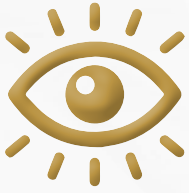
Namibia Statistics Agency

National Population Proximity Atlas

Health Facilities and Network Coverage

December 2024





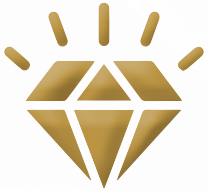
Vision

"To be a high performing and sustainable institution in quality statistics and spatial data delivery for research, planning, and decision-making"



Mission

"Leveraging on partnerships an innovative technologies, to produce and disseminate relevant, quality, timely statistics and spatial data that are fit-for purpose"



Core Values

Integrity
Excellent Performance
Professionalism
Accountability
Partnerships
Customer-focused

FOREWORD

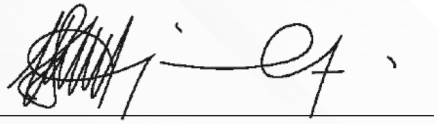


Namibia conducted her first digital Population and Housing Census (PHC) in 2023. It was the first census conducted by the Namibia Statistics Agency (NSA) since its establishment in 2012. The census, with digital workflows, was also spatially enabled to allow for the collection of both location and statistics in line with the United Nations' Global Statistical Geospatial Framework (GSGF). Due to the fragmented national physical address datasets across the country, Namibia adopted the geographic coordinates geocoding method, which allows for the collection of latitude and longitude coordinates of households linked to the census questionnaire.

With this approach, the country achieved the highest level of locational data disaggregation in the history of our census undertakings. Whereas past censuses associated the census questionnaire only with an enumeration area, the 2023 PHC provided data at the household level through the collection of precise Global Positioning System (GPS) coordinates. This elevated level of data granularity ensures an unprecedented level of data quality, instilling confidence in the statistical outputs generated from the census data. This integration of geography and thematic information also enables the production of non-traditional statistics as envisioned in the NSA Strategic Plan 2022-2027.

Over the past years, the NSA has developed in-house capacity to integrate statistics with spatial data at collection, analysis, and dissemination stages. This aligns with the NSA's commitment to providing statistics that are relevant, accurate, and timely for evidence-based development planning. This work is also within the framework of the National Spatial Data Infrastructure (NSDI), coordinated by the NSA, which aims to derive maximum value and benefits from government spatial data as a catalyst for spatially enabled policies and decision-making.

With the highlights in this Atlas, I must emphasize the importance of having relevant, accurate, and timely spatial data to provide planners, policymakers, and decision-makers with information to address prevailing national challenges. It is critical for data custodians to maintain their datasets if we are to continue on this statistical geospatial integration roadmap. Through our established statistical and spatial data coordination frameworks, I am confident that we will achieve maximum participation by all stakeholders, including the public.



ALEX SHIMUAFENI
STATISTICIAN-GENERAL & CEO

EXECUTIVE SUMMARY



This Atlas contains spatial measurements and spatial statistics for quantifying proximity, distribution pattern and relationships between the population and location of health facilities, as well as assessing telecommunication network coverage on the two themes. The data layers used are the Dwelling Unit Frame (DUF), mapped health facilities, health districts and telecommunications network coverage. The DUF is the location of dwelling structures with the number of persons and households in those structures. The frame was first attempted during the preparation of the 2011 Population and Housing Census (PHC) but could not produce the desired outcomes. Since the dwelling units are structures where households live, the census questionnaire was in this second attempt successfully linked to it to create a statistical collection surface. This enabled the association of spatial relationships to all the census demographic, social and economic variables collected during the census.

The DUF is compared in a geographic analysis to the health facilities and telecommunications network coverage (2G, 3G and 4G) to derive summary statistics at national, regional and constituency levels. The health facilities and health districts from the Ministry of Health and Social Services (MoHSS) and telecommunications network coverage from the Communication Regulatory Authority of Namibia (CRAN) used in the analyses are part of the National Spatial Data Infrastructure (NSDI) as coordinated by the NSA. It must be noted here that the proximity analyses were based on planar distances which are straight-line distances around or between the compared geographic features. The analyses did not take into consideration the surface curvature of the earth in terms of elevation. In summary, the following analyses were conducted:

- ✓ population proximity to health facilities and network coverage
- ✓ standard distances and directional distribution of population and health facilities as a measure of dispersion, compactness and directional distribution
- ✓ population farthest distance to the closest health facilities, etc.

This is the first chapter out of other expected specialised and detailed national spatial analysis chapters that will follow from the analyses of the census dataset. Examples of other chapters which are expected to be produced later are population proximity to Primary Schools and Transportation Networks. Below is a broad summary of the Atlas' results:

- The NSA used 530 mapped health facilities consisting of 49 hospitals, 60 health centres and 421 clinics to evaluate the proximity of the 2023 population (3 022 401) to health facilities.Khomas Region had the highest percentage of mapped health facilities at 11.1 percent, followed by Omusati and Erongo at 10.9 and 10.4 percent. Hardap had the lowest percentage (4.0%), followed by Omaheke (4.2%) and Oshana (4.5%) respectively.

- The 530 health facilities were overlayed on the 38 health district boundaries to derive the number of health facilities by health district. The results showed that the Windhoek health district had the highest percentage of health facilities at 11.1 percent, followed by Katima Mulilo and Engela at 7.2 and 4.5 percent, while Tsumkwe had the lowest at 0.8 percent respectively.

- The same analysis as conducted on health facilities was performed on population distribution to count the number of persons within each health district. The results showed that the Windhoek health district (16.4%) had more than double the number of persons of the second highest district which is Engela (6.5%). Rosh Pinah had the lowest at 0.4 percent of the population, followed by Tsumkwe at 0.5 percent respectively.

- An analysis was conducted to determine the ratio of health facilities to population by region which revealed that Oshana had the highest ratio of 1 health facility to 9 617 persons, followed by Khomas at 1 to 8 383 persons. //Kharas had the lowest health facility to population ratio at 1 health facility to 3 330 persons, followed by Kunene at 1 health facility to 3 552 persons respectively. This analysis was also conducted at regional level to reveal the trend at constituency level.

- The Atlas further aimed to determine the number of persons living within a 10 kilometer distance to a health facility. The results showed that in 2023, 87.1 percent of the population was within 10 kilometres of a health facility in Namibia. A total of 99.0 percent of the urban population were within the above radius compared to 75.3 percent of the rural population. At regional level Khomas had the highest proportion of the population within a 10-kilometer radius at 96.8 percent, followed by Oshana at 96.7 percent and Kavango East at 95.0 percent respectively. Omaheke and Kunene regions had the lowest population within the 10-kilometer radius at 59.4 percent and 59.8 percent respectively.

- In terms of spatial distribution at national level, both themes of health facilities and population had their geographic mean centers of their distribution in Otjozondjupa Region, Etunda Clinic being the most central health facility in the country.

- In terms of dispersion and compactness of the distributions, health facilities were generally more dispersed at 422.6 kilometres 1- standard distance compared to the population at 379.4 kilometres. At regional level, Kunene and //Kharas regions had more dispersed health facilities at 165.6 and 165.0 kilometres 1-standard distances. This is the same for population distributions of both regions at 161.8 and 160.0 kilometres respectively. Khomas Region, followed by Oshana had a more compact distribution of their health facilities at 12.2 and 15.3 kilometres, while in terms of population distribution, Oshana had a more compact distribution at 18.8 kilometres, followed by Khomas at 20.0 kilometres respectively.

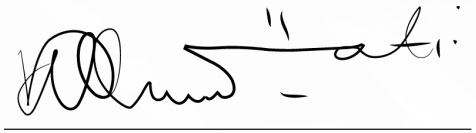
- In terms of directional distributions, both the health facilities and population distributions were generally distributed in a North East – South West orientation at 20.4 and 7.1 degree angles at 1-standard deviation ellipse respectively.

- The 1-standard deviation ellipse of health facilities covered 405 health facilities and a population of 2 531 477 while the population ellipse covered a population of 2 269 294 with a count of 350 health facilities.

- In Namibia, communities in and around Vergenoeg in Hardap Region travelled the farthest distance of approximately 119.9 kilometres to the nearest health facility (Aus Clinic) in //Kharas Region. This analysis was also conducted at regional level.

- Lastly, Namibia had 93.0 percent of the population and 90.6 percent of health facilities within the telecommunications network coverage of either 2G, 3G or 4G. At regional level, Oshana had the highest population covered by network at 99.8 percent. Hardap, Khomas and Oshana had 100 percent network coverage for all their health facilities. Kunene Region on the other hand, had the least percentage of population and health facilities covered by network at 65.6 and 58.8 percent respectively.

From the above summary, the benefit of the integration of statistical and geospatial information cannot be overemphasised. The generation of highly disaggregated statistics enables a more precise policy intervention, planning and decision making. It is for this reason that Namibia must prioritise the development of both the National Statistics System and National Spatial Data Infrastructure as a means for statistical-geospatial integration. Driven by the resolve to innovate, the NSA will continue to produce a new series of non-traditional statistics to meet the growing demand for a broader range of statistical products. This is in line with the current NSA strategic plan 2022 – 2027.



ALEX MUDABETI
EXECUTIVE: GIS AND NSDI COORDINATION

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CHAPTER 1:
HEALTH FACILITIES TO POPULATION SUMMARY STATISTICS

This chapter provides a summary of mapped health facilities as categorised into three classes of Clinics, Health Centers and Hospitals. Only the geographically mapped health facilities of 2022 which were available in the NSDI at the NSA were compared with the 2023 population statistics by area. The health districts dataset was generated by the NSA at the request of the MoHSS. The final health districts were still undergoing validation by MoHSS at the time of publication of this Atlas. The population and the number of health facilities per health district is included and ratios of population to health facilities are determined for comparison purposes. The results are shown in maps, graphs and tables. It must be noted that there might be some health facilities that were not having geographic coordinates by the time of this analysis. Such health facilities are not included in the summary statistics.

Over the years, the NSA has advocated for the reconciliation of administrative records of various Offices, Ministries and Agencies of government with those records of the Agency within the framework of the NSDI. This was to pave the way for the integration of statistics and geography as a mean to provide data and statistics at a more disaggregated level to support planning and decision making.



1.1. Percentage Distribution of Mapped Health Facilities by Region

Figure 1.1 1 Percentage Distribution of Mapped Health Facilities by Region

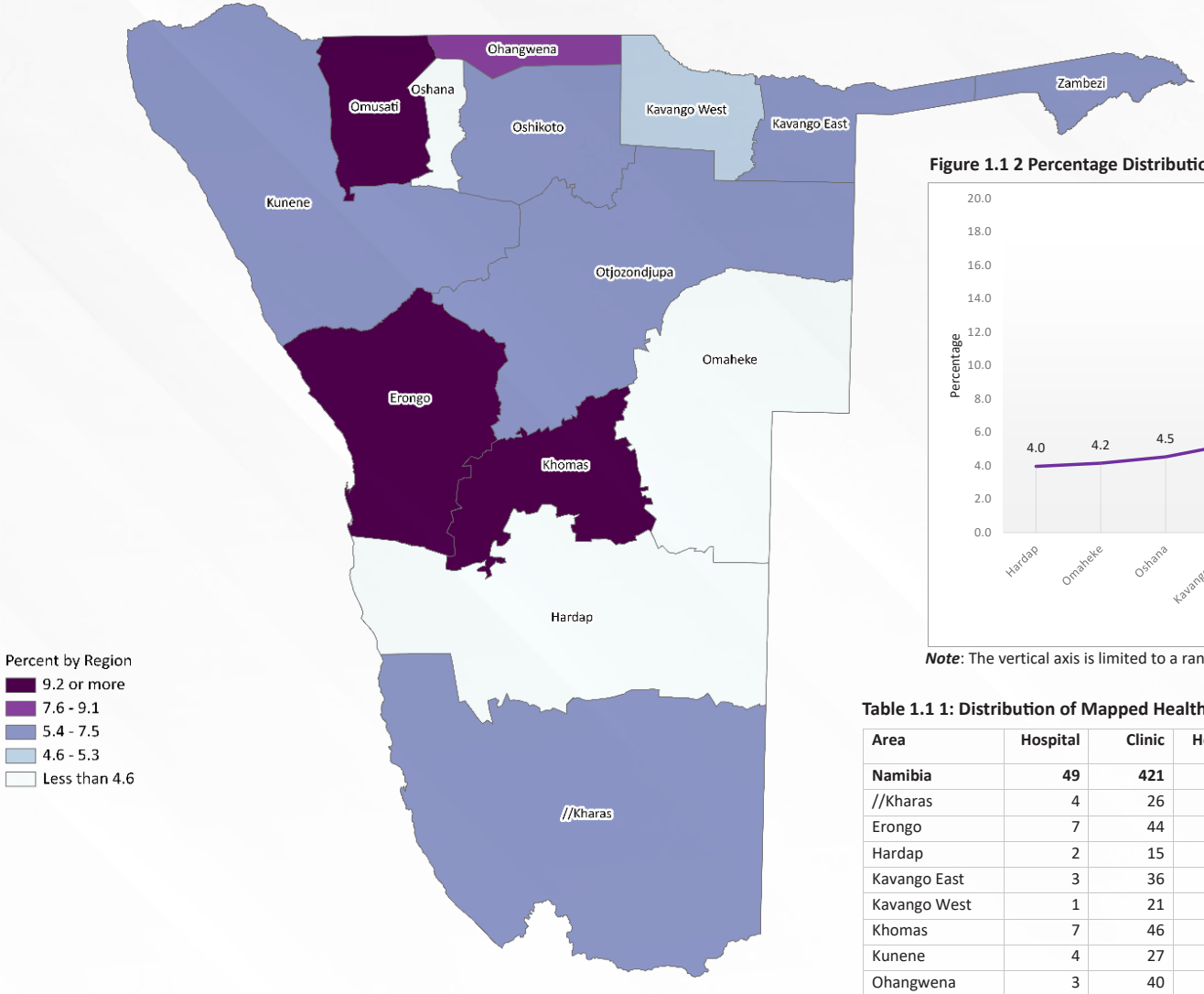
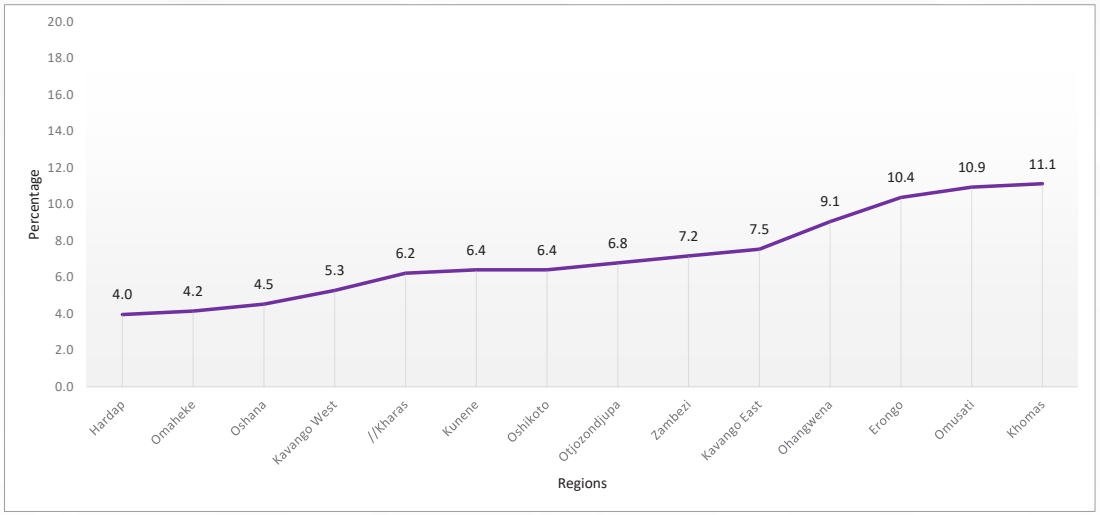


Figure 1.1 2 Percentage Distribution of Mapped Health Facilities by Region



Note: The vertical axis is limited to a range of 0-20% for clearer visualization, as all data points fall below 20%.

Table 1.1 1: Distribution of Mapped Health Facilities by Region

Area	Hospital	Clinic	Health Centre	Total	Percentage
Namibia	**49**	**421**	**60**	**530**	**100**
//Kharas	4	26	3	33	6.2
Erongo	7	44	4	55	10.4
Hardap	2	15	4	21	4.0
Kavango East	3	36	1	40	7.5
Kavango West	1	21	6	28	5.3
Khomas	7	46	6	59	11.1
Kunene	4	27	3	34	6.4
Ohangwena	3	40	5	48	9.1
Omaheke	1	19	2	22	4.2
Omusati	4	45	9	58	10.9
Oshana	3	15	6	24	4.5
Oshikoto	4	27	3	34	6.4
Otjozondjupa	5	27	4	36	6.8
Zambezi	1	33	4	38	7.2

Khomas, Omusati and Erongo regions had the highest percentages of mapped health facilities in the country at 11.1, 10.9 and 10.4 percent respectively. On the other hand, Hardap, Omaheke and Oshana regions had the lowest percentages at 4.0, 4.2 and 4.5 percent. For a detailed analysis, see Table 1.1 -1

1.2. Percentage Distribution of Mapped Health Facilities by Health District

Figure 1.2-1 Percentage Distribution of Mapped Health Facilities by Health District

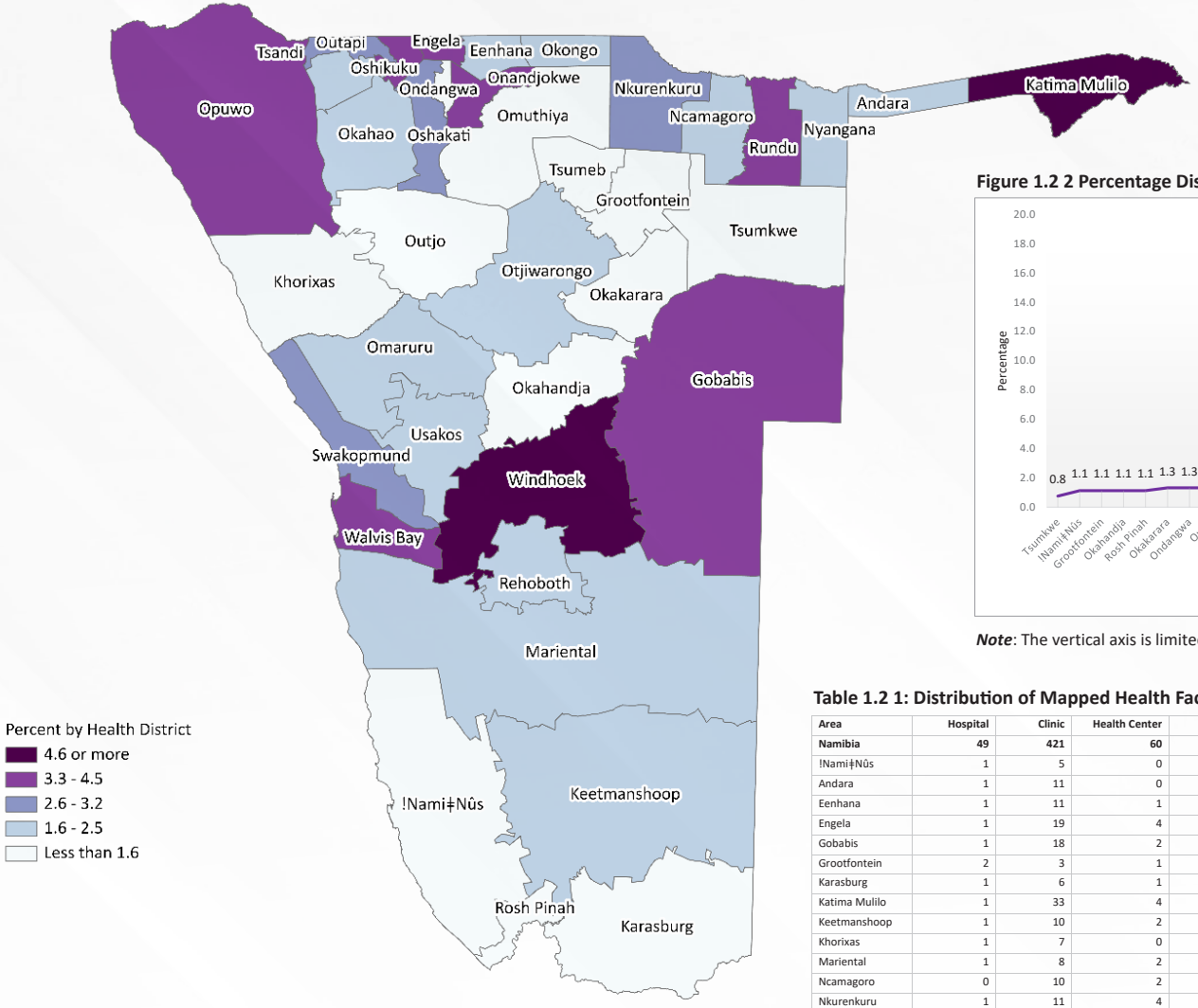
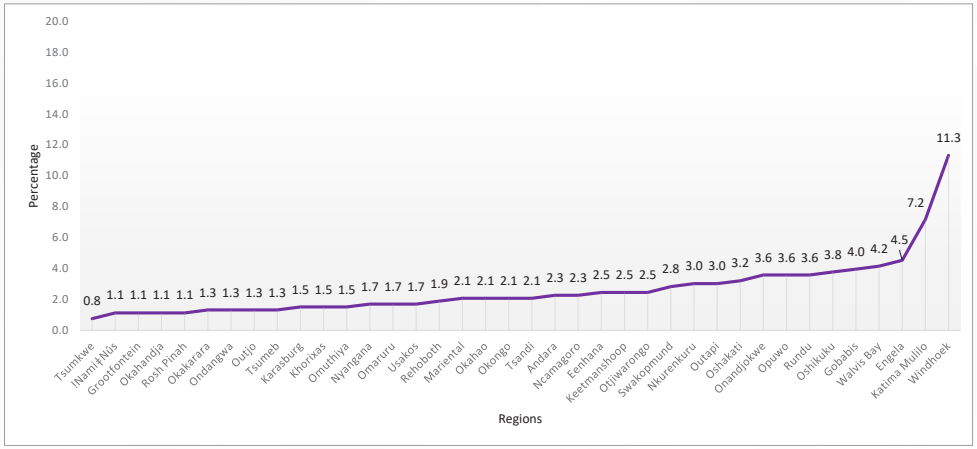


Figure 1.2 2 Percentage Distribution of Mapped Health Facilities by Health District



Note: The vertical axis is limited to a range of 0-20.0% for clearer visualization, as all data points fall below 20.0%.

Table 1.2 1: Distribution of Mapped Health Facilities by Health District

Area	Hospital	Clinic	Health Center	Total	Total Percentage
Namibia	**49**	**421**	**60**	**530**	**100.0**
!Nami‡Nûs	1	5	0	6	1.1
Andara	1	11	0	12	2.3
Eenhana	1	11	1	13	2.5
Engela	1	19	4	24	4.5
Gobabis	1	18	2	21	4.0
Grootfontein	2	3	1	6	1.1
Karasburg	1	6	1	8	1.5
Katima Mulilo	1	33	4	38	7.2
Keetmanshoop	1	10	2	13	2.5
Khorixas	1	7	0	8	1.5
Mariental	1	8	2	11	2.1
Ncamagoro	0	10	2	12	2.3
Nkurenkuru	1	11	4	16	3.0
Nyangana	1	8	0	9	1.7
Okahandja	1	5	0	6	1.1
Okahao	1	9	1	11	2.1
Okakarara	1	6	0	7	1.3
Okongo	1	10	0	11	2.1
Omaruru	2	7	0	9	1.7
Omuthiya	1	7	0	8	1.5
Onandjokwe	1	15	3	19	3.6
Ondangwa	1	5	1	7	1.3

Area	Hospital	Clinic	Health Center	Total	Total Percentage
Opuwo	1	16	2	19	3.6
Oshakati	2	10	5	17	3.2
Oshikuku	1	17	2	20	3.8
Otjiwarongo	1	10	2	13	2.5
Outapi	1	10	5	16	3.0
Outjo	2	4	1	7	1.3
Rehoboth	1	7	2	10	1.9
Rosh Pinah	1	5	0	6	1.1
Rundu	1	17	1	19	3.6
Swakopmund	1	13	1	15	2.8
Tsandi	1	9	1	11	2.1
Tsumeb	2	5	0	7	1.3
Tsumkwe	0	3	1	4	0.8
Usakos	2	6	1	9	1.7
Walvis Bay	2	18	2	22	4.2
Windhoek	7	47	6	60	11.3

Windhoek District had the highest percentages of total mapped health facilities in the country at 11.3 percent. On the other hand, Tsumkwe had the lowest percentage at 0.8 percent followed by !Nami‡Nûs, Grootfontein and Okahandja at 1.1 percent each. For a detailed analysis, see Table 1.2 -1

1.3. Percentage Distribution of Population by Health District

Figure 1.3 1 Percentage Distribution of Population by Health District

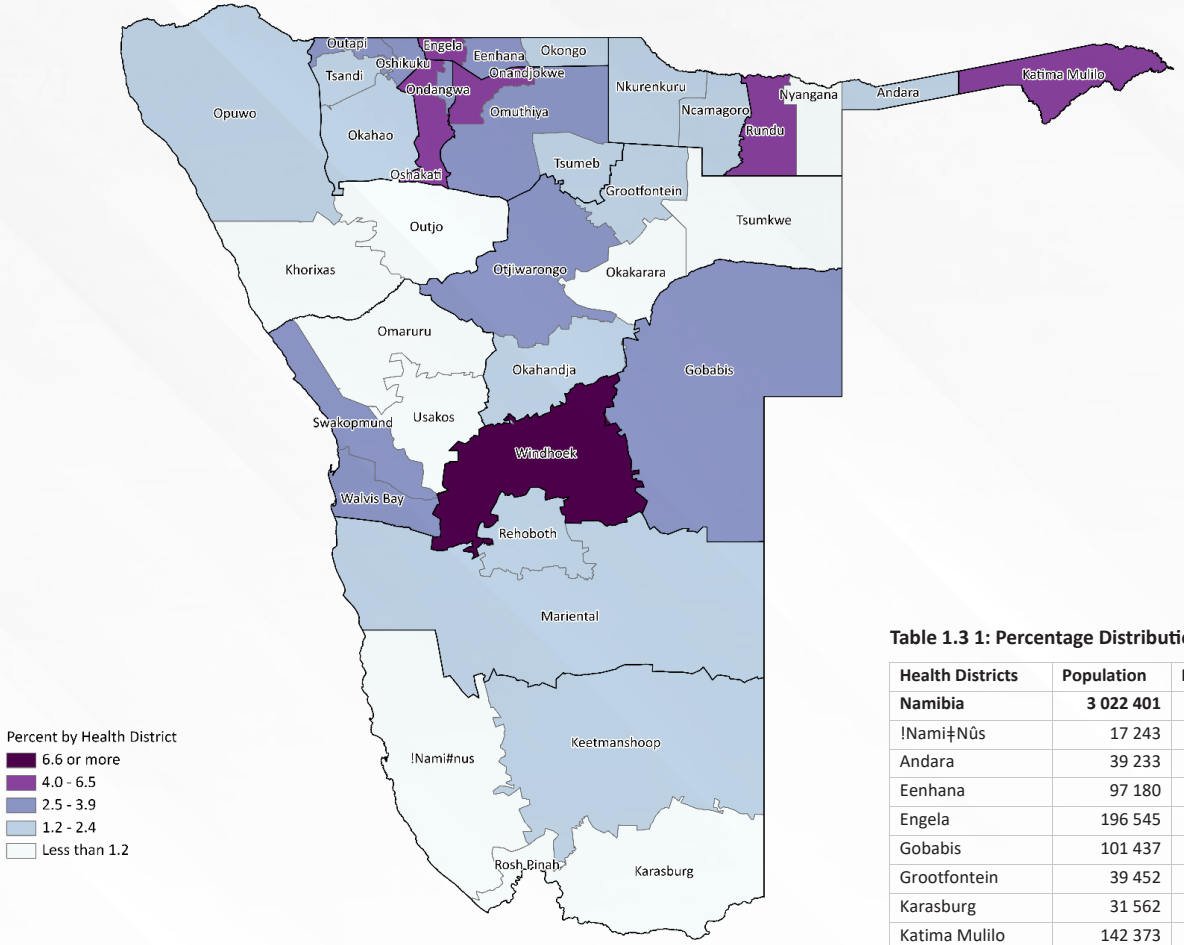


Figure 1.3 2 Percentage Distribution of Population by Health District

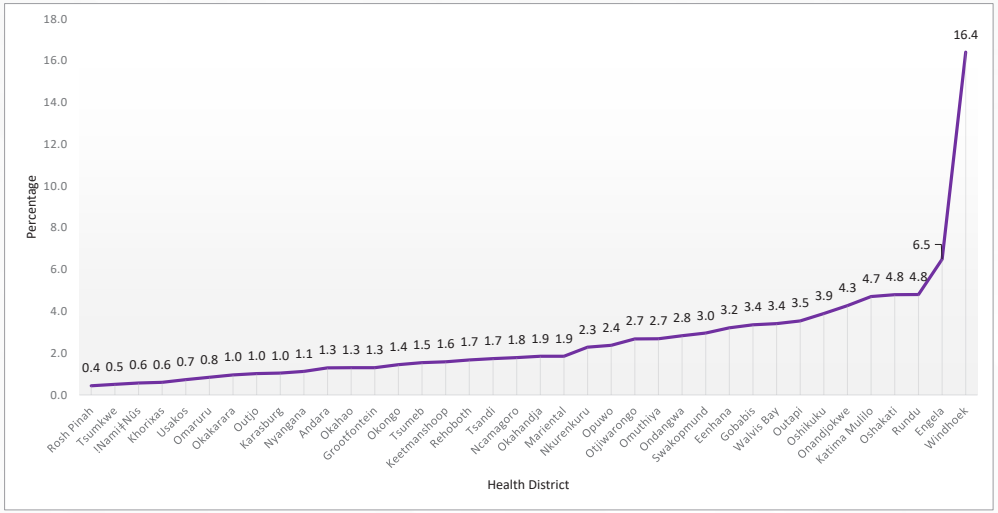


Table 1.3 1: Percentage Distribution of Population by Health District

Health Districts	Population	Percentage
Namibia	**3 022 401**	**100.0**
!Nami‡Nûs	17 243	0.6
Andara	39 233	1.3
Eenhana	97 180	3.2
Engela	196 545	6.5
Gobabis	101 437	3.4
Grootfontein	39 452	1.3
Karasburg	31 562	1.0
Katima Mulilo	142 373	4.7
Keetmanshoop	47 864	1.6
Khorixas	18 176	0.6
Mariental	56 028	1.9
Ncamagoro	54 125	1.8
Nkurenkuru	69 141	2.3
Nyangana	33 978	1.1
Okahandja	56 004	1.9
Okahao	39 341	1.3
Okakarara	29 011	1.0
Okongo	43 746	1.4
Omaruru	25 613	0.8

Health Districts	Population	Percentage
Namibia	**3 022 401**	**100.0**
Omuthiya	81 380	2.7
Onandjokwe	129 311	4.3
Ondangwa	85 751	2.8
Opuwo	71 773	2.4
Oshakati	144 951	4.8
Oshikuku	117 776	3.9
Otjiwarongo	80 978	2.7
Outapi	107 133	3.5
Outjo	30 831	1.0
Rehoboth	50 637	1.7
Rosh Pinah	13 224	0.4
Rundu	145 210	4.8
Swakopmund	89 463	3.0
Tsandi	52 659	1.7
Tsumeb	46 712	1.5
Tsumkwe	15 357	0.5
Usakos	22 015	0.7
Walvis Bay	103 115	3.4
Windhoek	496 073	16.4

Windhoek Health District had the highest percentage of population in the country at 16.4 percent, while Rosh Pinah had the lowest (0.4%).

1.4. Health Facilities to Population Ratio

This sub chapter provides an analysis of the health facility to population ratio across various regions, highlighting disparities in healthcare access relative to population size. This ratio is determined by dividing the total population in a region by the number of health facilities available. A higher ratio indicates a larger population served per health facility, reflecting a potential strain on healthcare services. Conversely, a lower ratio suggests that fewer persons are served per health facility, indicating better access to healthcare.

1.4.1. National Health Facility to Population Ratio

Figure 1.4.1 1 Health Facility to Population Ratio

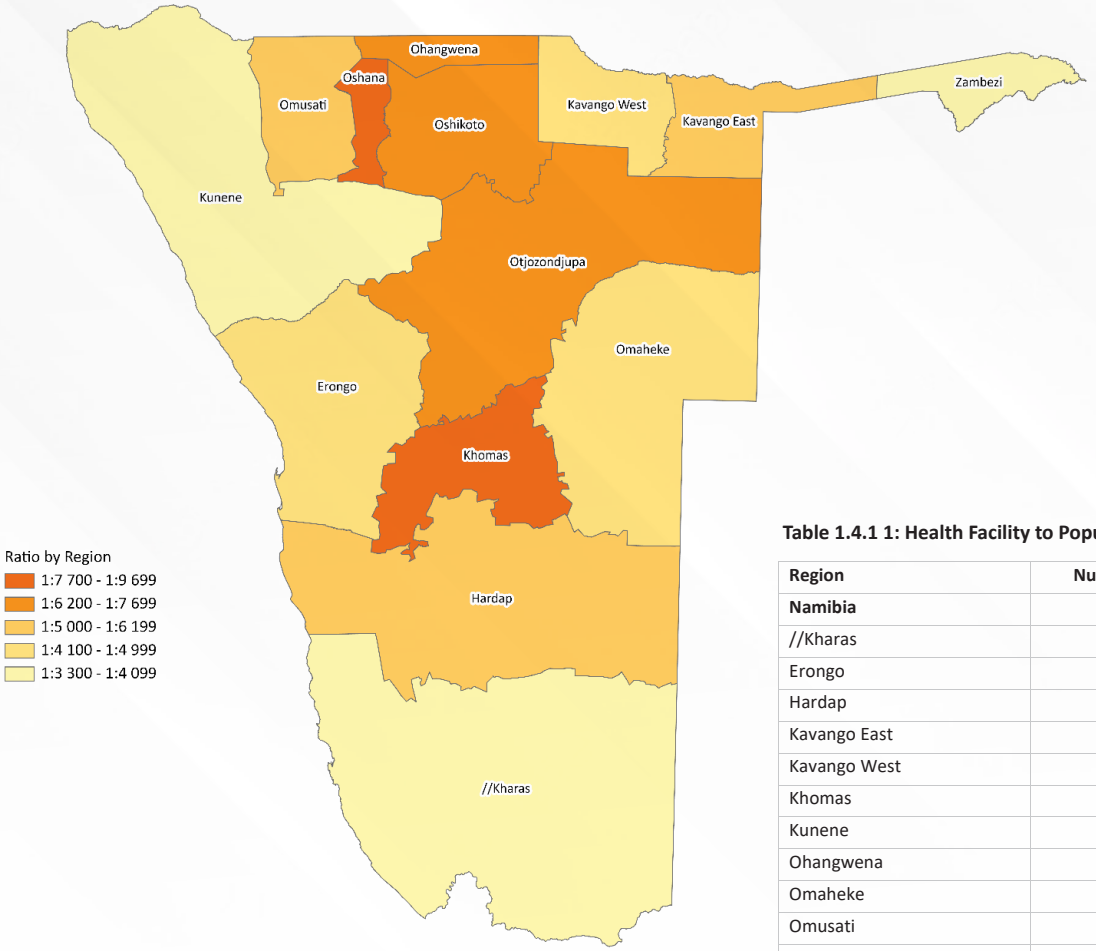


Figure 1.4.1 2 Health Facility to Population Ratio

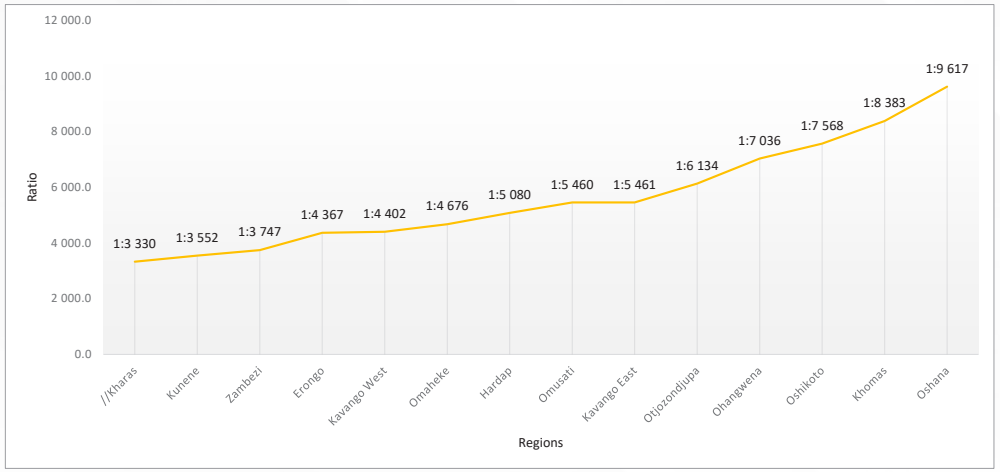


Table 1.4.1 1: Health Facility to Population Ratio

Region	Number of Health Facilities	Population	Ratio
Namibia	**530**	**3 022 401**	**1:5 703**
//Kharas	33	109 893	1:3 330
Erongo	55	240 206	1:4 367
Hardap	21	106 680	1:5 080
Kavango East	40	218 421	1:5 461
Kavango West	28	123 266	1:4 402
Khomas	59	494 605	1:8 383
Kunene	34	120 762	1:3 552
Ohangwena	48	337 729	1:7 036
Omaheke	22	102 881	1:4 676
Omusati	58	316 671	1:5 460
Oshana	24	230 801	1:9 617
Oshikoto	34	257 302	1:7 568
Otjozondjupa	36	220 811	1:6 134
Zambezi	38	142 373	1:3 747

Oshana Region had the highest health facility to population ratio (1:9 617), followed by Khomas (1:8 383) and Oshikoto (1:7 568). In contrast, //Kharas had the lowest health facilities to population ratio of 1:3 330.

1.4.2. //Kharas Region

Figure 1.4.2 1 Health Facility to Population Ratio

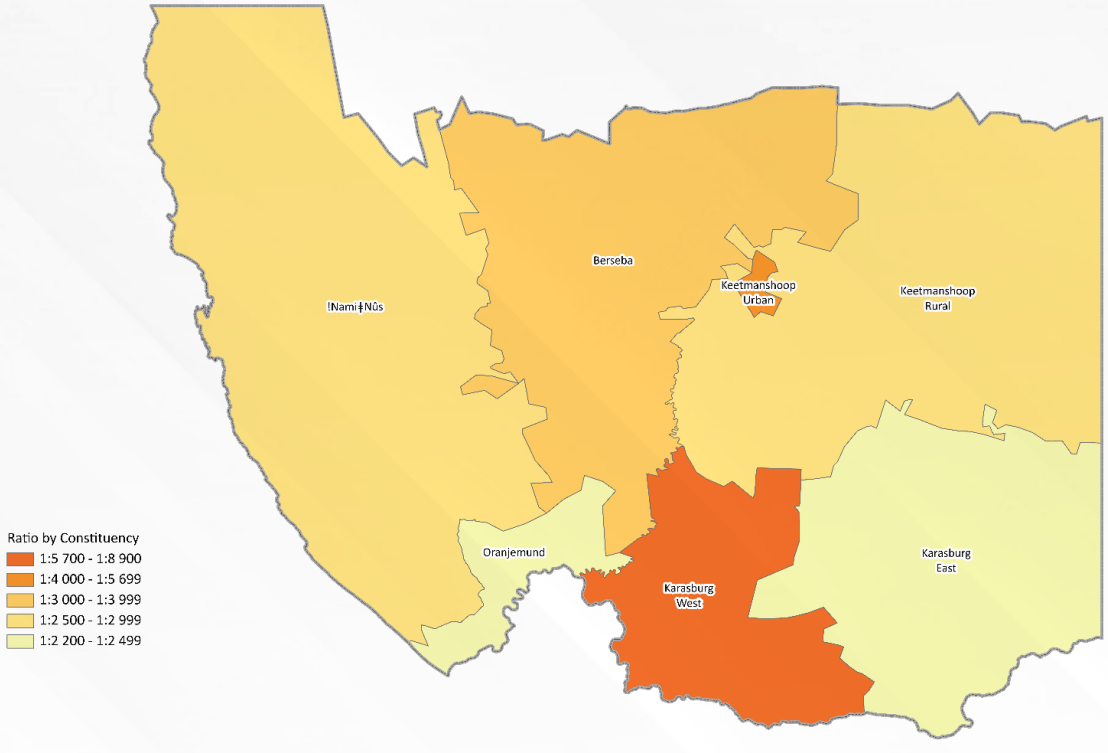
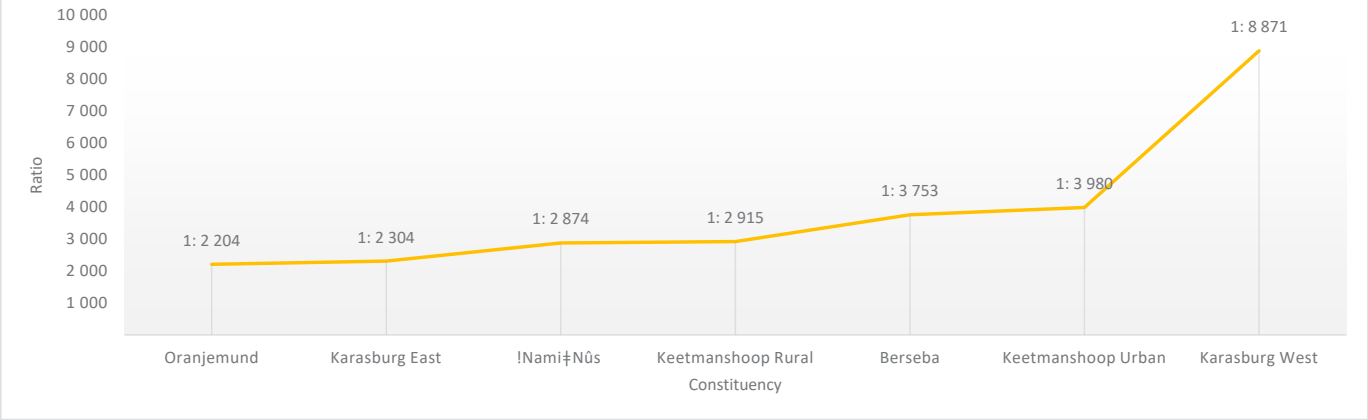


Table 1.4.2 1: Health Facility to Population Ratio

Constituency	Number of Health Facilities	Population	Ratio
//Kharas	**33**	**109 893**	**1:3 330**
!Nami‡Nûs	6	17 243	1:2 874
Berseba	3	11 258	1:3 753
Karasburg East	6	13 821	1:2 304
Karasburg West	2	17 741	1:8 871
Keetmanshoop Rural	3	8 744	1:2 915
Keetmanshoop Urban	7	27 862	1:3 980
Oranjemund	6	13 224	1:2 204

Figure 1.4.2 2 Health Facilities to Population Ratio



Karasburg West Constituency had the highest health facility to population ratio of 1:8 871 followed by Keetmanshoop Urban (1:3 980) and Berseba (1:3 753). In contrast, Oranjemund and Karasburg East Constituencies had the lowest health facility to population ratio of 1:2 304 and 1:2 204, respectively.

1.4.3. Erongo Region

Figure 1.4.3 1 Health Facility to Population Ratio

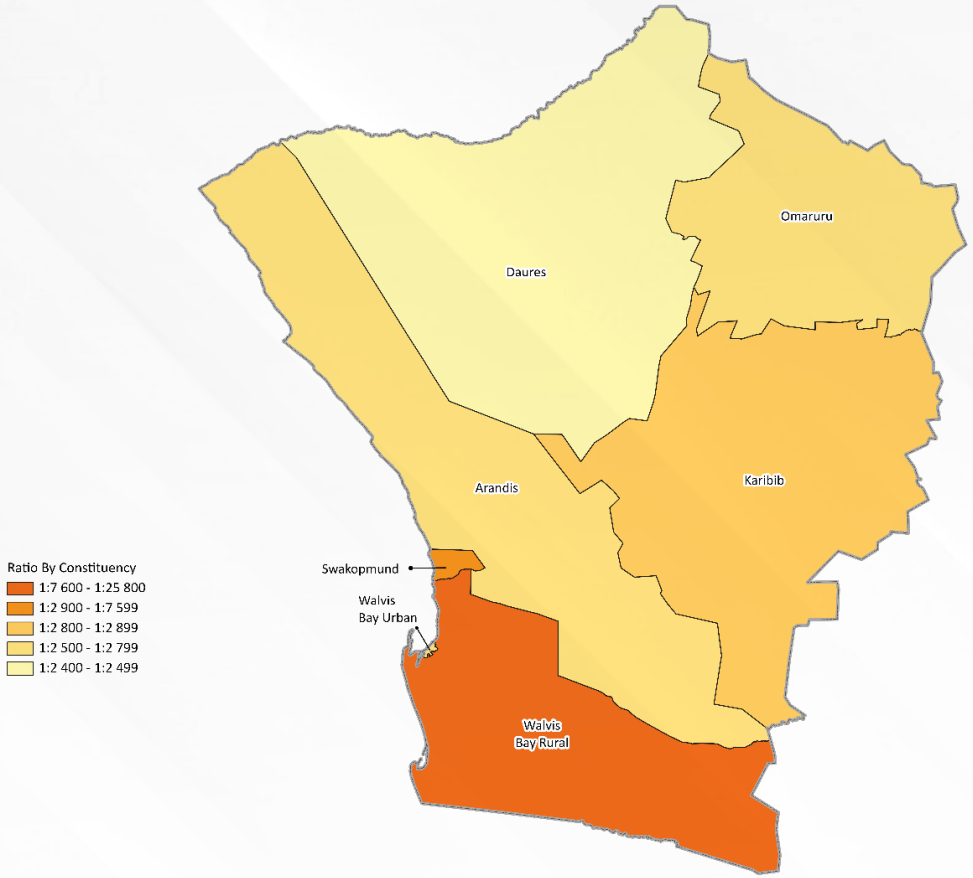


Figure 1.4.3 2 Health Facility to Population Ratio

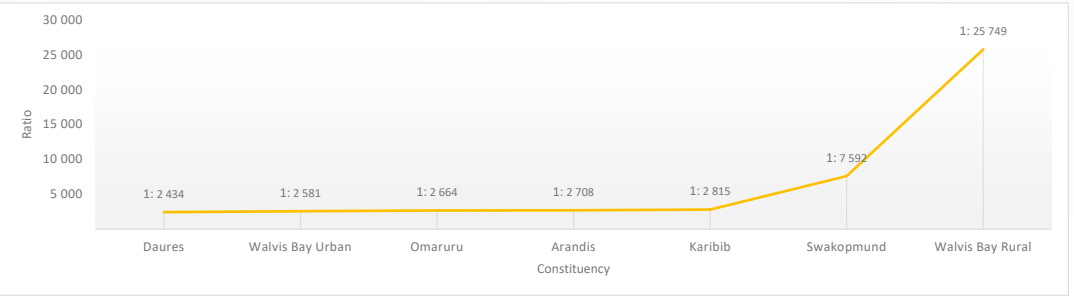


Table 1.4.3 1: Health Facility to Population Ratio

Constituency	Number of Health Facilities	Population	Ratio
Erongo	**55**	**240 206**	**1:4 367**
Arandis	5	13 542	1:2 708
Daures	6	14 601	1:2 434
Karibib	7	19 705	1:2 815
Omaruru	5	13 322	1:2 664
Swakopmund	10	75 921	1:7 592
Walvis Bay Rural	2	51 497	1:25 749
Walvis Bay Urban	20	51 618	1:2 581

Walvis Bay Rural Constituency had the highest health facility to population ratio of 1:25 749 followed by Swakopmund (1:7 592) and Karibib with (1:2 815). In contrast, Walvis Bay Urban and Daures Constituencies have the lowest health facility to population ratios of 1:2 581 and 1:2 434, respectively.

1.4.4. Hardap Region

Figure 1.4.4 1 Health Facility to Population Ratio

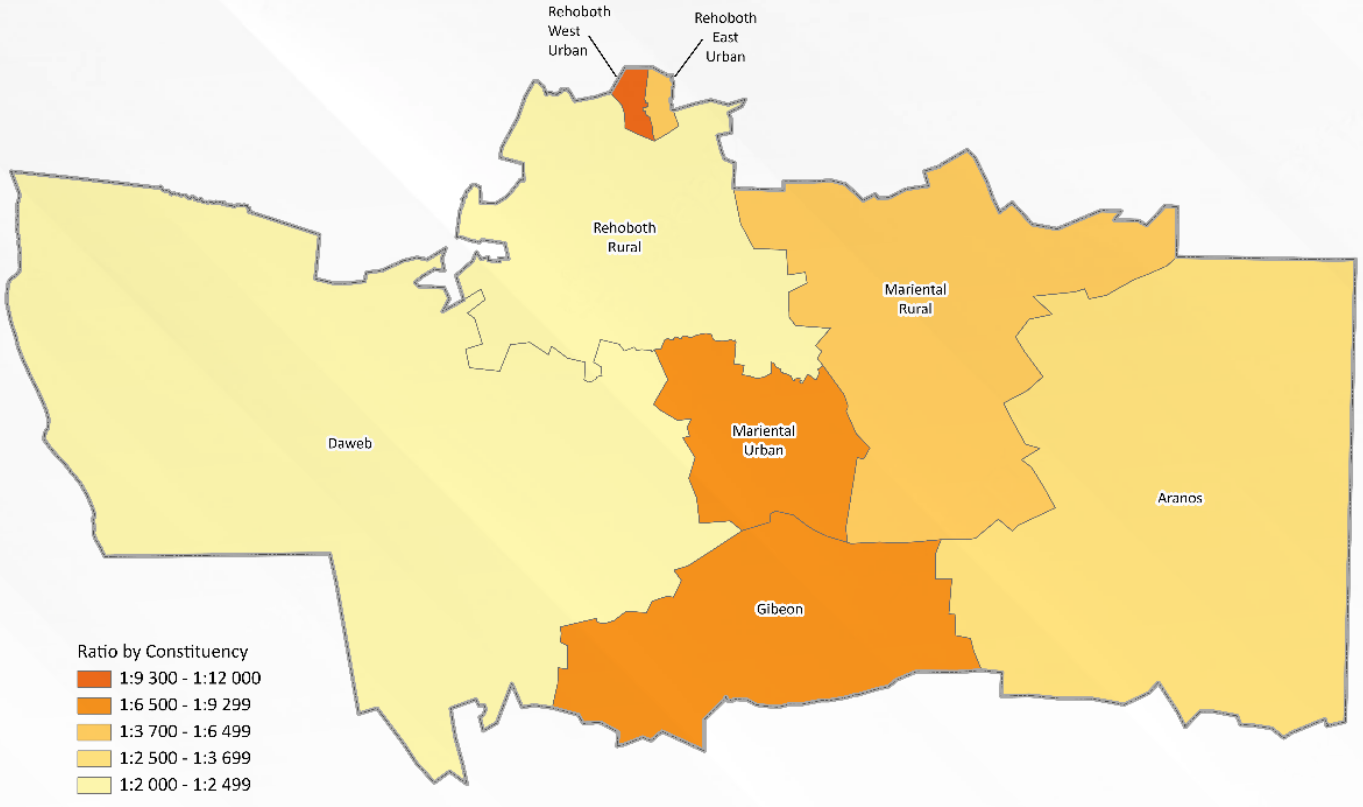
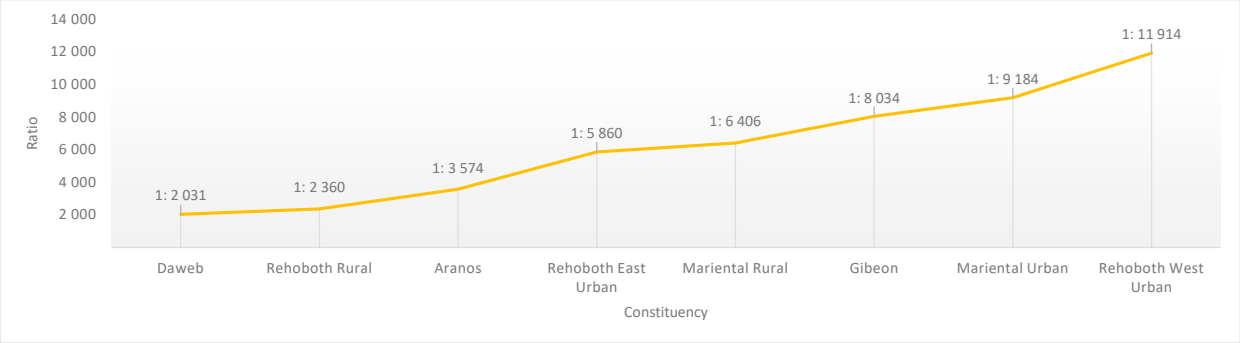


Table 1.4.4 1: Health Facility to Population Ratio

Constituency	Number of Health Facilities	Population	Ratio
Hardap	**21**	**106 680**	**1:5 080**
Aranos	3	10 722	1:3 574
Daweb	3	6 092	1:2 031
Gibeon	1	8 034	1:8 034
Mariental Rural	2	12 812	1:6 406
Mariental Urban	2	18 368	1:9 184
Rehoboth East Urban	5	29 299	1:5 860
Rehoboth Rural	4	9 439	1:2 360
Rehoboth West Urban	1	11 914	1:11 914

Figure 1.4.4 2 Health Facility to Population Ratio



Rehoboth West Urban Constituency had the highest health facility to population ratio of 1 health facility to 11 914 persons, followed by Mariental Urban (1:9 184) and Gibeon (1:8 034). In contrast, Daweb had the lowest health facility to population ratio of 1:2 030.

1.4.5. Kavango East Region

Figure 1.4.5 1 Health Facility to Population Ratio

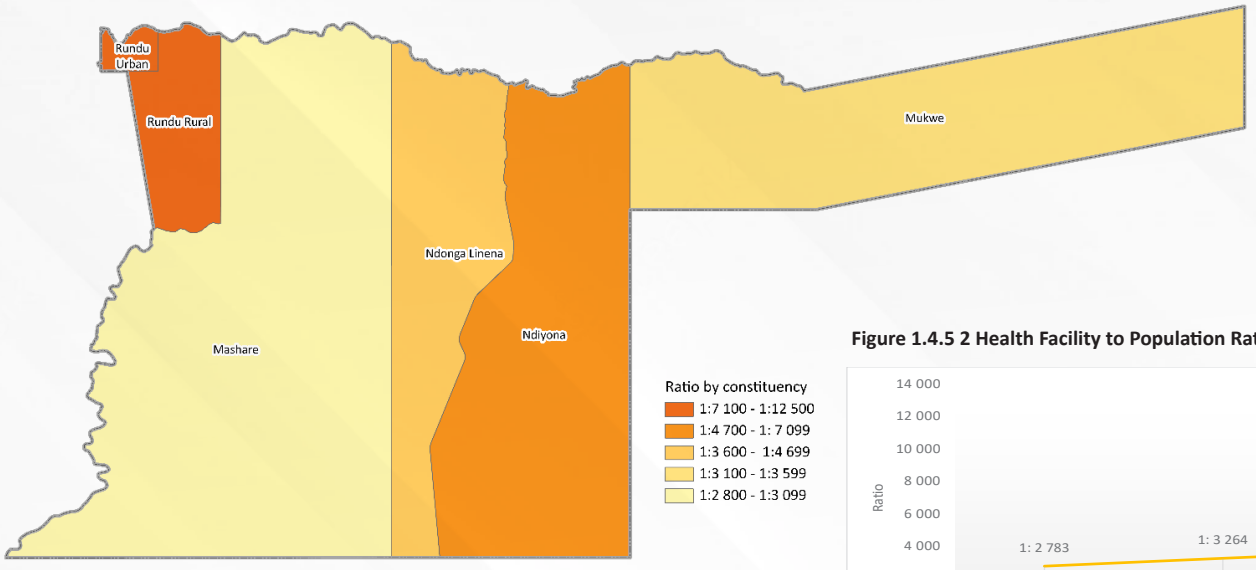


Figure 1.4.5 2 Health Facility to Population Ratio

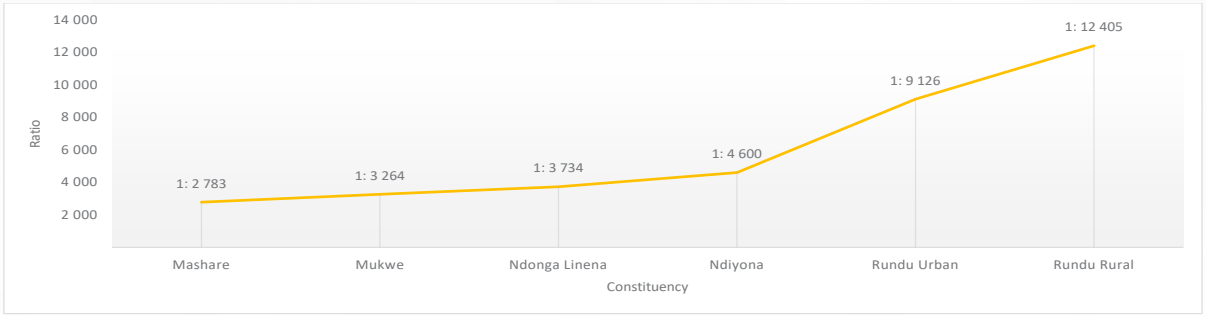


Table 1.4.5 1: Health Facility to Population Ratio

Constituency	Number of Health Facilities	Population	Ratio
Kavango East	**40**	**218 421**	**1:5 461**
Mashare	7	19 478	1:2 783
Mukwe	12	39 170	1:3 264
Ndonga Linena	4	14 936	1:3 734
Ndiyona	3	13 800	1:4 600
Rundu Urban	13	118 632	1:9 126
Rundu Rural	1	12 405	1:12 405

Rundu Urban and Rundu Rural Constituencies had the highest health facility to population ratio of 1:9 126 and 1:12 405 respectively, while Mashare had the lowest health facility to population ratio of 1:2 783.

1.4.6. Kavango West Region

Figure 1.4.6 1 Health Facility to Population Ratio

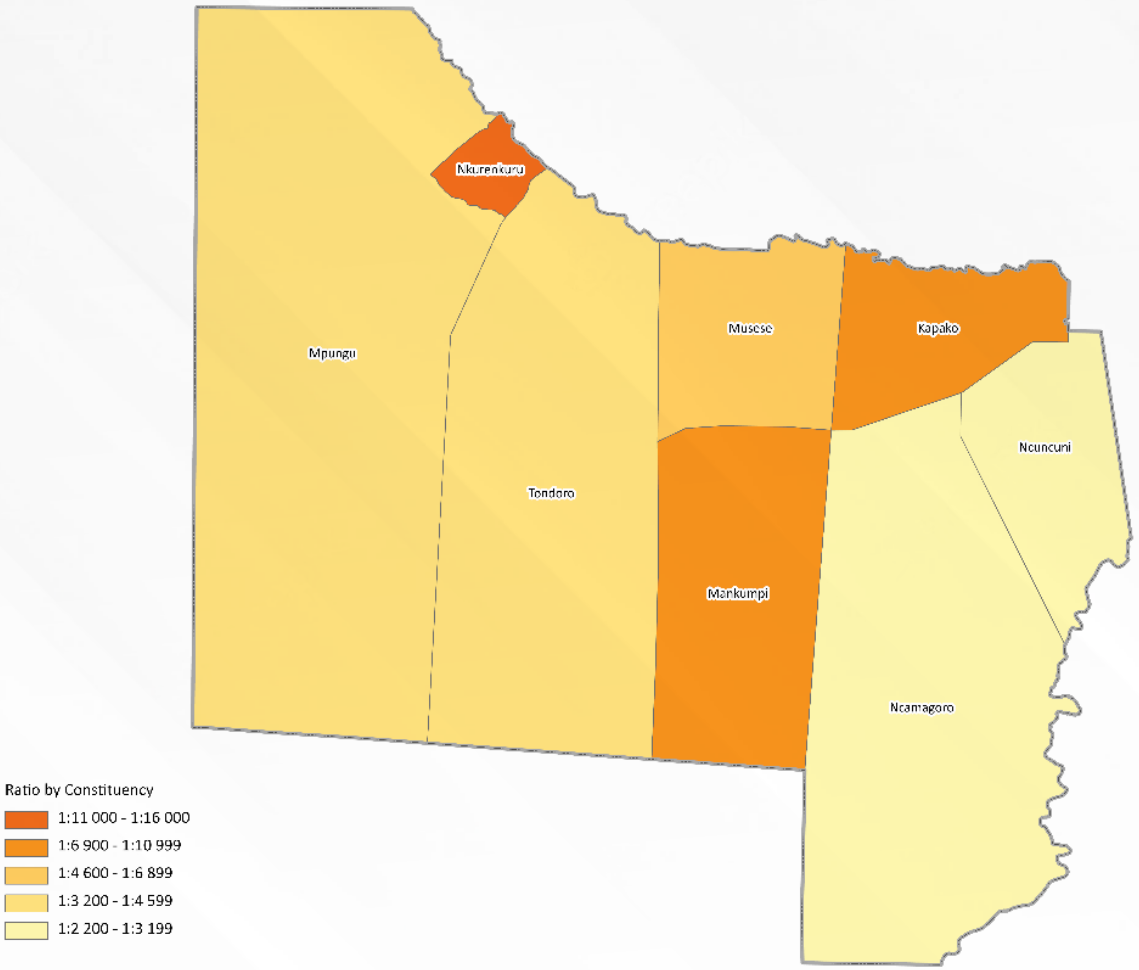


Figure 1.4.6 2 Health Facility to Population Ratio

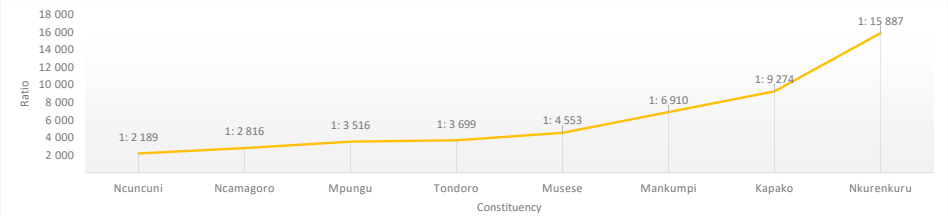


Table 1.4.6 1: Health Facility to Population Ratio

Constituency	Number of Health Facilities	Population	Ratio
Kavango West	**28**	**123 266**	**1:4 402**
Kapako	3	27 823	1:9 274
Mankumpi	1	6 910	1:6 910
Mpungu	6	21 098	1:3 516
Musese	3	13 659	1:4 553
Ncamagoro	3	8 449	1:2 816
Ncuncuni	5	10 943	1:2 189
Nkurenkuru	1	15 887	1:15 887
Tondoro	5	18 497	1:3 699

Nkurenkuru Constituency had the highest health facility to population ratio of 1:15 887, followed by Kapako (1:9 274) and Mankumpi (1:6 910). In contrast, Ncamagoro and Ncuncuni have the lowest health facility to population ratios of 1:2 816 and 1:2 189, respectively.

1.4.7. Khomas Region

Figure 1.4.7 1 Health Facility to Population Ratio

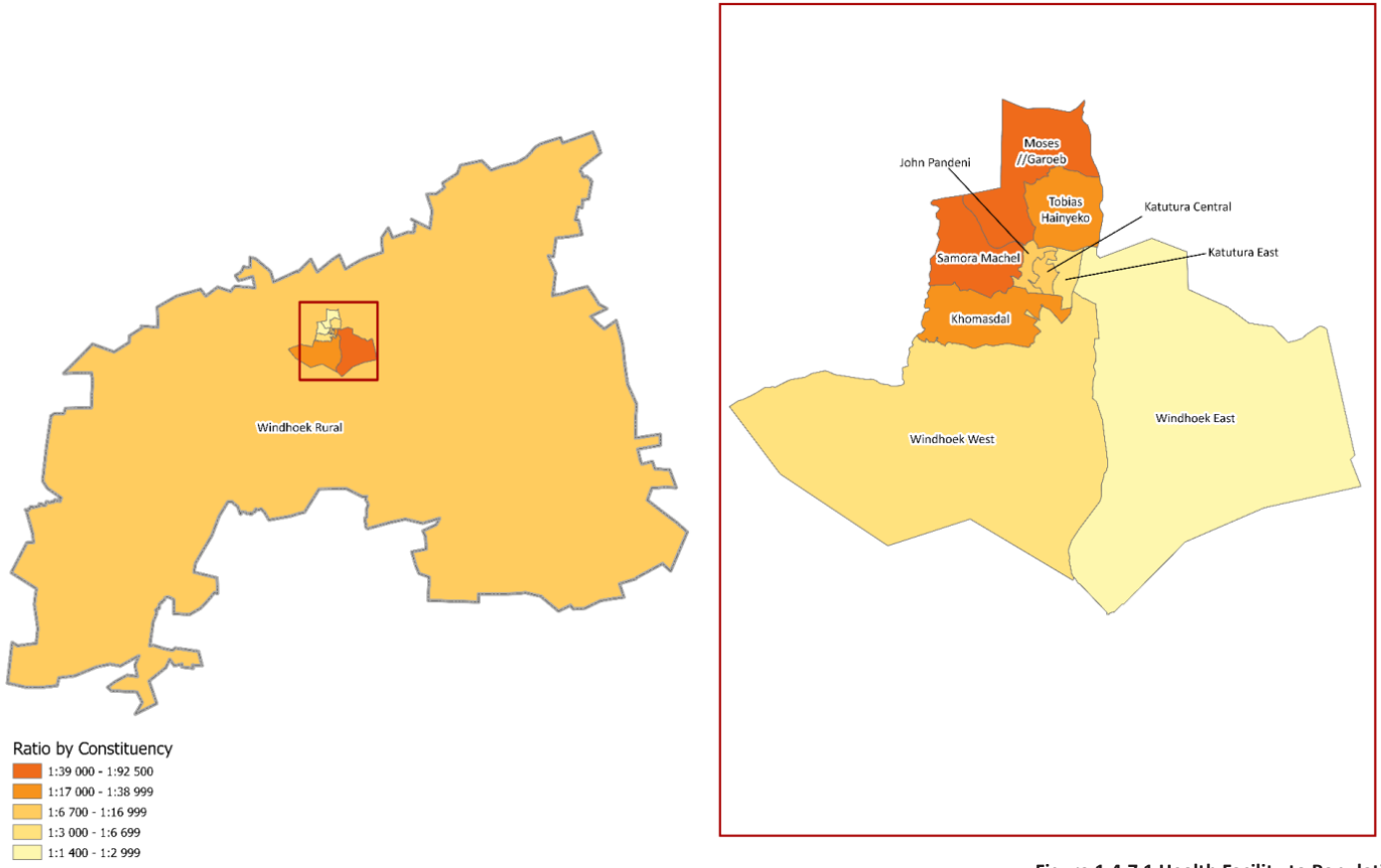
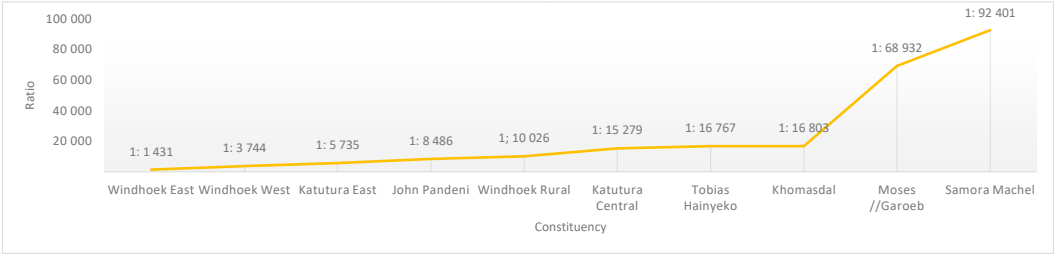


Figure 1.4.7 1 Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Khomas	**59**	**494 605**	**1:8 383**
John Pandeni	3	25 457	1:8 486
Katutura Central	2	30 557	1:15 279
Katutura East	4	22 940	1:5 735
Khomasdal	4	67 211	1:16 803
Moses //Garoeb	1	68 932	1:68 932
Samora Machel	1	92 401	1:92 401
Tobias Hainyeko	4	67 067	1:16 767
Windhoek East	21	30 054	1:1 431
Windhoek Rural	3	30 079	1:10 026
Windhoek West	16	59 907	1:3 744

Figure 1.4.7 1 Health Facility to Population Ratio



Samora Machel and Moses //Garoeb Constituencies had the highest health facility to population ratio of 1:92 401 and 1:68 932 respectively. In contrast, Windhoek East had the lowest health facility to population ratio of 1:1 431.

1.4.8. Kunene Region

Figure 1.4.8 1 Health Facility to Population Ratio

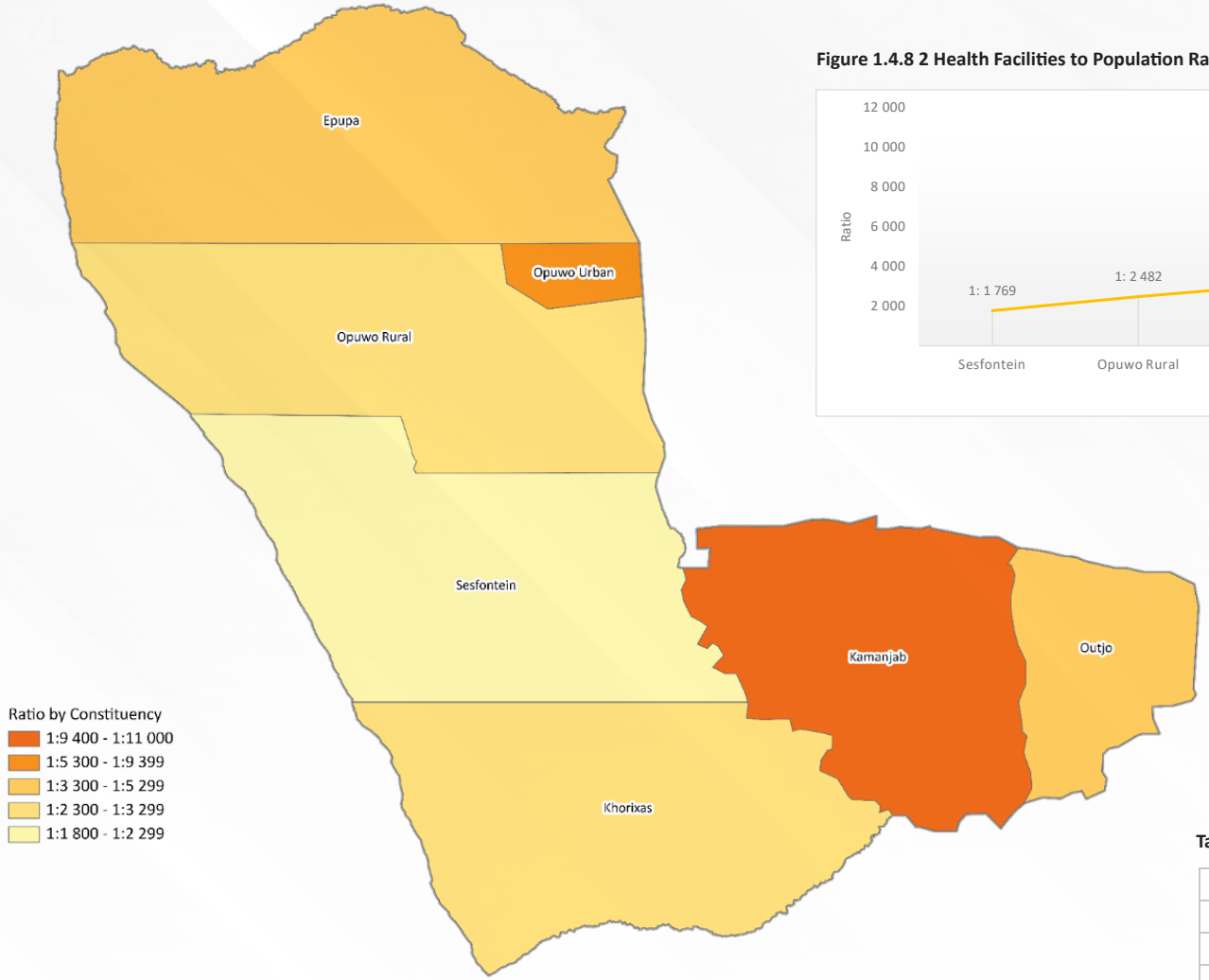
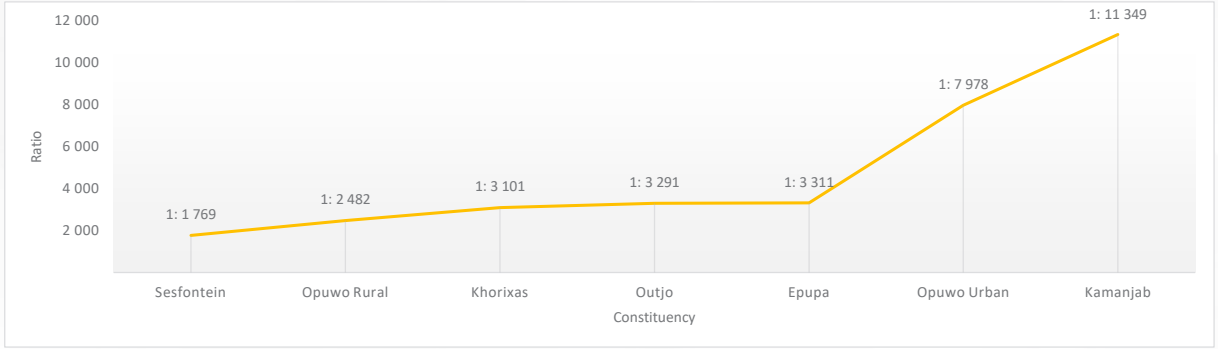


Figure 1.4.8 2 Health Facilities to Population Ratio



Kamanjab Constituency had the highest health facility to population ratio of 1:11 349 followed by Opuwo Urban (1:7 978) and Epupa (1:3 311). In contrast, Opuwo Rural and Sesfontein had the lowest health facility to population ratio of 1:2 482 and 1:1 769 respectively.

