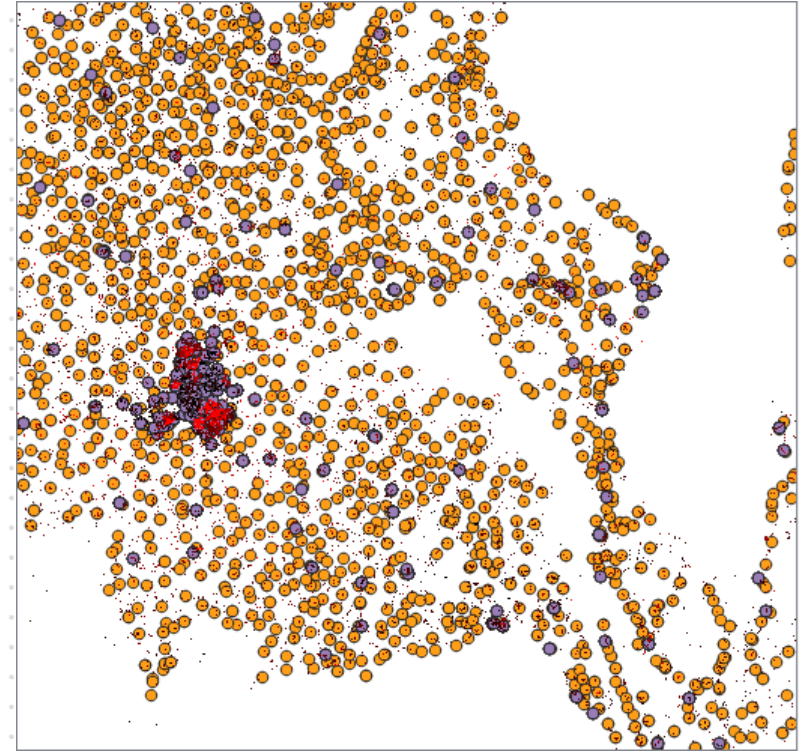
# Distribution of Health Facilities and Towers



Health facility and Tower



Zoomed version



Legend :

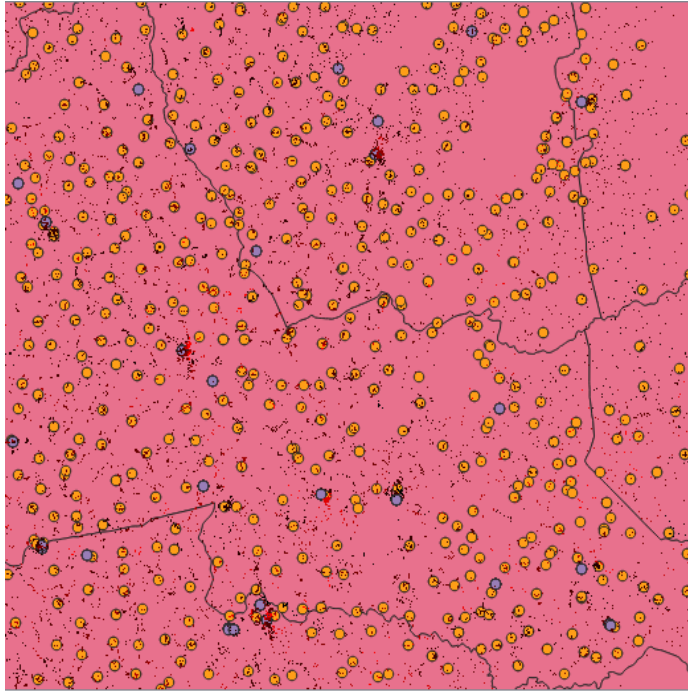
- Blue color signifies **Tower** location and **Orange** color signifies **health post** location



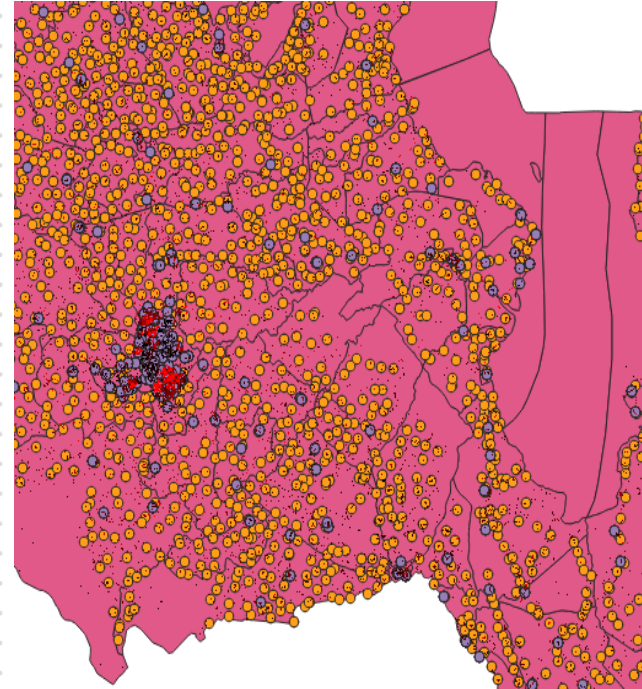
# Distribution of Health Facilities and Towers wrt administrative areas



