Physical Accessibility to Health Services Study (2019)

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MINISTRY OF HEALTH

Foreword

As the Director General, I am very pleased to present the Ministry of Health (MoH) Physical Accessibility to Health Services Study that aims to provide a better understanding on current levels of physical accessibility to the health care system. The availability of care and physical accessibility to health care services are important components of an overall health system. Measuring such accessibility contributes to a wider understanding of the performance of the health system and the identification of potential gaps. This in turns allows for better planning of resources to respond to the needs of individuals and communities, thereby directly impacting health outcomes.

The inaugural overviews of physical levels we present in this study will inform the implementation of key Ministry of Health policies such as the Role Delineation Policy and the Referral Policy in the coming decade, and will be used for multiple other purposes, including the reclassification of health facilities, capital planning and improving the allocation of human resources. The results will support the Ministry of Health in working towards the objectives outlined in the National Sustainable Development Plan: 'Ensure that the population of Vanuatu has equitable access to affordable, quality health care through the fair distribution of facilities that are suitably resourced and equipped'.

The main finding of the study shows that the primary health care system has already achieved most accessibility targets outlined in the Role Delineation Policy. The results will therefore be used to advocate for the improvement of resource (Human, Financial, Assets and Equipment) allocation within the current health care system, instead of the allocation of resources to new health facilities. Separate provincial accessibility reports have been developed that will guide provincial health management teams in provincial planning.

I take this opportunity to thank all internal and external partners for their commitment and continued support to help us deliver the health service that meets people's needs. We are determined that our people will have access to equitable and affordable quality health care, which we aim to achieve through evidence-based decision making.

Yours Sincerely,

Russel Taviri Tamata
Director General
Ministry of Health

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Acknowledgements

Acronyms

GIS: Geographic Information System
HIS: Health Information System
MIA: Ministry of Internal Affairs
MOH: Ministry of Health
MOLNR: Ministry of Lands and Natural Resources
NDMO: National Disaster Management Office
OSM: OpenStreetMap
PCRAFI: Pacific Catastrophe Risk Assessment and Financing Initiative
PMD: Ports and Maritime Department
PWD: Public Works Department
RDP: Role Delineation Policy
VNSO: Vanuatu National Statistics Office

Executive Summary

Vanuatu aims to ensure that the population has equitable access to affordable, quality health care through the fair distribution of facilities that are suitably resourced and equipped (National Sustainable Development Plan, 2016). To achieve this objective, Vanuatu, and the Ministry of Health (MOH) in particular, require an in-depth understanding on the needs, gaps and distribution of health resources in order to understand current accessibility to the health care system.

In this study and report, the MOH will provide inaugural overviews of physical accessibility levels in Vanuatu. The data and results obtained from the study can directly support planning processes, inform implementation of policies such as the Role Delineation Policy (RDP) and the Referral Policy, and for multiple other purposes, such as assisting in the reclassification of health facilities or improving the allocation of human resources.

All the results in this study were obtained by undertaking a set of GIS-based analyses using a tool called AccessMod 5.0. This report provides a short description of the tool (Chapter 2), describes the analyses (Chapter 3) and the data that has been used (Chapter 4). These Chapters will provide guidance to the Ministry of Health to undertake further analyses in the future, when tracking progress against the objectives outlined in the National Sustainable Development Plan (NSDP).

Important to note is that this study only examines whether facilities are in reasonable reach for those people that need them. It does not take into consideration the quality of services that is being provided at the facility, and if the facility is adhering to the standards outlined in the RDP.

In Chapter 5, the results obtained from the different analyses are presented. While all results in this report still need to be validated by Provincial Officials and some of the dataset improved, the findings to date are already providing a first picture of the situation observed in the country and allow for the identification of potential areas in which the Ministry of Health might want to perform more in-depth analyses. These potentials areas, together with recommendations related to geospatial data management are presented in Chapter 6.

Main Results

In the following paragraphs, a summary is provided of the comparison of the results of the GIS analyses against the accessibility and referral benchmarks set in the Role Delineation Policy (RDP).

Physical Accessibility

For Dispensaries, the RDP states: *"80% of people in the catchment area can access the facility within one hour (by the most common mode of access e.g. walking, paddling, truck etc.)"*. However, when a person lives closer to a Health Centre than a Dispensary, the person will most likely visit a Health Centre. For the purpose of this study, we therefore decided it was more realistic to assess what percentage of population can either access a Dispensary or Health Centre within 1 hour, by the most common mode of transport.

The results obtained from the physical accessibility study show that more than 90% of the population can access a Dispensary or Health Centre within 1 hour (see section 5.1 for more detailed results). The results vary by province, with almost a 100% accessibility rate in Shefa province, and around a 70% coverage rate in Penama Province (multiple Dispensaries have been closed at the time of this study due to the Ambae Volcano eruptions).

Geographical Coverage

When taking in consideration the maximum capacity of health facilities the population that can access a Dispensary or Health Centre within 1 hour drops however to 84% (see section 5.2). The highest coverage difference (difference between results of the physical accessibility analyses and the geographical coverage analyses) occurred in Shefa Province, with a drop from 99% to 79%. This means that although almost the entire population in Shefa can access a primary health care facility within 1 hour, the Dispensaries and Health Centres do not have the capacity to serve the population of Shefa. This lack of capacity contributes to the high number of outpatient visits at Vila Central Hospital.

With an estimated 84% geographical coverage rate, we could argue that Vanuatu's primary healthcare system (Dispensaries and Health Centres) has achieved the accessibility targets outlined in the RDP, as the system is accessible to more than 80% of the population within 1 hour). National data however masks inequalities at the lower administrative levels. When looking at the provincial level, we see for example that three provinces (Shefa, Torba & Penama) have a geographical coverage rate of under 80%. At the area council level, there are even 5 area councils that have a coverage rate of under 20% (see annex 11 for links to results).

The results of the Dispensary and Health Centre geographical analysis also brings to light another interesting finding. There are 16 Dispensaries in Vanuatu that could potentially be closed without having an impact on the geographical coverage rate (facility results can be found here). Due to their proximity to other facilities, the population around these areas could access another primary care facility within one hour (when applying the combined transport scenario). Given the finite financial and human resources available in Vanuatu for health, it is important to further explore the continuing need of these identified facilities.

In addition to analyzing the combined accessibility rates of Dispensaries and Health Centres, we analyzed accessibility for Health Centres alone. For Health Centres, the RPD states: *'80% of the people in the catchment area can access the facility within 4 hours (by the most common mode of access e.g. walking, padding, truck, etc.)".* The results of the accessibility analysis shows that 97% of the population can travel to the nearest health Centre within 4 hours. The coverage drops by 30% to 67% when taking into consideration the capacity of the Health Centres. At the provincial level, the geographical coverage analysis shows that the Health Centres in Shefa and Tafea province are respectively only able to cover around 50% and 40% of the population. The other four provinces have achieved accessibility targets of 80% and higher.

Scaling-up

Providing equal access to affordable, quality health care is a key objective of the NSDP. For this reason, we have modelled how we could improve equality to access in Vanuatu, and reach the

80% coverage rate for Dispensaries and Health Centres outlined in the RDP for every province. The results presented in section 5.4 show that in order to reach the 80% accessibility target for primary care in every province, one Enhanced Health Centre would need to be built on Efate, one on Ambae, and two Dispensaries in Torba Province (Toga and Vanua Lava).

Referral

Finally, besides setting standards for accessibility levels, the RDP also provides referral benchmarks. Namely, for Dispensaries, the RDP says: *'Access to next highest health facility within 1-4 hours (by the most common mode of access).* Similarly, for Health Centres the RDP states: " *All referral cases can access a provincial hospital from a Health Centre within 4 hours (by the most common mode of access e.g. walking, paddling, truck, boat, etc.) under non-emergency situation.*

Our results show that out of the 103 Dispensaries used in the referral analysis (section 5.3), 62 of the Dispensaries are within 1 hour of a Health Centre, 83 within 2 hours and 93 (90%) within 4 hours of a Health Centre. For Health Centres, 30 out of the 42 Health Centre (71%) are able to access a hospital within 4 hours in non-emergency situations. These results can guide the implementation of the recently (December 2019) launched Referral Policy and inform the allocation of nurses, midwifes and doctors.

To conclude, these preliminary results demonstrate on the Ministry of Health's 'target of accessibility to primary health care services in Vanuatu. Although some provinces would benefit from one or two new facilities to reach the RDP accessibility targets, on the greatest potential for improvement of accessibility would be gained from improving the allocation of resources (Human, Financial, Assets and Equipment) within the current health care system. The results presented in this report will also assist the Ministry of Health in making evidence based allocation decisions.

1. Introduction

The Ministry of Health in Vanuatu aims to provide patients with equal treatment for equal medical need, irrespective of characteristics such as income, race, and place of residence. This aim is reflected in Society Objective 3.1 (SOC3.1) of the Vanuatu National Sustainable Development Plan (NSPD):

"Ensure that the population of Vanuatu has equitable access to affordable, quality health care through the fair distribution of facilities that are suitably resourced and equipped (NSDP, 2016)"

In this context, AccessMod 5.0 has been used to conduct of set of GIS-based analyses to assess how the different level of health care are physically accessible to the population and therefore measure equity in access across these levels.

The results of this analyses provide the Ministry of Health with important baseline information that can directly support planning processes and that can inform the implementation of polices such as the Role Delineation Policy and the Referral Policy. As a result, this report provides the Ministry of Health with information that can support them in achieving Society Goal 3 and the policy objectives outlined in the NSDP.

This report provides a short description of the tool that has been used to conduct the analyses - AccessMod 5.0 - and describes the analyses in question, identifies the data that has been used and concludes with presenting the results that have been obtained.

2. Tool used to conduct the different analyses

All analyses reported in the present document have been conducted using AccessMod 5.0.

AccessMod 5.0 is an open-source toolbox that has been developed by the World Health Organization (WHO), and supported by UNICEF, to provide Ministries of Health, and other health partners, with the possibility to use the power of Geographic Information System (GIS) to:
- Measure physical accessibility to health care,
- Estimate geographical coverage (a combination of availability and accessibility coverage) of an existing health facility network,
- Measure the referral time and distances between health facilities
- Complement the existing network in the context of a scaling up exercise

AccessMod uses GIS-based functions to apply a set of specific algorithms on a series of GIS format layers containing the information influencing the time taken by a patient to reach the nearest health facility depending on the mode of travel (for example, by feet, by car, etc).

Version 5.0 of AccessMod is freely accessible and comes with a user manual and tutorial (online and pdf version) and a sample dataset to guide users on how to use the different modules of

AccessMod. All of this, together with additional information and publication resulting from its application can be accessed from AccesMod web site: www.accessmod.org .

The results obtained from the use of AccessMod have then been uploaded in MS Excel and QGIS to generate the tables, graphs and maps presented here.

3. Analyses that have been conducted

AccessMod 5.0 has been used to conduct the analyses reported in Annex 1.

These analyses have been grouped as follow:
- Physical accessibility (ACC): Assess how physically accessible each level of health care is to the total population considering different travel times (1, 2, 3 and 4 hours)
- Geographic coverage (GEO): Estimate the share of the total population that has physical access to each level of health care taking the capacity of each health facility into account (human resources, equipment,…). This analysis has been conducted for a specific travel time for each level of health care (see Annex 1 for reference)
- Referral (REF): Measure travel time and distances between the different level of health care to simulate the referral of patients to the nearest facility at the higher level
- Scaling up (SCA): Estimate the number and location of additional health facilities that should be added to the current health care delivery system in order to reach a specific population coverage

These indicators are developed from the proposed standardised geographical indicators of physical access to emergency obstetric and newborn care in low-income and middle-income countries [2].Further information on how each of the analyses have been conducted can be found in the pdf or online version of AccessMod user manual and the tutorial posted on AccessMod's web site.

The following assumptions have been considered when conducting the different analyses:
- The population is going to the nearest health facility (no by passing)
- The population movements take place during the dry season (roads potentially flooded during the rainy season have not been taken into account)
- The travelling speed is homogeneous over the same type of roads while variations might be observed in the reality due to different in the quality of the pavement
- The population has enough resources to pay for the use of the motorized vehicle on the road network
- A vehicle (ambulance, car, truck, etc.) is available at the site of the health facility at the time of referral

4. Data and norms used in the different analyses

Performing the different analyses considered in the context of this project requires an important volume of data that can be grouped into three main categories:
- **Statistical data** (numerical data),
- **Geospatial data** (information about the locations and shapes of geographic features and the relationships between them),
- **National norms** (input parameters used to run the different analysis),

From a statistical point of view, data collected at the health facility and Area Council level have been used.

From a geospatial perspective, the different analyses required for the following GIS layers:
1. Boundaries of the different zones according to which the results have been aggregated (islands, Health Zones, Area Councils and Provinces)
2. Geographic location of health facilities;
3. Geographic location of airports and airfields;
4. Transportation network (roads and boat routes);
5. Hydrographic network (major rivers);
6. Land cover;
7. Digital Elevation Model (DEM);
8. Extent of the exclusion areas in which it would be better not to locate new health facilities

In addition to these layers, the mosaic of satellite images accessible in ArcMap through ArcGIS Online and those accessible in Google Map have been used as ground reference to evaluate the accuracy, and to some extend level of completeness, of the different layers as well as ensure consistency among the different data layers.

Lastly, the following norms needed to be defined in order to conduct the analyses:
1. Maximum travel speed expected for a motor vehicle on the different types of roads and the boat routes as well as for walking outside of the road network.
2. Population coverage benchmark considered as acceptable by the Ministry of Health
3. Maximum coverage capacity of each health facility to define the maximum extent of the catchment area.

The following sections describe in more detail the sources of the data and norms used for Vanuatu as well as the potential preparation, adjustments or transformations that have been used to obtain the final dataset necessary to implement the different analyses described in Chapter 3.

The validity period that has been fixed for the analyses is the first quarter of 2019. Thanks to the data provided by the different government entities, it has been possible to respect such validity for most of the datasets used here.

This being said:

- The list and boundaries of the Area Councils used here are presented as of 2016. Five new Area Councils have been established since then but their boundaries were not available at the time of conducting the present analyses.
- The landcover layer used was last adjusted in 2013 (See Section 4.2.6) which might potentially result in some temporal discrepancies
- The mosaics of satellite images used for ground truthing might be older than 2019 which did not allow us to fully check the completeness of the road network.

4.1 Statistical data

4.1.1 Health facility level figures

The identification of the health facilities considered as being operational has been based on the results of the national human resource mapping exercise conducted mid-2019.

The Policy and Planning unit, together with the Provincial Administrators and Human Resource Officers have identified in this mapping exercise whether a facility was operational, and how current staffing levels compare to the staffing standards outlined in the Role Delineation Policy (RDP) [1]. This exercise resulted in the final list of health facilities reported in Section 4.2.2.

In addition to the above, the maximum coverage capacity of each facility needed to be estimated in order to run the geographic coverage analyses.

While the RDP [1] provide an expected benchmark when it comes to the size of the catchment area that each type of health facility should cover (see Table 3), it was important to check whether some of the facilities had the capacity to cover a bigger population than the benchmark set out in the RDP.

A check was performed for Dispensaries and Health Centres on the basis of the health facility level total number of outpatient visits reported for 2018 through the Health Information System (HIS). In case the number of visits was higher than the benchmark outlined in the RDP, the maximum coverage capacity was adjusted for those facilities. Note, these values have first been adjusted by dividing them by 1.2 as the average number of visits per patient in 2018, before doing the comparison. The result of this exercise is reported in Section 4.3.

4.1.2 Area Council level figures

In order for the population distribution layer used in the different analyses (see Section 4.2.8) to be representative of the situation observed in Vanuatu in 2019, the population collected during the 2016 mini-census has been projected to 2019.

The projection has been performed at the Area Council level based on annual growth rate calculated by the Ministry of Health in consultation with the Vanuatu National Statistics Office based on the 2009 Population and Housing census and 2016 mini-census figures[1].

The Area Council level population for 2016, the annual growth rate used to project the population as well as the resulting population for 2019 are reported in Annex 2.

4.2 Geospatial data

This section describes the geospatial data used to conduct the different analyses.

To ensure consistency between the different sources of GIS data, and in order for AccessMod to produce correct results, all the GIS data presented in this section has been homogenized in terms of projection, spatial resolution (for GIS data in raster format) and extent.

While all the GIS datasets have first been prepared un-projected (WGS84 Geographic Coordinate system), they have then been projected in the Universal transverse Mercator (UTM) as the data needs to be projected in a metric system for use in AccessMod. In this system, Vanuatu finds itself in between two zones, zones 58 and 59. It has finally been decided to use Zone 59 as the islands located within Zone 58 are closer to the limit of Zone 59 South than the islands located in Zone 59 South in regards to the limit of Zone 58. Here are therefore the different elements that define this particular projected coordinated system:

- Projected Coordinate System: WGS_1984_UTM_Zone_59S
- WKID: 32759
- Authority: EPSG
- Projection: Transverse_Mercator
- False_Easting: 500000.00000000
- False_Northing: 10000000.0
- Central_Meridian: 171.00000000
- Scale_Factor: 0.99960000
- Latitude_Of_Origin: 0.0
- Linear Unit: Meter

The geographic coordinate system on which the UTM system is based is the following:
- Geographic Coordinate System: GCS_WGS_1984
- Datum: D_WGS_1984
- Prime Meridian: Greenwich
- Angular Unit: Degree

The spatial resolution of the GIS data in raster format used in this project (land cover, DEM and birth distribution) has itself been decided based on two criteria:

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[1] Important: the 2019 Population estimates are **not** official VNSO estimates and have only been created for the purpose of this study.

1. The resolution of the freely available data for the concerned layers, especially the one of the Digital Elevation Model (DEM) as the resolution of this layer serves as reference in AccessMod;
2. The volume of RAM memory in the computer used for performing the different analyses as this is unfortunately one of the limiting factor when using AccessMod.

In view of the above, the spatial resolution finally used is the one of the DEM (See Section 4.2.7) and which corresponds to 0.00083 decimal degrees when the data is unprojected. This corresponds to 91.991 meters once projected according to the above-mentioned projected coordinate system.

91.991 meters is to be considered as a medium size resolution that induces an important simplification of the reality when performing the different analyses in AccessMod.

As an example, a road, which in reality would seldom be wider than 10 meters, would be presenting a width of 91.991 meters during the different analyses. This has two major implications:
1. The traveling speed within the cells crossed by road segments would be higher than in the reality for patients on their way to the road as the model would consider the patient to be travelling by road over the whole surface of these cells while she would normally still have to cross some land by feet before reaching the road;
2. When roads are located very close to rivers the combination of the layers in AccessMod might result into the creation of "artificial passages" and therefore potential crossover that do not exist in the reality.

While it has been possible to make some adjustments in the road and hydrographic GIS layers regarding the second point (see Section 6.2.5) nothing could unfortunately be done when it comes to the first one.

Because of this, catchment areas obtained with AccessMod tend to be a little bit bigger than what they would be in reality. This said, it is difficult to quantify this error (see AccessMod user manual for some figures), although it is assumed that the size of this error is likely to be much smaller than potential uncertainties generated by some of the other assumptions made in the context of this project.

When it comes to the extent of the study area, all the datasets that have been used are covering the whole country.

The following sections describe in more detail the source of the GIS data used in the context of this project as well as the modifications performed on them before conducting the different analyses described in Chapter 5.

> **Recommendation**
> - The Ministry of Health should investigate the strengthening of its current technical capacity when it comes to the management and use of geospatial data and technologies as well as ensuring the proper integration of the geographic and time dimensions in its Health information System (HIS)

4.2.1 Islands, administrative divisions and health zones

The results of the analyses have been aggregated according to the following types of divisions:
- Islands
- Administrative divisions (Provinces and Area Councils)
- Health Zones

In order to make sure that the geospatial data being used for the 3 types of divisions was complete, the data collection process, checking and cleaning process started with the creation of a list of reference.

In the case of the islands, such list of reference has been generated as follow:
1. The list of islands reported in the 2009 Census shape file has been combined with a more recent list provided by the VNSO
2. The inconsistencies between the two lists in terms of island names have been checked and solved with the VNSO
3. The islands that were not yet coded were attributed a temporary code in consultation with the VNSO, following a similar coding system as previously applied by VNSO

The above process resulted in a list of 155 islands reported in Annex 3.

When it comes to the administrative divisions, the list of the 66 Area Councils considered here has been provided by the VNSO. The official spelling of the Area Councils name was obtained from the Ministry of Internal Affairs (MIA), specifically the Department of Local Authorities. This list is reported in Annex 2.

The master list of health zones was provided by the Ministry of Health. In this list (Annex 4) the country is divided into 49 health zones and 2 inaccessible areas (MALNZ0 and SANNZ). Please note that these zones do not have a name, just a code.

In order to facilitate the process aimed at creating the boundaries in GIS format for the three types of zones, a separated table was prepared to facilitate the match between the list of Area Councils and list of islands and then between the list of Health zones and the same islands.

Once all these lists were finalized, the available GIS format datasets (shape files) have been checked against the different lists to identify with which one, or combination of different datasets, were a match.

