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TOMTOM CONSORTIUM

TUBERCULOSIS IN THE MINING SECTOR – SOUTHERN AFRICA PROGRAMME

FINAL REPORT

17 MARCH 2017

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CONTRACT

WITS DEVELOPMENT ENTERPRISE DIVISION, A DIVISION OF WITS HEALTH CONSORTIUM (PTY) LTD ("WDED"), contracted Riskscape (Pty) Ltd ("Riskscape" or TomTom consortium") in its own capacity and on behalf of the TomTom Consortium Members for a part of work funded by The Global Fund (TGF) under a Grant Titled "SARCM Regional TB in the Mining Sector South Africa". The scope of the work is specified under Addendum B of the contract between the WDED and the TomTom consortium dated XXXXX, and was specified as follows:

"The Scope of Work for this activity will generate strategic information on all 8 countries to support effective planning and implementation of the TIMS program and countries' National TB programme (NTPs). Specifically, a geospatial mapping of the mines, the mineworkers, ex-mineworkers and health and compensation services available to them in the eight countries will be conducted to inform the scale-up of the TIMS programme. This mapping study will be carried out in two phases:

- Phase 1 will establish the geospatial database of the mines, the mineworkers, ex-mineworkers and affected communities; identify mining locations, areas around the mines and labour-sending areas; and map the health facilities available in and around these locations. The mapping will be conducted using a mix of methodologies dependent on the country context and shall recognize the data sub-sets that are necessary for effective targeting of grant interventions (sub-KP groups, mine commodity, size, etc.). There are countries with secondary information that can be used for this exercise, while others may require primary data collection or a mix of the two sources. The successful SP will be responsible for identifying all relevant secondary data sources during an initial assessment to determine which countries may already have good quality mapping data to drive the geographic focus of key interventions under this grant.
- Phase 2 will assess the occupational health/TB and compensation services available in the health facilities located in the mines, areas around the mines and in labour-sending areas with high density of key populations. Data from phase 1 will assist in targeting the health facility assessment and serve as a basis for planning the scale-up of relevant services, including the regional occupational health service centres (OHSCs) [to be funded separately]."

"KEY ACTIVITIES
(a) Conduct an initial assessment and inventory of the data available in each country for mapping, including what data may be available from the mines themselves, district and sub-district health authorities, survey studies and previous mapping exercises. Identify gaps for where primary data collection may need to occur at country-level.
(b) Propose a country-specific study approach and strategy on how to apply geo-spatial mapping techniques to generate data regarding key population spread for all eight countries based on primary and secondary data. Consider how regional consensus will be reached for recommendations with varying levels of available data at country-level.
(c) Conduct geospatial mapping of mines, mineworkers, ex-mineworkers and communities to

identify areas of need. Eight country-specific maps will be generated as a regional map may not be possible depending on data availability.
(d) Assess the availability of healthcare facilities, workers' compensation services, and community based support structures in areas where key populations are in high density, or 'hot spots'
(e) Develop an inventory of available health care facilities and community-based structures, including compensation services in heavily affected areas for future use as well as contact details for all key stakeholders identified through the mapping exercise."

All deliverables of our work, including this report, is bound by the terms of our agreement.

Reliances and limitations

We have relied on the documentation provided for our findings and representations by stakeholders including the WDED and in-country officials. Our scope of work is specified in the contract dated XXX, and only the WDED may rely on our findings. No other inferences or conclusions should be made from our work except those explicitly stated in our report. The report should be read in its entirety, and inferences or conclusions made should as such be based on the entire report. We draw your attention to the limitation of liability clause in our contract.

EXECUTIVE SUMMARY

The TomTom Consortium successfully identified and mapped the mining and labour-sending populations for Botswana, Lesotho, Namibia, Malawi, Swaziland, Tanzania, Zambia, Zimbabwe and Mozambique. The results were used to determine TB Hotspot areas for field surveying of health care facilities to confirm the existence of TB screening and treatment equipment.

The methodology approach was unique in that it required both advanced GIS and statistical analysis on a scale that is normally associated with long term projects. The detail – and timelines - of mapping and analysis required for successful delivery on objectives of the project, being the identification of key populations of current and ex-mineworkers, identification of key mines and health care facilities, determination of TB Hotspot areas as well as inventory and targeting of health care facilities in these areas, required each consortium member's timely delivery on individual objectives and responsibilities, as the final Hotspot and HCF Target analysis was interdependent on accurate and complete information for all countries in the region. The 3 main risks, each with a profound impact on the methodology approach, were: accessing mineworker address lists, obtaining existing healthcare inventory lists and timely ethical clearance to limit delays in the project finalization. We subsequently experienced all the above risks in varying degrees, but managed to mitigate the majority of problems.

Although the GIS methodology approach was unique, the individual components of the methodology is widely used and well tested, e.g. geocoding, mapping of built-up areas and mines via remote sensing and the use of Thiessen polygons to represent the partitioning of cities, towns, villages or settlements, into sensible regions of influence for Hotspot analysis.

Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB in our statistical methodology, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria. Once the fields were combined, the resultant statistical values were available for all Thiessen polygons in each country.

The variability of the health care facility data available in each country required the identification of each target facility to be a manual process, while interpreting several contributing factors like locality within the Hotspot areas, TB equipment present, access to electricity and water, access to major road network etc.

The derived outcomes from the mapping exercise, being the identification and mapping of key populations (Hotspots) of mineworkers and ex-mineworkers throughout the region, visitation and TB equipement inventory of relevant health facilities in the Hotspot areas and analysis of health facilities in the Hotspot areas were analysed to produce a target list for facility scale-up.

The mapping thus provides valuable information and new insights on TB effected communities in the region and can be now used to improve access to strategically placed services for mineworkers and ex-mine workers.

1 INTRODUCTION

The TomTom Consortium's Final Report documents the various aspects and phases for mapping of mines, mineworkers, ex-mineworkers and available health and compensation services in the mining and labour-sending areas. Until now, there had been insufficient data on the type of mining, population sizes of the key populations, geographical locations and health services available for mineworkers and ex-mineworkers in the region.

The mining and labour-sending areas for Botswana, Lesotho, Namibia, Malawi, Swaziland, Tanzania, Zambia, Zimbabwe and Mozambique were identified and mapped. (Mining locations and associated commodities were identified for South Africa. Labour-sending areas from within South Africa were not identified, but the analysis was limited to labour-sending areas from neighbouring countries to South Africa, due to mandate of the contract.
Due to the specific dynamics involved in the spread of tuberculosis and its effect on related communities, the targeted key populations in this study was identified as:

- **Current mineworkers:** any person who works in a mine of any type (large, medium, small, artisanal, formal or informal) regardless of their immigration or employment status (full time/ part time, contract, sub-contract or casual).
- **Ex-mineworkers:** any person who previously worked in a mine, regardless of their immigration or employment status (full time/part time, contract, sub-contract or casual).
- **Families and affected communities of both current and ex-mineworkers, including their spouses and children**: in both peri-urban mining and labour-sending areas.

2 OBJECTIVES

The main objectives of this study was as follows:

1. The identification of key populations characteristics of current and ex-mineworkers in the region to drive service delivery and resource allocation.
2. The identification of key mines (and commodities) causal to TB in the region
3. Geocoding of current and ex mineworkers from available sources
4. The identification of all Health and Compensation services
5. Determination of TB Hotspot areas
6. Field Surveying of all relevant (50 locations per country) health care facilities in the Hotspot areas to confirm the existence of TB screening and treatment equipment, and the verification of location.

3 METHODOLOGIES AND MAPPING

3.1 DATA CAPTURE METHODOLOGY

The Methodology for Data Capturing required two types of work, as prescribed by our contract: In-Office work and Field Surveying Work.

3.1.1 IN OFFICE WORK

Data and information were collected from as many sources as possible though telephone calls, written communication and personal visits, and involved the following:

- Needs analysis of the GIS attribute data values to be able to hold all the required data information that had to be used during the process.
- Design and creation of the Spatial Databases. *(Annexure A: Spatial Databases.)*
- Collection and combining of spatial data for settlement locations and names, health facilities and names, mine locations and names, administrative boundaries including health districts from all consortium members.
- Designing and presentation of a questionnaire for health care facilities
- Collecting data pertaining to health care facilities with and without TB treatment capacity (including the physical location information)
- Mines and the commodities mined (including the physical location information)
- Creation of maps containing the location of communities and population sizes of these communities using satellite imagery and specialised image processing software and census data.
- Naming of the locations of the communities of interest
- Gathering of mine worker records and mapping of the number of mineworker's place of work and place of residence (where families reside) referred to as labour-sending areas.
- Geocoding process in which the worker's workplace and labour-sending area was pinpointed on a GIS map. Address details from worker records were used and matched to the map data (Country, Province, District, Municipality, and Town). In this step the community location data created earlier was used together with the map data in order to match the workers' addresses (on record) to the addresses on the map.
- Creating spatial mapping connections which showed relationships between labour-sending and worker receiving locations. (mines)
- Consolidate & analysed all inputs by spatial modelling processes to identify specific feeder (worker sending) areas for mines.
- Build travelling routes' origins and destinations (Workplace and Labour-Sending areas) on mapping software and map data to identify optimal Hotspot area locations (Routing

origin-destination Diagrams) which also included corridor developments along the routes

- Targeted facility analysis, in the Hotspot area locations, which provides a list of optimal located health care facilities for purpose of up-scaling.

Sources of information included the following:

- Various Departments of Health (National and if necessary on different levels District, Local Areas).
- Departments of Resources and Mining
- Mining houses such as the Chamber of Mines in South Africa
- Labour Unions
- Labour Recruitment Service Companies
- Other applicable NGO's
- Lists of the above contacts and contact details are available and can be supplied on request. The lists are still growing. Not all contacts are reachable in which case other avenues and methods are explored to gather the necessary information.

During the *In Office* work all relevant information collected were entered into a database which is connected to GIS feature layers. For example mine location points on the map have a connected database containing information specific to each mine like name of the mine, commodity being mined, contact details etc.

3.1.2 Field Surveying Work

The field surveying work involved the following activities:

- To create a questionnaire for gathering health care facility information
- Visit and survey locations of in-office identified health care facilities
- Gather information related to historic or government identified TB areas
- Confirm status of mine labour-sending area as Hotspots
- Other field survey work also included visiting government and non-Government organisations to gather information related to health and mining. During the in-office work those organisations which could not be reached or did not respond were recorded and required personal visits.

Field Survey results in the GIS database were populated and combined with the data collected during the in-office work. The GIS data was analysed and assisted in confirming or not confirming the target locations for the health care facilities.

3.2 METHODOLOGIES

3.2.1 HOTSPOT ANALYSIS

Two separate analysis methodologies (A & B) were used for the analysis of Hotspots in the Region. The need for the two different methodologies arose due to the unavailability of information related to mineworkers in all countries except for South Africa and labour-sending countries around South Africa. *(Note Annexure D for detailed discussion on the Hotspot Analysis Methodology.)*

The process of identifying Hotspot for each country involved mapping the relationship between mines, health care facilities and population settlement density areas. The use of Geographic Information Systems (GIS) was core to this process.

Methodology A: (Use of mineworker data) Botswana, Mozambique, Swaziland, Lesotho, South Africa. Note that South Africa was only used as a labor receiving country and no HOTSPOTS were identified within South Africa as pertaining to TIMS mandate.

Following the collection of remote-sensing data, collecting data from desktop studies and fieldwork, and geo-located data from TEBA, an approach was designed to enable the consistent and objective evaluation of “Hotspot” areas.

In terms of locating current and ex-mineworkers, the geo-located TEBA data was the main source of information for specified countries. The miners and ex-miners were geo-located to the relevant towns where they live (or lived), and for all of the geo-located miners and ex-miners, the records were allocated to the relevant Thiessen polygon.