Locations across districts (zoomed)



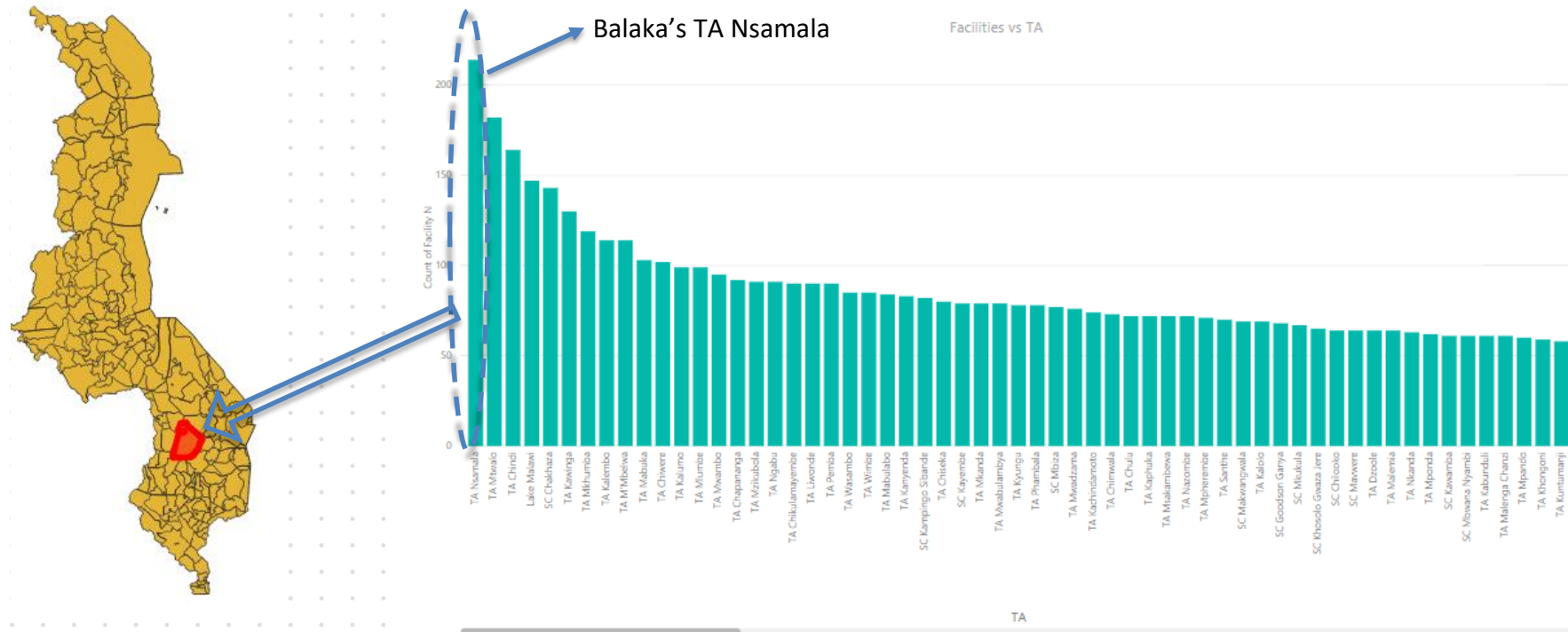
Locations across TA (zoomed)



Legend :