The process started by preparing the shape file containing all the islands observed in the country. The following steps have been applied using a GIS software (ArcMap):
1. The shapefiles available from different sources (VNSO, MOH, PCRAFI, POPGIS[2]) were compared to determine the best one in terms of consistency with the master list (Annex 3) and accuracy using the satellite images as ground reference. The exercise resulted in

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[2] http://vanuatu.popgis.spc.int/

identifying the shapefile containing the Health Zones from the Ministry of Health[3] as being the most suitable to start from.

2. The shapefile identified under step point has then been cleaned to primarily remove lakes and rivers extending inland.
3. Health zones have been merged and each island stored as a separated record using respectively the Merge and Multipart to Singlepart tools in ArcMap. This steps provided a shape file containing the most accurate coastline for all the islands in the country when using satellite imagery as ground reference.
4. The shapefile created by the VNSO in the context of the 2009 Census was then used to attribute known VNSO codes and names to the shapefile resulting from step 3. This has been done using the "Join by spatial location" function (spatial join) in ArcMap.
5. Using the master list of islands as a reference, it has then been possible to complete the attribute table of the shape file with the codes and names for the remaining islands, thus covering the 155 islands listed in Annex 3. The code and name of the province to which each of this island is attached was then also added in the attribute table.
6. A temporary code (starting from 1001) has been attributed to the 47 islands not listed in the master list but appearing on the satellite images, and therefore in the shapefile. The shape file contains finally 202 islands.
7. While preparing the road network layer (see Section 4.2.4), it was found that some road segments fell outside the coastline. The coastline in question has been adjusted to reach the final shapefile presented in Figure 1.

Figure 1 – Islands of Vanuatu considered during the analyses

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[3] This shape file was part of the 2015 Health Admin package (HA2015)

The shape file containing the boundaries of the 66 Area Council reported in Annex 2 has itself been created as following using the islands shapefile described above:

1. The Area Council shapefile prepared for the 2009 census has been identified as the most suitable dataset for this work as containing the 66 Area Councils considered here
2. The shapefile has been unprojected (WGS 84 geographic coordinate system)
3. The following editing work has then been performed in ArcMap:
   - For islands that are divided into several Area Councils: The VNSO Area Councils boundaries shapefile has been used as reference to divide the corresponding island in the island shapefile. This was done using the Split Polygons tool from ArcMap which allows an existing polygon (in the island shapefile) to be split/divided by an overlapping polygon (VNSO Area Council shapefile).
   - For area councils composed of a group of islands, the islands in question have been merged together using the Merge tool from the Editor toolbar in ArcMap
   - For the Area Councils composed of a part of an island together with other islands off the coast, the Merge tool was once again used to group these polygons together
4. The join by spatial location (spatial join) in ArcMap has then used to attribute the Area Councils codes and name from the original VNSO shapefile to the new one created here. The corresponding Province code and name was then added in the attribute table of the shapefile.

The Province boundaries shapefile has itself been created by merging the Area Councils boundaries shapefile using the Merge tool from the Editor toolbar in ArcMap. The resulting Area Councils and Province boundaries are reported in Figure 2.
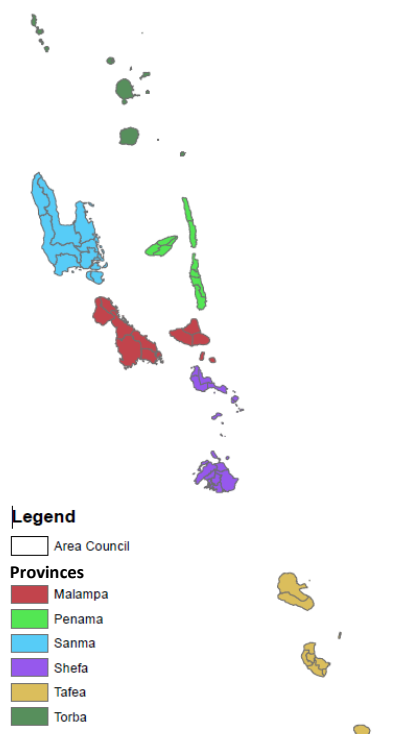
Figure 2 - Provinces and Area Councils boundaries of Vanuatu used for the analyses

The creation of the shapefile containing the boundaries of the Health Zones observed in the country followed a process similar to the one used to create the Area Councils shapefile.

In this case, the shapefile from the MOH containing the boundaries of the 49 Health Zones and 2 inaccessible areas has been used as the starting point. The following steps have then been applied:

1. The following editing work has then been performed in ArcMap:
    o For islands that are divided into Health Zones: The MOH Health Zones boundaries shapefile has been used as reference to divide the corresponding island in the island shapefile. This was done once again using the Split Polygons tool in ArcMap.
    o For Health Zones composed of a group of islands, the islands in question have been merged together using the Merge tool from the Editor toolbar in ArcMap
    o For the Health Zones composed of a part of an island together with other islands off the coast, the Merge tool was once again used to group these polygons together
2. The join by spatial location (spatial join) in ArcMap has then used to attribute the Health Zone code from the original MOH shapefile to the new one created here. The corresponding Province code and name was then added in the attribute table of the shapefile.

Figure 3 presents the Health Zones boundaries layer that resulted from this process.

Figure 3 – Health Zones of Vanuatu used for the analyses

Recommendation
- To facilitate data collection, geospatial analyses and decision making, Local Authorities & VNSO should endorse a fixed coding and naming system for Provinces, Islands and Area Councils
- The MOH should consider changing from health zones to area councils as the divisions of reference for data collection, monitoring and decision making within the health sector

4.2.2 Geographic location of the health facilities

The first step in the process to obtain accurate geographic coordinates for the operational health facilities that would be used in the context of the analyses conducted here has been to update the master list of health facilities.

This work has been performed by the Policy and Planning unit from the MOH of Vanuatu in close collaboration with their Provincial level counterparts, and resulted in the identification of 338 health facilities distributed into 5 types as reported in Table 1. The complete list of health facilities can itself be consulted in Annex 5.

Health facility type	Number of facilities
Aid Post	187
Dispensary	103
Health Centre	42
Provincial Hospital	4
Referral Hospital	2
Total	338

Table 1 -Number of health facilities by type used in the analyses

Some important observations regarding the content of Table 1:
- A health facility has been considered as operational when it had at least one active staff member (see Section 4.1.1)
- Temporarily closed health facilities have not been considered in the analyses. This affects 8 Dispensaries, 2 Health Centres and 44 Aid Posts
- Private health facilities have been included in the analyses. This includes 7 Clinics considered as Dispensaries and 5 as Health Centres based on their respective infrastructure and staffing as well as a Dispensary and a Health Centre, both located in Luganville
- Due to the difference in ownership and management compared to the other health facility types, the Aid Posts have been treated separately during the check of the master list and the geographic coordinates
- The process performed by the MOH identified the following cases which lead to the corresponding records to be removed from the master list:
  - For Aid Posts: 7 duplicates, 35 closed facilities and 11 Aid Posts that have been upgraded
  - For the other health facility types: 10 duplicates and 6 closed facilities
- The coding scheme initially used to uniquely identify each Aid Post was different from the one used for the other health facility types. The MOH therefore decided to homogenize the codification of all the health facilities by applying the coding scheme used for the other types of health facilities to the Aid Posts. The MOH created these codes and then added them to the master list.

Once the master list of health facilities was completed, the identification of the most accurate geographic coordinates for each of them was performed as follows:

1. The geographic coordinates available from different sources (Ministry of Health, WHO and TUPAIA) have been compared to identify what appeared to be the most accurate set using the following rules:

    1.1 When only one source was available: the coordinates were retained as long as they were falling on a built up area as well as on the island and within the Health Zone where the health facility is meant to be located based on the master list. If not, the health facility in question was left without location

    1.2 When more than one source was available, two cases were observed:

    a) All the sources were pointing to the same location on a built up area as well as on the island and within the Health Zone where the health facility is meant to be located based on the master list. In this case, the geographic coordinates from one of the sources was retained

    b) The sources were pointing to different locations. In this case, points falling outside a built area and/or the correct island and/or Health Zones were removed from the options. After that:

      - If no more sources remained, this facility was considered being without known location
      - If only one source remained, the corresponding geographic coordinates have been considered for this facility
      - If more than one source remained, the information regarding the method used to collect the coordinates has been used to decide on which coordinates to keep

2. The coordinates identified for each health facilities during step 1 have been plotted on two separated Google Maps (one for the Aid Posts and one for the other health facility types) and a SOP developed for the MOH to:

    2.1 Check their accuracy and, if needed move the coordinates to the right building on the satellite image. For 7 of these facilities, the presence of clouds on the satellite images available from Google Map required the use of another set of images to perform the check (Bing or the images available in ArcMap through ArcGIS Online)

    2.2 Identify the geographic coordinates for health facilities not yet located

    This step resulted in the following:

    - For Dispensaries, Health Centres and Hospitals:
      - 31 facilities for which the initial coordinates were considered as accurate (20.5%)
      - 115 facilities for which the initial coordinates have been moved to be on top of the health facility based on the satellite imagery (76.2%)
      - 4 facilities that have been identified as having no coordinates initially available (2.7%)
      - 1 facility for which the coordinates remained unsure (0.6%)
    - For Aid Posts: The time available during the project, as well as the difficulties in contacting the institution who had ownership over these type of facilities, led to effort being concentrated on finding the location of 35 Aid Posts for which this

information was initially not available (18.7% of all Aid Posts). The accuracy of the location for the other 152 operational Aid Posts (81.3%) remains therefore unknown and to be checked

3. The coordinates that have been corrected in Google Map, as well as the coordinates extracted from the images for the facilities that were initially not located, have been integrated in the master list of health facilities together with an indication of the source and method used to extract them as well as a qualitative measure of the accuracy associated to each of these method of extraction

4. For information only, and when this information was not already in the master list, the final location of each facility was used to indicate in which Area Council the coordinates were falling. This information remains nevertheless to be checked and is therefore highlighted in orange in the master list (Annex 5).

The location of the health facilities resulting from the implementation of the above process is reported in Figure 4.

It is important to mention here that the position of two Health Centres has been modified manually at the time of using AccessMod and this was because they were falling outside the areas covered by the landcover layer (see Section 4.2.6). This situation is linked to the format (raster) and resolution (91.9 meters) of such layer which leads to some areas along the coast being not attributed by a land cover class.

This modification has been done to keep the consistency among the different objects (roads, rivers and health facilities) and to avoid having health facilities located in areas covered by water and resulted in a shift smaller than 30 meters.
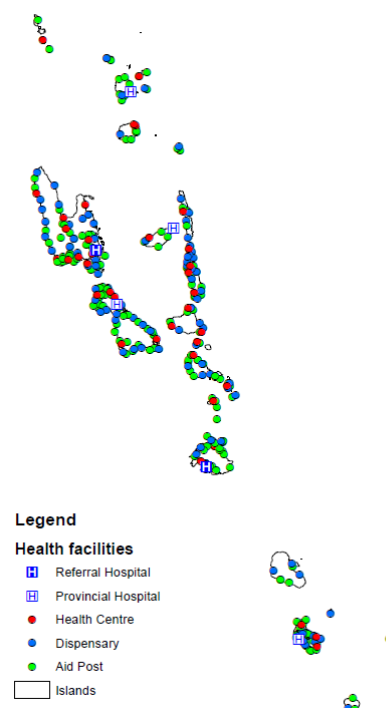
Figure 4 – Location of the health facilities used for the analyses

4.2.3 Geographic location of the airports and airfields

The scenarios considered for some of the referral analyses (REF 3 and REF 4) required to take into account the geographic location of commercial airports and emergency airfields.

The list of the 27 commercial airports has been established based on the airports currently served by Air Vanuatu. The 7 emergency airfields are themselves landing strips that were either included in the OSM dataset[4] or visible In Google Map. The complete list of airports and airfields is reported in Annex 6.

The geographic coordinates of each of the above mentioned airports and airfields have themselves been extracted either from the OSM dataset or Google Map. The resulting latitude and longitude, together with the source for these coordinates are reported in Annex 6. The accuracy for all of them is considered as high because this kind of infrastructure is easy to spot on satellite images.

It is important to mention that the last four emergency airfields reported in Annex 6 were only identified in Google Map. As such their name corresponds to the name of the island on which they are located.
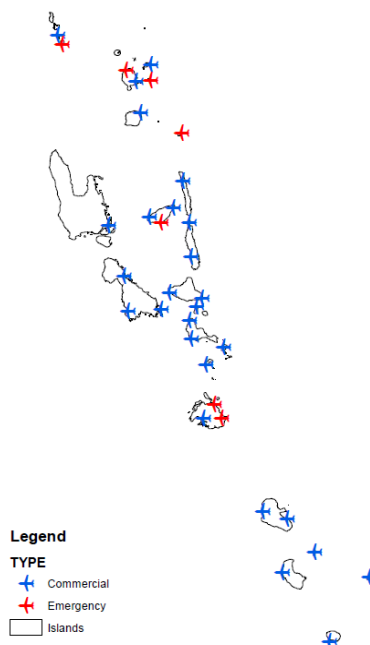
Figure 5 – Location of the airports and airfields used for the analyses

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[4] http://download.geofabrik.de/

4.2.4 Transportation network

Depending on the scenario being applied in the analyses (see Section 4.3) patients can use a motorized vehicle (car) on roads or use a boat on specific sea routes to reach the nearest health facility.

In view of the above, having access to the most complete transportation network (roads and boat routes) layer is important in view of the significant difference in speed that a motorized vehicle can reach compare to walking.

The process started by obtaining the most up-to-date road network.

Based on the Public Roads Act of Vanuatu, three types of roads are observed in the country: arterial roads, feeder roads, and urban roads. This being said, and according to the Public Works Department (PWD), the road speed depends on whether the road is sealed (concrete or asphalt), unsealed (gravel or earth), or an urban road. Therefore, there was a need to obtain a GIS format layer based on this last classification.

Among the road network datasets available at the time of the study (PWD, OSM, PCRAFI, MOH), the one from PWD was not only the most authoritative but also the most up-to-date and accurate as it was collected in the field in 2019 using GPS devices. This layer has therefore been used as the starting point for the process described here:

1. The PWD road network files were provided as separated KML files (one for each Province and road type for the feeder and arterial road and by island for the urban roads). These files have therefore been converted into shapefiles. The KML to Layer Conversion tool in ArcMap has first been used to convert the KML files to a geodatabase feature class. The resulting files have then been converted into shapefiles.
2. The shape files resulting from step 1 have been merged into one single shapefile
3. With PWD's help, the roads segments have been reclassified into sealed (mix of urban and arterial roads) and unsealed (mix of feeder and arterial roads). The classification for the remaining urban roads did not change.
4. The datasets resulting from step 3 was presenting an important number of disconnects and overlaps between segment due to the data collection method used and the fact that PWD had not the opportunity to clean the dataset at the time of sharing it with the project. After running some tests in AccessMod it was discovered that disconnects smaller than 60 meters were not an issue due to the rasterization of the road network layer performed in AccessMod prior to running the analyses. As a result of this, disconnects and overlaps of more than 60 meters have been corrected.

The above did not cover the significant number of trails visible on the satellite images and, even if it was considered that they would only be used for walking, it became important to include such trails in the transportation network layer as they were representing preferential walking path across areas presenting dense vegetation.

Depending on the Province, these trails have been extracted from the OSM, PCRAFI and MOH datasets and integrated with the road network.

Finally, it was checked that each health facility considered in the analyses (see Section 4.2.2) was either connected to a road network or a trail when such connection was visible on the satellite imagery.

When it comes to boat routes, no dataset was available at the time of conducting the study. These routes have therefore been created using the following process:

1. A list of ports and harbors used for transportation of people has been generated using datasets from the Ports and Maritime Department (PMD). The Office of the Maritime Regulator and the OSM dataset. This exercise resulted in the identification of 78 ports and harbors as well as less structured anchor points over the country.
2. The geographic coordinates for each of the anchor points identified under step 1 have been checked on Google Map
3. The list and location obtained at the end of step 2 being not fully representative of all the points along the coast from where people could be travelling by boat to reach a health facility, National MOH worked at identifying an additional 173 anchor points directly in Google Map with staff from Provincial Health Teams.
4. The location of all the anchor points were downloaded from Google Map and converted into a shapefile.
5. A first set of boat routes between the identified anchor points were then created in QGIS using the different satellite imagery as ground reference to ensure that these routes were not passing through mangroves or other obstacles.
6. The boat routes were then uploaded in Google Map together with the location of the health facilities for the MOH staff to check that:
   a. All the connections between islands have been captured
   b. Existing referral of patient between islands were indeed made possible
7. The final set of boat routes resulting from step 6 have been downloaded from Google Map, converted into shapefile and added to the roads and trails network shapefile created previously.
8. The connections between the boat routes and the road network have been checked and adjusted if needed.
9. The attribute table was cleaned to contain only the Road Class (code) and Road Label as follows (the code starts at 1001 to avoid an overlap with the simplified land cover classification ([Annex 7](#)) when merging the two in AccessMod):
   - 1001: Sealed roads
   - 1002: Unsealed roads
   - 1003: Urban roads
   - 1004: Boat routes
   - 1005: Trail

The transportation network layer resulting from the processed mentioned in this section is reported in Figure 6.

Legend

— Sealed
— Unsealed
— Urban
— Trail
— Boat route
☐ Islands
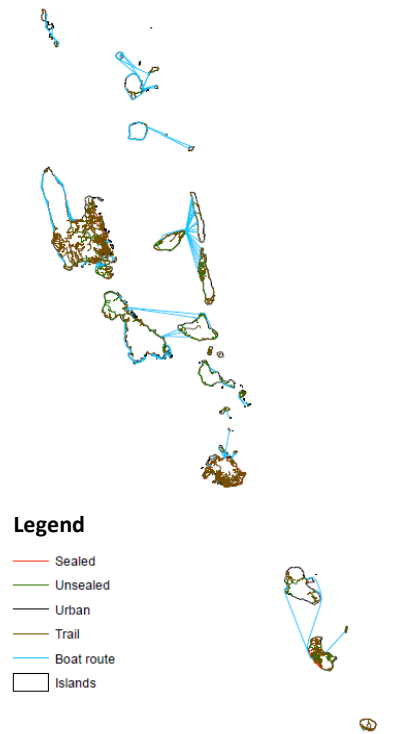
Figure 6 – Transportation network layer used in the different analyses

4.2.5 Hydrographic network

The rivers observed in the country have been considered as barriers in the current analyses. It was therefore important to have a GIS format layer containing such rivers.

After comparing the two available datasets (OSM and the dataset kindly provided by the National Disaster Management Office (NDMO)) and checking their respective level of completeness with the satellite imagery, it has been decided to use the one from OSM.

The only change operated on this layer has been to make sure that each segment was extending until the sea to avoid fake bridges being considered during the analyses. The layer resulting from this operation is presented in Figure 7.

The extent of the water bodies have themselves been captured in the land cover layer (see Section 4.2.7).
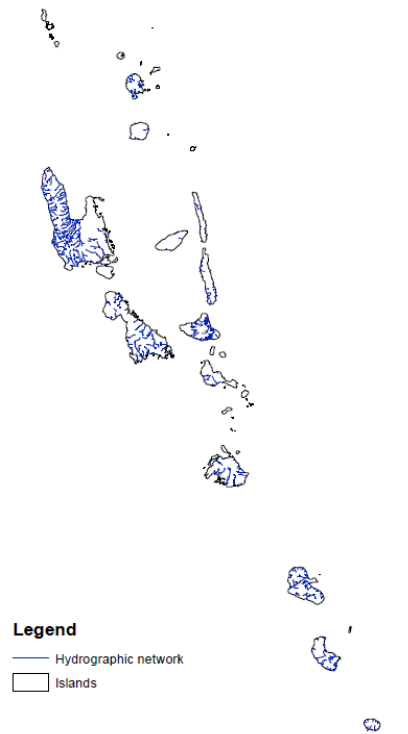
Figure 7 – River network layer used in the different analyses

4.2.6 Digital Elevation Model

The freely accessible 90 meters resolution Shuttle Radar Topography Mission (SRTM) dataset produced in 2000 by the NASA in collaboration with other institutions[5] has been used as the Digital Elevation Model (DEM) in the context of the present project.

The only modifications that have been performed on this dataset have been to:
1. Mosaic the different tiles covering the country
2. Clip the resulting mosaic to only cover the islands plus a buffer of a few kilometers to reduce the size of the layer and therefore the number of cells taken into account into the different analyses
3. Reclassify any altitude below 0 meters and cells classified as NoData to 0 meter of altitude and this to allow for movement by boat over the sea.

The layer resulting from this process is reported in Figure 8.