The approach in determining the Hotspot areas was based on the thinking that both a high-current incidence of TB, as well as the potential for TB spreading, should play a role in the prioritization. The spread of TB is a complex problem, involving factors related to income inequality, access to health facilities, hygiene, and other factors. It seems plausible however that as a basic principle, contagious diseases spread faster/easier under crowded conditions. This assumption appears to be generally supported in literature. It was considered that two factors should play a significant role in the identification of the Hotspot areas:

- Density of geo-located mine workers and ex mine-workers
- General population density

Population density was determined using remote sensing analysis of the built-up areas as well as superimposing country specific census data on this information. This was then apportioned to each Thiessen polygon. Please refer to as Annexure C for detailed information.

The data fields that were used in the identification of the Hotspot areas were the number of geocoded miners per Thiessen polygon (informed by the TEBA data), and the population density per square kilometer for each Thiessen polygon. The methodology used to identify Hotspot areas, using geo-located mine workers, were only applicable to those countries where we were able to obtain data relating to the origin/feeding areas of those mine workers:Lesotho, Swaziland, Mozambique, Botswana and South Africa.

Methodology B: (No mineworker data used) Namibia, Zambia, Malawi, Zimbabwe, Tanzania.

The data fields that were used in the identification of the Hotspot areas for Methodology B countries, where no accessible data exists on the number of miners, were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. This methodology – Methodology B - applies to the following countries – Namibia, Zambia, Zimbabwe, Malawi and Tanzania. The historic or government identified TB Focus Regions were obtained from the local Health Departments, and helped us focus our analysis on specific areas of interest.

3.2.2 HOTSPOT WEIGHING

Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria. Once the fields were combined, the resultant statistical values were available for all polygons in each country. Rather than decide on a subjective cut off point for the identification of Hotspot areas, we used a cut off point of 2 standard deviations from the mean for each country. This ensured that the polygons with the combined population density and number of mineworkers that were significantly higher than the norm, be prioritized. *(A detailed description of the Weighing can be found in Annexure C: Hotspot Analysis Methodology)*

3.2.3 TARGET ANALYSIS

The variability of the data available in each country required the identification of each target facility to be a manual process, while interpreting several contributing factors. (Only Health Facilities in Hotspot areas were considered in the Target Analysis.)

For countries where location of the TEBA recruitment offices were present, this formed part of the analytical parameters for target analysis, as the general population are very familiar with the location thereof, and often go to these offices asking for work or assistance in mine related queries. For other countries, the target analysis was determined in consultation with the various departments of health and other sources. The following factors were taken into account in target analysis:

1) Inside a Hotspot Area or Focus Region (depending on the country)
2) Near a TEBA Office (for countries where TEBA offices area present: Botswana, Mozambique, Swaziland & Lesotho)
3) TB Equipment Present: Chest X-ray or GenX machine
4) Electricity and Running Water Availability
5) Size of Facility (Number of Healthcare Patients and reported TB patients under treatment). Preference were given to larger facilities
6) Access to Major Road Network.

Taking the above factors into account a variable number of Targets were identified. For each Hotspot Area one or more target facilities were listed with the most likely candidate listed first. The sequence of Hotspots (e.g. A – F) should be taken as a guideline as to importance but not as an absolute sequence as suitability of conditions at the listed facilities should also be taken into account.

4 OUTCOMES

The following outcomes were derived from the mapping exercise:

1. Key populations (Hotspots) of mineworkers and ex-mineworkers were accurately mapped throughout the region, using 2 distinct methodologies as described in Section 6: Evaluation per Country.
2. All relevant health facilities in the Hotspot areas were visited and TB related services were documented in the GIS database.
3. Health Facilities in the Hotspot areas were analysed in terms of key population areas, location and other social-economic factors to produce a target list for facility scale-up.

The mapping thus provides valuable information and new insights on TB effected communities in the region and can be now used to improve access to strategically placed services for mineworkers and ex-mine workers.

The mapping provides the following deliverables:

- Geodatabase of mines, built-up areas, affected mineworker communities and location & inventory of Health Facilities' services in the Hotspot areas.
- Target list of Health Facilities best located for up-scaling of relevant services and equipment.
- Spatial Database of the whole region with relevant roads, towns, rivers, admin boundaries etc. as well as project specific data as described above.

5 CHALLENGES

5.1 MINEWORKER ADDRESSES

A major part of the success of this project depended on obtaining address lists for mineworkers and ex-mineworkers throughout the region. Address lists for the majority of mineworkers and ex-mineworkers do not exist for the majority of the countries in the region, except for South Africa.

In South Africa, the only source willing to share mineworker address lists with us, was the labour-recruitment agency called TEBA. No information related to the mineworkers' identity was provided, but this provided enough information to perform the geo-coding process as described in *Annexure E: GEO-CODING OF MINEWORKERS.*

It must further be noted that the mandate of the project only covered the labour sending areas to South Africa, and not analysis of South Africa itself. By the time of writing this document, no South Africa specific analysis had been done, except for the labour-sending countries to South Africa.

5.2 EXISTING HEALTHCARE INVENTORY LISTS

Below is a table of the types of audits done in the different countries in the past. The two main players are the WHO (SAM/SARA) and USAID (HFC/HFA/SPA). The dates of each audit is included in the table. We were able to access reports but not the raw data except for the SPA and then only for Malawi.

To access this data requires permission from the MoH in each country (except the SPA). Countries are not willing or are unable to provide the data. This is a major indictment against these countries as well as the organizations that funded them. We tried on many occasions to identify contacts in USAID but this turned out to be impossible - the DJS people were much more supportive but slack in making the geospatial data available.

5.3 ETHICAL CLEARANCE

Major challenges, resulting in delivery delays, were encountered with obtaining ethical clearance for purpose of doing healthcare facility data collection in each country. Initially we were informed that ethical clearance for the TIMS Regional Mapping Study would not be required. Letters were produced and ethical clearance were obtained for all countries except Zimbabwe and Swaziland. No fieldwork could thus be done in these 2 countries, and alternative methods were used in collecting the required data for doing Healthcare target analysis. *(A detailed description of the challenges encountered in the countries are described in ANNEXURE G: COUNTRY FIELDWORK REPORTS AND CHALLENGES)*

A description of the alternative data collection done for Swaziland and Zimbabwe are described in Section 6 Evaluation per Country, below.

6 EVALUATION PER COUNTRY

The section below provides the results of the evaluation of Hotspots done for each country. Annexure C provides more detail for each country.

6.1 METHODOLOGY: A COUNTRIES:

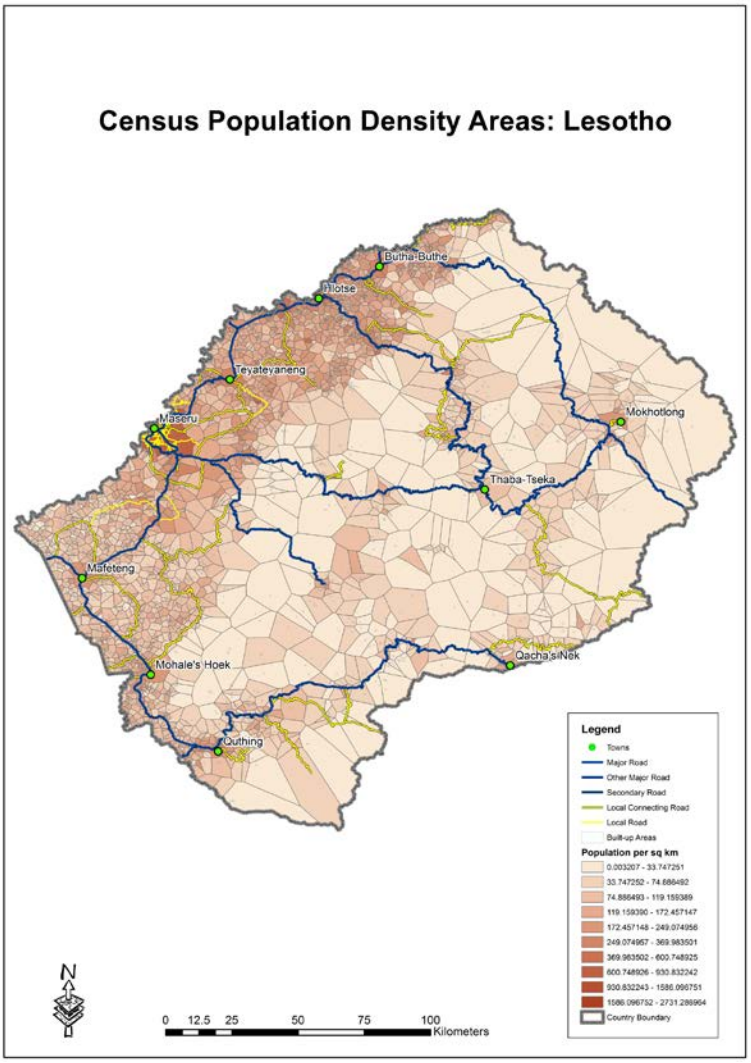
6.1.1 LESOTHO

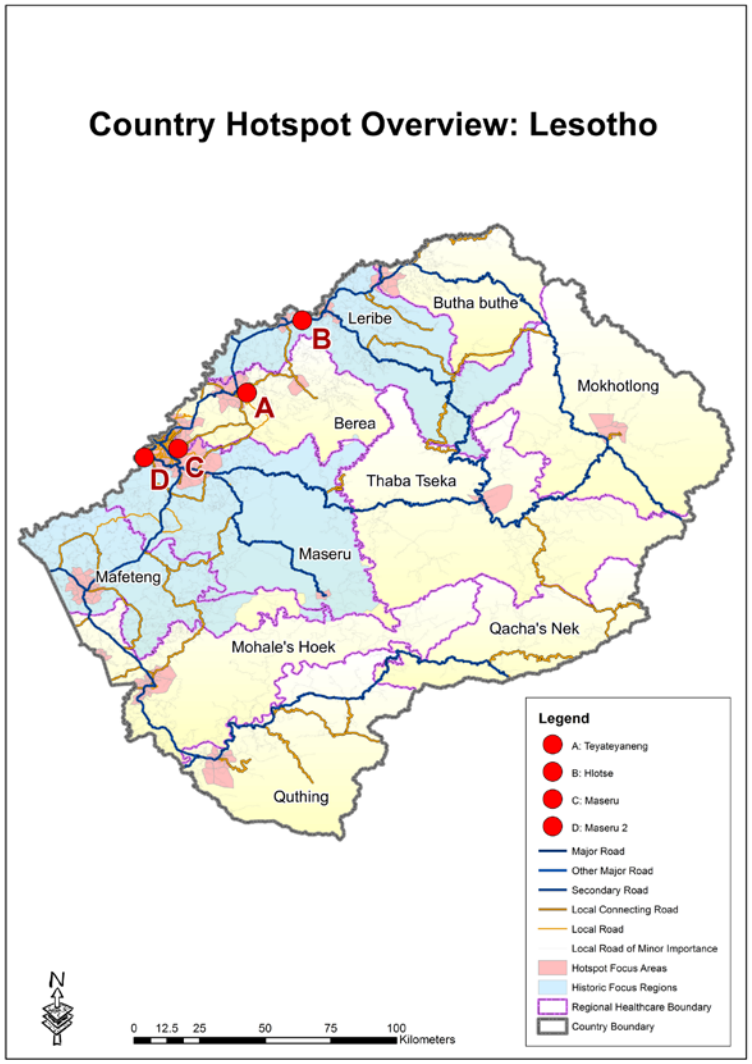
Local Insight: Based on a study by the Clinton Health Access Initiative (CHAI), the regions of Maseru, Mafeteng and Leribe were identified as focus areas for selection of health facilities. According to this study that was done among ex-mine workers who had worked for many years on gold mines in South Africa,

these three regions are the priority areas in Lesotho. In the Map below called Country Hotspot Overview: Lesotho, these areas are indicated in blue, and are referred to as Historic Focus Regions.

Hotspot Analysis: A Hotspot analysis by TomTom Consortium involved geo-locating data on miners and ex-mine workers from TEBA database – employed in South Africa - and identifying areas where there are high concentrations of miners and ex-miners in highly populated areas. The Hotspot analysis undertaken by TomTom Consortium identified 8 Hotspot areas, mainly around the major urban centres in the Mafeteng, Maseru, Berea and Leribe regions. In the Map below called Country Hotspot Overview: Lesotho, these Hotspot areas are indicated in pink, and are referred to as Hotspot Focus Areas.