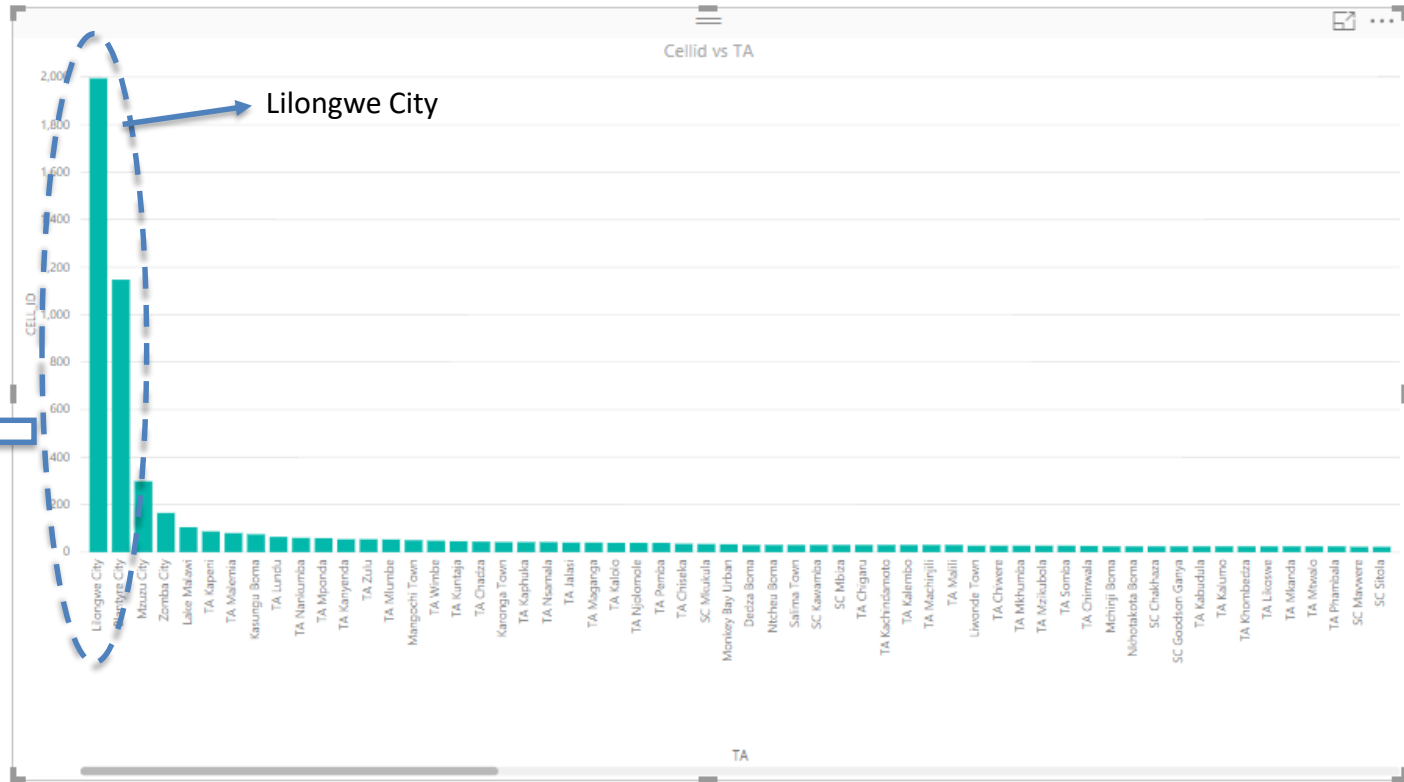
- **Blue** color signifies **Tower** location and **Orange** color signifies **health post** location

# Location of Health Facility at TA level



- Balaka's TA Nsamala has the **highest** number of facilities among TA(ADM-2 level)
- Boma's at Adm-2 level tend to have the **lowest** number of facilities

# Location of Tower at TA level



- Lilongwe city has the **highest** number of towers among ADM-2 level.



# Population coverage by each health facility

- Given a health facility, effort was made to identify the population within a given range of distance from it.
- It should be noted that the result obtained may contain populations which might be overlapping across two or more health facilities. **Please note this is an intermediate result.**

## Top 5 health facilities wrt. population around it

Facility Name	District	Region	Eastings	Northings	population 1km	population 2km	population 3km	population 4km	population 5km
KALIYEKA	Lilongwe	Central	33.80506	-14.0078	46446.46982	164933.6567	335277.6355	451877.512	481707.4755
MSIPE	Lilongwe	Central	33.803749	-14.022748	34005.42519	113578.3912	265467.4574	406484.6656	479211.2206
SOS	Lilongwe	Central	33.792844	-14.019732	25396.22311	143966.2435	281676.3102	404460.2963	473014.0582
NGWENYA	Lilongwe	Central	33.811766	-14.024238	30924.39924	104552.8891	208397.7816	356575.7897	470581.141
BIWI	Lilongwe	Central	33.79138	-13.99669	48452.447	153484.8829	279651.7395	388787.6208	465246.8827