Table 1.4.8 1: Health Facility to Population Ratio

Area	Health Facilities	Population	Ratio
Kunene	**34**	**120 762**	**1:3 552**
Epupa	8	26 491	1:3 311
Kamanjab	1	11 349	1:11 349
Khorixas	5	15 506	1:3 101
Opuwo Rural	6	14 894	1:2 482
Opuwo Urban	3	23 934	1:7 978
Outjo	6	19 743	1:3 291
Sesfontein	5	8 845	1:1 769

1.4.9. Ohangwena Region

Figure 1.4.9 1 Health Facility to Population Ratio

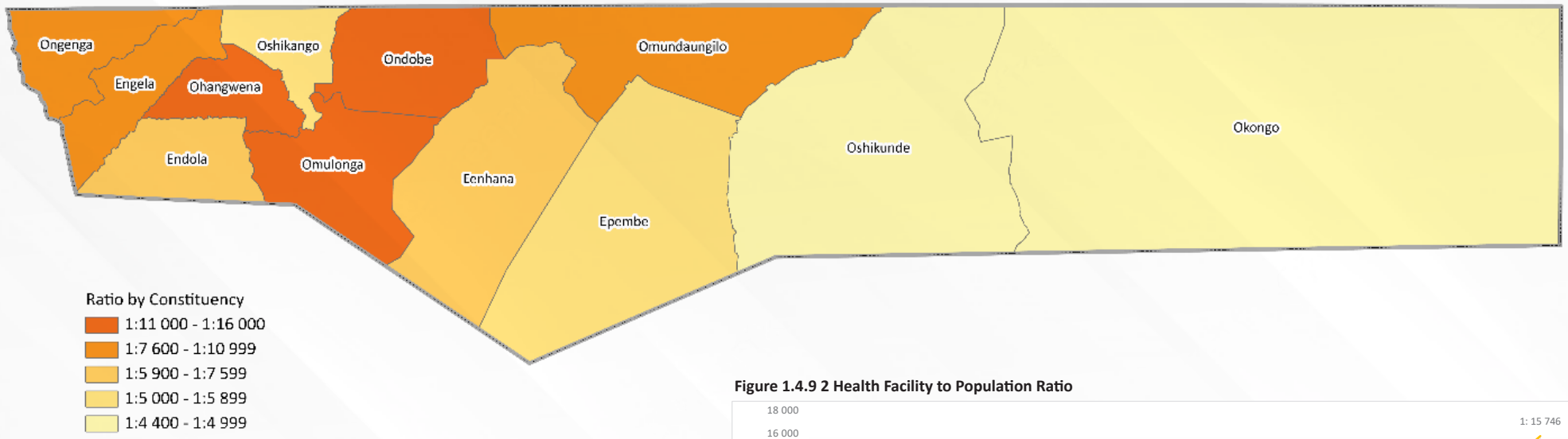


Figure 1.4.9 2 Health Facility to Population Ratio

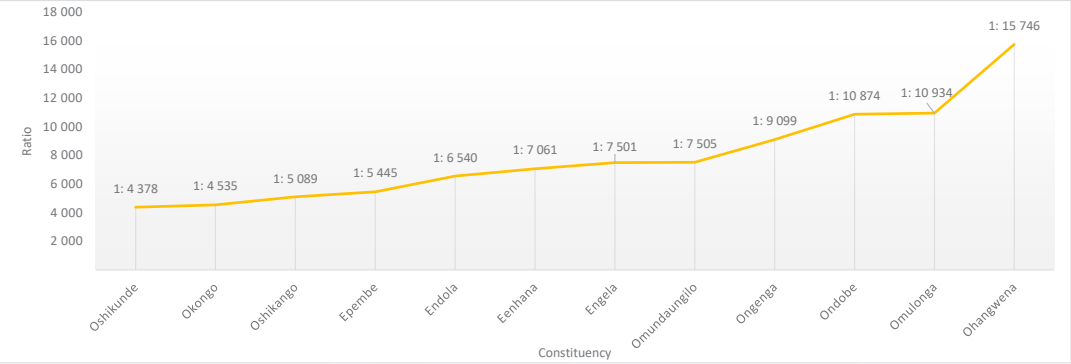


Table 1.4.9 1 Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Ohangwena	**48**	**337 729**	**1:7 036**
Eenhana	5	35 304	1:7 061
Endola	5	32 698	1:6 540
Engela	4	30 004	1:7 501
Epembe	3	16 336	1:5 445
Ohangwena	2	31 491	1:15 746
Okongo	7	31 746	1:4 535
Omulonga	3	32 802	1:10 934
Omundaungilo	2	15 009	1:7 505
Ondobe	3	32 622	1:10 874
Ongenga	3	27 296	1:9 099
Oshikango	6	30 531	1:5 089
Oshikunde	5	21 890	1:4 378

Ohangwena Constituency had the highest health facility to population ratio of 1:15 746, followed by Omulonga (1:10 934) and Ondobe (1:10 874). In contrast, Oshikunde had the lowest health facility to population ratio of 1:4 378.

1.4.10. Omaheke Region

Figure 1.4.10 1 Health Facility to Population Ratio

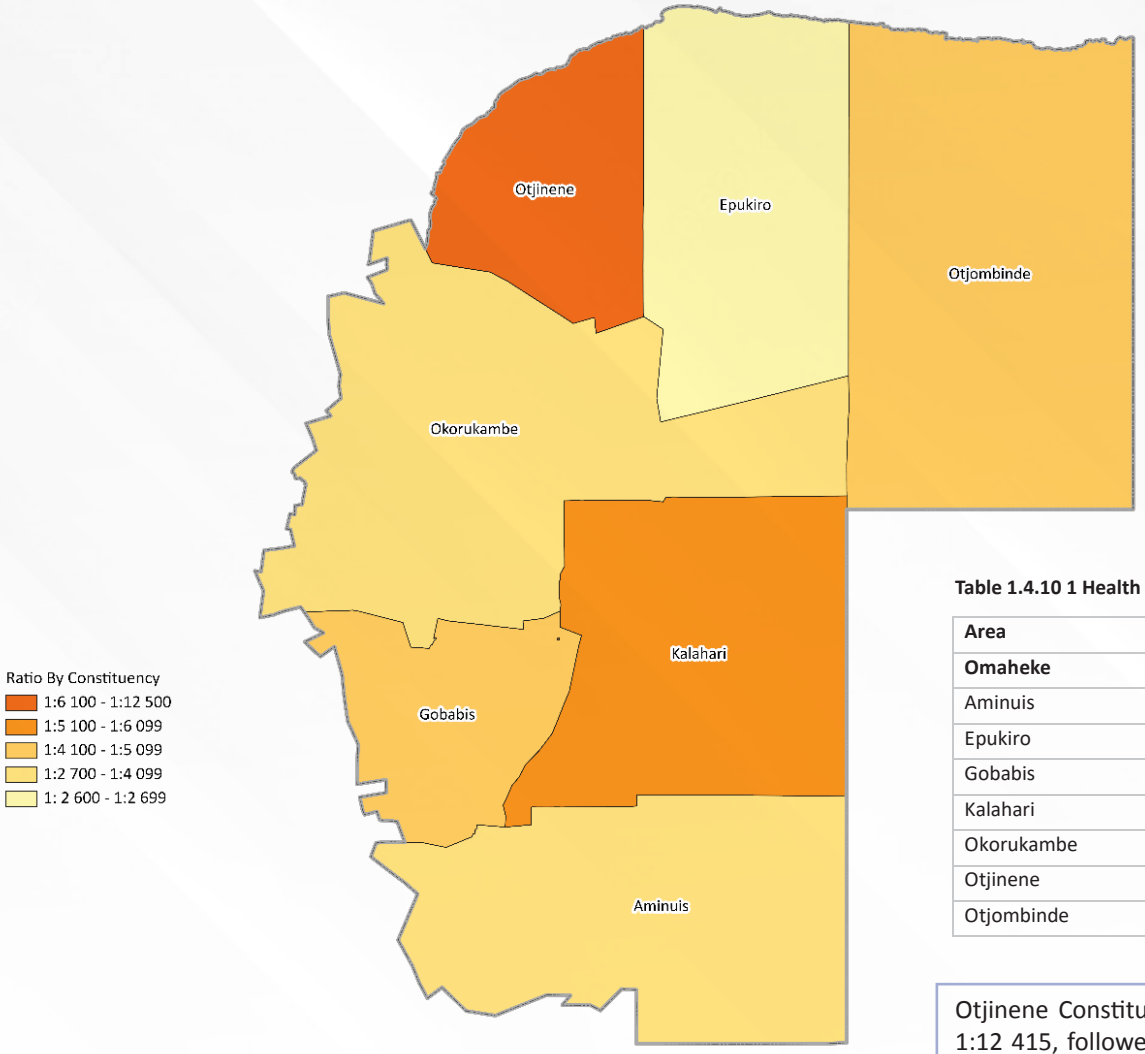


Figure 1.4.10 1 Health Facility to Population Ratio

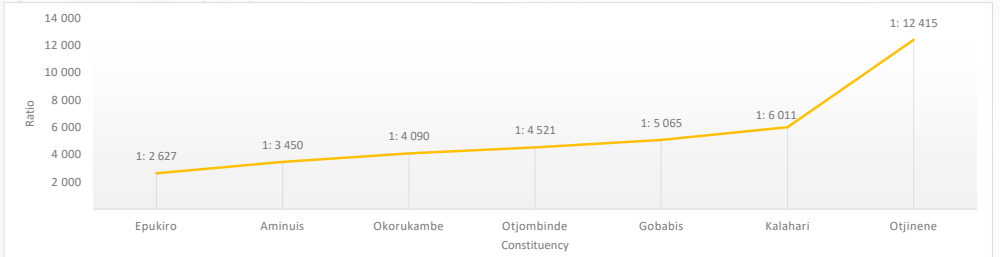


Table 1.4.10 1 Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Omaheke	**22**	**102 881**	**1:4 676**
Aminuis	4	13 801	1:3 450
Epukiro	3	7 880	1:2 627
Gobabis	7	35 452	1:5 065
Kalahari	2	12 021	1:6 011
Okorukambe	3	12 271	1:4 090
Otjinene	1	12 415	1:12 415
Otjombinde	2	9 041	1:4 521

Otjinene Constituency had the highest health facility to population ratio of 1:12 415, followed by Kalahari (1:6 011) and Gobabis (1:5 065). In contrast, Epukiro and Aminuis had the lowest health facility to population ratios of 1:2 627 and 1:3 450, respectively.

1.4.11. Omusati Region

Figure 1.4.11 1 Health Facility to Population Ratio

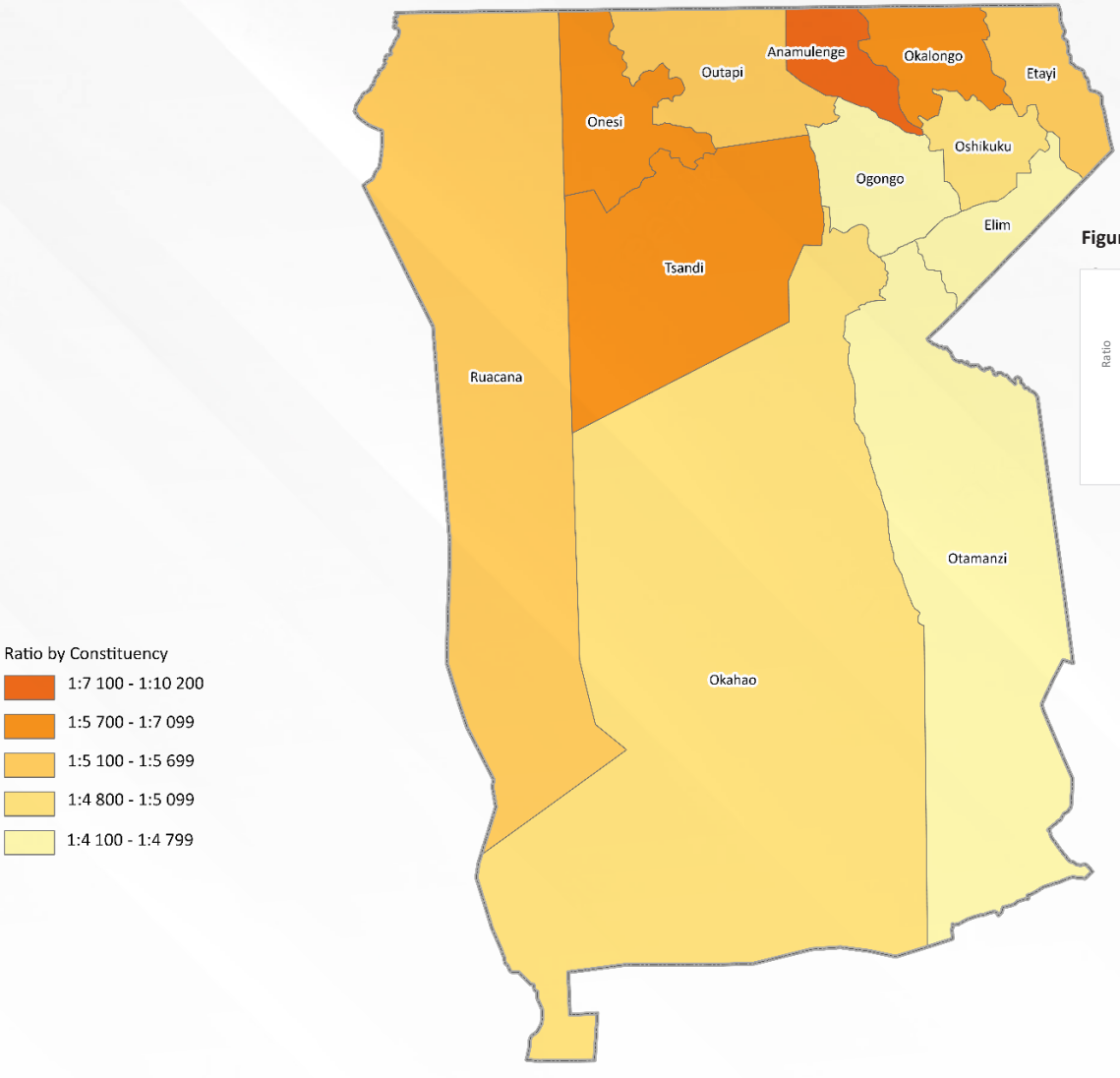


Figure 1.4.11 2 Health Facility to Population Ratio

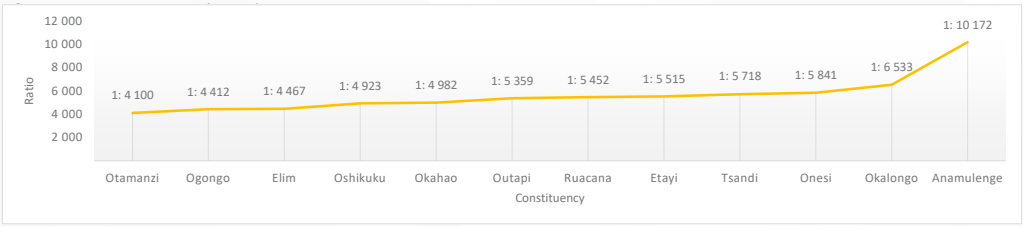


Table 1.4.11 1 Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Omusati	**58**	**316 671**	**1:5 460**
Anamulenge	2	20 344	1:10 172
Elim	3	13 400	1:4 467
Etayi	6	33 088	1:5 515
Ogongo	4	17 649	1:4 412
Okahao	5	24 909	1:4 982
Okalongo	5	32 663	1:6 533
Onesi	4	23 364	1:5 841
Oshikuku	4	19 693	1:4 923
Otamanzi	4	16 399	1:4 100
Outapi	10	53 594	1:5 359
Ruacana	5	27 261	1:5 452
Tsandi	6	34 307	1:5 718

Anamulenge Constituency had the highest health facility to population ratio of 1:10 172, followed by Okalongo (1:6 533) and Onesi (1:5 841). In contrast, Ogongo and Otamanzi had the lowest health facility to population ratios of 1:4 412 and 1:4 100, respectively.

1.4.12. Oshana Region

Figure 1.4.12 1 Health Facility to Population Ratio

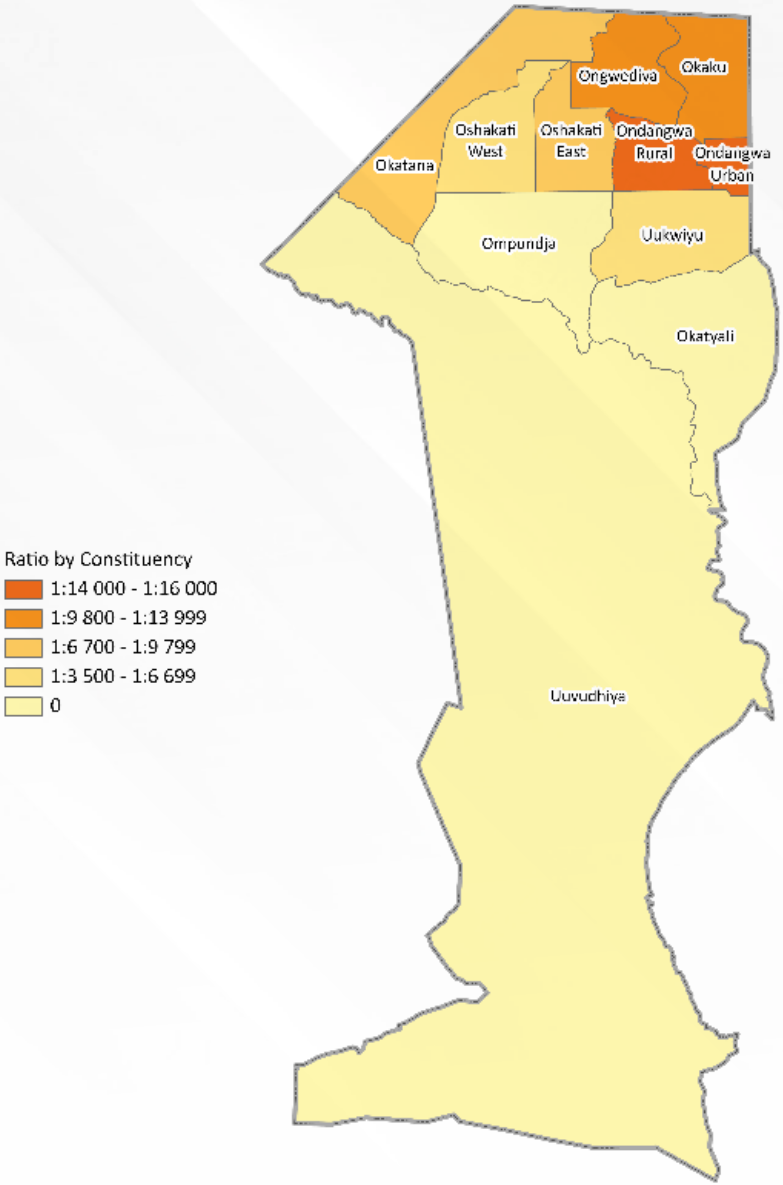


Figure 1.4.12 2 Health Facility to Population Ratio

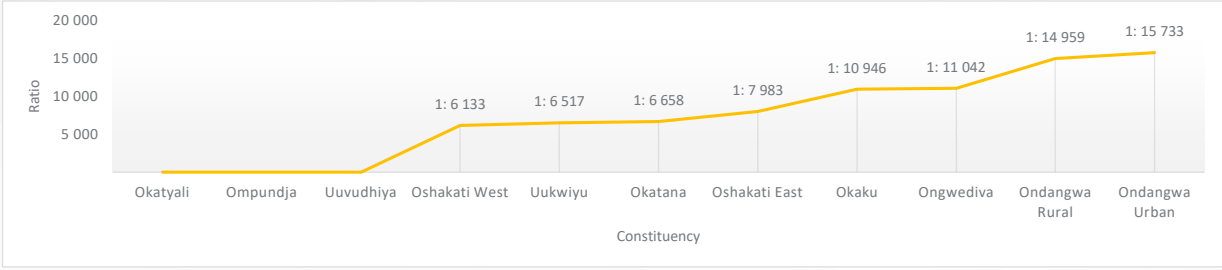


Table 1.4.12 1: Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Oshana	**24**	**230 801**	**1:9 617**
Okaku	2	21 892	1:10 946
Okatana	3	19 974	1:6 658
Okatyali	0	4 502	-
Ompundja	0	4 582	-
Ondangwa Rural	1	14 959	1:14 959
Ondangwa Urban	2	31 466	1:15 733
Ongwediva	4	44 166	1:11 042
Oshakati East	5	39 915	1:7 983
Oshakati West	5	30 665	1:6 133
Uukwiyu	2	13 033	1:6 517
Uuvudhiya	0	5 647	-

Ondangwa Urban Constituency had the highest health facility to population ratio of 1:15 733, followed by Ondangwa Rural (1:14 959) and Ongwediva (1:11 042). In contrast, Uuvudhiya, Okatyali, and Ompundja had no mapped heath facilities to determine the ratios.

1.4.13. Oshikoto Region

Figure 1.4.13 1 Health Facility to Population Ratio

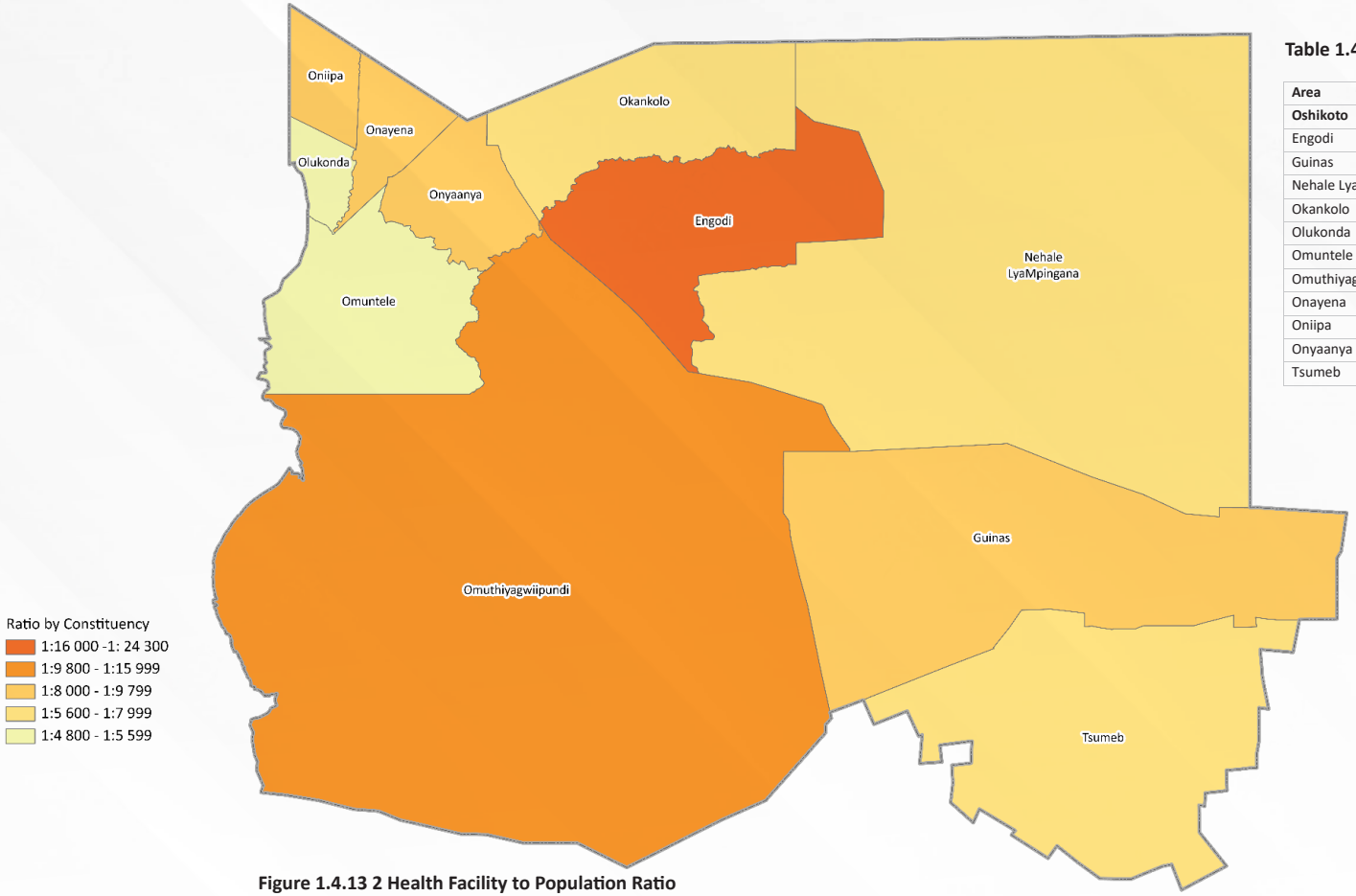
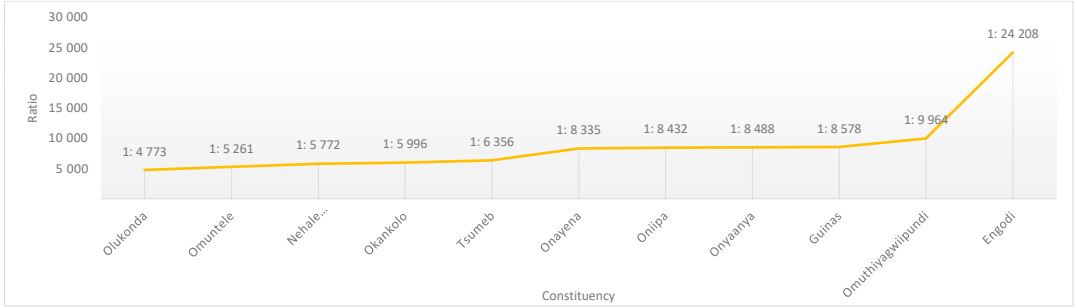


Table 1.4.13 1: Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Oshikoto	**34**	**257 302**	**1:7 568**
Engodi	1	24 208	1:24 208
Guinas	1	8 578	1:8 578
Nehale LyaMpingana	3	17 317	1:5 772
Okankolo	3	17 988	1:5 996
Olukonda	3	14 318	1:4 773
Omuntele	4	21 043	1:5 261
Omuthiyagwiipundi	4	39 855	1:9 964
Onayena	2	16 669	1:8 335
Oniipa	4	33 727	1:8 432
Onyaanya	3	25 465	1:8 488
Tsumeb	6	38 134	1:6 356

Figure 1.4.13 2 Health Facility to Population Ratio



Engodi Constituency had the highest health facility to population ratio of 1:24 208, followed by Omuthiyagwiipundi (1:9 964) and Guinas (1:8 578). In contrast, Olukonda and Omuntele had the lowest health facility to population ratios of 1:4 773 and 1:5 261 respectively.

1.4.14. Otjozondjupa Region

Figure 1.4.14 1 Health Facility to Population Ratio

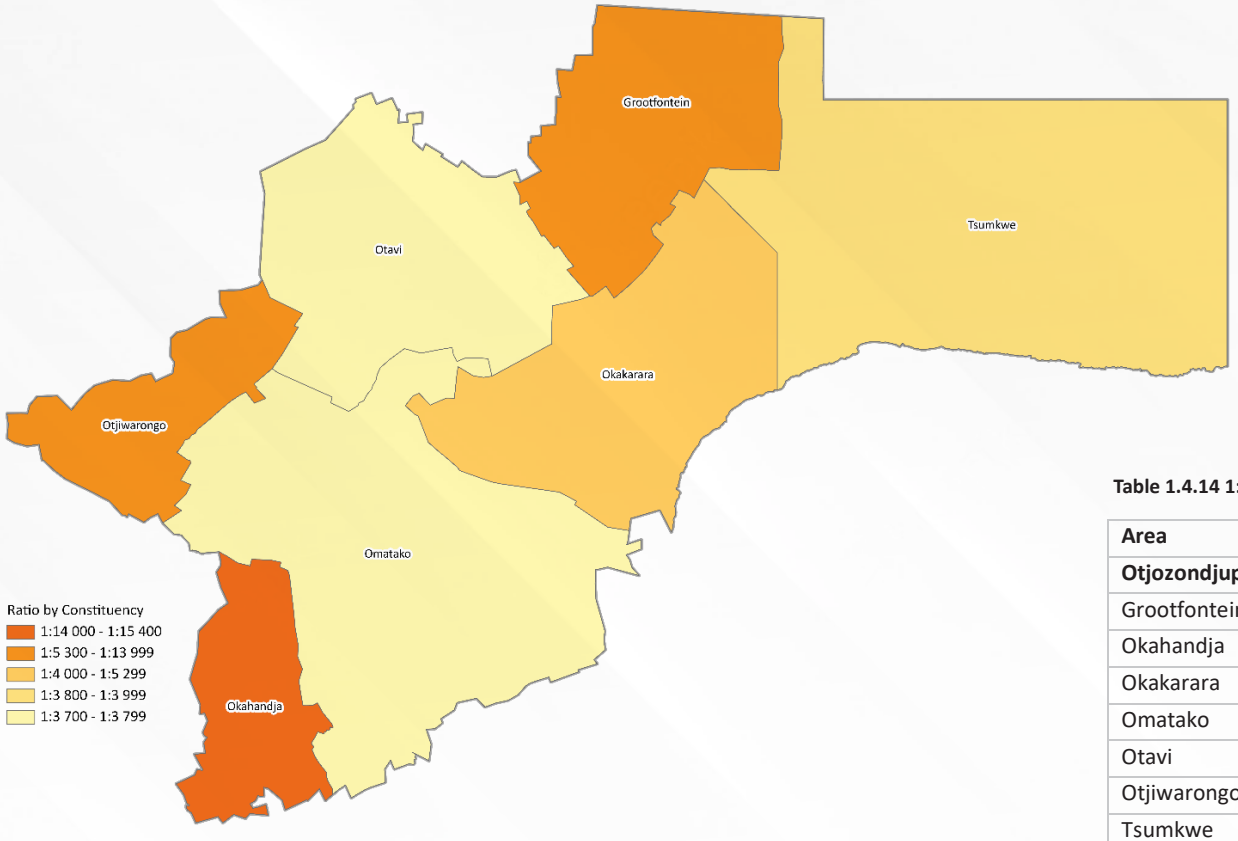
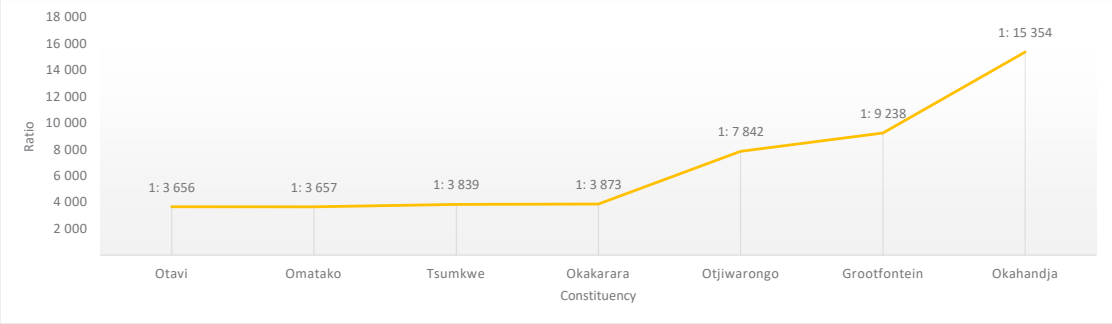


Table 1.4.14 1: Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Otjozondjupa	**36**	**220 811**	**1:6 134**
Grootfontein	4	36 951	1:9 238
Okahandja	3	46 061	1:15 354
Okakarara	8	30 987	1:3 873
Omatako	5	18 283	1:3 657
Otavi	5	18 279	1:3 656
Otjiwarongo	7	54 893	1:7 842
Tsumkwe	4	15 357	1:3 839

Figure 1.4.14 2 Health Facility to Population Ratio



Okahandja Constituency had the highest health facility to population ratio of 1:15 354, followed by Grootfontein (1:9 238) and Otjiwarongo (1:7 842). In contrast, Otavi and Omatako had the lowest health facility to population ratio of 1:3 656 and 1:3 657 respectively.

1.4.15. Zambezi Region

Figure 1.4.15 1 Health Facility to Population Ratio

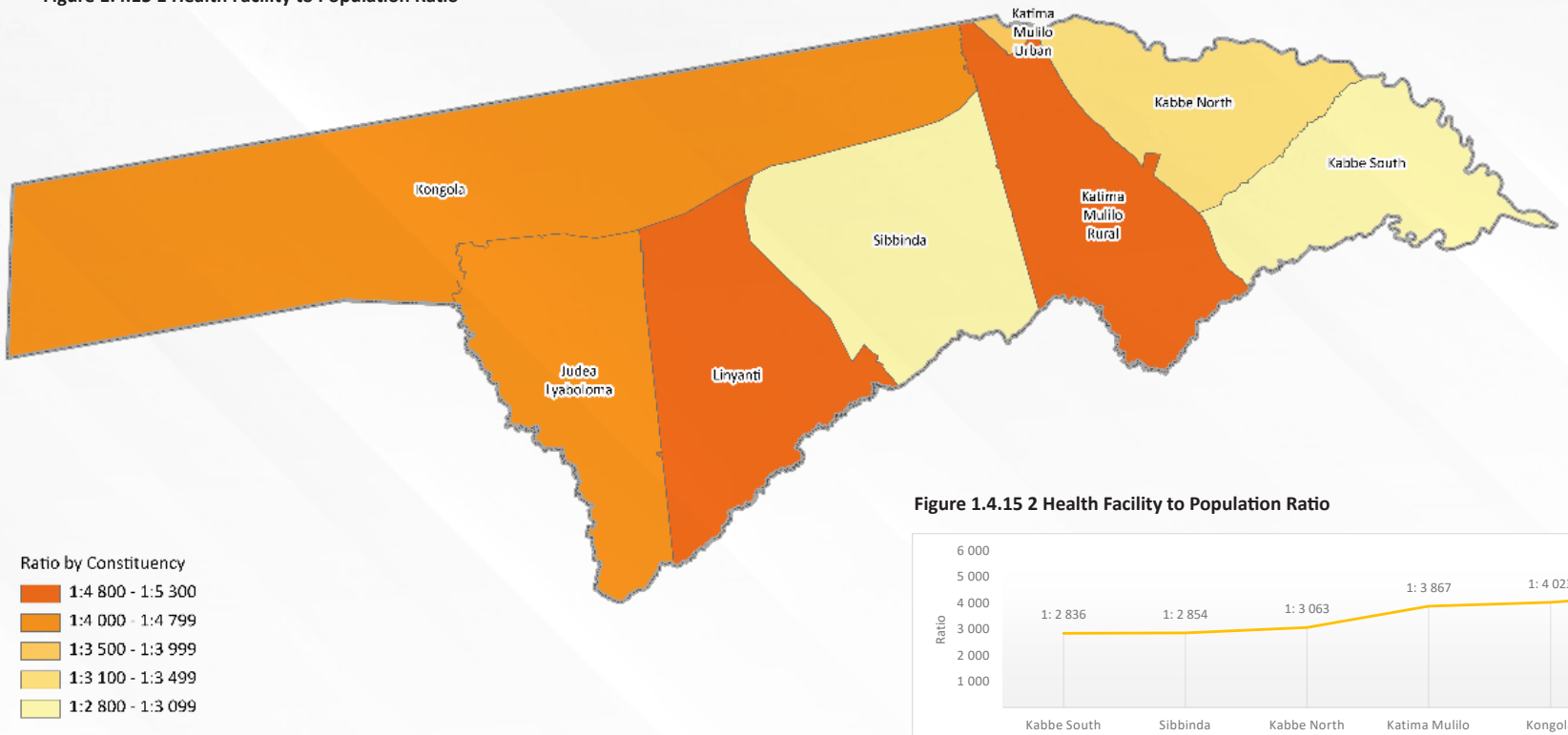


Figure 1.4.15 2 Health Facility to Population Ratio

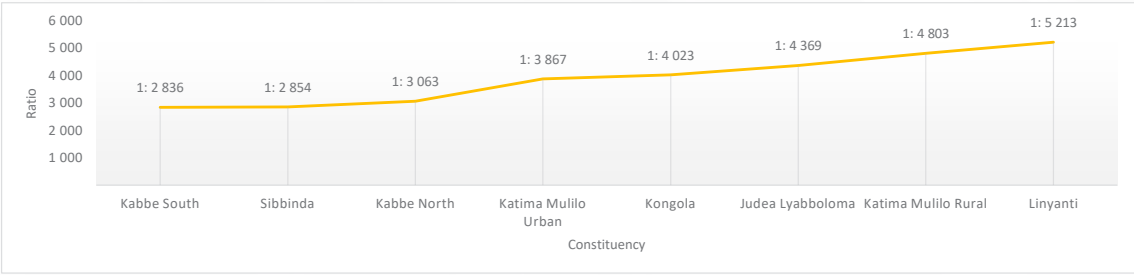


Table 1.4.15 1: Health Facility to Population Ratio

Area	Number of Health Facilities	Population	Ratio
Zambezi	**38**	**142 373**	**1:3 747**
Judea Lyabboloma	2	8 738	1:4 369
Kabbe North	4	12 253	1:3 063
Kabbe South	4	11 345	1:2 836
Katima Mulilo Rural	5	24 016	1:4 803
Katima Mulilo Urban	12	46 401	1:3 867
Kongola	3	12 069	1:4 023
Linyanti	2	10 425	1:5 213
Sibbinda	6	17 126	1:2 854

Linyanti Constituency had the highest health facility to population ratio of 1:5 213, followed by Katima Mulilo Rural (1:4 803) and Judea Lyabboloma (1:4 369). In contrast, Kabbe South and Sibbinda had the lowest health facility to population ratios of 1:2 836 and 1:2 854 respectively.

CHAPTER 2:
MOST CENTRAL HEALTH FACILITY AND POPULATION

This chapter identifies and evaluates the most central health facility in relation to population distribution across regions. The centrality of health facilities is determined using spatial analysis techniques, including the “Mean Center”, “Median Center”, and “Central Feature” spatial analysis techniques. These analyses aim to provide insights into which health facilities are most centrally located based on geographic coordinates and the spatial distribution of the population. The health facility and population locations are analysed to understand the differences in their distribution patterns.

The mean and median statistics are both measures of the central tendency of a distribution. In a normal distribution, the mean and median values are equal. It must be noted that most geographic distributions do not fit the normal distribution curve unlike many other statistical calculations. Geographic distributions generally tend to be random with extreme low or high value coordinates occurring randomly over the study area. The Central Feature, Mean Center and Median Center spatial statistics are used to determine the basic centrality of health facilities and population for further geographic analyses.

The above three measures are defined below:

Geographic Median Center (Median Center)	• is the middle most geographic coordinate values of the health facilities or population.
Geographic mean center (Mean Center)	• is the average of the geographic coordinates of a dataset. It is the average of the sum of the coordinate values in a feature distribution.
Geographic (Central Feature)	• this is the geographic feature located most central in a distribution and is selected among the geographic features. This is selected based on the evaluation of the geographic locations of all the features in a distribution.

Note: The geographic Median Center is the most useful measure of central tendency for skewed distributions such as geographic datasets or distributions with outliers.

2.1. National Most Central Health Facility and Population

Figure 2.1 1 Most Central Health Facility and Population

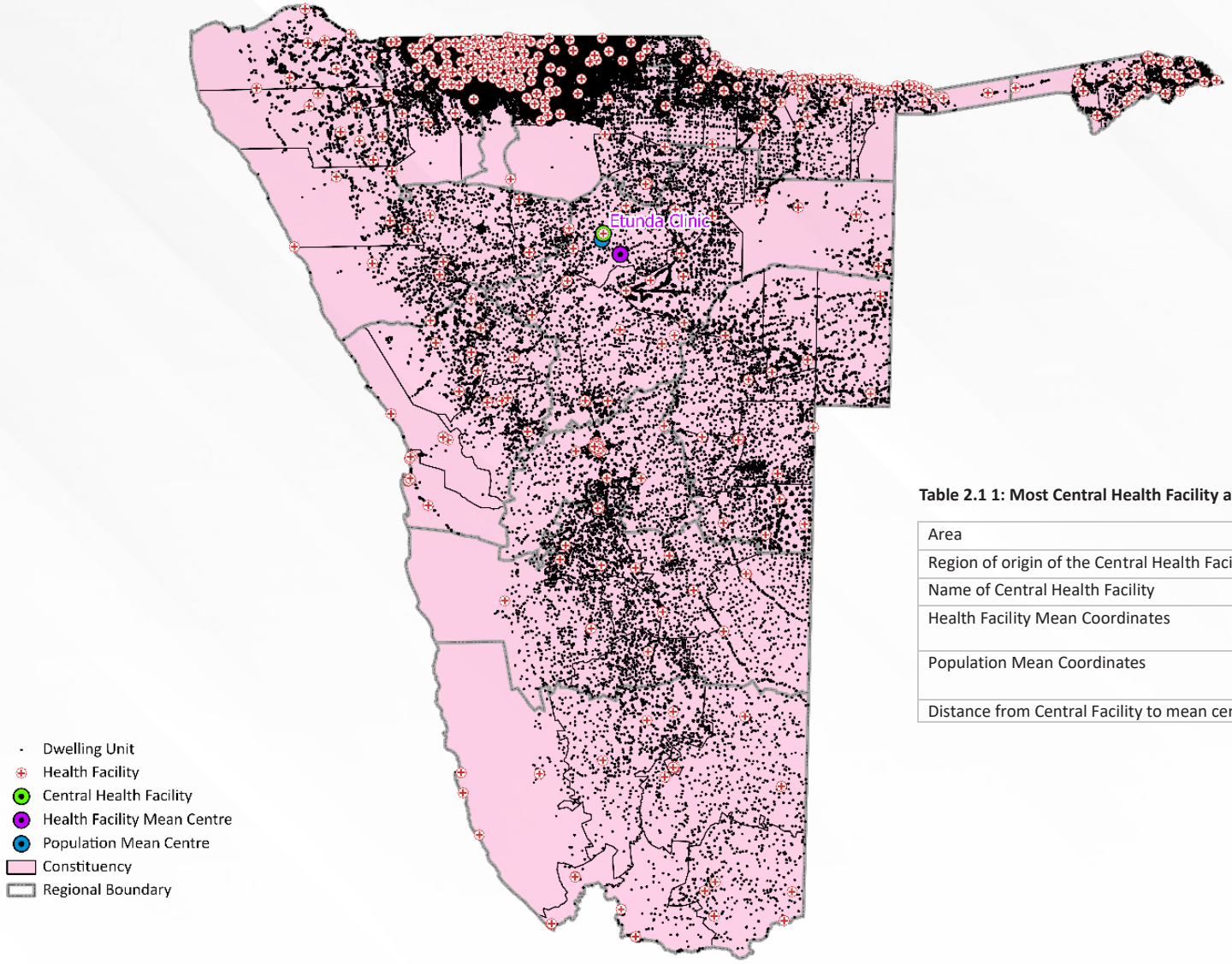


Table 2.1 1: Most Central Health Facility and Population

Area	Namibia
Region of origin of the Central Health Facility	Otjozondjupa
Name of Central Health Facility	Etunda Clinic
Health Facility Mean Coordinates	Longitude: 17.37315840 Latitude: -20.12983310
Population Mean Coordinates	Around Etunda, in Otavi Constituency
Distance from Central Facility to mean center of Health Facilities in kilometres	37.4

2.2. //Kharas Region

Figure 2.2 1 Most Central Health Facility and Population

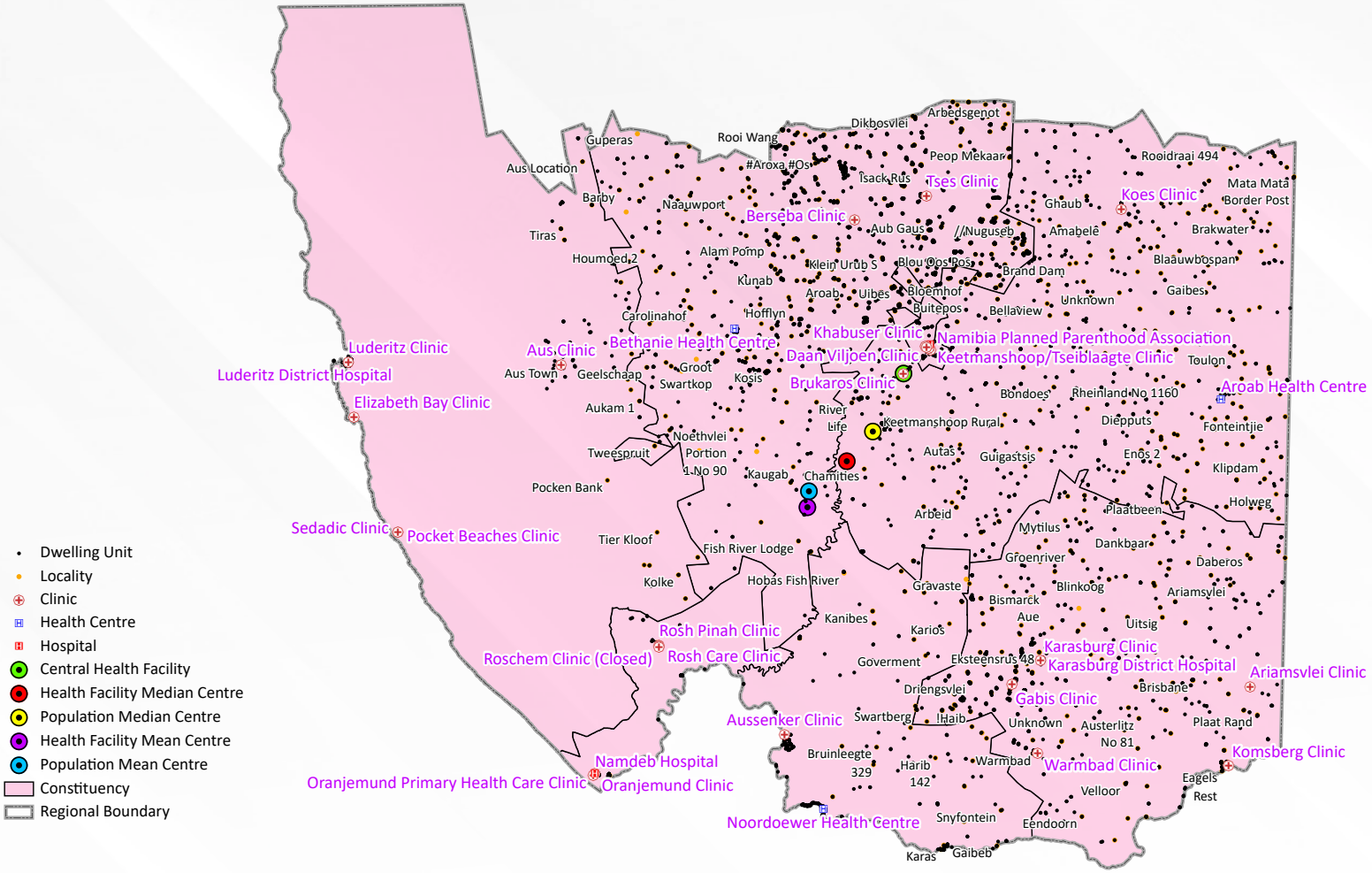


Table 2.2 1: Most Central Health Facility and Population

Area		//Kharas
Name of Central Health Facility		Brukaros Clinic
Population Coordinates	Median	Longitude: 17.86140850 Latitude: -26.97052910
	Mean	Longitude: 17.53352216 Latitude: -27.24770320
Health Facilities Coordinates	Median	Longitude: 17.72799400 Latitude: -27.10841300
	Mean	Longitude: 17.52605208 Latitude: -27.32137930
Distance from Central Facility to Health Facility Median Center in kilometres		53.4
Disance from Central Facility to Health Facilities Mean Center in kilometres		84.2

2.3. Erongo Region

Figure 2.3 1 Most Central Health Facility and Population

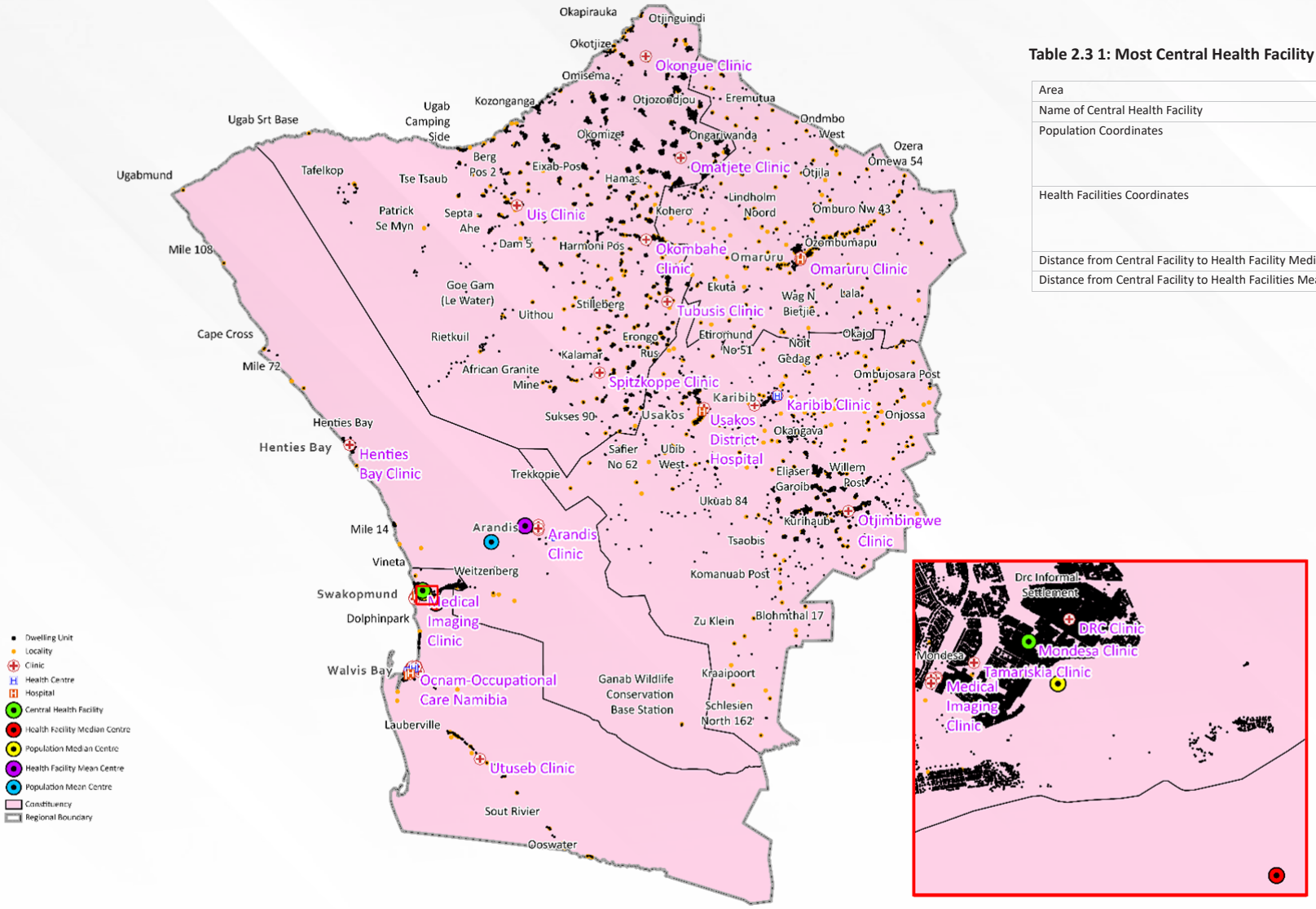


Table 2.3 1: Most Central Health Facility and Population

Area		Erongo
Name of Central Health Facility		Mondesa Clinic
Population Coordinates	Median	Longitude: 14.56004162 Latitude: -22.66006520
	Mean	Longitude: 14.80795216 Latitude: -22.47238374
Health Facilities Coordinates	Median	Longitude: 14.60314600 Latitude: -22.69787500
	Mean	Longitude: 14.93270720 Latitude: -22.41300293
Distance from Central Facility to Health Facility Median Center in kilometres		7.2
Distance from Central Facility to Health Facilities Mean Center in kilometres		47.0

2.4. Hardap Region

Figure 2.4 1 Most Central Health Facility and Population

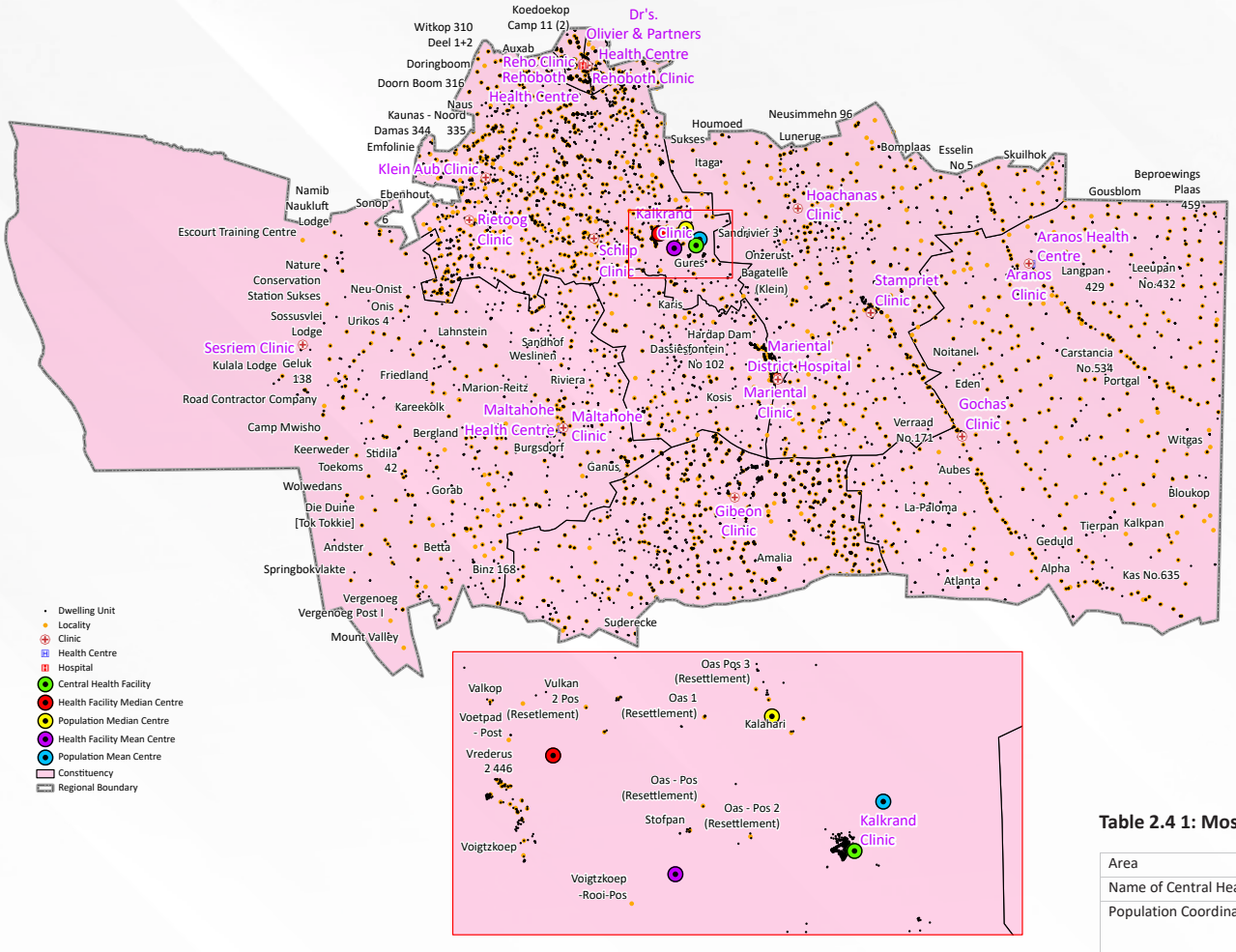


Table 2.4 1: Most Central Health Facility and Population

Area		Hardap
Name of Central Health Facility		Kalkrand Clinic
Population Coordinates	Median	Longitude: 17.54480527 Latitude: -24.00528870
	Mean	Longitude: 17.60685774 Latitude -24.04855940
Health Facilities Coordinates	Median	Longitude: 17.42326700 Latitude: -24.02563900
	Mean	Longitude: 17.49145459 Latitude: -24.08603135
Distance from Central Facility to Health Facility Median Center in kilometres		17.9
Distance from Central Facility to Health Facilities Mean Center in kilometres		10.2

2.5. Kavango East Region

Figure 2.5 1 Most Central Health Facility and Population

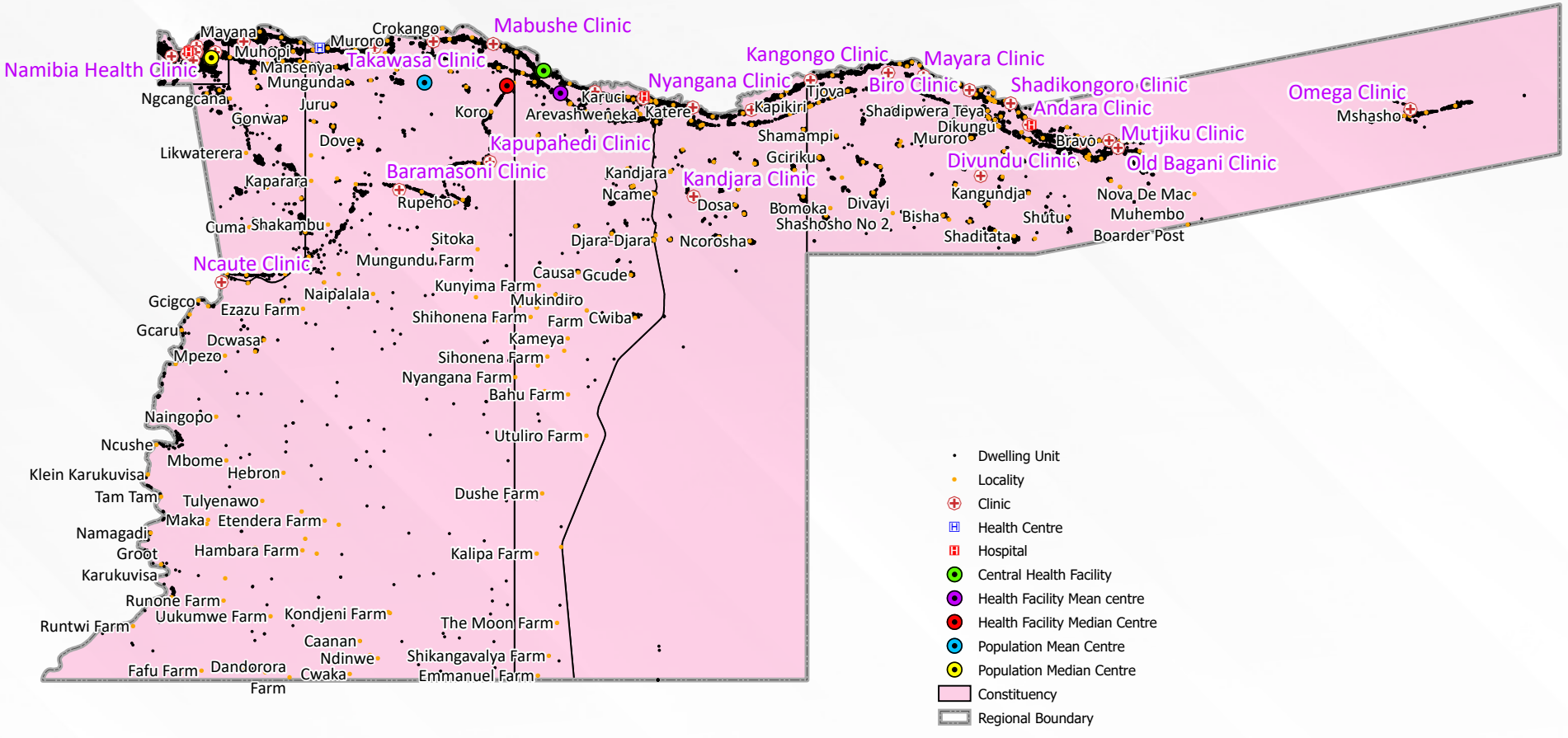


Table 2.5 1: Most Central Health Facility and Population

Area		Kavango East
Name of Central Health Facility		Ndonga Linena Clinic
Population Coordinates	Median	Longitude: 19.81279645 Latitude: -17.92617390
	Mean	Longitude: 20.23748734 Latitude: -17.97569240
Health Facilities Coordinates	Median	Longitude: 20.40184100 Latitude: -17.98196500
	Mean	Longitude: 20.50838865 Latitude: -17.99667750
Distance from Central Facility to Health Facility Median Center in kilometres		8.5
Distance from Central Facility to Health Facilities Mean Center in kilometres		6.1

2.5. Kavango West Region

Figure 2.6 1 Most Central Health Facility and Population

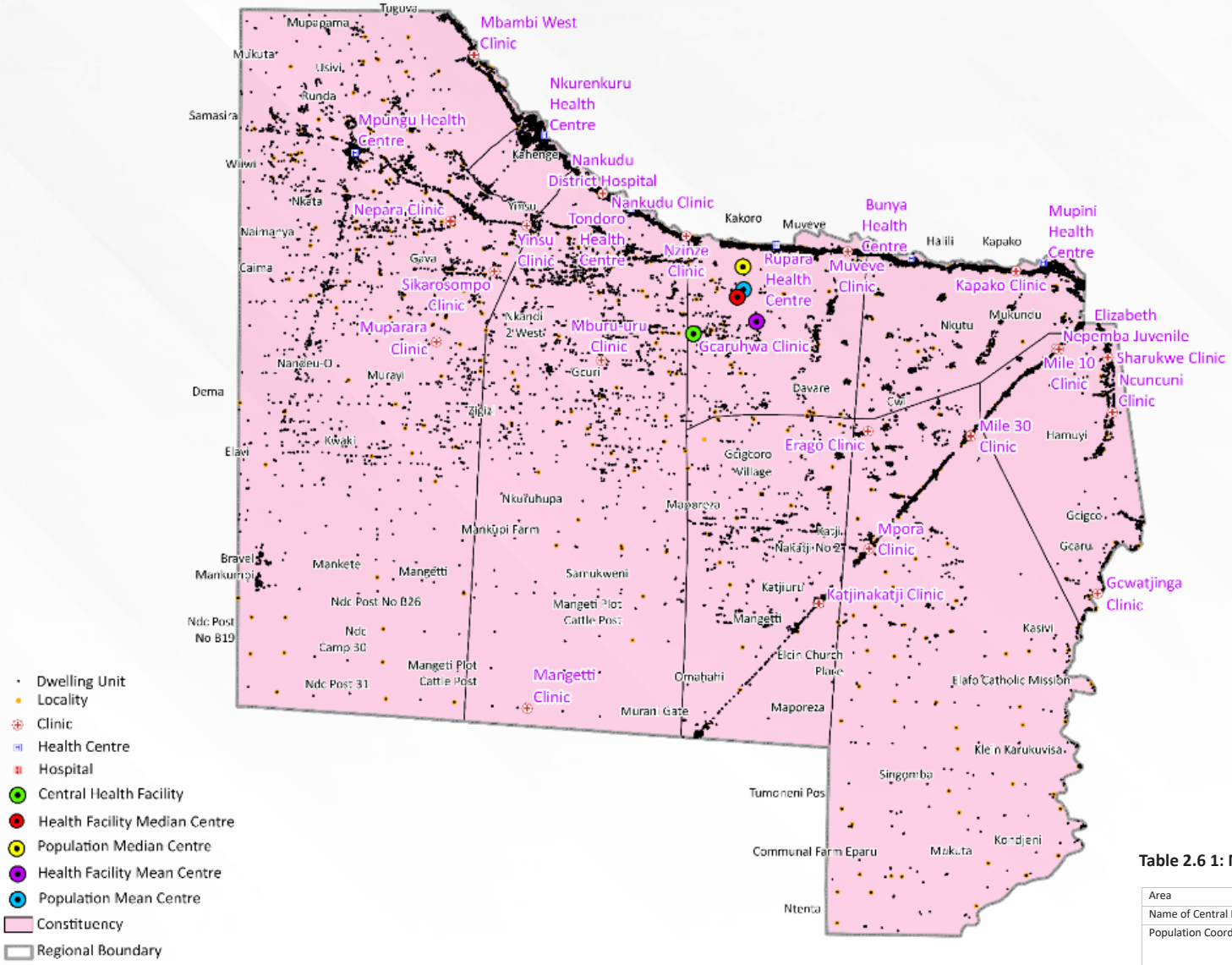
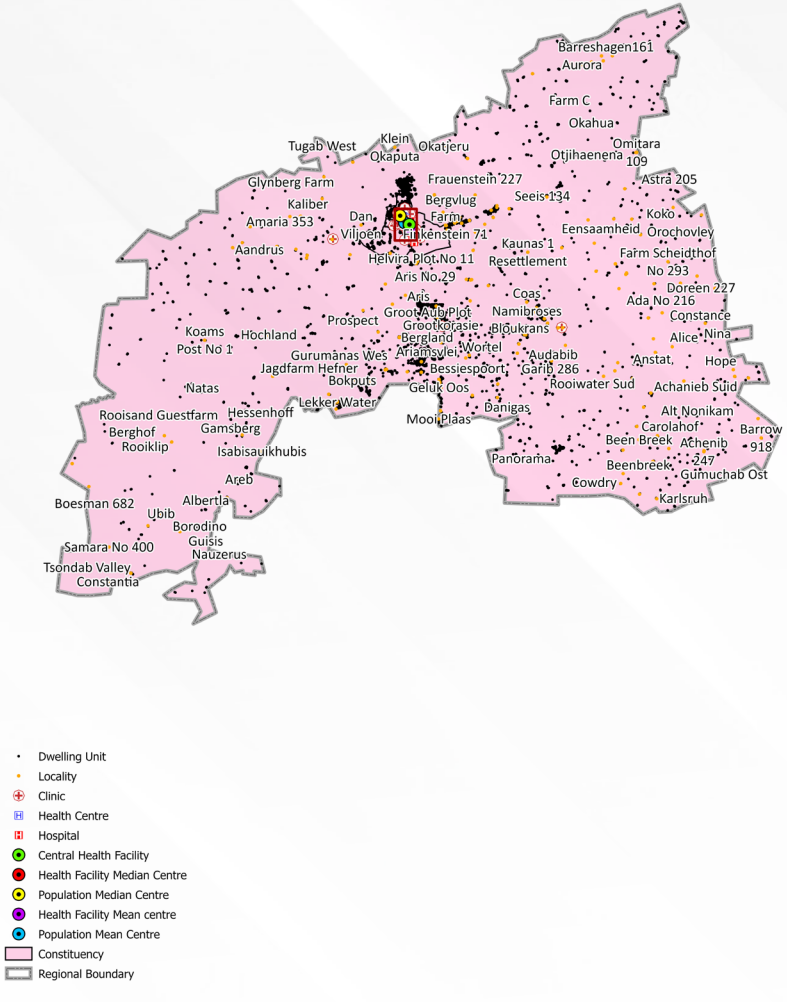


Table 2.6 1: Most Central Health Facility and Population

Area		Kavango West
Name of Central Health Facility		Gcaruhwa Clinic
Population Coordinates	Median	Longitude: 19.00694144 Latitude: -17.93779620
	Mean	Longitude: 19.01930601 Latitude: - 17.92317450
Health Facilities Coordinates	Median	Longitude: 19.00694100 Latitude: -17.93779600
	Mean	Longitude: 19.04613851 Latitude: 17.98486372
Distance from Central Facility to Health Facility Median Center in kilometres		12.3
Distance from Central Facility to Health Facilities Mean Center in kilometres		13.8

2.7. Khomas Region

Figure 2.7 1 Most Central Health Facility and Population



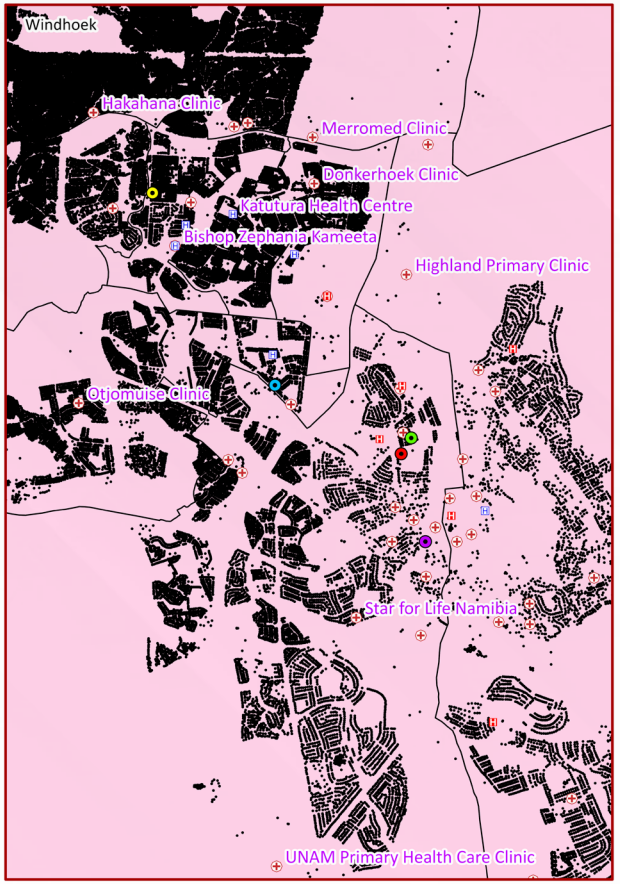


Table 2.7 1: Most Central Health Facility and Population

Area		Khomas
Name of Central Health Facility		Central Clinic
Population Coordinates	Median	Longitude:17.04080156 Latitude: 22.51968910
	Mean	Longitude:17.05777245 Latitude: -22.54631943
Health Facilities Coordinates	Median	Longitude:17.07527400 Latitude: -22.55582500
	Mean	Longitude:17.07862109 Latitude: -22.56799028
Distance from Central Facility to Health Facilities Median Center in kilometres		0.3
Distance from Central Facility to Health Facilities Mean Center in kilometres		1.6