A total of 52 health facilities were selected within these Hotspot areas to form part of the fieldwork.





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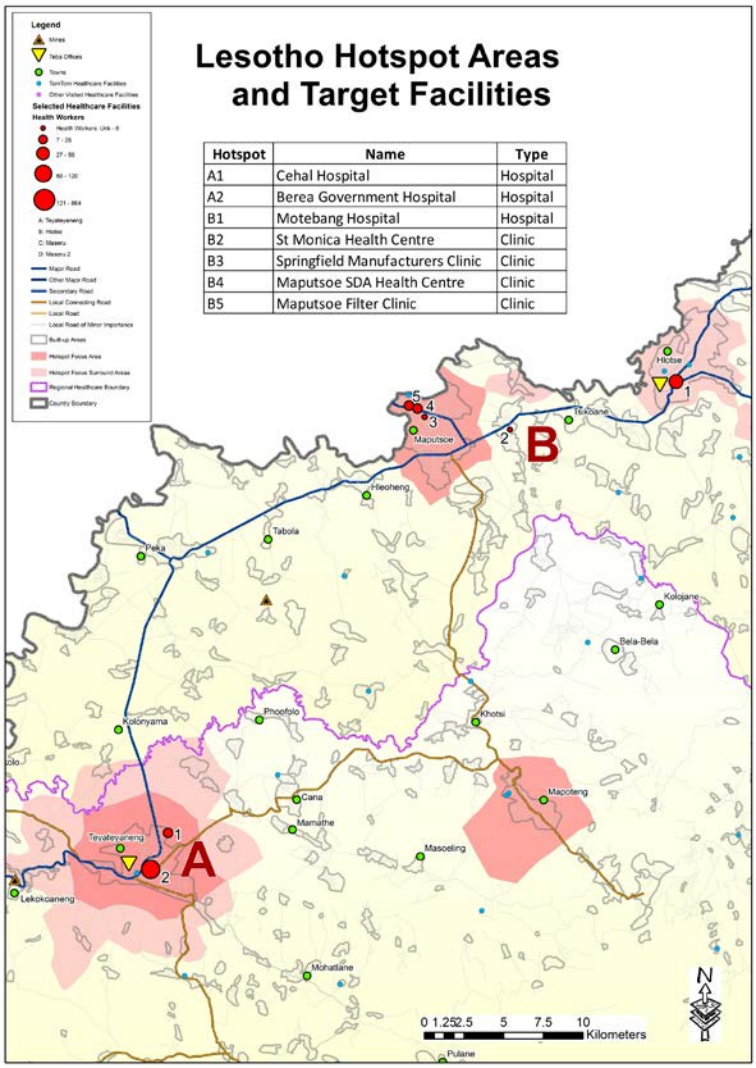
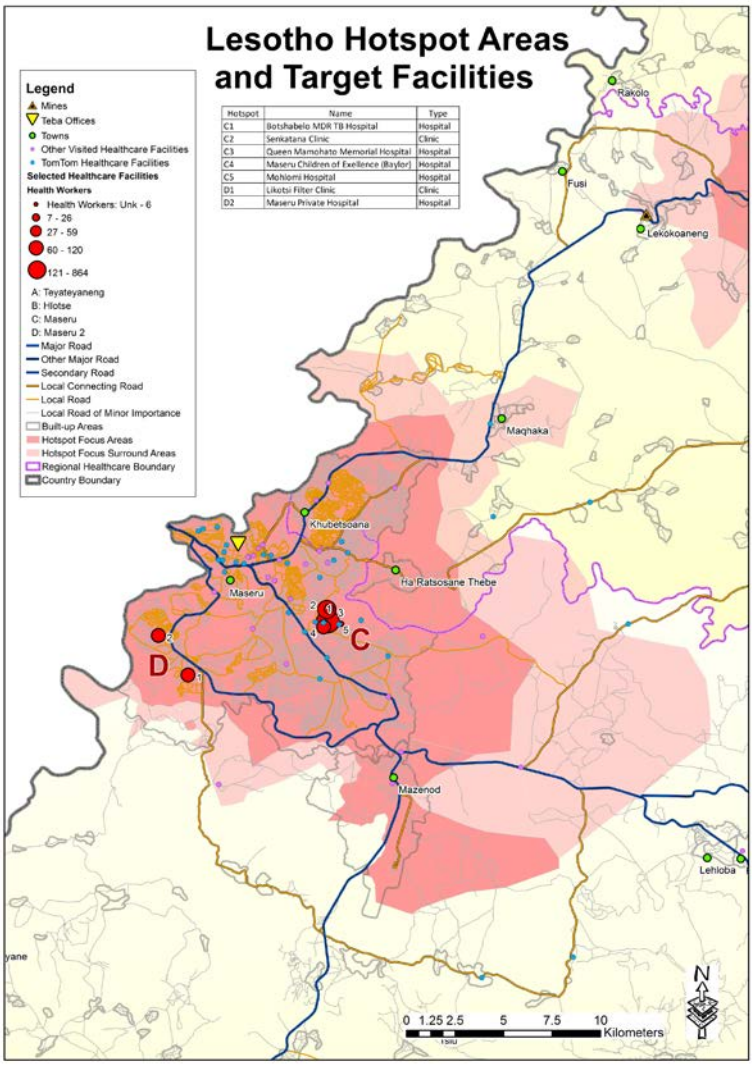
TT Lesotho HCF Target Analysis:

The Qualitative criteria used in Lesotho, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network
- Proximity to labour recruitment office



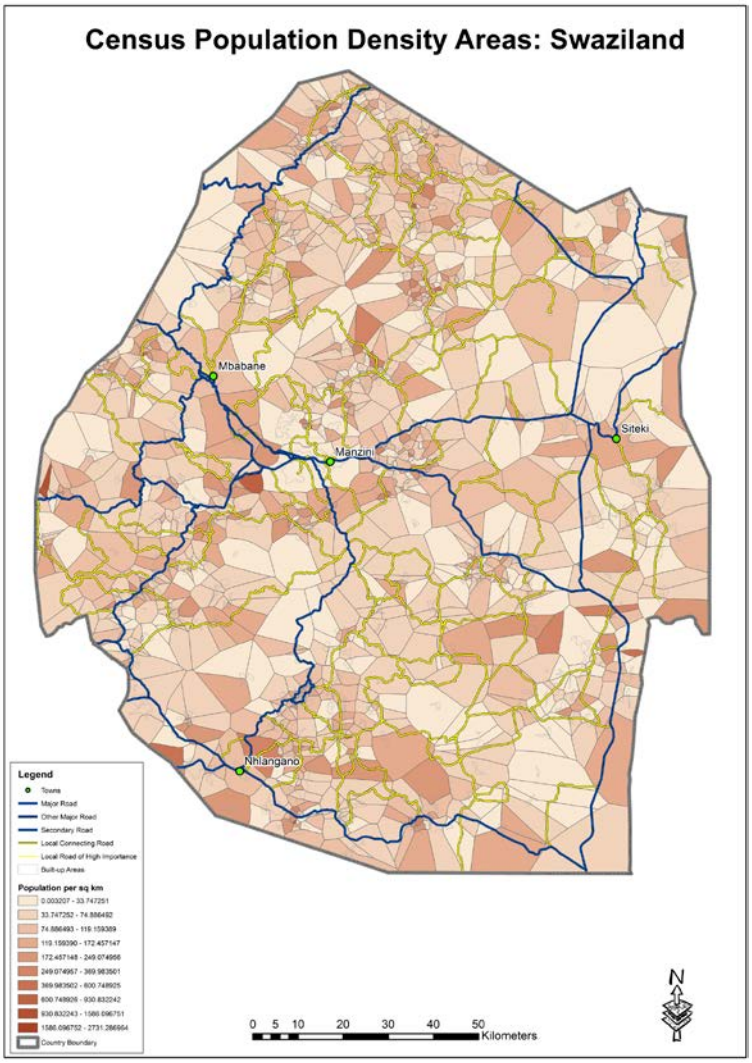


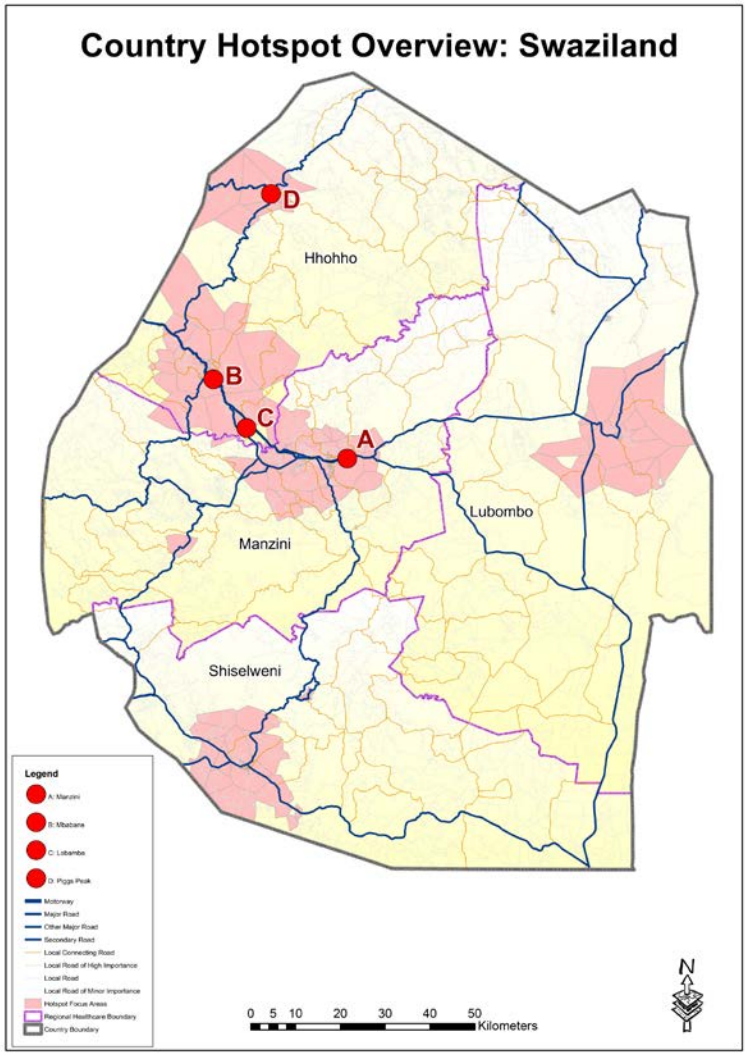
TT Lesotho HCF Target Analysis Data:

6.1.2 SWAZILAND

Local Insight: According to the International Organization for Migration (IOM), 8 - 10% of Swaziland households have family members employed on South African mines. Miners come from all over Swaziland but are mostly recruited by the labor recruitment agency, The Employment Bureau of Africa (TEBA) Limited in Hhohho, Manzini and Shiselweni. Most of these miners take on short term renewable contracts mainly in Gauteng and the North West province for companies such as Anglo Gold Ashanti, Goldfields, Harmony, DRD, Anglo Platinum and Implats. Since 2001 female mine workers were also employed.

Hotspot Analysis: A Hotspot analysis by TomTom Consortium involved geo-locating data on miners and ex-mine workers from TEBA database – employed in South Africa - and identifying areas where there are high concentrations of miners and ex-miners in highly populated areas. The health facilities for Swaziland were overlaid onto the identified Hotspot areas. Although the study by the IOM identified Hhohho, Manzini and Shiselweni as the priority areas, at the request of the Ministry of Health in Swaziland, the health facilities within all Hotspot areas were selected including those in Lubombo.