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[5] http://srtm.csi.cgiar.org/srtmdata/
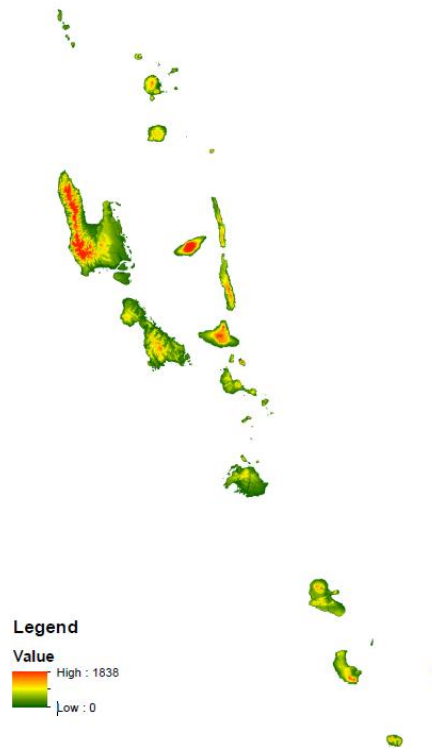
Figure 8 – Digital Elevation Model (DEM) used in the different analyses

4.2.7 Land cover

Two land cover distribution grid were available at the time of preparing the data for the project:

- The shape file accessible from PCRAFI's web site[6]. Created in 2004 based on satellite images, this dataset has been updated in 2013 using LiDAR data.
- The freely available 30 meters resolution GlobCover dataset created based on 2009 images[7].

It has finally been decided to use the dataset available from the PCRAFI web site as it has been updated more recently and also because it presented a better match with the islands coastline.

Such classification has nevertheless been simplified before using this layer in AccessMod and this was in order to obtain a limited number of classes representative of the type of walking speed that could be expected on each of them.

As a result, and in consultation with MONLR, the 27 classes observed in the original layer have been regrouped in order to end up with a simplified classification containing 7 classes (Annex 7).

Once the simplified classification applied on PCRAFI's original layer, the last step was the conversion into a grid presenting a resolution 91m. The layer resulting from this process is presented in Figure 9.

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[6] http://pcrafi.spc.int/
[7] http://due.esrin.esa.int/page_globcover.php

Legend
- Bare area
- Built area
- Limestone, reef, rock shelves, sand bay
- Low density vegetation
- Medium density vegetation
- High density vegetation
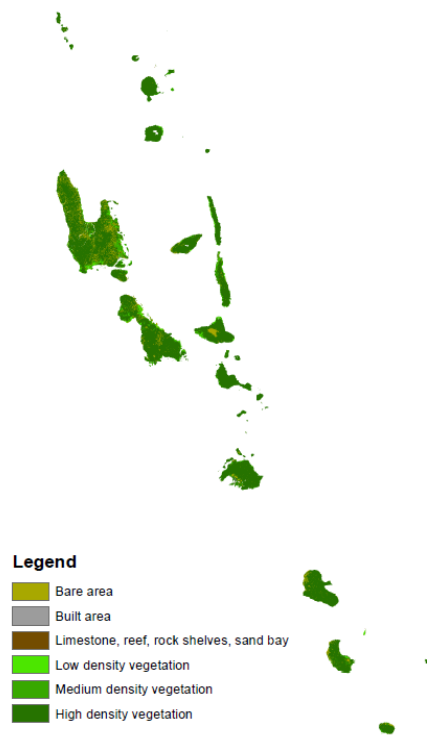
Figure 9 – Land cover distribution layer used in the different analyses

4.2.8 Spatial distribution of the total population

In order for the results of the analyses to be as close as possible to the reality there was a need to spatially distribute the total population leaving no one in the country below the Area Council level.

Two freely accessible raster format datasets spatially distributing the total population of Vanuatu were available at a resolution close to the one of the DEM (see Section 4.2.6) when compiling the data for the present study:

1. The 100 meters resolution dataset generated by the Worldpop project[8]
2. The 30 meters resolution dataset generated by Facebook[9] and accessible from the HDX platform for Vanuatu [10]

It has finally been decided to use the Facebook dataset and this because this dataset distributes the population based on the location of buildings observed on satellite images while the WorldPop dataset spatially distribute the population based on different factors resulting in a bigger dispersion of the population than what is being observed in the reality when it comes to Vanuatu.

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[8] http://www.worldpop.org.uk/
[9] https://dataforgood.fb.com/tools/population-density-maps/
[10] https://data.humdata.org/organization/facebook?q=vanuatu&ext_page_size=25

This being said, the Facebook dataset attribute the same number of people in each of the cells that it considered as inhabited within a given Area Council therefore not taking into account the variability in population density that can exist within such this kind of division.

The following steps have been implemented to address the above:

1. Each cell presenting a population value has been reclassified to 1
2. The dataset has been resampled to the resolution of the DEM and snapped to ensure consistency. This resulted in the spatial distribution of the number of 30 meters inhabited cells within the project resolution (91.991 meters). This new layer allows the variability in density issue mentioned here above as cells located in more densely inhabited areas were now presenting a higher value than those located in less densely populated area, to be addressed.
3. The merged landcover layer generated in AccessMod (see Section 5.2) has been converted into a mask and applied to the layer generated under step 2 to avoid any population beingplaced on barriers (rivers and water bodies)
4. A Summarize by Zone has been performed on the layer resulting from step 3 and this using the raster version of the Area Councils boundaries created for the project (see Section 4.2.1). This operation provided a table indicating the total number of 30 meters inhabited cells in each Area Council
5. An Area Council level specific correction factor has been calculated in order to convert the total number of cells obtained under step 4 into the 2019 population figures reported in Annex 2.
6. The correction factor generated under step 5 has been applied on the spatial distribution of the number of inhabited cells obtained under step 3
7. The layer resulting from step 6 has been checked to make sure that the total population in each Area Council was corresponding to the figures reported in Annex 2.

Figure 10 provides an extract of the population distribution GRID obtained through the application of the above mentioned process.

Legend
Value
High : 313.689
Low : 0.566966
Islands
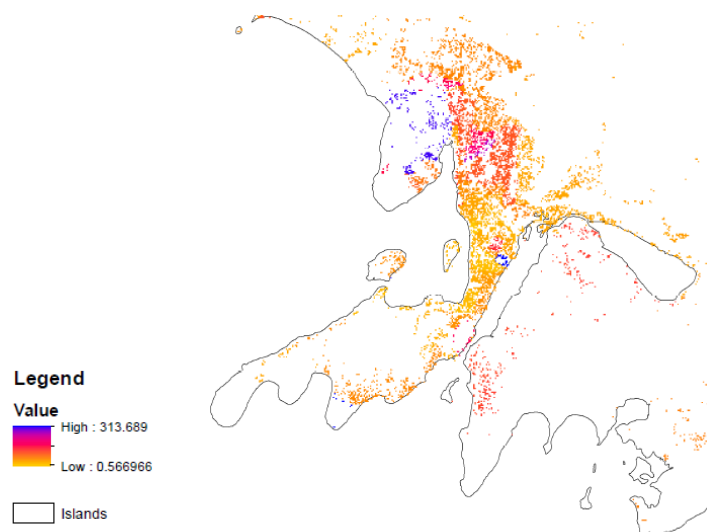
Figure10 – Spatial distribution of the total population used in the different analyses

4.2.9 Extent of the exclusion areas

When conducting the scaling up analysis to identify the most suitable sites to add a health facility that could increase population coverage (see Section 5.5) it is important to take into account the areas which should be excluded from the analysis.

These areas could for example be:
• Areas that are close to an already existing health facility to avoid overlaps in catchment area
• Hazard prone areas (e.g. volcanic eruptions, flood, storm surge,..)
• Protected areas (natural reserve, water reserve,…)
• Restricted areas (military camps,…)

While all these types of areas would apply in the case of Vanuatu, the data at the projects disposal only allowed to account for the first two. More specifically, it has been considered that new health facilities should not be located within:
• 10 kilometers of an existing health facility to avoid catchment area overlap. The distance of 10 km has been decided considering patients walking at a speed of 5 km/h and a maximum travel time of one hour
• Based on information provided by the NDMO:
  o Storm surge prone areas which correspond to any area within 20 meters of altitude from the sea level
  o 3 kilometers from the crater of an active volcano

While exclusion areas based on the location of existing health facilities can be directly defined in AccessMod, the other two types of exclusion areas needed to be captured in GIS format specific layers.

Storm surge prone areas have been extracted from the Digital Elevation Model (see Section 4.2.7). In order to avoid for any health facilities being located along a boat route, the exclusion area also covers the sea. An extract of such exclusion areas for the Province of Malampa is presented in Figure 11.

While comparing the location of the existing health facilities with the newly developed storm surge prone areas, it can be found that 111 health facilities (56 Aid post, 31 Dispensaries, 15 Health Centers, 7 Clinics & 2 Provincial Hospitals) are currently falling within the 20m altitude storm surge exclusions zones. Exclusion zones will therefore need to be more carefully considered while deciding on the location of a new facility.
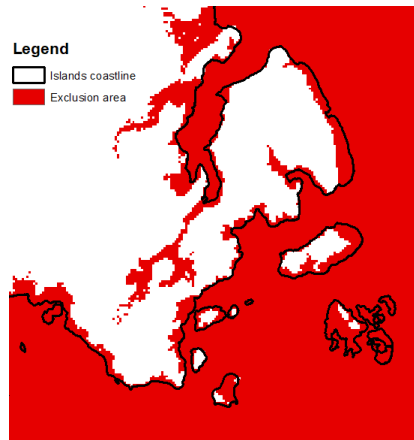
Figure 11 – An extract from the storm surge exclusion area (20 meters of altitude)

The 3 km buffer from each crater of the 6 active volcanoes (7 craters) observed in the country have themselves been created using the buffer tool in ArcGIS. Figure 12 a) presents the location of the 6 active volcanoes and b) an example of the resulting buffer for the

a)   b)
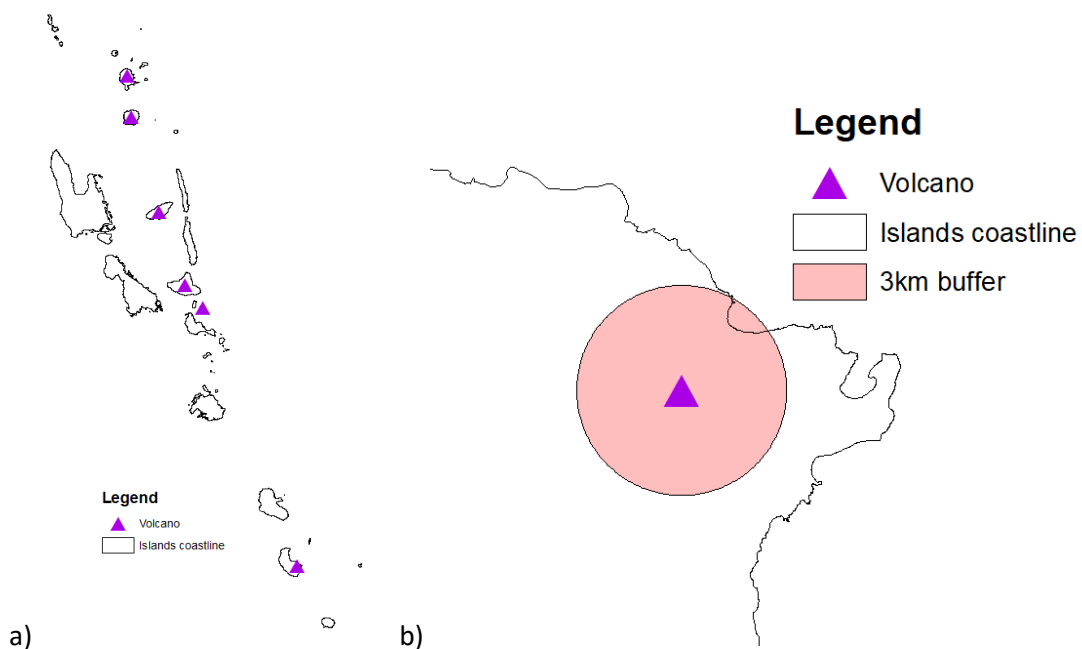
Figure 12 – a) Location of the 6 active volcanoes of Vanuatu and example of 3 km buffer around the Mount Yasur Volcano on Tanna island

Recommendation:
- Realistic Storm Surge Prone areas will need to be developed by the MOH in collaboration with the National Disasters Management Office, to inform the location of new facilities and capital planning of existing facilities.

4.3 Norms

As indicated at the beginning of Chapter 4, the following norms needed to be defined in order to conduct the different analyses in AccessMod 5.0:

- Maximum travel speed expected for a motor vehicle on the different types of roads and the boat routes as well as for walking outside of the road network.
- Population coverage benchmark considered as acceptable by the Ministry of Health
- Maximum coverage capacity of each health facility to define the maximum extent of the catchment area.

Regarding travelling speeds, three different scenarios have actually been considered depending on the analyses being conducted:

1. People are walking until reach a road or a boat route. From there, they take a motorized vehicle (car, boat) or a combination of the two to reach the nearest considered health facility.
2. People are only walking from their place of residence until the nearest considered health facility.
3. People are travelling to the nearest airport from where they use a plane to reach the airport on the island where the considered health facility is located, travelling then by car between the airport and the health facility in question.

Table 2 contains the speeds considered for each road type, the boat routes and landcover types when implementing the first scenario.

Transportation / land cover class	Transportation/land cover label	Speed on flat surface (km/h)	Transportation mode
1	Bare areas	5	WALKING
2	Built area	5	WALKING
3	Limestone/Reef/Rock Shelves/Sand bay	4	WALKING
4	Low density vegetation	4	WALKING
5	Medium density vegetation	3	WALKING
6	High density vegetation	2	WALKING
1001	Sealed roads	50	MOTORIZED
1002	Unsealed roads	25	MOTORIZED
1003	Urban roads	30	MOTORIZED
1004	Boat routes	15	MOTORIZED
1005	Trail	5	WALKING

Table 2 - Travelling speeds considered when implementing the first scenario

When implementing the second scenario:

- The transportation mode on roads has been set to walking and the speed on flat surface to 5km/h
- Movement by boat has not been considered

It is important to note that AccessMod allows for the walking speed to be adjusted for the slope observed on each of the cells crossed by the person traveling to the nearest facility. Please refer to section 3.3.3.2.2 of the online AccessMod user manual for more information regarding the model that is being used to perform such adjustment[11].

Finally, the flying speed considered when implementing the third scenario is dependent on the size of the plane being used for the trip (these speeds have been calculated based on real travel time between a set of given airports in the country):
- Small plane: 215 km/h
- Big plane: 330 km/h

When it comes to the population coverage benchmark considered as acceptable by the Ministry of Health, the value of 80% reported in the RDP has been used.

The following maximum travel time is associated to the 80% benchmark in the RDP when it comes to accessibility coverage:
- Dispensaries and Health Centres: 1 hour
- Health Centres: 4 hours

While coverage has been measured for different travel times, the above has been used as the reference when looking at the results of the ACC 1, ACC 2, GEO 1 and GEO 2 analyses.

The RDP also mentions the following maximum travel time when it comes to patient referral (Annex 1):
- From each Dispensary to the nearest Health Centre: 1-4 hours by the most common mode of transportation
- From each Health Centre and the nearest Hospital:
  - 4 hours by the most common mode of access in non-emergency conditions
  - 1 hour by the most expedient mode of access in emergency condition
- From each Provincial Hospital to the nearest Regional or National Referral Hospital:
  - 4 hours by the most common mode of access in non-emergency conditions
  - 1 hour by the most expedient mode of access in emergency condition

In addition to the above, each hospital is meant to be within 30 minutes of the nearest airport/airfield able to accommodate fixed wing and rotary wing aircraft use for referral.

These values have been used as a reference when looking at the results of the REF 2, REF 3 and REF 4 analyses.

The determination of the maximum coverage capacity for each health facility has been done starting from the information reported in the RDP when it comes to the ideal size of the catchment area associated to each type of health facility (Table 3).

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[11] https://doc-accessmod.unepgrid.ch/display/EN/3.3.2.2.+Traveling+scenario+table

In the case of Aid Posts, Dispensaries and Health Centres, the maximum coverage capacity has initially been set to correspond to the maximum catchment population indicated in the RDP

Due to the way Hospitals have been considered in the different analyses, the maximum coverage capacity for both the Provincial and the National Referral Hospitals have initially been set to match the total population of the Province in which they are located.

Health facility type	Catchment population as per the RDP		Maximum coverage capacity
	Min	Max	
Aid Posts	100	300	300
Dispensary	300	2000	2000
Health Centre	2000	5000	5000
Enhanced Health Center	Same as Health center but can be larger		7000
Provincial hospital	Province population		Province Population
National Referral Hospital	Vanuatu population		Province Population

Table 3 – Catchment population as reported in the RDP and corresponding maximum coverage capacity used in the different analyses

A check has been performed to see if some of the Dispensaries or Health Centres in the country did not already demonstrate having the capacity to cover a bigger population than the benchmark reported in Table 3.

As indicated in Section 4.1.1, this check has been performed based on the health facility level total number of visits reported for 2018 and resulted in the identification of 17 Dispensaries and 4 Health Centres for which the maximum coverage capacity used in the analyses has been higher than the benchmark reported in Table 3. The values in question are reported in the maximum coverage capacity column in Annex 5.

5. Results

This Chapter presents the results obtained for each of the analyses described in Chapter 3.

5.1 Accessibility coverage analyses

This set of analyses looked at measuring how different levels of health care are accessible, in terms of travel time, to the total population. They correspond to the analyses coded ACC_1, ACC_2, ACC_3, ACC_4 and ACC_5 in Annex 1.

These analyses have been performed using the following GIS layer and associated data described in the previous Chapter:
1. Islands, administrative divisions and health zones (see Section 4.2.1);

2. Geographic location of the health facilities (see Section4.2.2)
3. Transportation network (see Section 4.2.4)
4. Hydrographic network (see Section 4.2.5),
5. Digital Elevation Model (DEM) (see Section 4.2.6)
6. Land cover (see Section 4.2.7)
7. Spatial distribution of the population (see Section 4.2.8)
8. The following two scenarios:
   a. ACC 1, ACC 2 and ACC 3 analyses: Combined walking and motorized vehicle (travelling speeds reported in Table 2)
   b. ACC1 to ACC 5 analyses: Walking only (speed on road network set to 5 km/h and no travel by boat)

The merge land cover tool of AccessMod 5.0 has first been used to generate the merged land cover grid by combining the land cover layer with the transportation and hydrographic networks.

This layer, together with the DEM, the location of the health facilities and the scenarios have then been used as the input data for the physical accessibility analysis module in AccessMod 5.0.

The maximum travel time set for the different analyses has been of 250 minutes and this in order to estimate accessibility population coverage for 1, 2, 3 and 4 hours of travel time.

The first result coming out of this module is the spatial distribution of the travel time to the nearest health facility. Figure 13 provides an example of such travel time distribution grid when it comes to accessing the nearest Health Centre (Analysis ACC 2) with the combined scenario over the island of Efate and Figure 14 when considering the walking only scenario.
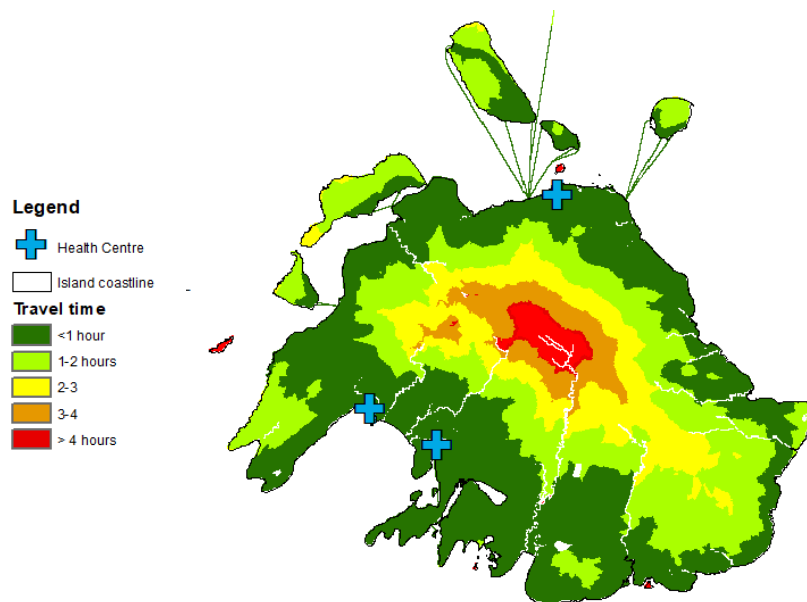
Figure 13 – Travel time to the nearest Health Centre over the island of Efate considering the combined travelling scenario
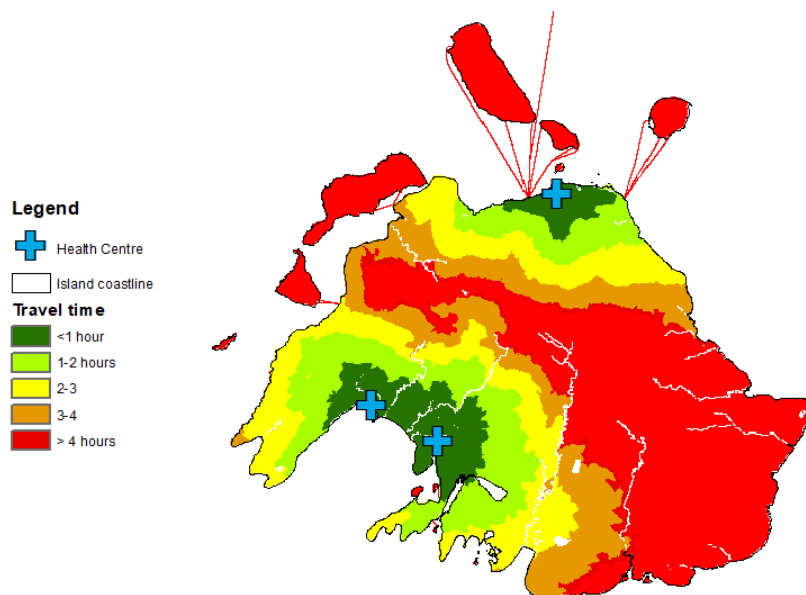
Figure 14 – Travel time to the nearest Health Centre over the island of Efate considering the walking only scenario

What we can observe from Figure 13 and 14 is that the possibility to use a motorized vehicle once reaching the road network or a boat route has a significant important positive impact on accessibility coverage. This confirms the importance of any programs that aim to facilitate the timely transportation of pregnant women to the nearest health facility.