2.8. Kunene Region

Figure 2.8 1 Most Central Health Facility and Population

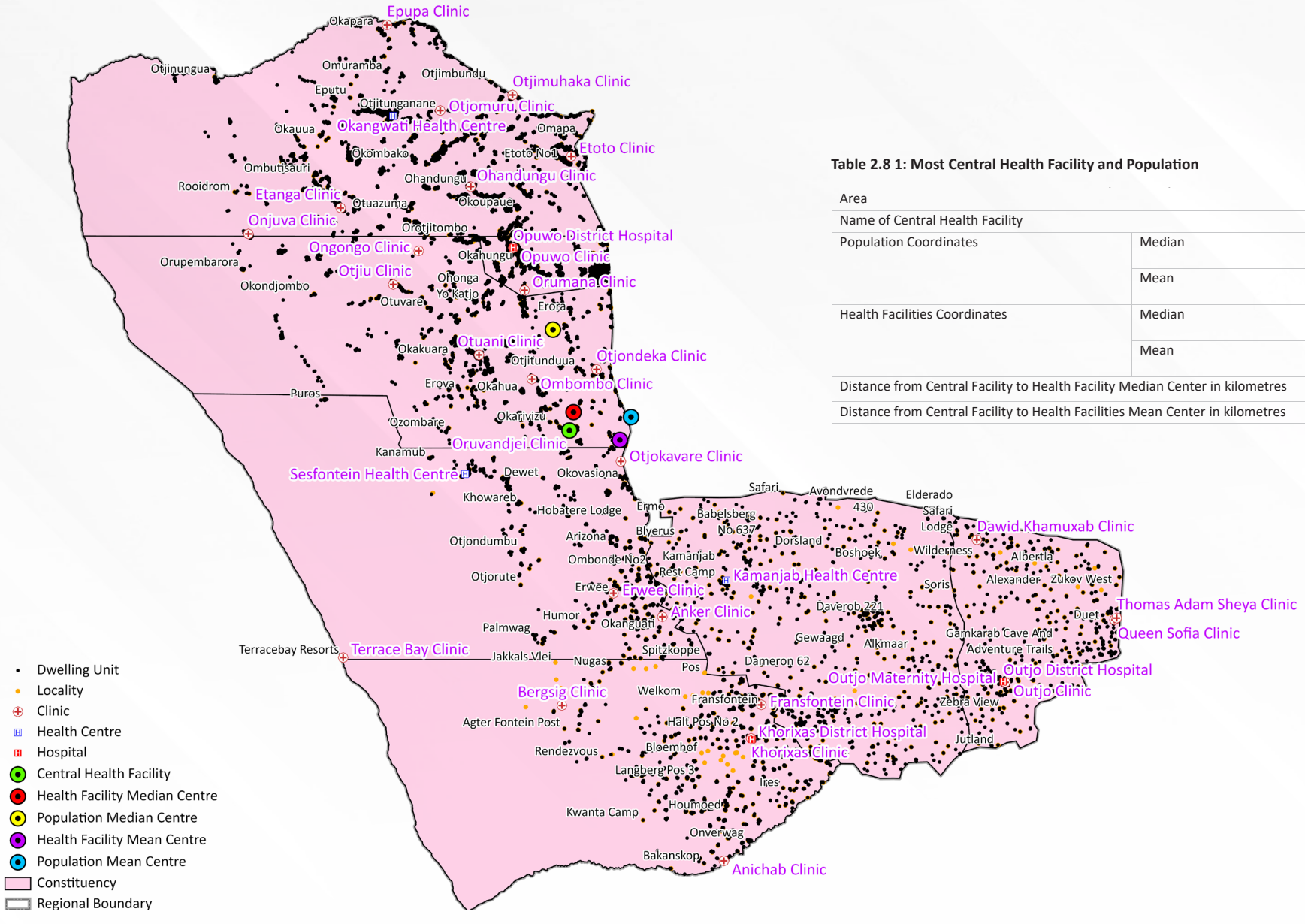


Table 2.8 1: Most Central Health Facility and Population

Area		Kunene
Name of Central Health Facility		Oruvandjei Clinic
Population Coordinates	Median	Longitude: 14.02858520 Latitude: -18.44224410
	Mean	Longitude: 14.39699435 Latitude: -18.85533160
Health Facilities Coordinates	Median	Longitude: 14.12587600 Latitude: -18.83230800
	Mean	Longitude: 14.34415529 Latitude: -18.96389649
Distance from Central Facility to Health Facility Median Center in kilometres		9.8
Distance from Central Facility to Health Facilities Mean Center in kilometres		25.5

2.9. Ohangwena Region

Figure 2.9 1 Most Central Health Facility and Population

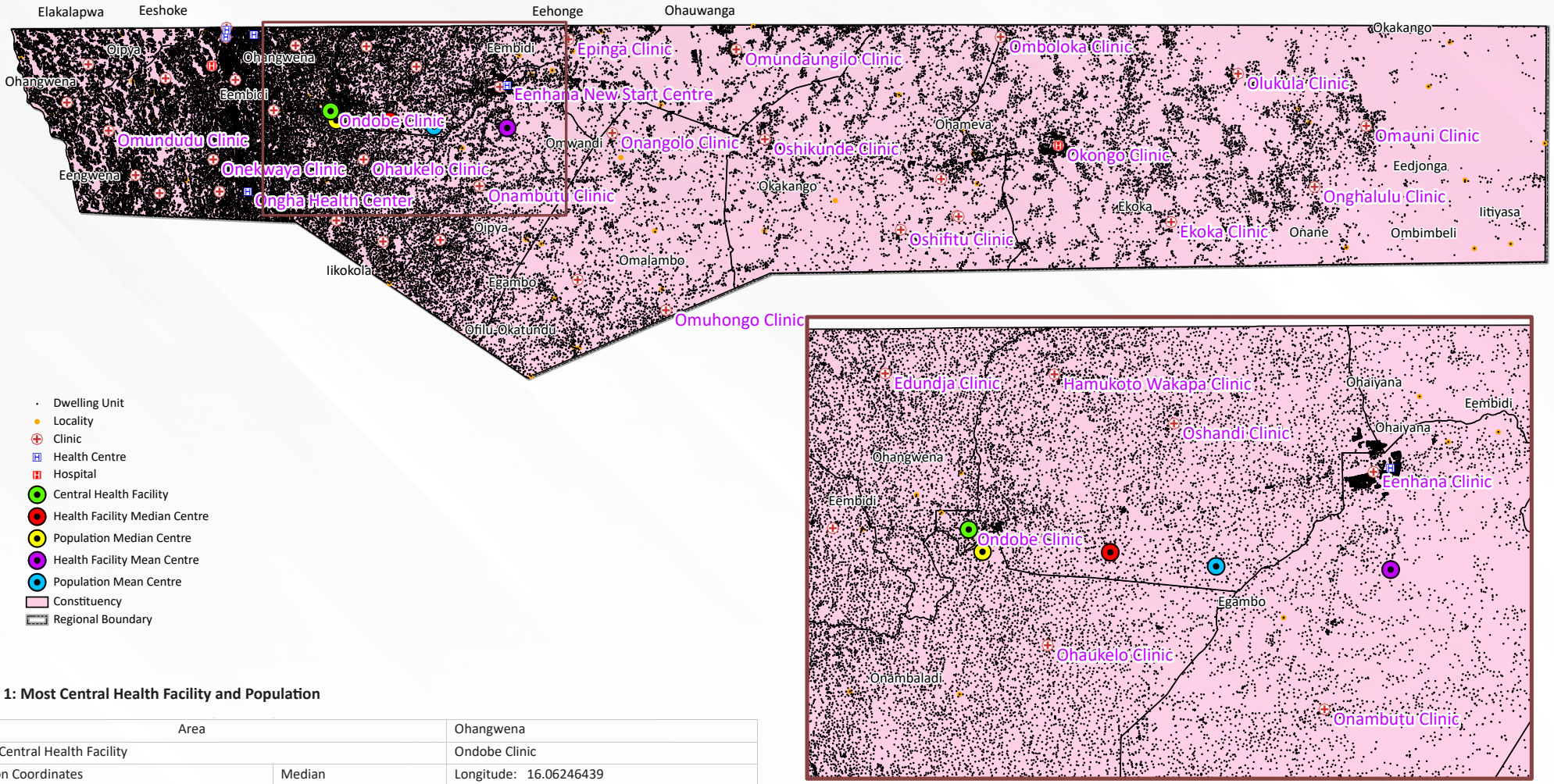


Table 2.9 1: Most Central Health Facility and Population

Area		Ohangwena
Name of Central Health Facility		Ondobe Clinic
Population Coordinates	Median	Longitude: 16.06246439 Latitude: -17.53296550
	Mean	Longitude: 16.21888092 Latitude: -17.54240760
Health Facilities Coordinates	Median	Longitude: 16.14797500 Latitude: -17.53370800
	Mean	Longitude: 16.33863663 Latitude: -17.54761388
Distance from Central Facility to Health Facilities Median Center in kilometres		9.8
Distance from Central Facility to Health Facilities Mean Center in kilometres		30.1

2.10. Omaheke Region

Figure 2.10 1 Most Central Health Facility and Population

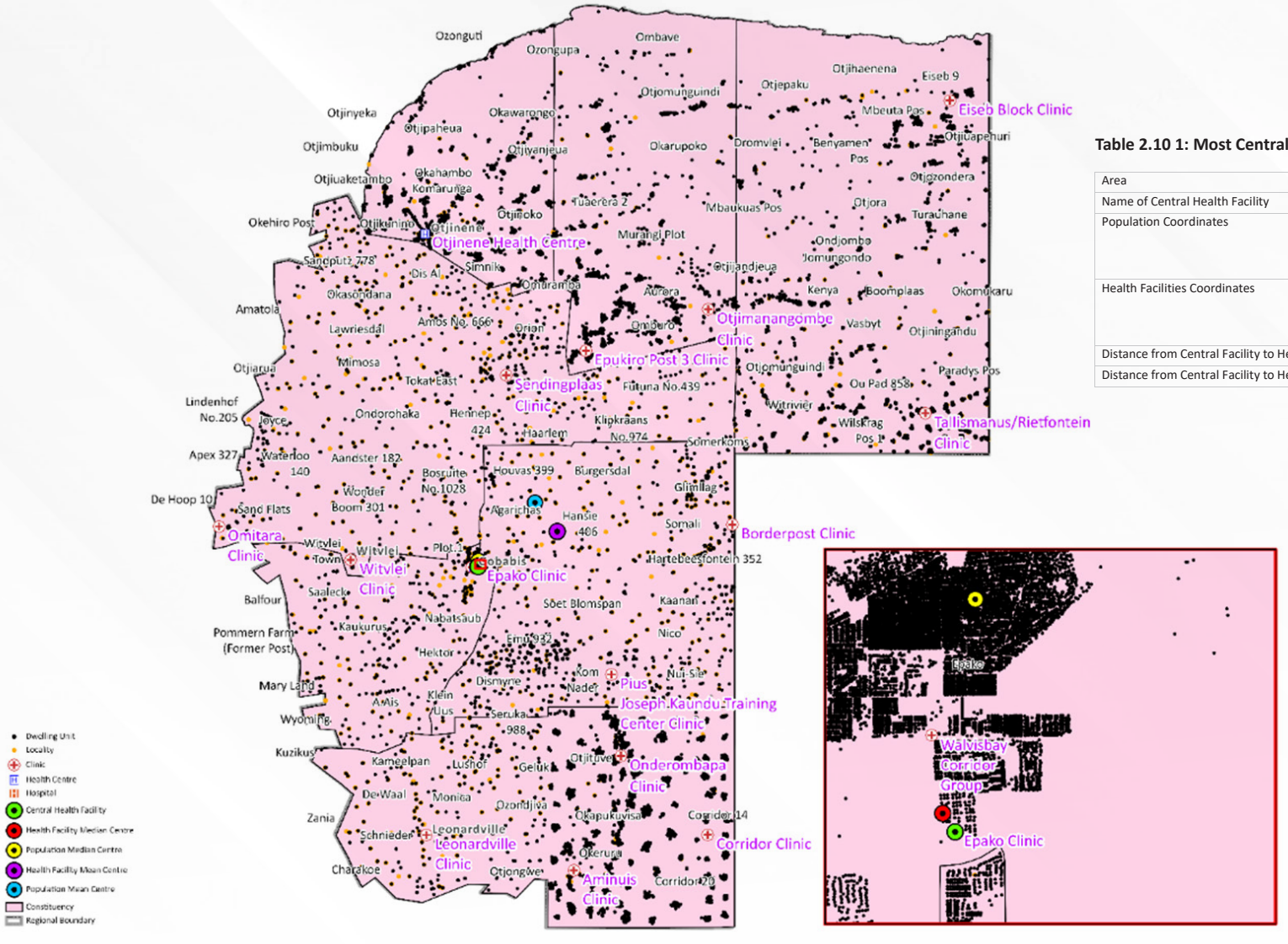
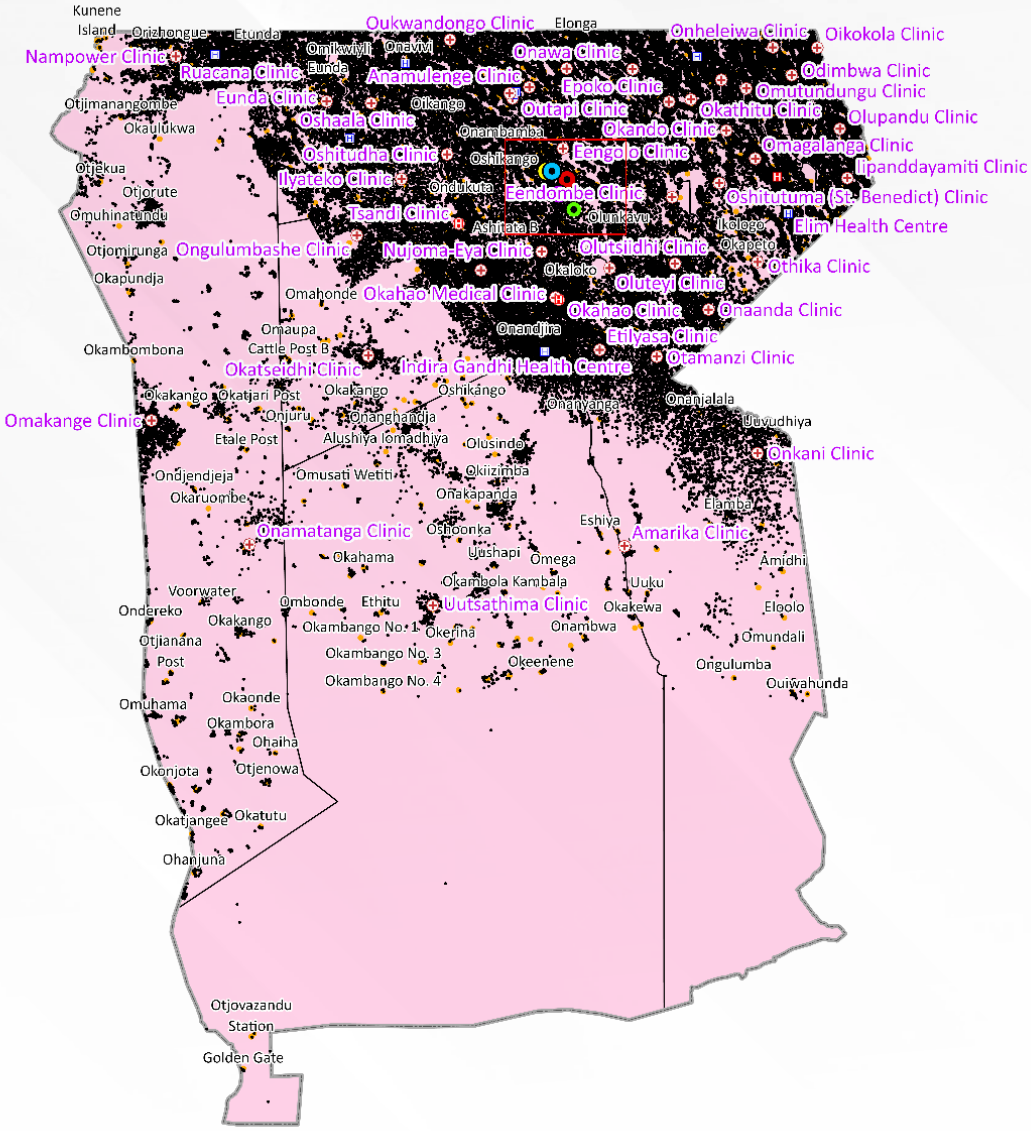


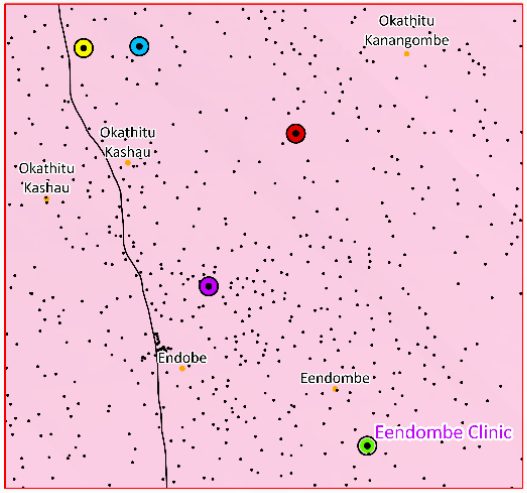
Table 2.10 1: Most Central Health Facility and Population

Area		Omaheke
Name of Central Health Facility		Epako Clinic
Population Coordinates	Median	Longitude: 18.99336510 Latitude: -22.42645860
	Mean	Longitude: 19.21510838 Latitude: -22.19490735
Health Facilities Coordinates	Median	Longitude: 18.99052400 Latitude: -22.44518300
	Mean	Longitude: 19.30250984 Latitude: -22.30858070
Distance from Central Facility to Health Facility Median Center in kilometres		0.2
Distance from Central Facility to Health Facilities Mean Center in kilometres		35.6

2.11. Omusati Region

Figure 2.11 1 Most Central Health Facility and Population





- Dwelling Unit
- Locality
- Clinic
- Health Centre
- Hospital
- Central Health Facility
- Health Facility Median Centre
- Population Median Centre
- Health Facility Mean Centre
- Population Mean Centre
- Constituency
- Regional Boundary

Table 2.11 1: Most Central Health Facility and Population

Area		Omusati
Name of Central Health Facility		Eendombe Clinic
Population Coordinates	Median	Longitude: 15.04851029, Latitude: -17.6506699
	Mean	Longitude: 15.05845459 Latitude: -17.6503607
Health Facilities Coordinates	Median	Longitude: 15.086339 Latitude: -17.665897
	Mean	Longitude: 15.07081329033 Latitude: -17.6931269479
Distance from Central Facility to Health Facility Median Center in kilometres		6.3
Distance from Central Facility to Health Facilities Mean Center in kilometres		4.3

2.12. Oshana Region

Figure 2.12 1 Most Central Health Facility and Population

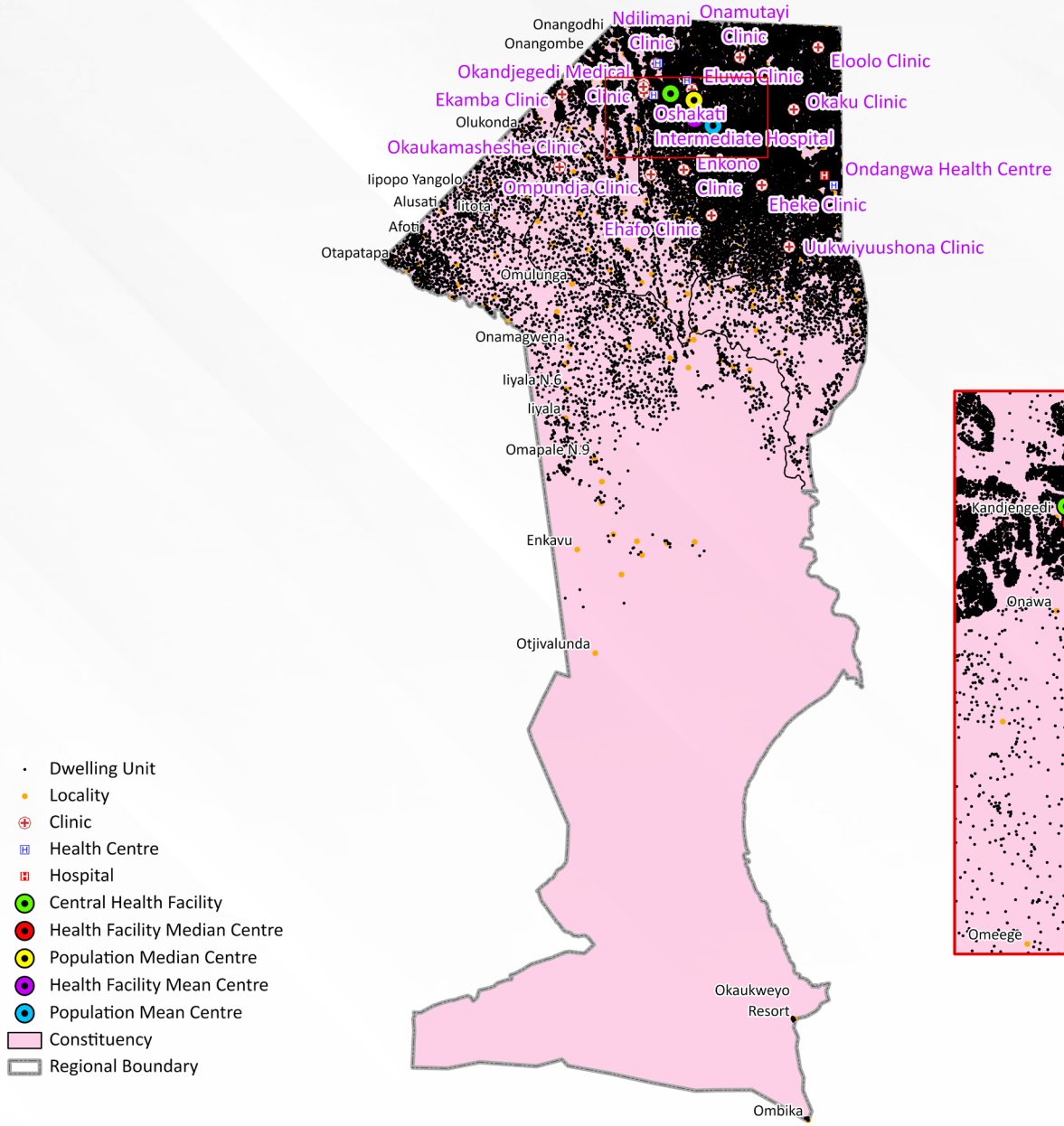
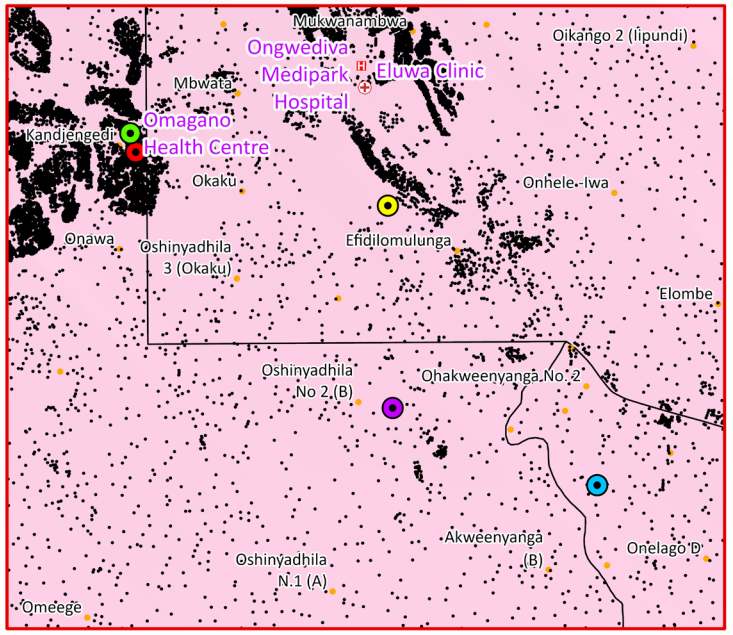


Table 2.12 1: Most Central Health Facility and Population

Area		Oshana
Name of Central Health Facility		Omagano Health Centre
Population Coordinates	Median	Longitude: 15.7696479 Latitude: -17.7971080
	Mean	Longitude: 15.7992268 Latitude: -17.8354471
Health Facilities Coordinates	Median	Longitude: 15.733763 Latitude: -17.7895780
	Mean	Longitude: 15.7701383 Latitude: -17.8247278
Distance from Central Facility to Health Facility Median Center in kilometres		0.3
Distance from Central Facility to Health Facilities Mean Center in kilometres		5.7



2.13. Oshikoto Region

Figure 2.13 1 Most Central Health Facility and Population

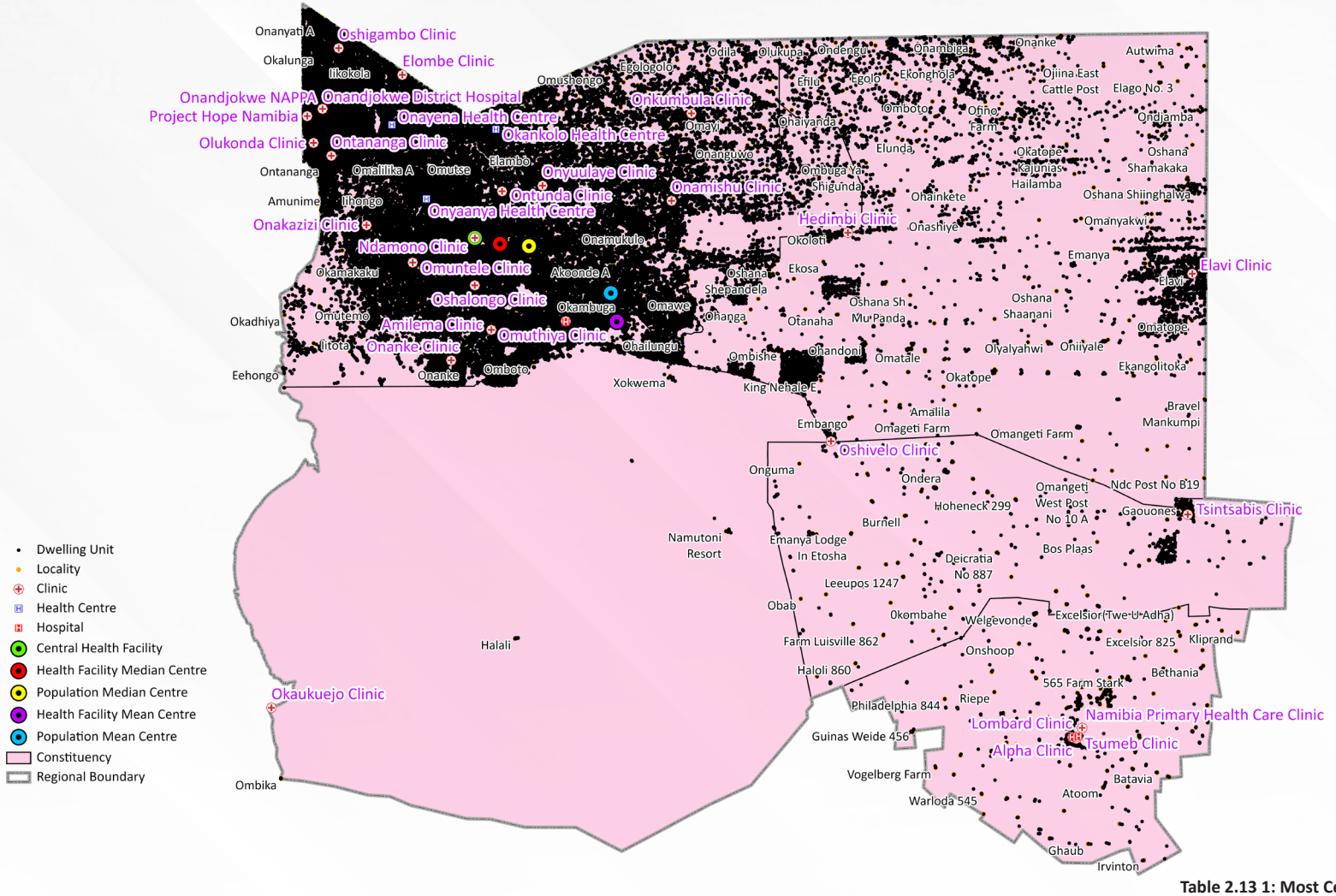


Table 2.13 1: Most Central Health Facility and Population

Area		Oshikoto
Name of Central Health Facility		Ndamono Clinic
Population Coordinates	Median	Longitude: 16.67928432 Latitude: -18.3042302
	Mean	Longitude: 16.67928432 Latitude: -18.3042302
Health Facilities Coordinates	Median	Longitude: 16.43368900 Latitude: -18.19930400
	Mean	Longitude: 16.69265485 Latitude: -18.36481661
Distance from Central Facility to Health Facility Median Center in kilometres		6.1
Distance from Central Facility to Health Facilities Mean Center in kilometres		38.7

2.14. Otjozondjupa Region

Figure 2.14 1 Most Central Health Facility and Population

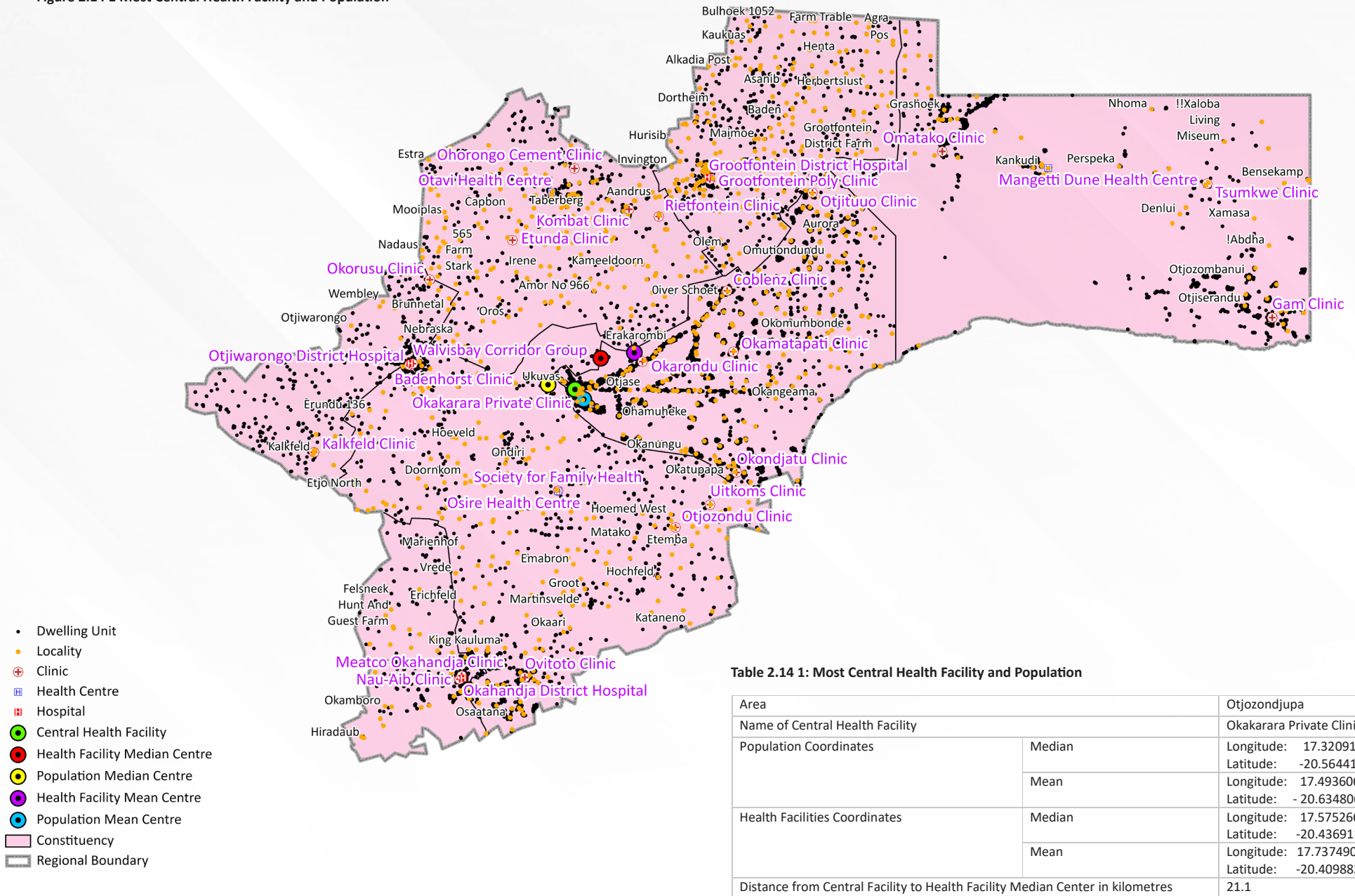


Table 2.14 1: Most Central Health Facility and Population

Area		Otjozondjupa
Name of Central Health Facility		Okakarara Private Clinic
Population Coordinates	Median	Longitude: 17.32091797 Latitude: -20.56441610
	Mean	Longitude: 17.49360656 Latitude: - 20.63480690
Health Facilities Coordinates	Median	Longitude: 17.57526600 Latitude: -20.43691100
	Mean	Longitude: 17.73749012 Latitude: -20.40988356
Distance from Central Facility to Health Facility Median Center in kilometres		21.1
Distance from Central Facility to Health Facilities Mean Center in kilometres		35.8

2.15. Zambezi Region

Figure 2.15 1 Most Central Health Facility and Population

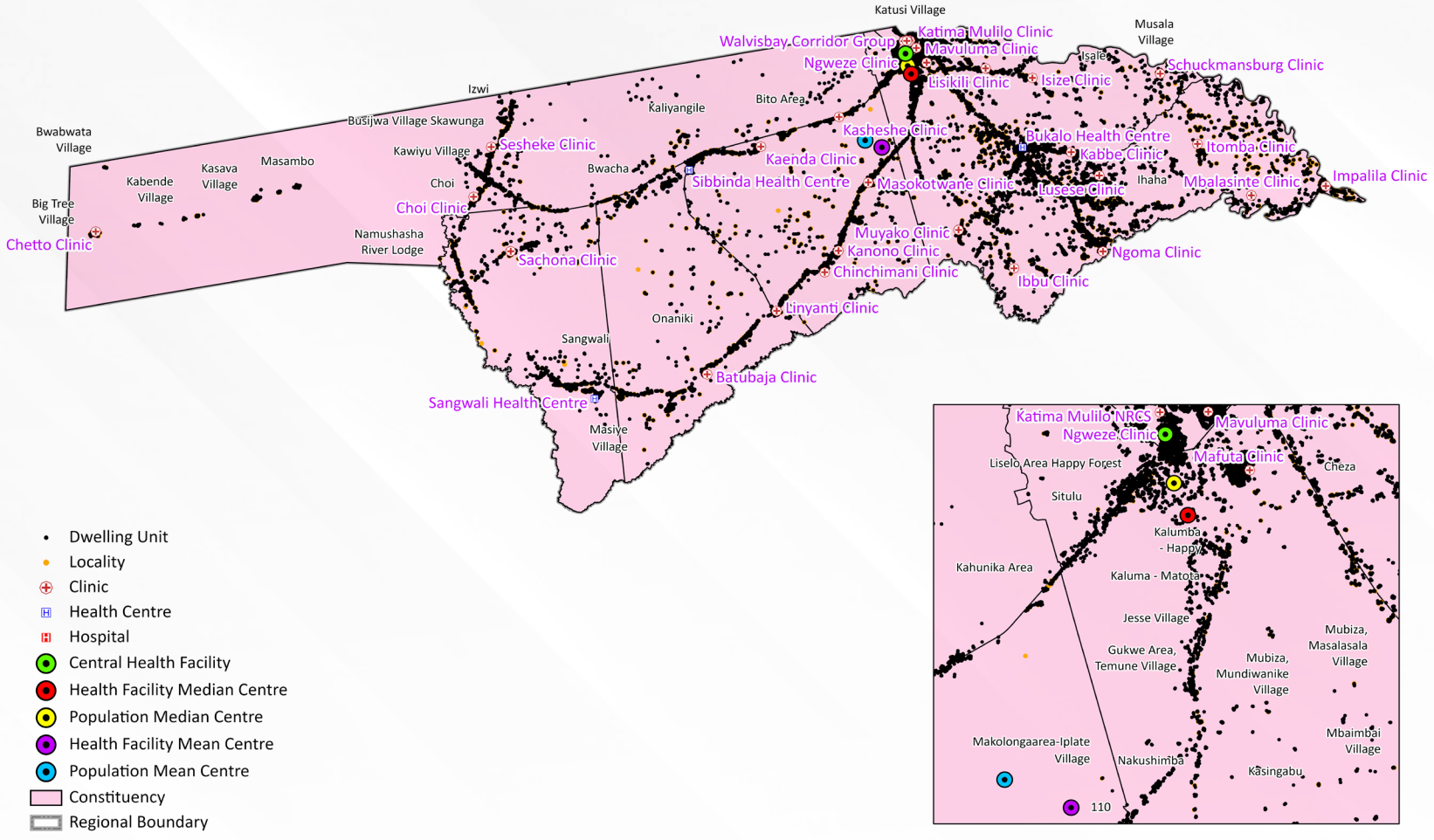


Table 2.15 1: Most Central Health Facility and Population

Area		Zambezi
Name of Central Health Facility		Ngweze Clinic
Population Coordinates	Median	Longitude: 24.27786166 Latitude: -17.55317410
	Mean	Longitude: 24.19355058 Latitude: -17.71033800
Health Facilities Coordinates	Median	Longitude: 24.28594500 Latitude: -17.56953300
	Mean	Longitude: 24.22967386 Latitude: -17.72354329
Distance from Central Facility to Health Facility Median Center in kilometres		4.9
Distance from Central Facility to Health Facilities Mean Center in kilometres		22.4



CHAPTER 3:

GEOGRAPHIC DISTRIBUTION OF HEALTH FACILITIES AND POPULATION

This chapter evaluates the geographic distribution of health facilities compared to the population distribution using a GIS function called standard distance. Also referred to as standard distance deviation statistic, it measures the extent to which the distances between the mean center and the mapped features vary from the average distance. It provides a single summary measure of feature distribution around their geographic center, like the way a standard deviation measures the distribution of data values around the statistical mean. The 1-standard distance represents the spatial equivalent of standard deviation in statistics.

The statistic will be used to measure the extent to which persons or health facilities are dispersed around the geographic mean center of their distribution. However, it must be mentioned here that there is a slight difference between the geographic or spatial 1-standard distance and the normal statistics standard deviation based on a normal distribution. **The 68 percent rule for 1-standard deviation slightly differs from the geographic standard distance because geographic standard distance does not always follow the same percentage rule as standard deviation in a normal distribution**. Geographic standard distance only tells us how dispersed the points are but does not directly indicate that 68% of the population or health facilities fall within that distance as **this can be below or above this percentage** for geographic data due to its multidimensionality (x, y coordinates) and randomness.

Therefore, the summary calculations in this chapter just tells us the dispersion or compactness of the health facilities or population. The smaller the radius of the standard distance circle the more compact the features are around the location of the mean center of the distribution. The bigger the circle the more dispersed or scattered they are from the mean center of that distribution.

Example applications: Usually, it is cost effective and cheaper to bring services to a more compact distribution than a scattered one. Health planners may want to plan for services where persons are concentrated to achieve optimum utilization of resources. Also, during an infectious disease outbreak like COVID-19, health officials would want to evaluate areas of higher concentration of both services and population. Comparing two standard distances helps to evaluate how closely distributed they are within a defined standard distance from the mean distribution e.g. 1, 2 or 3 Standard Distances.

Note: In this section, both the health facilities and population layers were evaluated at 1-Standard Distance and extraction of the number of persons and health facilities reflects this statistical measure.

3.1. National Standard Distance of Health Facilities and Population

Figure 3.1 1 Size of 1- Standard Distance of Health Facilities and Population at National Level

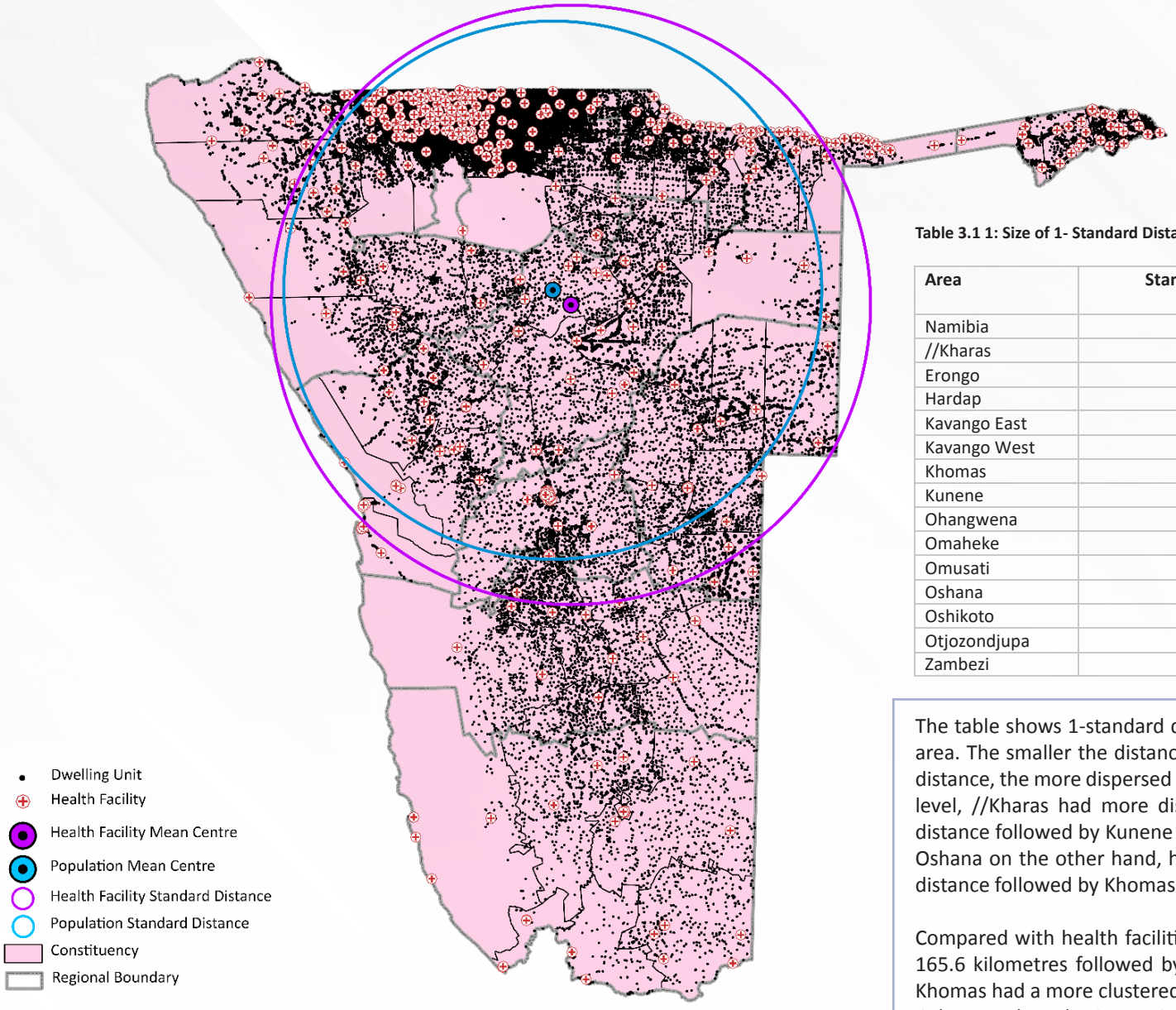


Table 3.1 1: Size of 1- Standard Distance of Health Facilities and Population at National Level

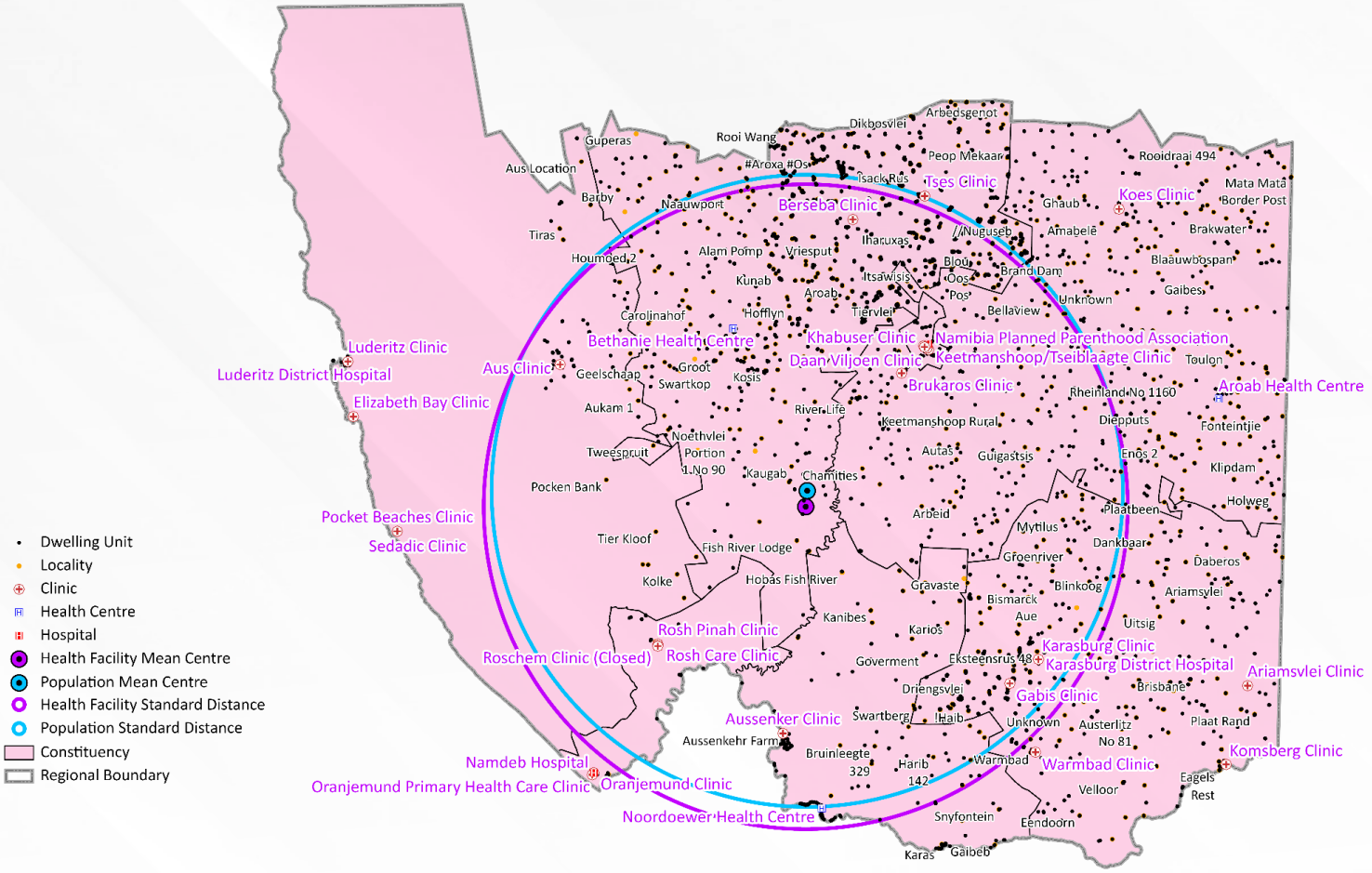
Area	Standard Distance (Kilometres) Namibia Health Facilities	Standard Distance (Kilometres) Namibia Population
Namibia	422.6	379.4
//Kharas	165.0	161.8
Erongo	90.6	77.7
Hardap	107.4	103.5
Kavango East	76.4	70.6
Kavango West	59.8	60.0
Khomas	12.2	20.0
Kunene	165.6	160.0
Ohangwena	63.1	53.9
Omaheke	107.7	102.3
Omusati	44.4	43.4
Oshana	15.3	18.8
Oshikoto	89.4	80.2
Otjozondjupa	137.2	142.6
Zambezi	56.9	51.3

The table shows 1-standard distance of the population distribution and health facilities by area. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center. In 2023, at regional level, //Kharas had more dispersed population in Namibia at 161.8-kilometre standard distance followed by Kunene and Otjozondjupa at 160.0 and 142.6 kilometres respectively. Oshana on the other hand, had a highly clustered population at 18.8 kilometres standard distance followed by Khomas and Zambezi at 20.0 and 51.3 kilometres respectively.

Compared with health facilities distribution, Kunene had a more dispersed distribution at 165.6 kilometres followed by //Kharas and Otjozondjupa at 165.0 and 137.2 kilometres. Khomas had a more clustered distribution of health facilities at 12.2 kilometres followed by Oshana and Zambezi at 15.3 and 56.9 kilometres respectively.

3.2. //Kharas Region

Figure 3.2 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows the sizes of 1-standard distance of the population and health facilities distributions in //Kharas Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from their geographic mean centers.

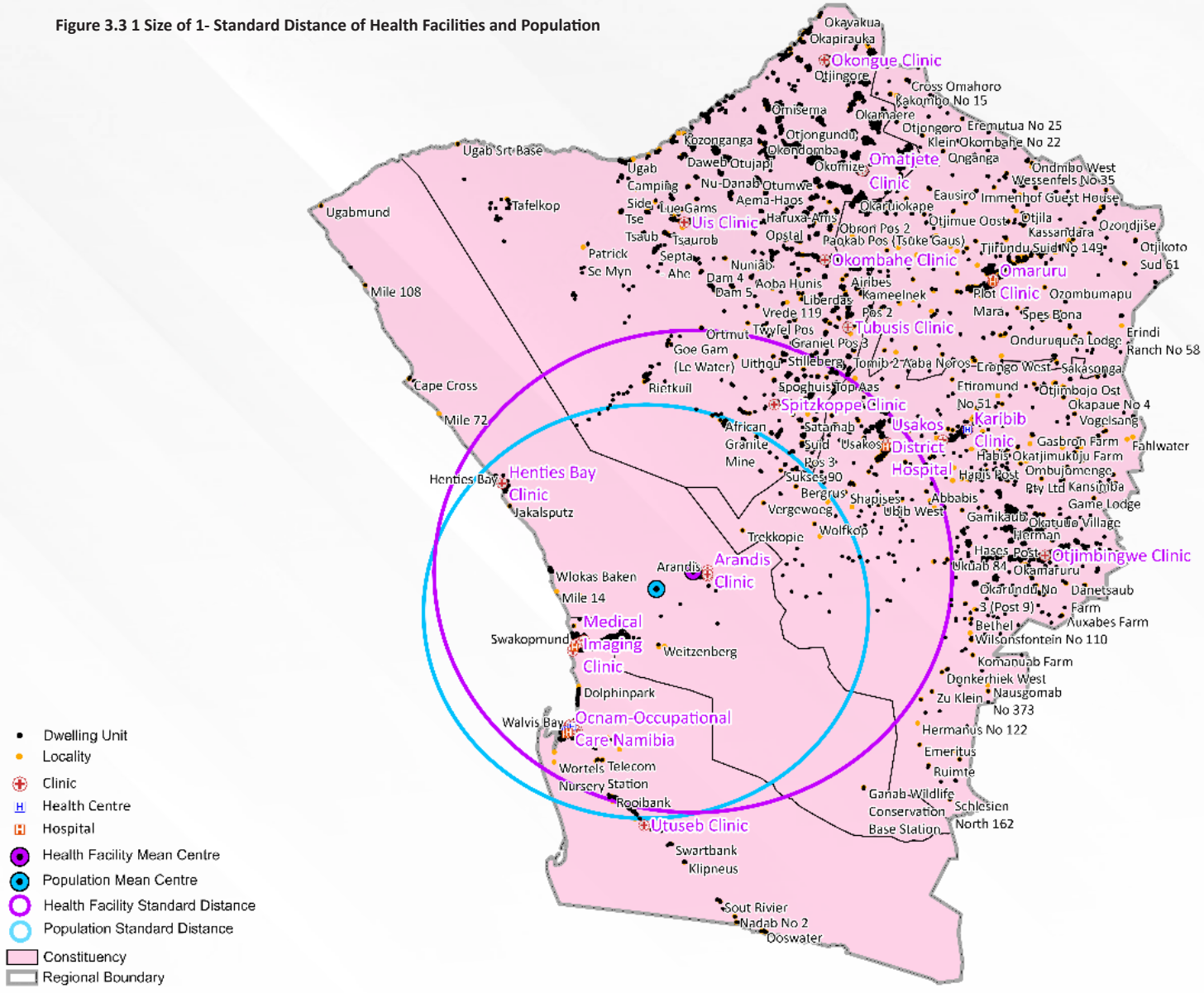
In 2023, 60.0% percent of the population was within 161.8 kilometres from the geographic mean center of the population distribution while 57.6% percent of health facilities were located within 165.0 kilometres standard distance of health facilities.

Table 3.2 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
//Kharas Health Facilities	165.0	19 Health Facilities covering 69 512 Persons	33	57.6
//Kharas Population	161.8	65 906 persons with a total count of 18 Health Facilities	109 893	60.0

3.3. Erongo Region

Figure 3.3 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Erongo Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

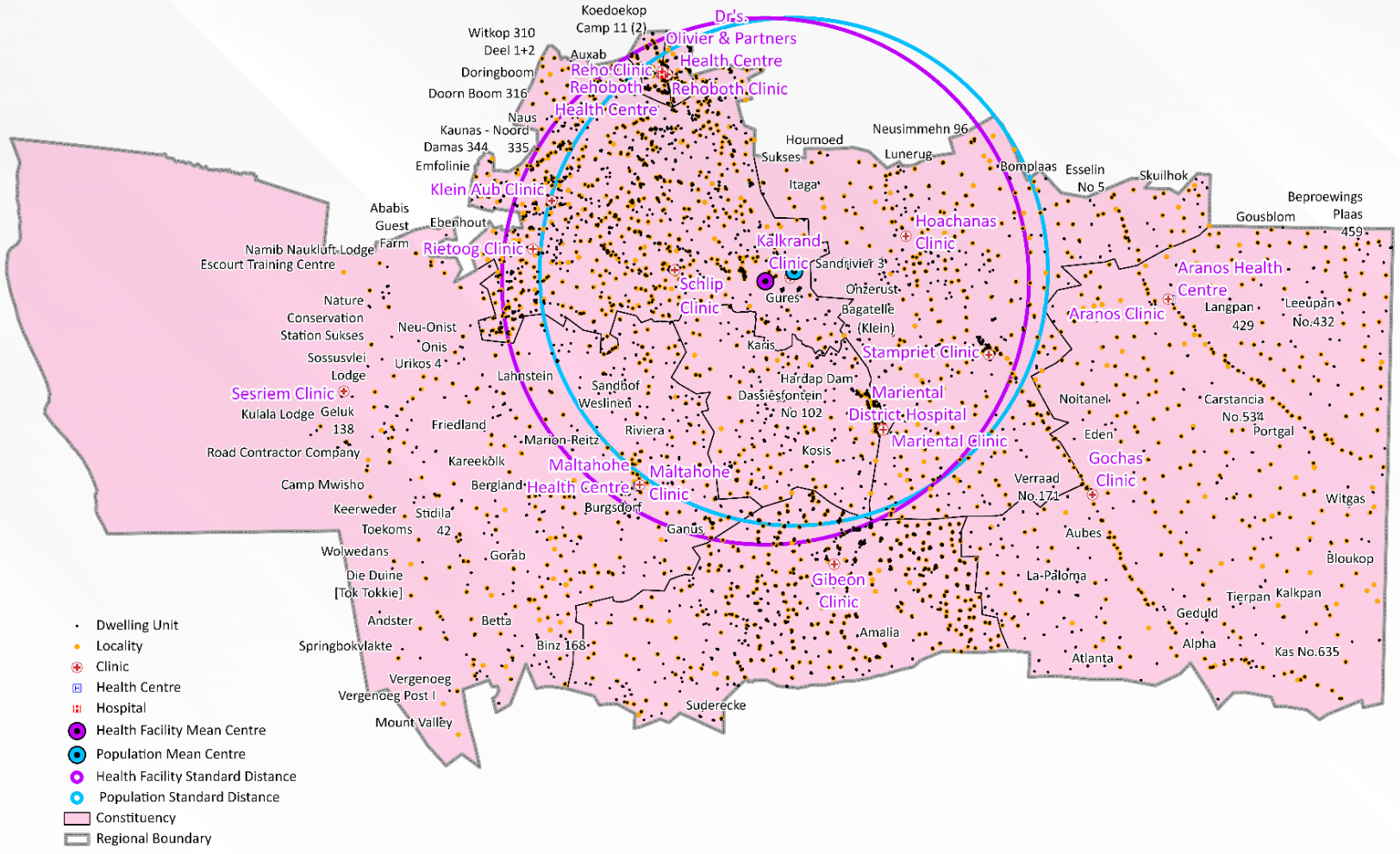
In 2023, 80.0% percent of the population was within 77.7 kilometres from the geographic mean center of the population distribution while 72.7 percent of health facilities were located within 90.6 kilometres.

Table 3.3 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Erongo Health Facilities	90.6	40 Health Facilities covering 199 401 Persons	55	72.7
Erongo Population	77.7	192 279 persons with a total count of 36 Health Facilities	240 206	80.0

3.4. Hardap Region

Figure 3.4 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Hardap Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

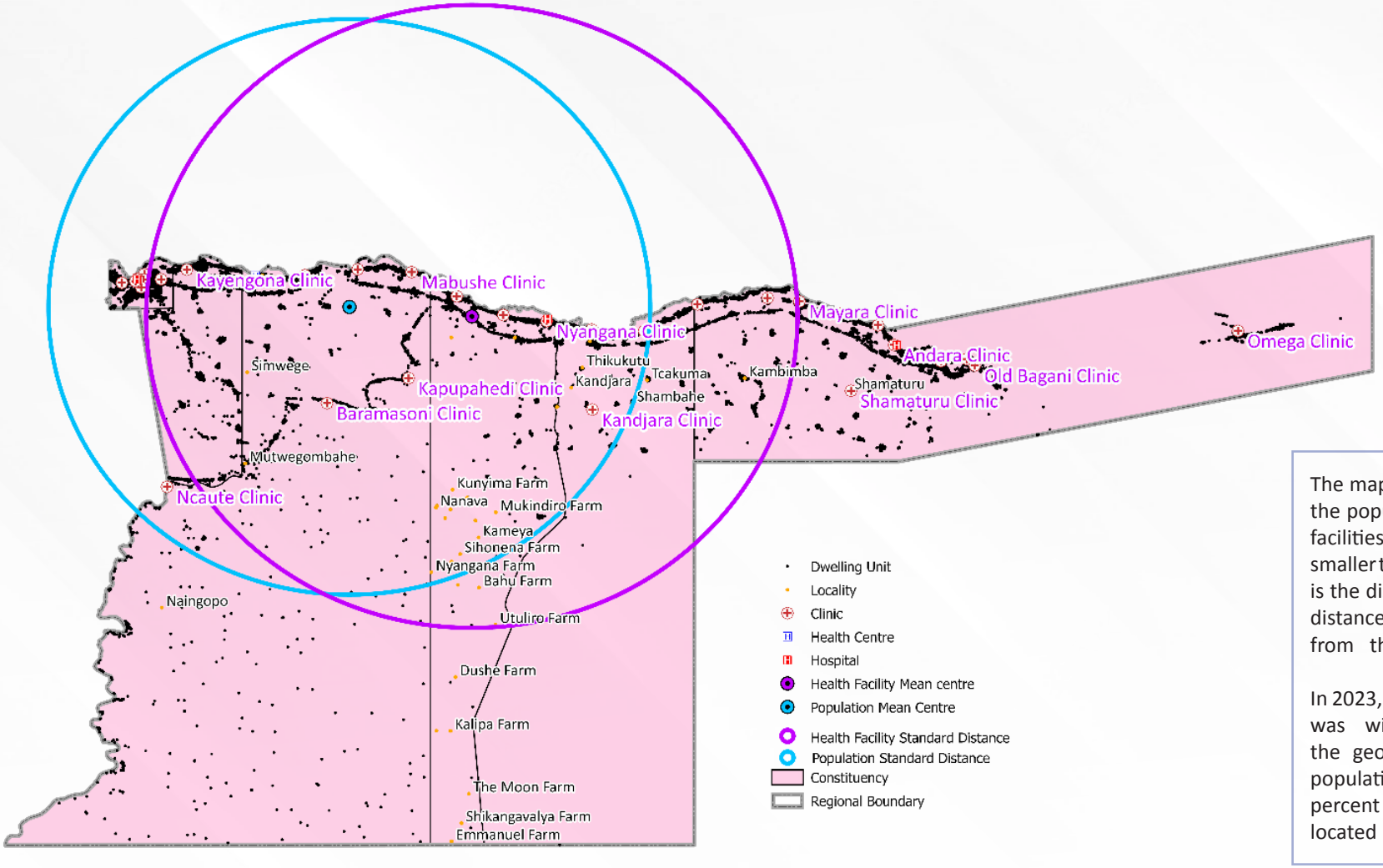
In 2023, 74.6 percent of the population was within 103.5 kilometres from the geographic mean center of the population distribution while 76.2 percent of health facilities were located within 107.4 kilometres.

Table 3.4 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Hardap Health Facilities	107.4	16 Health Facilities covering 84 836 Persons	21	76.2
Hardap Population	103.5	79 548 persons with a total count of 13 Health Facilities	106 680	74.6

3.5. Kavango East Region

Figure 3.5 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Kavango East Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

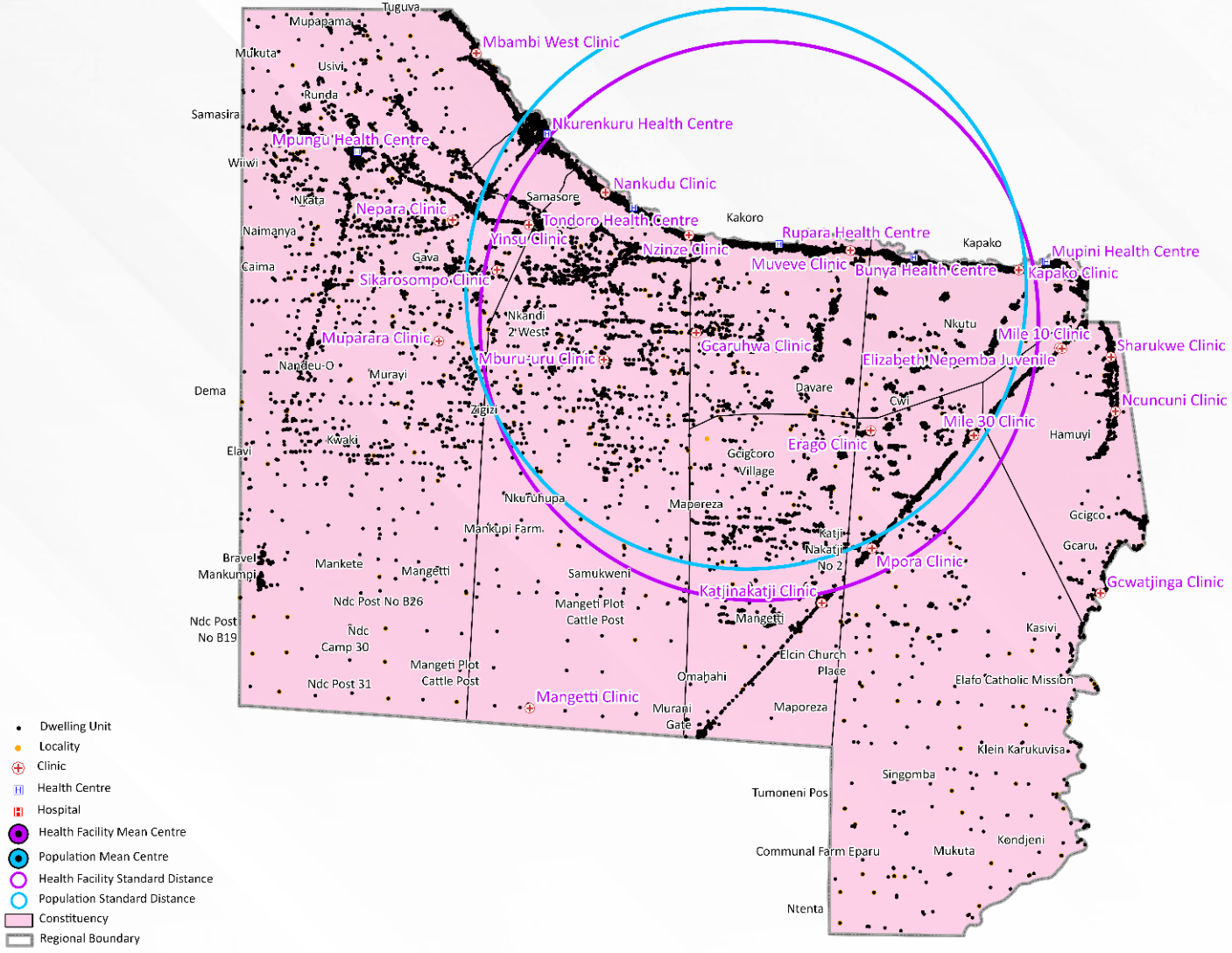
In 2023, 79.4 percent of the population was within 70.6 kilometres from the geographic mean center of the population distribution while 42.5 percent of health facilities were located within 76.4 kilometres.

Table 3.5 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Kavango East Health Facilities	76.4	17 Health Facilities covering 101 507 Persons	40	42.5
Kavango East Population	70.6	173 366 persons with a total count of 28 Health Facilities	218 421	79.4

3.6. Kavango West Region

Figure 3.6 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Kavango West Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

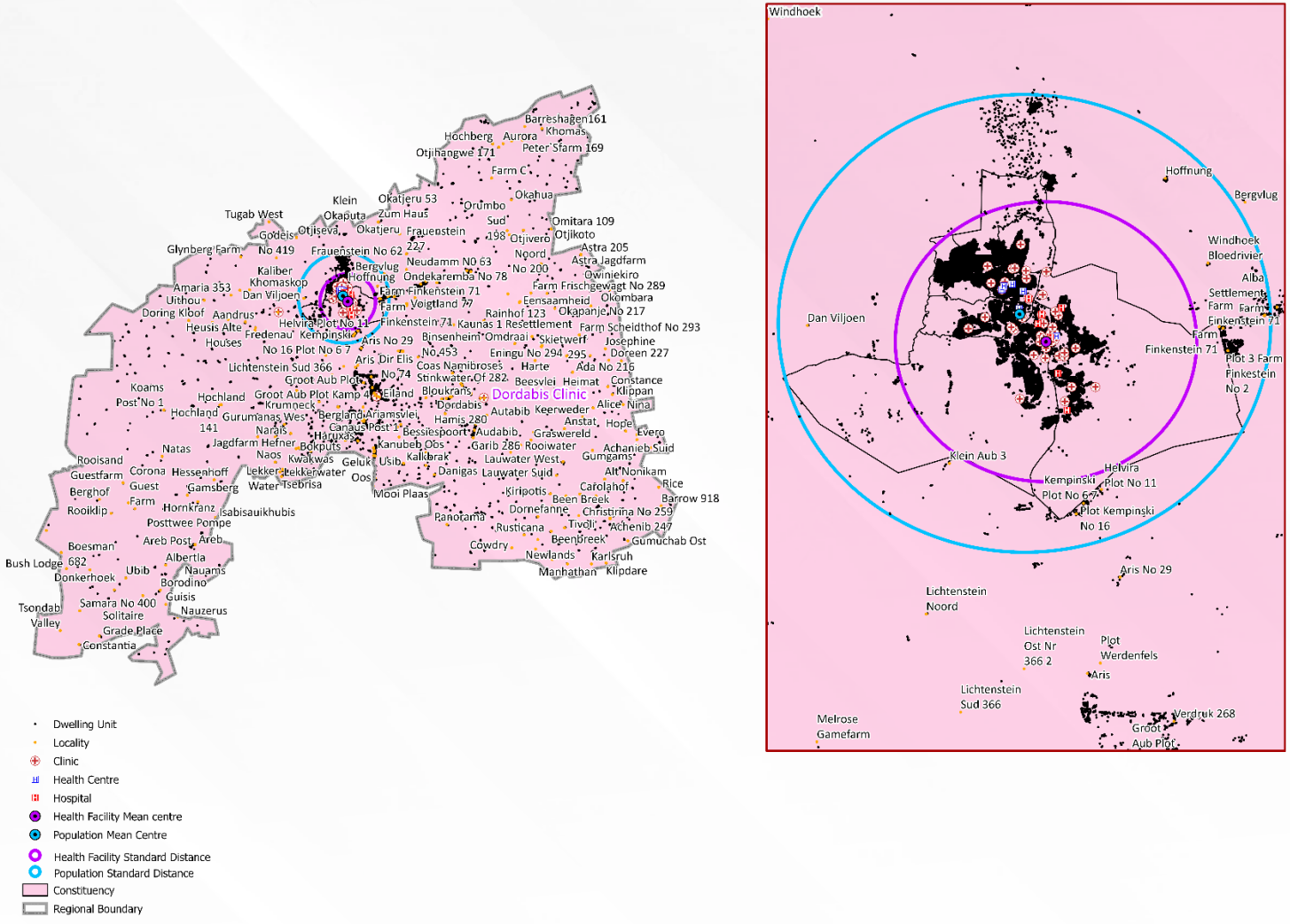
In 2023, 58.7 percent of the population was within 59.8 kilometres from the geographic mean center of the population distribution while 53.6 percent of health facilities were located within 60.0 kilometres.

Table 3.6 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Kavango East Health Facilities	76.4	17 Health Facilities covering 101 507 Persons	40	42.5
Kavango East Population	70.6	173 366 persons with a total count of 28 Health Facilities	218 421	79.4

3.7. Khomas Region

Figure 3.7 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Khomas Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

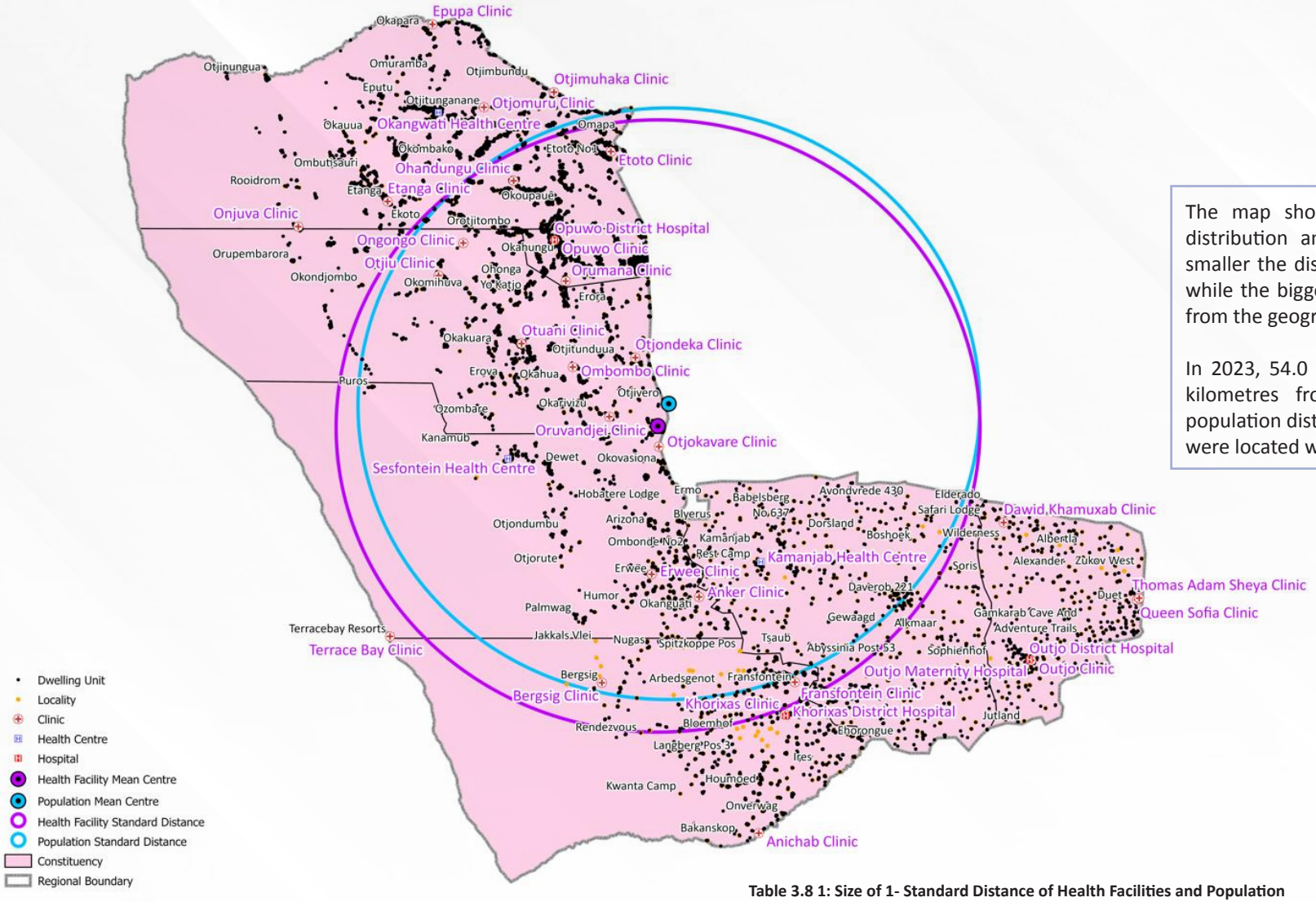
In 2023, 95.7 percent of the population was within 20.0 kilometres from the geographic mean center of the population distribution while 94.9 percent of health facilities were located within 12.2 kilometres.