TT Swaziland Hotspot Results:

The Qualitative criteria used in Swaziland, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network
- Proximity to labour recruitment office

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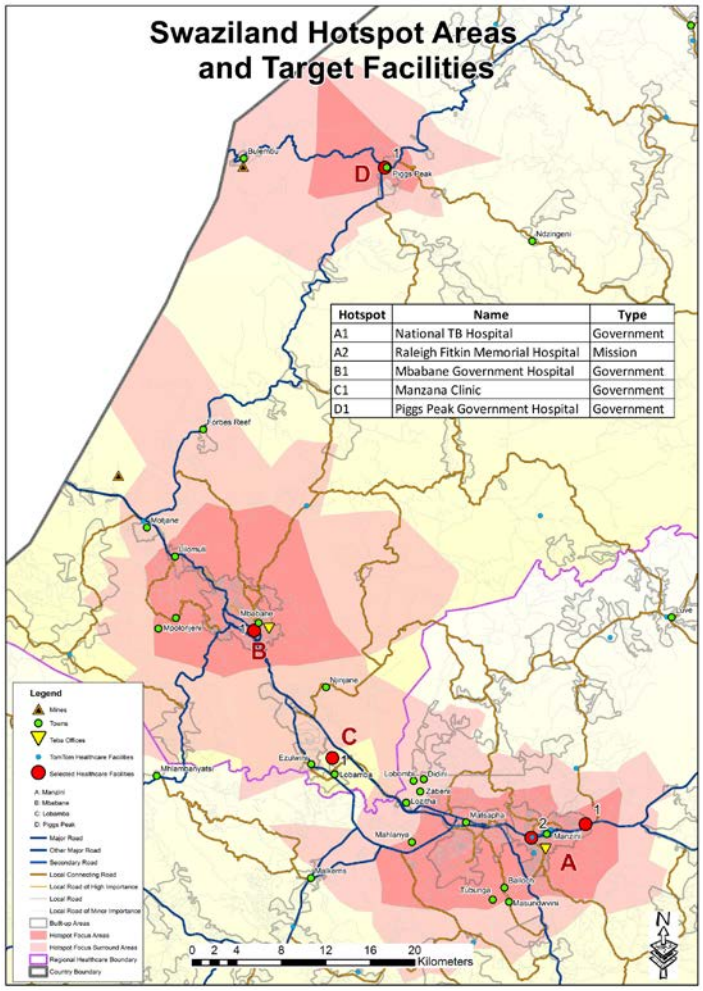


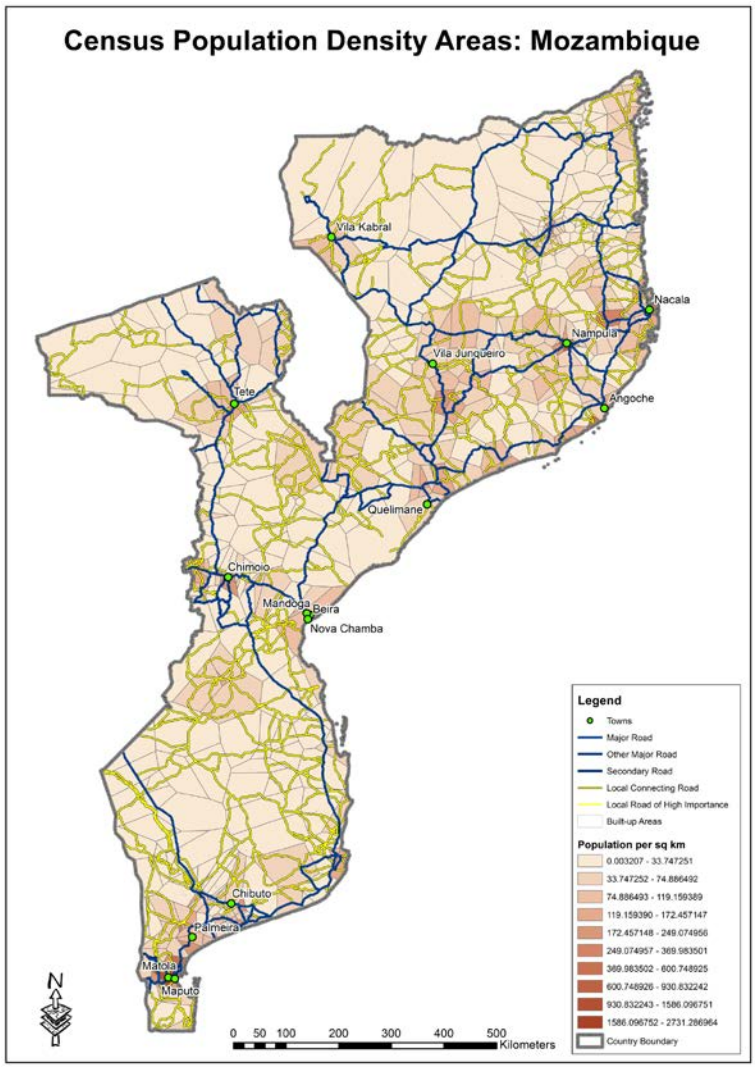
Hotspot	Name	Type
A1	National TB Hospital	Government
A2	Raleigh Fitkin Memorial Hospital	Mission
B1	Mbabane Government Hospital	Government
C1	Manzana Clinic	Government
D1	Piggs Peak Government Hospital	Government

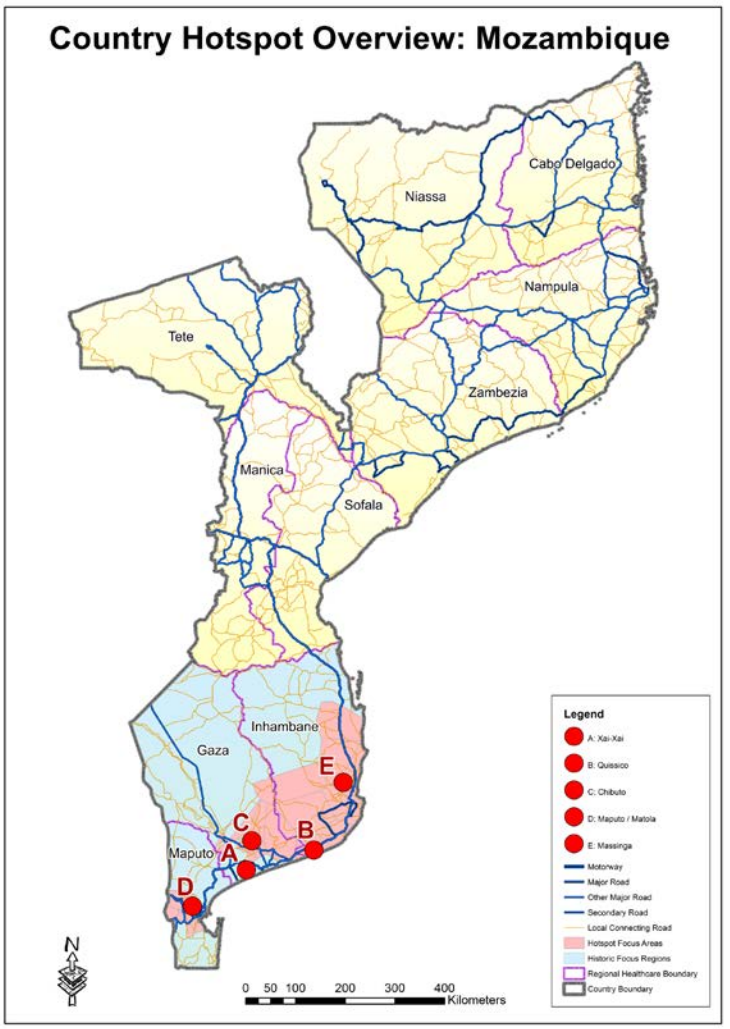
TT Lesotho HCF Target Analysis Data:

6.1.3 MOZAMBIQUE

Local Insight: Literature reviews ?? indicated a high prelevance of TB and HIV in the provinces of in Sofala, Manica and Zambezia. However, after consultation with the Ministry of Health (MoH), the focus was shifted to the provinces of Maputo, Gaza and Inhambane. A list of clinics was prepared and presented to the MoH. The list of clinics to be visited were changed in consultation with the MoH to focus on areas that they felt were high priority areas where large concentrations of miners live and there is a high TB prevalence.

Hotspot Analysis: A Hotspot analysis by TomTom Consortium involved geo-locating data on miners and ex-mine workers from TEBA database – employed in South Africa - and identifying areas where there are high concentrations of miners and ex-miners in highly populated areas. The location of the Hotspot areas are illustrated in the maps below.





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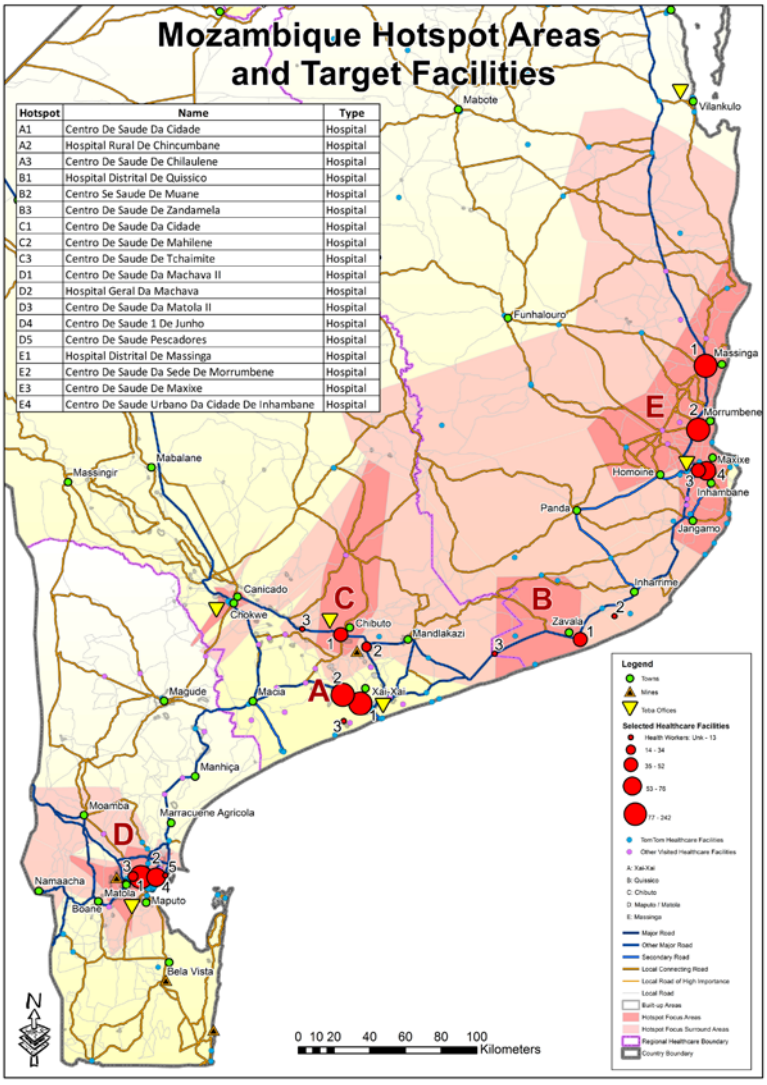
TT Mozambique Hotspot Results:

The Qualitative criteria used in Mozambique, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network
- Proximity to labour recruitment office