The zonal statistics module in AccessMod 5.0 does then allows the extraction of the total population as well as the percentage of the total population located within a given travel time (1, 2, 3 and 4 hours) to the nearest health facility for the level of care that is being considered. This can be done at the Province, Area Council, Health Zone and island level. This data has then been organized in tables, graphs and maps.

As this represent an important volume of results only the Province level results are reported in Annex 8 (map only for 1 hour of travel time). The complete set of results are themselves available through the links provided in Annex 9.

Some important information when looking at these results:
- The label for the different tables are as follow:
  - PRO_C_VNSO: Province code as per the VNSO
  - PRO_N_VNSO: Province name as per the VNSO
  - AC_C_VNSO_66: Area Council code as per the VNSO (2016 situation with 66 Area Councils)
  - AC_N_MIA_66: Area Council name as per the MIA (2016 situation with 66 Area Councils)
  - ISL_VNSO_C: Island code as per the VNSO
  - ISL_NAME: Island name as per the information that has been collected
  - HZ_ID: Health Zone code as per the MOH
  - Tot_Pop: Total population observed within the considered zone

- Pop (60 min): Total population located within 1 hour of travel time within the considered zone
- Cov (60min): Population coverage within 1 hour of travel time within the considered zone
- Pop (120 min): Total population located within 2 hours of travel time within the considered zone
- Cov (120min): Population coverage within 2 hours of travel time within the considered zone
- Pop (180 min): Total population located within 3 hours of travel time within the considered zone
- Cov (180min): Population coverage within 3 hours of travel time within the considered zone
- Pop (240 min): Total population located within 4 hours of travel time within the considered zone
- Cov (240min): Population coverage within 4 hours of travel time within the considered zone
- The colors used for population coverage in the tables and maps are based on the following classification:
    - Dark red: 0% coverage
    - Red: 0.1 to 20%
    - Orange: 20 to 40%
    - Yellow: 50.1 to 60%
    - Light green: 60.1 to 80%
    - Dark green: above 80%
- The colors used in the graphs presenting the evolution of accessibility coverage according to maximum travel time corresponding to the different Provinces

The results first confirm the visual observation made with Figures 13 and 14 regarding the impact that the use of motorized vehicles has on accessibility coverage. When looking at the ACC 1 analysis for 1 hour of travel time we can observe a drop in coverage:
- Of 24.5% at the country level
- Varying between 11.9 and 32.2% when considering Provinces
- Varying between 0 and 99.2% when considering Area Councils
- Varying between 0 and 79.8% when considering Health Zones
- Varying between 0 and 100% when considering islands

This observation is a good example on how aggregating data can mask the heterogeneity present at a lower level of desegregation and therefore the importance of choosing the appropriate type of zones for decision making.

If we are now using the benchmarks set in the RDP when it comes to accessibility coverage to the nearest operational Dispensary or Health Centre considering 1 hour of travel time (ACC 1) and the accessibility coverage to the nearest Health Centre considering 4 hours of travel time (ACC 2) we can observe that the benchmark is reached for (Table 4):
- Both indicators at the national level

- All Provinces when it comes to ACC 2 but that 2 Provinces are not reaching it for ACC 1
- 84.8% of the Area Councils for ACC1 and 89.4% for ACC 2 and that we find South Erromango at the bottom of each lists
- 76% of the Health Zones for ACC 1 and 86% for ACC 2 and that the health zones presenting the lowest values are located in different Provinces between the two indicators
- 65.3% of the inhabited islands for ACC1 and 80% for ACC 2

	80% of people in the catchment area can access the nearest Dispensary or Health Centre within one hour by the most common mode of access (eg walking, paddling, truck etc) – ACC 1	80% of people in the catchment area can access the nearest Health Centre within 4 hours by the most common mode of access (eg walking, paddling, truck etc) – ACC 2
National level	Passed (93.4%)	Passed (96.7%)
Province level	4 Provinces are above 80%. Torba (73.7%) and Penama (72.3%) are below the benchmark	All the Provinces are above 80%
Area Council level	56 Area Councils (84.8%) are above 80%. The lowest value are observed for South Erromango (14.8%), North Ambae (Vatubulei & Tagaro) (2.5%) and East Ambae (LungeiTagaro) (0%)	59 Area Councils (89.4%) are above 80%. The lowest value are observed for North Erromango, South Erromango, Futuna and Aneityum (all presenting 0% of coverage)
Health Zone level	38 Health Zones (76%) are above 80%. The lowest values are observed for PEN04 (32.1%), PEN01 (0%) and PEN03 (0%)	43 Health Zones (86%) are above 80%. The lowest values are observed for TAF02b, TAF04b and TAF04c (all presenting 0% of coverage)
Island level	49 islands (65.3% of the inhabited islands) are above 80%. The lowest values are observed for Ambae (36.2%), Ureparapara (33.3%) and Toga 17.4%)	60 islands (80% of the inhabited islands) are above 80%. The lowest values are observed for 13 islands for which the coverage is equal to 0%

Table 4 – National, Province, Area Council, Health Zone and island level results of the ACC1 and ACC2 accessibility analyses against the RDP benchmark

Key Results
- At the national level, more than 90% of the population is able to access the nearest Dispensary or Health Centre within one hour by the most common mode of access (e.g. walking, padding, truck). However, a number of inhabited islands have coverage rates below 80%, with the lowest values observed in Ambae, Ureparapara and Toga.
- Having access to motorized transport increases accessibility levels by around 25%, thereby stressing the importance of any program that aims to facility the timely transportation of patients.

5.2 Geographic coverage analyses

This second set of analyses includes the capacity of each facility into the accessibility coverage analyses conducted in the previous section.

The geographic coverage for each considered level of care has been measured based on the same data and input parameters than those used for the accessibility coverage analyses (see Section 5.1) except that:
- Only the combined travel scenario (walking + motorized vehicle) has been applied (Table 2)
- Each analysis has been conducted for only 1 maximum travel time when it comes to GEO 1, GEO 2, GEO 3 and GEO 5 and two travel times for GEO 4 (Annex 1)
- The maximum coverage capacity of each health facility has been taken into account (Annex 5)
- A processing order has been decided in order to define the preference of a person when located within the same travel time of two or more health facilities (catchment overlap). The processing order has been defined by sorting the considered health facilities according to:
  1. Decreasing order the total population of the island on which the health facility is located
  2. When more than 1 type of health facilities was considered in the analysis, the type being the highest in the health care delivery structure was processed first to give preference to the facilities having the bigger capacity
  3. Decreasing population located within 1 hour of travel time of the health facility to start the process by covering the most populated areas.

The analyses have been conducted using the Geographic coverage analysis in AccessMod 5.0 and generated the following products for each of them:
- An Excel file containing the health facility specific results generated by AccessMod 5.0
- An Excel file containing the total and percentage (coverage) of the population being covered at the Country, Province, Area Council, Health Zone and island level
- A map showing the resulting geographic coverage for the different levels

The volume of results being once again important, only the Province level tables and maps are presented in Annex 10. The links to the complete results are themselves reported in Annex 11.

Some important information when looking at the results:
- Health facility specific tables:
  o Each file contains a "Data Catalog" worksheet in which the content of each of the fields included in the "Results" worksheet is explained
- Aggregated tables
  o The labels are the same as those used for the table generated under the accessibility coverage analyses (see Section 5.1)
  o The result of the accessibility coverage analysis for the corresponding travel time are included in the table for comparison

- o The "Coverage difference" column on the right provides the difference in coverage between the accessibility and the geographic coverage analyses
  - o The colors used for the Coverage difference are based on the following classification
    - ▪ Dark green: 0% difference
    - ▪ Light green: 0.1 to 25%
    - ▪ Yellow: 25.1 to 50%
    - ▪ Orange: 50.1 to 75%
    - ▪ Red: 75.1 to 100%
- The colors used for population coverage in the tables and maps are based on the same classification than the one used for the accessibility coverage analyses (see Section 5.1)

Two type of observations are being performed on the basis of the results obtained here:
1. Comparing the results of the geographic coverage analysis with the result from the corresponding accessibility analysis and to identify areas in which there might be a shortage of capacity to cover all the population located within the catchment area for the defined travel time
2. Looking at the health facility level results to identify health facilities that:
   - o Could serve a larger population within the given travel time if their capacity was to be extended (full capacity being used before reaching the full extent of the catchment areas. This corresponds to health facilities for which the travel time reported in the "amTravelTimeCatchment" is lower than the "amTravelTimeMax")
   - o Have more capacity than the population they are actually serving within the catchment area. This corresponds to health facilities for which there is still some residual capacity in the "amCapacityResidual" column while the catchment area has reached its full extent (travel time reported in the "amTravelTimeCatchment" is equal to the "amTravelTimeMax".
   - o Don't see any of their capacity being used because the population located in their catchment area is covered by other health facilities that have been processed by AccessMod before the health facility in question

The results for these two types of observations across all the geographic coverage analyses are captured in Annex 12.

Key Results
- When taking in consideration the maximum capacity of health facilities the population that can access a Dispensary or Health Centre within 1 hour drops to 84% (from 93%). The highest coverage difference (difference between results of the physical accessibility analyses and the geographical coverage analyses) occurred in Shefa Province, with a drop from 99% to 79%.
- 16 Dispensaries could potentially be closed without having an impact on the geographical coverage rate, due to their proximity to other facilities
- The geographic coverage analyses reveals that geographic coverage is below 80% in Shefa (79%), Torba (74%) and Penama (72%).
- Health Centres in Shefa and Tafea province are respectively only able to cover around 50% and 40% of the population

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5.3 Referral analyses

The referral analyses conducted as part of the present study looked at measuring the travel time between different levels of the health care delivery system as reported in Annex 1 (Analysis REF 1 to REF 5).

These analyses have been performed considering the assumptions defined in Chapter 3 as well as using the following GIS layer and associated data described in the previous Chapter:
1. Location of the health facilities (Section 4.2.2);
2. Transportation network (Section 4.2.3),
3. Hydrographic network (Section 4.2.4),
4. Digital Elevation Model (DEM) (Section 4.2.6),
5. Land cover (Section 4.2.7)
6. The following travelling scenario depending on the analysis:
    a. REF 1, REF 2 and REF 5: The combined travelling scenario reported in Table 2
    b. REF 3 and REF 4
        i. People use any transport medium available except planes to reach the nearest Hospital (not possible for REF 4 as the National Referral Hospitals are on islands not connected by boat)
        ii. People use a plane during days when there is a commercial flight to reach the nearest Hospital
        iii. People use a plane during days when there is no commercial flights to reach the nearest Hospital (Health facilities located in Torba Province go to the Northern Province Hospital; all the others go to Vila Central Hospital). In this case, a plane would first have to fly from either Port Vila or Luganville until the airport/airfield where the patient is waiting before flying to the airport located near the hospital to which the patient is being referred.

The referral analysis tool of AccessMod 5.0 has then been used to measure the travel time between each of the health facilities from which the referral starts until the nearest facility to which the patient is being referred at the upper level of care.

For REF 1, REF 2, REF 3 (Scenario 1) and REF 5, this tool produces an Excel file containing the following information (extract in Table 5 for REF 1):
- o The code and name of the health facility from which the referral starts (from_Aid_Post_ID and from_Aid_Post_n and Table 5)
- o The code and name of the nearest health facility by time to which the patient is being referred (to_HC-DIS_n and to_HF_Type)
- o The travel time between the two facilities expressed in minutes (Ref_time)
- o The distance between the two facilities along the shortest path by time expressed in kilometers (Ref_dist)

from_Aid_Post_ID	from_Aid_Post_n	to_HC-DIS_ID	to_HC-DIS_n	to_HF_Type	Ref_time	Ref_dist
6542	Veningaibus (Veleta)	2985	Bonvor	Dispensary	747	22.749954
6106	South River	1865	Dillons Bay (Williams Bay)	Dispensary	607	32.400779
6351	Nakurakum	2762	Saramauri	Health Centre	438	18.230539
6102	Antioch	1865	Dillons Bay (Williams Bay)	Dispensary	388	25.631477
6104	Happy Land	1865	Dillons Bay (Williams Bay)	Dispensary	387	25.589155
6100	Port Patrick	1867	Yorien	Dispensary	217	15.347726
6217	Ambek	2661	Hanington (Vetuboso)	Dispensary	164	46.194056
6317	Jungle Mountain	2776	Wusi (Joseph Mape)	Dispensary	158	11.280296
6220	Vatop	2661	Hanington (Vetuboso)	Dispensary	132	38.25664
6411	Vuiberugu	2844	Nduindui	Health Centre	123	18.68865
6206	Tormeryau	2642	Loh	Health Centre	121	29.462327

Table 5 – Extract of the Excel file resulting from the REF 1 analysis

In the case of REF 3 (Scenario 2 and 3) and REF 4 (Scenario 3), AccesMod 5.0 has been used to measure the travel time between each considered facility and the nearest airport and then from the landing airport and the nearest hospital. The flying time between both airports has then been added to obtain the full referral time.

All the tables mentioned above are large and they have not been included in the present report but are available for download from the links reported in Annex 13. A data catalog is once again included in each file to describe the content of each field in the results worksheet.

A map showing the spatial distribution of the travel time for each analysis has also been generated and are available for download from the links reported in Annex 13. The one generated for the REF 1 analysis is also reported in Annex 14 as an example.

Table 6 does itself summarize the analyses by providing the distribution of the number of health facilities from which the referral started by travel time range.

If we compare the content of Table 6 with the benchmark reported in the RDP we can observe that:
- 94 Dispensaries (91.2%) are within 4 hours of the nearest Health Centre (REF 2)
- 30 Health Centre (71.4%) are within 4 hours of the nearest Hospital by the most common mode of access in non-emergency conditions (REF 3, scenario 1)
- 21 Health Centre (50%) are within 1 hour of the nearest Hospital by the most expedient mode of access in emergency condition considering commercial flights only (REF 3, scenario 2)
- 17 Health Centre (40.5%) are within 1 hour of the nearest Hospital by the most expedient mode of access in emergency condition considering emergency flights only (REF 3, scenario 3)
- None of the Provincial Hospital are within 4 hours of nearest Regional or National Referral Hospital 4 hours by the most common mode of access in non-emergency conditions (REF 4, Scenario 1)
- None of the Provincial Hospital are within 1 hour by the most expedient mode of access in emergency condition considering commercial flights only (REF 4, scenario 2)

- None of the Provincial Hospital are within 1 hour by the most expedient mode of access in emergency condition considering emergency flights only (REF 4, scenario 3)

Travel time range	REF1	REF 2	REF 3			REF 4		REF 5
			Scenario 1	Scenario 2	Scenario 3	Scenario 2	Scenario 3	
< 30 min	113	43	7	0	0	0	0	58
30 min 1 hour	39	19	7	4	1	0	0	39
1-2 hours	24	21	7	15	12	4	0	75
2-3 hours	5	10	4	5	8	0	4	34
3-4 hours	1	1	5	1	5	0	0	21
>4 hours	5	7	5	0	0	0	0	53
Out of reach	0	2	7	0	0	0	0	52
Going directly to the hospital	NA	NA	0	17	16	0	0	NA
Total	187	103	42			4	4	332

Table 6 – distribution of the number of health facilities from which the referral started by travel time range

The analyses that have been conducted also confirmed that all the Provincial and National Referral Hospitals are within 30 minutes from an airport.

Key Results
- The majority of Dispensaries meet the RDP benchmark, as over 90% of the Dispensaries are within 4 hours of the nearest Health Centre by the most common mode of transportation.
- 71% of the Health Centres are within 4 hours of the nearest Hospital, using the most common mode of access in non-emergency conditions. It is therefore crucial to prioritize resources (human resources and capital) in those Health Centres that face difficulties in accessing hospitals.
- 50% of the Health Centers are within 1 hour of the nearest Hospital by the most expedient mode of access in emergency condition considering commercial flights only.

5.4 Scaling up analyses

The geographic coverage analyses considering Dispensaries and Health Centres (GEO 1) revealed that 3 Provinces are presenting a geographic coverage below 80%, namely:
- Shefa (78.6%)
- Torba (73.7%)
- Penama (72.3%) [12]

The scaling up analysis tool of AccessMod 5.0 has therefore been used to identify how many Dispensaries, Health Centres and/or Enhanced Health Centres would need to be added and where they should be placed in each of these Provinces to the current network for them to reach the 80% benchmark.

These analyses have been conducted using the following input data and parameters:
1. Geographic location of already existing Dispensaries and Health Centres (see Section4.2.2)
2. Merged land cover distribution created as part of the accessibility coverage analysis (see Section 5.1)
3. Digital Elevation Model (DEM) (see Section 4.2.6)
4. Spatial distribution of the total population (see Section 4.2.8)
5. Spatial distribution of the population not covered during the Geographic Coverage Analysis (see Section 5.2)
6. The extent of the exclusion areas (see Section 4.2.9)
7. The combined walking and motor vehicle scenario (Table 2)
8. The following factors to identify the most suitable locations to place new health facilities:
   a. Population density: The most populated the area considering a 5 km buffer the more suitable
   b. Straight distance to the road network: The closer to the road network the better
9. The minimum and maximum catchment population as well as maximum population coverage capacity reported in Table 7.

Min	Max	Label	Capacity
0	300	Outreach services	300
300	2000	Dispensary	2000
2000	5000	Health Centre	5000
5000	999999999	Enhanced Health Centre	7000

Table 7 - minimum and maximum catchment population as well as maximum population coverage capacity considered in the scaling up analysis

The above data and parameters have been entered in AccessMod and the analysis conducted Province by Province.

In the case of Shefa Province, the analysis added one Enhanced Health Centre (Figure 15) for the geographic coverage over the Province to pass from 78.6 to 85.1%.