Table 3.7 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Khomas Health Facilities	12.2	56 Health Facilities covering 464 242 Persons	59	94.9
Khomas Population	20.0	473 578 persons with a total count of 56 Health Facilities	494 605	95.7

3.8. Kunene Region

Figure 3.8 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Kunene Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

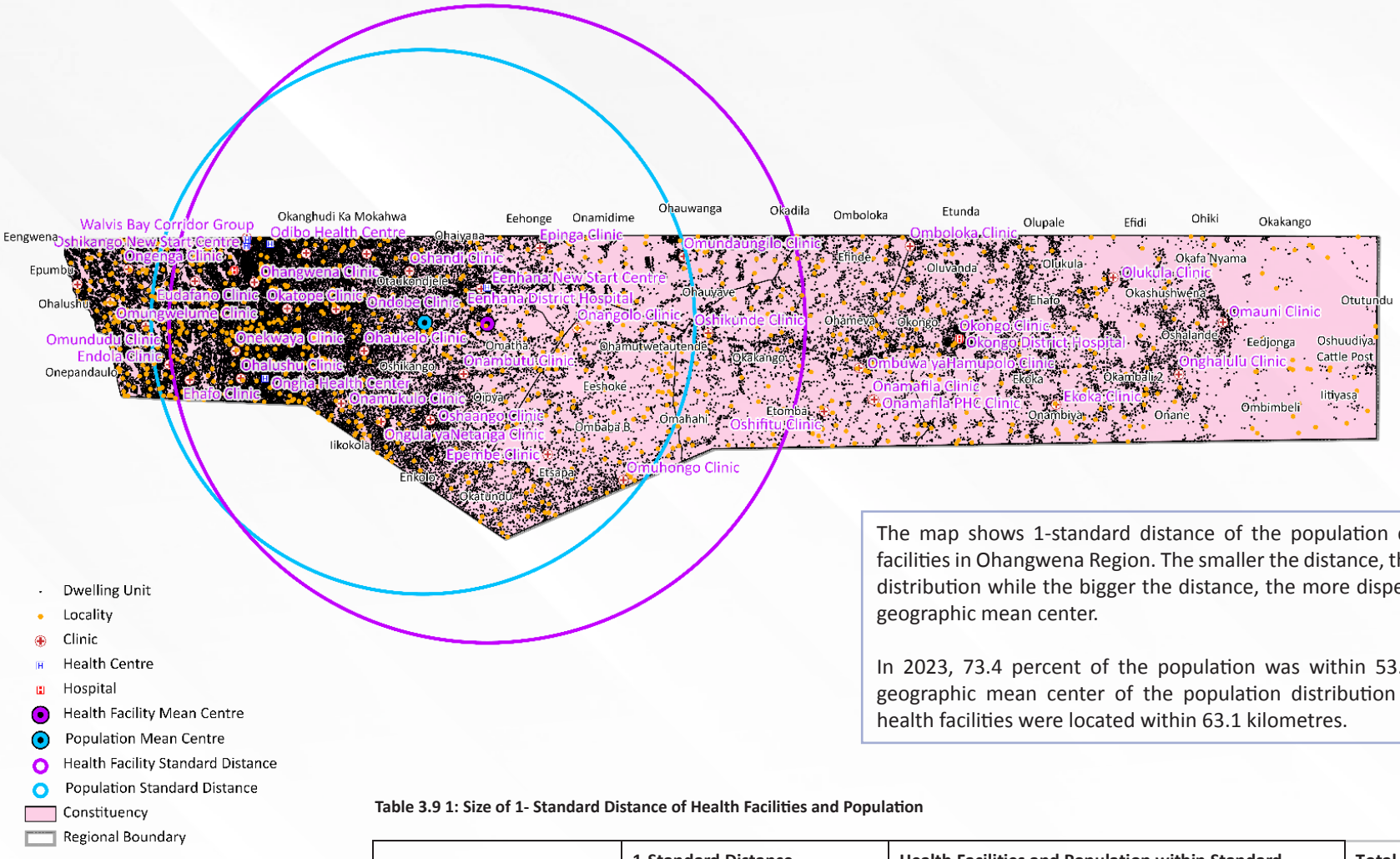
In 2023, 54.0 percent of the population was within 160.0 kilometres from the geographic mean center of the population distribution while 52.9 percent of health facilities were located within 165.6 kilometres.

Table 3.8 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Kunene Health Facilities	165.6	18 Health Facilities covering 67 572 Persons	34	52.9
Kunene Population	160.0	65 244 persons with a total count of 17 Health Facilities	120 762	54.0

3.9. Ohangwena Region

Figure 3.9 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Ohangwena Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

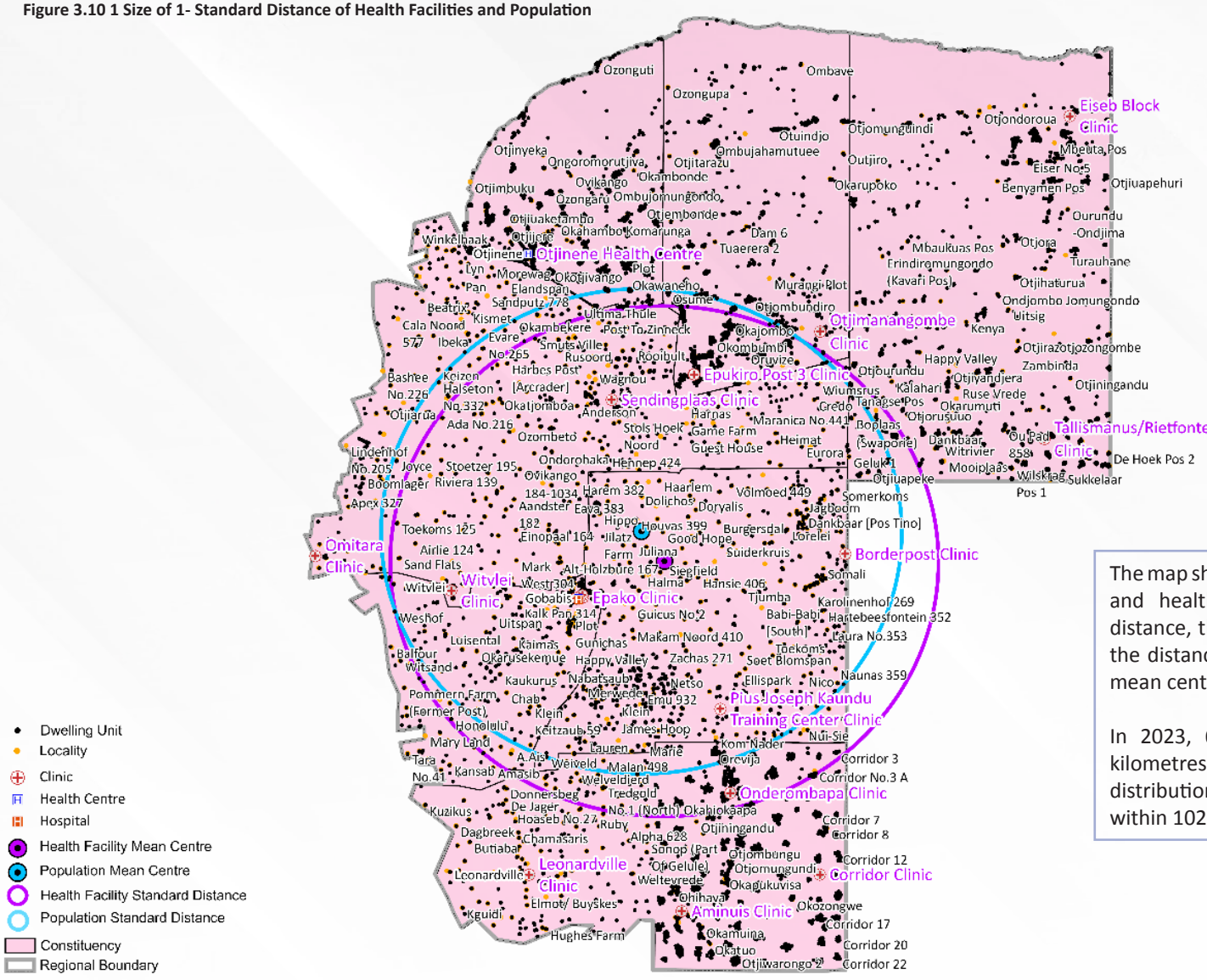
In 2023, 73.4 percent of the population was within 53.9 kilometres from the geographic mean center of the population distribution while 66.7 percent of health facilities were located within 63.1 kilometres.

Table 3.9 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Ohangwena Health Facilities	63.1	32 Health Facilities covering 254 087 Persons	48	66.7
Ohangwena Population	53.9	247 941 persons with a total count of 32 Health Facilities	337 729	73.4

3.10. Omaheke Region

Figure 3.10 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Omaheke Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

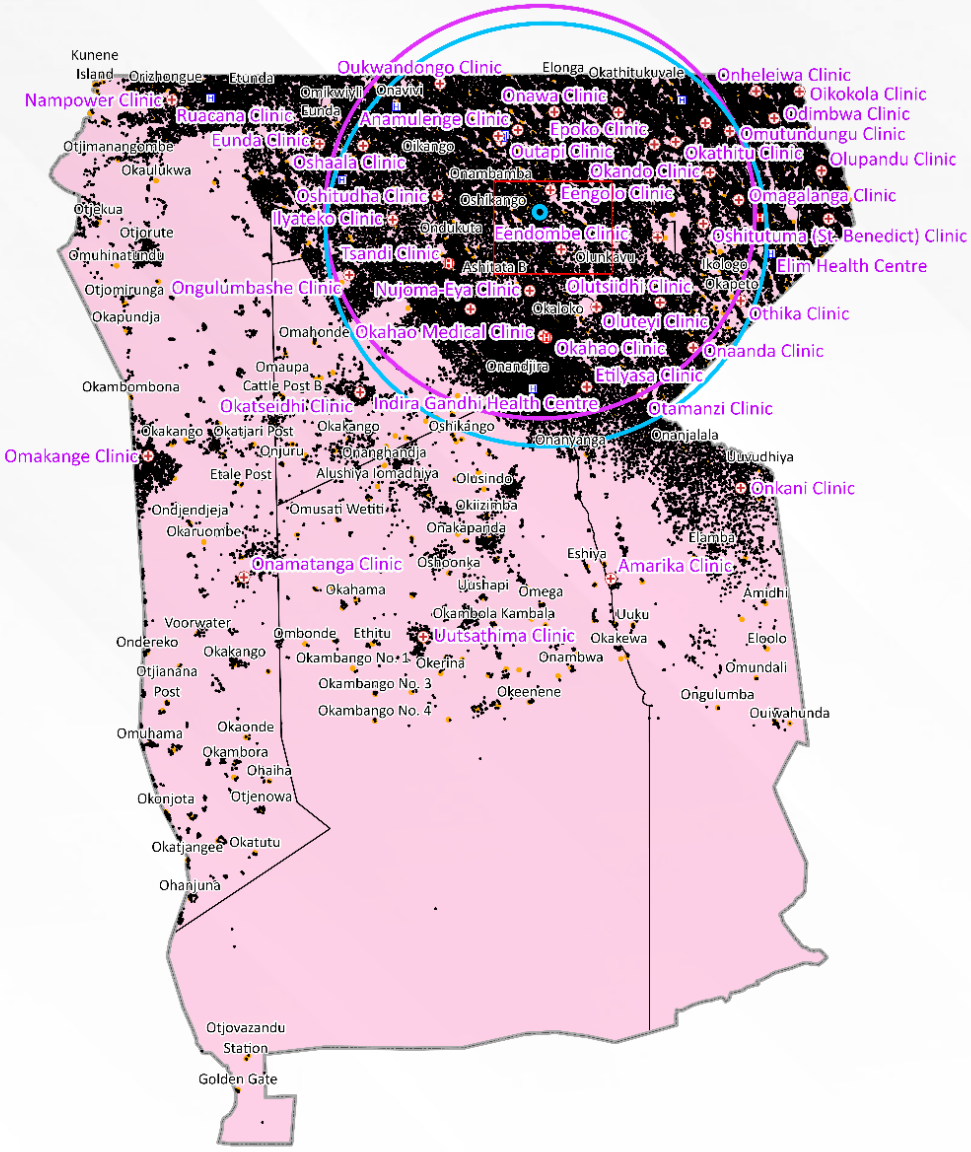
In 2023, 60.2 percent of the population was within 107.7 kilometres from the geographic mean center of the population distribution while 63.6 percent of health facilities were located within 102.3 kilometres.

Table 3.10 1 Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Omaheke Health Facilities	107.7	14 Health Facilities covering 63 477 Persons	22	63.6
Omaheke Population	102.3	61 958 persons with a total count of 13 Health Facilities	102 881	60.2

3.11. Omusati Region

Figure 3.11 1 Size of 1- Standard Distance of Health Facilities and Population



- Dwelling Unit
- Locality
- Clinic
- Health Centre
- Hospital
- Health Facility Mean Centre
- Population Mean Centre
- Health Facility Standard Distance
- Population Standard Distance
- Constituency
- Regional Boundary

The map shows 1-standard distance of the population distribution and health facilities in Omusati Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

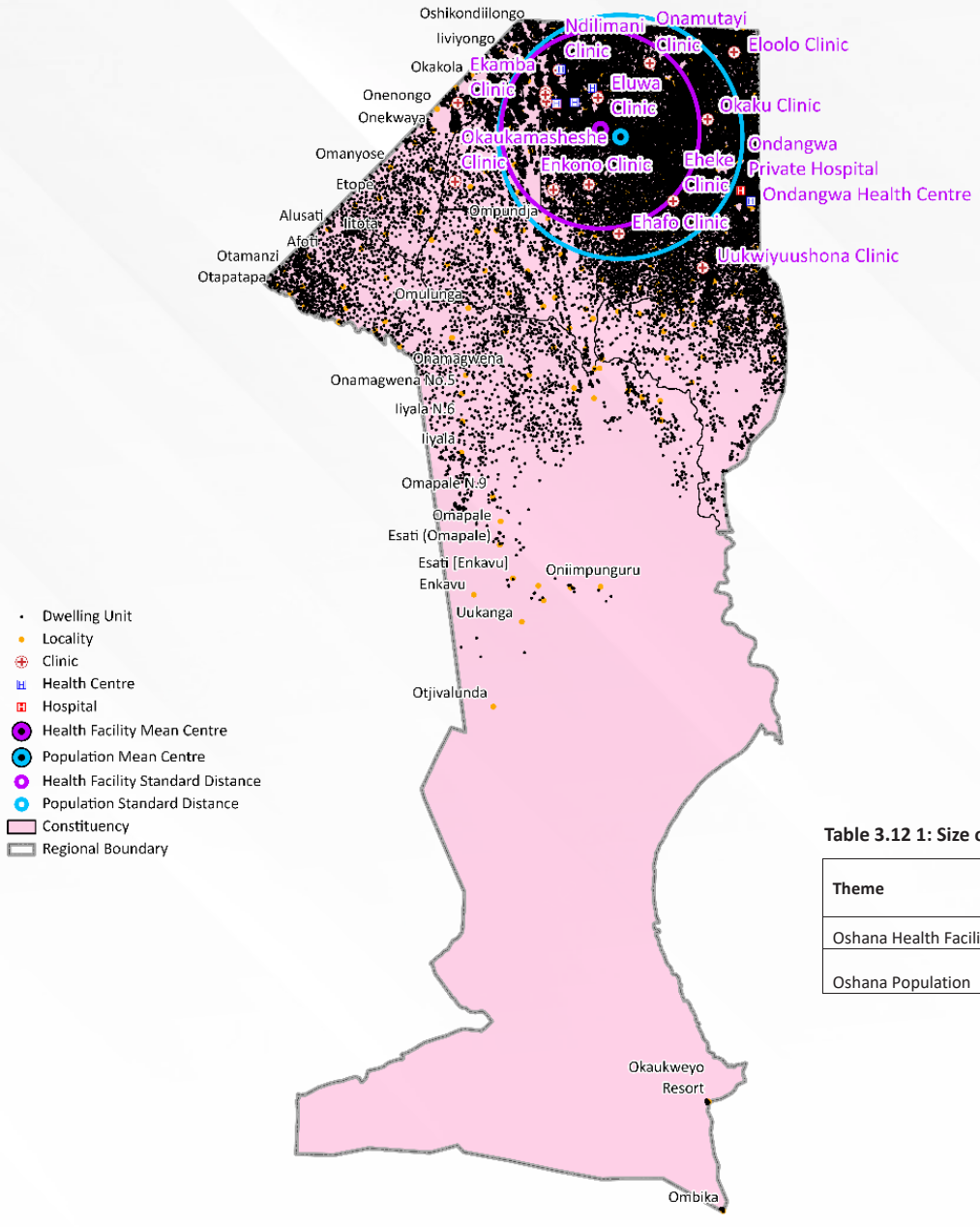
In 2023, 65.2 percent of the population was within 43.4 kilometres from the geographic mean center of the population distribution while 72.4 percent of health facilities were located within 44.4 kilometres.

Table 3.11 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Omusati Health Facilities	44.4	42 Health Facilities covering 218 130 Persons	58	72.4
Omusati Population	43.4	207 912 persons with a total count of 39 Health Facilities	316 671	65.7

3.12. Oshana Region

Figure 3.12 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Oshana Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they were from the geographic mean center.

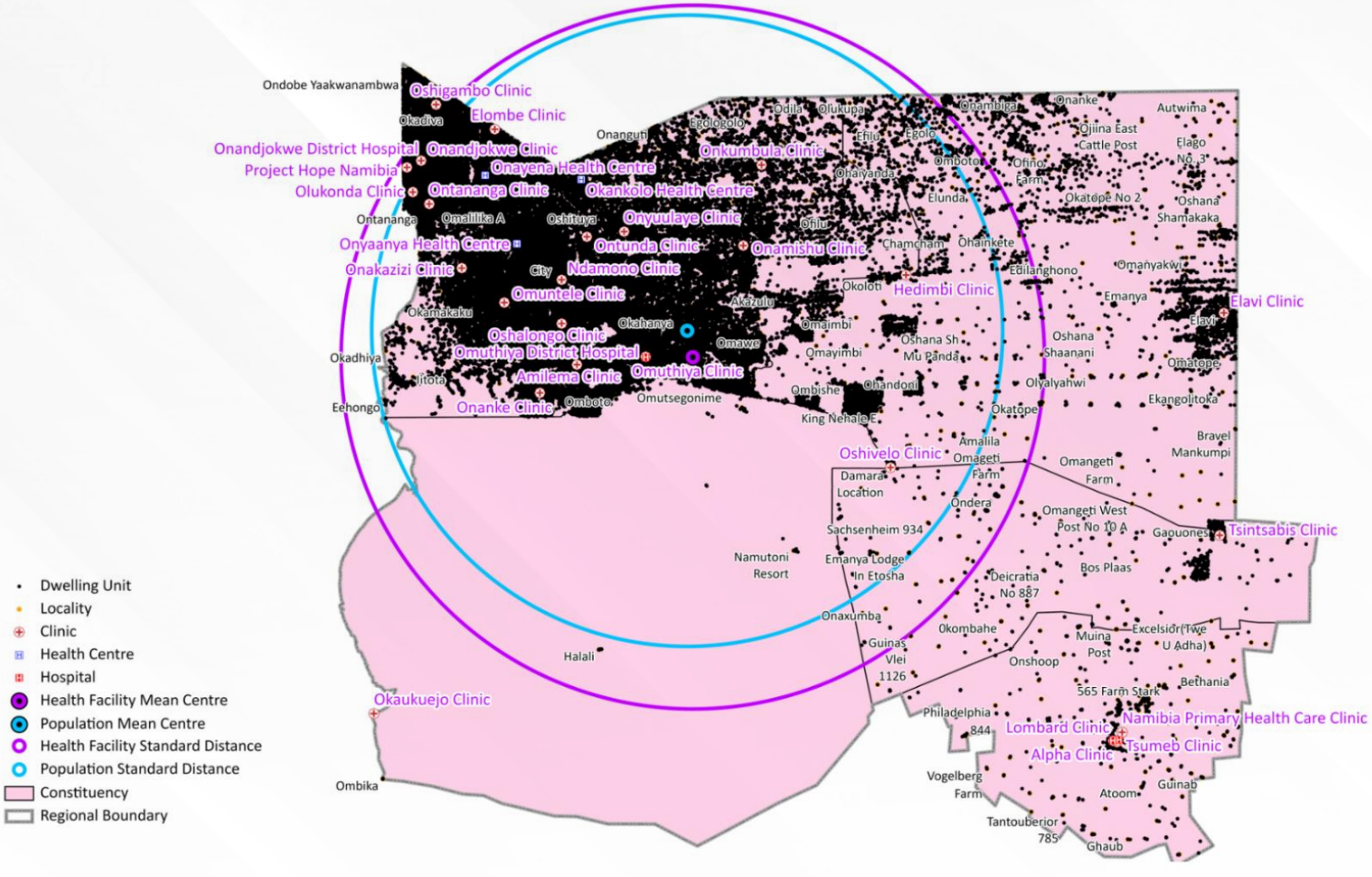
In 2023, 71.4 percent of the population was within 18.8 kilometres from the geographic mean center of the population distribution while 72.4 percent of health facilities were located within 15.3 kilometres.

Table 3.12 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Oshana Health Facilities	15.3	15 Health Facilities covering 136 937 Persons	24	62.5
Oshana Population	18.8	164 895 persons with a total count of 18 Health Facilities	230 801	71.4

3.13. Oshikoto Region

Figure 3.13 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Oshikoto Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

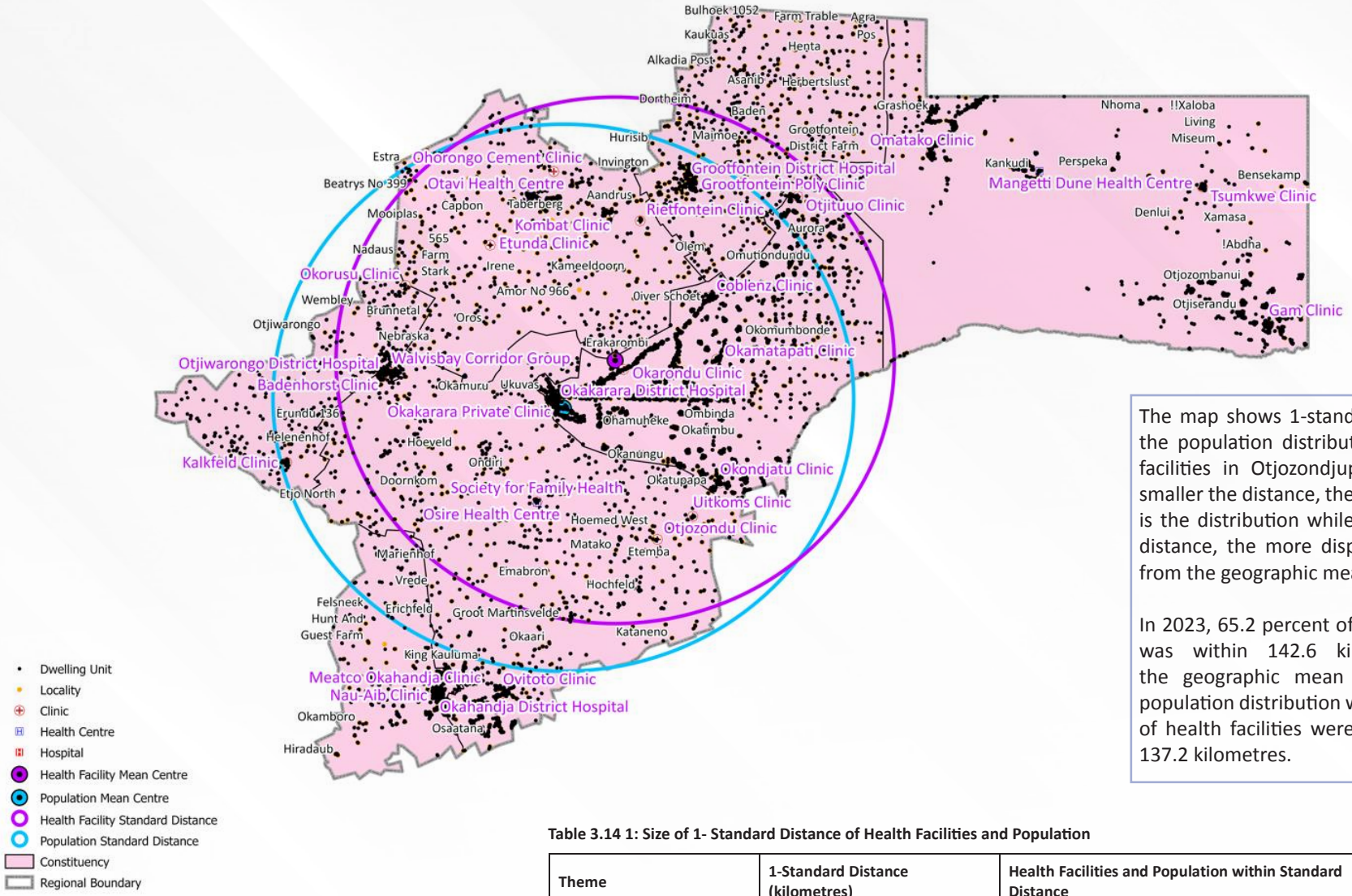
In 2023, 68.8 percent of the population was within 80.2 kilometres from the geographic mean center of the population distribution while 70.6 percent of health facilities were located within 89.4 kilometres.

Table 3.13 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Oshikoto Health Facilities	89.4	24 Health Facilities covering 198 424 Persons	34	70.6
Oshikoto Population	80.2	177 122 persons with a total count of 20 Health Facilities	257 302	68.8

3.14. Otjozondjupa Region

Figure 3.14 1 Size of 1- Standard Distance of Health Facilities and Population



The map shows 1-standard distance of the population distribution and health facilities in Otjozondjupa Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

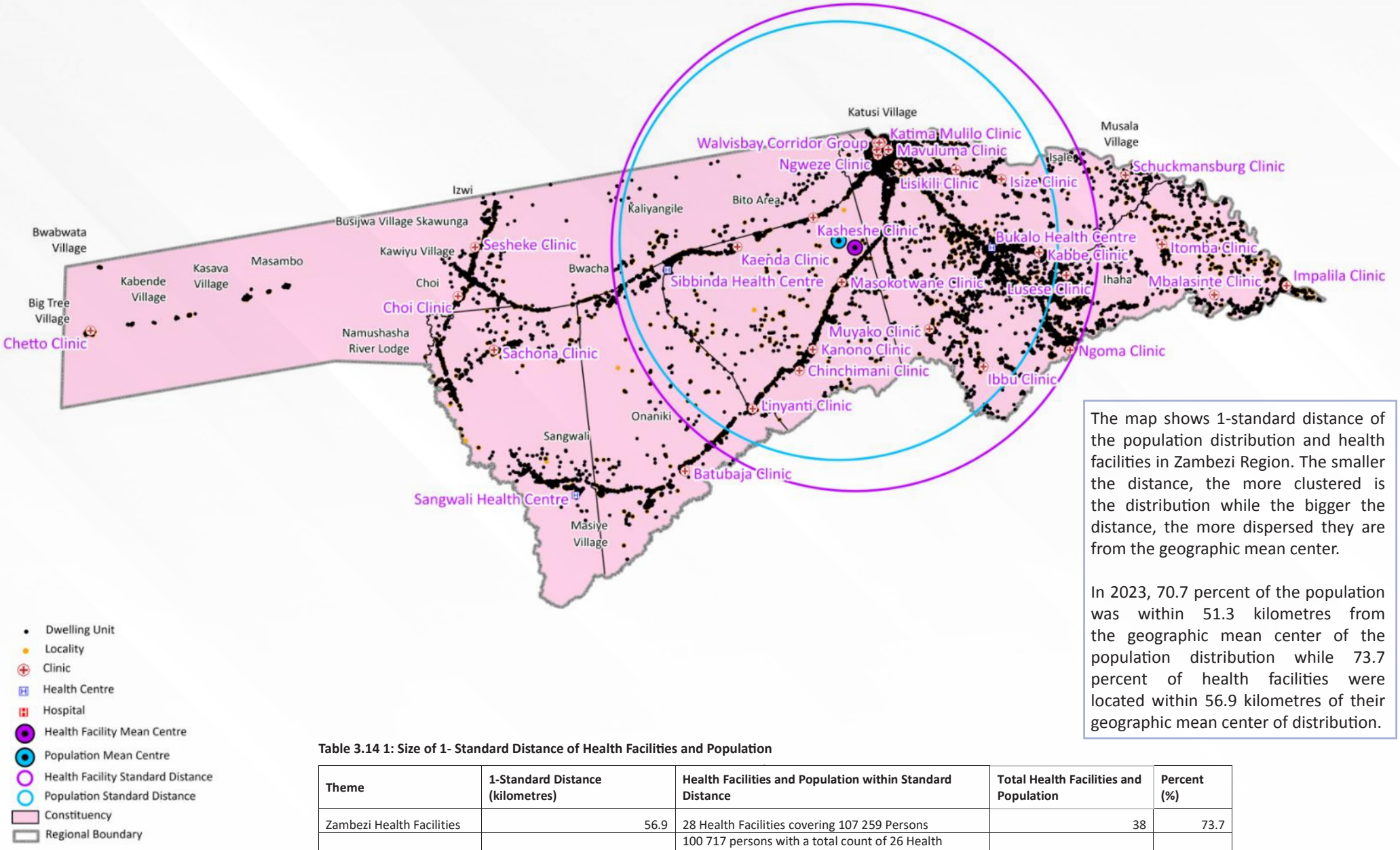
In 2023, 65.2 percent of the population was within 142.6 kilometres from the geographic mean center of the population distribution while 75 percent of health facilities were located within 137.2 kilometres.

Table 3.14 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Otjozondjupa Health Facilities	137.2	27 Health Facilities covering 143 378 Persons	36	75.0
Otjozondjupa Population	142.6	144 020 persons with a total count of 27 Health Facilities	220 811	65.2

3.15. Zambezi Region

Figure 3.15 1 Size of 1- Standard Distance of Health Facilities and Population

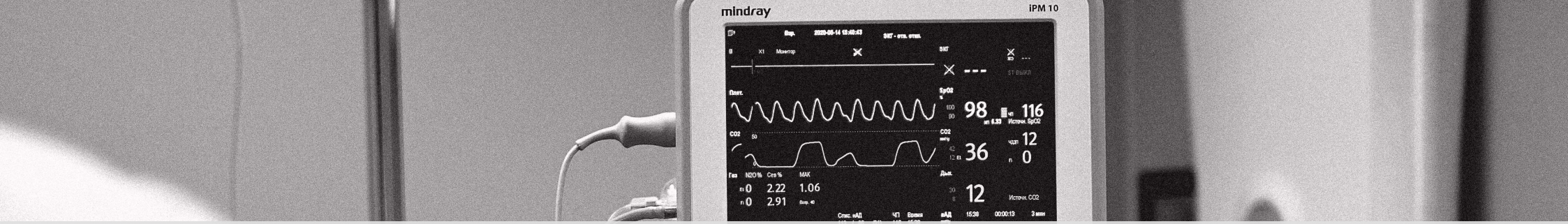


The map shows 1-standard distance of the population distribution and health facilities in Zambezi Region. The smaller the distance, the more clustered is the distribution while the bigger the distance, the more dispersed they are from the geographic mean center.

In 2023, 70.7 percent of the population was within 51.3 kilometres from the geographic mean center of the population distribution while 73.7 percent of health facilities were located within 56.9 kilometres of their geographic mean center of distribution.

Table 3.14 1: Size of 1- Standard Distance of Health Facilities and Population

Theme	1-Standard Distance (kilometres)	Health Facilities and Population within Standard Distance	Total Health Facilities and Population	Percent (%)
Zambezi Health Facilities	56.9	28 Health Facilities covering 107 259 Persons	38	73.7
Zambezi Population	51.3	100 717 persons with a total count of 26 Health Facilities	142 373	70.7



CHAPTER 4:
DIRECTIONAL DISTRIBUTION OF HEALTH FACILITIES AND POPULATION

This section shows the directional distribution of both health facilities and population. The placement of health facilities such as clinics, health centers and hospitals around the population is important in healthcare planning. A high population density is an indicator of greater demand for health care services. While population density is a good indicator for health care service demand, health care planners require other additional information that can be used to adequately plan health services for the current and future demand.

Among the key input indicators is the orientation or directional distribution of a population. Directional distribution is a measure of the orientation and spatial direction of a mapped geographic feature. This indicator shows the trend in which the mapped feature is distributed. The output is a spatial distribution ellipse and angle of orientation based on the standard distance and weight used. Comparison between or among different features assists in decision making as to their behavioural pattern and trend.

The aim of this section is to basically show the placement of health facilities around the population using the 2023 population census data. All the population directional distribution ellipses were weighted by the number of persons while health facilities were not weighted. The smaller the difference in the calculated angles, the more aligned were the health facilities to the population distribution.

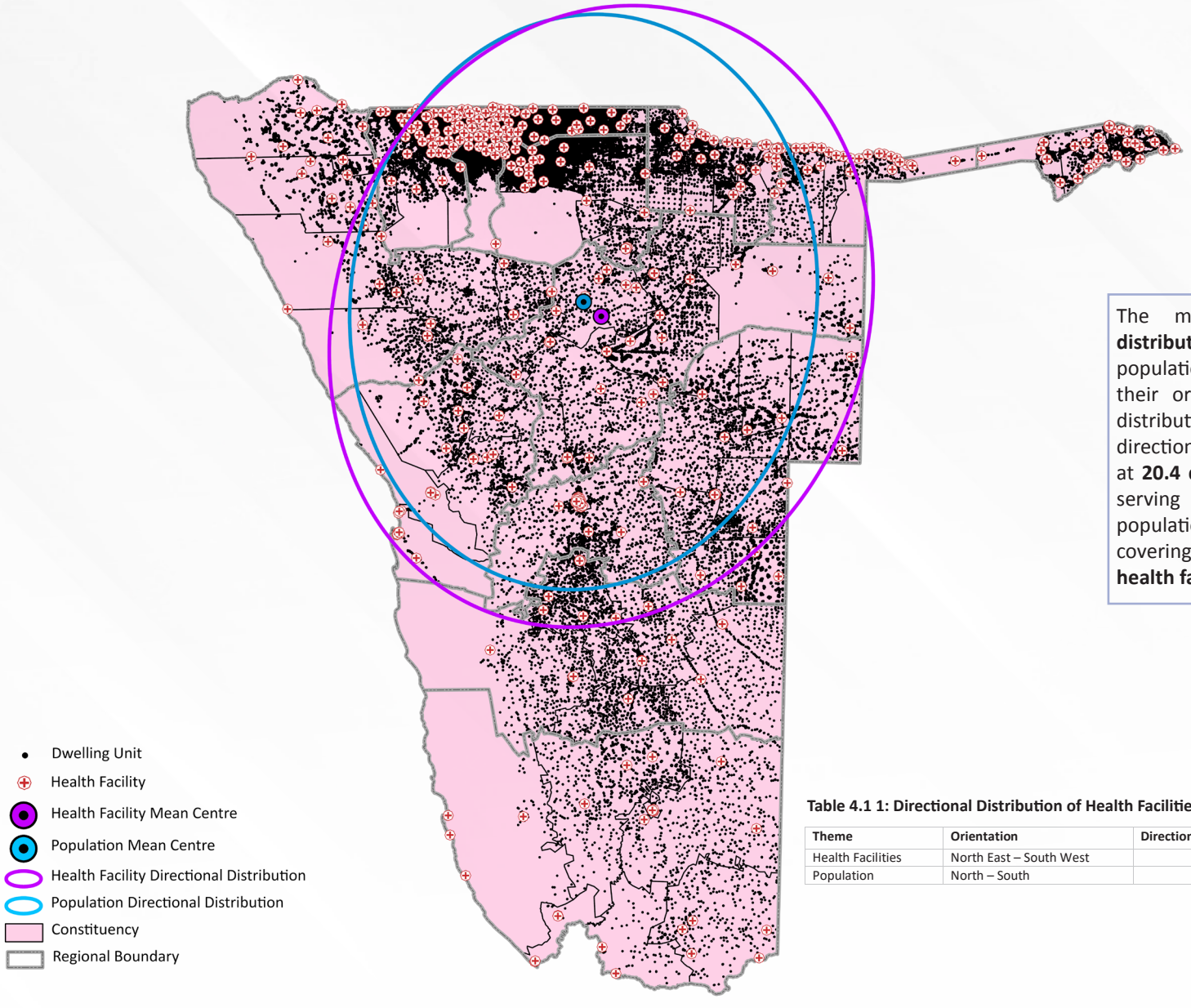
Example application: Usually, it is cost effective and cheaper to anticipate the direction and growth of a distribution such as population. Health planners may want to plan for services along the directional distribution of settlements. Also, governments in some instances would want to change the course of development by deliberately placing socioeconomic infrastructures away from the direction of a population distribution.

Note that deliberate government efforts/interventions aimed at bringing health care services to remote areas, the minority or marginalised communities can skew this assumption as part of national prioritization within the concept of Leave No One Behind (LNOB).



4.1. National Directional Distribution of Health Facilities and Population

Figure 4.1 1 National Directional Distribution of Health Facilities and Population



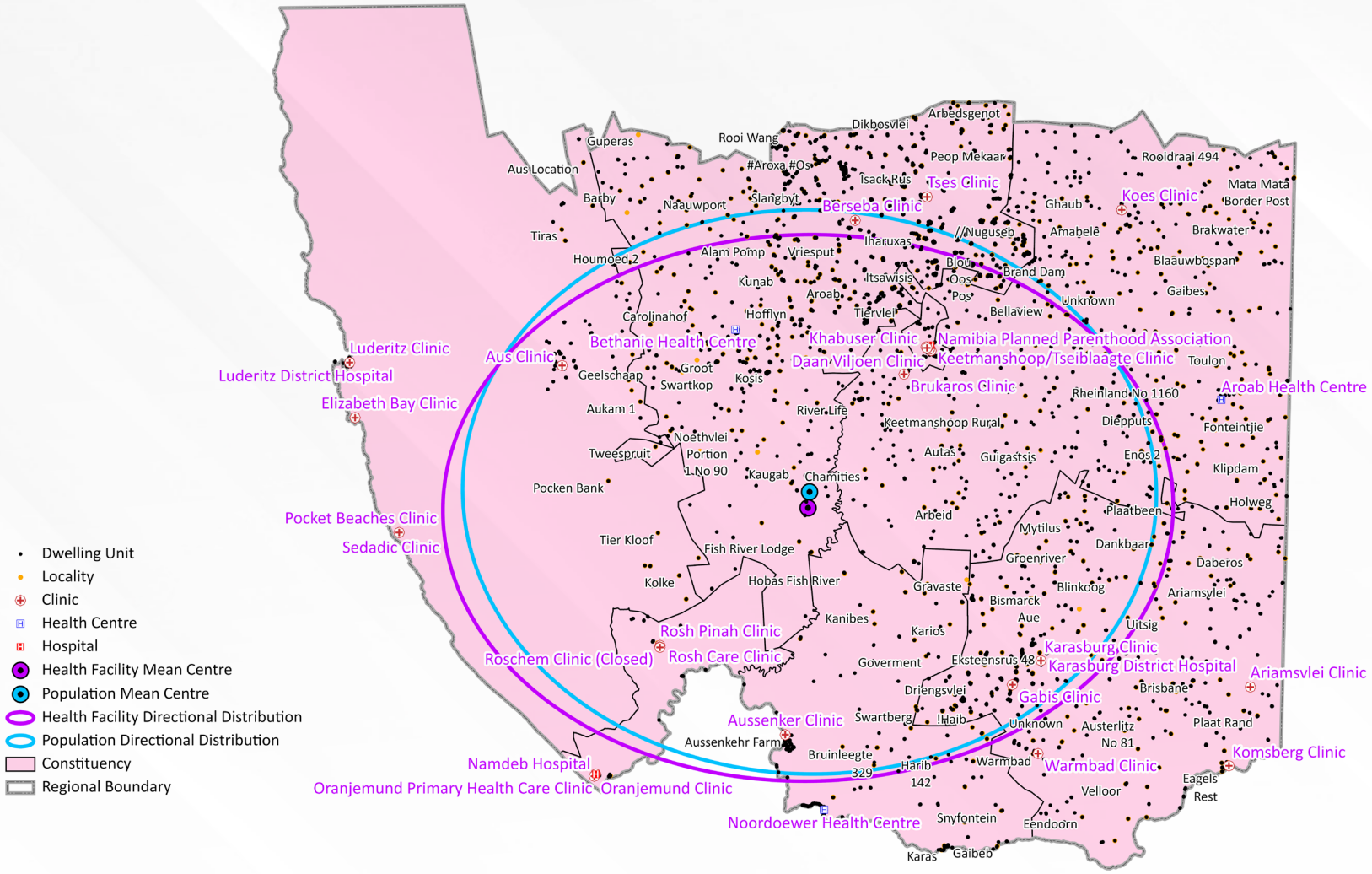
The map shows the **directional distribution** of health facilities and the population in Namibia, highlighting their orientation and direction. Both distributions follow a **North to South** direction, with health facilities oriented at **20.4 degrees**, covering **405 facilities** serving **2 531 477 persons**, and the population oriented at **7.1 degrees**, covering **2 269 294 persons** with **350 health facilities.**

Table 4.1 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North East – South West	20.4	405 Health Facilities covering 2 531 477 persons
Population	North – South	7.1	2 269 294 persons with a total count of 350 Health Facilities

4.2. //Kharas Region

Figure 4.2 1 Directional Distribution of Health Facilities and Population



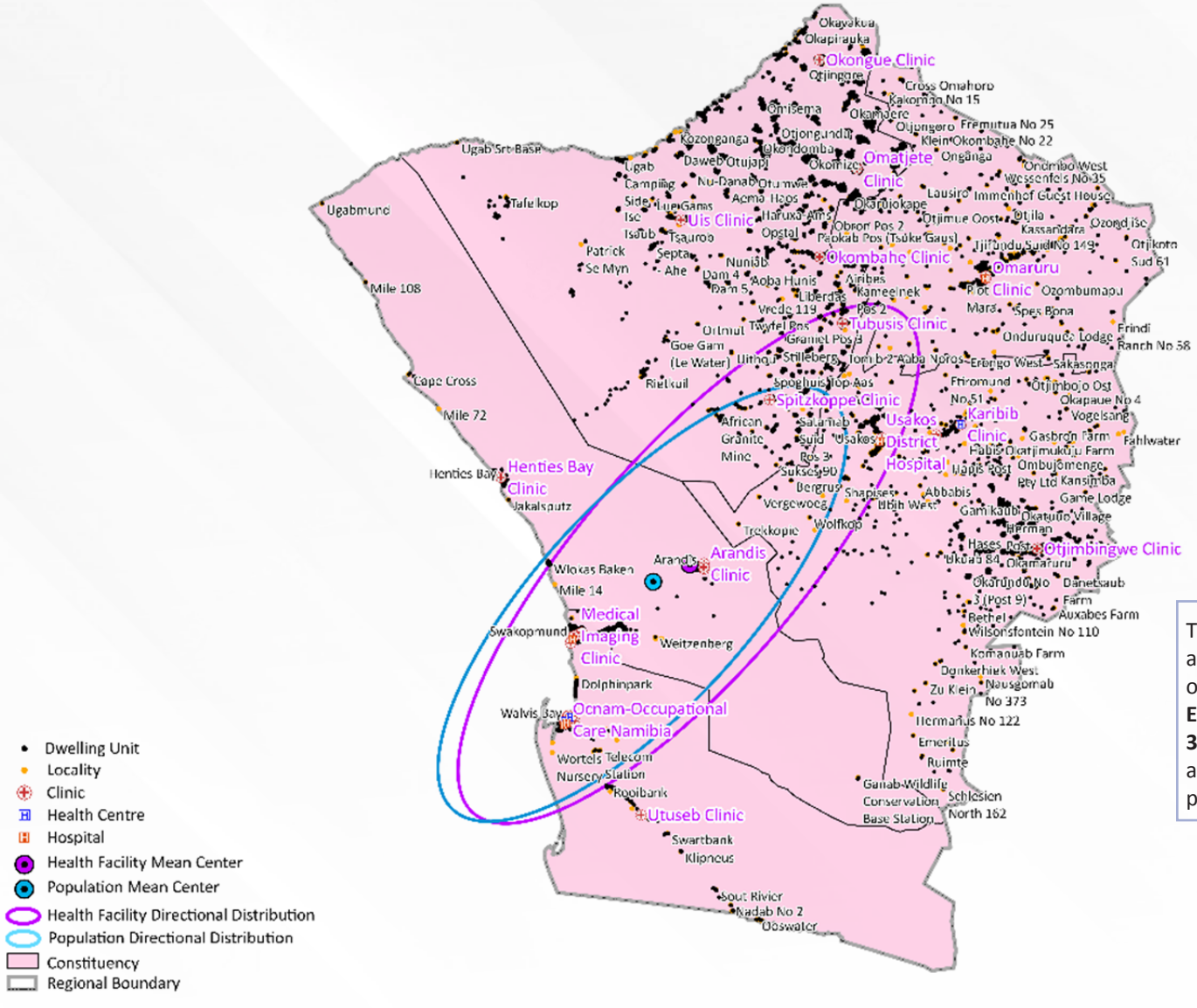
The map shows the **directional distribution** of health facilities and the population in the // Kharas Region, highlighting their orientation and direction. Both distributions followed an **East to West** direction, with health facilities oriented at **89.1 degrees**, covering **17 facilities** serving **63 692 persons,** and the population oriented at **91.3 degrees**, covering **65 143 persons** with **18 health facilities.**

Table 4.2 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	East to West	89.1	17 Health Facilities covering 63 692 persons
Population	East to West	91.3	65 143 persons with a total count of 18 Health Facilities

4.3. Erongo Region

Figure 4.3 1 Directional Distribution of Health Facilities and Population



The map shows the **directional distribution** of health facilities and the population in the Erongo Region, highlighting their orientation and direction. Both distributions followed a **North East to South West** direction, with health facilities oriented at **37.4 degrees**, covering **40 facilities** serving **192 716 persons**, and the population oriented at 38.9 degrees, covering **185 701** persons with **36 health facilities.**

Table 4.3 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North East – South West	37.4	40 Health Facilities covering 192 716 persons
Population	North East – South West	38.9	185 701 persons with a total count of 36 Health Facilities.

4.4. Hardap Region

Figure 4.4 1 Directional Distribution of Health Facilities and Population

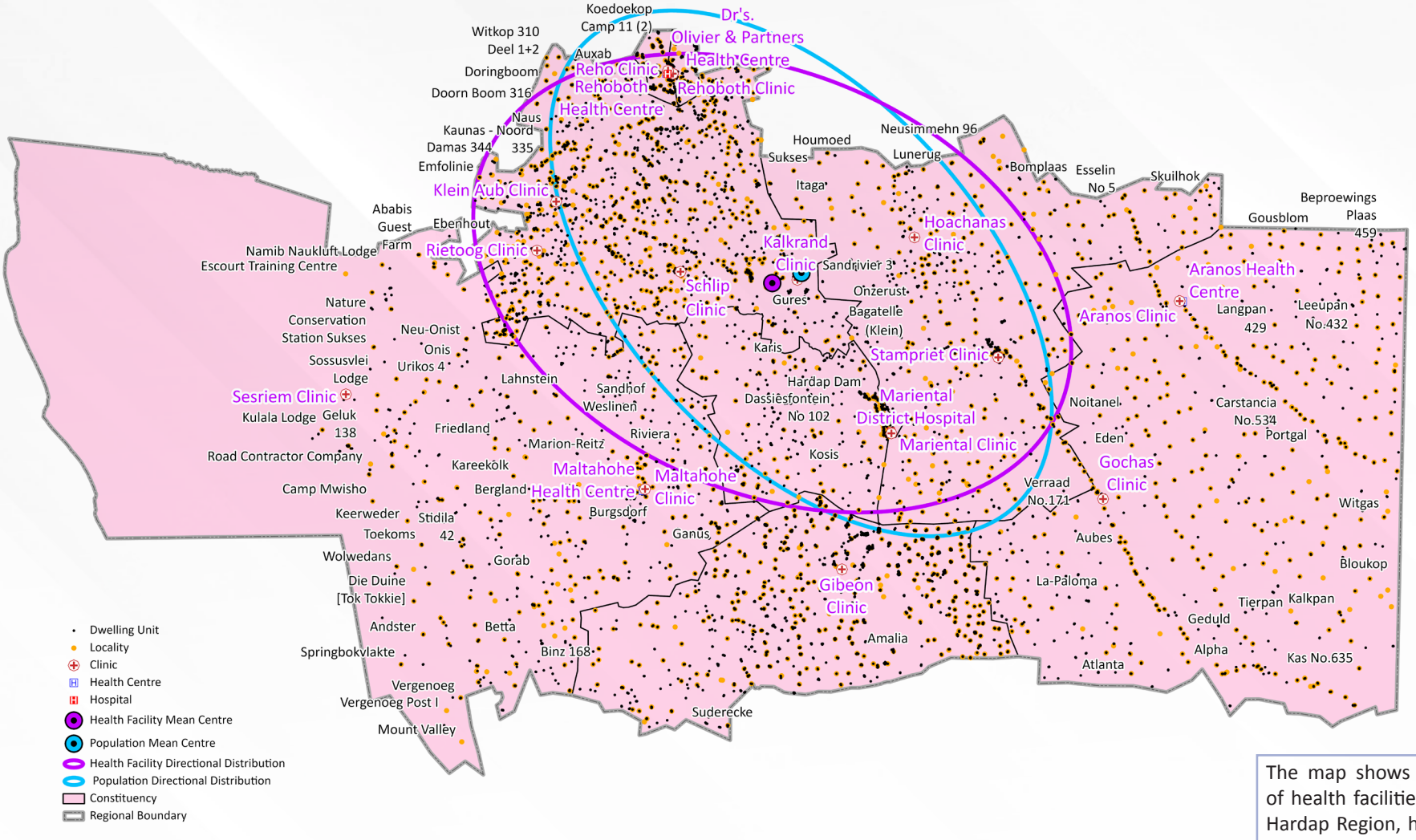


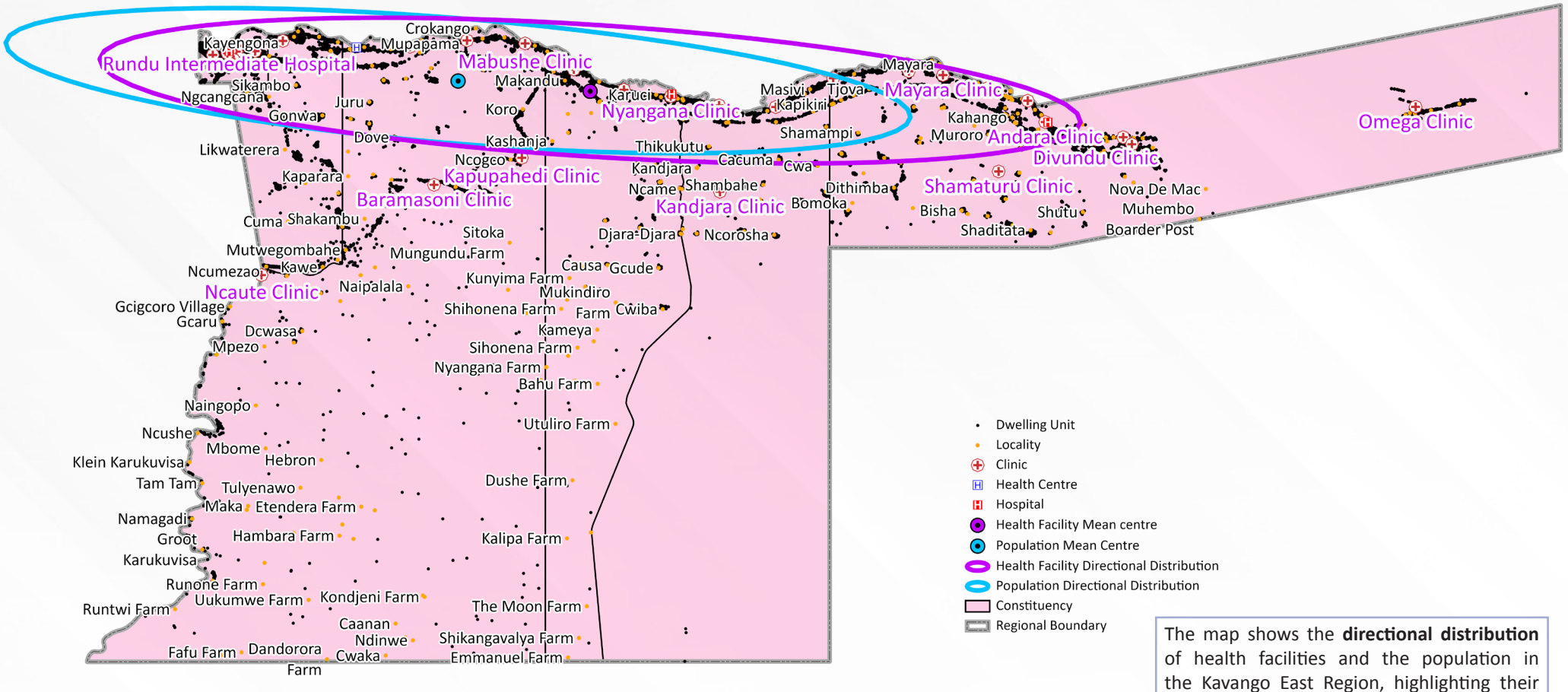
Table 4.4 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West – South East	113.6	14 Health Facilities covering 80 642 persons
Population	North West – South East	137.6	78 838 persons with a total count of 12 Health Facilities

The map shows the directional distribution of health facilities and the population in the Hardap Region, highlighting their orientation and direction. Both distributions followed a North West to South East direction, with health facilities oriented at 113.6 degrees, covering 14 facilities serving 80 642 persons, and the population oriented at 38.9 degrees, covering 78 838 persons with 12 health facilities.

4.5. Kavango East Region

Figure 4.5 1 Directional Distribution of Health Facilities and Population



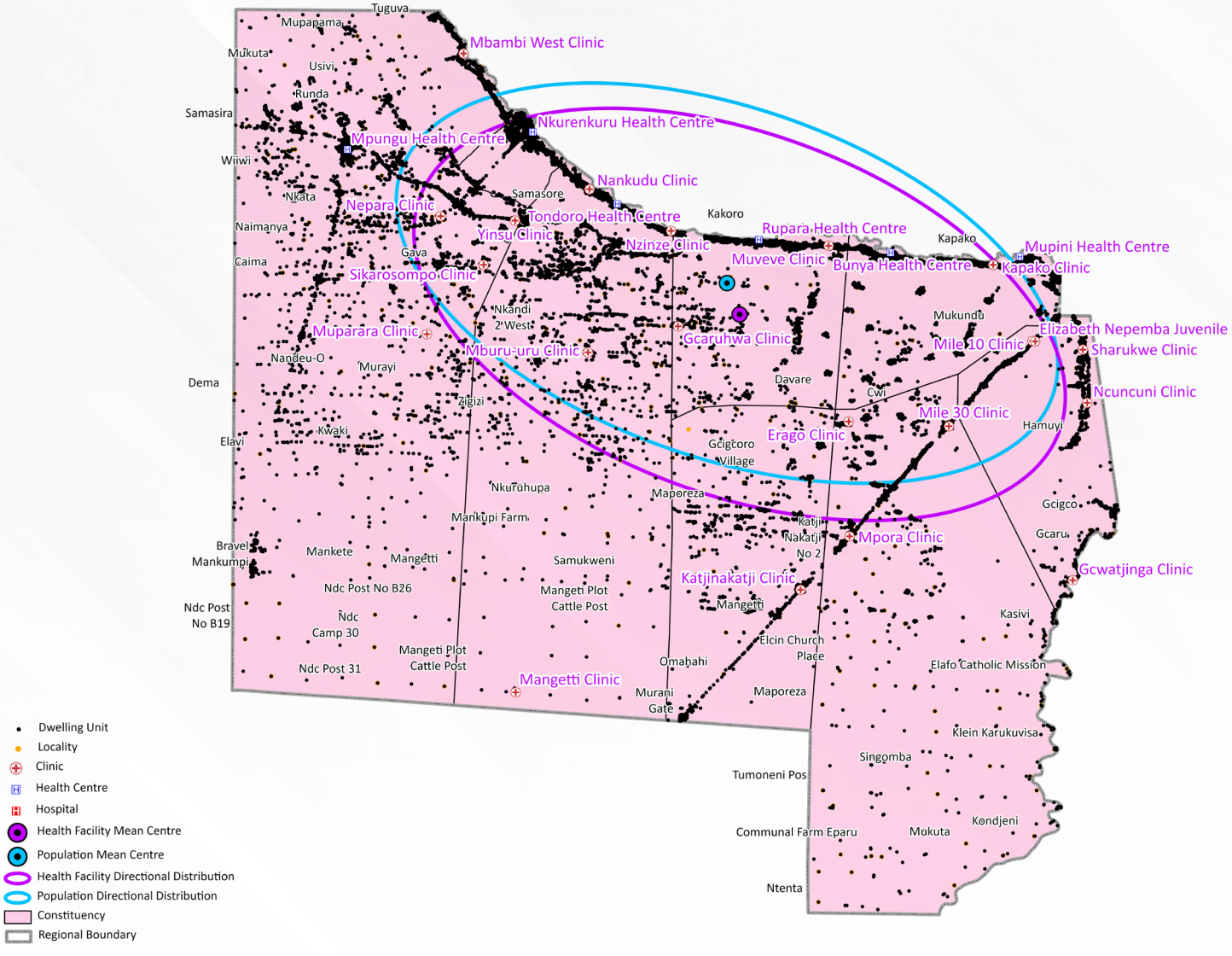
The map shows the **directional distribution** of health facilities and the population in the Kavango East Region, highlighting their orientation and direction. Both distributions followed an **East to West** direction, with health facilities oriented at **93.7 degrees**, covering **31 facilities** serving **190 457 persons**, and the population oriented at **95.9 degrees**, covering **172 052 persons** with **25 health facilities.**

Table 4.5 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	East - West	93.7	31 Health Facilities covering 190 457
Population	East - West	95.9	172 052 persons with a total count of 25 Health Facilities

4.6. Kavango West Region

Figure 4.6 1 Directional Distribution of Health Facilities and Population



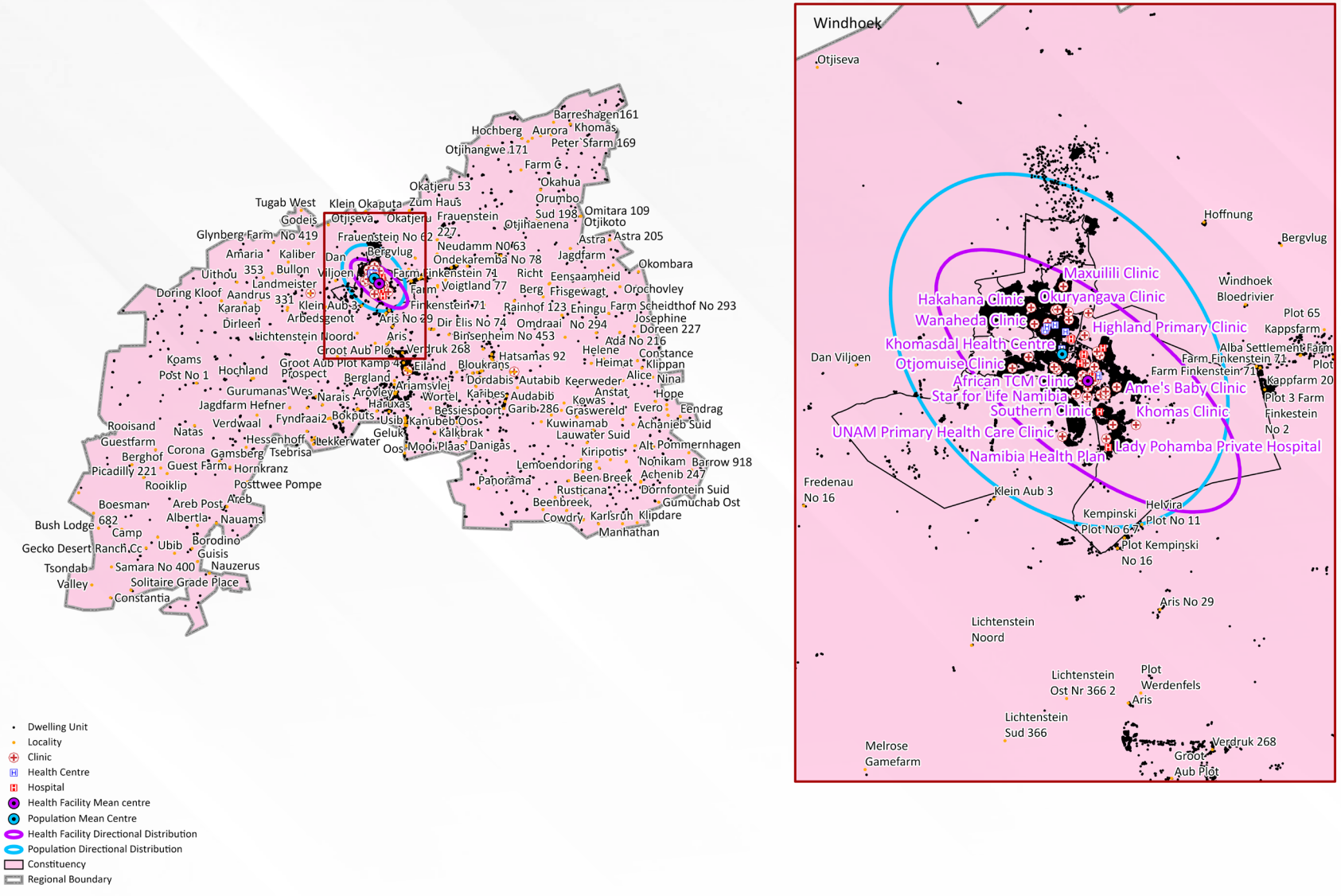
The map shows the **directional distribution** of health facilities and the population in the Kavango West Region, highlighting their orientation and direction. Both distributions followed a **North West to South East** direction, with health facilities oriented at **110.0 degrees,** covering 18 facilities serving **76 858 persons**, and the population oriented at **109.0 degrees**, covering **78 682 persons** with **18 health facilities.**

Table 4.6 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West - South East	110.0	18 Health Facilities covering 76 858 persons
Population	North West - South East	109.0	78 682 persons with a total count of 18 Health Facilities

4.7. Khomas Region

Figure 4.7 1 Directional Distribution of Health Facilities and Population



- Dwelling Unit
- Locality
- Clinic
- Health Centre
- Hospital
- Health Facility Mean centre
- Population Mean Centre
- Health Facility Directional Distribution
- Population Directional Distribution
- Constituency
- Regional Boundary

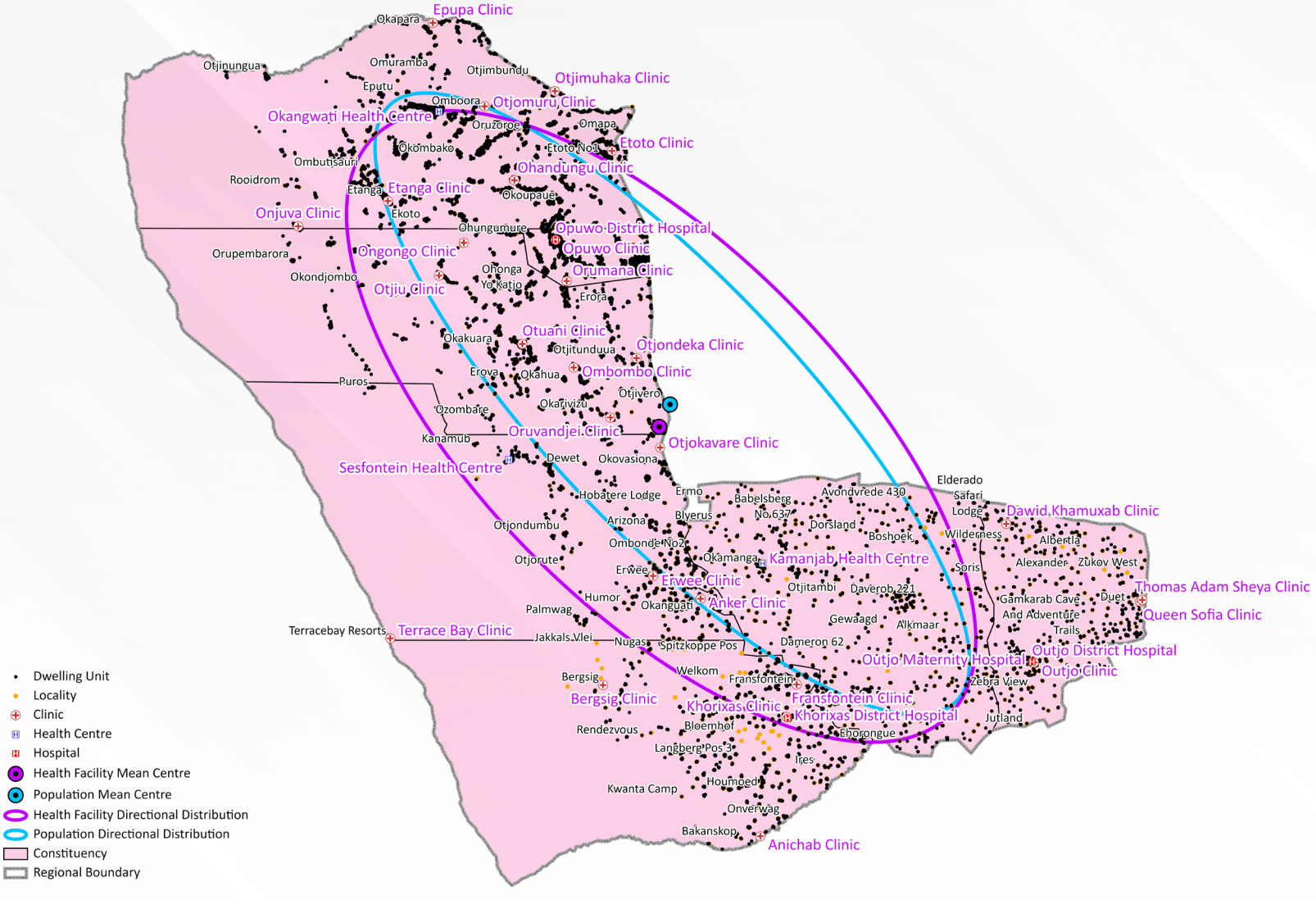
The map shows the **directional distribution** of health facilities and the population in the Khomas Region, highlighting their orientation and direction. Both distributions followed a **North West to South East** direction, with health facilities oriented at **129.1 degrees**, covering **56 facilities** serving **463 461 persons**, and the population oriented at **145.7 degrees**, covering **468 152 persons** with **56 health facilities.**

Table 4.7 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West - South East	129.1	56 Health Facilities covering 463 461 persons
Population	North West - South East	145.7	468 152 persons with a total count of 56 Health Facilities

4.8. Kunene Region

Figure 4.8 1 Directional Distribution of Health Facilities and Population



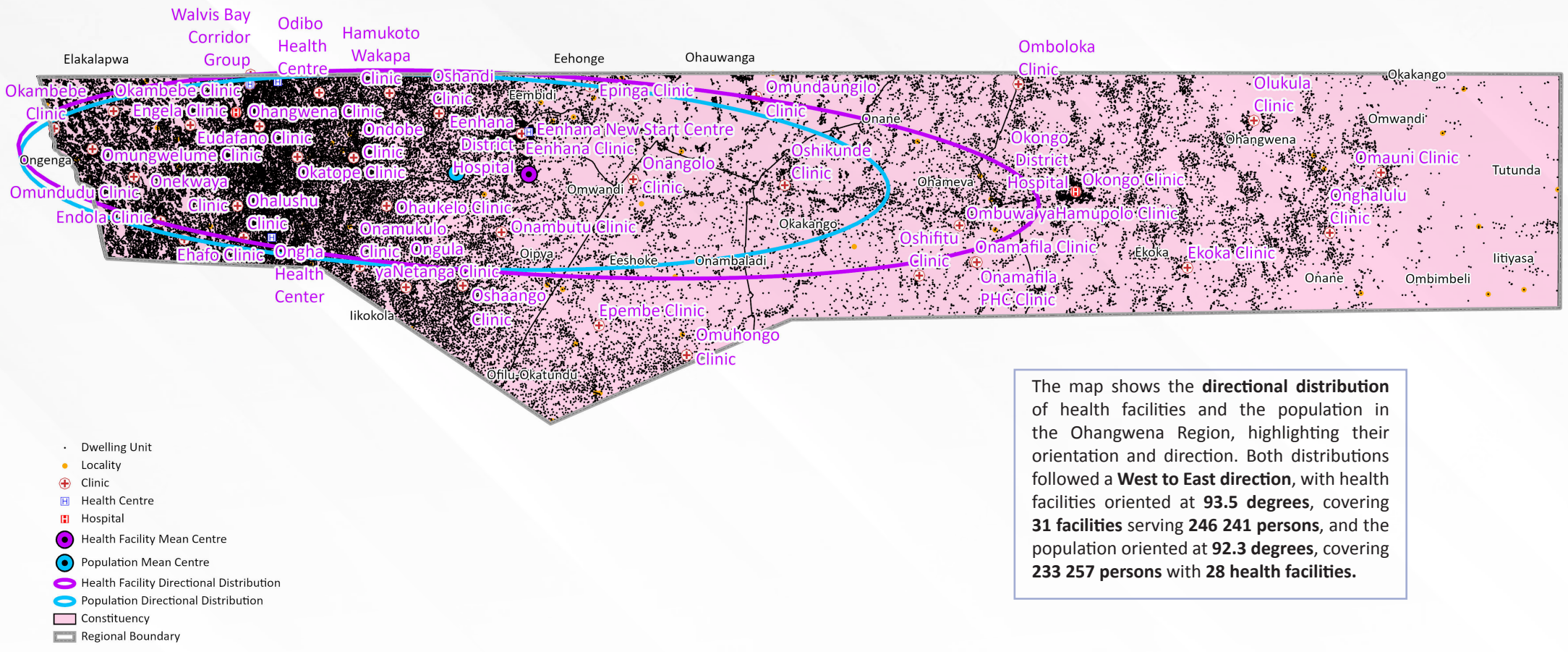
The map shows the **directional distribution** of health facilities and the population in the Kunene Region, highlighting their orientation and direction. Both distributions followed a **North West to South East** direction, with health facilities oriented at **136.4 degrees**, covering **20 facilities** serving **82 885 persons,** and the population oriented at **137.4 degrees**, covering **65 331 persons** with **15 health facilities.**

Table 4.8 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West – South East	136.4	20 Health Facilities covering 82 885 persons
Population	North West – South East	137.4	65 331 persons with a total count of 15 Health Facilities

4.9. Ohangwena Region

Figure 4.9 1 Directional Distribution of Health Facilities and Population



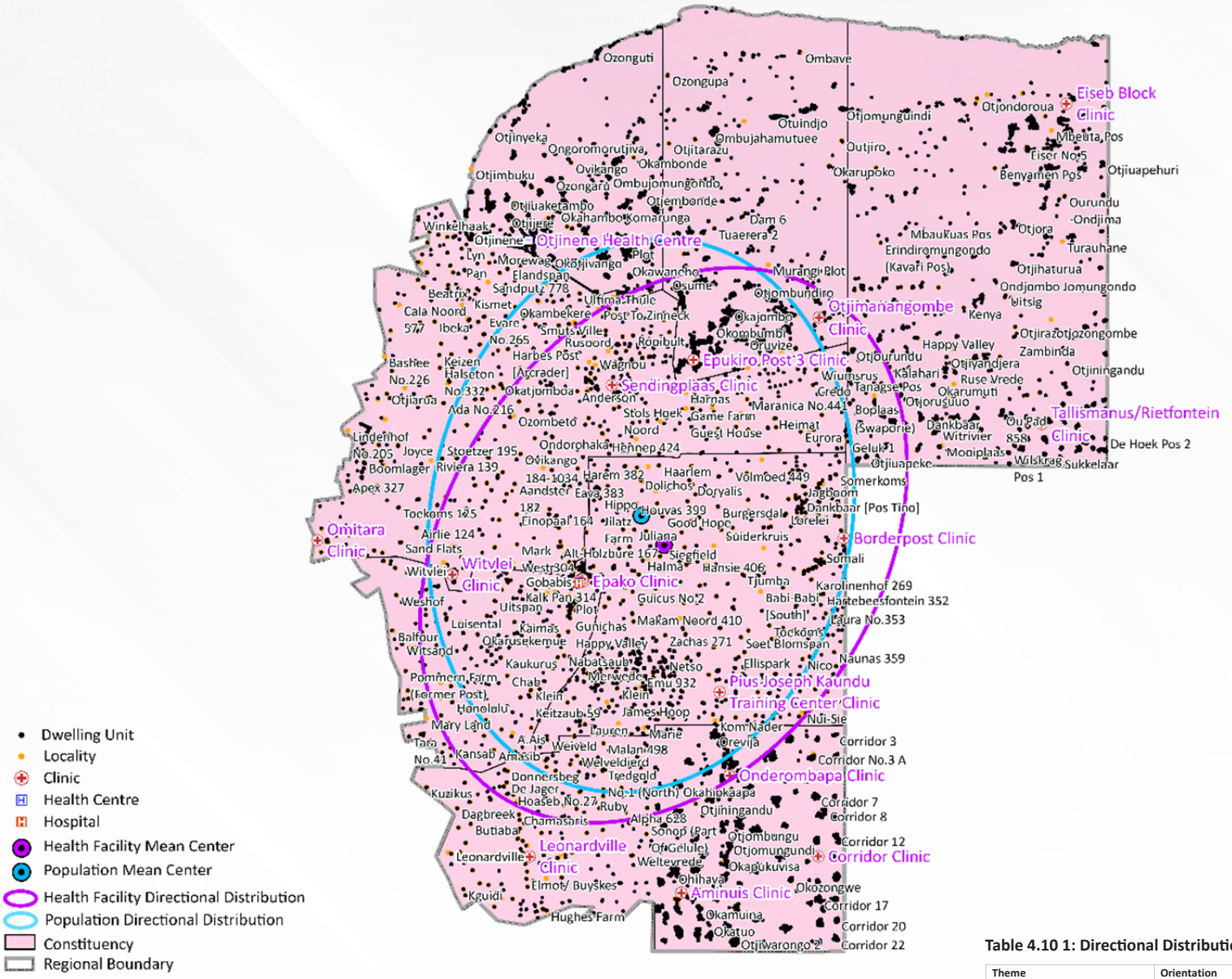
The map shows the **directional distribution** of health facilities and the population in the Ohangwena Region, highlighting their orientation and direction. Both distributions followed a **West to East direction**, with health facilities oriented at **93.5 degrees**, covering **31 facilities** serving **246 241 persons**, and the population oriented at **92.3 degrees**, covering **233 257 persons** with **28 health facilities.**