## Bottom 5 health facilities wrt population around it

Facility Name	District	Region	Eastings	Northings	population 1km	population 2km	population 3km	population 4km	population 5km
CHILINDA	Rumphi	North	33.808544	-10.586809	1.315113226	1.815554542	2.315995857	2.618588281	3.270325809
CHILINDA	Rumphi	North	33.808544	-10.586809	1.315113226	1.815554542	2.315995857	2.618588281	3.270325809
LIFUPA	Kasungu	Central	33.146923	-13.049063	15.50711123	16.73135685	19.1798481	27.34148559	35.50312308
CHEGHAMILA	Karonga	North	33.558060	-9.968177	30.01696352	90.05089055	114.0644614	115.0483606	157.555286
KAZOMBA	Nkhotakota	Central	33.832959	-12.301259	13.74984974	27.17370967	55.54255387	87.92340155	219.6554548



# Appendix

# Features created

- Patient to Population =  $\frac{\text{Total number of cases registered in district A}}{\text{Population of district A}}$

Proportion of patients in each District

- Patient to Facility =  $\frac{\text{Total number of cases registered in district A}}{\text{Number of facilities in district A}}$

Number of patients catered to by a facility in a district

- Patient to HSA =  $\frac{\text{Total number of cases registered in district A}}{\text{Number of HSAs in district A}}$

Number of patients catered to by a HSA in a district

- Population to Facility =  $\frac{\text{Population of district A}}{\text{Number of facilities in district A}}$

Number of people expected to be catered to by the existing facilities in a district

# EDA Approach

## Steps

- Analyze MNO sample data
- Analyze overall disease burden data on districts
- ✓ **Metric-**
  - ❖ Patient burden
  - ❖ Facility Burden
  - ❖ HSA burden

## Definitions and units

- Patient burden= # of patients/# of population, expressed as ratio
- Facility burden= # of patients/# of facility, expressed as ratio
- HSA burden= # of patients/# of HSA, expressed as ratio

# Health in Malawi -Facts

- Health system ranking
  - ✓ 185 out of 190 Worldwide (source : WHO)
- Disease burden rates
  - ✓ Very high especially for HIV /AIDS, malaria, tuberculosis
- Health staffing
  - ✓ 2 physicians per 10000 population (compared to 25 in USA)
  - ✓ 3.4 nurses per 10000 population
  - ✓ One qualified cardiac consultant for population
- Healthcare accessibility
  - ✓ Limited access to health facility affect large number of Malawians
  - ✓ Only 46% of population live within 5km healthcare facility radius
  - ✓ Despite most public services are free, there are often a lot of costs associated with transportation to the healthcare facility
- There is no emergency systems in place for medical services, fire service or crime response.
- Challenges
  - ✓ Lack of Manpower
  - ✓ Lack of basic skill sets
  - ✓ Lack of advanced technologies
  - ✓ Overpopulation
  - ✓ Poor budget planning
  - ✓ Lack of motivation among personnel

# Comparison-Top 5 Districts

District	Patient/ population	population	Patient/facility	% Uncovered Population
Blantyre	0.28	1197372.59	13889	6.60
Lilongwe	0.26	2624470.89	15584	28.00
Mwanza	0.61	127867.44	19548(highest burdened)	37.42
Nkhotakota	0.97	387427.52	17936	34.75
Salima	0.54	432679.45	13915	39.05

## Observations :

- Of the 5 patient burdened districts 2 districts are highest populated districts of Malawi
- Mwanza and Nkhotakota have high patient burdens without required number of facilities to cater to
- Nkhotakota is being moderately populated district but severely lacks facility to cater to the requirement.
- All the five districts are not geographically concentrated, they are spread over Malawi.

**Health facilities are unevenly distributed in Malawi**

# Uneven distributions of facilities

## Districts with lowest facility burden

District	Population	patients by_ facility	patients by_ population
Nsanje	287413	2067.50	0.14
Thyolo	734558	4598.04	0.15
Rumphi	223128	5510.81	0.39
Chiradzulu	344194	5803.38	0.22
Mzimba South	680199	5894.63	0.24

## Districts with highest facility burden

District	Population	patients_ by_facility	patients_ by_population
Mwanza	127867	19548.50	0.61
Nkhotakota	387427	17936.38	0.97
Lilongwe	2624470	15584.56	0.27
Salima	432679	13915.88	0.55
Blantyre	1197372	13889.04	0.29

### Observations -

- Dist. with lowest facility burdens
  - Lowest facility burdens tend to have low patient burden as well
- Dist. with Highest facility burdens
  - All the districts are in central and south Malawi



Thank You