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[12] Due to the Ambae Volcano Eruption in 2018, multiple dispensaries were closed in Penama Province.
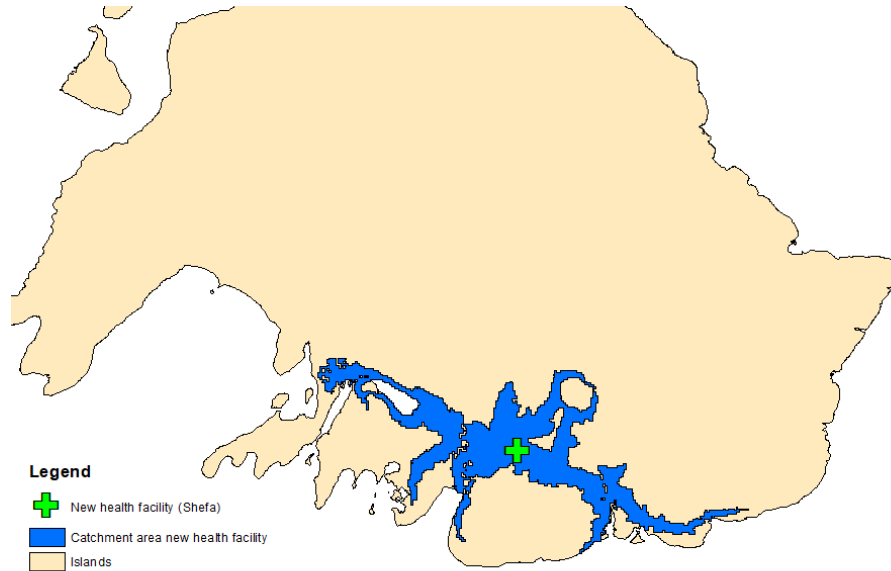
Figure 15 – Location of the new Enhanced Health Centre and its catchment area resulting from the scaling up analysis over Shefa Province

For Torba Province, the analysis added two Dispensaries (Figure 16) for the geographic coverage over the Province to pass from 73.7 to 80.5%.
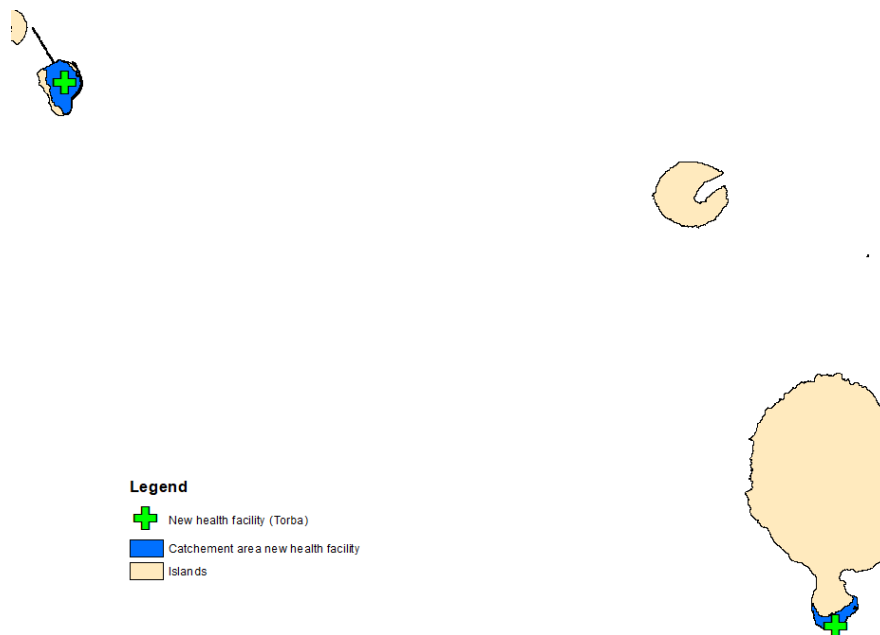
Figure 16 – Location of the two new Dispensaries (on Toga and Vanua Lava) and their catchment area resulting from the scaling up analysis over Torba Province

Finally, in Penama Province, the analysis added one Enhanced Health Centre (Figure 17) for the geographic coverage over the Province to pass from 72.3 to 92.6%.
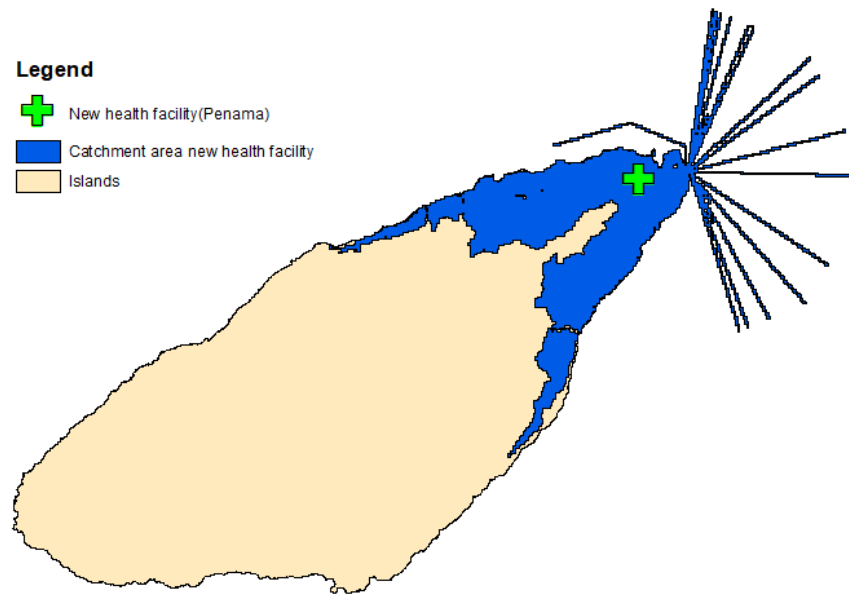
Figure 17 – Location of the new Enhanced Health Centre and its catchment area resulting from the scaling up analysis over Penama Province

Key Results:
- The scaling-up analysis shows that in order to reach the 80 Accessibility target for primary health care facilities in every province, one Enhanced Health Centre would need to be built on Efate, one on Ambae, and two Dispensaries in Torba Province (Toga and Vanua Lava)

6. Conclusions and recommendations

The results obtained in the context of this project have the objective of informing policy discussions on how to optimize the spatial distribution of health services and as such ensure equity in access across the different levels of the health care delivery network to reach Society Objective 3.1 of Vanuatu National Sustainable Development Plan.

Using the Role Delineation Policy (RDP) as a reference, several analysis have been conducted using AccessMod 5.0 to assess the current situation across the levels in question.

The accessibility coverage analysis looked at how physically accessible the different levels of care are to the total population within a given set of travel time (1, 2, 3 and 4 hours). This analysis allowed for the identification of areas in the country for which physical accessibility to Dispensaries and/or Health Centre are below the benchmark promoted by the RDP. The results show that at the national level, more than 90% of the population is able to access the nearest Dispensary or Health Centre within one hour by the most common mode of access (e.g. walking, padding, truck). Only in Torba and Penama, less than 80% of the population is access the facility within an hour.

In addition to that, this analysis not only confirmed the positive impact that the use of motorized vehicles have on accessibility but demonstrated also how a measure such as accessibility coverage can vary depending on the level at which the results are being aggregated (Country, Province, Area Council, Health Zone, Island) and how aggregating the data can mask pockets of heterogeneity visible at the lowest level of desegregation.

The geographic coverage analysis did allow for the identification of areas in the country where the availability of services might be a barrier to equitable access to health care services. These areas have been identified by comparing the results of this analysis with those obtained during the accessibility analysis. The highest coverage difference (difference between results of the physical accessibility analyses and the geographical coverage analyses) occurred in Shefa Province, with a drop from 99% to 79%. This means that although almost the entire population in Shefa can access a primary health care facility within 1 hour, the Dispensaries and Health Centres do not have the capacity to serve the population of Shefa. Moreover, the results show that due to their proximity to other facilities, the population around 16 dispensaries could access another primary care facility within one hour.

The results provided by AccessMod at the health facility level did provide more detailed information that could guide the redistribution of human resources in order to not only ensure a more equitable access, but also more cost-effective coverage of the population.

The referral analysis provided information on how many facilities are currently compliant with the benchmark reported in the RDP when it comes to referring patients to the upper level of care. The majority of Dispensaries met the RDP benchmark, as 90% of the Dispensaries are within 4 hours of the nearest Health Centre. In contrast, only 30% of the Health Centers are within 4 hours of the nearest Hospital, using the most common mode of transport.

Last but not least, the scaling up analysis allowed the identification of how many Dispensaries, Health Centres and/or Enhanced Heath Centres would be needed to be established in order to bring geographic coverage above the 80% benchmark in the Provinces of Shefa, Torba and Penama.

While all results presented in this report still need to be validated by Provincial officials and some of the datasets improved, the findings provide a first picture of the current situation in the country and allow for the identification of potential areas in which the Ministry of Health might want to perform more in-depth analyses.

The importance of data quality on the final results and the time it took for the preparation of such data before being able to conduct the analyses (estimated at 70% of the overall project time) emphasize the importance of the National Geospatial Data Policy process currently taking place in the county.

This also underlines the need for the Ministry of Health to look into strengthening its current technical capacity when it comes to the management and use of geospatial data and technologies as well as ensuring the proper integration of the geographic and time dimensions in its Health information System (HIS).

In this context, the training workshop organized in Port Vila during the week of December 2nd has not only contributed to strengthening such technical capacity but also demonstrated the wealth of capacity that exists in other Ministries as well as their interest in applying the analysis conducted here to other sectors such as education, water and sanitation.

Recommendations

In the view of the above, the following recommendations related to: 1) geospatial data management, 2) utilizing the results and 3) further analyses, are proposed for consideration by the Ministry of Health.

Geospatial Data Management:
- ***Geospatial Capacity Building***: Consider the results of the present study as a driver to strengthen the technical capacity of the Ministry of Health when it comes to the management and use of geospatial data and technologies as well as the proper integration of the geographic and time dimensions in the HIS

- ***Islands, administrative divisions and health zones***:
  o To facilitate data collection, geospatial analyses and decision making, Local Authorities & VNSO should endorse a fixed coding and naming system for Provinces, Islands and Area Councils
  o The MOH should consider changing from health zones to area councils as the divisions of reference for data collection, monitoring and decision making within the health sector

- *Geographic location of the health facilities:* The Ministry of Health should establish the necessary supporting environment and mechanism to facilitate improved health facility data (starting with the geographic coordinates of the Aid Posts) as well as regular updates and sharing of the health facilities master list

- *Exclusion Zones:* Realistic Storm Surge Prone areas will need to be developed by the MOH in collaboration with the National Disasters Management Office, to inform the location of new facilities and capital planning of existing facilities. Currently 111 primary health care facilities are within the 20m altitude exclusion zone of NDMO.

- **HIS Geo-enabling framework**: The Ministry of Health should use the HIS geo-enabling framework[13] as the reference for implementing all the above and gain the benefit available from combined use of geography, geospatial data and technologies

Utilizing the Results:
- **Role Delineation Policy:**
    - Use the results as a basis for the reclassification of facilities according to the new Role Delineation Policy
    - The results can guide the implementation plan for the Role Delineation Policy

- **Human Resources**: Use the results to develop more allocative efficiency in the approach to the distribution of human resources in the country. For example, the results from the Referral Analyses can be used to determine which Health Centre should receive a Midwife.

- **Capital Planning**:
    - Use the results to influence the national and provincial capital plans
    - The results should be used to advocate for the improvement of resource (Human, Financial, Assets and Equipment) allocation within the current health care system, instead of the allocation of resources to new health facilities

- **Patient Referral**: The results can be used to assist with an implementation plan for the recently launched Referral Policy

Further Analyses:
- **Data Improvement**:
    - The current analyses have spatially distributed the population by Area Council Level. To improve the analyses, the newly available VNSO population data by Island should be used for further analysis on a Province by Province basis.
    - Collect geographic coordinates of all Aid post during the next Village Health Worker survey.

- **Physical Accessibility Analyses**:

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[13] https://www.healthgeolab.net/DOCUMENTS/HIS_geo-enabling_toolkit.pdf

- o Consider further analysis on province by province basis once the datasets have been improved (health facilities location, population, distribution)
- o Simplify the way in which the results are presented so that the National Executive Level and Provincial Executive Committee can use the information to guide planning
- o Undertake future analysis on a regular basis to account for the changes that occur in the number and distribution of the population and health facilities or in the transportation network. It is especially recommended that this study is replicated once the 2020 Census has been completed.
- o Assist other sections such as education, water and sanitation in applying the analysis conducted here.

References

[1]   Ministry of Health of Vanuatu (2017): Role Delineation Policy

[2]   Ebener S., Stenberg K., Brun M., et al. (2019): Proposing standardised geographical indicators of physical access to emergency obstetric and newborn care in low-income and middle-income countries. BMJ Global Health June 2019, Volume 4, Suppl 5

Annex 1 – Analysis conducted in the present study

Analysis type	Analysis Code	Analysis description	Media for the presentaton of the	Information from the role delineation policy	Policy benchmark to reach	Nbr of health facilities included	Travel scenario
Physical accessibility	ACC 1	Accesibility coverage of the population traveling to the nearest operational dispensary or health centre (1, 2, 3, 4 hours)	Table, graph, map	80% of people in the catchment area can access the facility within one hour (By the most common mode of access eg walking, paddling, truck etc)	80%	145	Scenario 1: Combined walking and motorized vehicle; Scenario 2: Walking only
	ACC 2	Accesibility coverage of the population traveling to the nearest operational health centre (1, 2, 3, 4 hours)	Table, graph, map	80% of people in the catchment area can access the facility within 4 hours (by the most common mode of access eg walking, paddling, truck etc)	80%	42	
	ACC 3	Accesibility coverage of the population traveling to the nearest operational hospital (1, 2, 3, 4 hours)	Table, graph, map	None	No benchmark	6	
	ACC 4	Accesibility coverage of the population traveling to the nearest operational Aid Post (1, 2, 3, 4 hours)	Table, graph, map	None	No benchmark	187	Combined walking and motorized vehicle
	ACC 5	Accesibility coverage of the population traveling to the nearest Aid Post, Dispensary or Health Centre (1, 2, 3, 4 hours)	Table, graph, map	None	No benchmark	332	
Geographic coverage analysis	GEO 1	Geographic coverage of the population traveling to the nearest operational dispensary or health centre (1 hour)	Table, map	Local catchment population for dispensary = 300 – 2,000 ; Catchment population for health centres = 2000-5000	80%	145	Walking until a road or a boat route and then taking a motorized vehicle
	GEO 2	Geographic coverage of the population traveling to the nearest operational health centre (4 hours)	Table, map	Catchment population for health centres = 2000-5000 population including referral catchment	80%	42	
	GEO 3	Geographic coverage of the population traveling to the nearest operational hospital (4 hours)	Table, map	Catchment Population = Provincial population	No benchmark	6	
	GEO 4	Geographic coverage of the population traveling to the nearest operational Aid Post (30 m, 1 h)	Table, map	Catchment population = 100 – 300 people	No benchmark	187	
	GEO 5	Geographic coverage of the population traveling to the nearest primary health care centre (1 hour)	Table, map	See GEO_1, GEO_2 and GEO_3	80%	332	

Analysis type	Analysis Code	Analysis description	Media for the presentaton of the	Information from the role delineation policy	Policy benchmark to reach	Nbr of health facilities included	Travel scenario
Referral analysis	REF 1	Travel time between each Aidpost and the nearest Dispensary or Health centre	Table, map	Access to Dispensary may require land or sea transport services (Transport assets not held at AP level)	No benchmark	187 Aid Posts to 145 Dispensaries/health centres	Walking until a road or a boat route and then taking a motorized vehicle
	REF 2	Travel time between each Dispensary and the nearest health Centre	Table, map	Access to next highest health facility within 1-4 hours (By the most common mode of access)	No benchmark	103 Dispensaries to 42 health centres	
	REF 3	Travel time between each Health Centre and the nearest Hospital considering 3 scenarios: 1. People don't use plane and go to Provincial or referral hosptial: 2. People use a plane during days when there is a commercial flight and go to the referral hospital; 3: people use a plane during days when there is no commercial flights and go to the referral hospital (Health centres in Torba Province go to NPH; all the others go to VCH)	Table, maybe map	Scenario 1: All referral cases can access the facility from a Health Centre or Enhanced Health Centre, within 4 hours (by the most common mode of access eg walking, paddling, truck, boat etc) under nonemergency situation; Scenario 2 and 3: a. Priority (emergency) referral cases can reach the hospital within one (1) hour from a health centre utilising most expedient form of transport; b. The provincial hospital has access to airfield within 30 mins land transport from hospital location for fixed wing and rotary wing aircraft	No benchmark	42 health centres to 6 hospitals	Scenario 1: Walking until a road or a boat route and then taking a motorized vehicle

Scenario 2: Same as scenario 1 + taking commercial flights

Scenario 3: Same as scenario ! + taking commercial or emergency flight |
	REF 4	Travel time between each Provincial Hospital and the nearest Regional or National Referral Hospital considering 3 scenarios: 1. People don't use plane; 2. People use a plane during days when there is a commercial flight; 3: people use a plane during days when there is no commercial flights	Table, maybe map	Scenario 1: All referral cases can access the facility from Provincial Hospital, within 4 hours (by the most common mode of access eg walking, paddling, truck, boat etc) in non-emergency. Scenario 2 and 3: a.Priority (emergency) referral cases can reach the hospital within one (1) hour from Provincial Hospital utilising most expedient form of transport; b. The hospital has access to airfield within 30 mins land transport from hospital location for fixed wing and rotary wing aircraft	No benchamrk	4 Provincial hospitals to 2 Referral hospitals	
	REF 5	Travel time between the lower level health facilities (Aid Posts, Dispensaries, Health centres) and the nearest Hospital	Table, maybe map	None	No benchmark	332 Primary health facilities to 6 hospitals	Walking until a road or a boat route and then taking a motorized vehicle
Scaling up analysis	SCA 1	Number and location of the Dispensaries or health centres to be added to reach 80% of the population in each of the Provinces	Map	80% of people in the catchment area can access the facility within one hour (By the most common mode of access eg walking, paddling, truck etc)	80%	NA	Walking until a road or a boat route and then taking a motorized vehicle

Annex 2 – Area Council level population from the 2016 mini-census, annual growth rate and resulting projection for 2019

Province code	Province name	Area Council code	Area Council name	Population 2016	Growth rate	Population 2019
4	Malampa	403	Central Malekula	6045	0.275%	6,095
4	Malampa	407	North Ambrym	3156	-0.201%	3,137
4	Malampa	402	North East Malekula	7346	2.250%	7,853
4	Malampa	401	North West Malekula	5563	2.803%	6,044
4	Malampa	410	Paama	1810	0.786%	1,853
4	Malampa	409	South East Ambrym	1552	-1.905%	1,465
4	Malampa	405	South East Malekula	5123	2.283%	5,482
4	Malampa	406	South Malekula	3961	-0.295%	3,926
4	Malampa	404	South West Malekula	3546	1.262%	3,682
4	Malampa	408	West Ambrym	2944	2.031%	3,127
3	Penama	308	Central Pentecost 1 or CP1 (Suru)	2631	0.542%	2,674
3	Penama	309	Central Pentecost 2 or CP 2 (Ulinsalean)	3672	-1.120%	3,550
3	Penama	303	East Ambae (LungeiTagaro)	2965	3.883%	3,324
3	Penama	302	North Ambae (VatubuleiTagaro)	3935	2.873%	4,284
3	Penama	305	North Maewo (Banganvanua)	2362	1.089%	2,440
3	Penama	307	North Pentecost (Vatunmalanvanua)	5942	0.101%	5,960
3	Penama	304	South Ambae (Vatueulu)	1522	0.153%	1,529
3	Penama	306	South Maewo	1301	-1.720%	1,235
3	Penama	310	South Pentecost (Malbangbang)	4994	0.854%	5,123
3	Penama	301	West Ambae (Tokatara)	4024	1.316%	4,185
2	Sanma	207	Canal/Fanafo	4918	5.281%	5,739
2	Sanma	210	East Malo	2012	-0.299%	1,994
2	Sanma	205	East Santo	4685	2.512%	5,047
2	Sanma	208	Luganville	16345	2.619%	17,663
2	Sanma	202	North santo	4754	2.014%	5,047
2	Sanma	201	North west santo	1697	-0.493%	1,672
2	Sanma	206	South east santo	5956	4.399%	6,777
2	Sanma	204	South santo	8434	2.018%	8,955
2	Sanma	209	West Malo	2353	0.675%	2,401
2	Sanma	203	West Santo	3072	1.612%	3,223
5	Shefa	509	Emau	685	1.863%	724
5	Shefa	516	Erakor	8918	5.299%	10,412
5	Shefa	517	Eratap	6640	5.604%	7,820
5	Shefa	518	Eton	3518	11.113%	4,826
5	Shefa	514	Ifira	1186	5.433%	1,390
5	Shefa	507	Makimae	1213	6.591%	1,469
5	Shefa	510	Malorua	2976	10.479%	4,013
5	Shefa	512	Mele	4738	3.937%	5,320
5	Shefa	508	Nguna, Pela	1728	1.201%	1,791
5	Shefa	511	North Efate	2987	1.115%	3,088
5	Shefa	505	North Tongoa	1789	0.813%	1,833
5	Shefa	515	Pango	2359	-0.369%	2,333
5	Shefa	513	Port vila	51551	2.326%	55,232
5	Shefa	504	South Epi	1449	2.205%	1,547
5	Shefa	506	Tongariki	987	-1.024%	957
5	Shefa	503	Varsu	1618	1.602%	1,697
5	Shefa	501	Vermali	2088	2.734%	2,264
5	Shefa	502	Vermaul	1461	3.503%	1,620
6	Tafea	611	Aneityum	1464	6.411%	1,764
6	Tafea	603	Aniwa	420	3.004%	459
6	Tafea	610	Futuna	709	3.277%	781
6	Tafea	606	Central Tanna	6007	3.302%	6,622
6	Tafea	601	North Erromango	1516	1.366%	1,579
6	Tafea	604	North Tanna	4186	-0.328%	4,145
6	Tafea	602	South Erromango	618	0.323%	624
6	Tafea	609	South Tanna	1332	3.504%	1,477
6	Tafea	607	South West Tanna	5593	3.533%	6,207
6	Tafea	605	West Tanna	8568	0.665%	8,740
6	Tafea	608	Whitesands	6742	0.970%	6,940
1	Torba	106	Gaua	2576	0.155%	2,588
1	Torba	107	Merelava	588	-0.915%	572
1	Torba	105	Mota	682	-0.147%	679
1	Torba	103	Motalava	1678	0.769%	1,717
1	Torba	101	Torres	1022	0.228%	1,029
1	Torba	102	Ureparapara	458	0.363%	463
1	Torba	104	Vanualava	3160	1.599%	3,314