Table 4.9 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	West- East	93.5	31 Health facilities covering 246 241 persons
Population	West- East	92.3	233 257 persons with a total count of 28 Health Facilities

4.10. Omaheke Region

Figure 4.10 1 Directional Distribution of Health Facilities and Population



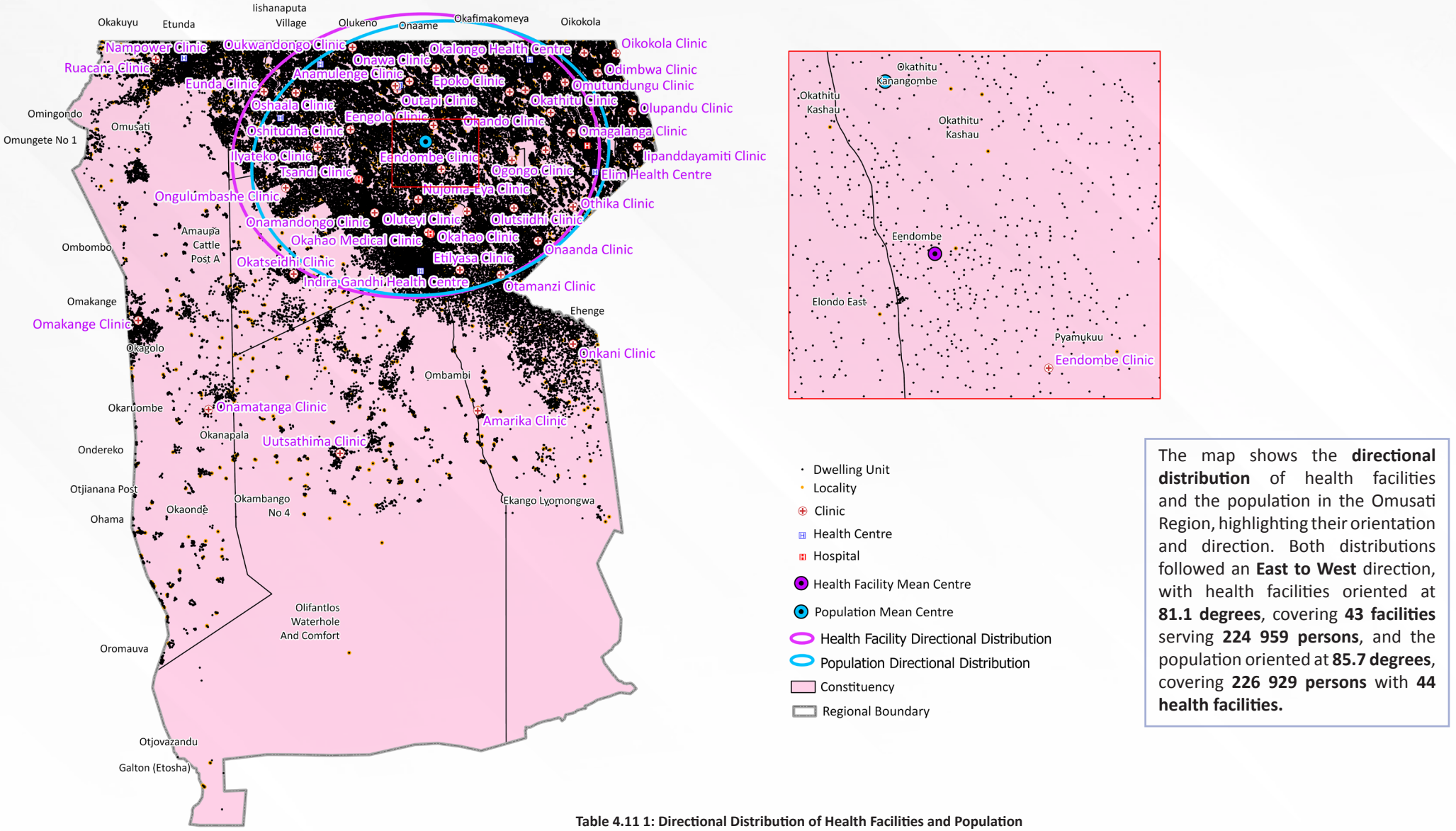
The map shows the **directional distribution** of health facilities and the population in the Omaheke Region, highlighting their orientation and direction. The Health Facilities distribution followed a **North East to South West** direction, with health facilities oriented at **28.2 degrees**, covering **15 facilities** serving **64 560 persons**, while the population followed a North to South distribution oriented at **9.0 degrees**, covering **63 212 persons** with **13 health facilities.**

Table 4.10 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North East – South West	28.2	15 Health Facilities covering 64 560 persons
Population	North - South	9.0	63 212 persons with a total count of 13 Health Facilities

4.11. Omusati Region

Figure 4.11 1 Directional Distribution of Health Facilities and Population



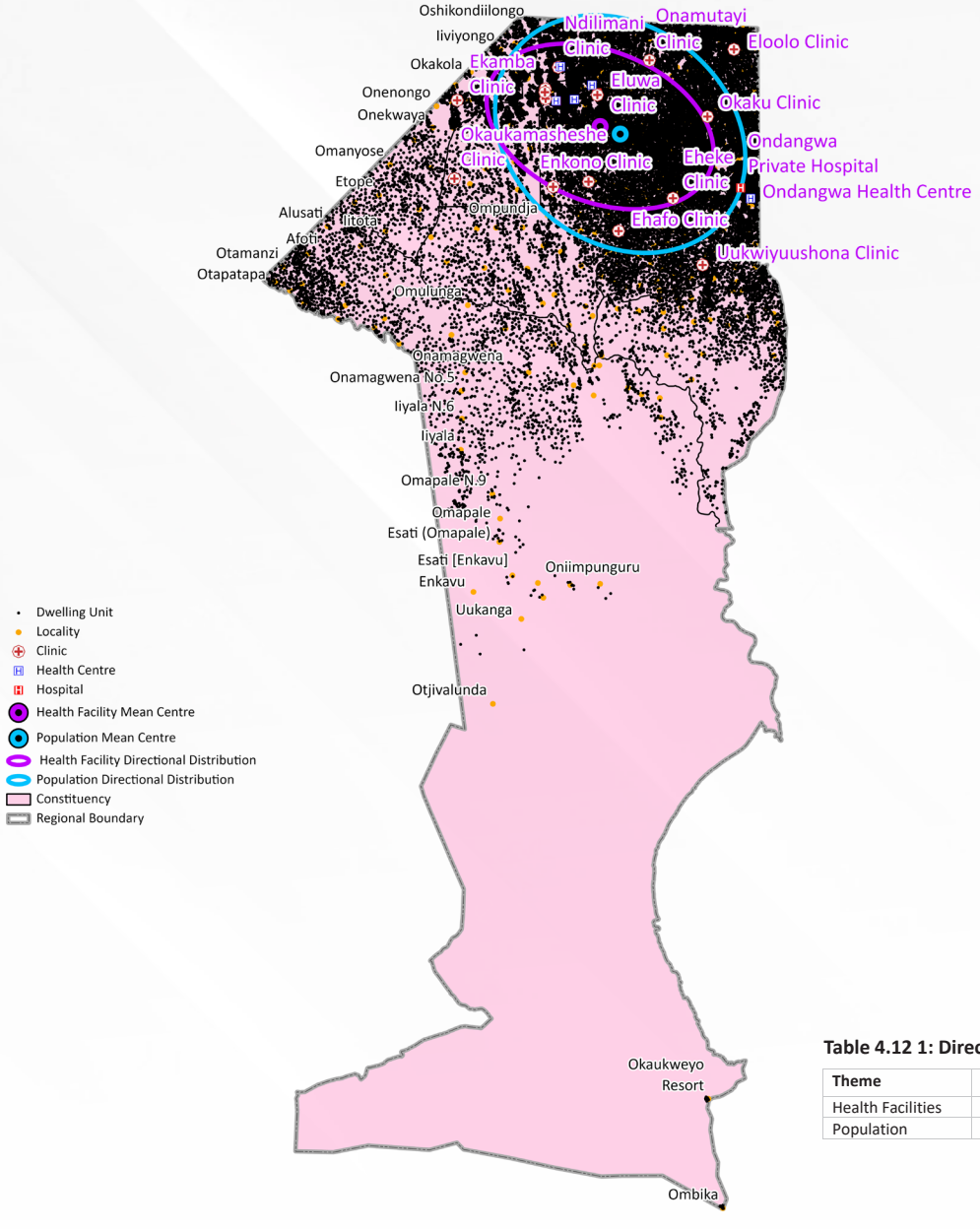
The map shows the **directional distribution** of health facilities and the population in the Omusati Region, highlighting their orientation and direction. Both distributions followed an **East to West** direction, with health facilities oriented at **81.1 degrees**, covering **43 facilities** serving **224 959 persons**, and the population oriented at **85.7 degrees**, covering **226 929 persons** with **44 health facilities.**

Table 4.11 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	East - West	81.1	43 Health Facilities covering 224 959 persons
Population	East - West	85.7	226 929 Persons with a total count of 44 Health Facilities

4.12. Oshana Region

Figure 4.12 1 Directional Distribution of Health Facilities and Population



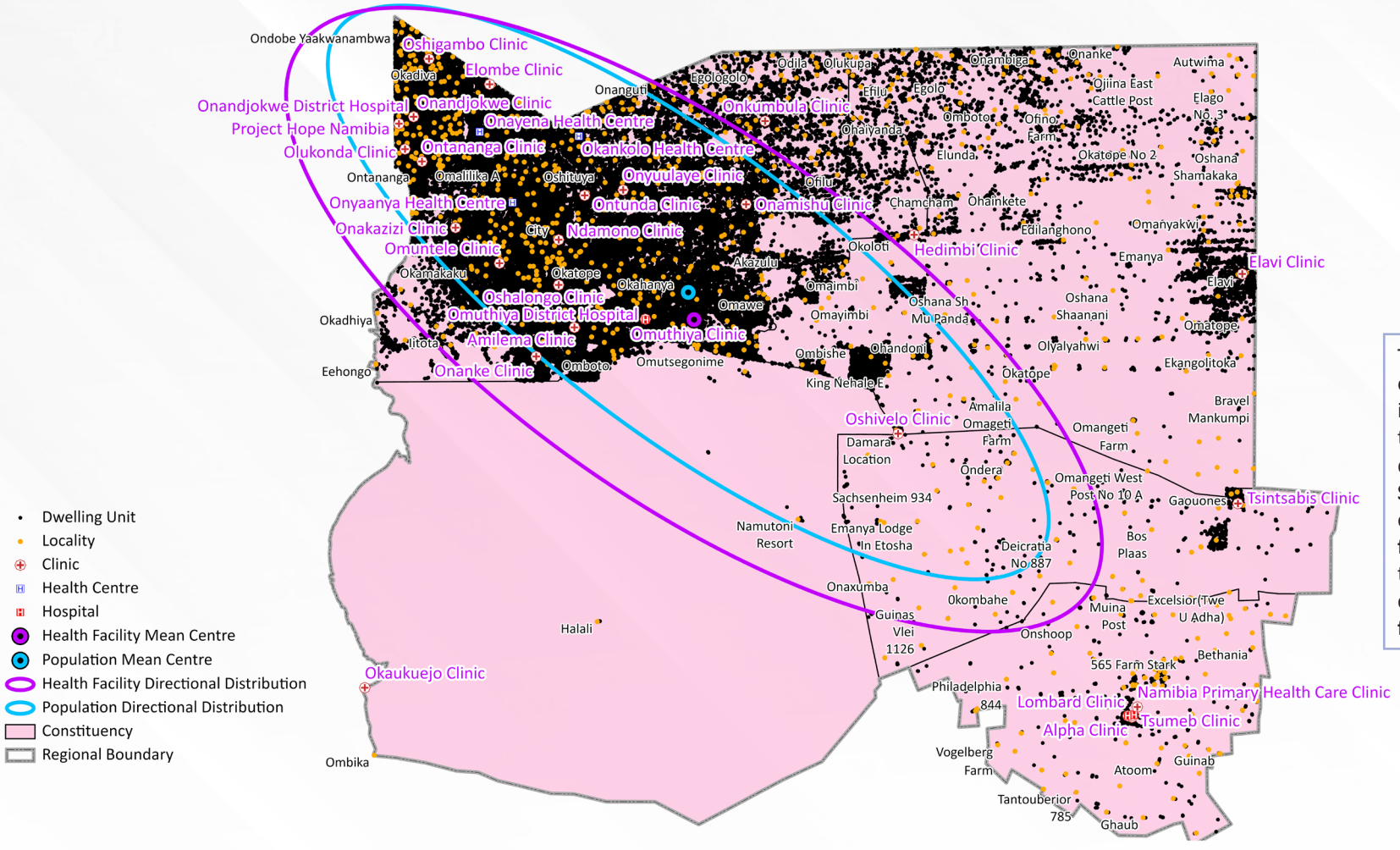
The map shows the directional distribution of health facilities and the population in the Oshana Region, highlighting their orientation and direction. Both distributions followed a North West to South East direction, with health facilities oriented at 111.9 degrees, covering 15 facilities serving 135 566 persons, and the population oriented at 127.8 degrees, covering 167 553 persons with 19 health facilities.

Table 4.12 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West – South East	111.9	15 Health Facilities covering 135 566 persons
Population	North West – South East	127.8	167 553 persons with a total count of 19 Health Facilities

4.13. Oshikoto Region

Figure 4.13 1 Directional Distribution of Health Facilities and Population



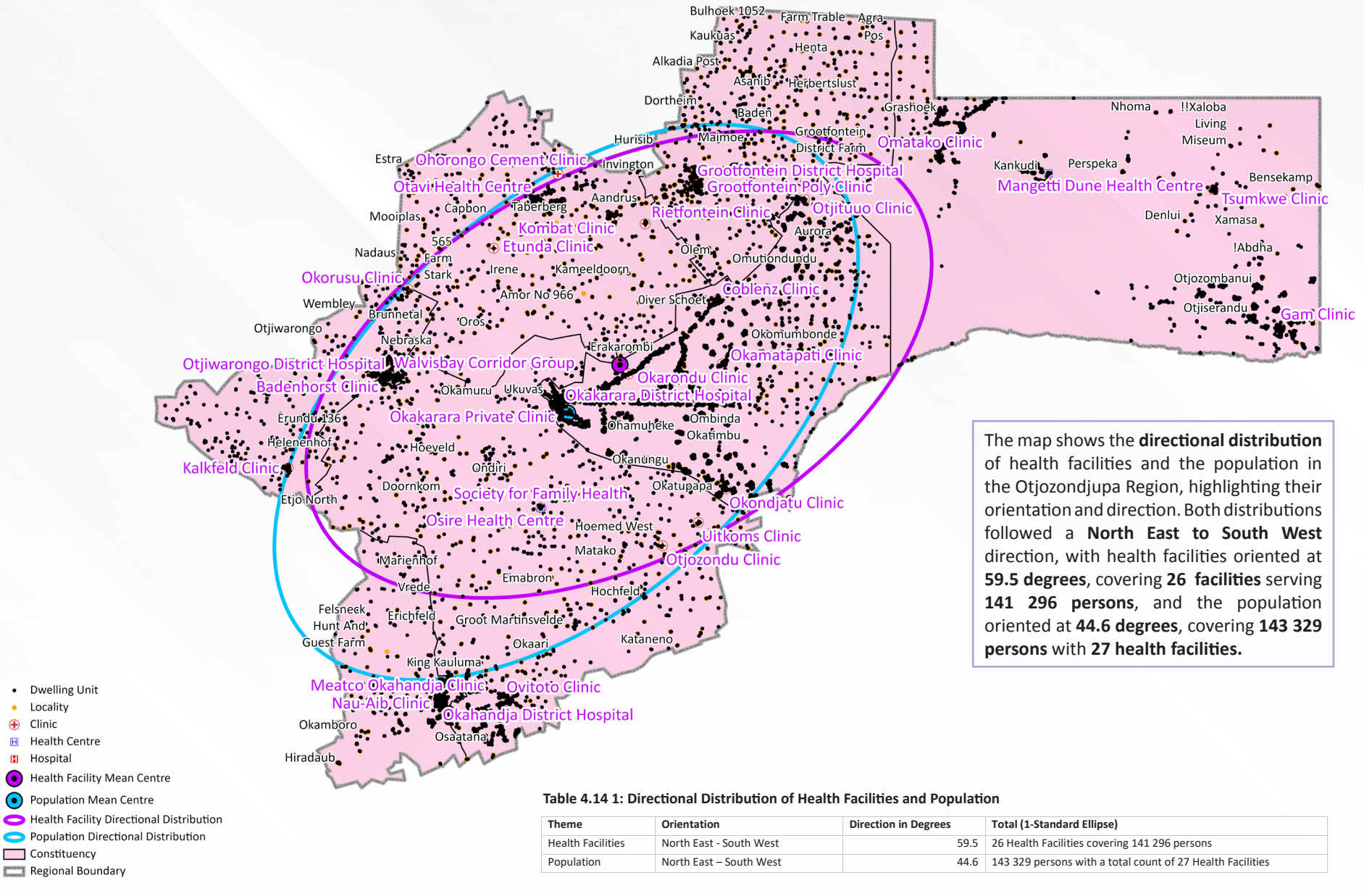
The map shows the **directional distribution** of health facilities and the population in the Oshikoto Region, highlighting their orientation and direction. Both distributions followed a **North West to South East** direction, with health facilities oriented at **124.7 degrees**, covering **23 facilities** serving **195 124 persons**, and the population oriented at **126.9 degrees**, covering **188 591 persons** with **22 health facilities.**

Table 4.13 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North West - South East	124.7	23 Health Facilities covering 195 124 persons
Population	North West - South East	126.9	188 591 persons with a total count of 22 Health Facilities

4.14. Otjozondjupa Region

Figure 4.14 1 Directional Distribution of Health Facilities and Population



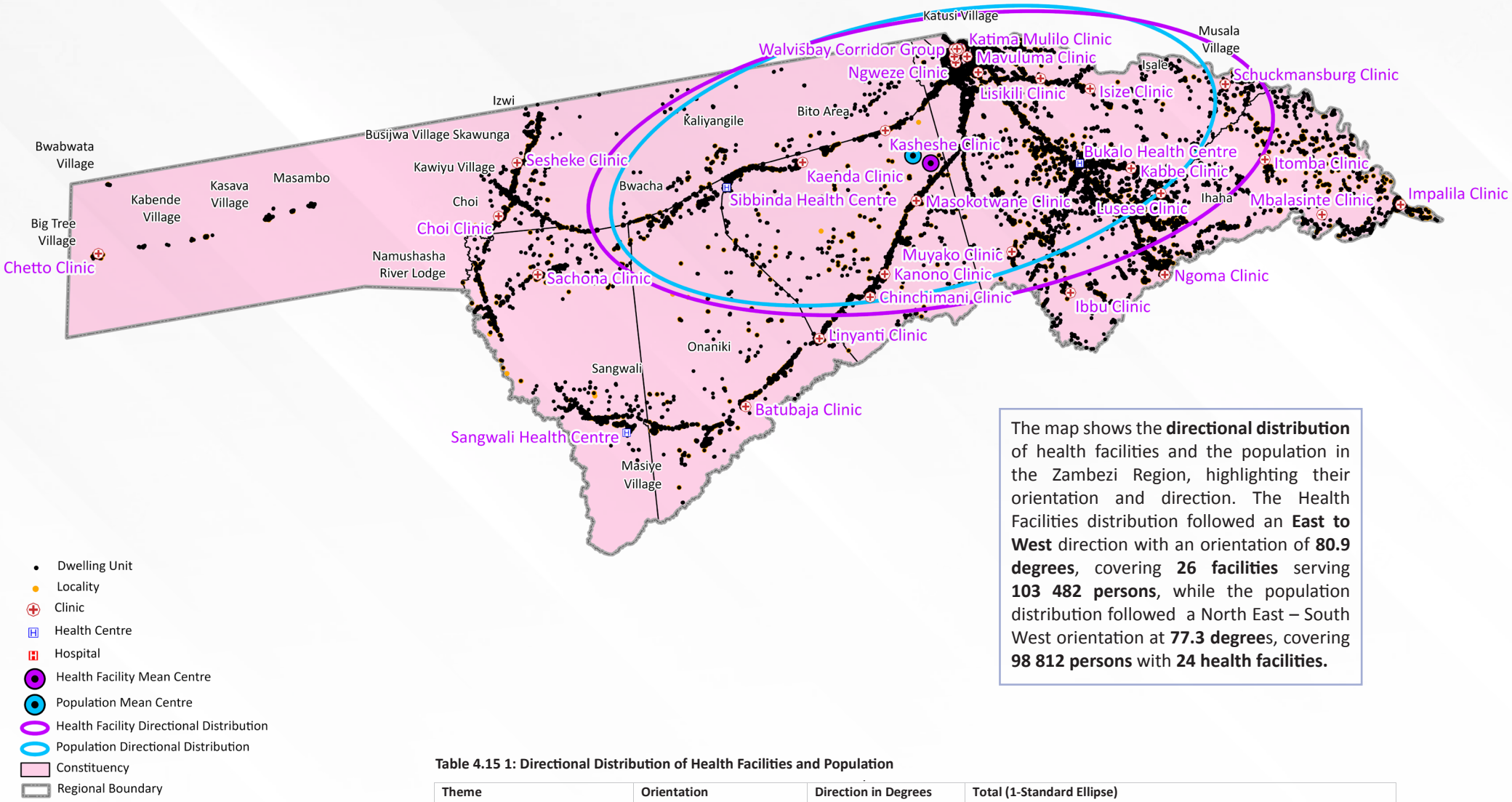
The map shows the **directional distribution** of health facilities and the population in the Otjozondjupa Region, highlighting their orientation and direction. Both distributions followed a **North East to South West** direction, with health facilities oriented at **59.5 degrees**, covering **26 facilities** serving **141 296 persons**, and the population oriented at **44.6 degrees**, covering **143 329 persons** with **27 health facilities.**

Table 4.14 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Health Facilities	North East - South West	59.5	26 Health Facilities covering 141 296 persons
Population	North East – South West	44.6	143 329 persons with a total count of 27 Health Facilities

4.15. Zambezi Region

Figure 4.15 1 Directional Distribution of Health Facilities and Population



The map shows the **directional distribution** of health facilities and the population in the Zambezi Region, highlighting their orientation and direction. The Health Facilities distribution followed an **East to West** direction with an orientation of **80.9 degrees**, covering **26 facilities** serving **103 482 persons**, while the population distribution followed a North East – South West orientation at **77.3 degrees**, covering **98 812 persons** with **24 health facilities.**

- Dwelling Unit
- Locality
- Clinic
- Health Centre
- Hospital
- Health Facility Mean Centre
- Population Mean Centre
- Health Facility Directional Distribution
- Population Directional Distribution
- Constituency
- Regional Boundary

Table 4.15 1: Directional Distribution of Health Facilities and Population

Theme	Orientation	Direction in Degrees	Total (1-Standard Ellipse)
Zambezi Health Facilities	East - West	80.9	26 Health Facilities covering 103 482 persons
Zambezi Population	North East - South West	77.3	98 812 persons with a total count of 24 Health Facilities



CHAPTER 5:
POPULATION PROXIMITY TO HEALTH FACILITIES

This chapter evaluates the proximity of geographically mapped health facilities to the location of people. The evaluation applies a geographic distance method to calculate a 10-kilometer distance buffer around a health facility. A buffer is a defined distance around one or more features. The population is derived by summing the number of persons within the defined buffer.

The World Health Organization (WHO) recommends that for optimal access, a person should live within a 5-kilometer radius to a health facility, however, because of the sparseness of Namibia, a 10-kilometer radius was used throughout this section. The National Demographic and Health Survey (NDHS) of 2000 used various distance thresholds of which the 10-kilometer distance was more pronounced. The survey revealed that about a quarter of Namibia's households lived within a 10-kilometer radius of a health facility. Therefore, the evaluation made in this section can be used to compare with previously conducted proximity assessments as a means to track progress.



5.1. National Population within a 10-kilometre Radius of a Health Facility

Figure 5.1 1 National Population within a 10-kilometre Radius of a Health Facility

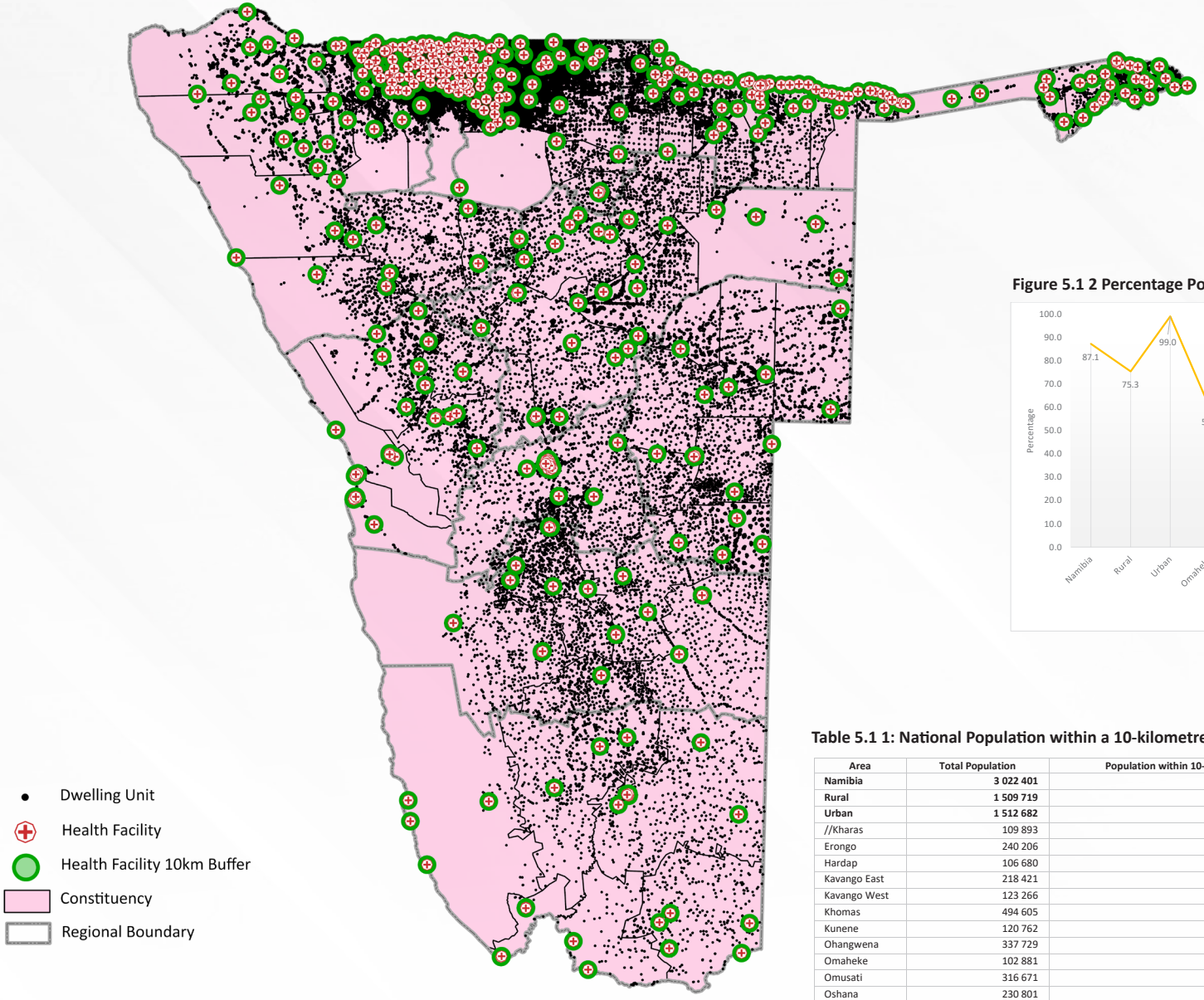


Figure 5.1 2 Percentage Population within a 10-kilometre Radius of a Health Facility

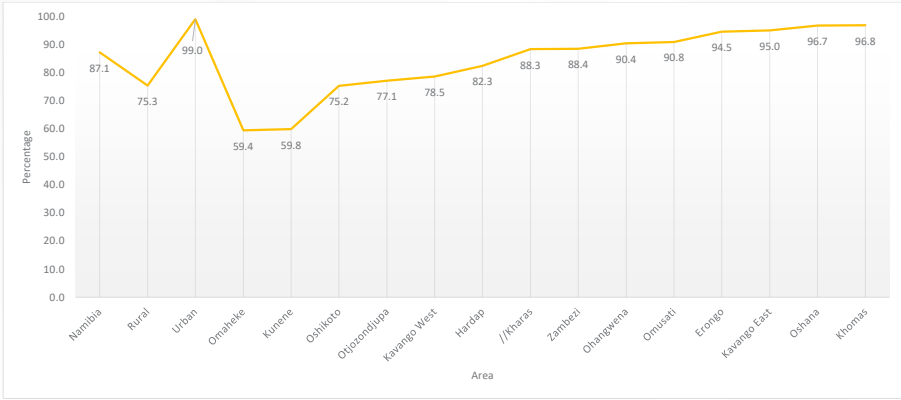


Table 5.1 1: National Population within a 10-kilometre Radius of a Health Facility

Area	Total Population	Population within 10-kilometres of a Health Facility	Percentage
Namibia	**3 022 401**	**2 633 726**	**87.1**
Rural	**1 509 719**	**1 136 746**	**75.3**
Urban	**1 512 682**	**1 496 980**	**99.0**
//Kharas	109 893	96 997	88.3
Erongo	240 206	226 883	94.5
Hardap	106 680	87 828	82.3
Kavango East	218 421	207 503	95.0
Kavango West	123 266	96 818	78.5
Khomas	494 605	478 789	96.8
Kunene	120 762	72 203	59.8
Ohangwena	337 729	305 222	90.4
Omaheke	102 881	61 106	59.4
Omusati	316 671	287 695	90.8
Oshana	230 801	223 088	96.7
Oshikoto	257 302	193 564	75.2
Otjozondjupa	220 811	170 165	77.1
Zambezi	142 373	125 865	88.4

The percentage population Namibia within the 10-kilometre radius was 87.1, with rural recording 75.3, while urban recorded 99.0. At regional level, Khomas had the highest percentage of the population covered within a 10-kilometre radius of a health facility at 96.8 percent while Omaheke and Kunene had the lowest at 59.4 and 59.8 percent respectively.

5.2. //Kharas Region

Figure 5.2 1 Population Proximity to Health Facilities

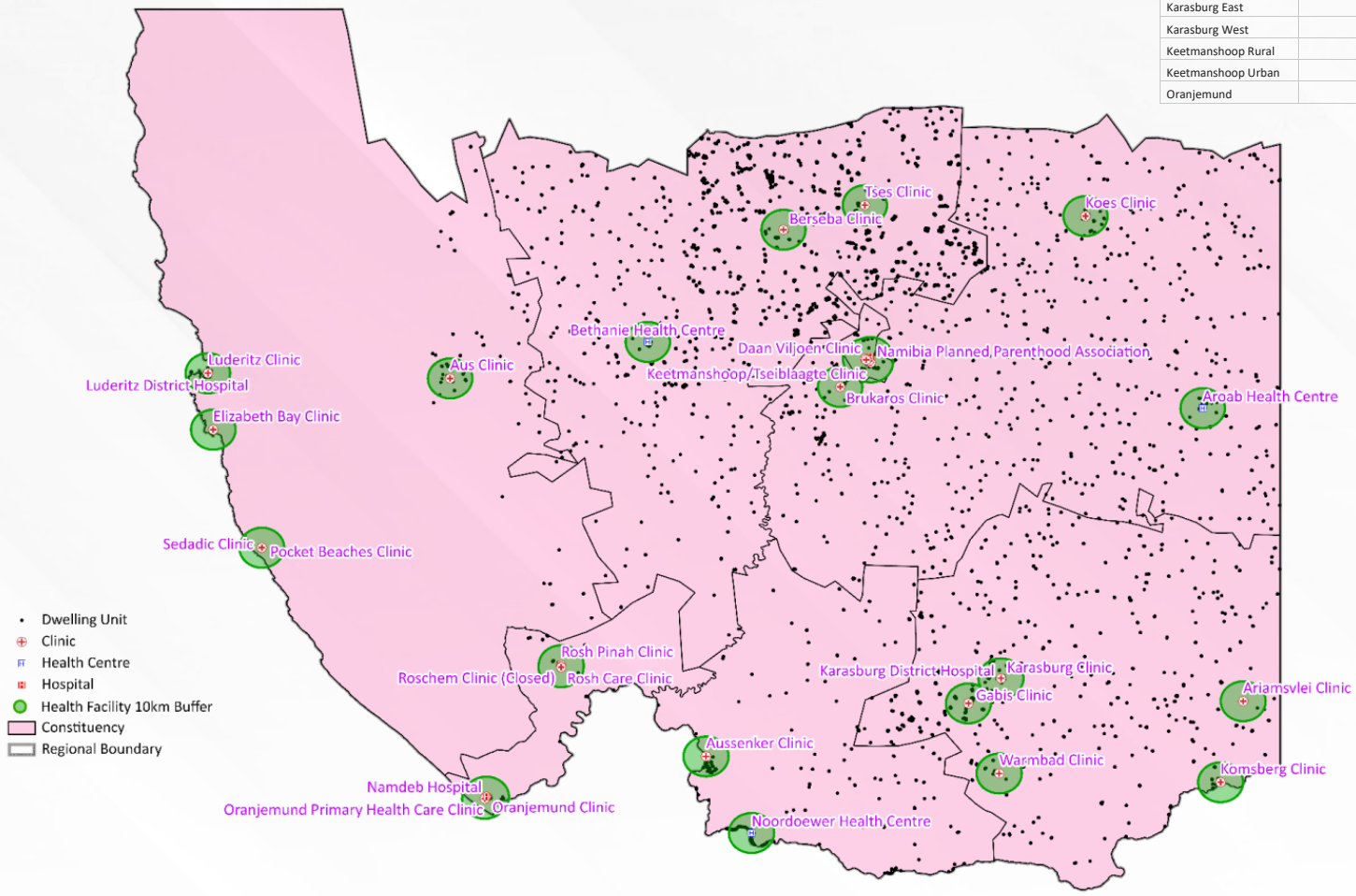
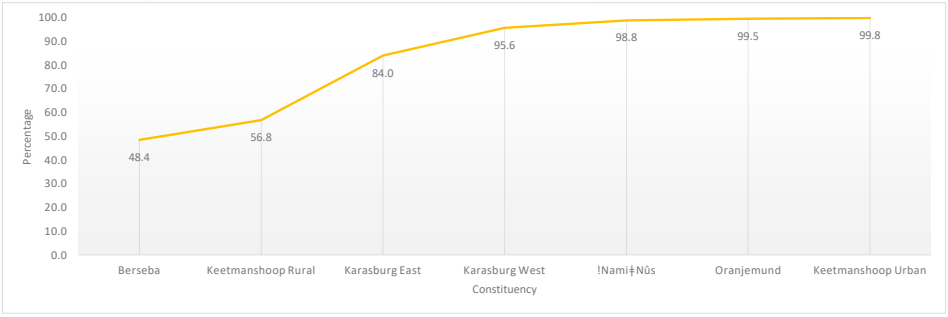


Table 5.2 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10-kilometres of a Health Facility	Percentage
!Nami‡Nûs	17 243	17 038	98.8
Berseba	11 258	5 453	48.4
Karasburg East	13 821	11 604	84.0
Karasburg West	17 741	16 966	95.6
Keetmanshoop Rural	8 744	4 963	56.8
Keetmanshoop Urban	27 862	27 812	99.8
Oranjemund	13 224	13 161	99.5

Keetmanshoop Urban Constituency had the highest percentage of the population covered within a 10-kilometre radius of a health facility at 99.8 percent while Berseba and Keetmanshoop Rural had the lowest at 48.4 and 56.8 percent respectively.

Figure 5.2 2 Percentage Population Proximity to Health Facilities



5.3. Erongo Region

Figure 5.3 1 Population Proximity to Health Facilities

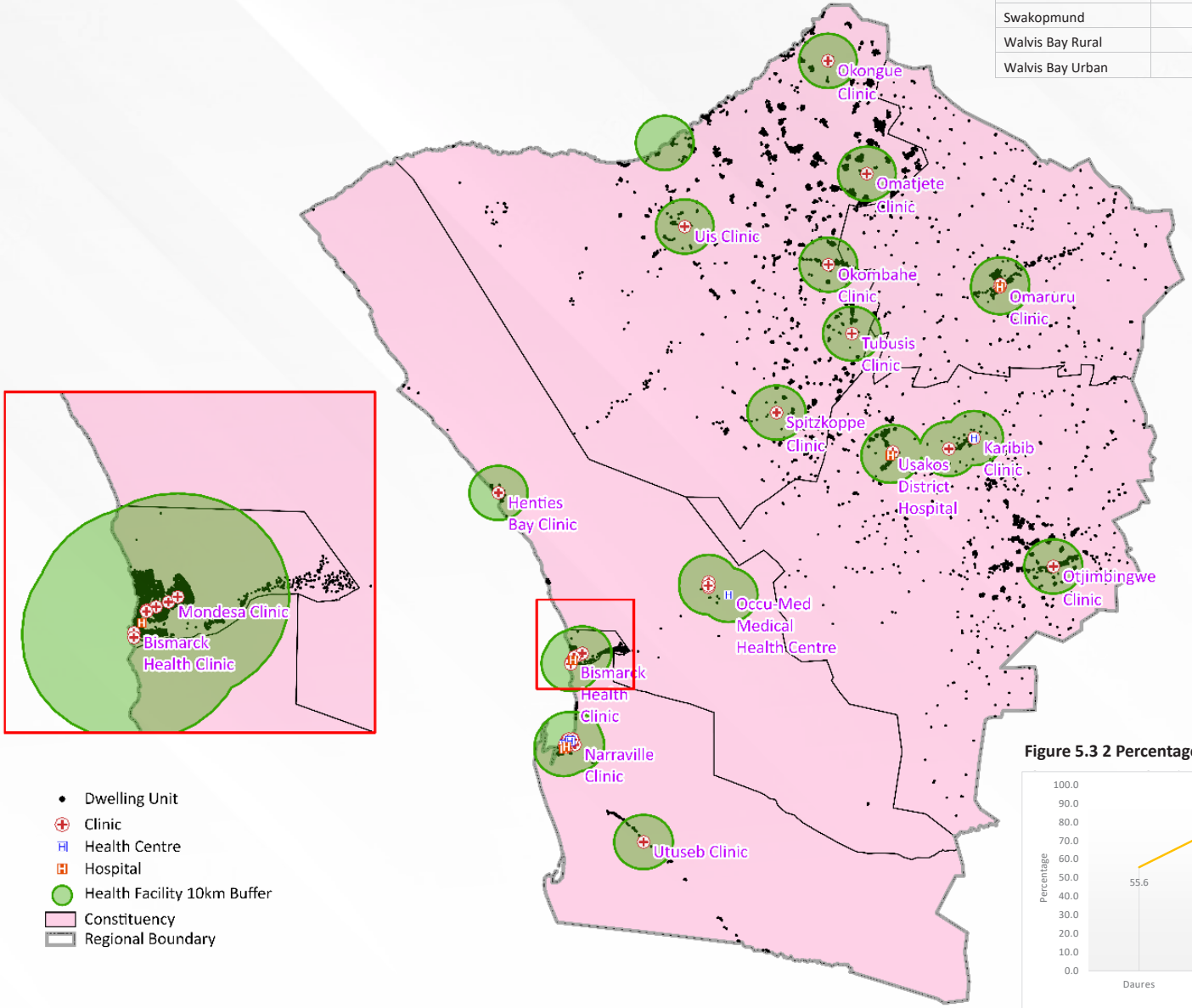
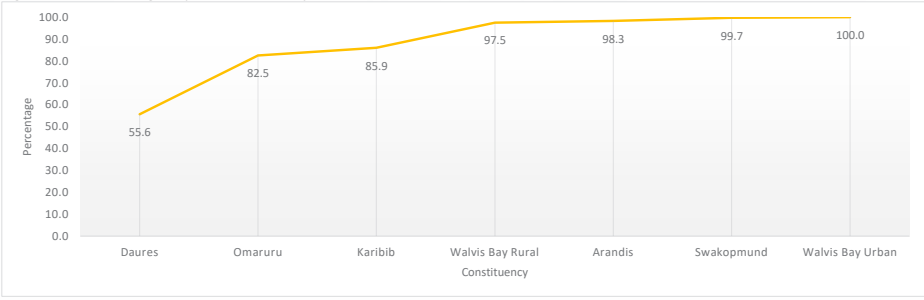


Table 5.3 1: Population Proximity to Health Facilities

Arandis	13 542	13 311	98.3
Daures	14 601	8 123	55.6
Karibib	19 705	16 935	85.9
Omaruru	13 322	10 996	82.5
Swakopmund	75 921	75 708	99.7
Walvis Bay Rural	51 497	50 192	97.5
Walvis Bay Urban	51 618	51 618	100.0

Walvis Bay Urban had the entire population within 10 kilometres of a health facility, while Daures had the lowest coverage, with only 55.6 percent of its population living close to a health facility.

Figure 5.3 2 Percentage Population Proximity to Health Facilities



5.4. Hardap Region

Figure 5.4 1 Population proximity to Health Facilities

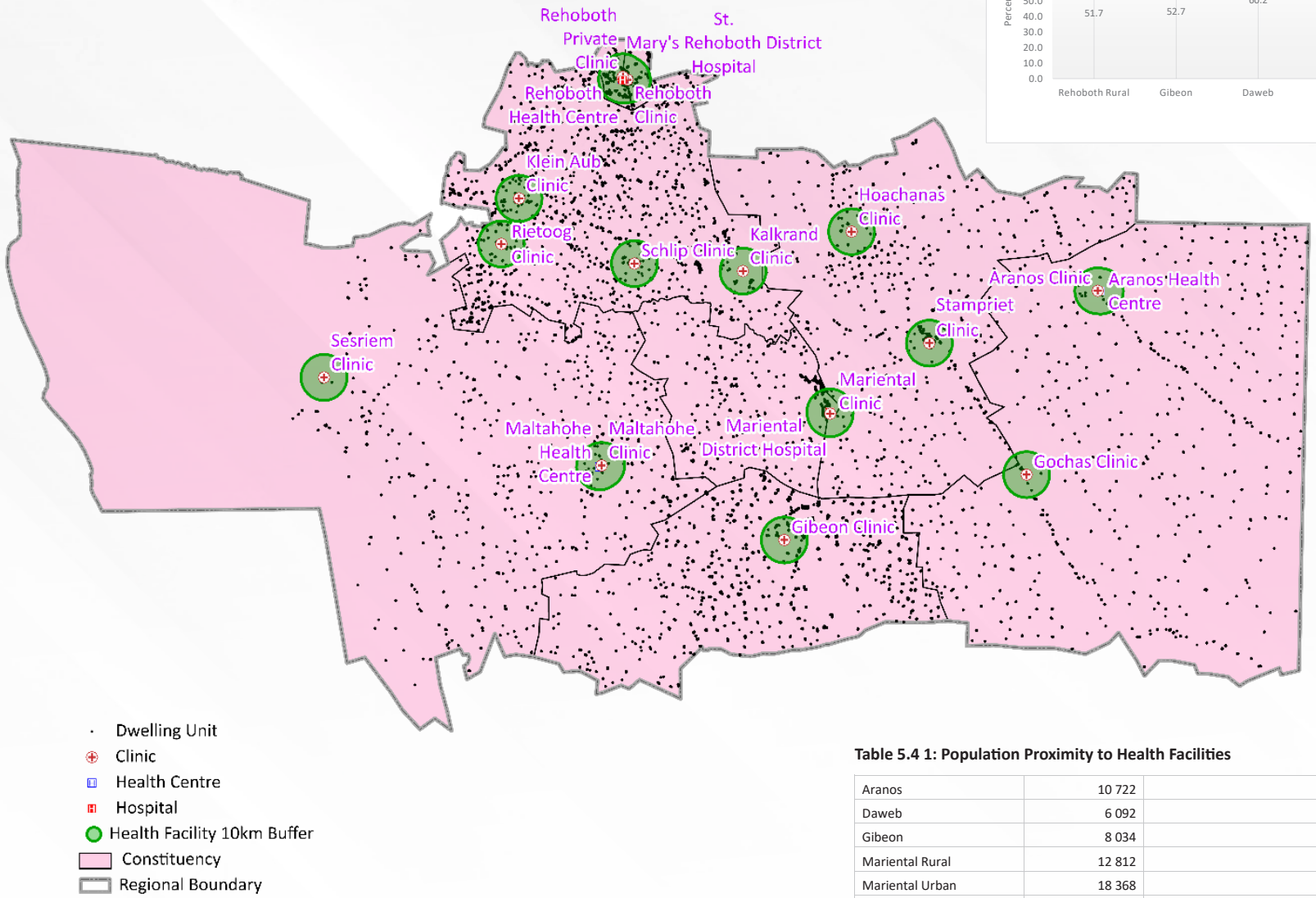
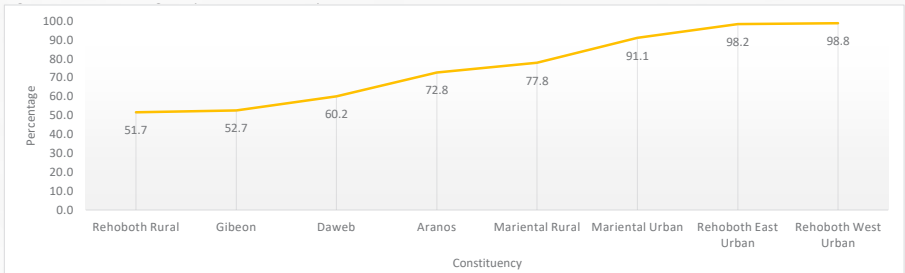


Figure 5.4 2 Percentage Population Proximity to Health Facilities



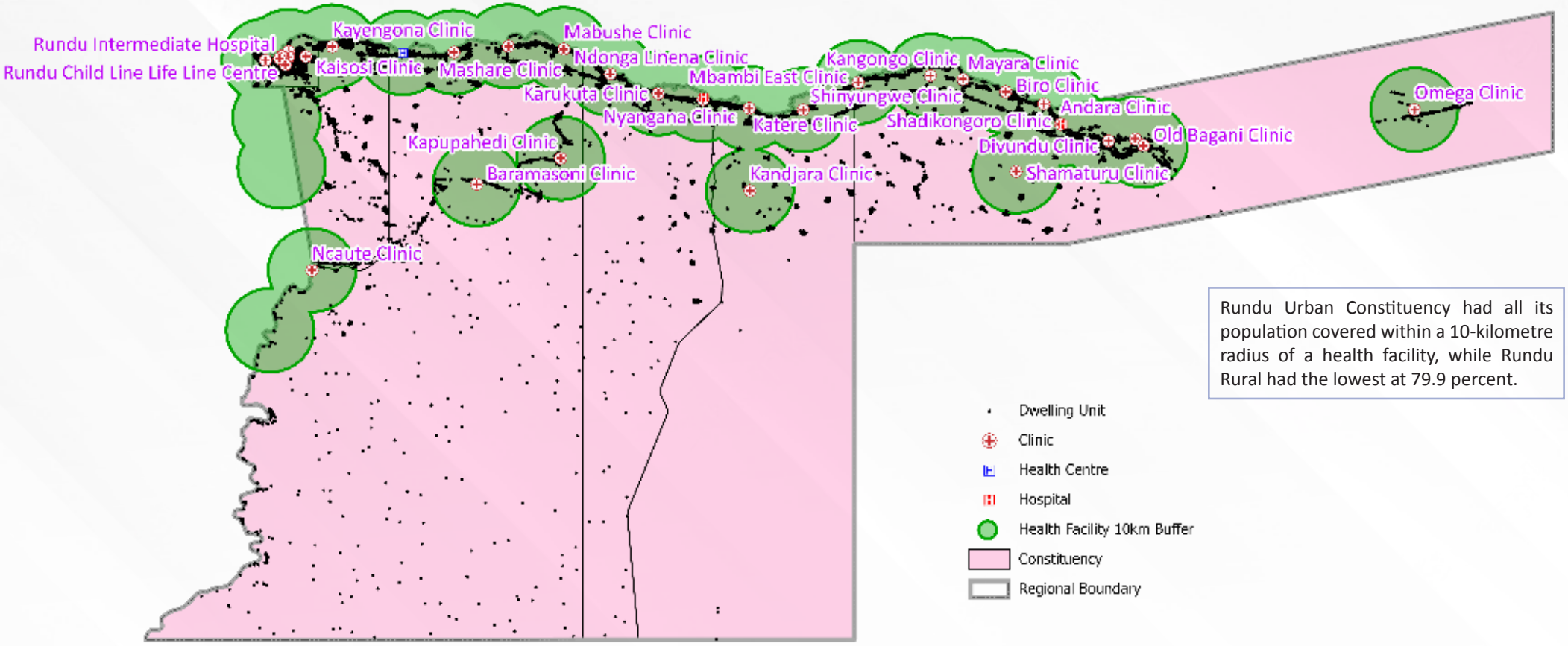
Rehoboth West Urban had the highest percentage of the population covered within a 10-kilometre radius of a health facility at 98.8 percent while Rehoboth Rural and Gibeon had the lowest at 51.7 and 52.7 percent respectively.

Table 5.4 1: Population Proximity to Health Facilities

Aranos	10 722	7 803	72.8
Daweb	6 092	3 667	60.2
Gibeon	8 034	4 231	52.7
Mariental Rural	12 812	9 973	77.8
Mariental Urban	18 368	16 725	91.1
Rehoboth East Urban	29 299	28 784	98.2
Rehoboth Rural	9 439	4 877	51.7
Rehoboth West Urban	11 914	11 768	98.8

5.5. Kavango East Region

Figure 5.5 1 Population proximity to Health Facilities



Rundu Urban Constituency had all its population covered within a 10-kilometre radius of a health facility, while Rundu Rural had the lowest at 79.9 percent.

Figure 5.5 2 Percentage Population Proximity to Health Facilities

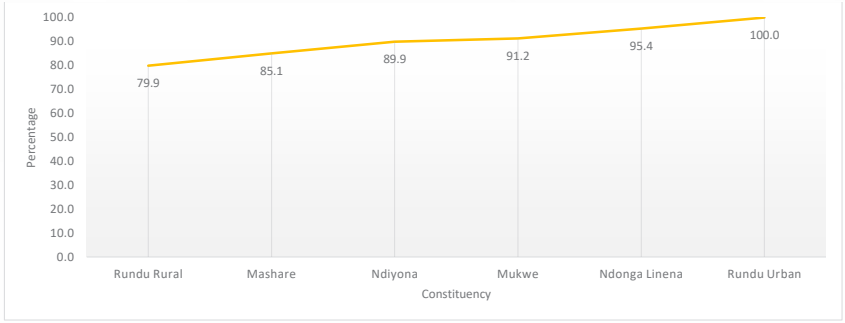


Table 5.5 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Mashare	19 478	16 570	85.1
Mukwe	39 170	35 731	91.2
Ndiyona	13 800	12 410	89.9
Ndonga Linena	14 936	14 250	95.4
Rundu Rural	12 405	9 910	79.9
Rundu Urban	118 632	118 632	100.0

5.6. Kavango West Region

Figure 5.6 1 Population Proximity to Health Facilities

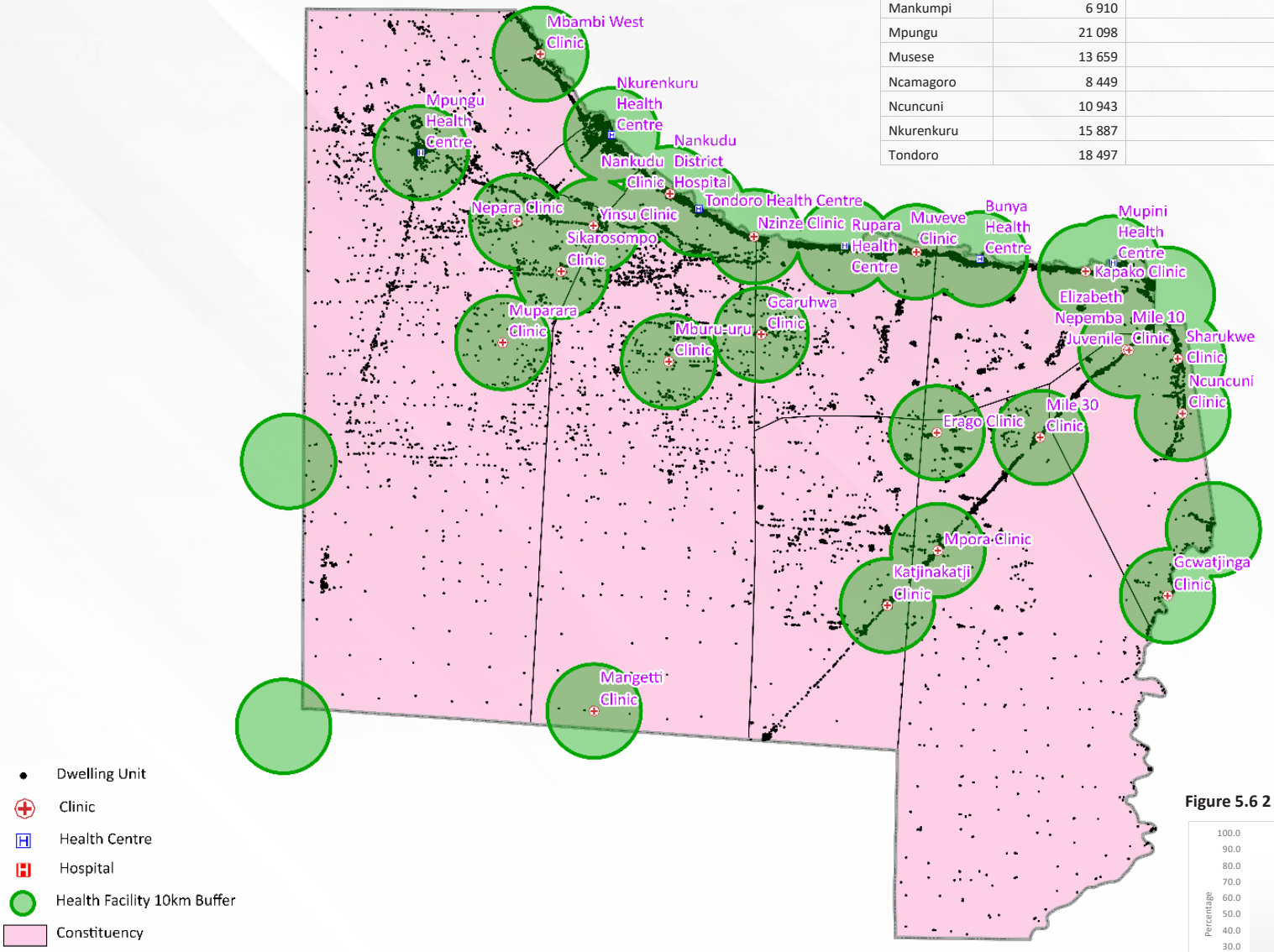
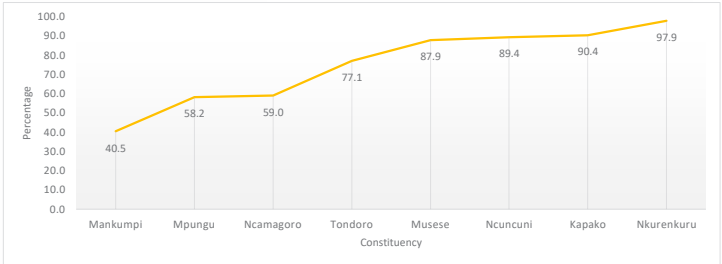


Table 5.6 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Kapako	27 823	25 161	90.4
Mankumpi	6 910	2 798	40.5
Mpungu	21 098	12 277	58.2
Musese	13 659	12 006	87.9
Ncamagoro	8 449	4 986	59.0
Ncuncuni	10 943	9 781	89.4
Nkurenkuru	15 887	15 553	97.9
Tondoro	18 497	14 256	77.1

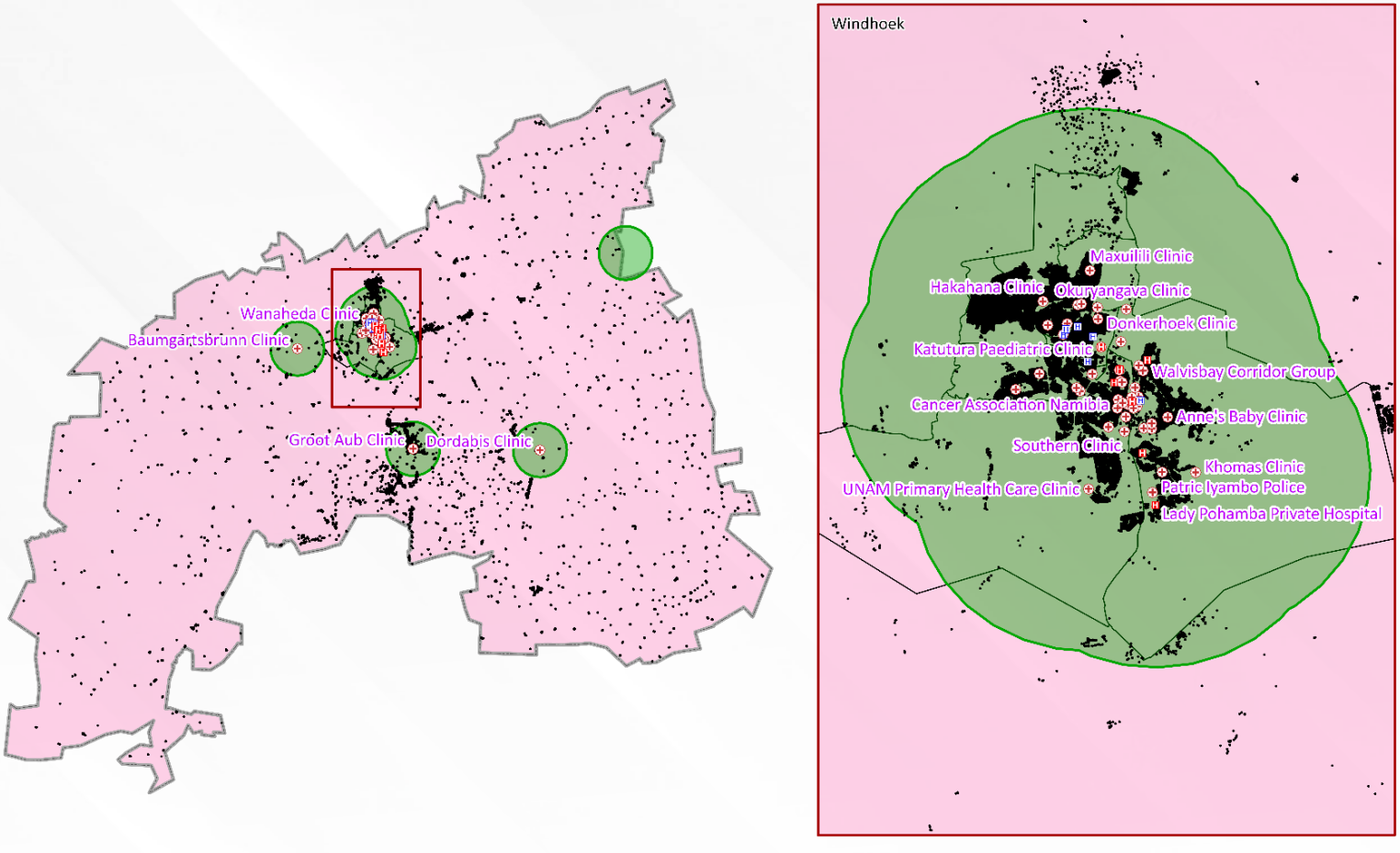
Nkurenkuru Constituency had the highest percentage of the population covered within a 10-kilometre radius of a health facility at 97.9 percent while Mankumpi and Mpungu had the lowest at 40.5 and 58.2 percent respectively.

Figure 5.6 2 Percentage Population Proximity to Health Facilities



5.7. Khomas Region

Figure 5.7 1 Population Proximity to Health Facilities



Windhoek Rural Constituency had the lowest percentage of the population covered within a 10-kilometre radius of a health facility at 47.7 percent, while the rest of the constituencies had either 99.9 or 100 percent.

Figure 5.7 2 Percentage Population Proximity to Health Facilities

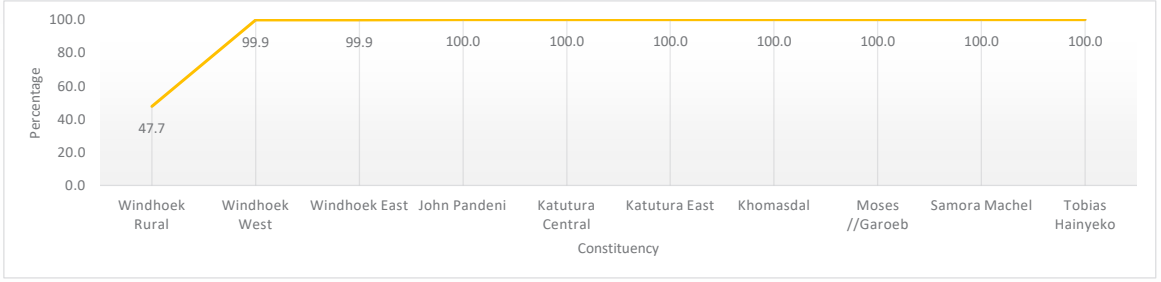


Table 5.7 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Total Population
John Pandeni	25 457	25 457	100.0
Katutura Central	30 557	30 557	100.0
Katutura East	22 940	22 940	100.0
Khomasdal	67 211	67 211	100.0
Moses //Garoeb	68 932	68 932	100.0
Samora Machel	92 401	92 401	100.0
Tobias Hainyeko	67 067	67 067	100.0
Windhoek East	30 054	30 030	99.9
Windhoek Rural	30 079	14 343	47.7
Windhoek West	59 907	59 851	99.9

5.8. Kunene Region

Figure 5.8 1 Population Proximity to Health Facilities

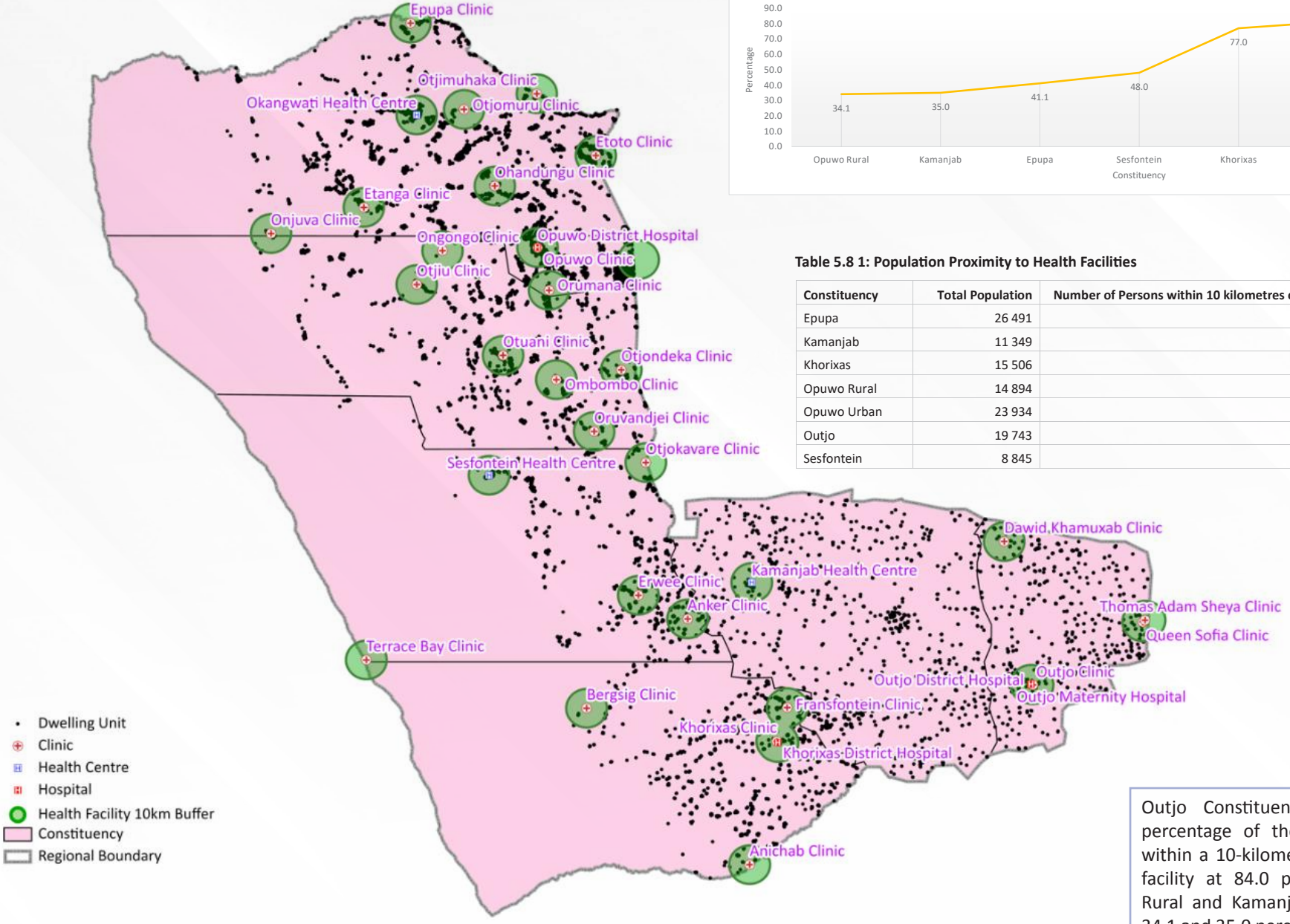


Figure 5.8 2 Percentage Population Proximity to Health Facilities

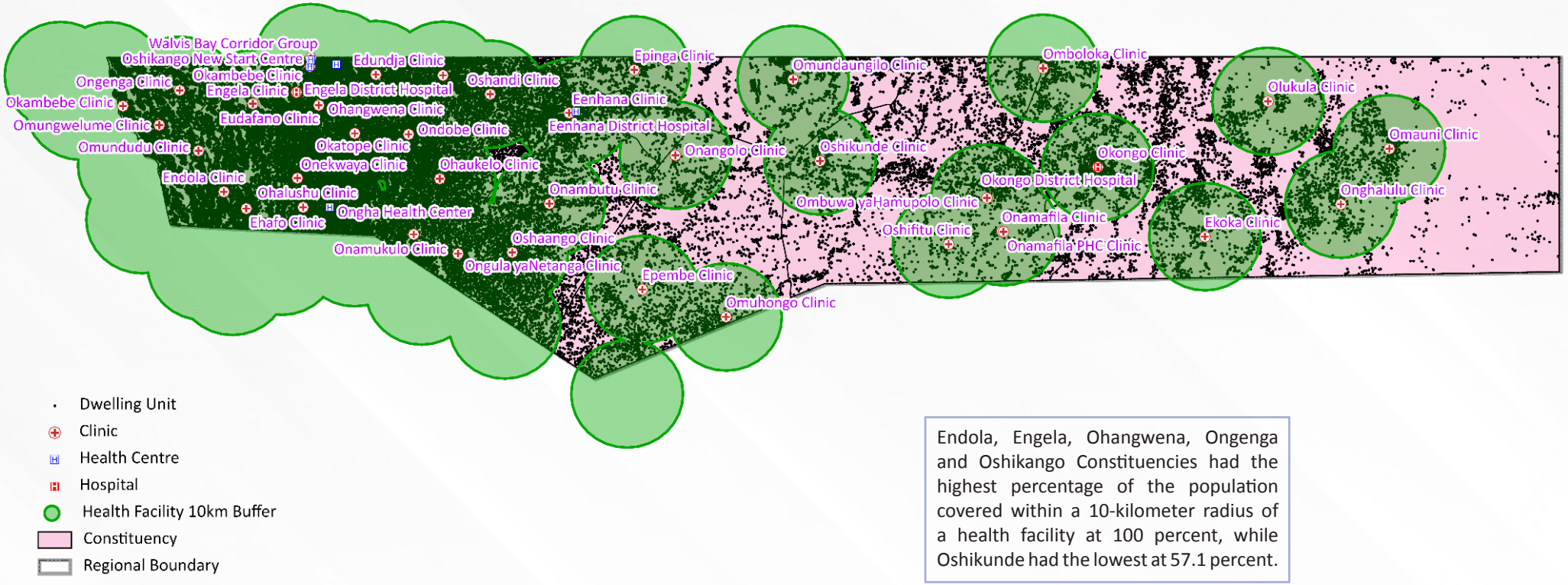
Table 5.8 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Epupa	26 491	10 890	41.1
Kamanjab	11 349	3 975	35.0
Khorixas	15 506	11 935	77.0
Opuwo Rural	14 894	5 078	34.1
Opuwo Urban	23 934	19 492	81.4
Outjo	19 743	16 587	84.0
Sesfontein	8 845	4 246	48.0

Outjo Constituency had the highest percentage of the population covered within a 10-kilometer radius of a health facility at 84.0 percent, while Opuwo Rural and Kamanjab had the lowest at 34.1 and 35.0 percent respectively.

5.9. Ohangwena Region

Figure 5.9 1 Population Proximity to Health Facilities



Endola, Engela, Ohangwena, Ongenga and Oshikango Constituencies had the highest percentage of the population covered within a 10-kilometer radius of a health facility at 100 percent, while Oshikunde had the lowest at 57.1 percent.