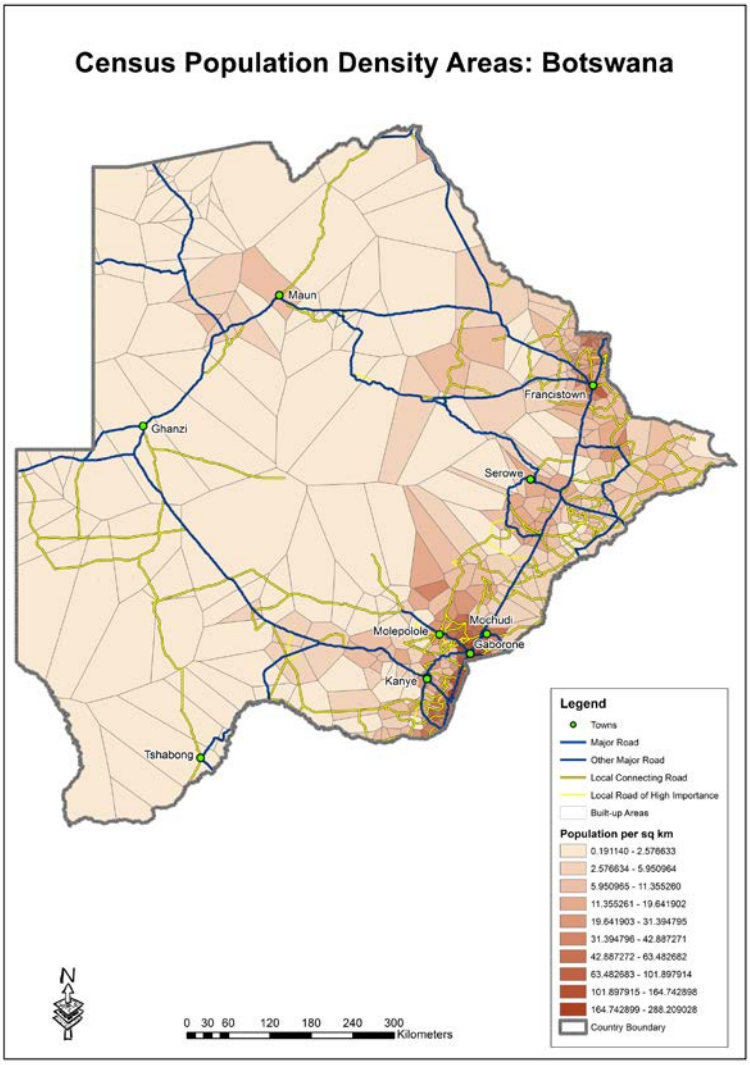


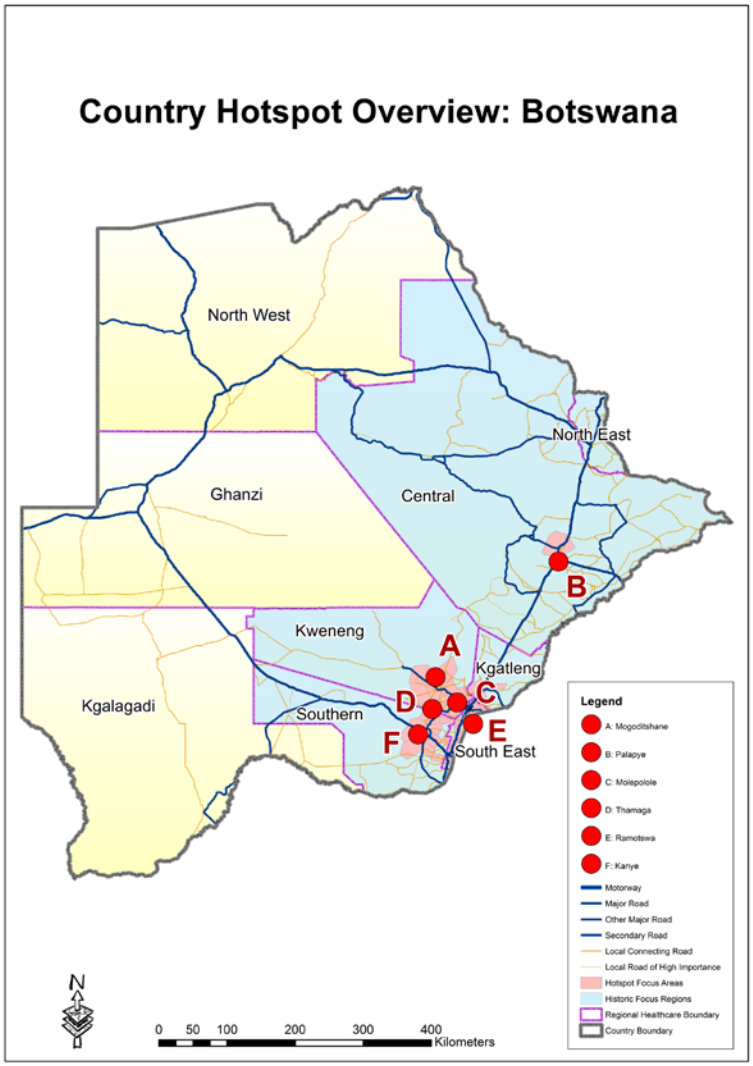
TT Lesotho HCF Target Analysis Data:

6.1.4 BOTSWANA

Local Insight: The Central, Francistown, Southern/Kweneng/Kgalteng and Gaborone regions were identified as TB focus areas.

Hotspot Analysis: A Hotspot analysis by TomTom Consortium involved geo-locating data on miners and ex-mine workers from TEBA database – employed in South Africa - and identifying areas where there are high concentrations of miners and ex-miners in highly populated areas. (It is important to emphasize that the Hotspots are feeder areas to the mines in South Africa and that there are other communities, especially in Ghanzi district, which have high prevalence of TB and are feeder areas to the mines in Botswana.)

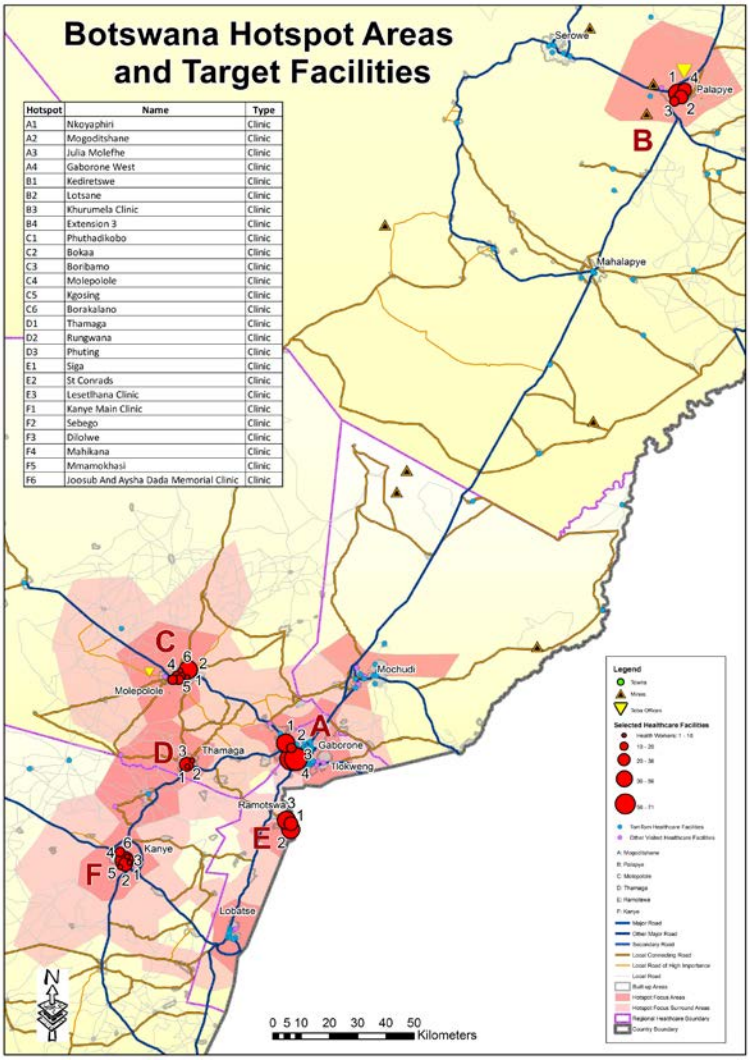




TT Botswana Hotspot Results:

The Qualitative criteria used in Botswana, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network
- Proximity to labour recruitment office



TT Lesotho HCF Target Analysis Data:

6.1.5 SOUTH AFRICA

Local Insight: Using data on TB prevalence provided by the Department of Health at a district and health facility level as well as the distribution of gold, platinum, diamond and coal mines in South Africa, two Hotspot areas were identified. One being around the gold and platinum mining belts in Free State, North West and Gauteng. The other being in the rural district of OR Tambo District Municipality that has the highest prevalence of TB and an area known to be one of the largest feeder areas of mine workers into the mines of South Africa. In the future if fieldwork is done in South Africa, these two areas could be considered for that purpose.

Map of Regions – In process

Hotspot Analysis: A Hotspot analysis by TomTom Consortium involved geo-locating data on miners and ex-mine workers from TEBA database – employed in South Africa - and identifying areas where there are high concentrations of miners and ex-miners in highly populated areas.

HS Map – In Process

6.2 METHODOLOGY B COUNTRIES

6.2.1 NAMIBIA

Local Insight: According to Namibia's Country Operational Plan (COP) of 2015, the priority regions and Hotspots in focusing on TB and HIV is Kavango, Khomas, Ohangwena, Omusati, Oshana, Oshikoto and Zambezi.

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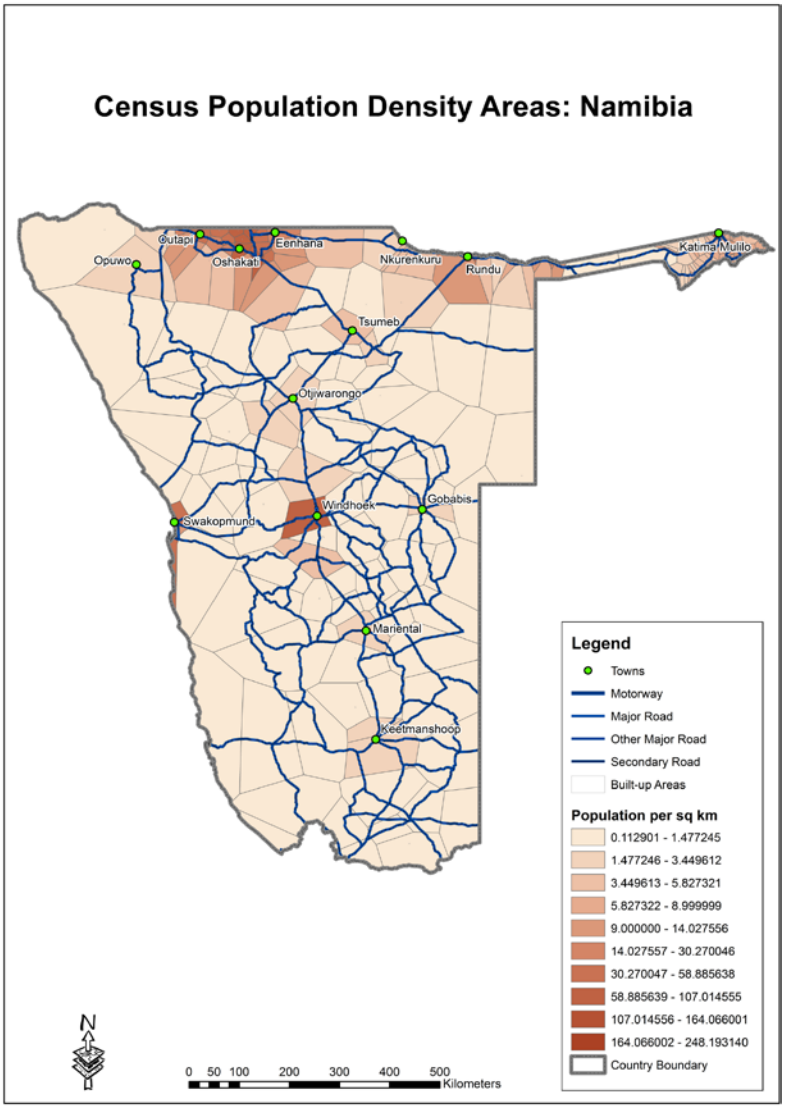
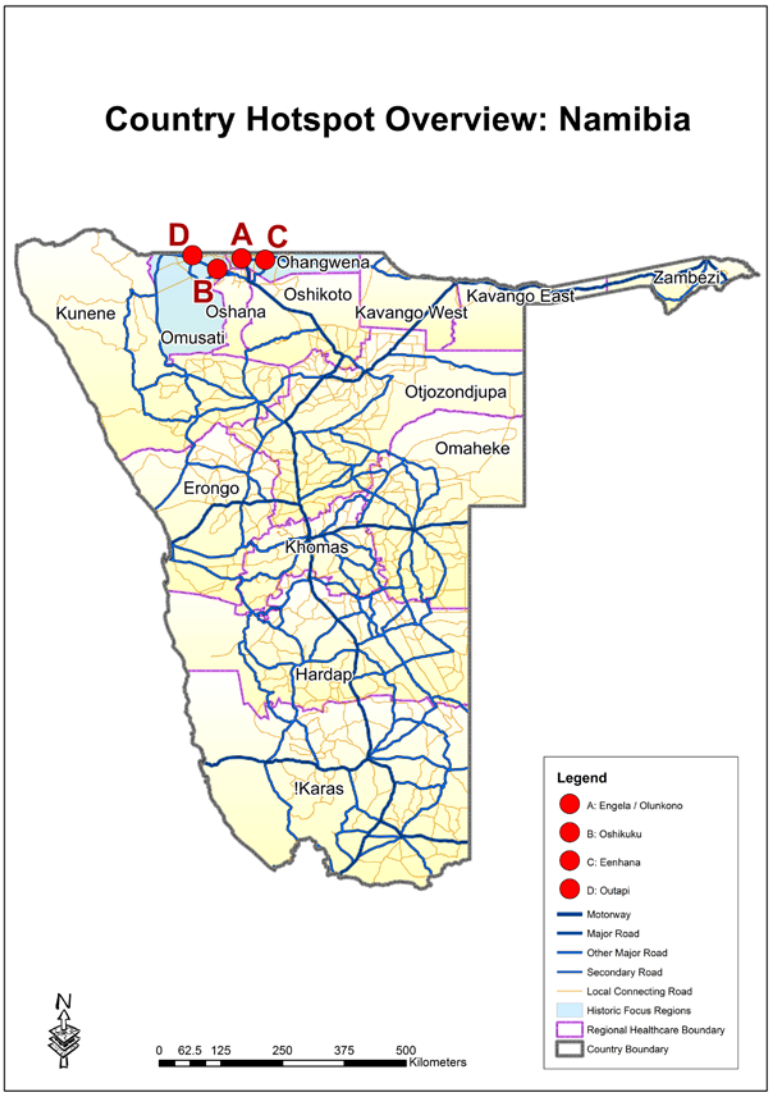
Hotspot Analysis: A Hotspot analysis by TomTom Consortium did not involve the integration of geocoded mineworkers, but were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria





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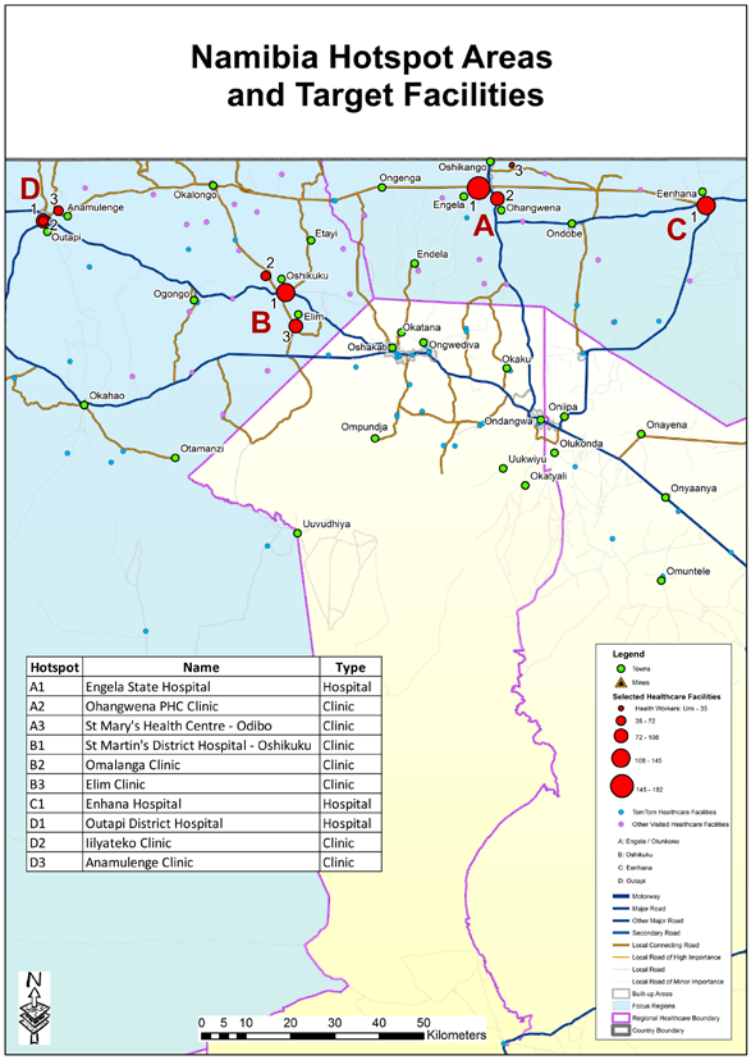
TT Namibia Hotspot Results:

The Qualitative criteria used in Namibia, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network



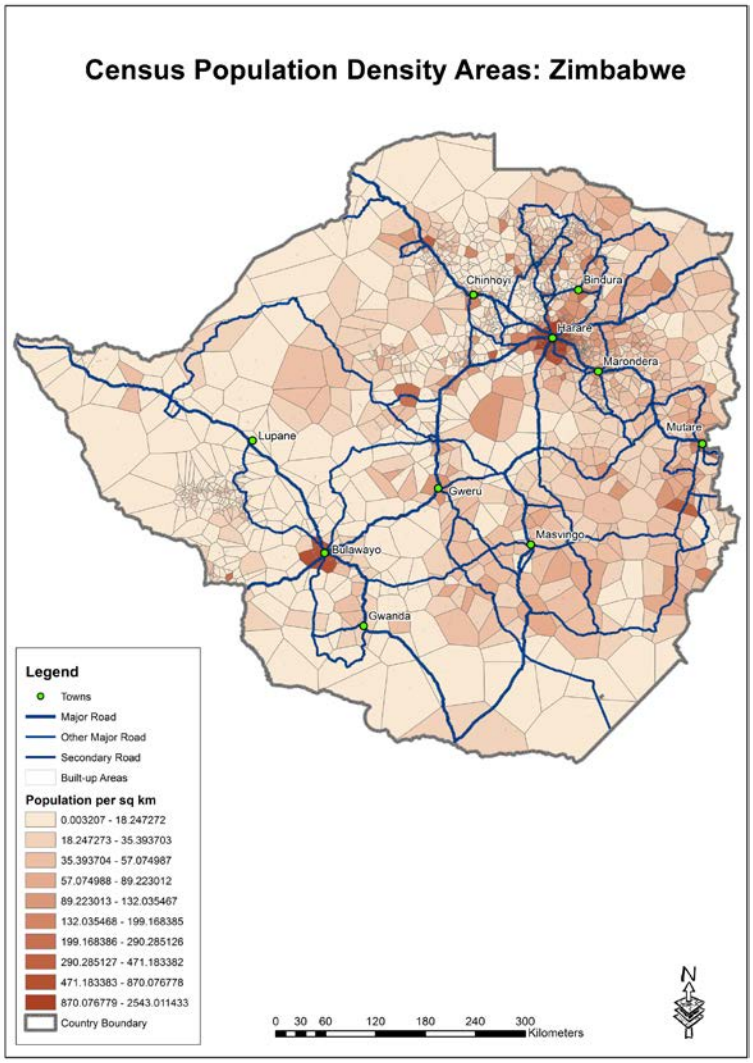
TT Namibia HCF Target Analysis Data:

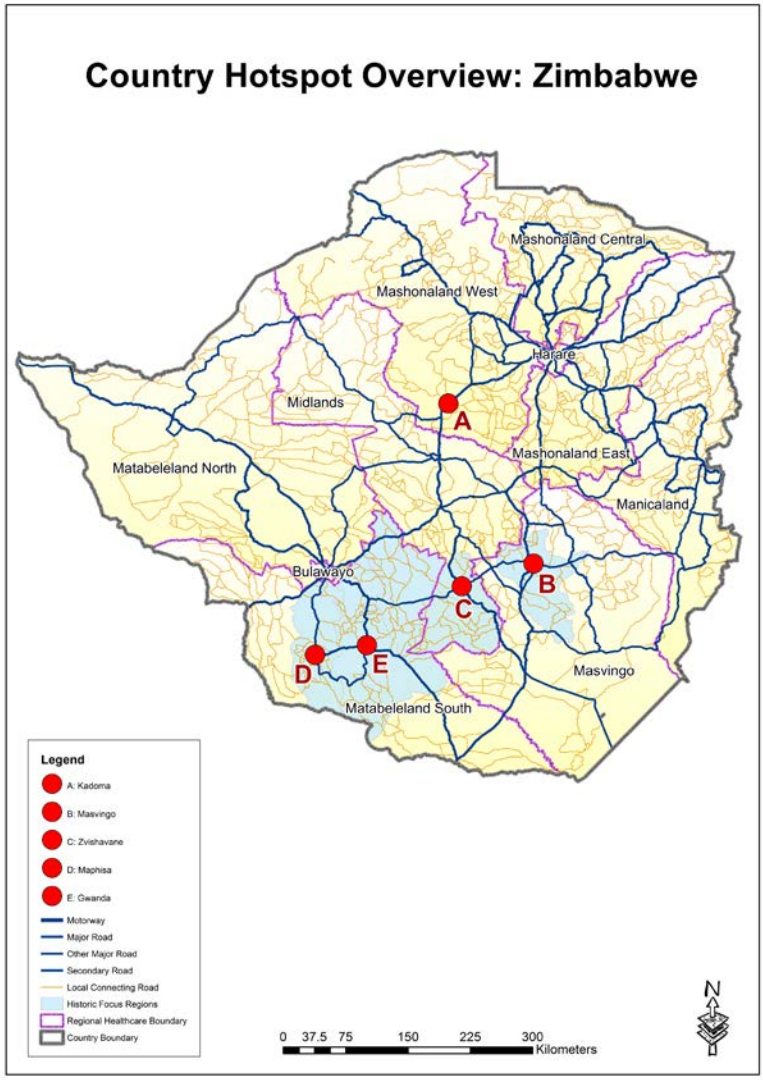
6.2.2 ZIMBABWE

Local Insight: According to the Citizens Health Watch (CHW) TB Advocacy Brief of October 2015 the provinces of Matabeleland South, Midlands and Masvingo were identified as areas with a high prevalence of TB and HIV. Using this as the starting point, information on mines were overlaid on the provinces of Zimbabwe. Within these three provinces there are areas with high concentrations of gold mines. The gold mines are the blue triangles in Figure 5.