Total 273,830   293,522

Annex 3 – List of islands considered in the present study

Island code	Island name	Province code	Province name	Island code	Island name	Province code	Province name
101	Hiu	1	Torba	231	Malohu	2	Sanma
102	Metoma	1	Torba	232	Malone	2	Sanma
103	Tegua	1	Torba	233	Malotina	2	Sanma
104	Linua	1	Torba	234	Maloveleo	2	Sanma
105	Loh	1	Torba	235	Maltinerava	2	Sanma
106	Toga	1	Torba	236	Malvanua	2	Sanma
107	Vot Tande	1	Torba	237	Malvapevu	2	Sanma
108	Ureparapara	1	Torba	238	Malve	2	Sanma
110	Mota Lava	1	Torba	239	Malvorol	2	Sanma
111	Rah	1	Torba	240	Malwepe	2	Sanma
112	Vanua Lava	1	Torba	241	Melevatu	2	Sanma
113	Kwakea	1	Torba	242	Onevutu	2	Sanma
114	Mota	1	Torba	243	Purumamasa	2	Sanma
115	Gaua	1	Torba	244	Ureiova Rock	2	Sanma
116	Merig	1	Torba	245	Urenahuepe	2	Sanma
117	Mere Lava	1	Torba	246	Urenarave	2	Sanma
118	Kwetenwul	1	Torba	247	Venue	2	Sanma
119	Nawila	1	Torba	301	Maewo	3	Penama
120	Ngere Newet	1	Torba	302	Ambae	3	Penama
121	Ngwel	1	Torba	303	Pentecost	3	Penama
122	Ravenga	1	Torba	401	Malekula	4	Malampa
123	Reef	1	Torba	402	Vao	4	Malampa
124	Vot Totlav	1	Torba	403	Atchin	4	Malampa
201	Santo	2	Sanma	404	Wala	4	Malampa
202	Lathi (Sakao)	2	Sanma	405	Rano	4	Malampa
203	Thion	2	Sanma	406	Norsup	4	Malampa
204	Lathu	2	Sanma	407	Uripiv	4	Malampa
205	Le Tharo	2	Sanma	408	Uri	4	Malampa
206	Le Tharia	2	Sanma	409	Sakao (Khoti)	4	Malampa
207	Malparavu (oyster)	2	Sanma	410	Uliveo	4	Malampa
208	Mavea	2	Sanma	411	Batghutong	4	Malampa
209	Aese	2	Sanma	412	Khuneveo	4	Malampa
210	Aore	2	Sanma	413	Avokh	4	Malampa
211	Tutuba	2	Sanma	414	Lembong	4	Malampa
212	Bokissa	2	Sanma	415	Arseo	4	Malampa
213	Ratua	2	Sanma	416	Awei	4	Malampa
214	Malo	2	Sanma	417	Vala	4	Malampa
215	Malokilikiki	2	Sanma	418	Akhamb	4	Malampa
217	Tangisi	2	Sanma	419	Tomman	4	Malampa
218	Urelapa	2	Sanma	420	Ambrym	4	Malampa
219	Tangoa	2	Sanma	421	Paama	4	Malampa
220	Araki	2	Sanma	422	Lopevi	4	Malampa
221	Elia	2	Sanma	423	Lanur	4	Malampa
222	Tuvana	2	Sanma	424	Leumanang	4	Malampa
223	Amalo Vorivori	2	Sanma	425	Mbogoreugh Rock	4	Malampa
224	Asuleka	2	Sanma	426	Metai	4	Malampa
225	Laororo	2	Sanma	427	Moloimbi	4	Malampa
226	Malao	2	Sanma	428	Namaltiptip	4	Malampa
227	Malheunvol	2	Sanma	429	Neurtombu (raneor)	4	Malampa
228	Malleuth	2	Sanma	430	Porlamb	4	Malampa
229	Malli	2	Sanma	431	Raunampa	4	Malampa
230	Malmas	2	Sanma	432	Sowan	4	Malampa

Island code	Island name	Province code	Province name
433	Staro	4	Malampa
434	Tetaka	4	Malampa
435	Ulendeuv	4	Malampa
501	Lamen	5	Shefa
502	Epi	5	Shefa
503	Tongoa	5	Shefa
504	Tongariki	5	Shefa
505	Buninga	5	Shefa
506	Emae	5	Shefa
507	Makira	5	Shefa
508	Mataso	5	Shefa
509	Nguna	5	Shefa
510	Pele	5	Shefa
511	Emau	5	Shefa
512	Kakula	5	Shefa
513	Moso	5	Shefa
514	Efate	5	Shefa
515	Lelepa	5	Shefa
516	Artoka (Hat)	5	Shefa
517	Hideaway	5	Shefa
518	Ifira	5	Shefa
519	Iririki	5	Shefa
520	Erakor	5	Shefa
521	Eratap	5	Shefa
522	Ekapum	5	Shefa
523	Erueti	5	Shefa
524	Laika	5	Shefa
525	Tevala	5	Shefa
526	Tevala Kiki	5	Shefa
527	Namuka	5	Shefa
528	Ekapum Rik	5	Shefa
529	Emal	5	Shefa
530	Erueti - Rik	5	Shefa
531	Etarik	5	Shefa
532	Ewose	5	Shefa
533	Falea	5	Shefa
534	Fitimasun Rock	5	Shefa
535	Naore	5	Shefa
536	Ngiolala	5	Shefa
537	Ngiotiparas	5	Shefa
538	Uremanu	5	Shefa
601	Erromango	6	Tafea
602	Tanna	6	Tafea
603	Aniwa	6	Tafea
604	Futuna	6	Tafea
605	Aneityum	6	Tafea
606	Inyeuc (Mystery)	6	Tafea
607	Anehetou	6	Tafea
608	Nokobure	6	Tafea
609	Tanpondit	6	Tafea
610	Vetemanu	6	Tafea

Annex 4– List of health zones considered in the present study

HZ_ID	PRO_C	PRO_N	HZ_ID	PRO_C	PRO_N
MAL01	4	Malampa	SAN04	2	Sanma
MAL02	4	Malampa	SAN05	2	Sanma
MAL03	4	Malampa	SAN06	2	Sanma
MAL04	4	Malampa	SAN07	2	Sanma
MAL05	4	Malampa	SAN08	2	Sanma
MAL06	4	Malampa	SAN09	2	Sanma
MAL07	4	Malampa	SANNZ	2	Sanma
MAL08	4	Malampa	SHE01	5	Shefa
MAL09	4	Malampa	SHE02	5	Shefa
MAL10	4	Malampa	SHE03	5	Shefa
MAL11	4	Malampa	SHE04	5	Shefa
MAL12	4	Malampa	TAF01	6	Tafea
MALNZ	4	Malampa	TAF02a	6	Tafea
PEN01	3	Penama	TAF02b	6	Tafea
PEN02	3	Penama	TAF03a	6	Tafea
PEN03	3	Penama	TAF03b	6	Tafea
PEN04	3	Penama	TAF04a	6	Tafea
PEN05	3	Penama	TAF04b	6	Tafea
PEN06	3	Penama	TAF04c	6	Tafea
PEN07	3	Penama	TOR01	1	Torba
PEN08	3	Penama	TOR02a	1	Torba
PEN09	3	Penama	TOR02b	1	Torba
PEN10	3	Penama	TOR03	1	Torba
SAN01	2	Sanma	TOR04	1	Torba
SAN02	2	Sanma	TOR05	1	Torba
SAN03	2	Sanma			

Annex 5 – Master list of operational health facilities considered in the present study

Health facility ID	Health facility name	Health facility type (Original)	Health facility type (Analysis)	Maximum coverage capacity	Povince code	Povince name	Area Council code	Area Council name	Island code	Island name	Health Zone ID	Ownership	Setting	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
6509	Ashuruk	Aid Post	Aid Post	300	4	Malampa	405	South East Malekula	401	Malekula	MAL03	Community	Rural	-16.32175	167.71538	2018 Master List	Unknown
6507	Avock	Aid Post	Aid Post	300	4	Malampa	406	South Malekula	413	Avokh	MAL04	Community	Rural	-16.51851	167.78646	Google Maps	Moderate
6510	Bonvor	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL04	Community	Rural	-16.52800	167.57688	TUP	High
6511	Botovro	Aid Post	Aid Post	300	4	Malampa	402	North East Malekula	401	Malekula	MAL07	Community	Rural	-15.88425	167.25097	2018 Master List	Unknown
6512	Brakar	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL06	Community	Rural	-16.12428	167.23257	2018 Master List	Unknown
6513	Burbar	Aid Post	Aid Post	300	4	Malampa	405	South East Malekula	401	Malekula	MAL03	Community	Rural	-16.38638	167.77615	2018 Master List	Unknown
6514	Dixon	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL05	Community	Rural	-16.34844	167.37789	2018 Master List	Unknown
6515	Eresfa (Louni)	Aid Post	Aid Post	300	4	Malampa	403	Central Malekula	401	Malekula	MAL01	Community	Rural	-16.17922	167.51672	2018 Master List	Unknown
6516	Farun	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL04	Community	Rural	-16.49265	167.62048	2018 Master List	Unknown
6517	Galilee	Aid Post	Aid Post	300	4	Malampa	402	North East Malekula	401	Malekula	MAL08	Community	Rural	-15.96592	167.27745	2018 Master List	Unknown
6518	Hatbol	Aid Post	Aid Post	300	4	Malampa	403	Central Malekula	401	Malekula	MAL01	Community	Rural	-16.18265	167.46792	2018 Master List	Unknown
6519	Lakatoro	Aid Post	Aid Post	300	4	Malampa	403	Central Malekula	401	Malekula	MAL01	Camunity	Rural	-16.10635	167.41695	2018 Master List	Unknown
6520	Lawa	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL05	Community	Rural	-16.44503	167.42620	2018 Master List	Unknown
6501	Lolibulo	Aid Post	Aid Post	300	4	Malampa	407	North Ambrym	420	Ambrym	MAL10	Community	Rural	-16.14378	168.12647	2018 Master List	Unknown
6546	Luvil	Aid Post	Aid Post	300	4	Malampa	410	Paama	421	Paama	MAL12	Community	Rural	-16.46497	168.25032	Google Maps	Moderate
6524	Malvakal	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL05	Community	Rural	-16.55094	167.56509	2018 Master List	Unknown
6525	Melip	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL05	Community	Rural	-16.57730	167.49485	2018 Master List	Unknown
6527	Metkun	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL07	Community	Rural	-15.99103	167.21898	2018 Master List	Unknown
6502	Moru	Aid Post	Aid Post	300	4	Malampa	409	South East Ambrym	420	Ambrym	MAL09	Community	Rural	-16.35571	168.25345	Google Maps	Moderate
6528	Okai	Aid Post	Aid Post	300	4	Malampa	406	South Malekula	401	Malekula	MAL04	Community	Rural	-16.53847	167.73808	2018 Master List	Unknown
6529	Orap	Aid Post	Aid Post	300	4	Malampa	402	North East Malekula	401	Malekula	MAL08	Community	Rural	-15.97068	167.34062	2018 Master List	Unknown
6530	Palu	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL06	Community	Rural	-16.10122	167.22697	2018 Master List	Unknown
6531	Pikair	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL06	Community	Rural	-16.05793	167.21585	2018 Master List	Unknown
6534	Repaksivir	Aid Post	Aid Post	300	4	Malampa	405	South East Malekula	401	Malekula	MAL03	Community	Rural	-16.35235	167.76813	2018 Master List	Unknown
6547	Selusa	Aid Post	Aid Post	300	4	Malampa	410	Paama	421	Paama	MAL12	Community	Rural	-16.46570	168.25027	2018 Master List	Unknown
6504	Tefon	Aid Post	Aid Post	300	4	Malampa	408	West Ambrym	420	Ambrym	MAL10	Community	Rural	-16.24720	167.95257	2018 Master List	Unknown
6535	Tisvel (Maorian Tisvel)	Aid Post	Aid Post	300	4	Malampa	403	Central Malekula	401	Malekula	MAL01	Community	Rural	-16.27193	167.39920	2018 Master List	Unknown
6538	Travol	Aid Post	Aid Post	300	4	Malampa	402	North East Malekula	401	Malekula	MAL07	Community	Rural	-15.89250	167.22688	2018 Master List	Unknown
6539	Unua	Aid Post	Aid Post	300	4	Malampa	405	South East Malekula	401	Malekula	MAL02	Community	Rural	-16.24776	167.61736	Google Maps	Moderate
6541	Vao	Aid Post	Aid Post	300	4	Malampa	402	North East Malekula	401	Malekula	MAL08	Community	Rural	-15.90867	167.30078	2018 Master List	Unknown
6542	Veningaibus (Veleta)	Aid Post	Aid Post	300	4	Malampa	404	South West Malekula	401	Malekula	MAL05	Community	Rural	-16.45450	167.50532	2018 Master List	Unknown
6543	Wiaru	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL06	Community	Rural	-16.08498	167.25617	2018 Master List	Unknown
6506	Willit	Aid Post	Aid Post	300	4	Malampa	407	North Ambrym	420	Ambrym	MAL09	Community	Rural	-16.12498	168.18420	2018 Master List	Unknown
6544	Win	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL07	Community	Rural	-16.07850	167.15497	2018 Master List	Unknown
6545	Womul	Aid Post	Aid Post	300	4	Malampa	401	North West Malekula	401	Malekula	MAL07	Community	Rural	-15.97407	167.23555	2018 Master List	Unknown
2963	Akhamb	Dispensary	Dispensary	2000	4	Malampa	406	South Malekula	418	Akhamb	MAL04	MOH	Rural	-16.51568	167.65311	Google Map	Moderate
2979	Amelatin (Lambubu)	Dispensary	Dispensary	2000	4	Malampa	403	Central Malekula	401	Malekula	MAL01	MOH	Rural	-16.16539	167.39927	Google Map	Moderate
2960	Aulua	Dispensary	Dispensary	2000	4	Malampa	405	South East Malekula	401	Malekula	MAL03	MOH	Rural	-16.34071	167.74381	Google Map	Moderate
2985	Bonvor	Dispensary	Dispensary	2000	4	Malampa	404	South West Malekula	401	Malekula	MAL 05	Church	Rural	-16.52882	167.57710	Google Map	Moderate
2962	Carolyn Bay	Dispensary	Dispensary	2000	4	Malampa	404	South West Malekula	401	Malekula	MAL05	MOH	Rural	-16.56380	167.46028	Google Map	Moderate
2975	Endu	Dispensary	Dispensary	2000	4	Malampa	409	South East Ambrym	420	Ambrym	MAL09	MOH	Rural	-16.26040	168.25417	Google Map	Moderate
2978	Lehili	Dispensary	Dispensary	2000	4	Malampa	410	Paama	421	Paama	MAL12	MOH	Rural	-16.48261	168.21638	Google Map	Moderate
2967	Leviamp	Dispensary	Dispensary	2000	4	Malampa	401	North West Malekula	401	Malekula	MAL06	MOH	Rural	-16.14577	167.23135	Google Map	Moderate
2980	Maskelynes (Vanmaur)	Dispensary	Dispensary	2000	4	Malampa	406	South Malekula	410	Uliveo	MAL04	MOH	Rural	-16.52850	167.82985	Google Map	Moderate
2974	Olal	Dispensary	Dispensary	2000	4	Malampa	407	North Ambrym	420	Ambrym	MAL10	MOH	Rural	-16.10052	168.16245	Google Map	Moderate
2976	Port Vato (Melumlum)	Dispensary	Dispensary	2000	4	Malampa	408	West Ambrym	420	Ambrym	MAL11	MOH	Rural	-16.33202	168.03897	Google Map	Moderate
2973	Rensarie	Dispensary	Dispensary	3000	4	Malampa	405	South East Malekula	401	Malekula	MAL02	MOH	Rural	-16.20902	167.56864	Google Map	Moderate
2950	Sameou	Dispensary	Dispensary	2000	4	Malampa	409	South East Ambrym	420	Ambrym	MAL09	MOH	Rural	-16.31076	168.28643	Google Map	Moderate
2968	Tanmaru	Dispensary	Dispensary	2000	4	Malampa	401	North West Malekula	401	Malekula	MAL07	MOH	Rural	-16.02594	167.17646	Google Map	Moderate
2961	Tisman	Dispensary	Dispensary	2000	4	Malampa	405	South East Malekula	401	Malekula	MAL02	MOH	Rural	-16.27816	167.66821	Google Map	Moderate
2969	Tontar	Dispensary	Dispensary	2000	4	Malampa	401	North West Malekula	401	Malekula	MAL07	MOH	Rural	-15.90667	167.18007	Google Map	Moderate
2966	Unmet	Dispensary	Dispensary	2000	4	Malampa	401	North West Malekula	401	Malekula	MAL06	MOH	Rural	-16.12849	167.29005	Google Map	Moderate
2981	Uripiv	Dispensary	Dispensary	2000	4	Malampa	403	Central Malekula	407	Uripiv	MAL01	MOH	Rural	-16.07398	167.44722	Google Map	Moderate
2972	Vao	Dispensary	Dispensary	3000	4	Malampa	402	North East Malekula	402	Vao	MAL08	MOH	Rural	-15.90132	167.30665	Google Map	Moderate
2965	Vinmavis	Dispensary	Dispensary	2000	4	Malampa	403	Central Malekula	401	Malekula	MAL01	MOH	Rural	-16.22700	167.38306	Google Map	Moderate
2970	Atchin	Health Centre	Health Centre	5000	4	Malampa	402	North East Malekula	401	Malekula	MAL08	MOH	Rural	-15.93785	167.32569	Google Map	Moderate
2944	Baiap	Health Centre	Health Centre	5000	4	Malampa	408	West Ambrym	420	Ambrym	MAL11	MOH	Rural	-16.28751	167.96338	Google Map	Moderate
2982	Espigles Bay	Health Centre	Health Centre	5000	4	Malampa	401	North West Malekula	401	Malekula	MAL07	MOH	Rural	-15.97444	167.19289	Google Map	Moderate
2940	Lamap	Health Centre	Health Centre	5000	4	Malampa	406	South Malekula	401	Malekula	MAL04	MOH	Rural	-16.42206	167.80654	Google Map	Moderate
2945	Liro	Health Centre	Health Centre	5000	4	Malampa	410	Paama	421	Paama	MAL12	MOH	Rural	-16.45146	168.22582	Google Map	Moderate