Figure 5.9 2 Percentage Population Proximity to Health Facilities

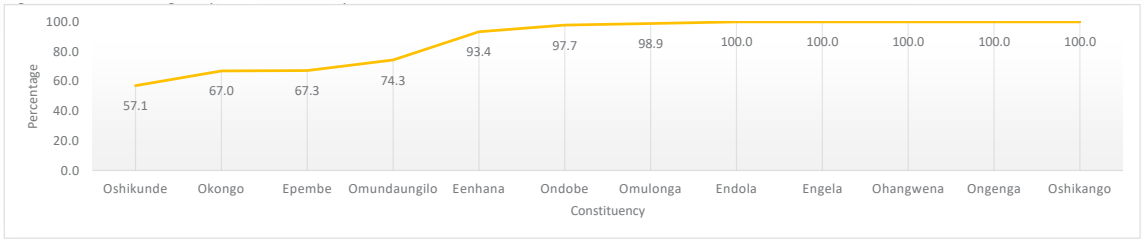


Table 5.8 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Eenhana	35 304	32 964	93.4
Endola	32 698	32 698	100.0
Engela	30 004	30 004	100.0
Epembe	16 336	10 992	67.3
Ohangwena	31 491	31 491	100.0
Okongo	31 746	21 272	67.0
Omulonga	32 802	32 452	98.9
Omundaungilo	15 009	11 155	74.3
Ondobe	32 622	31 875	97.7
Ongenga	27 296	27 296	100.0
Oshikango	30 531	30 531	100.0
Oshikunde	21 890	12 492	57.1

5.10. Omaheke Region

Figure 5.10 1 Population Proximity to Health Facilities

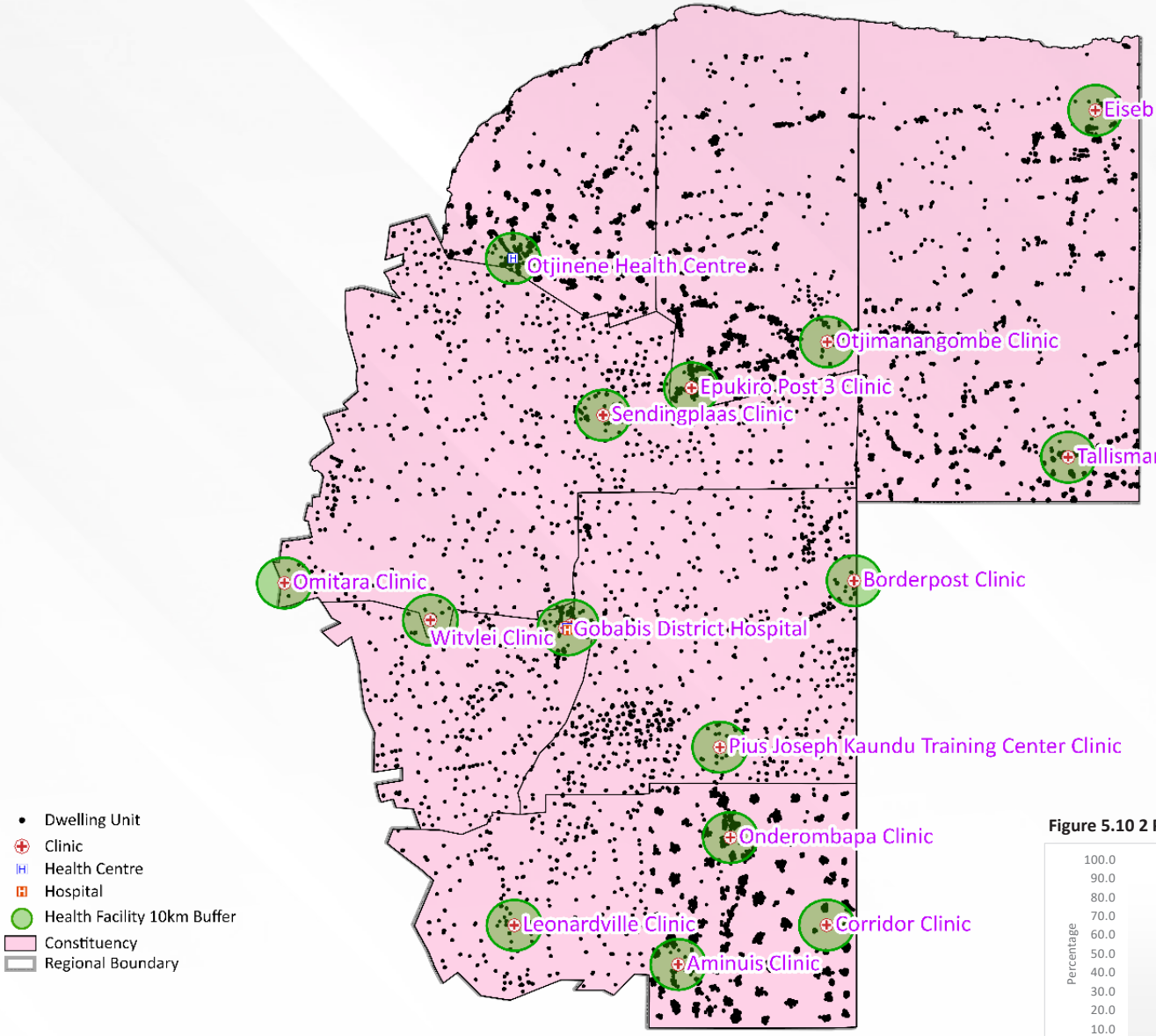
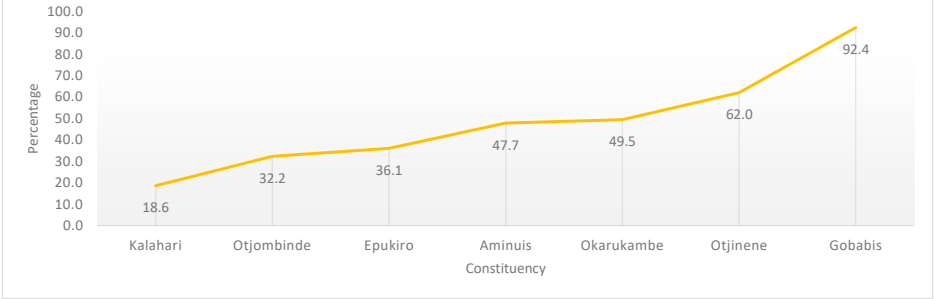


Table 5.10 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Aminuis	13 801	6 589	47.7
Epukiro	7 880	2 842	36.1
Gobabis	35 452	32 748	92.4
Kalahari	12 021	2 237	18.6
Okarukambe	12 271	6 074	49.5
Otjinene	12 415	7 703	62.0
Otjombinde	9 041	2 913	32.2

Gobabis Constituency had the highest percentage of the population covered within a 10-kilometer radius of a health facility at 92.4 percent, while Kalahari had the lowest at 18.6 percent.

Figure 5.10 2 Percentage Population Proximity to Health Facilities



5.11. Omusati Region

Figure 5.11 1 Population Proximity to Health Facilities

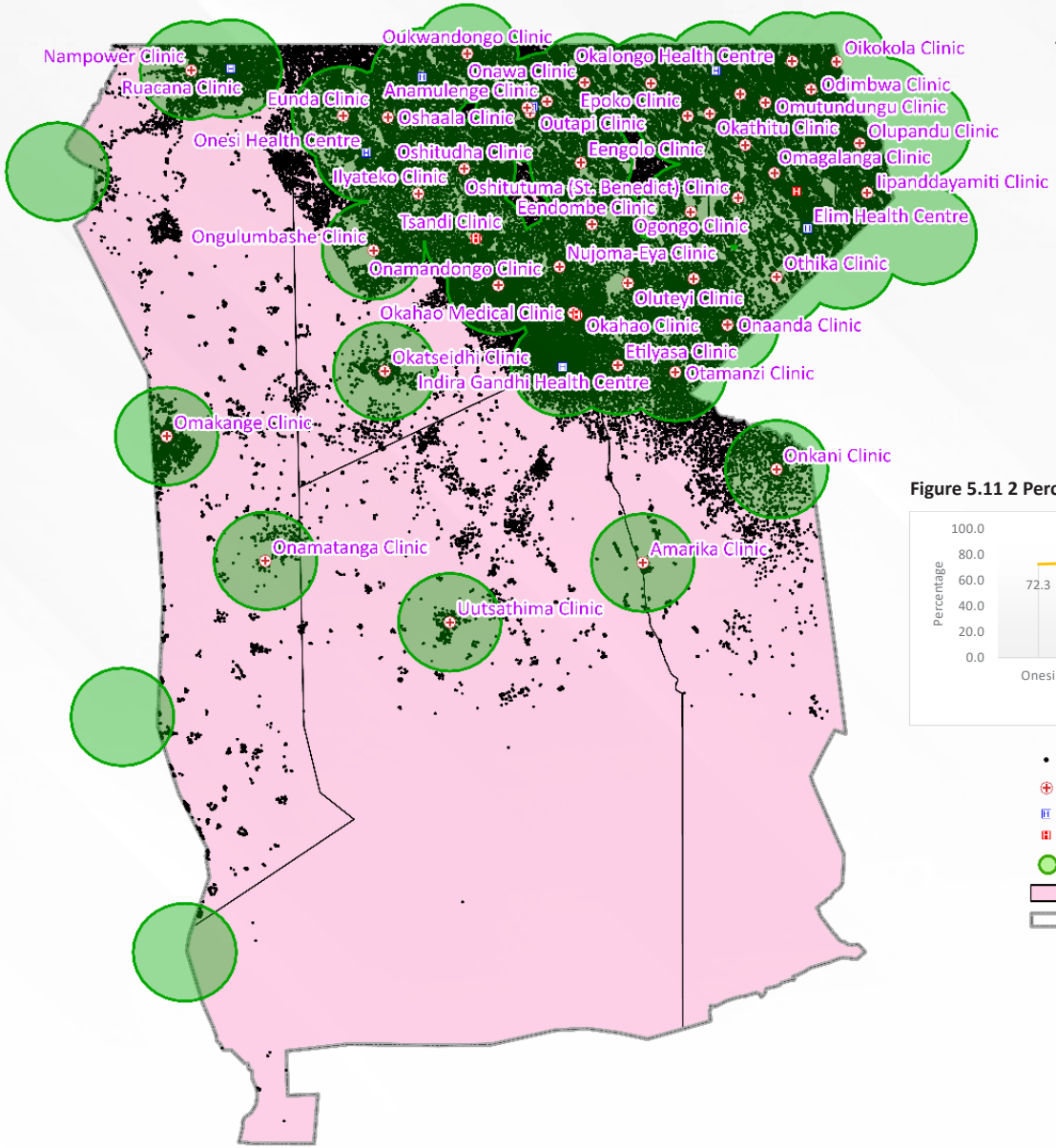
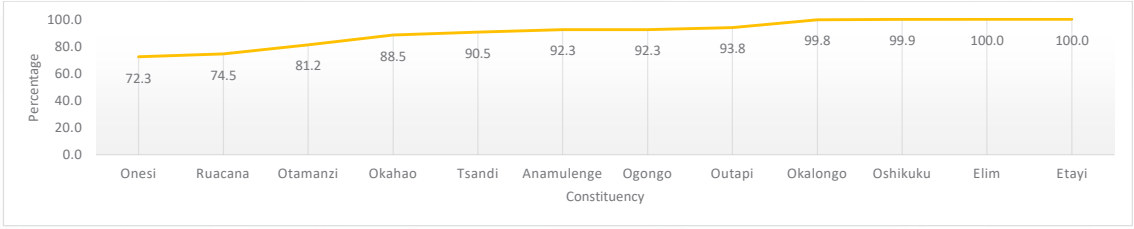


Table 5.11 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Anamulenge	20 344	18 776	92.3
Elim	13 400	13 400	100.0
Etayi	33 088	33 088	100.0
Ogongo	17 649	16 290	92.3
Okahao	24 909	22 035	88.5
Okalongo	32 663	32 586	99.8
Onesi	23 364	16 894	72.3
Oshikuku	19 693	19 680	99.9
Otamanzi	16 399	13 321	81.2
Outapi	53 594	50 291	93.8
Ruacana	27 261	20 298	74.5
Tsandi	34 307	31 036	90.5

Figure 5.11 2 Percentage of Population within 10 kilometres to Health Facilities





Elim and Etayi Constituencies had all the population covered within a 10-kilometer radius of a health facility, while Onesi and Ruacana had the lowest at 72.3 and 74.5 percent respectively.

5.12. Oshana Region

Figure 5.12 1 Population Proximity to Health Facilities

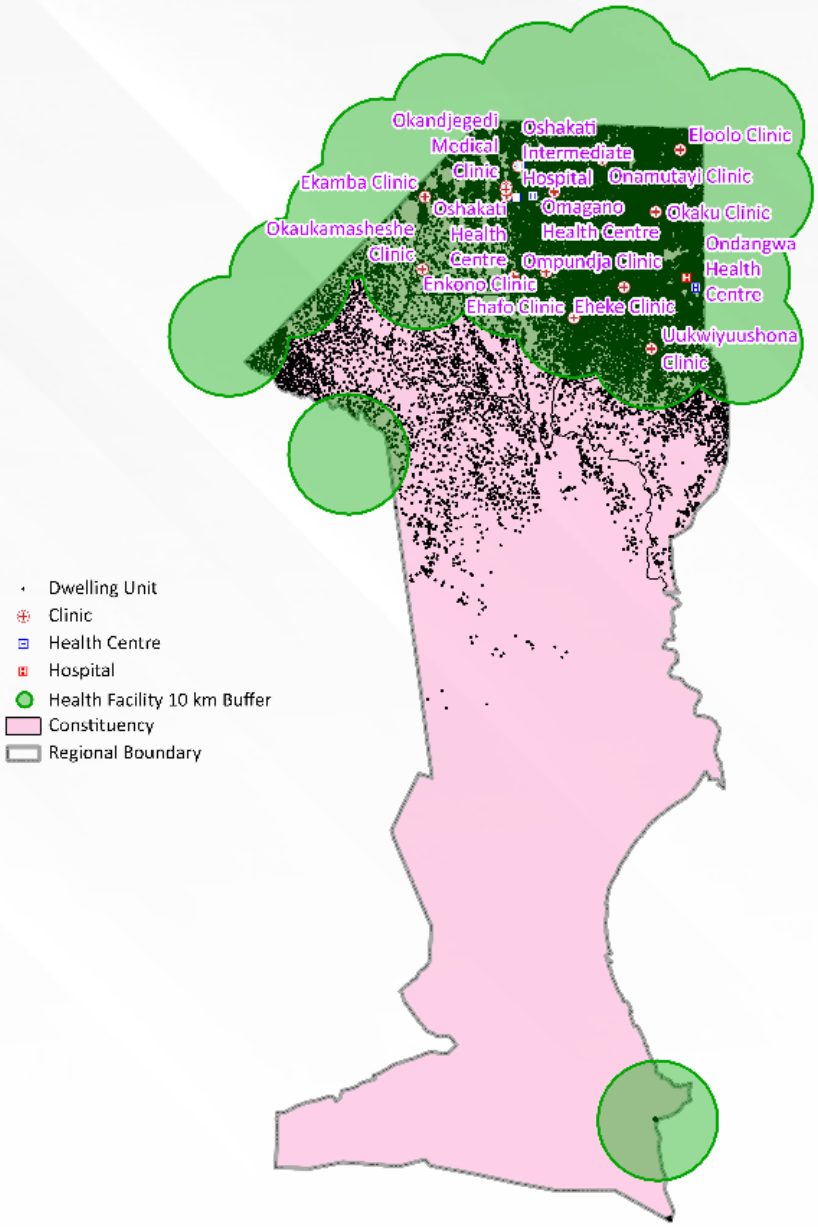


Figure 5.12 2 Percentage Population Proximity to Health Facilities

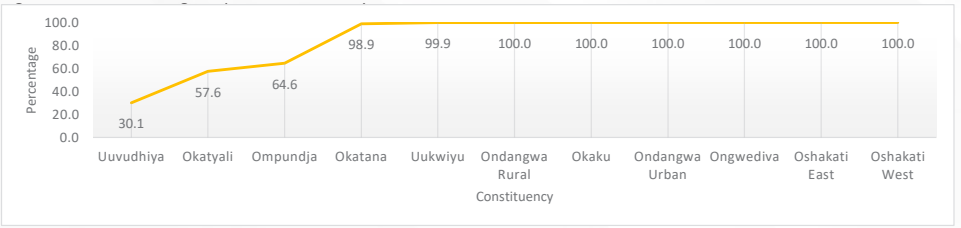


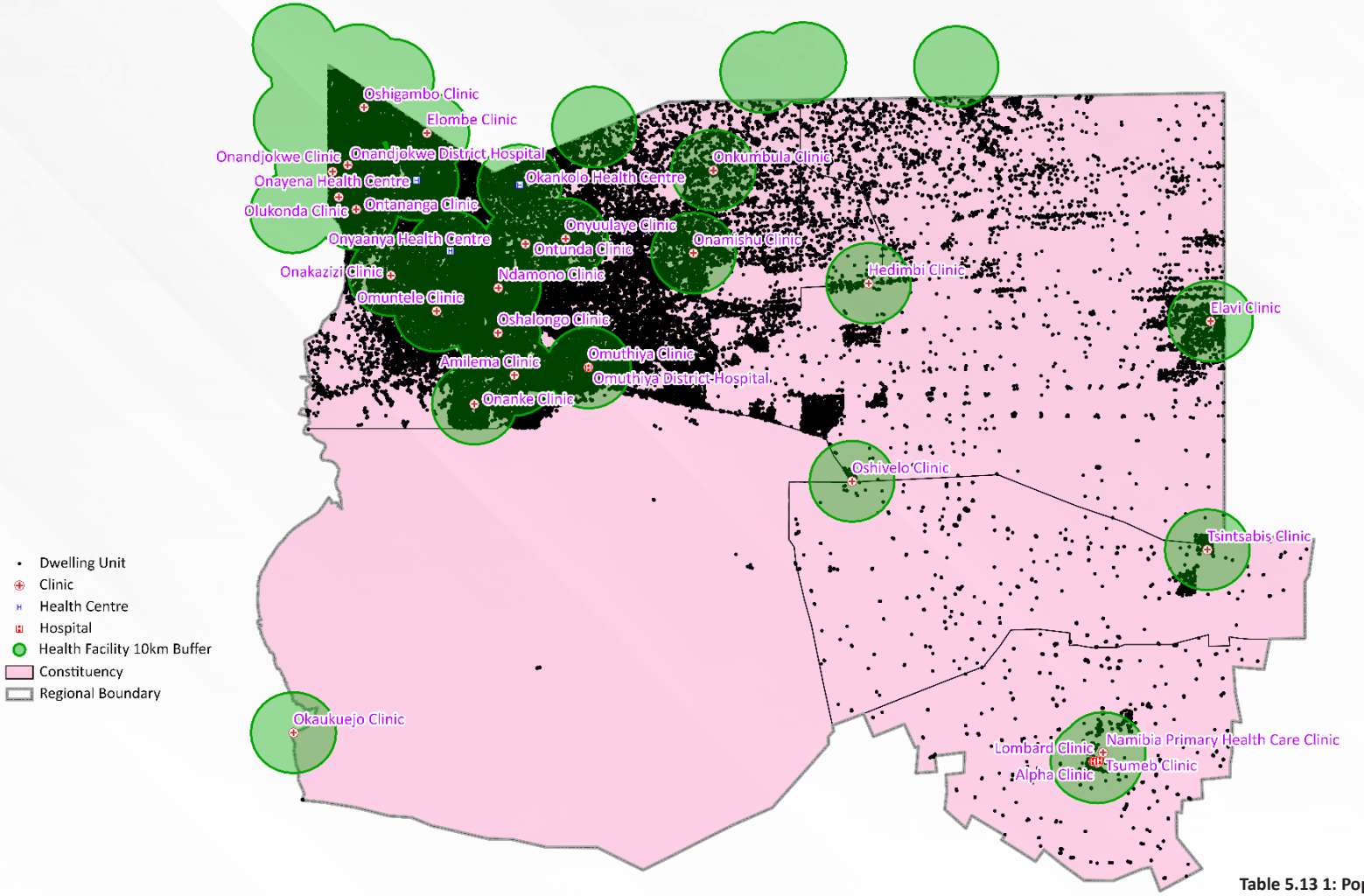
Table 5.12 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Okaku	21 892	21 892	100.0
Okatana	19 974	19 763	98.9
Okatyali	4 502	2 591	57.6
Ompundja	4 582	2 958	64.6
Ondangwa Rural	14 959	14 956	100.0
Ondangwa Urban	31 466	31 466	100.0
Ongwediva	44 166	44 166	100.0
Oshakati East	39 915	39 915	100.0
Oshakati West	30 665	30 665	100.0
Uukwiyu	13 033	13 015	99.9
Uuvudhiya	5 647	1 701	30.1

Ondangwa Rural, Okaku, Ondangwa Urban, Ongwediva, Oshakati East and Oshakati West constituencies had all their population covered within a 10-kilometer radius of a health facility, while Uvudhiya and Okatyali had the lowest at 30.1 and 57.6 percent respectively.

5.13. Oshikoto Region

Figure 5.13 1 Population Proximity to Health Facilities



Oniipa Constituency had the highest percentage of the population covered within a 10-kilometer radius of a health facility at 99.9 percent, while Nehale LyaMpingana and Engodi had the lowest percentage of population covered of 17.7 and 27.9 percent respectively.

Figure 5.13 2 Percentage Population Proximity to Health Facilities

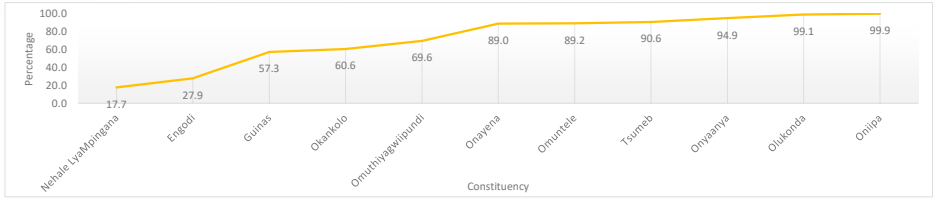
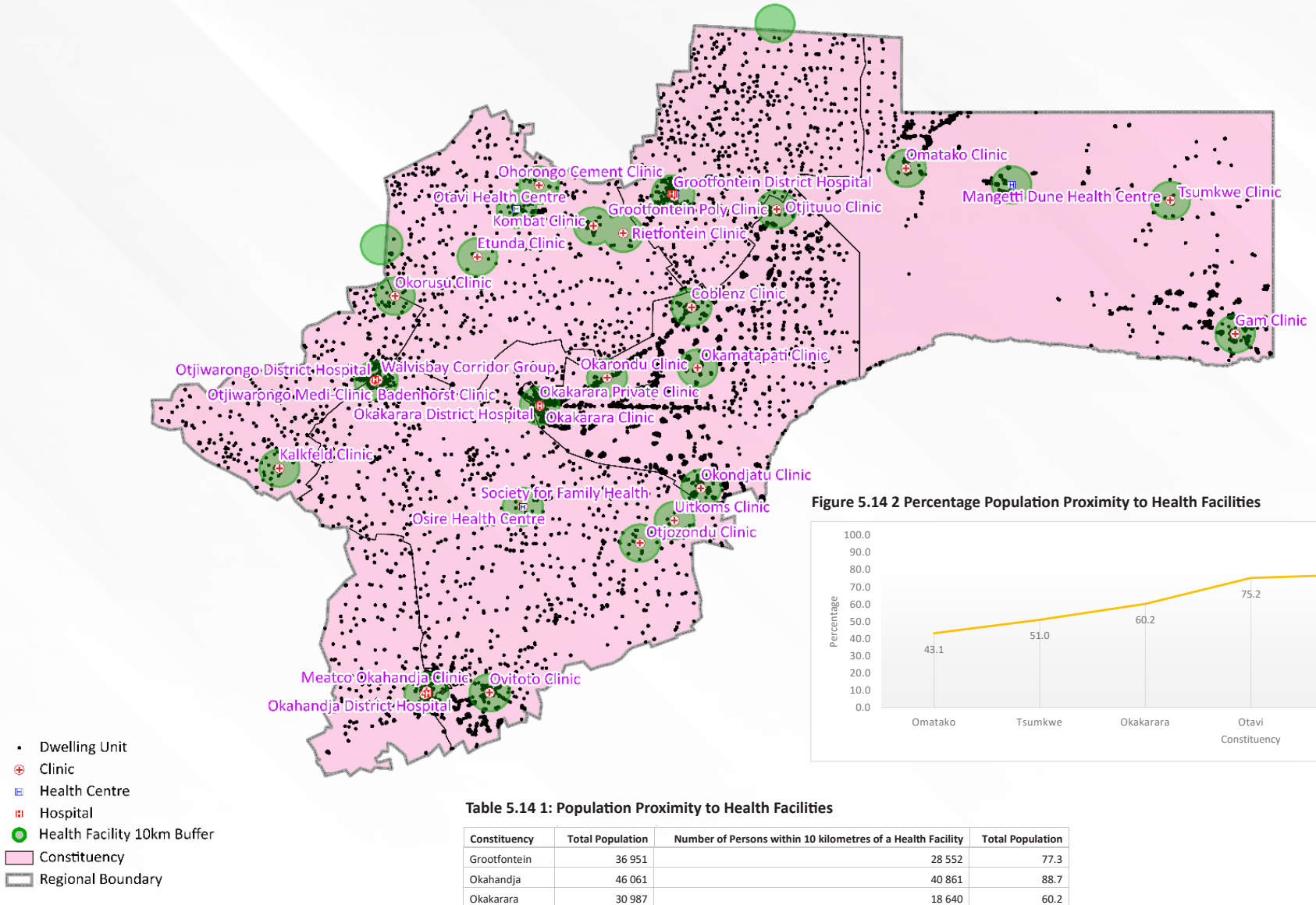


Table 5.13 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Percentage
Engodi	24 208	6 746	27.9
Guinas	8 578	4 917	57.3
Nehale LyaMpingana	17 317	3 057	17.7
Okankolo	17 988	10 903	60.6
Olukonda	14 318	14 184	99.1
Omuntele	21 043	18 770	89.2
Omuthiyagwiipundi	39 855	27 750	69.6
Onayena	16 669	14 832	89.0
Oniipa	33 727	33 695	99.9
Onyaanya	25 465	24 175	94.9
Tsumeb	38 134	34 535	90.6

5.14. Otjozondjupa Region

Figure 5.14 1 Population Proximity to Health Facilities



Otjiwarongo Constituency had the highest percentage of the population covered within a 10-kilometer radius of a health facility at 95.9 percent, while Omatako and Tsumkwe had the lowest,at 43.1 and 51.0 percent respectively.

Figure 5.14 2 Percentage Population Proximity to Health Facilities

Table 5.14 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10 kilometres of a Health Facility	Total Population
Grootfontein	36 951	28 552	77.3
Okahandja	46 061	40 861	88.7
Okakarara	30 987	18 640	60.2
Omatako	18 283	7 880	43.1
Otavi	18 279	13 747	75.2
Otjiwarongo	54 893	52 657	95.9
Tsumkwe	15 357	7 828	51.0

5.15. Zambezi Region

Figure 5.15 1 Population Proximity to Health Facilities

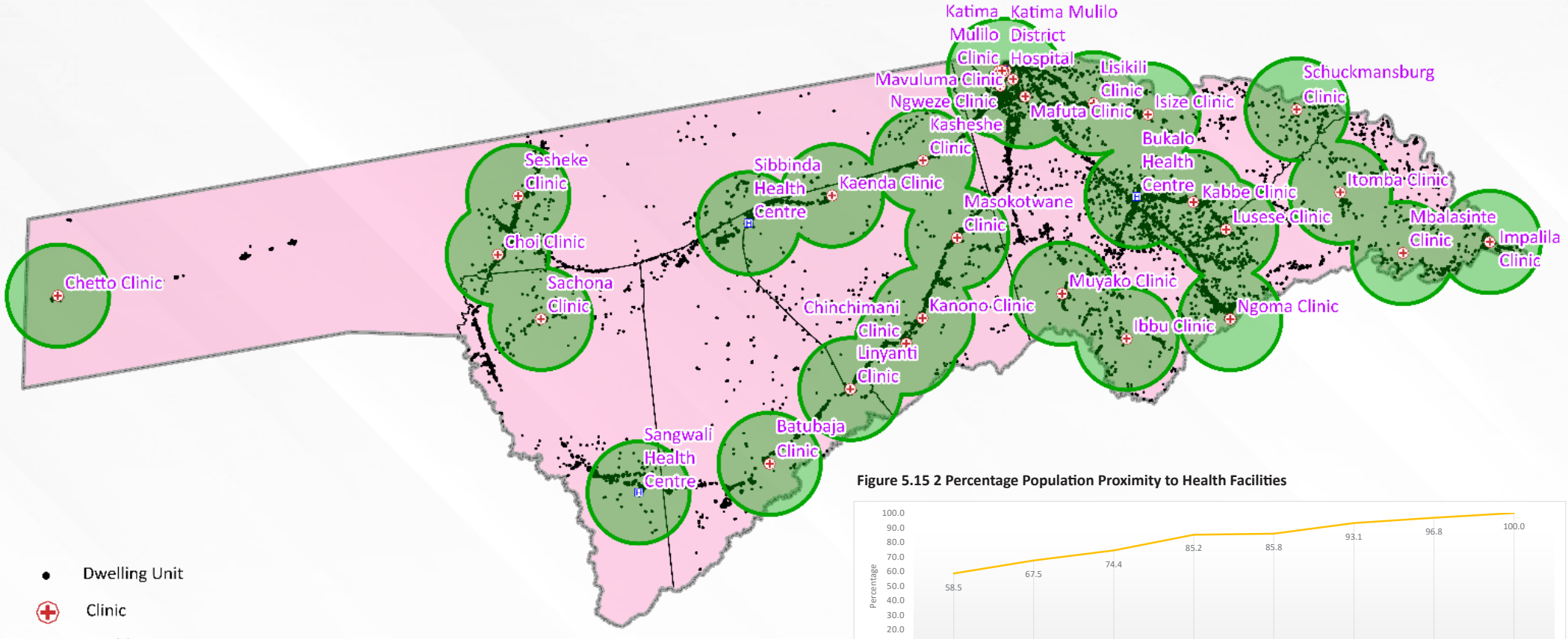


Figure 5.15 2 Percentage Population Proximity to Health Facilities

Table 5.15 1: Population Proximity to Health Facilities

Constituency	Total Population	Number of Persons within 10kilometres of a Health Facility	Percentage
Judea Lyabboloma	8 738	5 116	58.5
Kabbe North	12 253	11 412	93.1
Kabbe South	11 345	8 437	74.4
Katima Mulilo Rural	24 016	20 595	85.8
Katima Mulilo Urban	46 401	46 401	100.0
Kongola	12 069	10 281	85.2
Linyanti	10 425	7 037	67.5
Sibbinda	17 126	16 586	96.8

Katima Mulilo Urban Constituency had all its population covered within a 10-kilometer radius of a health facility, while Judea Lyabboloma and Linyanti had the lowest at 58.5 and 67.5 percent respectively.



CHAPTER 6:
LONGEST DISTANCE TO CLOSEST HEALTH FACILITY

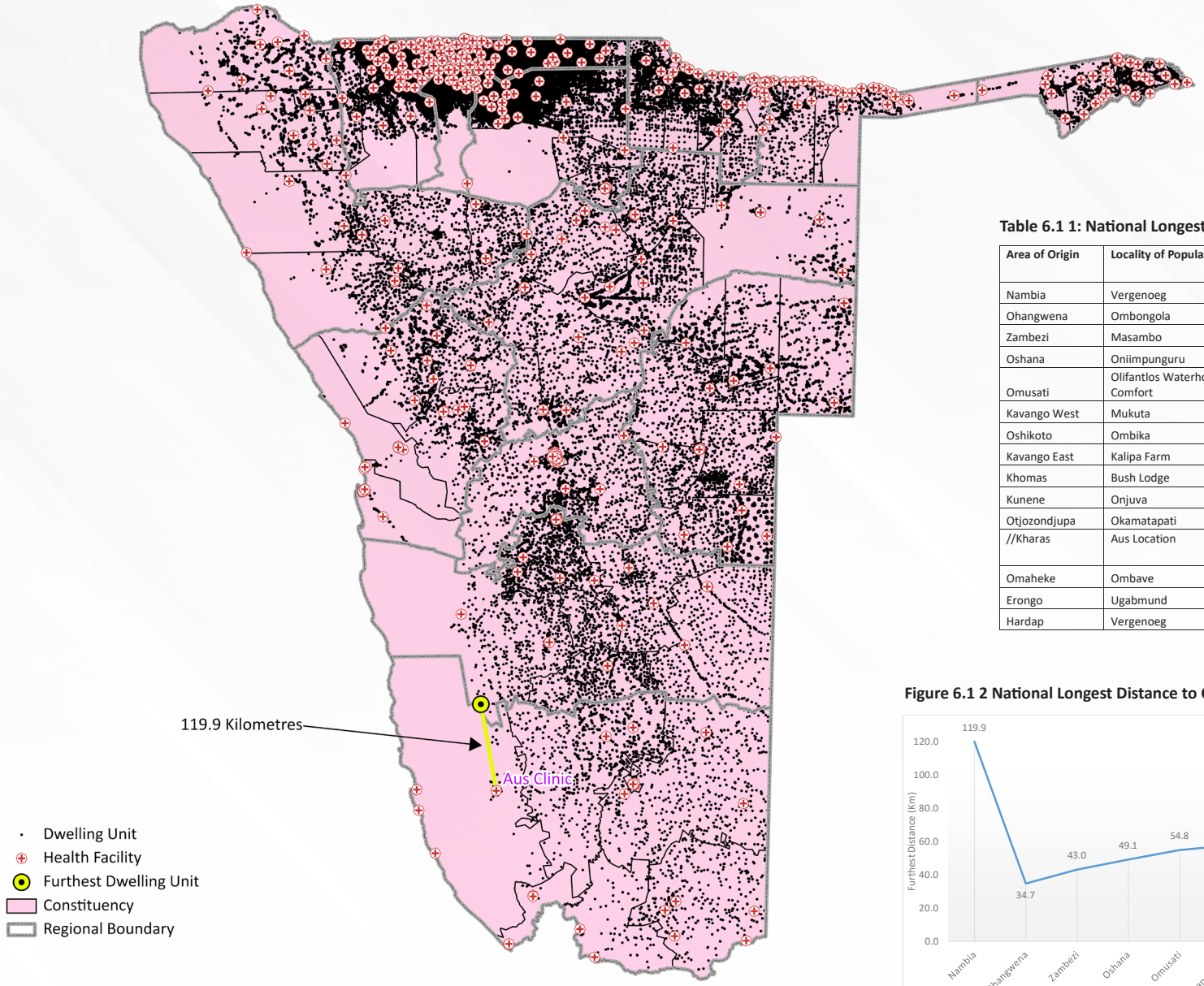
This chapter examines the farthest distances individuals must travel to reach the nearest health facility. Using straight-line distances, the shortest path is calculated from dwelling units to their closest health facility. This allows us to identify population within regions where the longest travel distances exist, potentially indicating challenges in healthcare accessibility. The analysis is based on the geographic coordinates of mapped 2022 health facilities and population data from the 2023 Census. These insights help highlight areas with potential healthcare access gaps, guiding decisions on resource allocation and infrastructure development to reduce travel burdens for communities.

It must be noted that the government provides mobile health care services serving the underserved population across the country. These mobile services were not considered in this Atlas due to the lack of data on these mobile service points. Furthermore, new clinics might have been constructed after the last data update of 2022 which might not be included in this Atlas.



6.1. National Longest Distance to Closest Health Facility

Figure 6.1 1 National Longest Distance to Closest Health Facility

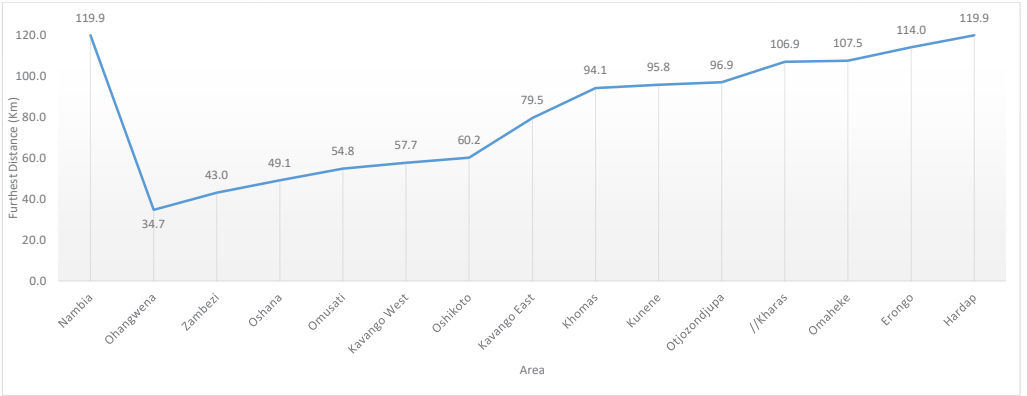


In 2023, Persons in and around Vergenoeg (Post 1) travelled the farthest distance of 119.9 Kilometres to reach the nearest health facility, Aus Clinic located in the //Kharas Region.

Table 6.1 1: National Longest Distance to Closest Health Facility

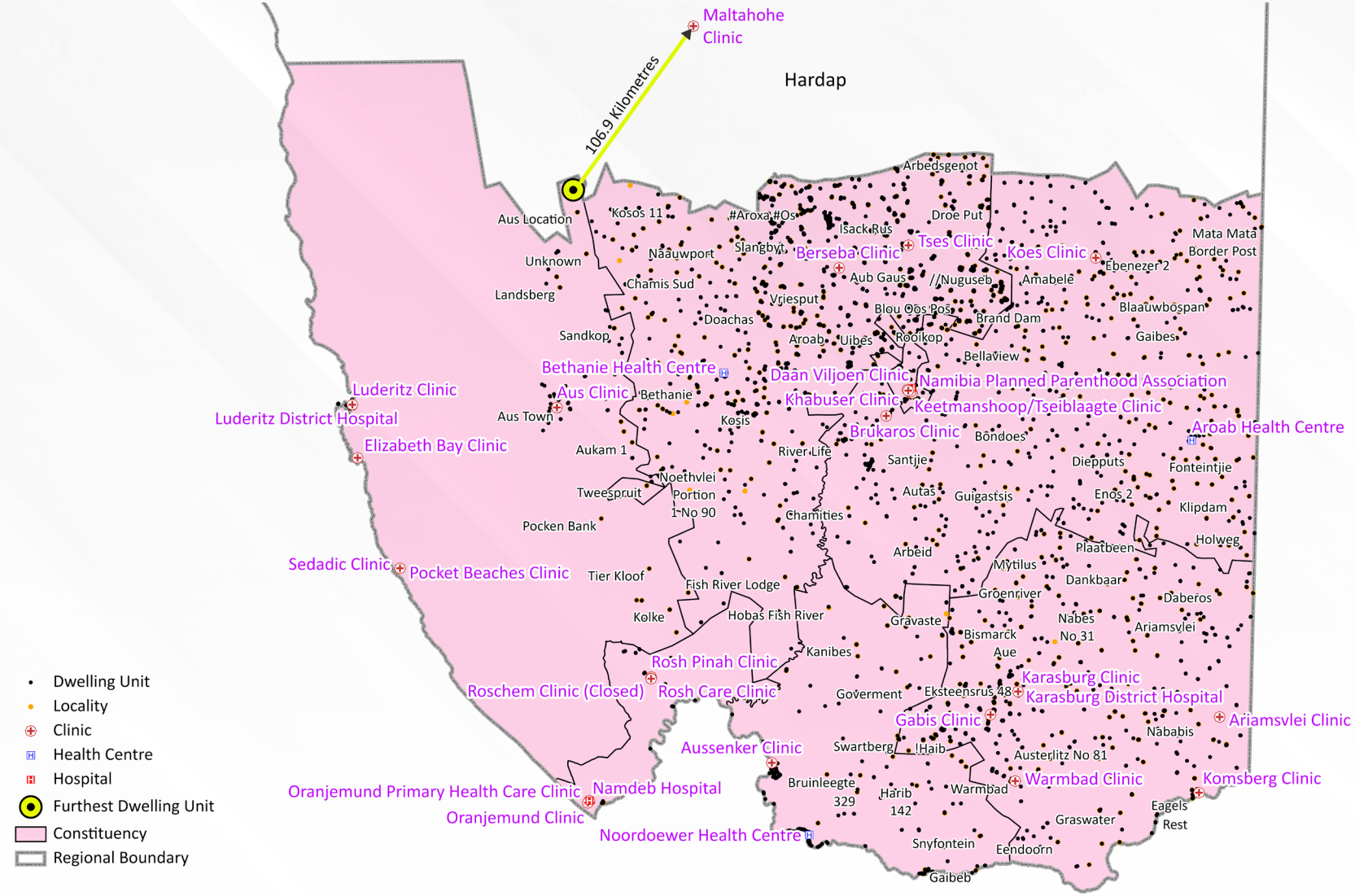
Area of Origin	Locality of Population	Farthest Distance (Km)	Nearest Health Facility
Nambia	Vergenoeg	119.9	Aus Clinic
Ohangwena	Ombongola	34.7	Omauni Clinic
Zambezi	Masambo	43.0	Chetto Clinic
Oshana	Oniimpunguru	49.1	Okahao Medical Clinic
Omusati	Olifantlos Waterhole and Comfort	54.8	Otjokavare Clinic
Kavango West	Mukuta	57.7	Gcwatjinga Clinic
Oshikoto	Ombika	60.2	Okaukuejo Clinic
Kavango East	Kalipa Farm	79.5	Ncaute Clinic
Khomas	Bush Lodge	94.1	Klein Aub Clinic
Kunene	Onjuva	95.8	Onjuva Clinic
Otjozondjupa	Okamatapati	96.9	Omatako Clinic
//Kharas	Aus Location	106.9	Maltahohe Health Centre and Maltahohe Clinic
Omaheke	Ombave	107.5	Otjinene Health Centre
Erongo	Ugabmund	114.0	Bersig Clinic
Hardap	Vergenoeg	119.9	Aus Clinic

Figure 6.1 2 National Longest Distance to Closest Health Facility



6.2. //Kharas Region

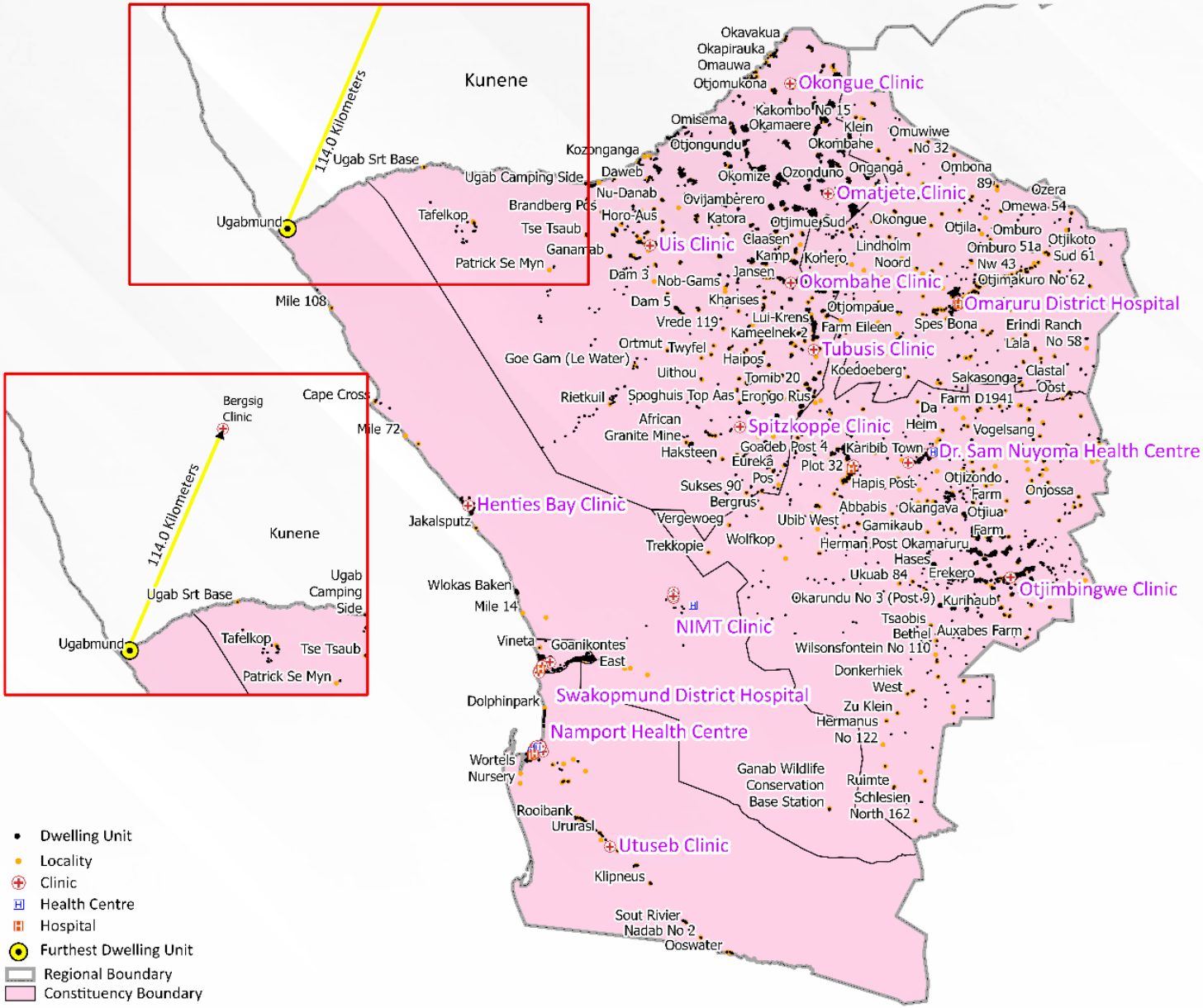
Figure 6.2 1 Longest Distance to Closest Health Facility



In 2023, residents in and around the Aus area were located the farthest from the nearest health facility, Maltahöhe Health Clinic, situated in the Hardap Region, approximately 106.9 kilometres away.

6.3. Erongo Region

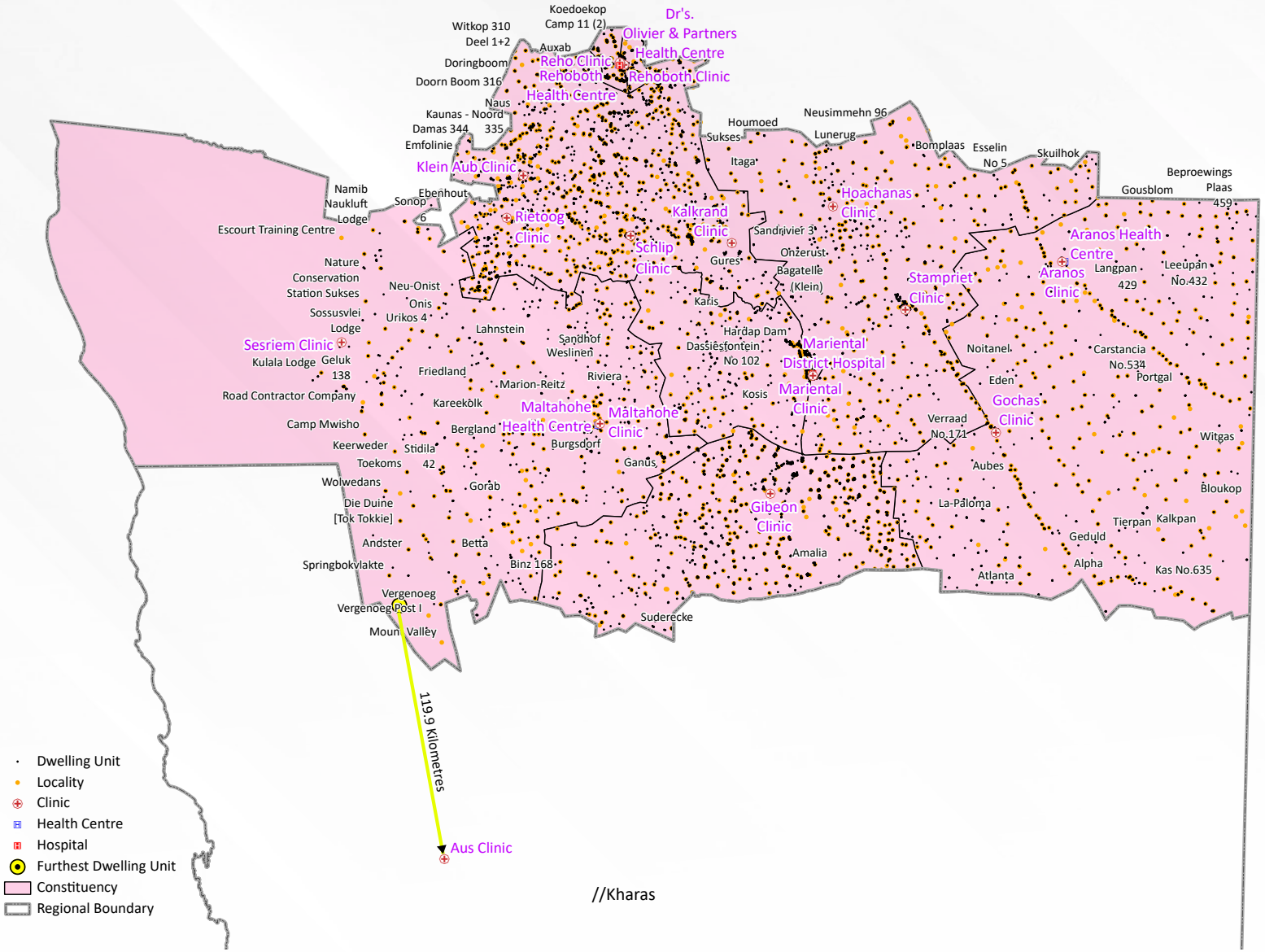
Figure 6.3 1 Longest Distance to Closest Health Facility



In 2023, residents in and around the Ugabmund area in Erongo Region were located the farthest from the nearest health facility, Bergsig Clinic, situated in the Kunene Region, approximately 114.0 Kilometres away.

6.4. Hardap Region

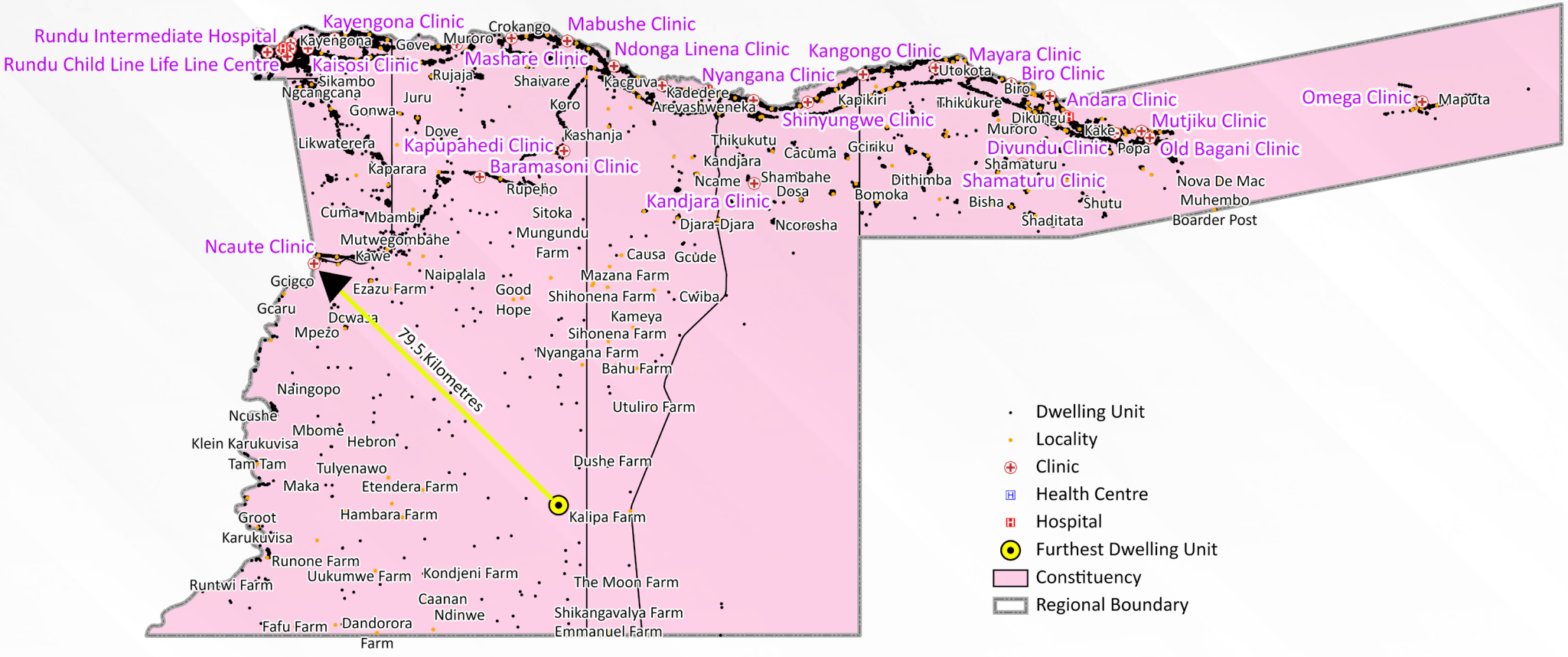
Figure 6.4 1 Longest Distance to Closest Health Facility



In 2023, residents in and around the Vergenoeg (Post 1) in Hardap Region were located the farthest from the nearest health facility, Bergsig Clinic, situated in the //Kharas Region, approximately 119.9 Kilometres away.

6.5. Kavango East Region

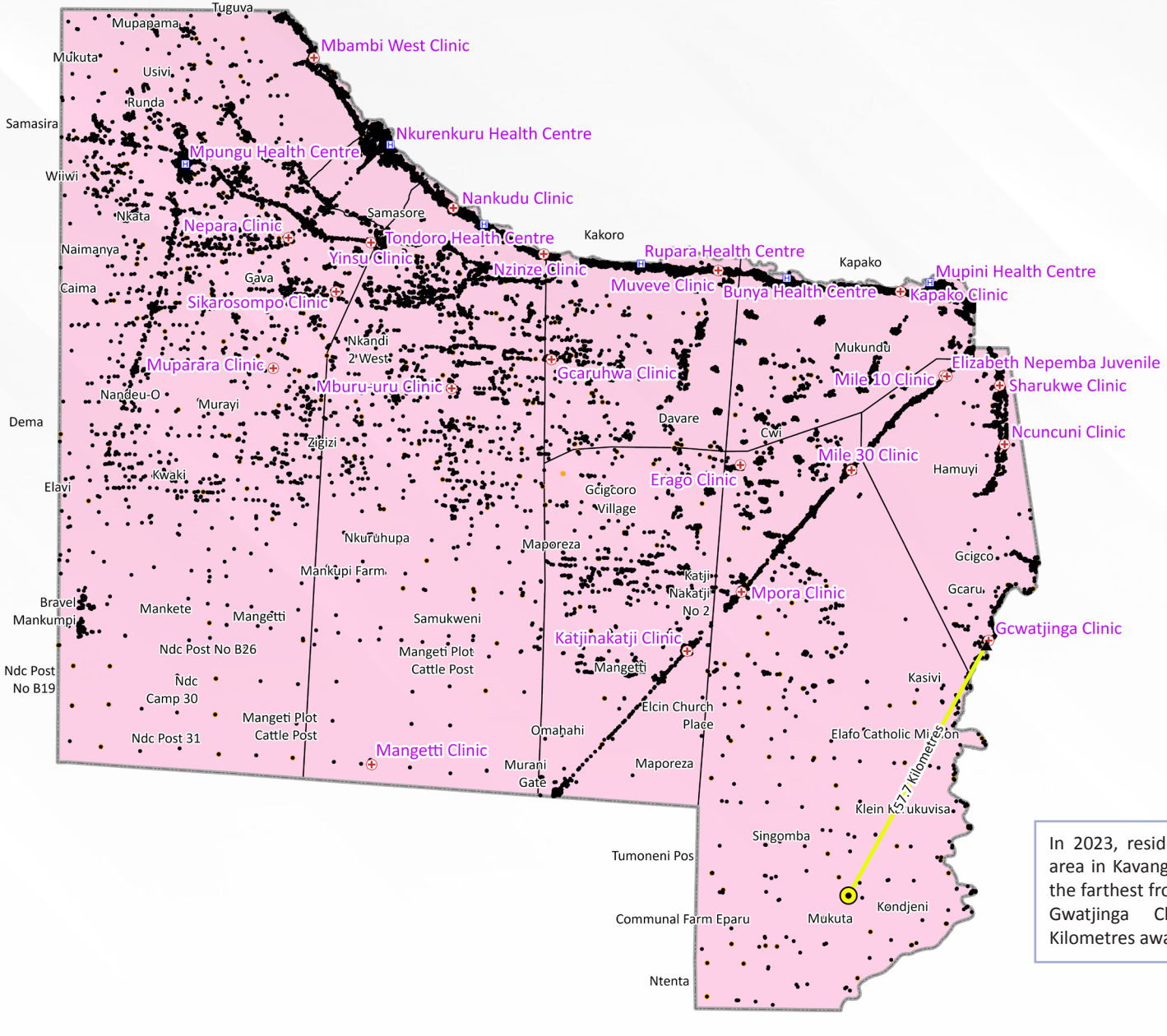
Figure 6.5 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Kalipa Farm in Kavango East Region were located the farthest from the nearest health facility, Ncaute Clinic, situated in the same region, approximately 79.5 Kilometres away.

6.5. Kavango West Region

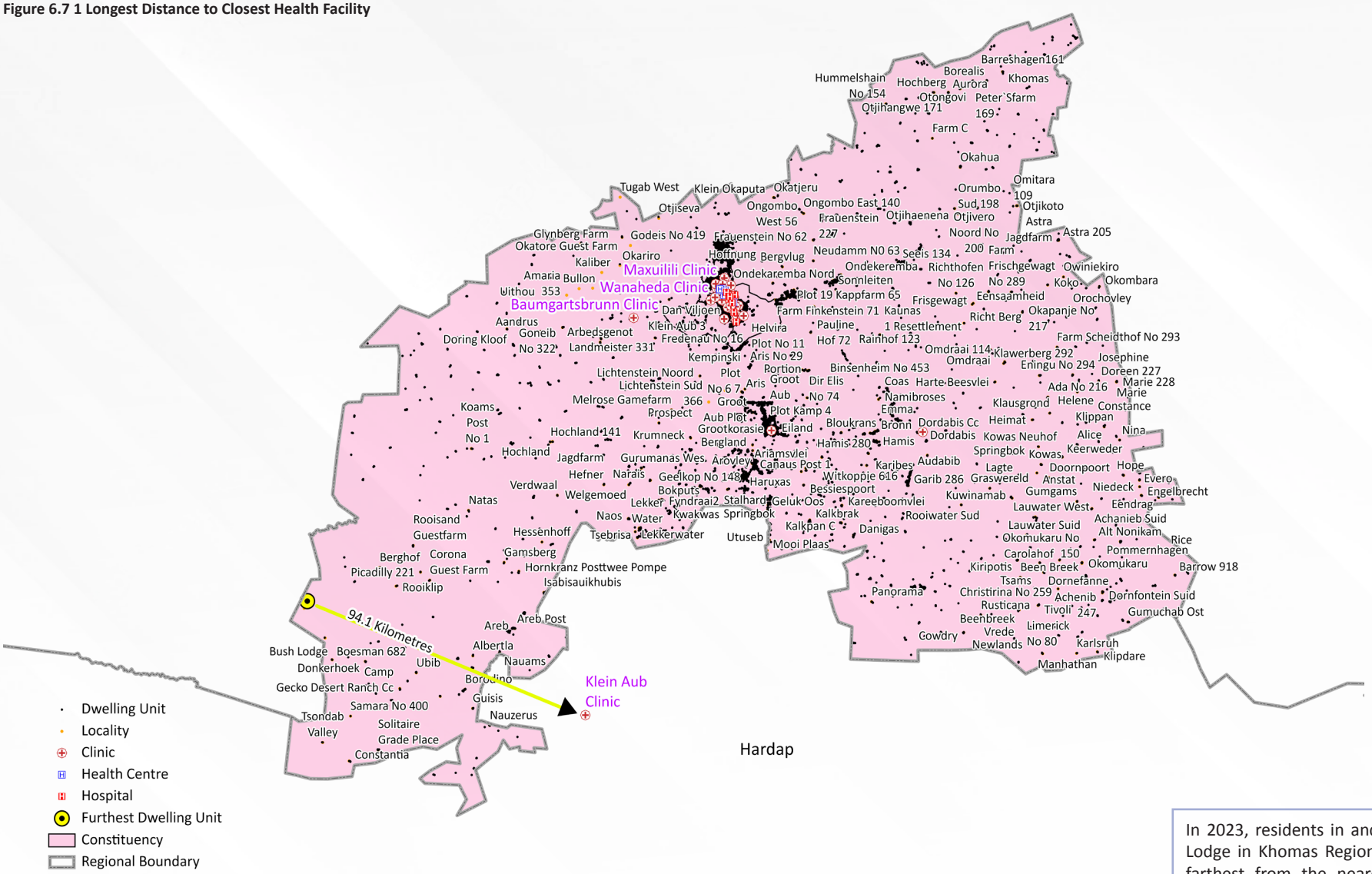
Figure 6.6 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Mukuta area in Kavango West Region were located the farthest from the nearest health facility, Gwatjinga Clinic, approximately 57.7 Kilometres away.

6.7. Khomas Region

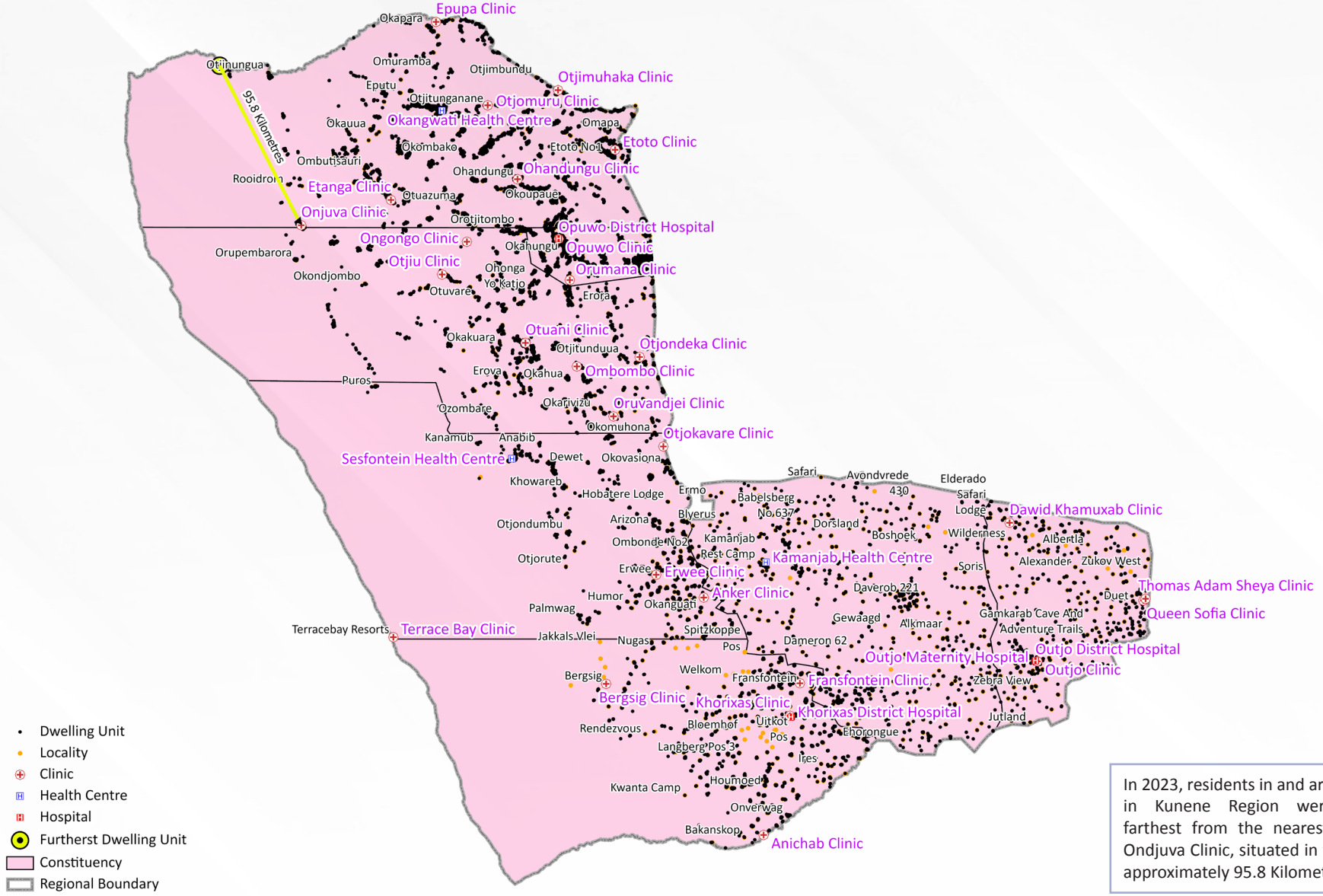
Figure 6.7 1 Longest Distance to Closest Health Facility



In 2023, residents in and around the Bush Lodge in Khomas Region were located the farthest from the nearest health facility, Klein Aub Clinic, situated in the Hardap Region, approximately 94.1 Kilometres away.

6.8. Kunene Region

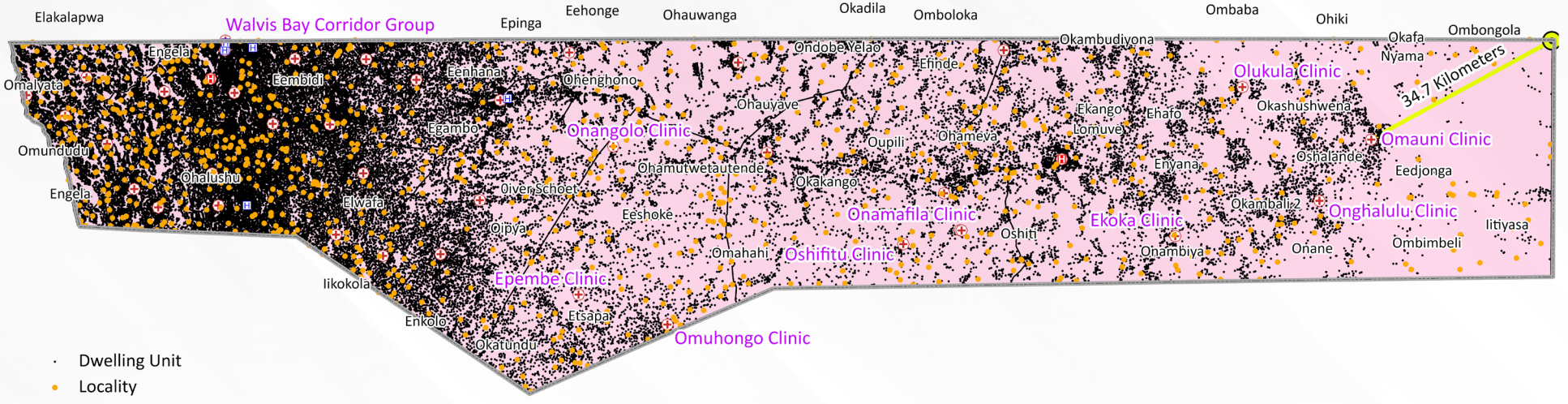
Figure 6.8 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Otjinungua in Kunene Region were located the farthest from the nearest health facility, Ondjuva Clinic, situated in the same region, approximately 95.8 Kilometres away.

6.9. Ohangwena Region

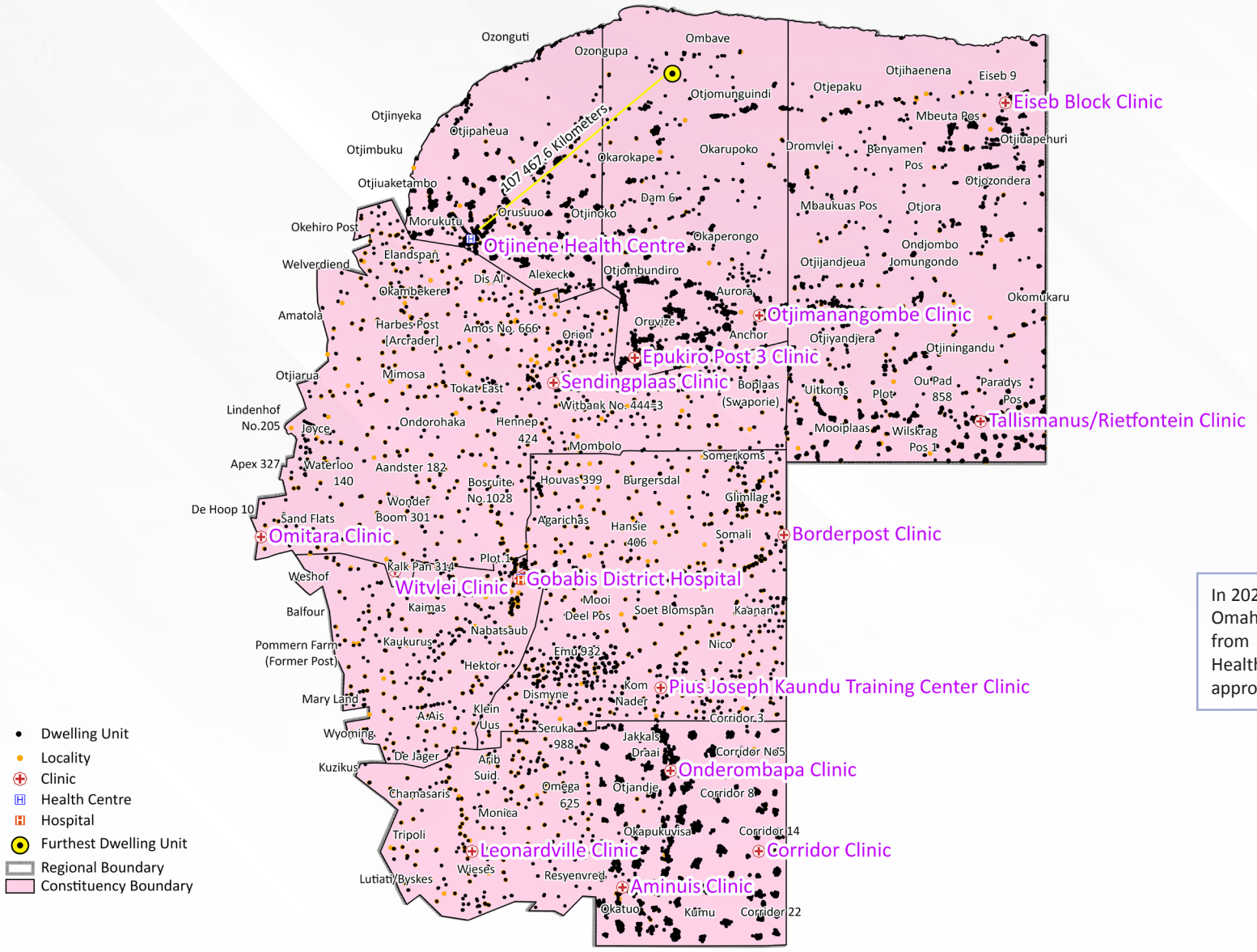
Figure 6.9 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Ombongola in Ohangwena Region were located the farthest from the nearest health facility, Omauni Clinic, situated in the same region, approximately 34.7 Kilometres away.

6.10. Omaheke Region

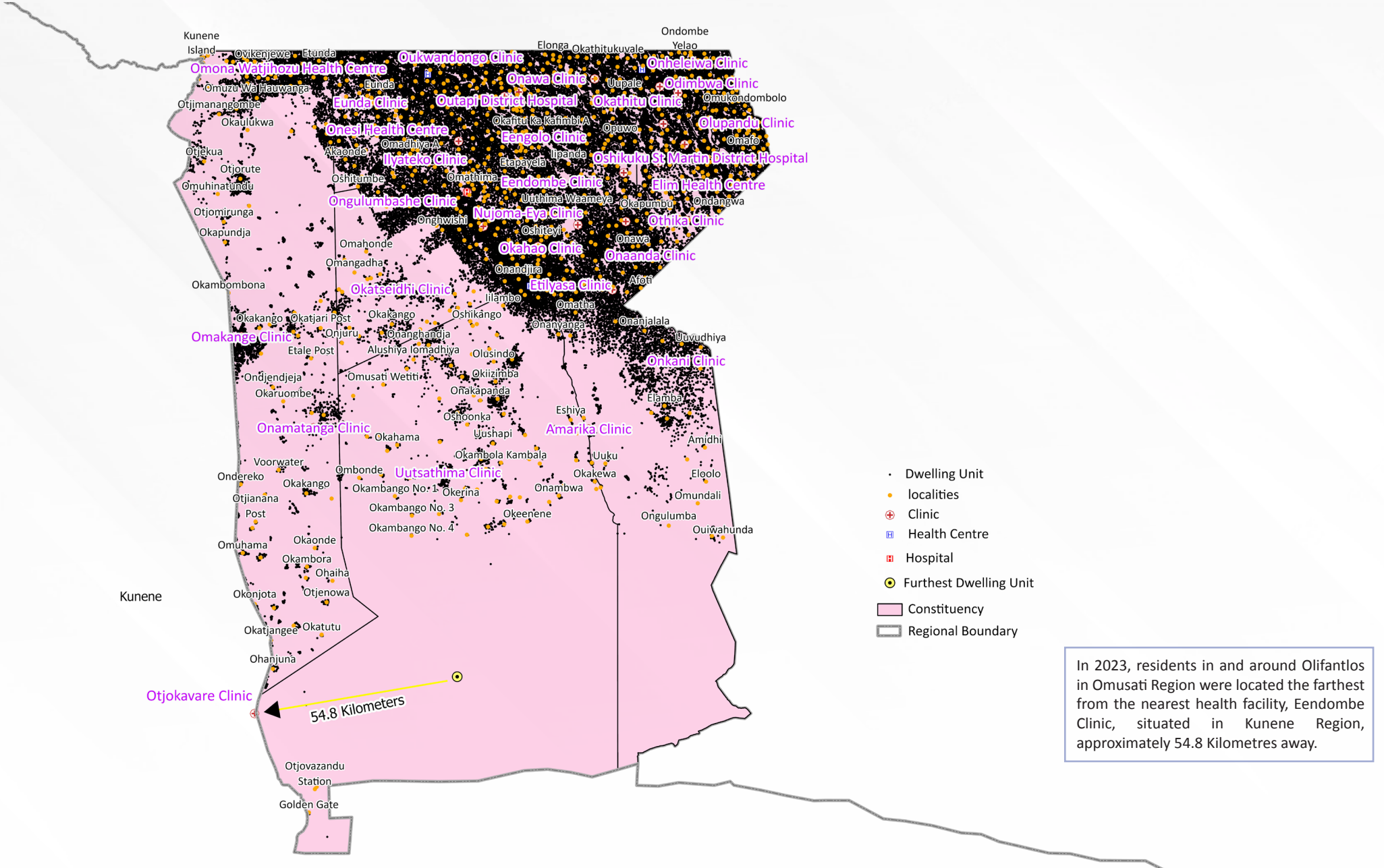
Figure 6.10 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Ombave in Omaheke Region were located the farthest from the nearest health facility, Otjinene Health Facility, situated in the same region, approximately 107.5 Kilometres away.