TT Hotspot Analysis:

A Hotspot analysis by TomTom Consortium did not involve the integration of geocoded mineworkers, but were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria

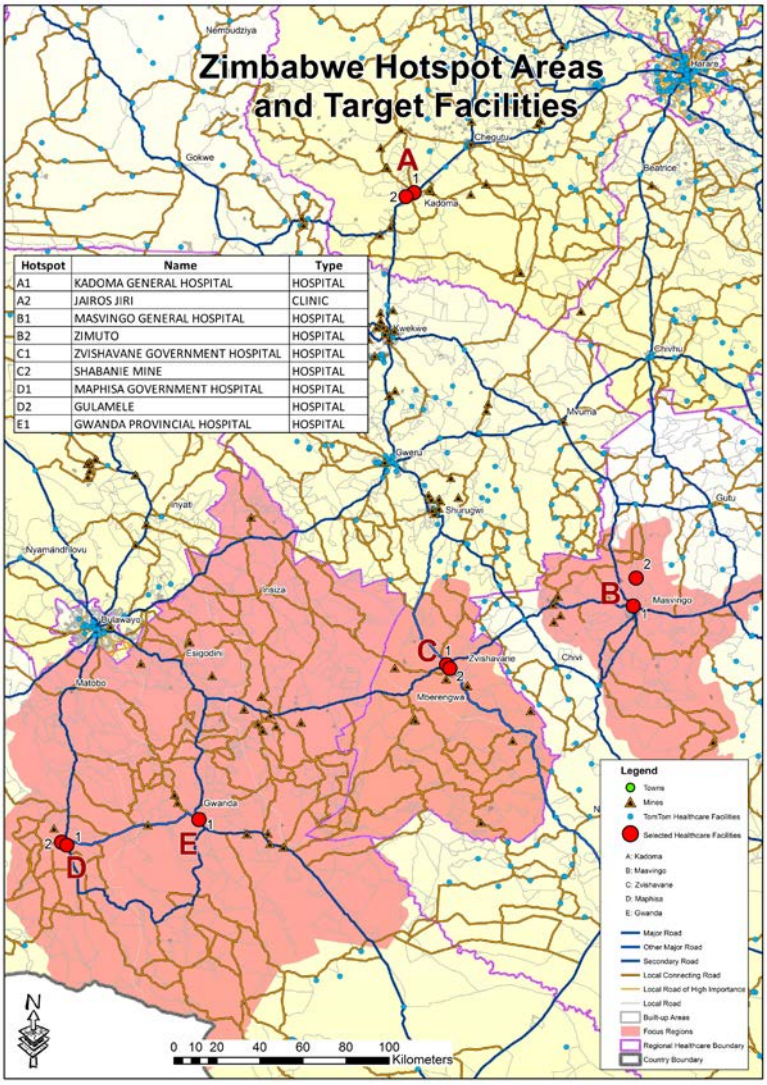




TT Zimbabwe Hotspot Results:

The Qualitative criteria used in Zimbabwe, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network



TT Zimbabwe HCF Target Analysis Data:

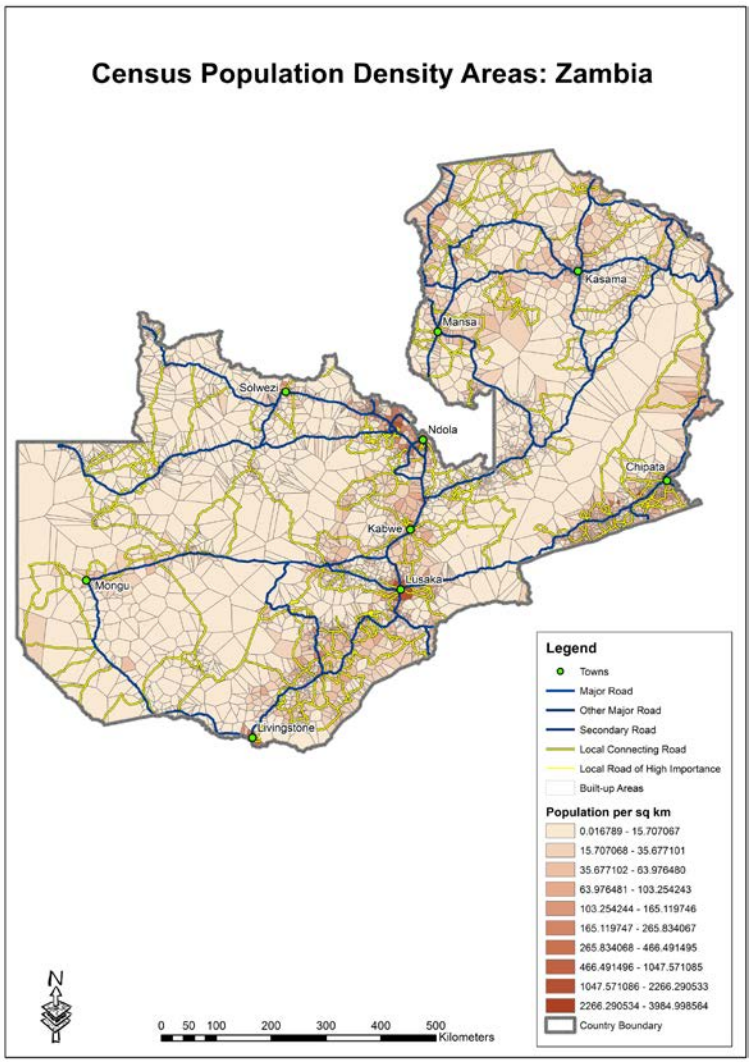
6.2.3 ZAMBIA

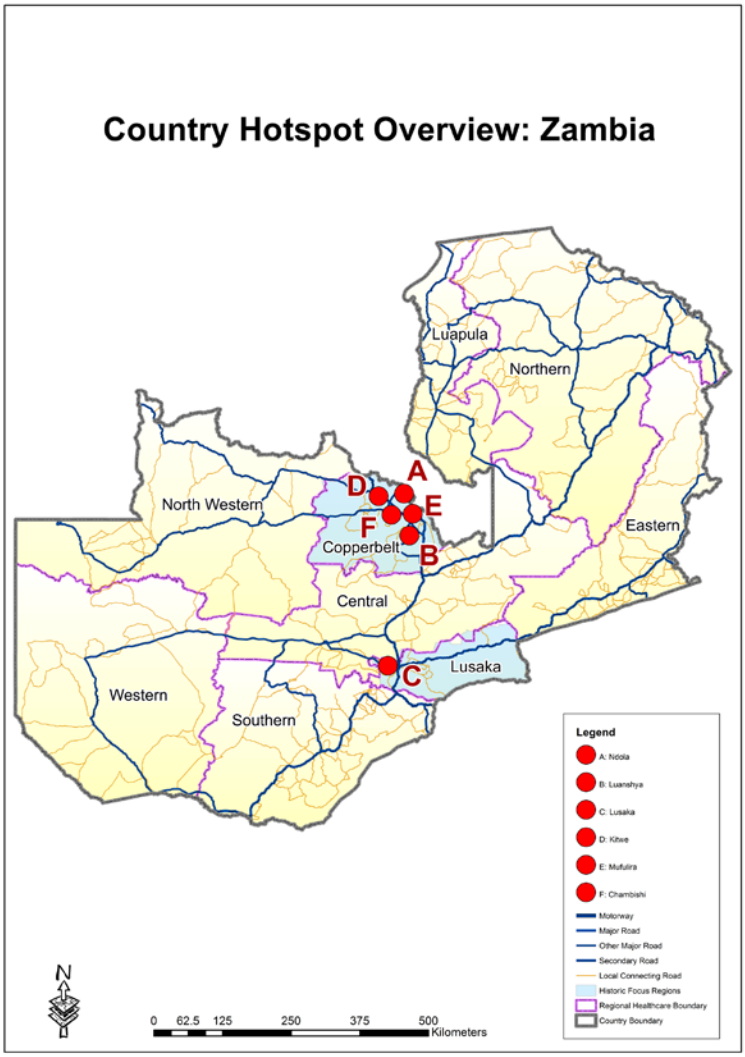
Local Insight: There is very little information on the prevalence of TB or which areas are feeder areas for the mines. However, studies on HIV prevalence have identified Lusaka and the Copperfield region as Hotspots. Data on the distribution of gold mines (yellow dots on map below) was overlaid on the two Hotspot areas and health facilities within the immediate vicinity were selected for the fieldwork. The selected clinics in the Copperbelt and Lusaka are shown as red crosses on the map below.

These two areas represent not only high HIV prevalence areas but also one of the largest mining belts in Zambia as well as one of the largest possible feeder areas to mines in Zambia and other countries.

TT Botswana Hotspot Results:

A Hotspot analysis by TomTom Consortium did not involve the integration of geocoded mineworkers, but were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria

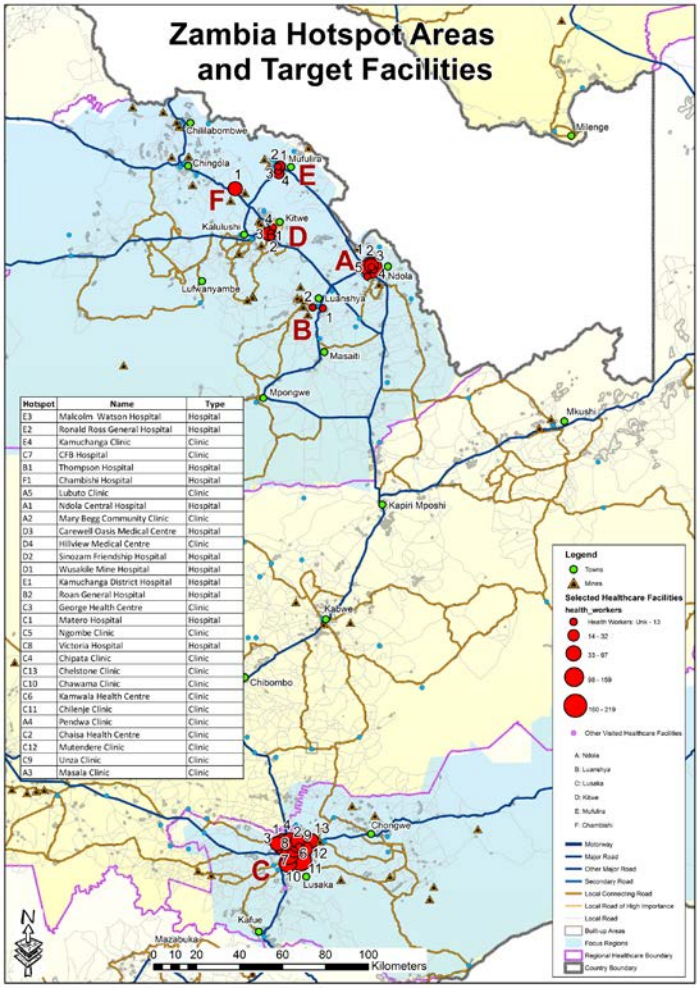




TT Zambia Hotspot Results:

The Qualitative criteria used in Zambia, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network



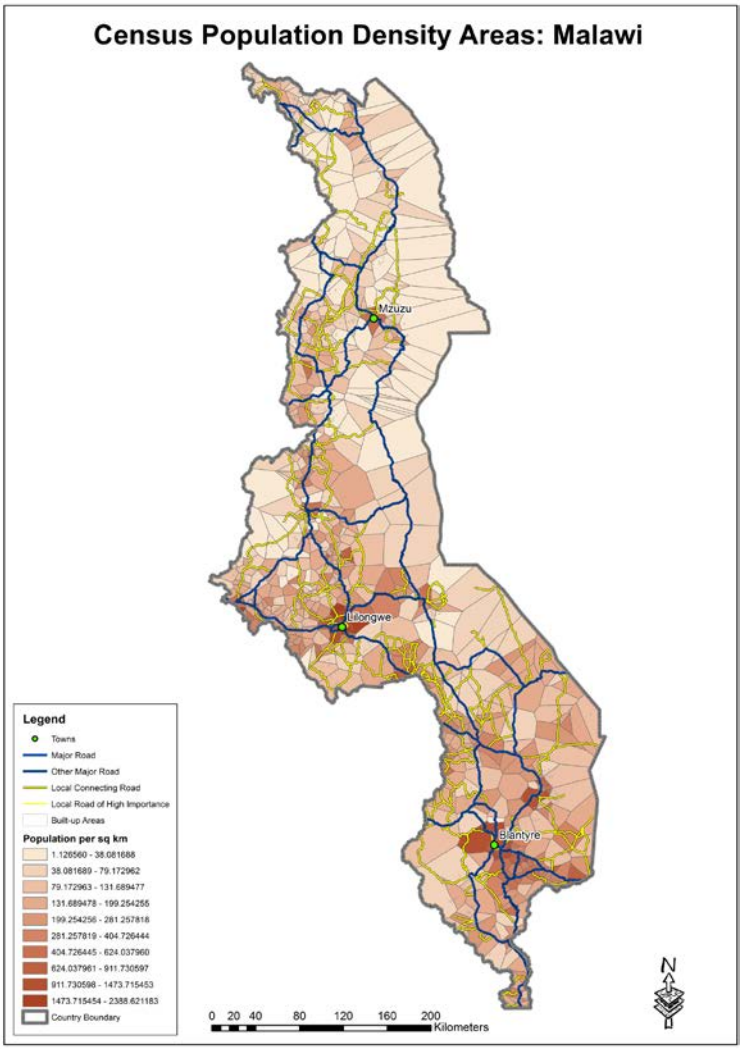
TT Zambia HCF Target Analysis Data:

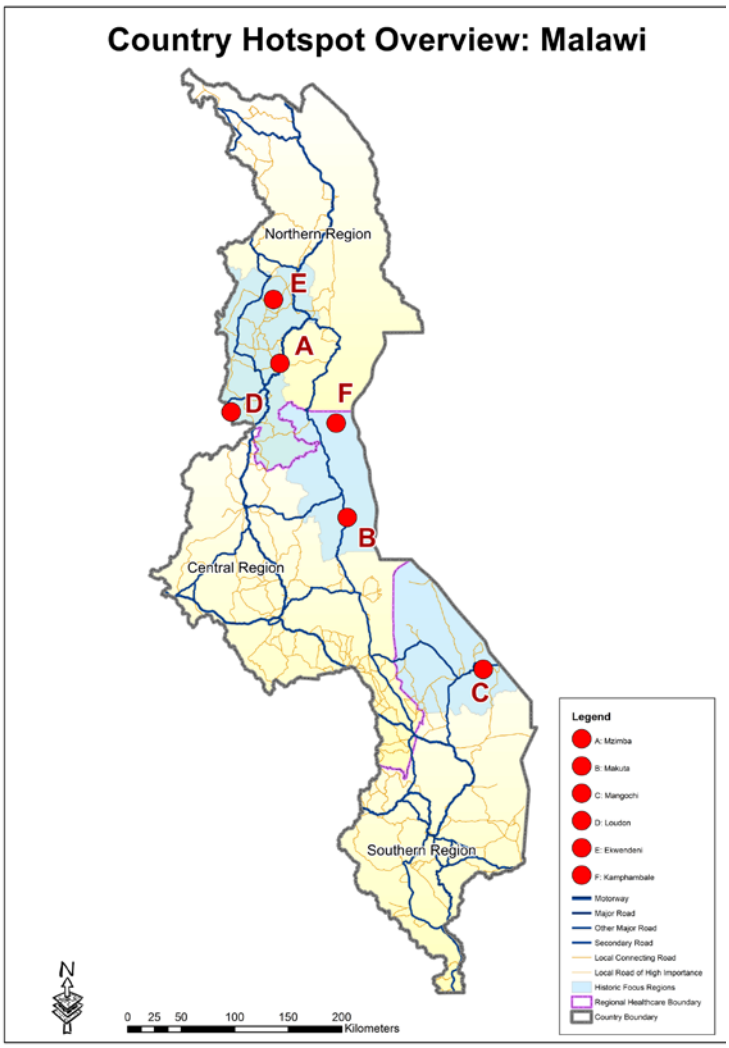
6.2.4 MALAWI

Local Insight: In consultation with the Ministry of Health in Malawi, the 'Historic Regions' indicated in the map below: Country Hotspot Overview: Malawi was provided. It shows that there are 8 districts in Malawi that have high concentrations of mine workers, namely: Karonga, Mzimba, Nkhata Bay, Nkhotakota, Mangochi, Machinga, Mulanje and Thyolo. Initially, it was agreed that initially the focus would be on the districts of Mulanje and Thyolo that were also felt to be areas most likely to provide mine workers for surrounding countries including South Africa. In consultation with the Ministry of Health and using Malawi's Service Provision Assessment (MSPA) undertaken in 2013-24, which is an invaluable source of data on health facilities and their access to TB services and equipment, it was decided that the Hotspot areas for Malawi are in the districts of Mzimba, Nkhotakota and Mangochi. Figure 14 shows the distribution of health facilities selected in these three districts.

TT Malawi Hotspot Results:

A Hotspot analysis by TomTom Consortium did not involve the integration of geocoded mineworkers, but were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria

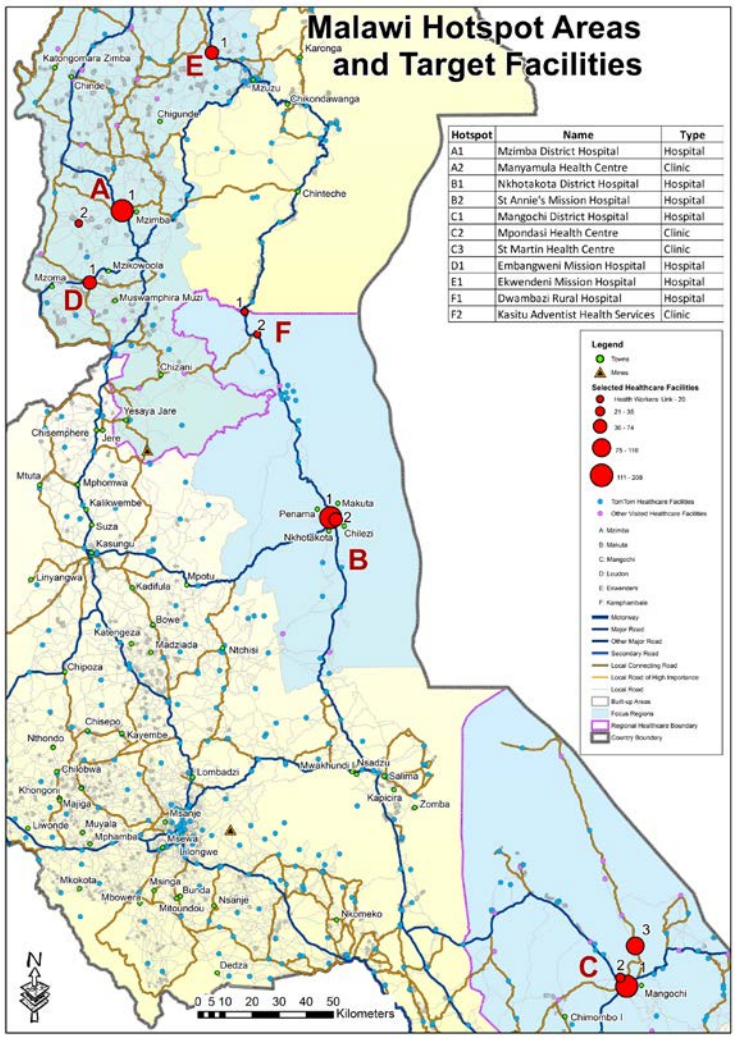




TT Malawi Hotspot Results:

The Qualitative criteria used in Malawi, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network



6.2.5 TANZANIA

Local Insight: Using a combination of literature researches, data from national studies and health reports as well as the location of health facilities in close proximity to the relevant mines, focus areas were identified. The report on the First National Tuberculosis Prevalence Survey in the United Republic of Tanzania done by the Ministry of Health and Social Welfare identified areas where there was high prevalence of TB. Figure 1 show the location of districts incorporated into the survey and the prevalence of TB per 100 000 people. This report provided an initial understanding of where the focus should be with the north-west clearly showing high prevalence rates of TB.

The location of active mines was sourced from the Ministry of Energy and Minerals. The location of gold mines was extracted and overlaid on the districts in Tanzania. From Figure it can be seen that there are a number of areas where there are high concentrations of gold mines in the north west, east, south east

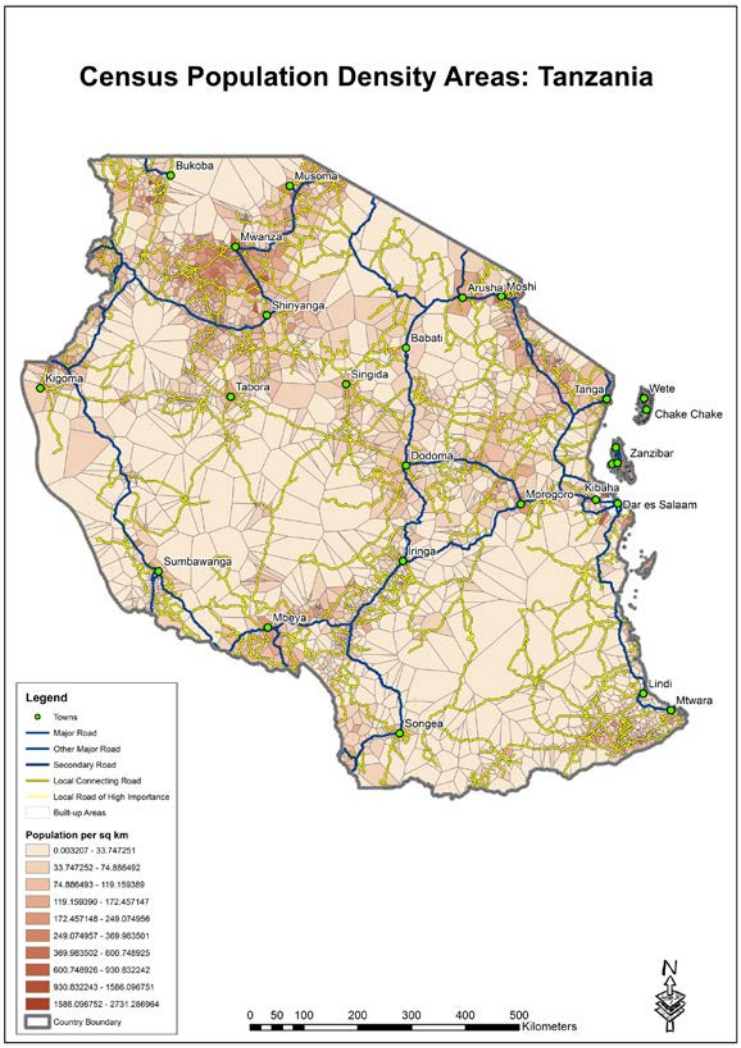
and on the south western border of Tanzania. However, it is in the north west where there is by far the highest number of gold mines. It is also in this area where there is the highest prevalence of TB. It was therefore decided to focus on this area and conduct fieldwork in selected health facilities.

Considering the districts with high TB prevalence and the location of gold mines, health facilities within a 1.2 km distance of the highly concentrated gold mines in the north-west Tanzania were selected. This included the districts of Chalo, Geita, Sengerema, Bukombe, Mbogwe, Nyang'hwale, Kaha Township Authority, Shinyanga, Msungwi, Kwimba, Nzega and Igunga.

The maps were shown to the National TB Manager and it was requested that health facilities also be selected around the Tanzanite mines near Mererani. The reason given for this is the high prevalence of TB. Figure ? shows the location of selected Tanzanite mines in the districts of Meru and Simanjiro. Not only does this area have the highest concentration of Tanzanite mines but it also has many gold mines. A total of 50 health facilities formed part of the fieldwork with 6 in the Meru/Simanjiro area and 44 in the north-western region of Tanzania.

Hotspot Analysis:

A Hotspot analysis by TomTom Consortium did not involve the integration of geocoded mineworkers, but were limited to towns within a 10km radius to large Gold, Copper, Coal and Diamond mining operations, and the population density per square kilometer for each Thiessen polygon. Given the lack of an industry accepted theorem that prescribes the relationship between population density and the spread of TB, it was considered reasonable to use a linear approach to blend the population density and observed miners. This was done by combining the standardised population density per square kilometer with the standardized observed miners, for each polygon, with a weight that was determined with some qualitative criteria



<u>TT Malawi Hotspot Results:</u>

The Qualitative criteria used in Malawi, to identify best possible HCF for scale-up, were the following:

- TB Equipment present in the facility
- Access to electricity
- Access to water
- Access to major road network

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Tanzania Hotspot Areas and Target Facilities

Hotspot	Name	Type
A1	Geita Region Hospital	Hospital
A2	Busanda Dispensary	Clinic
A3	Kifufu Dispensary	Clinic
A4	Nyalwanzaja Dispensary	Clinic
B1	Kahama District Hospital	Hospital
B2	Tumaini Wazazi Dispensary	Clinic
C1	Mirerani UHC Health Centre	Clinic
C2	Calvary Dispensary	Clinic
C3	Mbuguni Health Centre	Clinic
C4	Valeska Dispensary	Clinic
C5	Makiba Health Centre	Clinic