Health facility ID	Health facility name	Health facility type (Original)	Health facility type (Analysis)	Maximum coverage capacity	Povince code	Povince name	Area Council code	Area Council name	Island code	Island name	Health Zone ID	Ownership	Setting	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
2942	Nebul	Health Centre	Health Centre	5000	4	Malampa	407	North Ambrym	420	Ambrym	MAL10	MOH	Rural	-16.10698	168.13262	Google Map	Moderate
2941	South West Bay (Wintua)	Health Centre	Health Centre	5000	4	Malampa	404	South West Malekula	401	Malekula	MAL05	MOH	Rural	-16.48123	167.44573	Google Map	Moderate
2943	Utas	Health Centre	Health Centre	5000	4	Malampa	409	South East Ambrym	420	Ambrym	MAL09	MOH	Rural	-16.35312	168.27215	Google Map	Moderate
2971	Wallarano	Health Centre	Health Centre	5000	4	Malampa	402	North East Malekula	401	Malekula	MAL08	MOH	Rural	-15.99034	167.37612	Google Map	Moderate
2230	Norsup	Provincial Hospital	Provincial Hospital	42664	4	Malampa	403	Central Malekula	401	Malekula	MAL01	MOH	Rural	-16.06463	167.39925	Google Map	Moderate
6414	Baitora	Aid Post	Aid Post	300	3	Penama	306	South Maewo	301	Maewo	PEN06	Community	Rural	-15.25833	168.11655	2018 Master List	Unknown
6419	ILA	Aid Post	Aid Post	300	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN08	Community	Rural	-15.69015	168.12158	2018 Master List	Unknown
6420	Lewamemeh	Aid Post	Aid Post	300	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN08	Community	Rural	-15.71493	168.14181	Google Maps	Moderate
6406	Lolovoli	Aid Post	Aid Post	300	3	Penama	303	East Ambae	302	Ambae	PEN04	Community	Rural	-15.37003	167.92247	2018 Master List	Unknown
6408	Navuturiki	Aid Post	Aid Post	300	3	Penama	301	West Ambae	302	Ambae	PEN02	Community	Rural	-15.42013	167.68078	Google Maps	Moderate
6423	Neilebati	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN09	Community	Rural	-15.99433	168.19643	2018 Master List	Unknown
6415	Ngota	Aid Post	Aid Post	300	3	Penama	305	North Maewo	301	Maewo	PEN05	Community	Rural	-15.10087	168.12448	2018 Master List	Unknown
6424	Onlaba	Aid Post	Aid Post	300	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN09	Community	Rural	-15.73593	168.22163	2018 Master List	Unknown
6425	Rahuana	Aid Post	Aid Post	300	3	Penama	307	North Pentecost	303	Pentecost	PEN07	Community	Rural	-15.47173	168.15408	2018 Master List	Unknown
6426	Ransrek	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN09	Community	Rural	-15.86055	168.17067	2018 Master List	Unknown
6427	Ranwadi	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN09	Community	Rural	-15.77592	168.15843	2018 Master List	Unknown
6428	Ranwas	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN10	Community	Rural	-15.96838	168.26798	2018 Master List	Unknown
6409	Red cliff	Aid Post	Aid Post	300	3	Penama	304	South Ambae	302	Ambae	PEN04	Community	Rural	-15.47288	167.82468	2018 Master List	Unknown
6429	St Henri	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN10	Community	Rural	-15.88643	168.26952	2018 Master List	Unknown
6431	Tanbok	Aid Post	Aid Post	300	3	Penama	308	Central Pentecost 1	303	Pentecost	PEN08	Community	Rural	-15.67050	168.18592	2018 Master List	Unknown
6416	Titiro Tamuhi	Aid Post	Aid Post	300	3	Penama	305	North Maewo	301	Maewo	PEN05	Community	Rural	-15.06745	168.07597	Google Maps	Moderate
6411	Vuiberugu	Aid Post	Aid Post	300	3	Penama	302	North Ambae	302	Ambae	PEN03	Community	Rural	-15.31717	167.85807	2018 Master List	Unknown
6413	Vureas	Aid Post	Aid Post	300	3	Penama	302	North Ambae	302	Ambae	PEN01	Community	Rural	-15.27745	167.96332	2018 Master List	Unknown
6432	Wanur	Aid Post	Aid Post	300	3	Penama	310	South Pentecost	303	Pentecost	PEN10	Community	Rural	-15.98415	168.20368	VNSO Village 2009	Unknown
2861	Aligu (Renbura)	Dispensary	Dispensary	2000	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.58993	168.18942	Google Map	Moderate
2878	Angoro	Dispensary	Dispensary	2000	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.46344	168.15065	Google Map	Moderate
2860	Asanvari	Dispensary	Dispensary	2000	3	Penama	306	South Maewo	301	Maewo	PEN06	MOH	Rural	-15.37901	168.12990	Google Map	Moderate
2862	Aute	Dispensary	Dispensary	2500	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.52550	168.16973	Google Map	Moderate
2841	Baie Barrier	Dispensary	Dispensary	2000	3	Penama	310	South Pentecost	303	Pentecost	PEN10	MOH	Rural	-15.92867	168.26573	Google Map	Moderate
2863	Bwatnapni	Dispensary	Dispensary	2000	3	Penama	308	Central Pentecost 1	303	Pentecost	PEN08	MOH	Rural	-15.66323	168.12192	Google Map	Moderate
2879	Enkul	Dispensary	Dispensary	2000	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN08	MOH	Rural	-15.70025	168.16988	Google Map	Moderate
2867	Latano	Dispensary	Dispensary	2000	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.55376	168.14632	Google Map	Moderate
2868	Lelevia (Neyroro)	Dispensary	Dispensary	2000	3	Penama	305	North Maewo	301	Maewo	PEN05	MOH	Rural	-14.97428	168.05864	Google Map	Moderate
2882	Mann (Walaha)	Dispensary	Dispensary	2000	3	Penama	301	West Ambae	302	Ambae	PEN02	MOH	Rural	-15.40777	167.69401	Google Map	Moderate
2869	Namaram	Dispensary	Dispensary	2000	3	Penama	308	Central Pentecost 1	303	Pentecost	PEN08	MOH	Rural	-15.63274	168.12226	Google Map	Moderate
2870	Nasawa	Dispensary	Dispensary	5000	3	Penama	306	South Maewo	301	Maewo	PEN06	MOH	Rural	-15.20277	168.11251	Google Map	Moderate
2877	Naviso (Mamaluvanua)	Dispensary	Dispensary	2000	3	Penama	305	North Maewo	301	Maewo	PEN05	MOH	Rural	-15.11968	168.14440	Google Map	Moderate
2871	Point Cross	Dispensary	Dispensary	2000	3	Penama	310	South Pentecost	303	Pentecost	PEN10	MOH	Rural	-16.00653	168.22930	Google Map	Moderate
2873	Ranmawat	Dispensary	Dispensary	2000	3	Penama	310	South Pentecost	303	Pentecost	PEN09	MOH	Rural	-15.80117	168.17024	Google Map	Moderate
2880	Tari Ilo (Nabarangiut)	Dispensary	Dispensary	2000	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.57931	168.13005	Google Map	Moderate
2875	Tsingbwege	Dispensary	Dispensary	2000	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN09	MOH	Rural	-15.73585	168.22176	Google Map	Moderate
2840	Abwatuntora (Mauna)	Health Centre	Health Centre	5000	3	Penama	307	North Pentecost	303	Pentecost	PEN07	MOH	Rural	-15.49447	168.14095	Google Map	Moderate
2842	Kerembei	Health Centre	Health Centre	5000	3	Penama	305	North Maewo	301	Maewo	PEN05	MOH	Rural	-15.10474	168.08109	Google Map	Moderate
2876	Ledungsivi	Health Centre	Health Centre	5000	3	Penama	308	Central Pentecost 1	303	Pentecost	PEN08	MOH	Rural	-15.66991	168.15090	Google Map	Moderate
2843	Melsisi	Health Centre	Health Centre	5000	3	Penama	309	Central Pentecost 2	303	Pentecost	PEN09	MOH	Rural	-15.73794	168.13492	Google Map	Moderate
2844	Nduindui	Health Centre	Health Centre	5000	3	Penama	301	West Ambae	302	Ambae	PEN02	MOH	Rural	-15.37470	167.73154	Google Map	Moderate
2872	Pangi	Health Centre	Health Centre	5000	3	Penama	310	South Pentecost	303	Pentecost	PEN10	MOH	Rural	-15.94582	168.19349	Google Map	Moderate
2330	Lolowai	Provincial Hospital	Provincial Hospital	34304	3	Penama	303	East Ambae	302	Ambae	PEN01	MOH	Rural	-15.27930	167.98251	Google Map	Moderate
6300	Araki (Tanopeta)	Aid Post	Aid Post	300	2	Sanma	204	South Santo	220	Araki	SAN04	Community	Rural	-15.62908	166.95788	Google Maps	Moderate
6302	Aworani	Aid Post	Aid Post	300	2	Sanma	209	West Malo	214	Malo	SAN02	Community	Rural	-15.71122	167.13087	2018 Master List	Unknown
6311	Buama	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.57840	166.84312	2018 Master List	Unknown
6312	Butmas	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN03	Community	Rural	-15.54193	166.91292	2018 Master List	Unknown
6313	Foreginal	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.47569	166.91292	2018 Master List	Unknown
6314	Ipaiato	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.62105	166.86583	2018 Master List	Unknown
6315	Jereviu	Aid Post	Aid Post	300	2	Sanma	202	North Santo	201	Santo	SAN07	Community	Rural	-15.08968	166.80728	2018 Master List	Unknown
6316	Jorove	Aid Post	Aid Post	300	2	Sanma	202	North Santo	201	Santo	SAN07	Community	Rural	-15.23767	166.83798	2018 Master List	Unknown
6317	Jungle Mountain	Aid Post	Aid Post	300	2	Sanma	203	West Santo	201	Santo	SAN05	Community	Rural	-15.43255	166.69755	2018 Master List	Unknown
6318	Kerepua	Aid Post	Aid Post	300	2	Sanma	203	West Santo	201	Santo	SAN05	Community	Rural	-15.30175	166.66562	2018 Master List	Unknown
2790	Kokonai	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.59273	166.84346	Google Maps	Moderate
6322	Luluvatu Memorial	Aid Post	Aid Post	300	2	Sanma	207	Canal - Fanafo	201	Santo	SAN01	Community	Rural	-15.48603	167.14847	2018 Master List	Unknown

Health facility ID	Health facility name	Health facility type (Original)	Health facility type (Analysis)	Maximum coverage capacity	Povince code	Povince name	Area Council code	Area Council name	Island code	Island name	Health Zone ID	Ownership	Setting	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
6323	Malotao	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.54182	166.91800	2018 Master List	Unknown
6351	Nakurakum	Aid Post	Aid Post	300	2	Sanma	203	West Santo	201	Santo	SAN08	Community	Rural	-15.38071	166.81885	Google Maps	Moderate
6326	Nambauk	Aid Post	Aid Post	300	2	Sanma	207	Canal - Fanafo	201	Santo	SAN01	Community	Rural	-15.45395	167.10185	2018 Master List	Unknown
6303	Nandiutu	Aid Post	Aid Post	300	2	Sanma	210	East Malo	214	Malo	SAN02	Community	Rural	-15.62868	167.17396	Google Maps	Moderate
6327	Nasitwan	Aid Post	Aid Post	300	2	Sanma	206	South East Santo	201	Santo	SAN03	Community	Rural	-15.34677	167.13867	Google Maps	Moderate
6329	Olboe	Aid Post	Aid Post	300	2	Sanma	201	North West Santo	201	Santo	SAN06	Community	Rural	-14.86162	166.55547	2018 Master List	Unknown
6330	Palon	Aid Post	Aid Post	300	2	Sanma	207	Canal - Fanafo	201	Santo	SAN03	Community	Rural	-15.45250	167.08197	2018 Master List	Unknown
6304	Sao	Aid Post	Aid Post	300	2	Sanma	210	East Malo	214	Malo	SAN02	Community	Rural	-15.68263	167.19850	2018 Master List	Unknown
6335	St Daniel	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.56613	166.90947	2018 Master List	Unknown
6336	Stonehill	Aid Post	Aid Post	300	2	Sanma	206	South East Santo	201	Santo	SAN03	Community	Rural	-15.35068	167.10955	2018 Master List	Unknown
6305	Tabunveresake	Aid Post	Aid Post	300	2	Sanma	210	East Malo	214	Malo	SAN02	Community	Rural	-15.65660	167.22887	2018 Master List	Unknown
6349	Tangoa	Aid Post	Aid Post	300	2	Sanma	204	South Santo	219	Tangoa	SAN04	Community	Rural	-15.59132	166.98841	Google Maps	Moderate
2783	Tutuba	Aid Post	Aid Post	300	2	Sanma	207	Canal - Fanafo	211	Tutuba	SAN02	Community	Rural	-15.56319	167.27830	Google Maps	Moderate
6342	Valavalet	Aid Post	Aid Post	300	2	Sanma	206	South East Santo	201	Santo	SAN03	Community	Rural	-15.35609	167.04371	Google Maps	Moderate
6341	Valivosaulo (Valapei)	Aid Post	Aid Post	300	2	Sanma	201	North West Santo	201	Santo	SAN06	Community	Rural	-14.76303	166.55395	2018 Master List	Unknown
6345	Vatnaur (Lovenu)	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN05	Community	Rural	-15.62890	166.78398	Google Maps	Moderate
6339	Vavasnaur (Tanovusvus)	Aid Post	Aid Post	300	2	Sanma	204	South Santo	201	Santo	SAN04	Community	Rural	-15.63333	166.84045	2018 Master List	Unknown
6344	Vunameleus (Vatelulu)	Aid Post	Aid Post	300	2	Sanma	203	West Santo	201	Santo	SAN08	Community	Rural	-15.38752	166.95287	2018 Master List	Unknown
6347	Vusiroro	Aid Post	Aid Post	300	2	Sanma	202	North Santo	201	Santo	SAN08	Community	Rural	-15.24923	166.85920	2018 Master List	Unknown
6348	Vuswongo	Aid Post	Aid Post	300	2	Sanma	202	North Santo	201	Santo	SAN08	Community	Rural	-15.32904	166.91279	Google Maps	Moderate
2760	Aore	Dispensary	Dispensary	2000	2	Sanma	207	Canal - Fanafo	210	Aore	SAN02	MOH	Rural	-15.60723	167.18020	Google Map	Moderate
2771	Atariboe	Dispensary	Dispensary	2000	2	Sanma	210	East Malo	214	Malo	SAN02	MOH	Rural	-15.75010	167.20231	Google Map	Moderate
2745	Banaviti	Dispensary	Dispensary	2000	2	Sanma	209	West Malo	214	Malo	SAN02	MOH	Rural	-15.67170	167.09912	Google Map	Moderate
2765	Capricon	Dispensary	Dispensary	5000	2	Sanma	208	Luganville	201	Santo	SAN01	LMC	Urban	-15.53842	167.15207	Google Map	Moderate
2763	Hog Harbour	Dispensary	Dispensary	4000	2	Sanma	205	East Santo	201	Santo	SAN09	MOH	Rural	-15.14282	167.10314	Google Map	Moderate
2777	Kole	Dispensary	Dispensary	2000	2	Sanma	205	East Santo	201	Santo	SAN09	MOH	Rural	-15.23039	167.15810	Google Map	Moderate
2791	Matevulu College	Clinic	Dispensary	2000	2	Sanma	206	South East Santo	201	Santo	SAN01	College	Rural	-15.38555	167.16972	Google Map	Moderate
2746	MCH	Clinic	Dispensary	2000	2	Sanma	208	Luganville	201	Santo	SAN01	MOH	Urban	-15.51466	167.17670	Google Map	Moderate
2785	Paparama	Dispensary	Dispensary	3000	2	Sanma	202	North Santo	201	Santo	SAN08	Church	Rural	-15.24399	166.90409	Google Map	Moderate
2747	Pelvus	Dispensary	Dispensary	2000	2	Sanma	202	North Santo	201	Santo	SAN01	MOH	Rural	-15.037049	166.799249	Google Map	Moderate
2794	Penour (Lelesvare)	Dispensary	Dispensary	2000	2	Sanma	201	North West Santo	201	Santo	SAN06	MOH	Rural	-14.99119	166.60932	Google Map	Moderate
2761	Pesena	Dispensary	Dispensary	2000	2	Sanma	202	North Santo	201	Santo	SAN07	MOH	Rural	-14.83410	166.75374	Google Map	Moderate
2778	Rustron	Dispensary	Dispensary	2000	2	Sanma	210	East Malo	214	Malo	SAN02	MOH	Rural	-15.66656	167.18411	Google Map	Moderate
2792	Sapi (Nabulvaravara)	Dispensary	Dispensary	2500	2	Sanma	208	Luganville	201	Santo	SAN01	LMC	Urban	-15.50201	167.19060	Google Map	Moderate
2779	Sara	Dispensary	Dispensary	2000	2	Sanma	205	East Santo	201	Santo	SAN09	MOH	Rural	-15.18627	167.04629	Google Map	Moderate
2770	Sarakata	Dispensary	Dispensary	2500	2	Sanma	208	Luganville	201	Santo	SAN01	LMC	Urban	-15.51084	167.17072	Google Map	Moderate
2780	Selei	Dispensary	Dispensary	2000	2	Sanma	203	West Santo	201	Santo	SAN03	MOH	Rural	-15.39034	166.95266	Google Map	Moderate
2767	Sulemauri	Dispensary	Dispensary	2000	2	Sanma	203	West Santo	201	Santo	SAN05	MOH	Rural	-15.51442	166.72858	Google Map	Moderate
2768	Tasmate	Dispensary	Dispensary	2000	2	Sanma	203	West Santo	201	Santo	SAN06	MOH	Rural	-15.21204	166.66144	Google Map	Moderate
2773	Tataikala	Dispensary	Dispensary	2000	2	Sanma	204	South Santo	201	Santo	SAN04	MOH	Rural	-15.47070	166.91436	Google Map	Moderate
2748	Tiroas	Dispensary	Dispensary	2000	2	Sanma	208	Luganville	201	Santo	SAN01	VMF	Rural	-15.51437	167.20621	Google Map	Moderate
2784	Vaturei (Jarailand)	Dispensary	Dispensary	2000	2	Sanma	204	South Santo	201	Santo	SAN04	MOH	Rural	-15.53595	166.99387	Google Map	Moderate
2774	Wailapa (Isu)	Dispensary	Dispensary	2500	2	Sanma	204	South Santo	201	Santo	SAN04	MOH	Rural	-15.57887	166.94347	Google Map	Moderate
2787	Wunavae	Dispensary	Dispensary	2000	2	Sanma	203	West Santo	201	Santo	SAN06	MOH	Rural	-15.08343	166.62579	Google Map	Moderate
2769	Wunpuku	Dispensary	Dispensary	2000	2	Sanma	201	North West Santo	201	Santo	SAN06	MOH	Rural	-14.70165	166.57427	Google Map	Moderate
2776	Wusi (Joseph Mape)	Dispensary	Dispensary	2000	2	Sanma	203	West Santo	201	Santo	SAN05	MOH	Rural	-15.36464	166.65719	Google Map	Moderate
2744	Avunatari	Health Centre	Health Centre	5000	2	Sanma	209	West Malo	214	Malo	SAN02	MOH	Rural	-15.64352	167.09316	Google Map	Moderate
2796	Family Health (VFHA)	Clinic	Health Centre	6500	2	Sanma	208	Luganville	201	Santo	SAN01	NGO	Urban	-15.51205	167.17466	Google Map	Moderate
2772	Fanafo	Health Centre	Health Centre	5000	2	Sanma	207	Canal - Fanafo	201	Santo	SAN03	MOH	Rural	-15.40157	167.10642	Google Map	Moderate
2749	Lamalvatu	Clinic	Health Centre	8500	2	Sanma	208	Luganville	201	Santo	SAN01	Private	Urban	-15.54708	167.14663	Google Map	Moderate
2740	Malau	Health Centre	Health Centre	5000	2	Sanma	202	North Santo	201	Santo	SAN07	MOH	Rural	-15.16924	166.84914	Google Map	Moderate
2750	Medical Santo (Church of Christ Mini Hospital)	Health Centre	Health Centre	5000	2	Sanma	208	Luganville	201	Santo	SAN01	Private	Urban	-15.51240	167.18649	Google Map	Moderate
2743	Nokuku	Health Centre	Health Centre	5000	2	Sanma	201	North West Santo	201	Santo	SAN06	MOH	Rural	-14.91930	166.57108	Google Map	Moderate
2797	NTM	Clinic	Health Centre	5000	2	Sanma	208	Luganville	201	Santo	SAN01	Church	Urban	-15.51690	167.16805	Google Map	Moderate
2741	Port Olry	Health Centre	Health Centre	5000	2	Sanma	205	East Santo	201	Santo	SAN09	MOH	Rural	-15.04124	167.07528	Google Map	Moderate
2762	Saramauri	Health Centre	Health Centre	5000	2	Sanma	202	North Santo	201	Santo	SAN08	MOH	Rural	-15.28568	166.87302	Google Map	Moderate
2766	Tasiriki	Health Centre	Health Centre	5000	2	Sanma	204	South Santo	201	Santo	SAN05	MOH	Rural	-15.59425	166.78209	Google Map	Moderate
2742	Tasmalum	Health Centre	Health Centre	5000	2	Sanma	204	South Santo	201	Santo	SAN04	MOH	Rural	-15.60725	166.89661	Google Map	Moderate
2764	Vulesepe	Health Centre	Health Centre	5000	2	Sanma	204	South Santo	201	Santo	SAN04	MOH	Rural	-15.57884	167.00136	Google Map	Moderate
2793	Youth Centre (NCYC)	Clinic	Health Centre	5000	2	Sanma	208	Luganville	201	Santo	SAN01	NGO	Urban	-15.51129	167.17787	Google Map	Moderate