6.11. Omusati Region

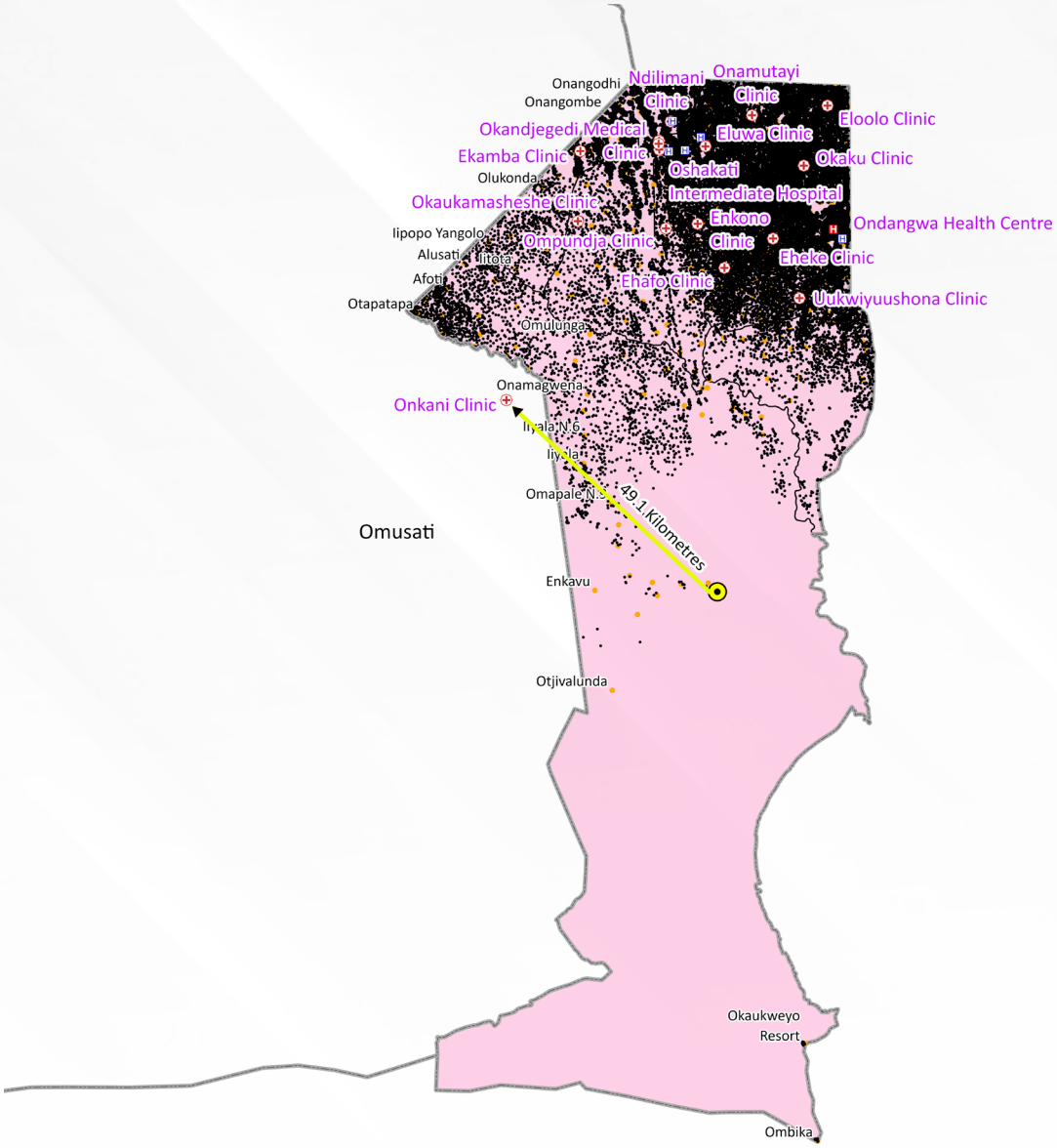
Figure 6.11 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Olifantlos in Omusati Region were located the farthest from the nearest health facility, Eendombe Clinic, situated in Kunene Region, approximately 54.8 Kilometres away.

6.12. Oshana Region

Figure 6.12 1 Longest Distance to Closest Health Facility

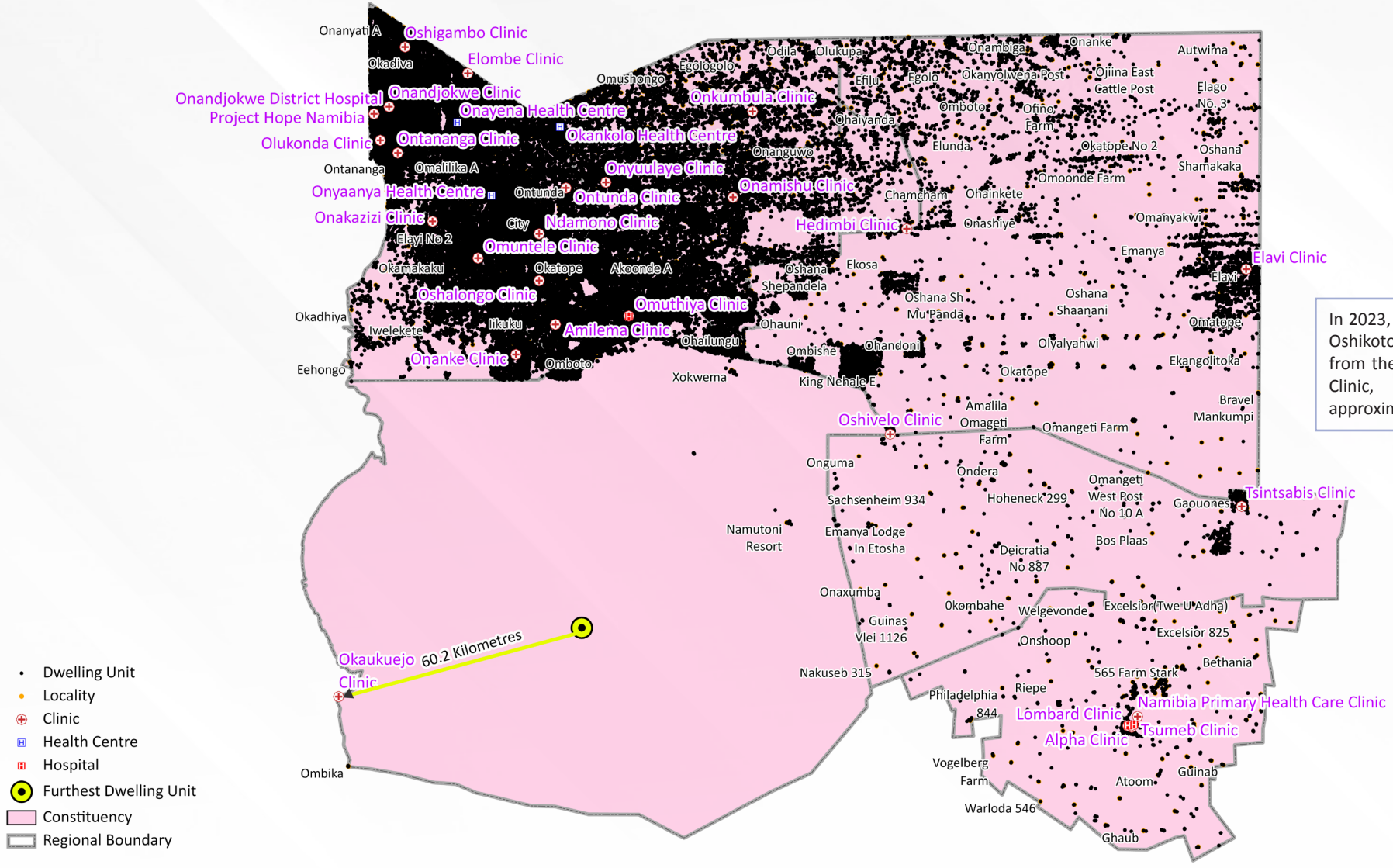


In 2023, residents in and around Oniimpunguru in Oshana Region were located the farthest from the nearest health facility, Onkani Clinic, situated in Omusati Region, approximately 49.1 Kilometres away.

- Dwelling Unit
- Locality
- Clinic
- Health Centre
- Hospital
- Furthest Dwelling Unit
- Constituency
- Regional Boundary

6.13. Oshikoto Region

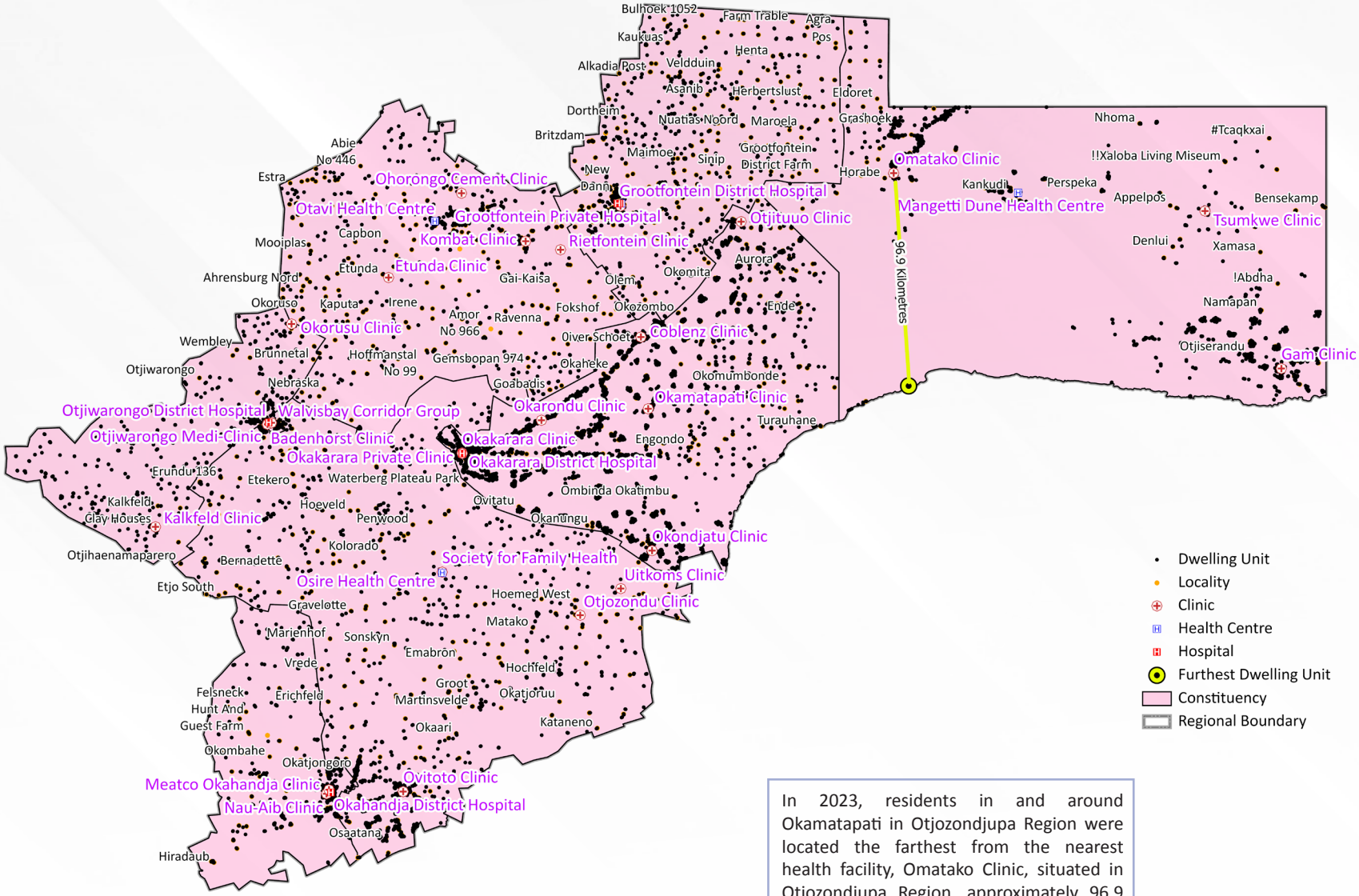
Figure 6.13 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Ombika in Oshikoto Region were located the farthest from the nearest health facility, Okaukuejo Clinic, situated in Oshikoto Region, approximately 60.2 Kilometres away.

6.14. Otjozondjupa Region

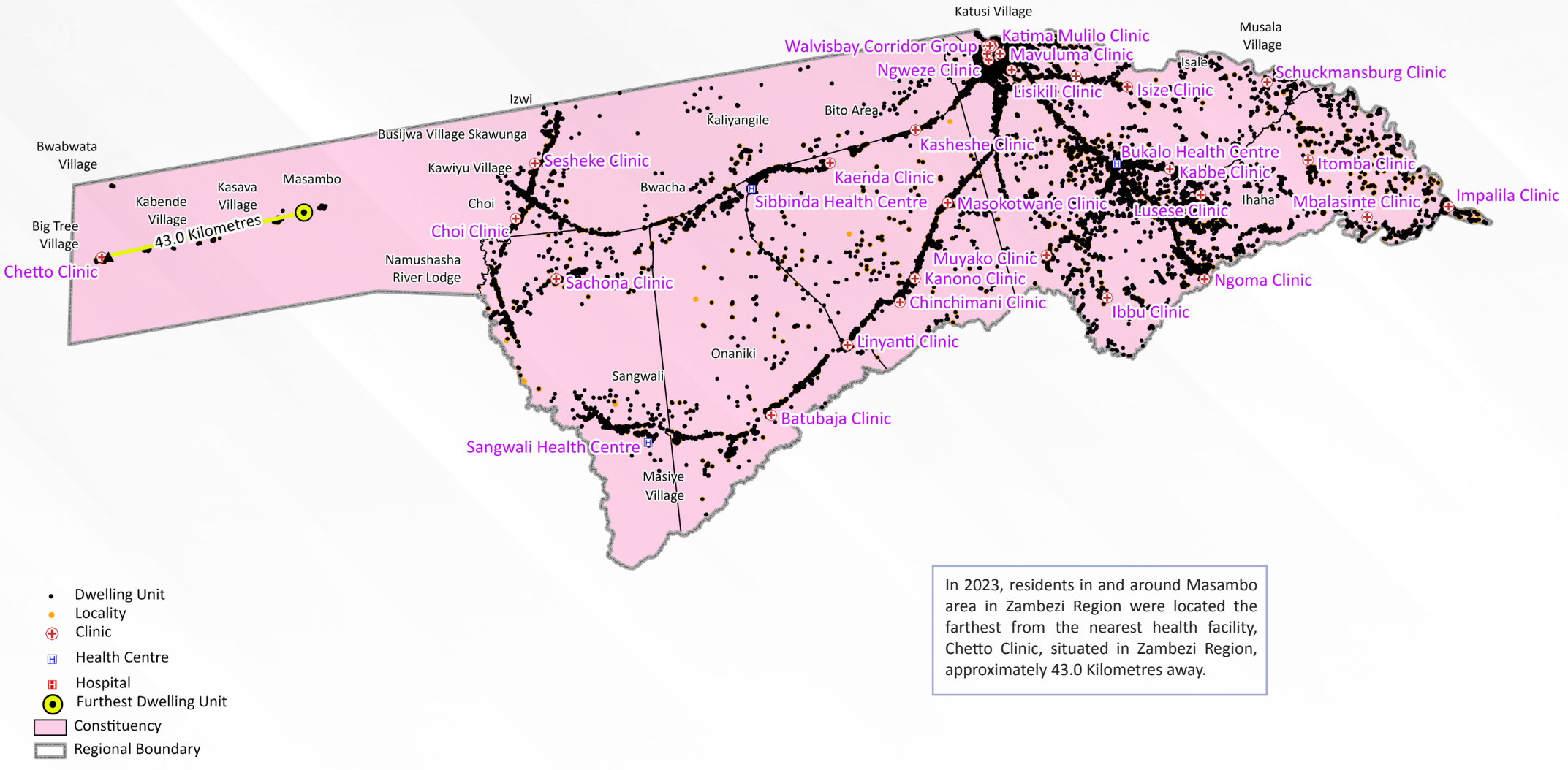
Figure 6.14 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Okamatapati in Otjozondjupa Region were located the farthest from the nearest health facility, Omatako Clinic, situated in Otjozondjupa Region, approximately 96.9 Kilometres away.

6.15. Zambezi Region

Figure 6.15 1 Longest Distance to Closest Health Facility



In 2023, residents in and around Masambo area in Zambezi Region were located the farthest from the nearest health facility, Chetto Clinic, situated in Zambezi Region, approximately 43.0 Kilometres away.

CHAPTER 7:
HEALTH FACILITIES AND POPULATION BY NETWORK COVERAGE

This chapter explored the spatial relationship between population and health facilities distribution to mobile network coverage of 2G, 3G and 4G. The analysis provided the number of health facilities and persons within network coverage areas and those without. It used spatial data from health facilities (hospitals, clinics and health centers), population distribution, and mobile network coverage. Spatial queries were performed to calculate the number of health facilities and population intersecting the 2G, 3G, and 4G network coverage. The total population and facilities without coverage were identified through the absence of intersection with any network coverage.

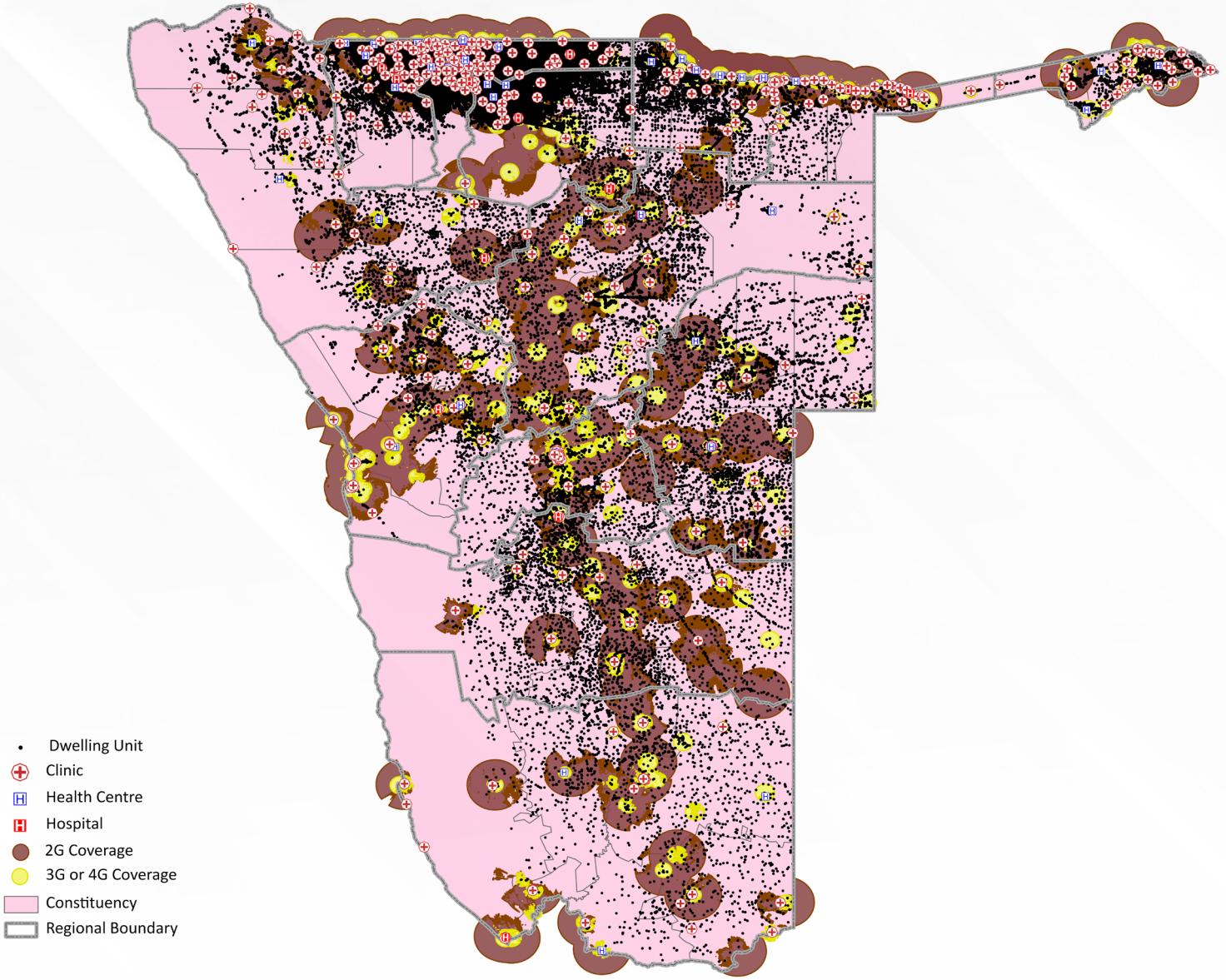
For the purposes of this analysis, 3G and 4G were combined into a single layer. Additionally, 3G and 4G coverage areas were removed from the 2G, therefore the 2G layer in this Atlas excluded 3G and 4G to prevent double counting. However, this does not necessarily imply that areas with 3G or 4G coverage lack 2G coverage, as many areas may have overlapped coverage for both 2G and 3G or 4G network types.

The summary write-ups in this chapter emphasize on population and health facilities that only have 2G and those without any network coverage as they are more in need of network services. In this chapter “2G” refers to areas that ONLY have 2G coverage, while “3G OR 4G” refers to areas that have either 3G or 4G.



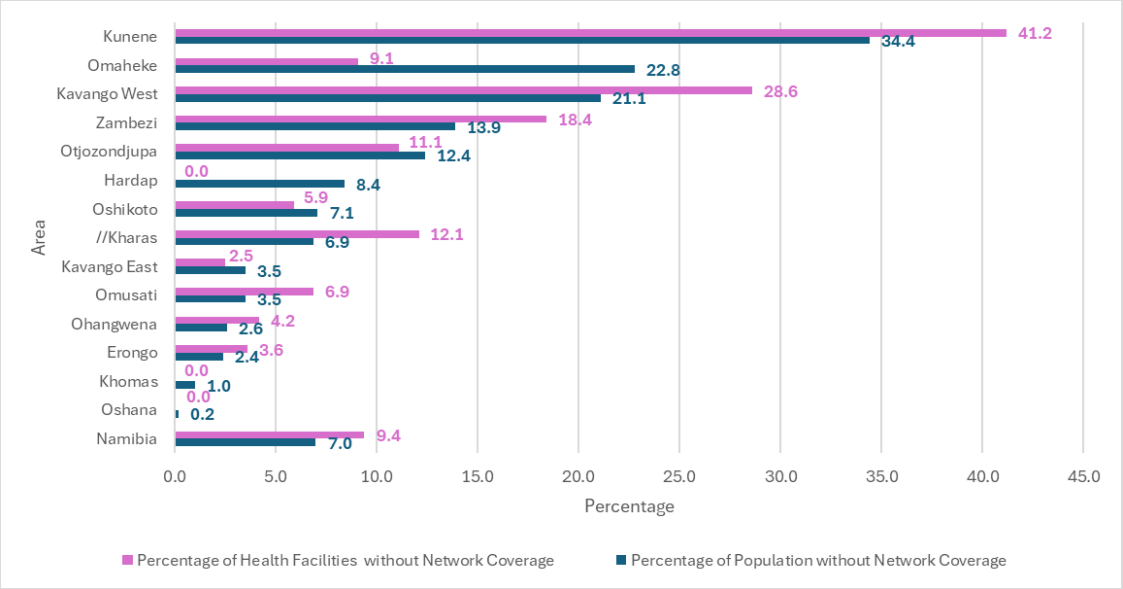
7.1. National Network Coverage

Figure 7.1 1 Health Facilities and Population by Network Coverage, Namibia



Note: The vertical axis is limited to a range of 0-50% for clearer visualization, as all data points fall below 50%.

Figure 7.1 2 Health Facilities and Population without Network Coverage, Namibia



Namibia had 93.0 percent of the population and 90.6 percent of health facilities within network coverage of 2G, 3G and 4G. At regional level, Oshana had the highest population covered by network at 99.8 percent. Hardap, Khomas and Oshana had 100 percent network coverage for all their health facilities. Kunene Region had the least percentage of population and health facilities covered by network 65.6 and 58.8 percent respectively.

Table 7.1 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facilities			
	Total	Percentage within 2G Coverage Only	Percentage within 3G and 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage Only	Percentage within 3G and 4G Coverage	Percentage without Network
Namibia	**3 022 401**	5.8	87.2	7.0	**530**	6.4	84.2	9.4
//Kharas	**109 893**	4.3	88.8	6.9	**33**	6.1	81.8	12.1
Erongo	**240 206**	2.4	95.2	2.4	**55**	5.5	90.9	3.6
Hardap	**106 680**	9.6	82	8.4	**21**	9.5	90.5	0.0
Kavango East	**218 421**	10.6	85.9	3.5	**40**	17.5	80.0	2.5
Kavango West	**123 266**	14.1	64.8	21.1	**28**	17.9	53.6	28.6
Khomas	**494 605**	0.8	98.2	1.0	**59**	1.7	98.3	0.0
Kunene	**120 762**	16.4	49.3	34.4	**34**	17.6	41.2	41.2
Ohangwena	**337 729**	4.7	92.6	2.6	**48**	4.2	91.7	4.2
Omaheke	**102 881**	12.5	64.7	22.8	**22**	0.0	90.9	9.1
Omusati	**316 671**	2.0	94.6	3.5	**58**	0.0	93.1	6.9
Oshana	**230 801**	1.5	98.3	0.2	**24**	4.2	95.8	0.0
Oshikoto	**257 302**	8.3	84.6	7.1	**34**	5.9	88.2	5.9
Otjozondjupa	**220 811**	8.3	79.3	12.4	**36**	2.8	86.1	11.1
Zambezi	**142 373**	8.3	77.8	13.9	**38**	5.3	76.3	18.4

7.2. //Kharas Region

Figure 7.2 1 Health Facilities and Population by Network Coverage

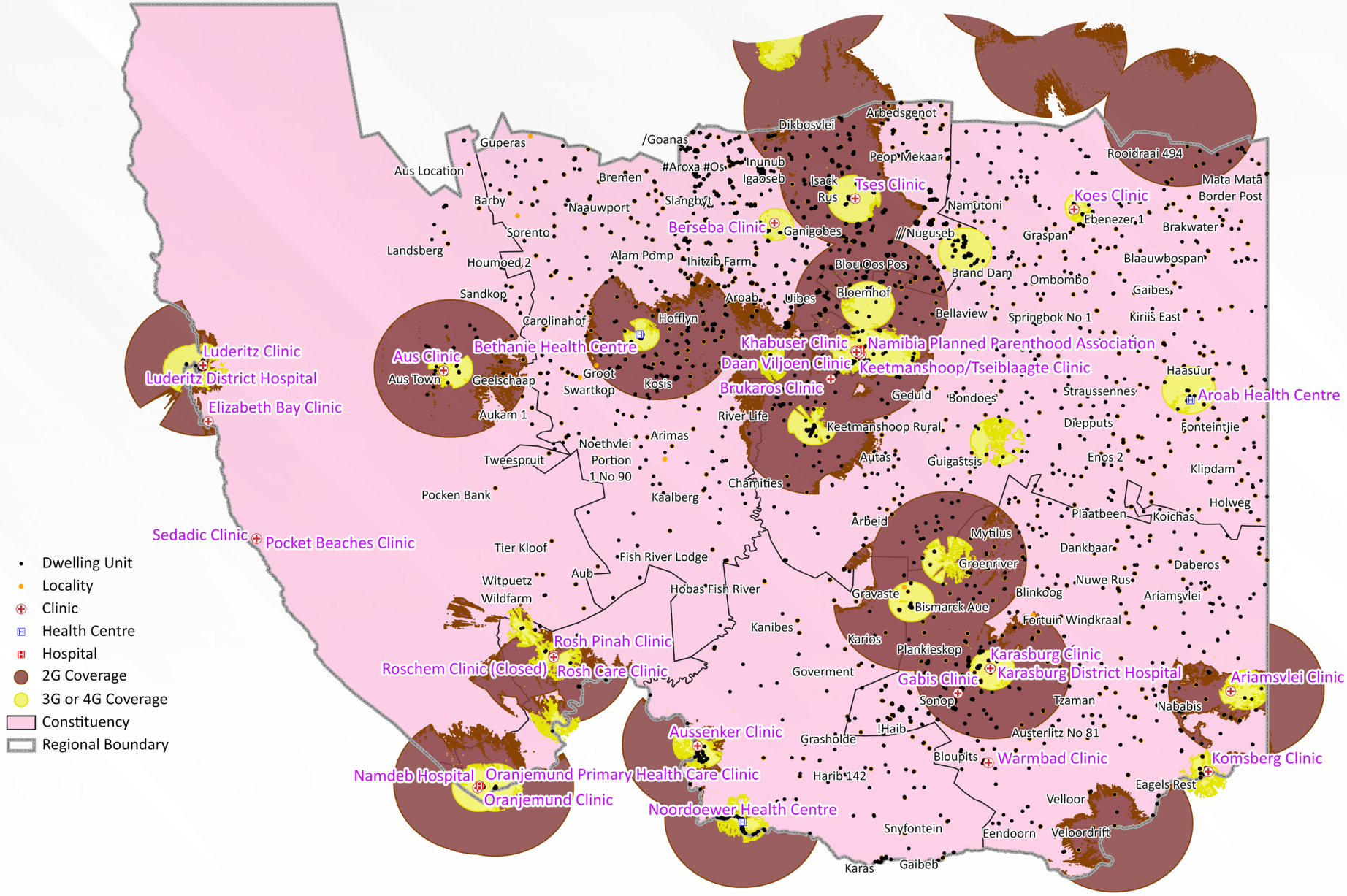
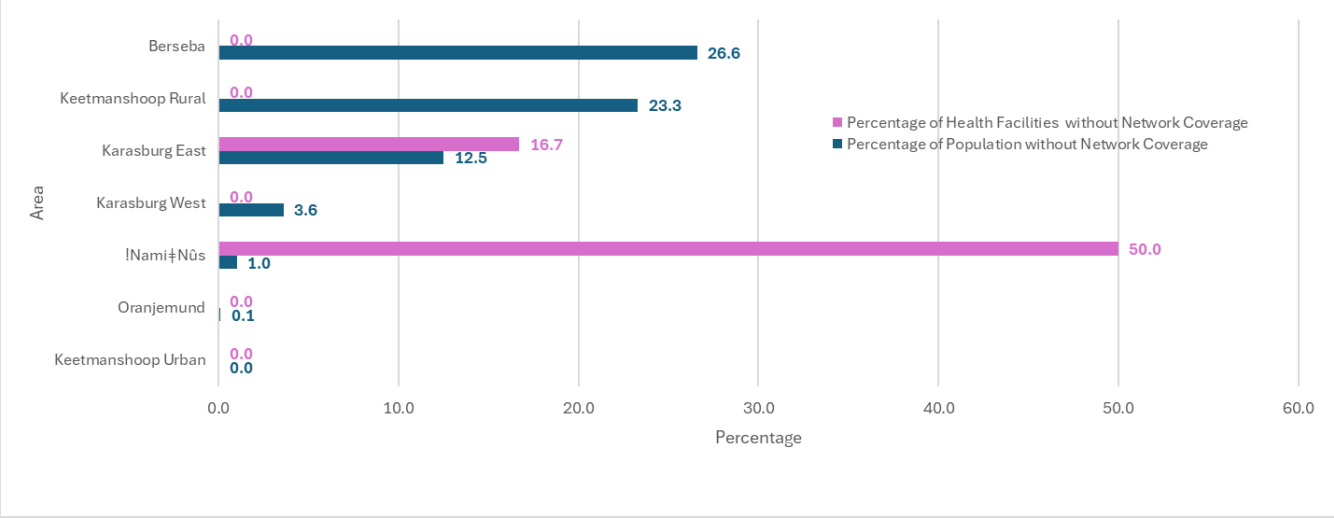


Figure 7.2 2 Health Facilities and Population without Network Coverage



//Kharas Region had 93.1 percent of the population and 93.9 percent of health facilities with network coverage. At constituency level, Berseba had the highest percentage (20.9%) of its population within 2G network coverage, followed by Karasburg East with (11.5%). Keetmanshoop Urban and Oranjemund had the highest percentage (both 99.8%) of their population covered by 3G or 4G network, while Berseba had the least percentage (52.5%). Berseba had the highest percentage (26.6%) of its population without any network coverage.

For health facilities, Keetmanshoop Rural had the most 2G coverage (33.3%), followed by Karasburg East (16.7%). Berseba, Oranjemund, Keetmanshoop Urban, and Karasburg West had the highest percentage (100.0%) of health facilities covered by 3G and 4G network, while !Nami‡Nûs had the lowest (50.0%) of health facilities covered by 3G and 4G. !Nami‡Nûs had the highest percentage (50.0%) of its health facility without any network coverage.

Table 7.2 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
//Kharas	**109 893**	4.3	88.8	6.9	**33**	6.1	81.8	12.1
!Nami‡Nûs	**17 243**	0.3	98.7	1.0	**6**	0.0	50.0	50.0
Berseba	**11 258**	20.9	52.5	26.6	**3**	0.0	100.0	0.0
Karasburg East	**13 821**	11.5	76.0	12.5	**6**	16.7	66.7	16.7
Karasburg West	**17 741**	0.8	95.6	3.6	**2**	0.0	100.0	0.0
Keetmanshoop Rural	**8 744**	5.8	70.9	23.3	**3**	33.3	66.7	0.0
Keetmanshoop Urban	**27 862**	0.2	99.8	0.0	**7**	0.0	100.0	0.0
Oranjemund	**13 224**	0.1	99.8	0.1	**6**	0.0	100.0	0.0

7.3. Erongo Region

Figure 7.3 1 Health Facilities and Population by Network Coverage

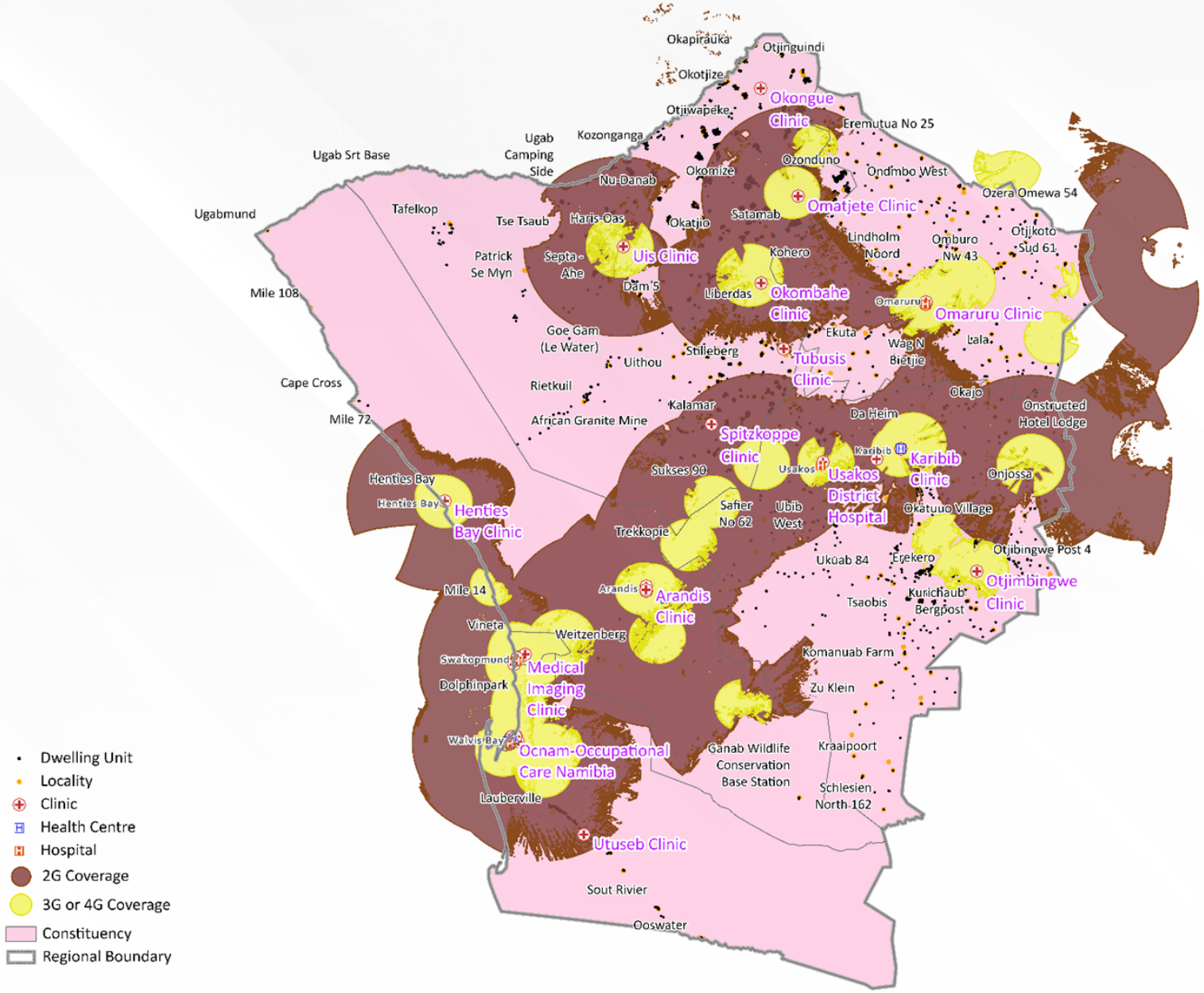
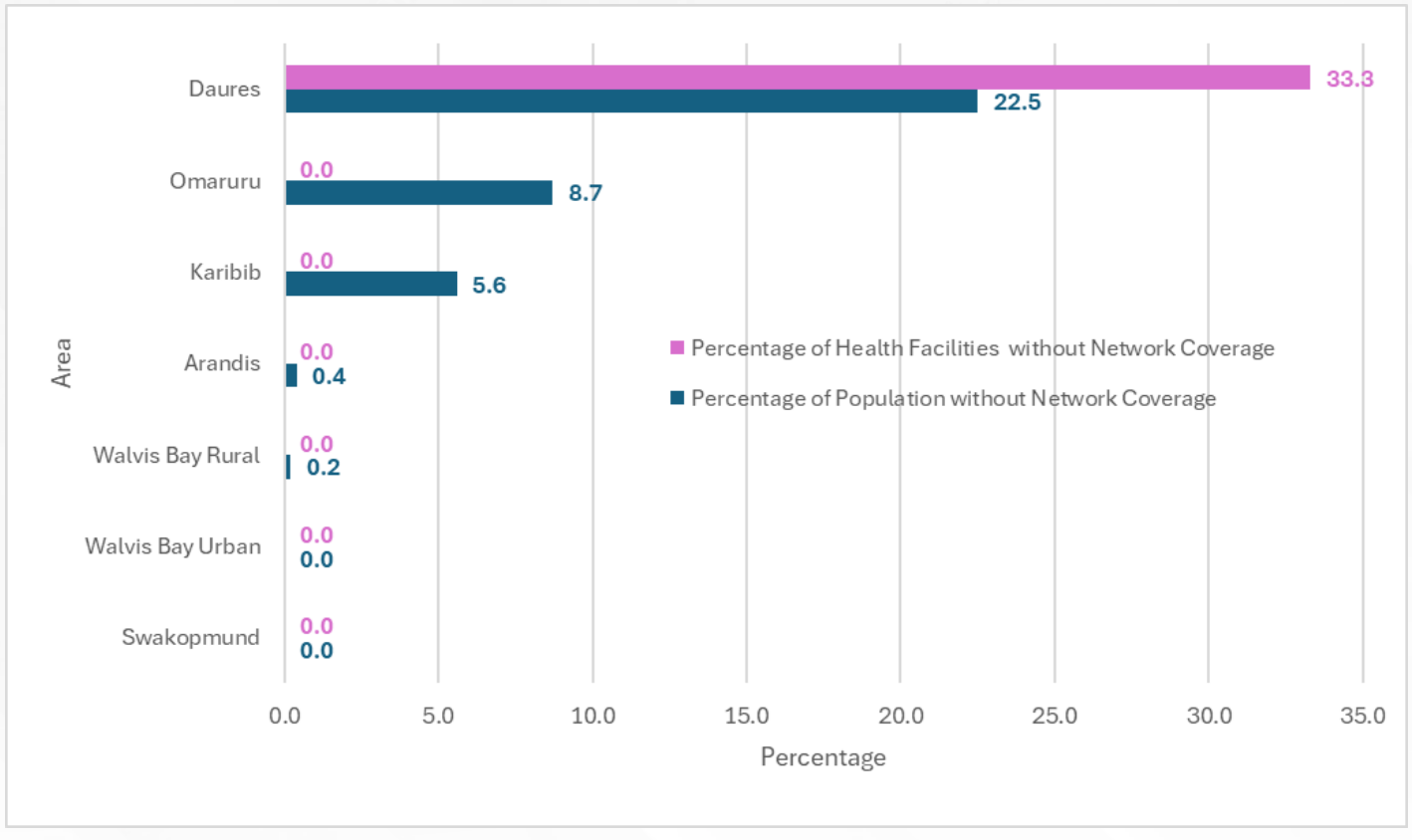


Figure 7.2 2 Health Facilities and Population without Network Coverage



Erongo Region had 97.6 percent of the population and 96.4 percent of health facilities with network coverage. At constituency level, Daures had the highest percentage (28.4%) of its population within 2G network coverage, followed by Karibib (4.7%) and Omaruru (2.3%). Swakopmund and Walvis Bay had their entire population covered by 3G or 4G networks, while Daures had the least percentage(49.1%). Daures also had the highest percentage (22.5 %) of its population without network coverage, while the remaining constituencies in the region had less than 10% of their populations without network coverage.

In terms of health facilities, Arandis had the highest percentage (50.0%) of its health facilities within 2G network coverage, followed by Karibib (16.7%) and Walvis Bay Urban (14.3%). Daures, Swakopmund, and Walvis Bay Urban are the only constituencies that did not have all their health facilities covered by 3G and 4G networks, with coverage rates of 50.0%, 50.0%, and 85.7%, respectively. Daures is the only constituency with health facilities without any network coverage (33.3%), while the other constituencies had complete network coverage across all health facilities.

Table 7.2 2 Health Facilities and Population without Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Erongo	**240 206**	2.4	95.2	2.4	55	5.5	90.9	3.6
Arandis	**13 542**	0.3	99.3	0.4	**5**	0.0	100.0	0.0
Daures	**14 601**	28.4	49.1	22.5	**6**	16.7	50.0	33.3
Karibib	**19 705**	4.7	89.7	5.6	**10**	0.0	100.0	0.0
Omaruru	**13 322**	2.3	89.0	8.7	**5**	0.0	100.0	0.0
Swakopmund	**75 921**	0.0	100.0	0.0	**2**	50.0	50.0	0.0
Walvis Bay Rural	**51 497**	0.9	98.9	0.2	**20**	0.0	100.0	0.0
Walvis Bay Urban	**51 618**	0.0	100.0	0.0	**7**	14.3	85.7	0.0

7.4. Hardap Region

Figure 7.4 1 Health Facilities and Population by Network Coverage

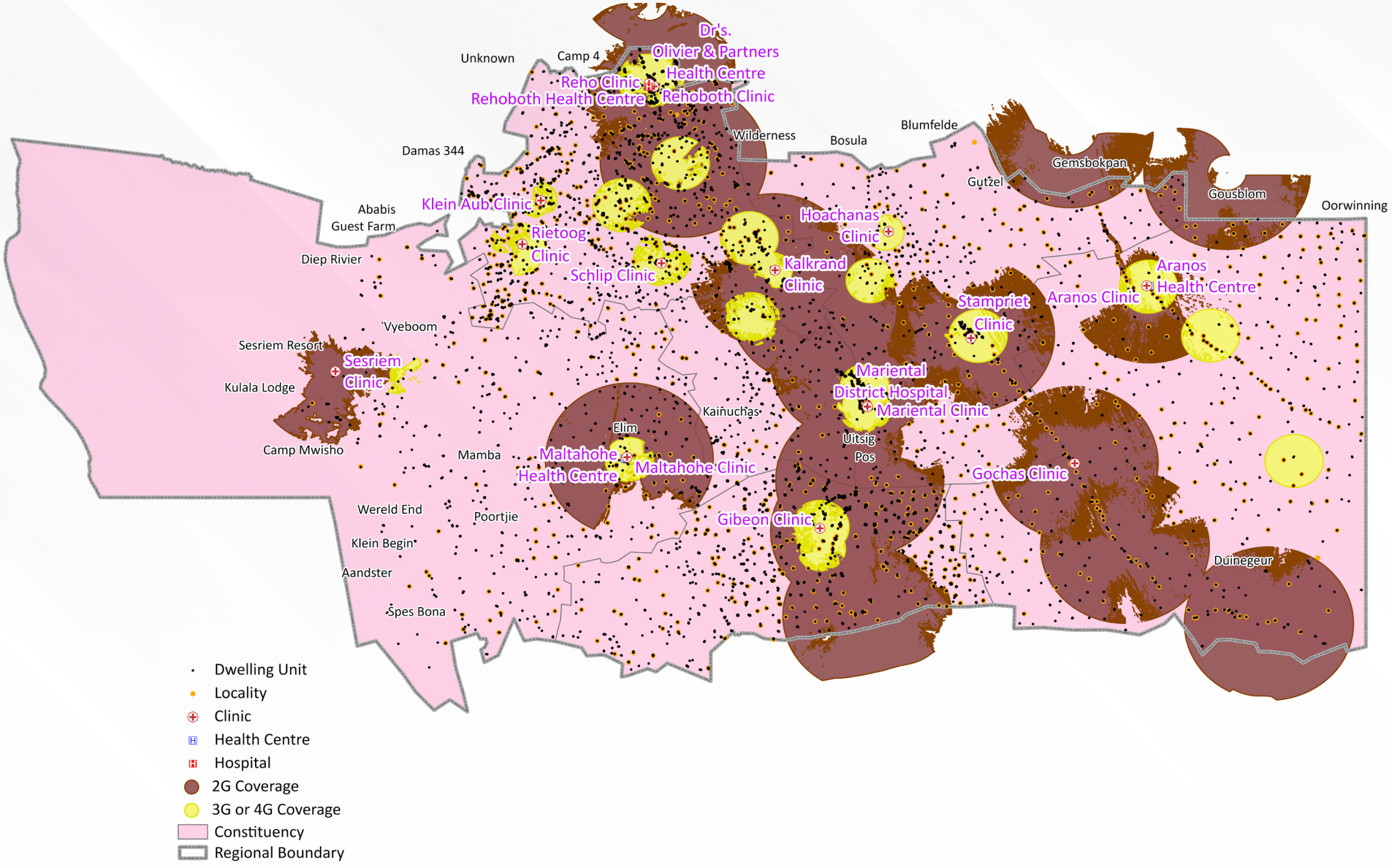
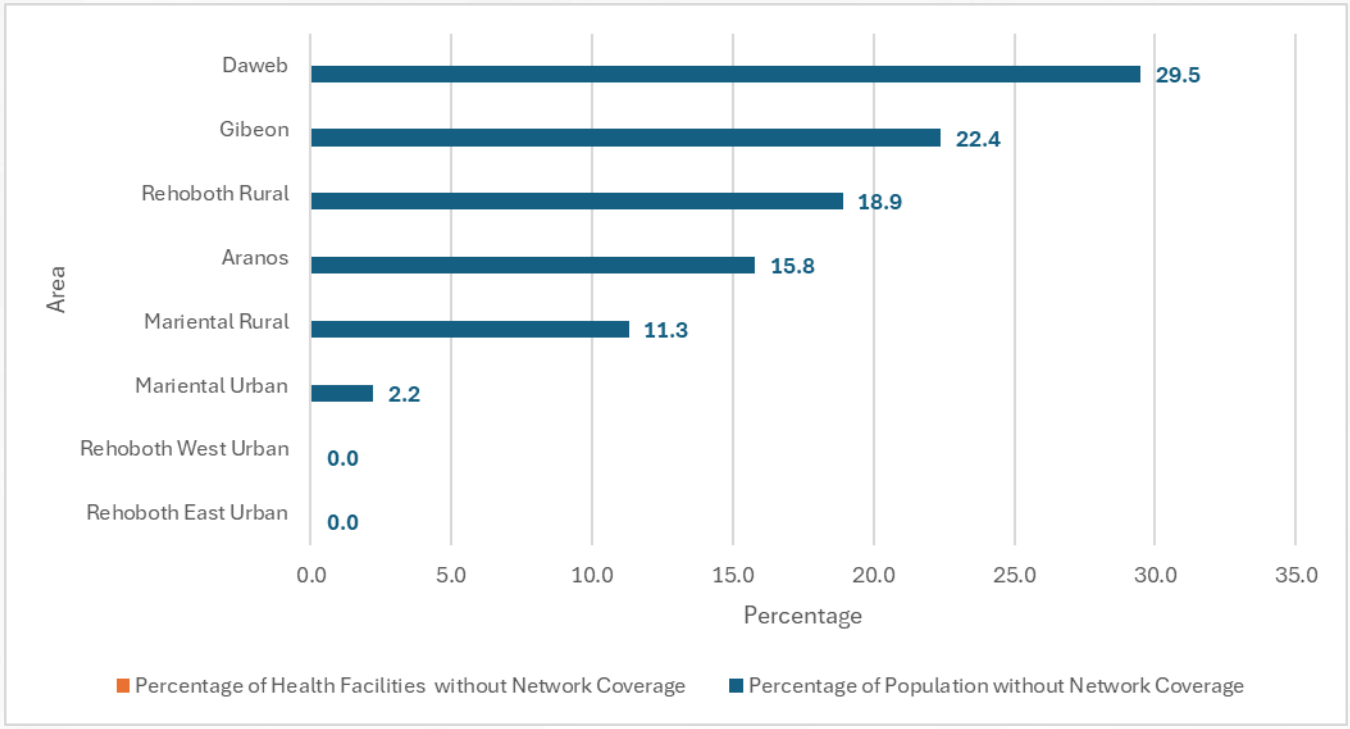


Figure 7.4 2 Health Facilities and Population without Network Coverage



Hardap Region had 91.6 percent of the population and 100.0 percent of health facilities with network coverage. At constituency level, Aranos had the highest percentage (30.3%) of its population within 2G network coverage, followed by Gibeon with (24.5%). Rehoboth East Urban had the highest percentage (98.3%) of its population covered by 3G or 4G network, followed by Rehoboth West Urban (97.9%) while Gibeon had the least percentage (53.1%). Daweb had the highest percentage (29.5%) of its population without any network coverage.

In terms of health facilities, Only Daweb and Aranos constituencies had the highest percentage (both with 33.3%) of health facilities within 2G network coverage. Rehoboth West Urban, Rehoboth East Urban, Mariental Urban, Mariental Rural, Rehoboth Rural and Gibeon had all their health facilities covered by 3G and 4G network, while Daweb and Aranos constituencies had the lowest (both with 66.7%) of health facilities covered.

Table 7.4 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Hardap	**106 680**	9.6	82.0	8.4	**21**	9.5	90.5	0.0
Aranos	**10 722**	30.3	53.9	15.8	**3**	33.3	66.7	0.0
Daweb	**6 092**	11.2	59.2	29.5	**3**	33.3	66.7	0.0
Gibeon	**8 034**	24.5	53.1	22.4	**1**	0.0	100.0	0.0
Mariental Rural	**12 812**	10.5	78.2	11.3	**2**	0.0	100.0	0.0
Mariental Urban	**18 368**	2.1	95.8	2.2	**2**	0.0	100.0	0.0
Rehoboth East Urban	**29 299**	1.7	98.3	0.0	**5**	0.0	100.0	0.0
Rehoboth Rural	**9 439**	20.1	61.1	18.9	**4**	0.0	100.0	0.0
Rehoboth West Urban	**11 914**	2.1	97.9	0.0	**1**	0.0	100.0	0.0

7.5. Kavango East Region

Figure 7.5 1 Health Facilities and Population with Network Coverage

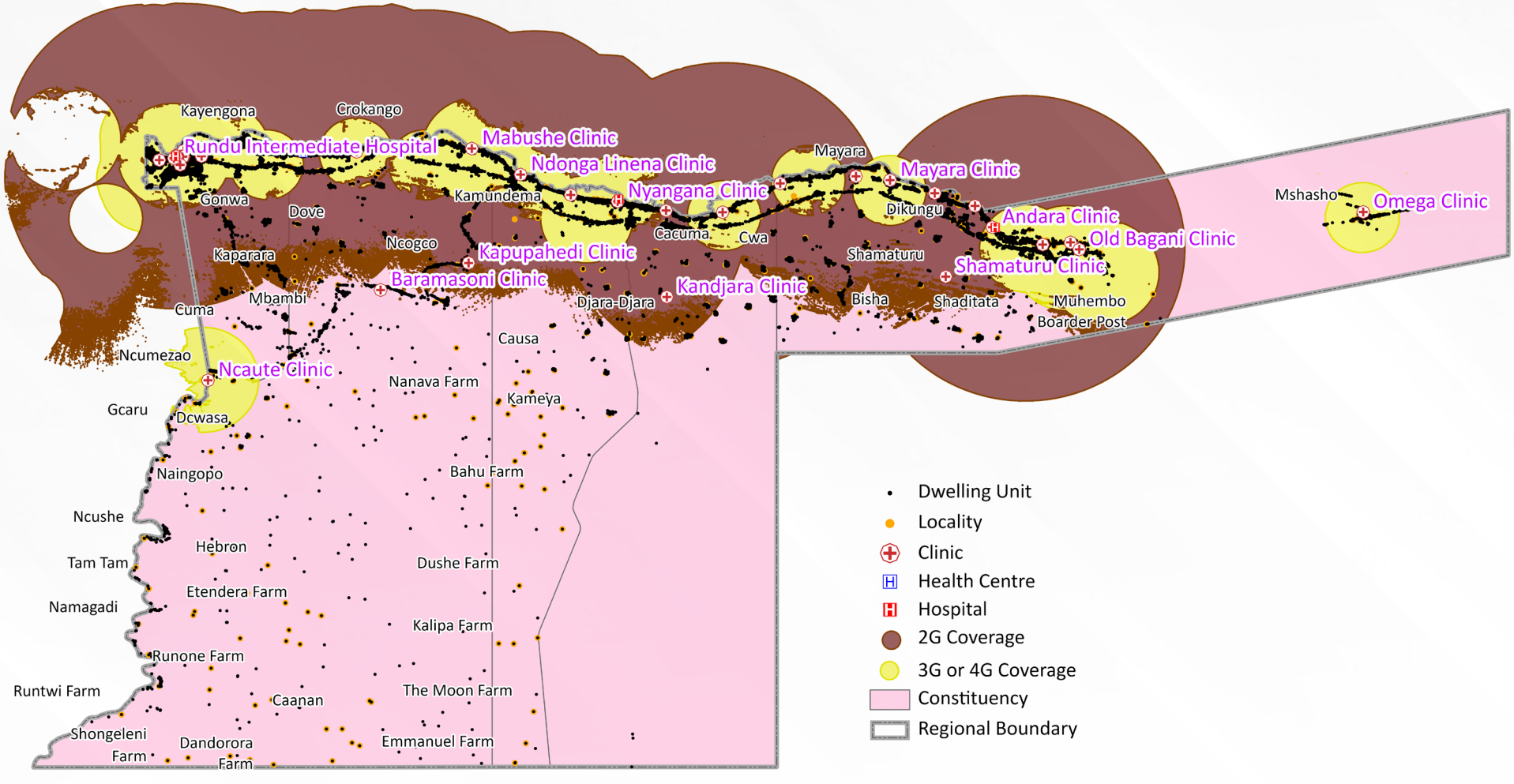
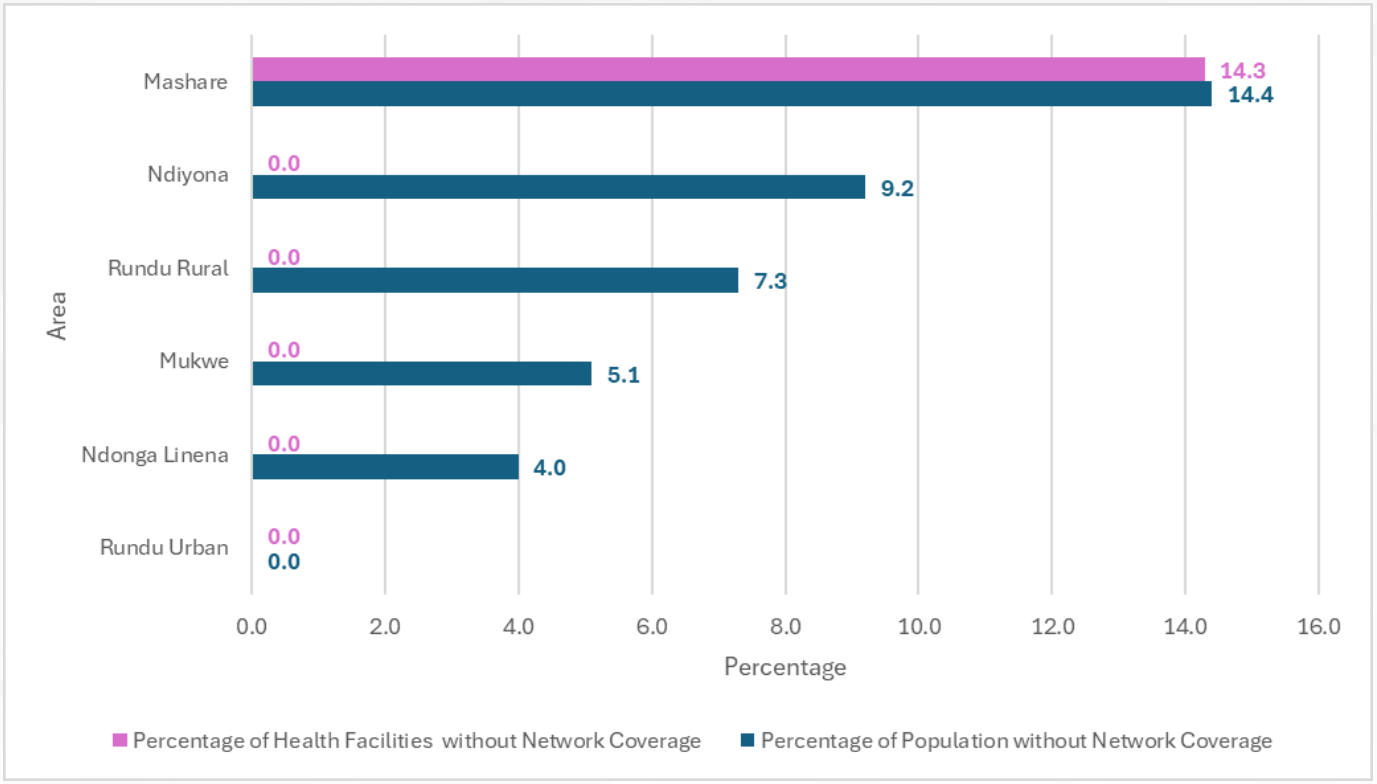


Figure 7.5 2 Health Facilities and Population without Network Coverage



The Kavango East Region had 96.5 percent of the population and 97.5 percent of health facilities with network coverage. At constituency level, Ndiyona and Mashare constituencies had the highest population within the 2G network coverage of 37.3 percent and 28.2 percent respectively. Rundu Urban had the highest percentage (100%) of its population covered by 3G or 4G network, followed by Ndonga Linena (94.8%). Mashare had the highest percentage (14.4%) of the population without any network coverage.

In terms of health facilities, Ndiyona recorded 66.7 percent of the health facilities within the 2G network coverage. Rundu Urban, Ndonga Linena and Rundu Rural constituencies had all the health facilities within the 3G or 4G network coverage. Mashare recorded 14.3 percent of its health facilities without any network coverage.

Table 7.5 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Kavango East	**218 421**	10.6	85.9	3.5	**40**	17.5	80.0	2.5
Mashare	**19 478**	28.2	57.4	14.4	**7**	28.6	57.1	14.3
Mukwe	**39 170**	27.5	67.4	5.1	**12**	25.0	75.0	0.0
Ndiyona	**13 800**	37.3	53.4	9.2	**3**	66.7	33.3	0.0
Ndonga Linena	**14 936**	1.3	94.8	4.0	**4**	0.0	100.0	0.0
Rundu Rural	**12 405**	13.0	79.8	7.3	**1**	0.0	100.0	0.0
Rundu Urban	**118 632**	0.0	100.0	0.0	**13**	0.0	100.0	0.0

7.6. Kavango West Region

Figure 7.6 1 Health Facilities and Population by Network Coverage

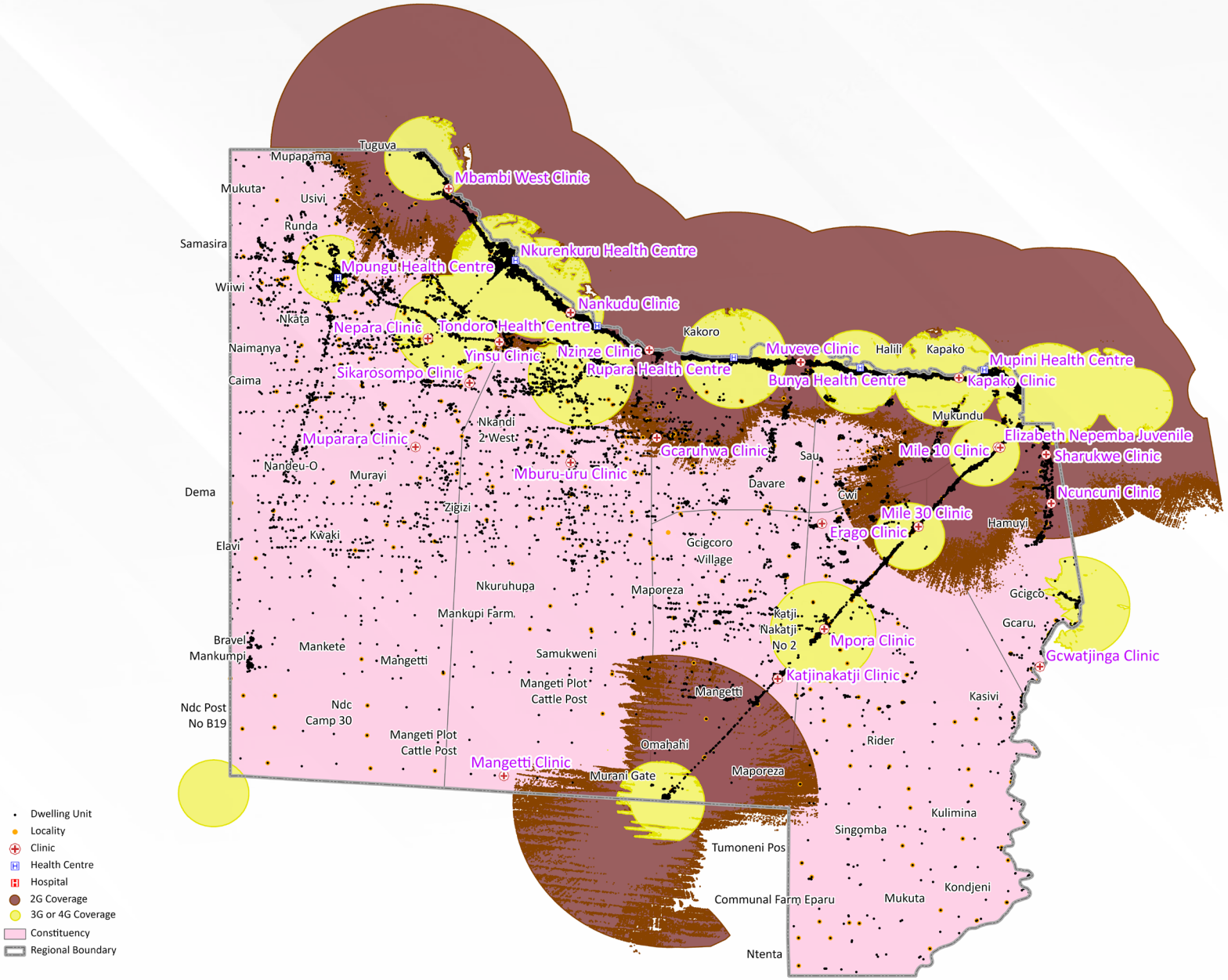
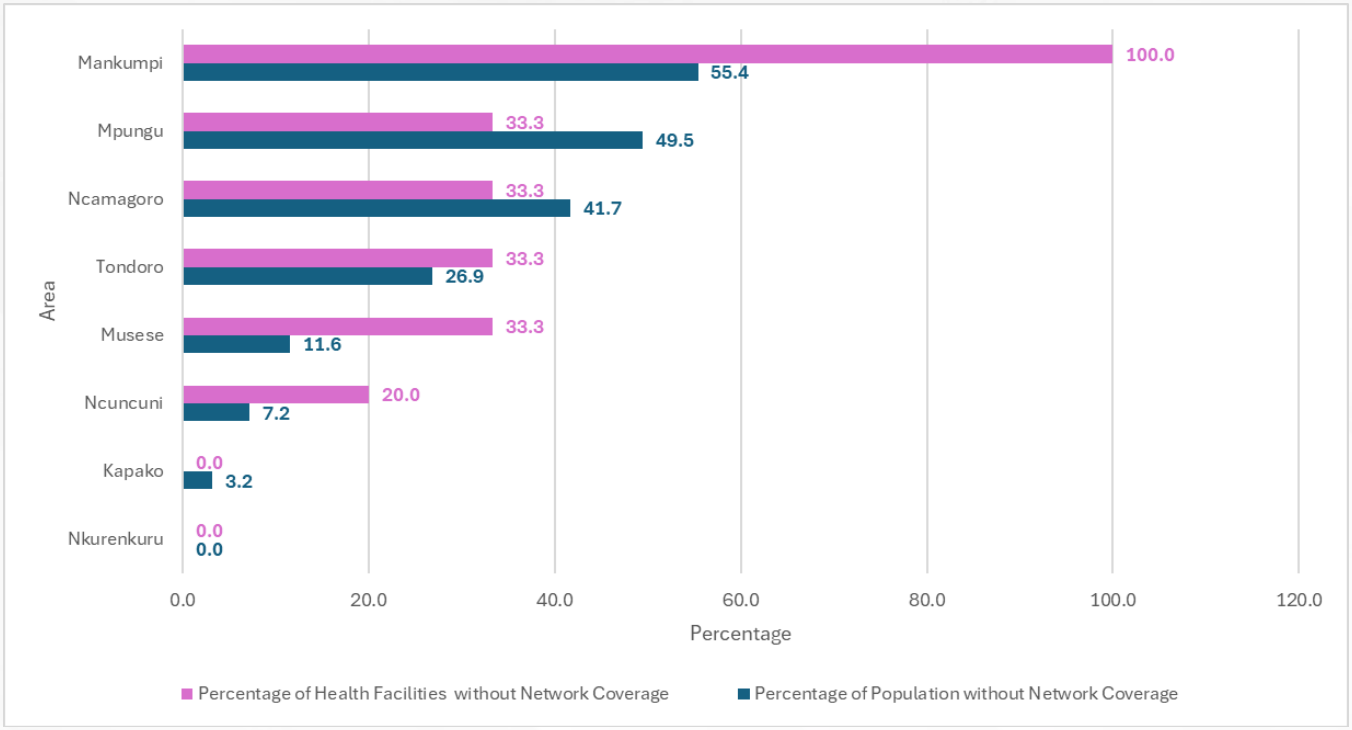


Figure 7.6 2 Health Facilities and Population without Network Coverage



Kavango West Region had 78.9 percent of the population and 71.4 percent of health facilities with network coverage. At constituency level, Ncuncuni had the highest percentage (40.7%) of its population within 2G network coverage. Nkurenkuru had all its population covered by 3G or 4G network, while Mankumpi had the least percentage (25.4%). Mankumpi also had the highest percentage (55.4%) of its population without any network coverage.

In terms of health facilities, Ncuncuni had the highest percentage (40.0%) of its health facilities within 2G network coverage. Nkurenkuru and Kapako constituencies had all their health facilities covered by 3G or 4G network, while Musese had the lowest (33.3%). Mankumpi had all its health facility without any network coverage.

Table 7.6 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Kavango West	**123 266**	14.1	64.8	21.1	**28**	17.9	53.6	28.6
Kapako	**27 823**	5.7	91.1	3.2	**3**	0.0	100.0	0.0
Mankumpi	**6 910**	19.2	25.4	55.4	**1**	0.0	0.0	100.0
Mpungu	**21 098**	10.9	39.6	49.5	**6**	16.7	50.0	33.3
Musese	**13 659**	24.2	64.2	11.6	**3**	33.3	33.3	33.3
Ncamagoro	**8 449**	3.6	54.7	41.7	**3**	0.0	66.7	33.3
Ncuncuni	**10 943**	40.7	52.1	7.2	**5**	40.0	40.0	20.0
Nkurenkuru	**15 887**	0.0	100.0	0.0	**1**	0.0	100.0	0.0
Tondoro	**18 497**	22.1	51.0	26.9	**6**	16.7	50.0	33.3

7.7. Khomas Region

Figure 7.7 1 Health Facilities and Population with Network Coverage

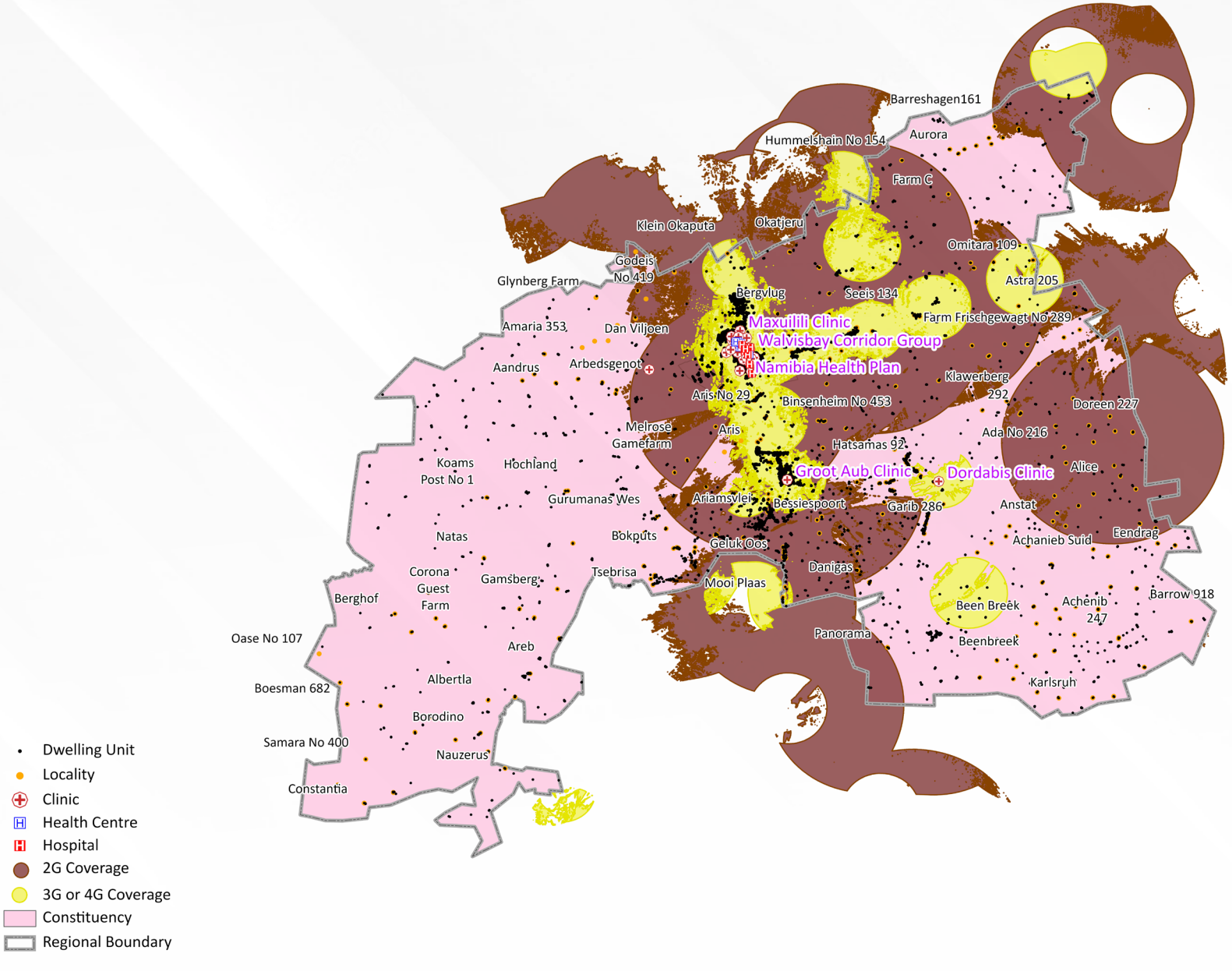
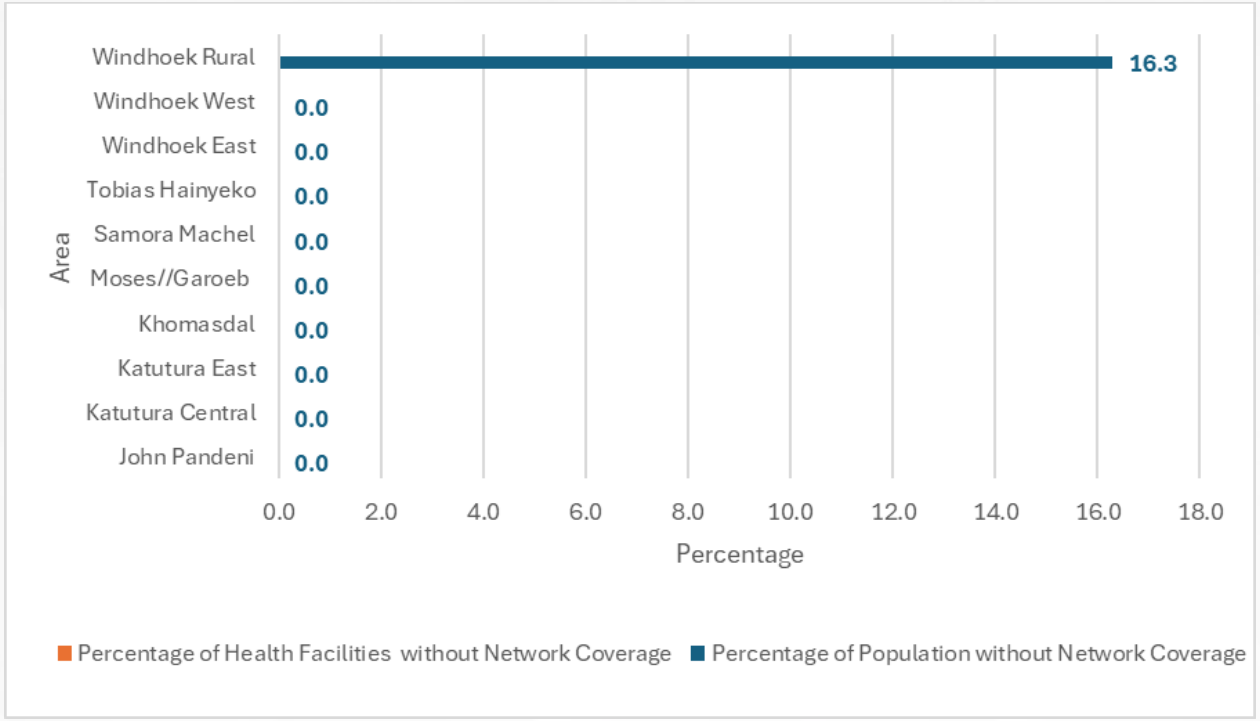


Figure 7.7 2 Health Facilities and Population without Network Coverage



The Khomas Region had 99.0 percent of the population and 100.0 percent of health facilities covered by network coverage. At constituency level, Windhoek Rural constituency (12.8%) and Windhoek West (0.3%) were the only constituencies in the Khomas Region with population covered by 2G network, while the rest of the constituencies had 100 percent of their population covered by 3G or 4G network. Windhoek Rural constituency was the only constituency in the Khomas region with population without any network coverage which stood at (16.3%).

Table 7.7 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Khomas	**494 605**	0.8	98.2	1.0	**59**	1.7	98.3	0.0
John Pandeni	**25 457**	0.0	100.0	0.0	**3**	0.0	100.0	0.0
Katutura Central	**30 557**	0.0	100.0	0.0	**2**	0.0	100.0	0.0
Katutura East	**22 940**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Khomasdal	**67 211**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Moses //Garoeb	**68 932**	0.0	100.0	0.0	**1**	0.0	100.0	0.0
Samora Machel	**92 401**	0.0	100.0	0.0	**1**	0.0	100.0	0.0
Tobias Hainyeko	**67 067**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Windhoek East	**30 054**	0.0	100.0	0.0	**21**	0.0	100.0	0.0
Windhoek Rural	**30 079**	12.8	70.9	16.3	**3**	33.3	66.7	0.0
Windhoek West	**59 907**	0.3	99.7	0.0	**16**	0.0	100.0	0.0

7.8. Kunene Region

Figure 7.8 1 Health Facilities and Population by Network Coverage

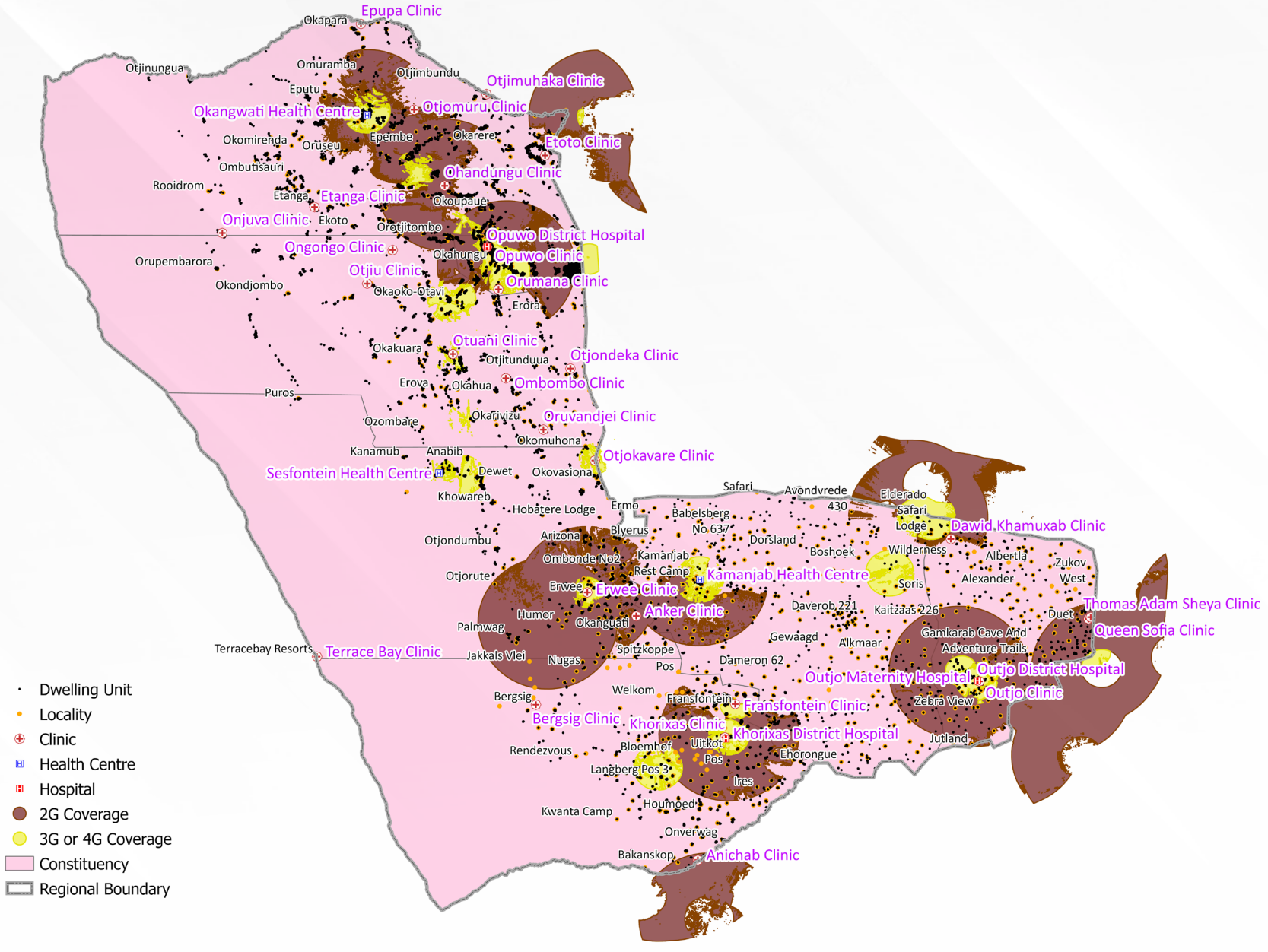
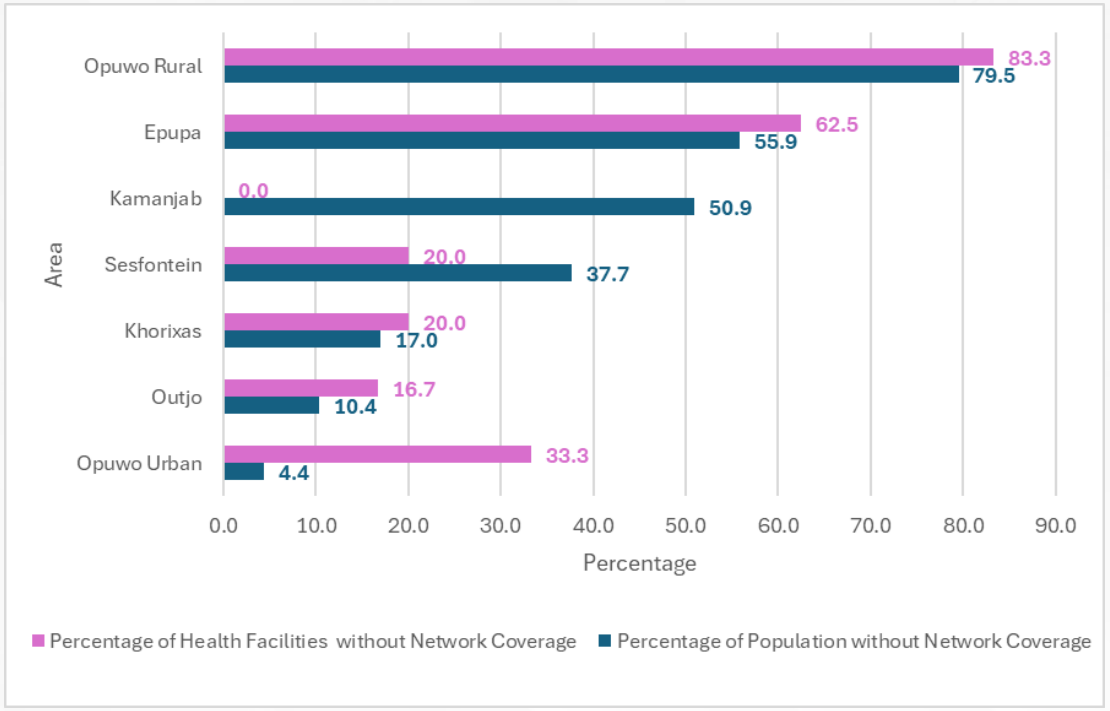


Figure 7.8 2 Health Facilities and Population without Network Coverage



Kunene Region had 65.6 percent of the population and 58.8 percent of health facilities with network coverage. At constituency level, Epupa had the highest percentage (29.8%) of its population within 2G network coverage, followed by Sesfontein (28.3%). Opuwo Urban had the highest percentage (82.5%) of its population covered by 3G and 4G network, while Opuwo Rural had the least percentage (13.5%). Opuwo Rural also had the highest percentage (79.5%) of its population without any network coverage.

In terms of health facilities, Opuwo Rural had the highest percentage (83.3%) of its health facilities within 2G network coverage, followed by Epupa with (62.5%). Outjo had the highest percentage (33.3%) of its health facilities covered by 3G and 4G network, while Kamanjab, Opuwo Rural and Opuwo Urban had the least percentages with 0.0%. Kamanjab had the highest percentage (100.0%) of its health facility without any network coverage, while Epupa had the lowest percentage (12.5%) of its health facilities without any network coverage.

Table 7.8 1 Health Facilities and Population by Network Coverage

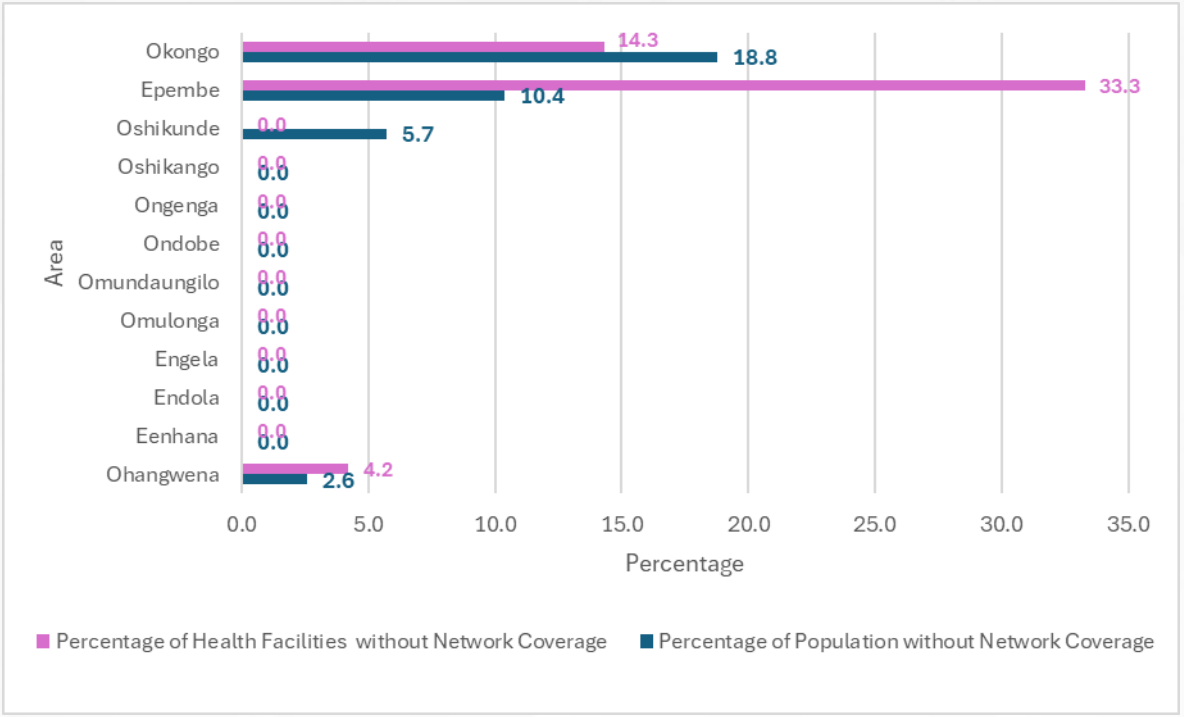
Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Kunene	**120 762**	16.4	49.3	34.4	**34**	17.6	41.2	41.2
Epupa	**26 491**	29.8	14.3	55.9	**8**	62.5	25.0	12.5
Kamanjab	**11 349**	12.3	36.8	50.9	**1**	0.0	0.0	100.0
Khorixas	**15 506**	11.7	71.3	17.0	**5**	20.0	20.0	60.0
Opuwo Rural	**14 894**	7.0	13.5	79.5	**6**	83.3	0.0	16.7
Opuwo Urban	**23 934**	13.1	82.5	4.4	**3**	33.3	0.0	66.7
Outjo	**19 743**	10.2	79.5	10.4	**6**	16.7	33.3	50.0
Sesfontein	**8 845**	28.3	34.1	37.7	**5**	20.0	20.0	60.0

7.9. Ohangwena Region

Figure 7.9 1 Health Facilities and Population with Network Coverage



Figure 7.9 2 Health Facilities and Population without Network Coverage



Ohangwena Region had 97.3 percent of the population and 95.8 percent of health facilities covered by network coverage. At constituency level, Epembe had the highest percentage (24.9%) of its population within 2G network coverage. Endola, Engela, Ohangwena, Ongenga and Oshikango had all their population covered by 3G or 4G network, while Epembe and Okongo had the least percentages (64.6% and 65.7%, respectively). Okongo also had the highest percentage (18.8%) of its population without any network coverage.

In terms of health facilities, Omundaungilo had the highest percentage (50.0%) of its health facilities within 2G network coverage. Eenhana, Omulonga, Ondobe, Endola, Oshikango, Ongenga, Ohangwena and Engela had all their health facilities covered by 3G and 4G network, while Omundaungilo had the lowest (50.0%). Epembe had the highest percentage (33.3%) of its health facility without any network coverage.

Table 7.9 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Ohangwena	**337 729**	4.7	92.6	2.6	**48**	4.2	91.7	4.2
Eenhana	**35 304**	4.8	95.2	0.0	**5**	0.0	100.0	0.0
Endola	**32 698**	0.0	100.0	0.0	**5**	0.0	100.0	0.0
Engela	**30 004**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Epembe	**16 336**	24.9	64.6	10.4	**3**	0.0	66.7	33.3
Ohangwena	**31 491**	0.0	100.0	0.0	**2**	0.0	100.0	0.0
Okongo	**31 746**	15.5	65.7	18.8	**7**	0.0	85.7	14.3
Omulonga	**32 802**	0.3	99.7	0.0	**3**	0.0	100.0	0.0
Omundaungilo	**15 009**	14.2	85.8	0.0	**2**	50.0	50.0	0.0
Ondobe	**32 622**	0.1	99.9	0.0	**3**	0.0	100.0	0.0
Ongenga	**27 296**	0.0	100.0	0.0	**3**	0.0	100.0	0.0
Oshikango	**30 531**	0.0	100.0	0.0	**6**	0.0	100.0	0.0
Oshikunde	**21 890**	14.0	80.3	5.7	**5**	20.0	80.0	0.0

7.10. Omaheke Region

Figure 7.10 1 Health Facilities and Population with Network Coverage

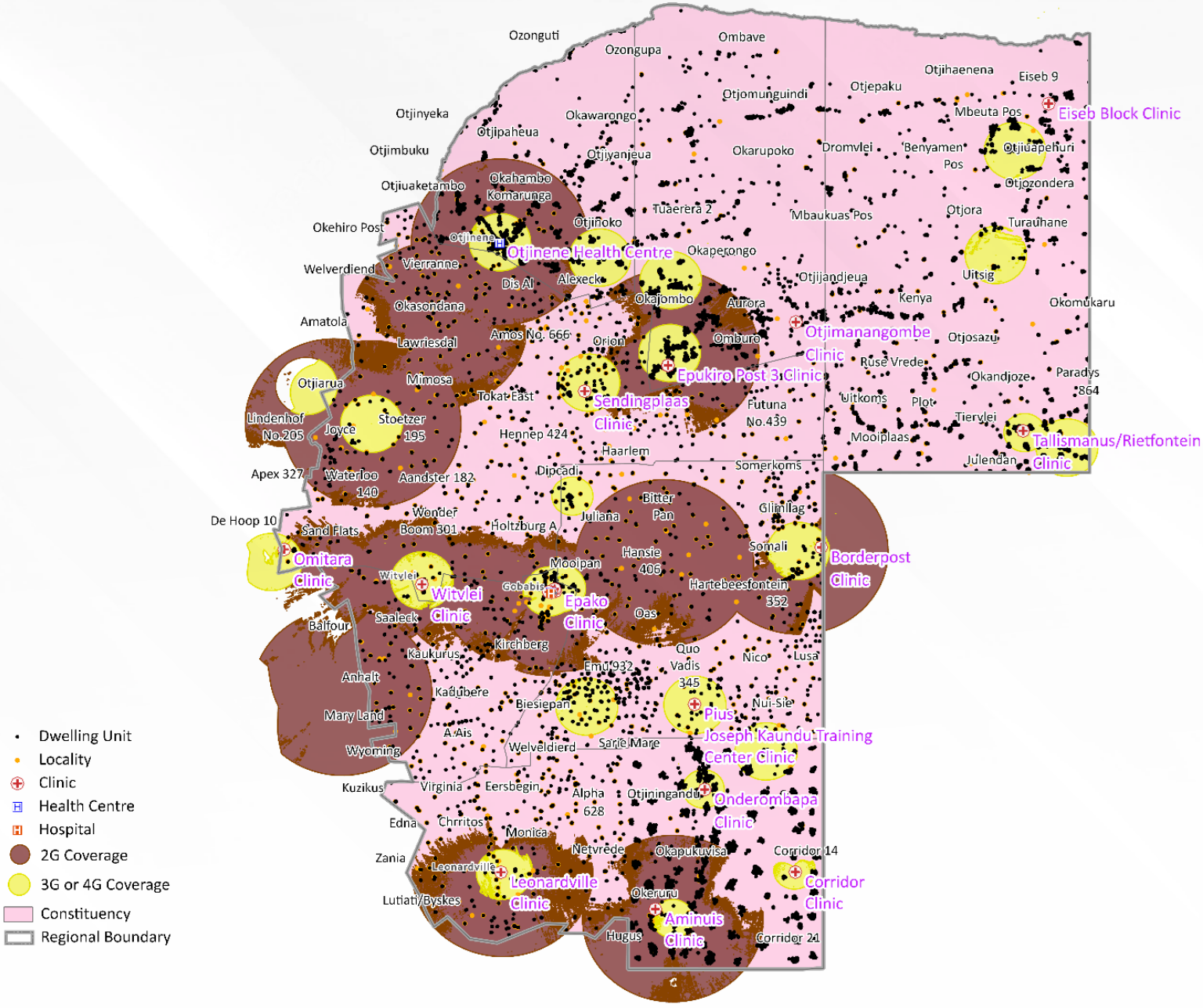
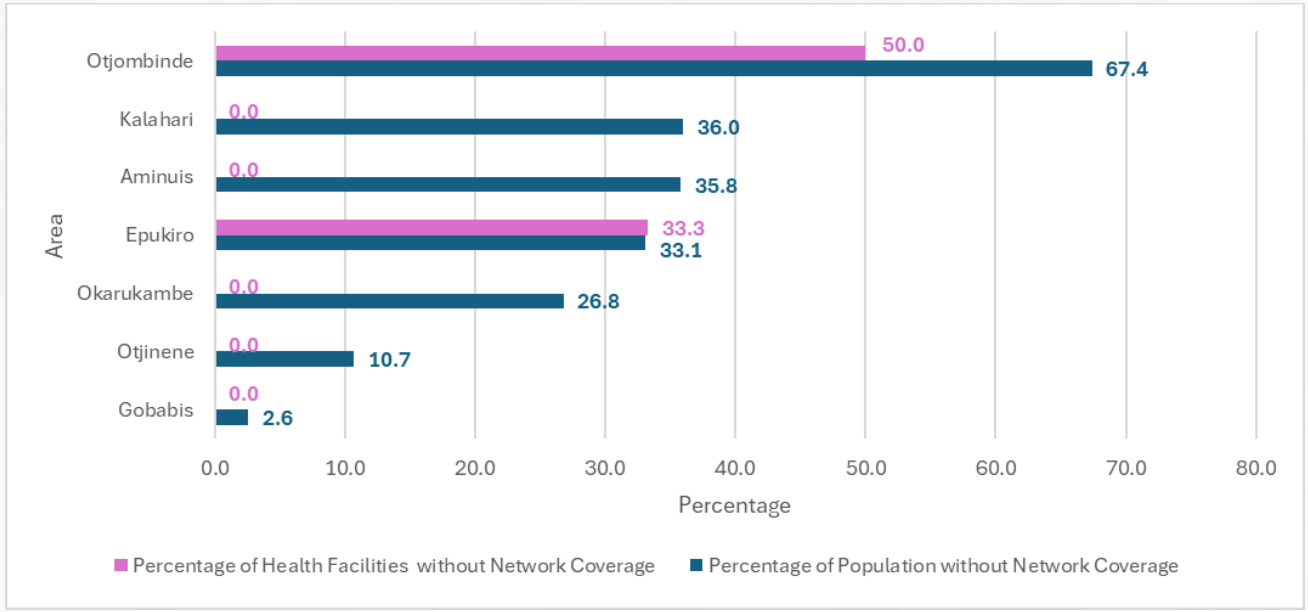


Figure 7.10 2 Health Facilities and Population without Network Coverage



Omaheke Region had 77.2 percent of the population and 90.9 percent of health facilities with network coverage. At constituency level, Okorukambe had the highest percentage (23.9%) of its population within 2G network coverage. Gobabis had the majority of its population (92.5%) covered by 3G or 4G networks, while Otjombinde had the least percentage (32.6%). Otjombinde also had the highest percentage (67.4%) of its population without network coverage.

In terms of health facilities, Omaheke Region had no health Facility within a 2G network coverage. Kalahari, Okorukambe, Otjinene, Gobabis and Aminuis had all their health facilities within a 3G or 4G network. Otjombinde (50.0%) followed by Epukiro (33.3%) had the highest percentage of their health facilities without any network coverage, while the other constituencies had no health facilities without network coverage.

Table 7.10 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Omaheke	**102 881**	**12.5**	64.7	22.8	**22**	0.0	90.9	9.1
Aminuis	**13 801**	22.2	42.0	35.8	**4**	0.0	100.0	0.0
Epukiro	**7 880**	16.6	50.3	33.1	**3**	0.0	66.7	33.3
Gobabis	**35 452**	4.9	92.5	2.6	**7**	0.0	100.0	0.0
Kalahari	**12 021**	13.1	50.9	36.0	**2**	0.0	100.0	0.0
Okarukambe	**12 271**	23.9	49.3	26.8	**3**	0.0	100.0	0.0
Otjinene	**12 415**	18.1	71.3	10.7	**1**	0.0	100.0	0.0
Otjombinde	**9 041**	0.0	32.6	67.4	**2**	0.0	50.0	50.0

7.11. Omusati Region

Figure 7.11 1 Health Facilities and Population with Network Coverage

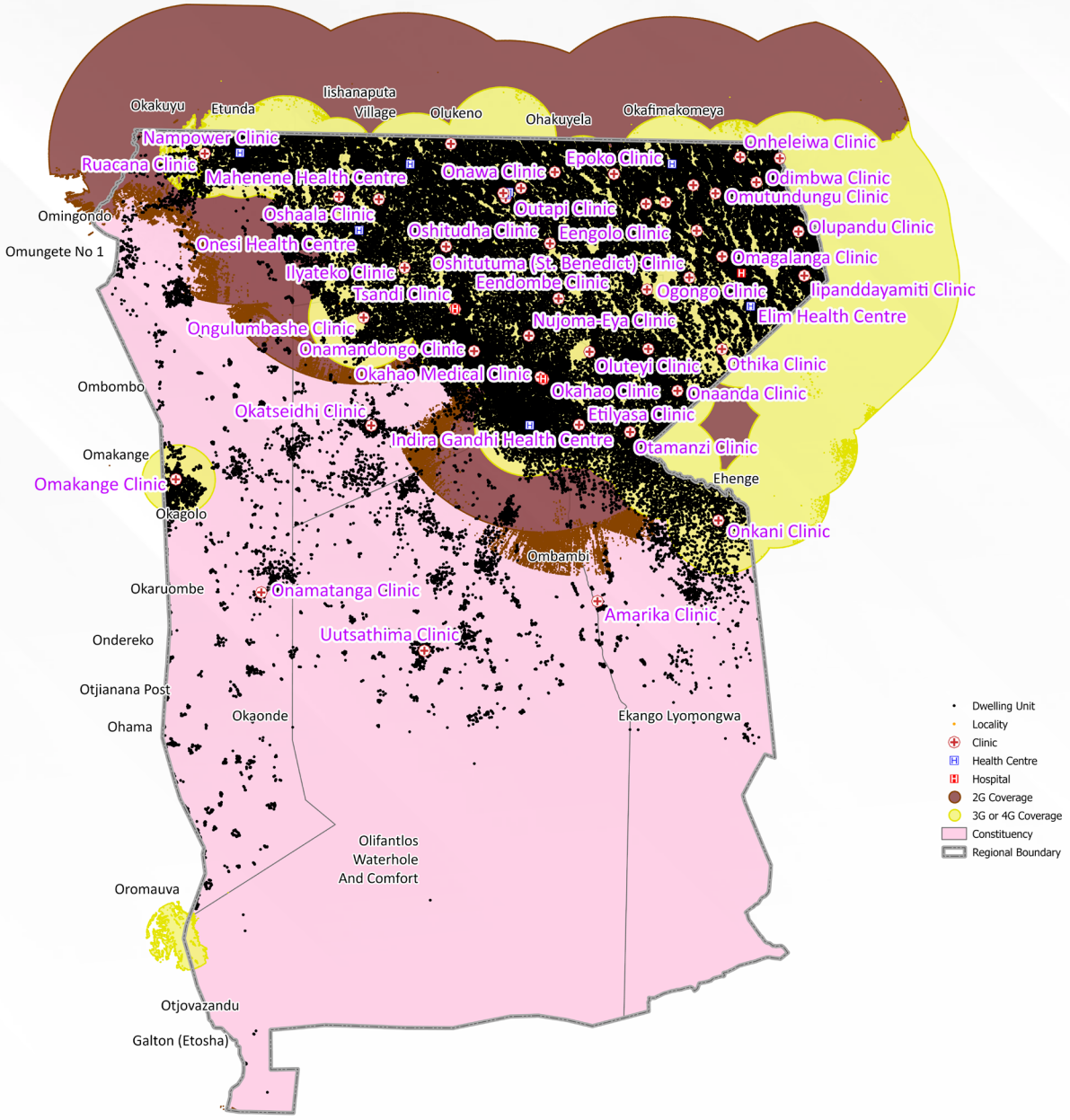
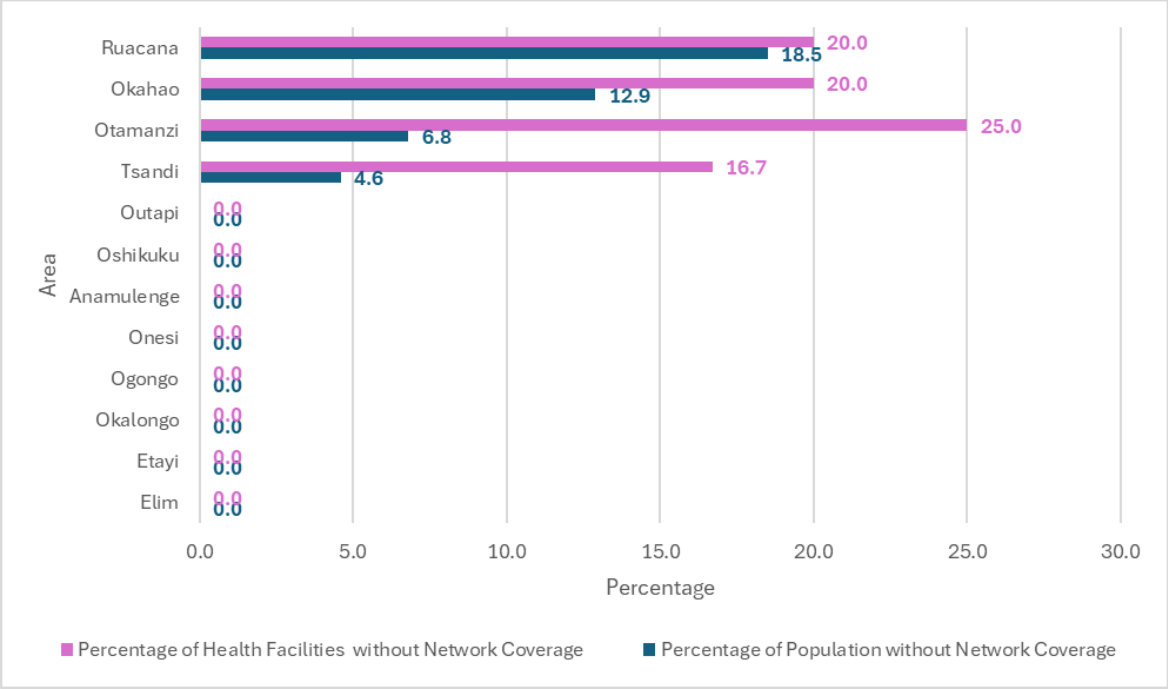


Figure 7.11 1 Health Facilities and Population without Network Coverage



Omusati Region had 96.5 percent of the population and 93.1 percent of health facilities with network coverage. At constituency level, Ruacana had the highest percentage (7.0%) of its population within 2G network coverage. Etayi, Ogongo, Oshikuku and Outapi had all their population covered by 3G or 4G network, while Ruacana had the least percentage (74.4%). Ruacana also had the highest percentage (18.5%) of its population without any network coverage.

In terms of health facilities, Otamanzi had the highest number of health facilities without network coverage (25.0%), followed by Ruacana and Okahao costituencies (both with 20.0%). None of the health facilities in Omusati region had 2G network coverage. Otamanzi had the lowest 3G or 4G network coverage (75.0%).

Table 7.11 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Omusati	**316 671**	2.0	94.6	3.5	58	0.0	93.1	6.9
Anamulenge	**20 344**	0.9	99.1	0.0	**2**	0.0	100.0	0.0
Elim	**13 400**	0.0	100.0	0.0	**3**	0.0	100.0	0.0
Etayi	**33 088**	0.0	100.0	0.0	**6**	0.0	100.0	0.0
Ogongo	**17 649**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Okahao	**24 909**	2.6	84.5	12.9	**5**	0.0	80.0	20.0
Okalongo	**32 663**	2.4	97.6	0.0	**5**	0.0	100.0	0.0
Onesi	**23 364**	6.4	93.6	0.0	**4**	0.0	100.0	0.0
Oshikuku	**19 693**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Otamanzi	**16 399**	2.4	90.8	6.8	**4**	0.0	75.0	25.0
Outapi	**53 594**	0.0	100.0	0.0	**10**	0.0	100.0	0.0
Ruacana	**27 261**	7.0	74.4	18.5	**5**	0.0	80.0	20.0
Tsandi	**34 307**	2.3	93.1	4.6	**6**	0.0	83.3	16.7

7.12. Oshana Region

Figure 7.12 1 Health Facilities and Population with Network Coverage

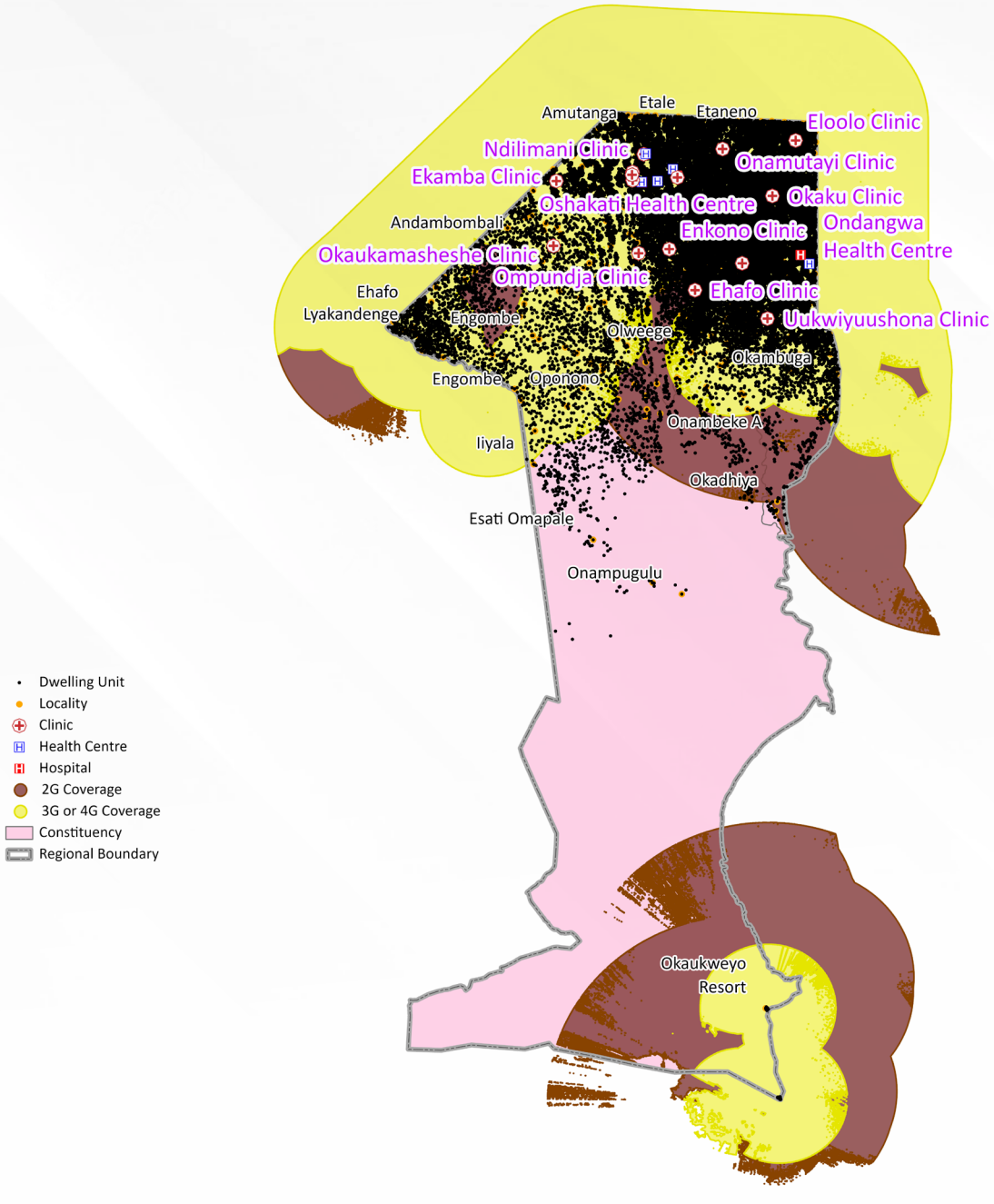
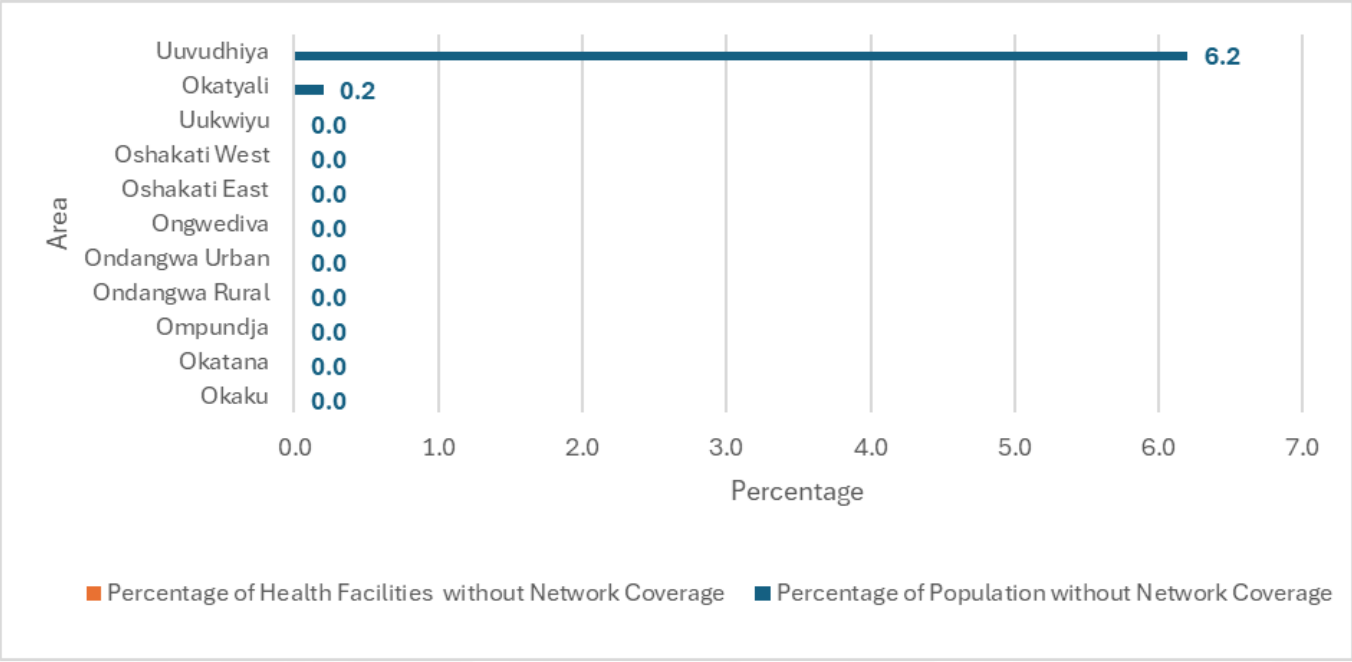


Figure 7.12 2 Health Facilities and Population without Network Coverage



Oshana Region had 99.8 percent of the population and 100.0 percent of health facilities with network coverage. At constituency level, Ompundja had the highest percentage (33.5%) of its population within 2G network coverage, followed by Uuvudhiya with (15.2%). Okaku, Ondangwa Urban, Ondangwa Rural, Ongwediva, Oshakati East and Oshakati West constituencies had all their population covered by 3G or 4G network, while Ompundja had the least percentage (66.5%). Uuvudhiya had the highest percentage (6.2%) of its population without any network coverage.

In terms of health facilities, Uukwiyu is the only constituency with a health facility within a 2G network coverage (50.0%). Okatyali, Ompundja, and Uuvudhiya had no mapped health facilities, while Uukwiyu had the lowest percentage (50.0%) of health facilities within 3G or 4G network coverage.

Table 7.12 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Oshana	**230 801**	1.5	98.3	0.2	24	4.2	95.8	0.0
Okaku	**21 892**	0.0	100.0	0.0	**2**	0.0	100.0	0.0
Okatana	**19 974**	3.2	96.8	0.0	**3**	0.0	100.0	0.0
Okatyali	**4 502**	4.2	95.6	0.2	**0**	0.0	0.0	0.0
Ompundja	**4 582**	33.5	66.5	0.0	**0**	0.0	0.0	0.0
Ondangwa Rural	**14 959**	0.0	100.0	0.0	**1**	0.0	100.0	0.0
Ondangwa Urban	**31 466**	0.0	100.0	0.0	**2**	0.0	100.0	0.0
Ongwediva	**44 166**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Oshakati East	**39 915**	0.0	100.0	0.0	**5**	0.0	100.0	0.0
Oshakati West	**30 665**	0.0	100.0	0.0	**5**	0.0	100.0	0.0
Uukwiyu	**13 033**	2.6	97.4	0.0	**2**	50.0	50.0	0.0
Uuvudhiya	**5 647**	15.2	78.6	6.2	**0**	0.0	0.0	0.0

7.13. Oshikoto Region

Figure 7.13 1 Health Facilities and Population with Network Coverage

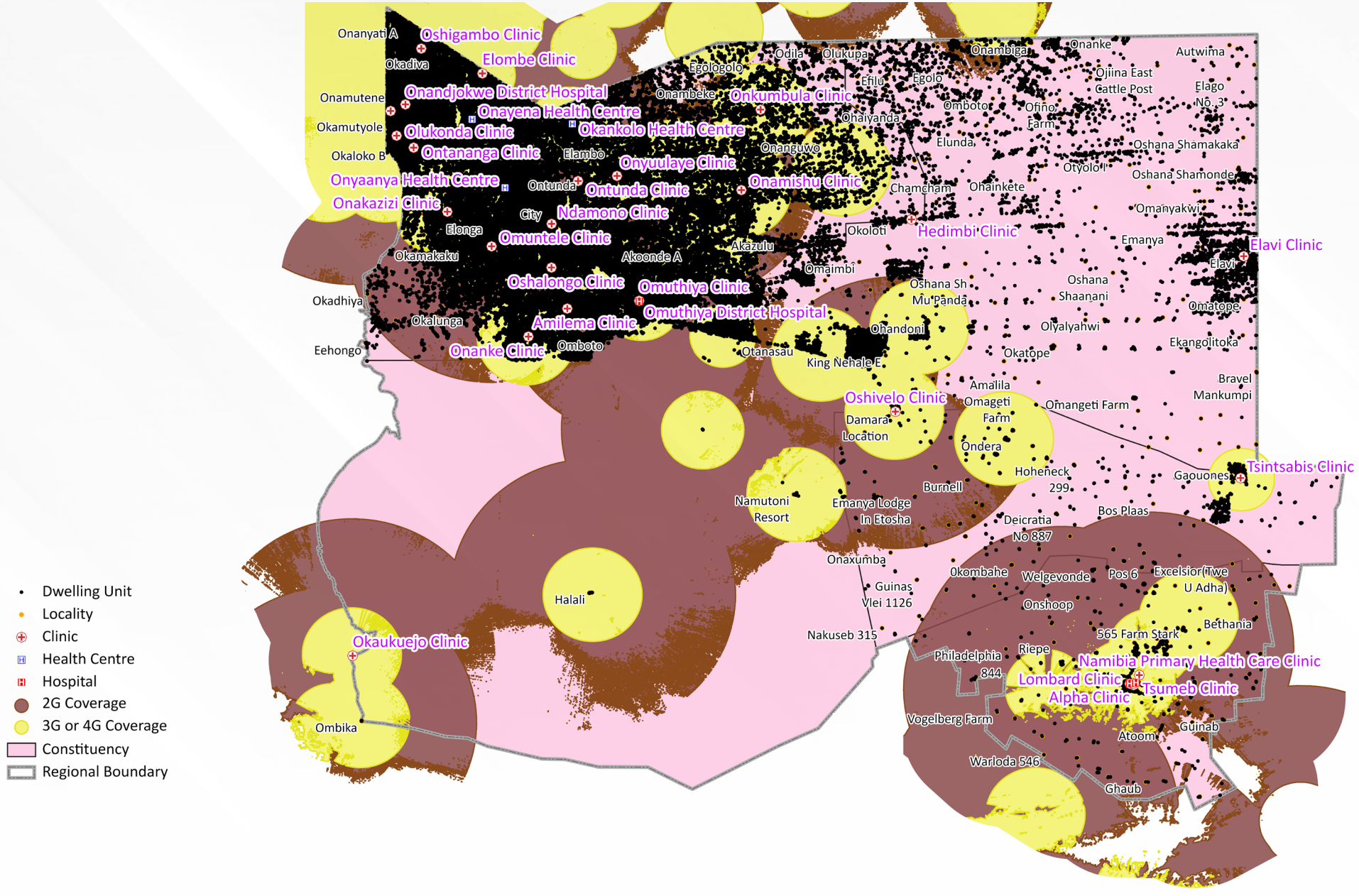
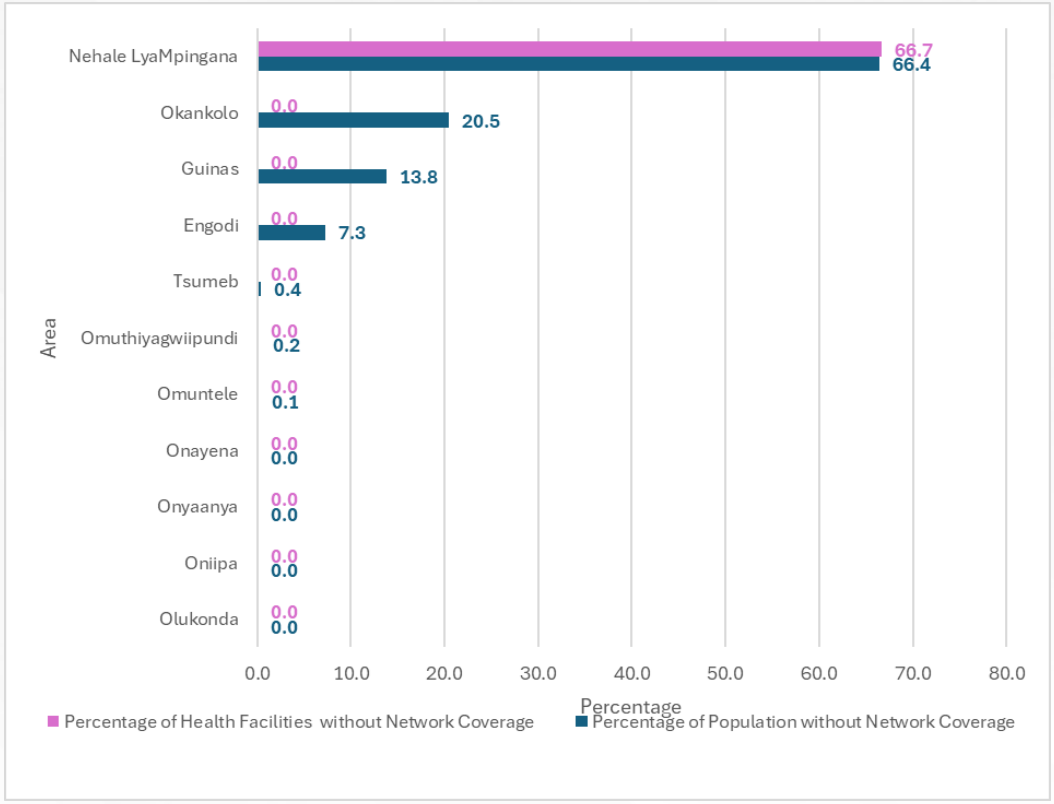


Figure 7.13 2 Health Facilities and Population without Network Coverage



Oshikoto Region had 92.9 percent of the population and 94.1 percent of health facilities with network coverage. At constituency level, Omuthiyagwiipundi had the highest population (18.5%) within 2G network coverage. Oniipa had all its population covered by 3G or 4G network, while Nehale LyaMpingana had the least (29.8%). Nehale LyaMpingana also had the highest percentage (66.4%) of its population without any network coverage.

For health facilities, only Omuntele and Omuthiyagwiipundi had 2G network coverage (25.0% each). Eengodi, Okankolo, Olukonda, Oniipa, Onyaanya, Onayena, Tsumeb and Guinas had all their health facilities covered by 3G or 4G network, while Nehale LyaMpingana had the lowest (33.3%) and was the only constituency with health facilities without any network coverage.

Table 7.13 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Oshikoto	**257 302**	8.3	84.6	7.1	**34**	5.9	88.2	5.9
Engodi	**24 208**	12.4	80.4	7.3	**1**	0.0	100.0	0.0
Guinas	**8 578**	8.3	77.9	13.8	**1**	0.0	100.0	0.0
Nehale LyaMpingana	**17 317**	3.9	29.8	66.4	**3**	0.0	33.3	66.7
Okankolo	**17 988**	14.5	65.0	20.5	**3**	0.0	100.0	0.0
Olukonda	**14 318**	0.8	99.2	0.0	**3**	0.0	100.0	0.0
Omuntele	**21 043**	11.6	88.3	0.1	**4**	25.0	75.0	0.0
Omuthiyagwiipundi	**39 855**	18.5	81.3	0.2	**4**	25.0	75.0	0.0
Onayena	**16 669**	2.9	97.1	0.0	**2**	0.0	100.0	0.0
Oniipa	**33 727**	0.0	100.0	0.0	**4**	0.0	100.0	0.0
Onyaanya	**25 465**	6.9	93.1	0.0	**3**	0.0	100.0	0.0
Tsumeb	**38 134**	5.6	94.0	0.4	**6**	0.0	100.0	0.0

7.14. Otjozondjupa Region

Figure 7.14 1 Health Facilities and Population by Network Coverage

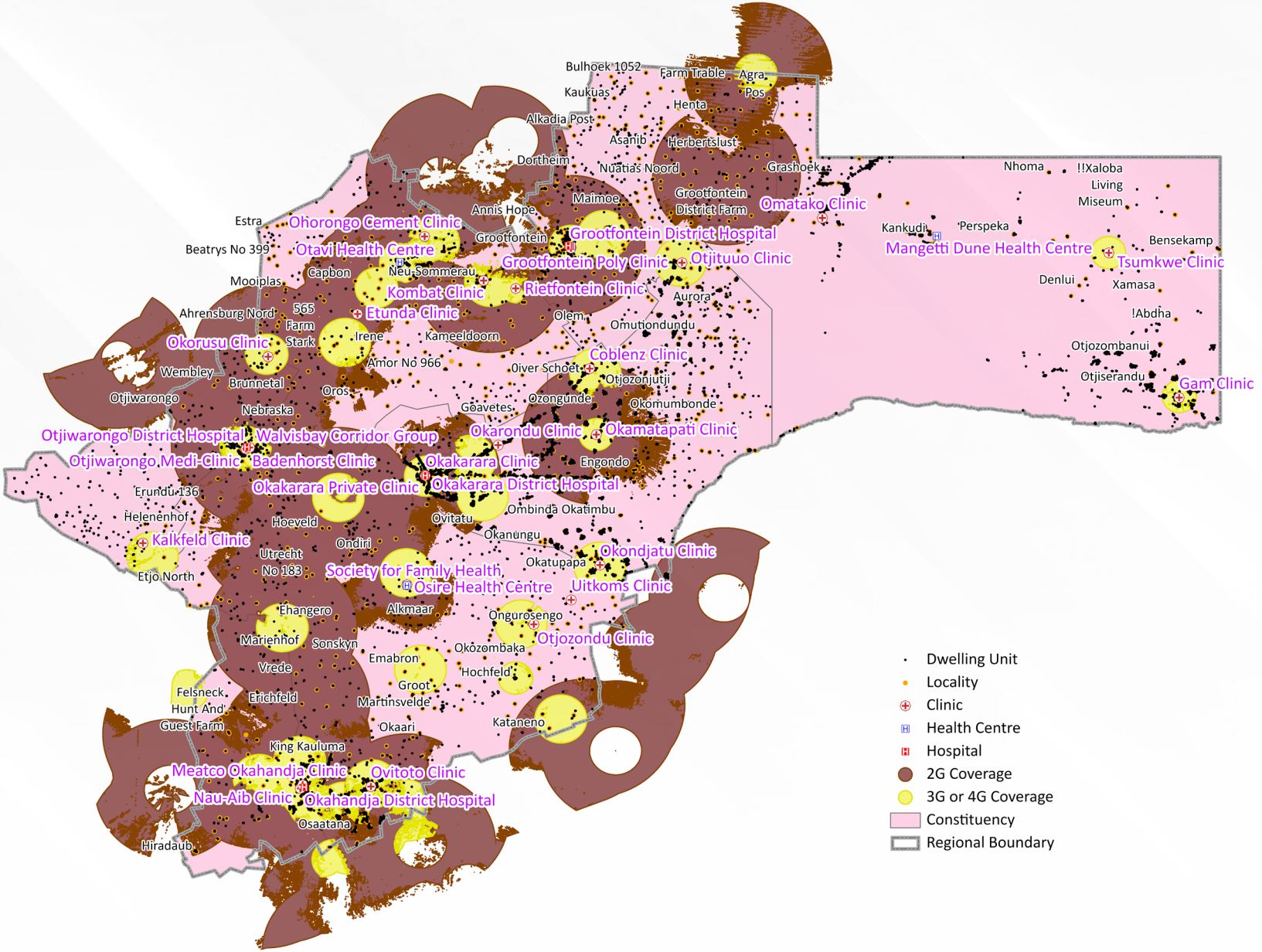
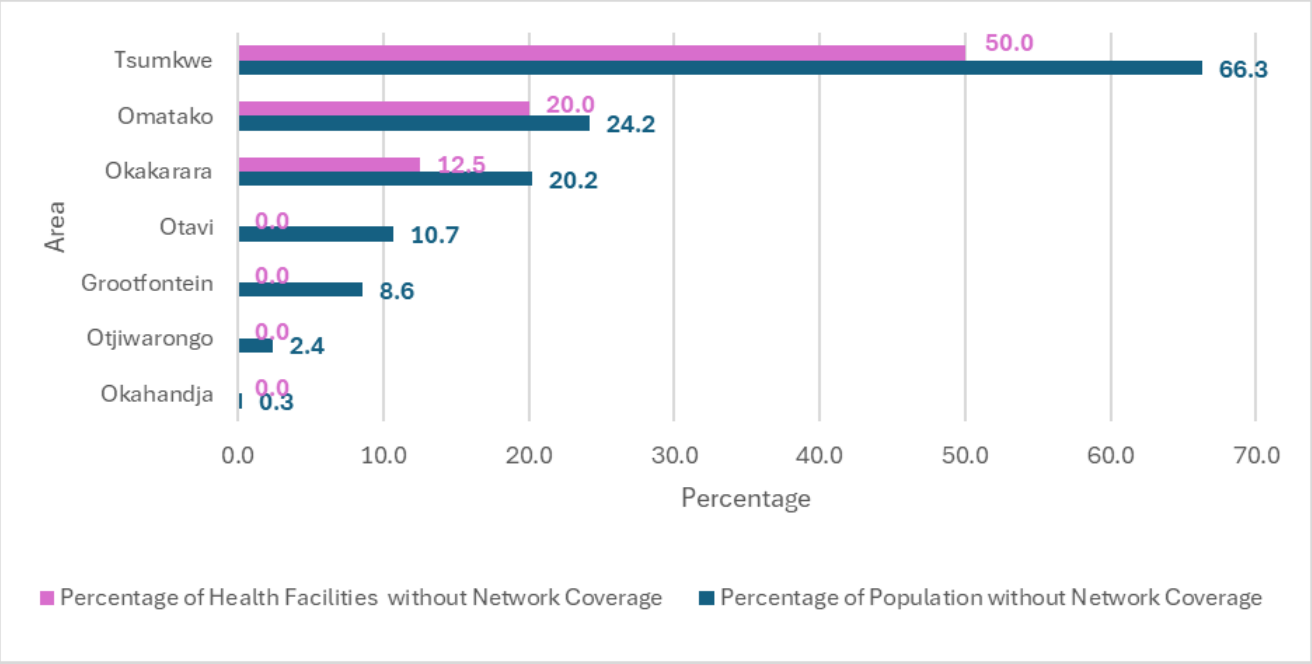


Figure 7.14 2 Health Facilities and Population without Network Coverage



Otjozondjupa Region had 87.6 percent of the population and 88.9 percent of health facilities with network coverage. At constituency level, Omatako had the highest percentage (26.6%) of its population within 2G network coverage. Okahandja had the highest percentage (97.7%) of its population covered by 3G or 4G network, while Tsumkwe had the least percentage (31.7%) and had the highest percentage (66.3%) of its population without any network coverage.

In terms of health facilities, Otavi was the only constituency with a health facility within 2G network coverage. Otjiwarongo, Okahandja and Grootfontein had all their health facilities covered by 3G or 4G network, while Tsumkwe had the least (50.0%) and had the highest percentage of health facilities (50.0%) without network coverage.

Table 7.14 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Otjozondjupa	**220 811**	8.3	79.3	12.4	**36**	2.8	86.1	11.1
Grootfontein	**36 951**	11.7	79.7	8.6	**4**	0.0	100.0	0.0
Okahandja	**46 061**	2.0	97.7	0.3	**3**	0.0	100.0	0.0
Okakarara	**30 987**	13.8	66.1	20.2	**8**	0.0	87.5	12.5
Omatako	**18 283**	26.6	49.2	24.2	**5**	0.0	80.0	20.0
Otavi	**18 279**	13.8	75.5	10.7	**5**	20.0	80.0	0.0
Otjiwarongo	**54 893**	1.9	95.7	2.4	**7**	0.0	100.0	0.0
Tsumkwe	**15 357**	2.0	31.7	66.3	**4**	0.0	50.0	50.0

7.15. Zambezi Region

Figure 7.15 1 Health Facilities and Population Network Coverage

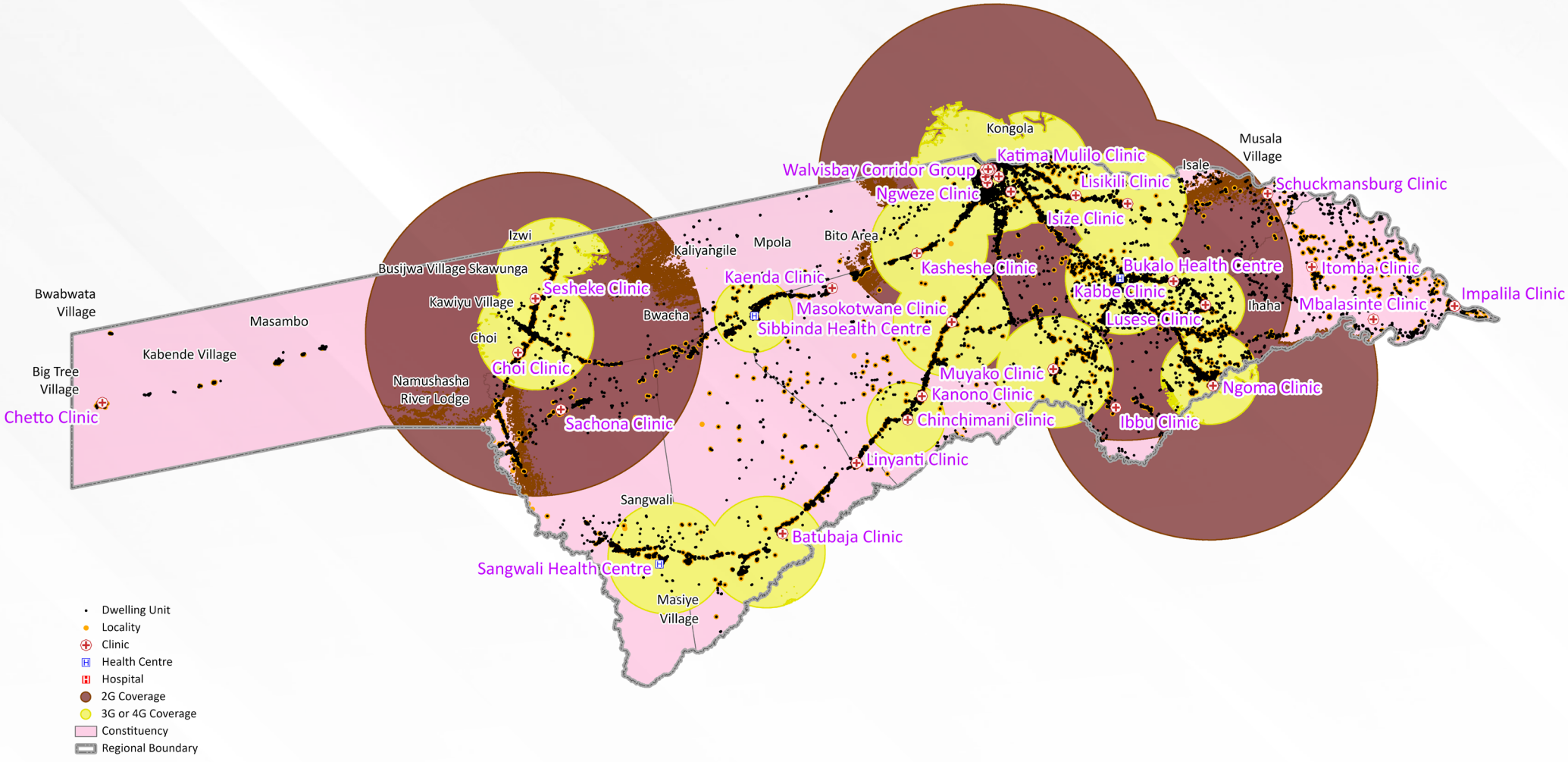
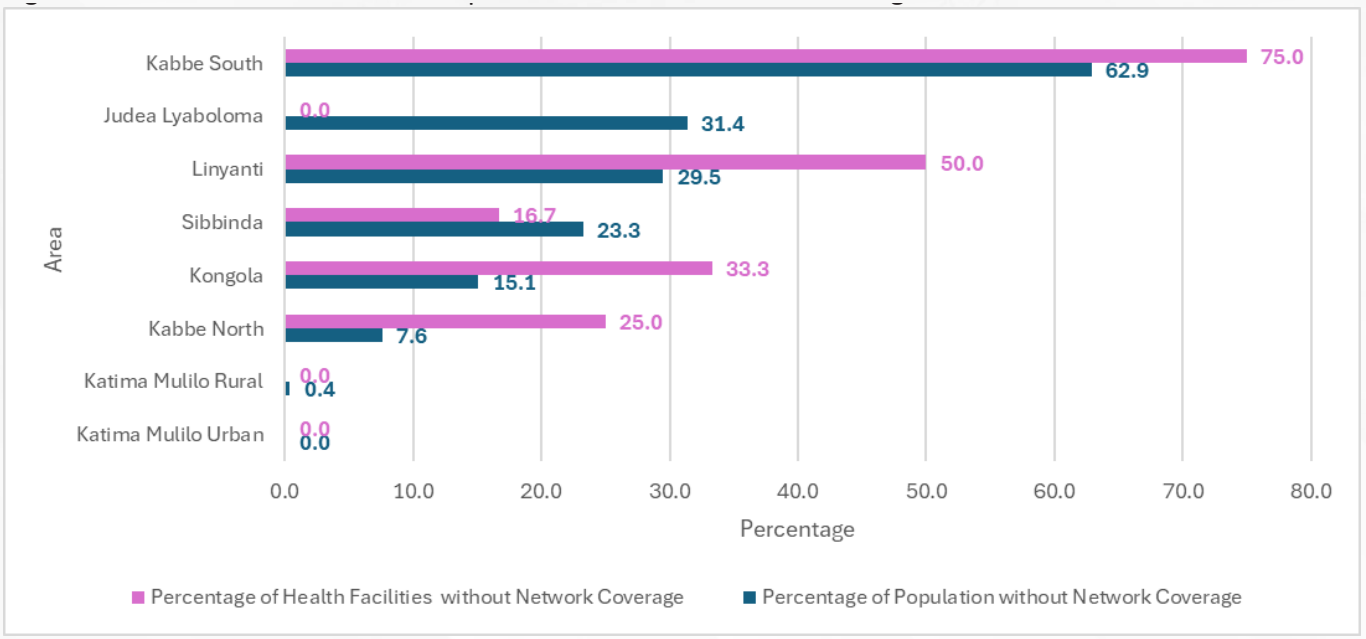


Figure 7.15 2 Health Facilities and Population without Network Coverage



Zambezi Region had 86.1 percent of the population and 81.6 percent of health facilities with network coverage. At constituency level, Judea Lyabboloma had the highest (31.8%) of its population within 2G network coverage. Katima Mulilo Urban had all its population covered by 3G or 4G network, while Kabbe South had the least (27.7%) and had the highest (62.9%) of its population without any network coverage.

In terms of health facilities, Judea Lyabboloma had the highest percentage (50.0%) of its health facilities within 2G network coverage. Katima Mulilo Urban had all the health facilities covered by 3G or 4G network, while Kabbe South had the lowest (25.0%) and had the highest percentage (75.0%) of its health facility without any network coverage.

Table 7.15 1 Health Facilities and Population by Network Coverage

Area	Population				Health Facility			
	Total	Percentage within 2G Coverage Only	Percentage within 3G or 4G Coverage	Percentage without Network Coverage	Total	Percentage within 2G Coverage	Percentage within 3G or 4G Coverage	Percentage without Network Coverage
Zambezi	**142 373**	8.3	77.8	13.9	**38**	5.3	76.3	18.4
Judea Lyabboloma	**8 738**	31.8	36.8	31.4	**2**	50.0	50.0	0.0
Kabbe North	**12 253**	14.0	78.4	7.6	**4**	0.0	75.0	25.0
Kabbe South	**11 345**	9.3	27.7	62.9	**4**	0.0	25.0	75.0
Katima Mulilo Rural	**24 016**	17.8	81.8	0.4	**5**	20.0	80.0	0.0
Katima Mulilo Urban	**46 401**	0.0	100.0	0.0	**12**	0.0	100.0	0.0
Kongola	**12 069**	1.8	83.1	15.1	**3**	0.0	66.7	33.3
Linyanti	**10 425**	15.0	55.4	29.5	**2**	0.0	50.0	50.0
Sibbinda	**17 126**	1.3	75.4	23.3	**6**	0.0	83.3	16.7

CHAPTER 8:
APPENDICES



8.1 Formulas

8.1.1 Calculating the distance between two geographic points

- Euclidean distance (d) between 2 points:

$d = \sqrt{((x2 - x1)^2 + (y2 - y1)^2)}$

8.1.2. Calculating population covered within a 10-kilometer buffer of a health facility

- Percentage of covered population = (Population within 10 kilometres of a health facility / Total Population) x 100

8.1.3. Mean Center of the geographic distribution.

In this Atlas we are using ArcGIS software to calculate geographic distributions. We are only interested in the mean centers of the health facilities and population. The mean center of the population distribution is weighted by the number of persons per dwelling point. We are not interested in the mean center for the Z or elevation value. However, the Z mean formula has included for completeness only.

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} \quad , \quad \bar{Y} = \frac{\sum_{i=1}^{n} y_i}{n} \qquad (1)$$

where x_i and y_i are the coordinates for feature i, and n is equal to the total number of features.

The Weighted Mean Center extends to the following:

$$\bar{X}_w = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \quad , \quad \bar{Y}_w = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i} \qquad (2)$$

where w_i is the weight at feature i.

The tool also calculates the center for a 3rd dimension if a z attribute exists for each feature:

$$\bar{Z} = \frac{\sum_{i=1}^{n} z_i}{n} \quad , \quad \bar{Z}_w = \frac{\sum_{i=1}^{n} w_i z_i}{\sum_{i=1}^{n} w_i} \qquad (3)$$

8.1.4. Standard Distance

This tool measures the extent to which the distance between the mean center and the features varies from the average distance. The result of this calculation is a distance in the unit of measure of the coordinates the geographic features are. The greater the standard distance value, the more the distances vary from the average, and the more widely dispersed the features around the center of distribution. We have weighed the standard distance of population with the number

of persons per dwelling unit.

The formula is given as:

Notice that the above standard distance calculation does not consider the directional distribution or orientation of the health facilities or population. A perfect circle is drawn based on the calculated standard distance, the size of which depends on how compact or widely dispersed the distribution is.

8.1.4. Directional Distribution Ellipses

When we introduce orientation or direction to the standard distance formula, our resulting output is a directional ellipse which shows the direction of the distribution. This shows whether there is a directional trend in the distribution of health facilities or population. For instance, there may be a pull factor if the population distribution shows a directional trend such as people settling along a river or road. As such, development might also follow the trend unless there is a deliberate government intervention to change the course of development.

The formula is given as follows:

$$C = \begin{pmatrix} var(x) & cov(x,y) \\ cov(y,x) & var(y) \end{pmatrix} = \frac{1}{n} \begin{pmatrix} \sum_{i=1}^{n} \tilde{x}_i^2 & \sum_{i=1}^{n} \tilde{x}_i \tilde{y}_i \\ \sum_{i=1}^{n} \tilde{x}_i \tilde{y}_i & \sum_{i=1}^{n} \tilde{y}_i^2 \end{pmatrix} \quad \text{where}$$

$$var(x) = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2 = \frac{1}{n} \sum_{i=1}^{n} \tilde{x}_i^2$$

$$cov(x,y) = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y}) = \frac{1}{n} \sum_{i=1}^{n} \tilde{x}_i \tilde{y}_i$$

$$var(y) = \frac{1}{n} \sum_{i=1}^{n} (y_i - \bar{y})^2 = \frac{1}{n} \sum_{i=1}^{n} \tilde{y}_i^2$$

Where x and y are the coordinates for feature i, {$\bar{x}$, $\bar{y}$} represent the Mean Center for the features and n is equal to the total number of features.

The sample covariate matrix is factored into a standard form which results in the matrix being represented by its eigenvalues and eigenvectors. The standard deviations for the x- and y-axis are then:

$$\sigma_{1,2} = \left(\frac{(\sum_{i=1}^{n} \tilde{x}_i^2 + \sum_{i=1}^{n} \tilde{y}_i^2) \pm \sqrt{(\sum_{i=1}^{n} \tilde{x}_i^2 - \sum_{i=1}^{n} \tilde{y}_i^2)^2 + 4(\sum_{i=1}^{n} \tilde{x}_i \tilde{y}_i)^2}}{2n} \right)^{1/2}$$

These equations can be extended to solutions for three-dimensional data. The variances are scaled by an adjustment factor to produce an ellipse or ellipsoid containing the desired percentage of the data points. These adjustment factors are provided in the table below.

	1-dimensional data	2-dimensional data	3-dimensional data
1 standard deviation	1.00	1.41	1.73
2 standard deviations	2.00	2.83	3.46
3 standard deviations	3.00	4.24	5.20

A health planner might be interested to see whether the current health facilities in Namibia are aligned to the population distribution. Comparing two ellipses helps to evaluate the direction.

- An ellipse calculated using one standard deviation will show where the health facilities or population are concentrated.
- An ellipse calculated using two or more standard deviations will show where most of the two features occur.
- Notice that one standard deviation is approximately 68%, two standard deviations cover 95% while three standard deviations cover 99% of the features. However, this is not always true for geographic features because of the multidimensionality and randomness of this data type. Usually, the percentage can be below or above the normal standard deviation thresholds.

Key Resources

1. Andy, M. (2005). The ESRI Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics. ESRI Press.
2. Build expertise and connect with the ArcGIS Pro community. Accessible on https://www.esri.com/en-us/arcgis/products/arcgis-pro/resources

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