Health facility ID	Health facility name	Health facility type (Original)	Health facility type (Analysis)	Maximum coverage capacity	Povince code	Povince name	Area Council code	Area Council name	Island code	Island name	Health Zone ID	Ownership	Setting	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
2180	Northern Provincial Hospital	Regional Referral Hospital	Referral Hospital	58519	2	Sanma	208	Luganville	201	Santo	SAN01	MOH	Urban	-15.50918	167.18355	Google Map	Moderate
6025	Bonkovio	Aid Post	Aid Post	300	5	Shefa	501	Vermali	502	Epi	SHE04	Community	Rural	-16.66745	168.13067	2018 Master List	Unknown
6001	Britano	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.71747	168.30143	Google Maps	Moderate
6000	Buninga	Aid Post	Aid Post	300	5	Shefa	506	Tongariki	505	Buninga	SHE03	Community	Rural	-17.02220	168.58717	2018 Master List	Unknown
6002	Ekipe	Aid Post	Aid Post	300	5	Shefa	511	North Efate	514	Efate	SHE02	Community	Rural	-17.59025	168.48625	2018 Master List	Unknown
6004	Epau	Aid Post	Aid Post	300	5	Shefa	518	Eton	514	Efate	SHE02	Community	Rural	-17.61982	168.50047	2018 Master List	Unknown
6005	Epule	Aid Post	Aid Post	300	5	Shefa	511	North Efate	514	Efate	SHE02	Community	Rural	-17.57108	168.45727	2018 Master List	Unknown
6026	Esake (Malvasie)	Aid Post	Aid Post	300	5	Shefa	501	Vermali	502	Epi	SHE04	Community	Rural	-16.64527	168.13523	2018 Master List	Unknown
6007	Etas Elang	Aid Post	Aid Post	300	5	Shefa	516	Erakor	514	Efate	SHE01	Community	Rural	-17.74314	168.38189	Google Maps	Moderate
6008	Eton	Aid Post	Aid Post	300	5	Shefa	518	Eton	514	Efate	SHE02	Community	Rural	-17.75053	168.56338	2018 Master List	Unknown
6009	Ewekau (Teouma)	Aid Post	Aid Post	300	5	Shefa	517	Eratap	514	Efate	SHE02	Community	Rural	-17.77830	168.42092	TUP	High
6027	Filakara	Aid Post	Aid Post	300	5	Shefa	504	South Epi	502	Epi	SHE04	Community	Rural	-16.81443	168.41335	2018 Master List	Unknown
6011	INTV	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.72685	168.31607	2018 Master List	Unknown
6012	Kiemkepip	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE02	Community	Rural	-17.71135	168.31563	2018 Master List	Unknown
6042	Lakalaka	Aid Post	Aid Post	300	5	Shefa	505	North Tongoa	503	Tongoa	SHE03	Community	Rural	-16.88328	168.54762	2018 Master List	Unknown
6028	Lamen Bay Vermali Area	Aid Post	Aid Post	300	5	Shefa	501	Vermali	502	Epi	SHE04	Community	Rural	-16.58823	168.16727	2018 Master List	Unknown
6029	Lamen Island	Aid Post	Aid Post	300	5	Shefa	503	Varisu	502	Epi	SHE04	Community	Rural	-16.63920	168.22800	2018 Master List	Unknown
6023	Lausake	Aid Post	Aid Post	300	5	Shefa	509	Emau	511	Emau	SHE02	Community	Rural	-17.49193	168.48865	2018 Master List	Unknown
6013	Lycee	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.72607	168.31422	2018 Master List	Unknown
6030	Mafilao	Aid Post	Aid Post	300	5	Shefa	502	Vermaul	502	Epi	SHE04	Community	Rural	-16.75143	168.15322	2018 Master List	Unknown
6037	Makira	Aid Post	Aid Post	300	5	Shefa	507	Makimae	507	Makira	SHE03	Community	Rural	-17.13020	168.43042	2018 Master List	Unknown
6014	Mangaliliu	Aid Post	Aid Post	300	5	Shefa	510	Malorua	514	Efate	SHE02	Community	Rural	-17.63665	168.20278	2018 Master List	Unknown
6043	Mangamena	Aid Post	Aid Post	300	5	Shefa	505	North Tongoa	503	Tongoa	SHE03	Community	Rural	-16.91517	168.56587	2018 Master List	Unknown
6024	Mapau	Aid Post	Aid Post	300	5	Shefa	509	Emau	511	Emau	SHE02	Community	Rural	-17.47682	168.49550	2018 Master List	Unknown
6022	Marae	Aid Post	Aid Post	300	5	Shefa	507	Makimae	506	Emae	SHE03	Community	Rural	-17.03996	168.38150	2018 Master List	Unknown
6038	Mataso	Aid Post	Aid Post	300	5	Shefa	507	Makimae	508	Mataso	SHE03	Community	Rural	-17.25728	168.42998	2018 Master List	Unknown
6031	Mate	Aid Post	Aid Post	300	5	Shefa	503	Varisu	502	Epi	SHE04	Community	Rural	-16.68182	168.28905	2018 Master List	Unknown
6015	Monmarte school	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.74178	168.35737	2018 Master List	Unknown
6032	Nalema	Aid Post	Aid Post	300	5	Shefa	504	South Epi	502	Epi	SHE04	Community	Rural	-16.83473	168.46407	Google Maps	Moderate
6033	Nikaura	Aid Post	Aid Post	300	5	Shefa	503	Varisu	502	Epi	SHE04	Community	Rural	-16.63937	168.23117	Google Maps	Moderate
6016	Onesua	Aid Post	Aid Post	300	5	Shefa	511	North Efate	514	Efate	SHE02	Community	Rural	-17.55287	168.45577	2018 Master List	Unknown
6041	Pele	Aid Post	Aid Post	300	5	Shefa	508	Nguna	510	Pele	SHE02	Community	Rural	-17.49987	168.40932	2018 Master List	Unknown
6034	Penopo (Nul)	Aid Post	Aid Post	300	5	Shefa	504	South Epi	502	Epi	SHE04	Community	Rural	-16.81407	168.41410	2018 Master List	Unknown
6035	Saventer (Sara)	Aid Post	Aid Post	300	5	Shefa	502	Vermaul	502	Epi	SHE04	Community	Rural	-16.80678	168.19287	2018 Master List	Unknown
6018	Siviri	Aid Post	Aid Post	300	5	Shefa	510	Malorua	514	Efate	SHE02	Community	Rural	-17.52990	168.32885	2018 Master List	Unknown
6019	Surossa	Aid Post	Aid Post	300	5	Shefa	510	Malorua	514	Efate	SHE02	Community	Rural	-17.57283	168.29397	2018 Master List	Unknown
6039	Taloa	Aid Post	Aid Post	300	5	Shefa	508	Nguna	509	Nguna	SHE02	Community	Rural	-17.48293	168.38568	2018 Master List	Unknown
6044	Tongamea	Aid Post	Aid Post	300	5	Shefa	507	Makimae	506	Emae	SHE03	Community	Rural	-17.06419	168.41493	Google Maps	Moderate
6020	USP	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.73450	168.32213	2018 Master List	Unknown
6040	Vatuaw	Aid Post	Aid Post	300	5	Shefa	508	Nguna	509	Nguna	SHE02	Community	Rural	-17.42877	168.32827	2018 Master List	Unknown
6021	VMF	Aid Post	Aid Post	300	5	Shefa	513	Port Vila	514	Efate	SHE01	Community	Rural	-17.72418	168.31513	2018 Master List	Unknown
1660	Amauri (Lelepa)	Dispensary	Dispensary	2000	5	Shefa	510	Malorua	515	Lelepa	SHE02	MOH	Rural	-17.61241	168.22110	Google Map	Moderate
1664	Amboh (Tongariki)	Dispensary	Dispensary	2000	5	Shefa	506	Tongariki	504	Tongariki	SHE03	MOH	Rural	-17.00577	168.62266	Google Map	Moderate
1647	Anabrou Special Needs Clinic	Clinic	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SHE01	MOH	Urban	-17.72146	168.31498	Google Map	Moderate
1662	Burumba	Dispensary	Dispensary	2000	5	Shefa	502	Vermaul	502	Epi	SHE04	MOH	Rural	-16.70762	168.13130	Google Map	Moderate
1668	Erakor	Dispensary	Dispensary	2500	5	Shefa	516	Erakor	514	Efate	SHE01	MOH	Urban	-17.77339	168.31548	Google Map	Moderate
1643	Erasa (Numbatri)	Dispensary	Dispensary	3500	5	Shefa	513	Port Vila	514	Efate	SHE01	Municipal	Urban	-17.75986	168.30968	Google Map	Moderate
1683	Kampushum Hed (Wan Smol Bag)	Clinic	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SHE02	NGO	Urban	-17.70618	168.30731	Google Map	Moderate
1672	Leimarowia (Moso)	Dispensary	Dispensary	2000	5	Shefa	510	Malorua	513	Moso	SHE02	MOH	Rural	-17.54627	168.26436	Google Map	Moderate
1665	Marowia (Emau)	Dispensary	Dispensary	2000	5	Shefa	509	Emau	511	Emau	SHE02	MOH	Rural	-17.48518	168.47689	Google Map	Moderate
1661	Ngala	Dispensary	Dispensary	2000	5	Shefa	503	Varisu	502	Epi	SHE04	MOH	Rural	-16.68043	168.27834	Google Map	Moderate
1674	Nimair (Bongabonga)	Dispensary	Dispensary	2000	5	Shefa	506	Tongariki	503	Tongoa	SHE03	MOH	Rural	-16.93258	168.54438	Google Map	Moderate
1648	Nodamasan	Clinic	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SAN01	Private	Urban	-17.72804	168.32028	Google Map	Moderate
1677	Omega (Ohlen)	Dispensary	Dispensary	3000	5	Shefa	513	Port Vila	514	Efate	SHE01	Municipal	Urban	-17.71650	168.31847	Google Map	Moderate
1670	Port Quimie	Dispensary	Dispensary	3500	5	Shefa	504	South Epi	502	Epi	SHE04	MOH	Rural	-16.78803	168.36240	Google Map	Moderate
1666	Silmoli (Nguna)	Dispensary	Dispensary	2000	5	Shefa	508	Nguna	509	Nguna	SHE02	MOH	Rural	-17.46930	168.37219	Google Map	Moderate
1644	St Camille de lelis (Namburu)	Dispensary	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SHE01	Church	Urban	-17.72414	168.31227	Google Map	Moderate
1671	Tavalapa	Dispensary	Dispensary	2000	5	Shefa	505	North Tongoa	503	Tongoa	SHE03	MOH	Rural	-16.88255	168.56316	Google Map	Moderate
1645	Teiwaikara (Freshwota)	Dispensary	Dispensary	6500	5	Shefa	513	Port Vila	514	Efate	SHE01	Municipal	Urban	-17.73004	168.31808	Google Map	Moderate
1682	Vanuatu Family Health	Clinic	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SHE01	NGO	Urban	-17.73683	168.31411	Google Map	Moderate

Health facility ID	Health facility name	Health facility type (Original)	Health facility type (Analysis)	Maximum coverage capacity	Povince code	Povince name	Area Council code	Area Council name	Island code	Island name	Health Zone ID	Ownership	Setting	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
1673	Votlo	Dispensary	Dispensary	2000	5	Shefa	502	Vermaul	502	Epi	SHE04	MOH	Rural	-16.80203	168.27988	Google Map	Moderate
1646	Wellu	Dispensary	Dispensary	2000	5	Shefa	513	Port Vila	514	Efate	SHE01	Private	Urban	-17.73812	168.31446	Google Map	Moderate
1681	Gudfala Health Centre (NTM)	Health Centre	Health Centre	30000	5	Shefa	513	Port Vila	514	Efate	SHE01	Church	Urban	-17.71168	168.31224	Google Map	Moderate
1667	Maurifanga (Imere)	Health Centre	Health Centre	5000	5	Shefa	512	Mele	514	Efate	SHE01	MOH	Urban	-17.68529	168.26274	Google Map	Moderate
1641	Saupia (Paunangisu)	Health Centre	Health Centre	8500	5	Shefa	511	North Efate	514	Efate	SHE02	MOH	Rural	-17.53545	168.40373	Google Map	Moderate
1642	Silimauri	Health Centre	Health Centre	5000	5	Shefa	506	Tongariki	503	Tongoa	SHE03	MOH	Rural	-16.90727	168.53176	Google Map	Moderate
1640	Vaemali	Health Centre	Health Centre	5000	5	Shefa	501	Vermali	502	Epi	SHE04	MOH	Rural	-16.58816	168.18673	Google Map	Moderate
1663	Vaemauri	Health Centre	Health Centre	5000	5	Shefa	507	Makimae	506	Emae	SHE03	MOH	Rural	-17.06275	168.39374	Google Map	Moderate
1180	Vila Central Hospital	National Referral Hospital	Referral Hospital	108336	5	Shefa	513	Port Vila	514	Efate	SHE01	MOH	Urban	-17.74248	168.32113	Google Map	Moderate
6102	Antioch	Aid Post	Aid Post	300	6	Tafea	602	South Erromango	601	Erromango	TAF02b	Community	Rural	-18.91467	169.08651	Google Maps	Moderate
6103	Cooks Bay	Aid Post	Aid Post	300	6	Tafea	601	North Erromango	601	Erromango	TAF02b	Community	Rural	-18.77490	169.20988	2018 Master List	Unknown
6109	Ekumahau	Aid Post	Aid Post	300	6	Tafea	607	South West Tanna	602	Tanna	TAF01	Community	Rural	-19.59643	169.34681	Google Maps	Moderate
6110	Enapkasu	Aid Post	Aid Post	300	6	Tafea	607	South West Tanna	602	Tanna	TAF01	Community	Rural	-19.56322	169.34973	2018 Master List	Unknown
6111	Etanmalen	Aid Post	Aid Post	300	6	Tafea	607	South West Tanna	602	Tanna	TAF01	Community	Rural	-19.55970	169.32515	Google Maps	Moderate
6112	Etukei	Aid Post	Aid Post	300	6	Tafea	609	South Tanna	602	Tanna	TAF04a	Community	Rural	-19.57997	169.45919	2018 Master List	Unknown
6113	Greenhome	Aid Post	Aid Post	300	6	Tafea	604	North Tanna	602	Tanna	TAF02a	Community	Rural	-19.36749	169.31845	Google Maps	Moderate
6104	Happy Land	Aid Post	Aid Post	300	6	Tafea	602	South Erromango	601	Erromango	TAF02b	Community	Rural	-18.91433	169.08665	2018 Master List	Unknown
6107	Harold Bay	Aid Post	Aid Post	300	6	Tafea	610	Futuna	604	Futuna	TAF04b	Community	Rural	-19.52018	170.20667	2018 Master List	Unknown
6114	Iamanuohne	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF02a	Community	Rural	-19.41713	169.28707	2018 Master List	Unknown
6115	Iaruareng	Aid Post	Aid Post	300	6	Tafea	607	South West Tanna	602	Tanna	TAF04a	Community	Rural	-19.63559	169.38589	2018 Master List	Unknown
6116	Ikapau	Aid Post	Aid Post	300	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF02a	Community	Rural	-19.47740	169.33437	Google Maps	Moderate
6118	Imaio	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF04a	Community	Rural	-19.54562	169.42380	2018 Master List	Unknown
6119	Imanmatautu	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.53727	169.30262	Google Maps	Moderate
6120	Imarapu	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Community	Rural	-19.48567	169.35843	2018 Master List	Unknown
6121	Ipai	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.50247	169.25947	2018 Master List	Unknown
6122	Isaka	Aid Post	Aid Post	300	6	Tafea	609	South Tanna	602	Tanna	TAF04a	Community	Rural	-19.57958	169.45933	2018 Master List	Unknown
6123	Isla	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.53340	169.30457	2018 Master List	Unknown
6124	Kwamera	Aid Post	Aid Post	300	6	Tafea	607	South West Tanna	602	Tanna	TAF04a	Community	Rural	-19.64670	169.39865	2018 Master List	Unknown
6125	Kwaraka	Aid Post	Aid Post	300	6	Tafea	609	South Tanna	602	Tanna	TAF04a	Community	Rural	-19.63403	169.45730	2018 Master List	Unknown
6126	Lavis	Aid Post	Aid Post	300	6	Tafea	604	North Tanna	602	Tanna	TAF02a	Community	Rural	-19.34740	169.25405	2018 Master List	Unknown
6129	Lenawawa	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.52410	169.32412	2018 Master List	Unknown
6130	Letakren (Lautaliko)	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.51465	169.31423	2018 Master List	Unknown
6131	Lohatan	Aid Post	Aid Post	300	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF03a	Community	Rural	-19.45937	169.35392	2018 Master List	Unknown
6132	Lonunatke	Aid Post	Aid Post	300	6	Tafea	604	North Tanna	602	Tanna	TAF02a	Community	Rural	-19.32681	169.34864	2018 Master List	Unknown
6133	Louanatom	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.50783	169.24902	Google Maps	Moderate
6135	Louanuialu Kapalpal	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Community	Rural	-19.49488	169.36902	2018 Master List	Unknown
6136	Lounahuru	Aid Post	Aid Post	300	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF02a	Community	Rural	-19.47047	169.30172	2018 Master List	Unknown
6137	Lounapikiko	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.50593	169.28157	2018 Master List	Unknown
6139	Lounou	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Community	Rural	-19.47852	169.36335	Google Maps	Moderate
6140	Lousula	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.47312	169.26455	2018 Master List	Unknown
6141	Loutapunga	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Community	Rural	-19.48280	169.39050	Google Maps	Moderate
6108	Matangi	Aid Post	Aid Post	300	6	Tafea	610	Futuna	604	Futuna	TAF04b	Community	Rural	-19.53817	170.23175	2018 Master List	Unknown
6142	Namlou	Aid Post	Aid Post	300	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Community	Rural	-19.47590	169.37020	2018 Master List	Unknown
6143	Nariakene	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.51071	169.29090	Google Maps	Moderate
6144	Nimatane	Aid Post	Aid Post	300	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF01	Community	Rural	-19.49962	169.31248	2018 Master List	Unknown
6100	Port Patrick	Aid Post	Aid Post	300	6	Tafea	611	Aneityum	605	Aneityum	TAF04c	Community	Rural	-20.13785	169.83050	2018 Master List	Unknown
6106	South River	Aid Post	Aid Post	300	6	Tafea	602	South Erromango	601	Erromango	TAF02b	Community	Rural	-18.93882	169.17542	2018 Master List	Unknown
6145	Tafea College	Aid Post	Aid Post	300	6	Tafea	605	West Tanna	602	Tanna	TAF01	Community	Rural	-19.48048	169.25644	Google Maps	Moderate
6101	Umej	Aid Post	Aid Post	300	6	Tafea	611	Aneityum	605	Aneityum	TAF04c	Community	Rural	-20.24640	169.85118	2018 Master List	Unknown
1865	Dillons Bay (Williams Bay)	Dispensary	Dispensary	2000	6	Tafea	601	North Erromango	601	Erromango	TAF02b	MOH	Rural	-18.81733	169.01598	Google Map	Moderate
1864	Ikiti	Dispensary	Dispensary	2000	6	Tafea	607	South West Tanna	602	Tanna	TAF01	MOH	Rural	-19.58577	169.34051	Google Map	Moderate
1873	Ikuarmanu	Dispensary	Dispensary	2000	6	Tafea	608	Whitesands	602	Tanna	TAF04	MOH	Rural	-19.55210	169.44549	Google Map	Moderate
1872	Iounanen	Dispensary	Dispensary	2000	6	Tafea	607	South West Tanna	602	Tanna	TAF01	MOH	Rural	-19.54745	169.32547	Google Map	Moderate
1866	Ipota	Dispensary	Dispensary	2000	6	Tafea	601	North Erromango	601	Erromango	TAF02b	MOH	Rural	-18.85901	169.28432	Google Map	Moderate
1861	Jet (Louieru)	Dispensary	Dispensary	4500	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF02	MOH	Rural	-19.44465	169.30824	Google Map	Moderate
1877	Lamlu (St Raphael)	Dispensary	Dispensary	2000	6	Tafea	606	Middle Bush Tanna	602	Tanna	TAF02	Church	Rural	-19.46615	169.31971	Google Map	Moderate
1870	Loanialu (Kapelpel)	Clinic	Dispensary	2000	6	Tafea	608	Whitesands	602	Tanna	TAF03a	Church	Rural	-19.49235	169.42986	Google Map	Moderate
1869	Naukero (Futuna)	Dispensary	Dispensary	2000	6	Tafea	610	Futuna	604	Futuna	TAF04b	MOH	Rural	-19.51541	170.23067	Google Map	Moderate
1871	Port Narvin	Dispensary	Dispensary	2000	6	Tafea	601	North Erromango	601	Erromango	TAF02b	MOH	Rural	-18.74631	169.20317	Google Map	Moderate
1878	Port Resolution	Dispensary	Dispensary	2000	6	Tafea	608	Whitesands	602	Tanna	TAF04	Church	Rural	-19.52686	169.50123	Google Map	Moderate

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1868	Rotobeca (Aniwa)	Dispensary	Dispensary	2000	6	Tafea	603	Aniwa	603	Aniwa	TAF03b	MOH	Rural	-19.26027	169.59928	Google Map	Moderate
1874	Tanyepa	Dispensary	Dispensary	2000	6	Tafea	605	West Tanna	602	Tanna	TAF01	MOH	Rural	-19.49676	169.26983	Google Map	Moderate
1867	Yorien	Dispensary	Dispensary	3000	6	Tafea	611	Aneityum	605	Aneityum	TAF04c	MOH	Rural	-20.23659	169.78348	Google Map	Moderate
1860	Green Hill	Health Centre	Health Centre	5000	6	Tafea	604	North Tanna	602	Tanna	TAF02	MOH	Rural	-19.37674	169.29740	Google Map	Moderate
1863	Imaki	Health Centre	Health Centre	5000	6	Tafea	609	South Tanna	602	Tanna	TAF04	MOH	Rural	-19.60211	169.46232	Google Map	Moderate
1840	White Sands (Iatalakei)	Health Centre	Health Centre	5000	6	Tafea	608	Whitesands	602	Tanna	TAF04	MOH	Rural	-19.50100	169.45507	Google Map	Moderate
1230	Lenakel	Provincial Hospital	Provincial Hospital	39338	6	Tafea	605	West Tanna	602	Tanna	TAF01	MOH	Rural	-19.53033	169.27393	Google Map	Moderate
6217	Ambek	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.73640	167.42170	2018 Master List	Unknown
6218	Amon Memorial	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.78920	167.53113	2018 Master List	Unknown
6207	Aorta	Aid Post	Aid Post	300	1	Torba	107	Merelava	117	Mere Lava	TOR05	Community	Rural	-14.47733	168.0506	VNSO Village 2009	Unknown
6200	Beam	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.36369	167.49131	VNSO Village 2009	Unknown
6215	Diver's Bay	Aid Post	Aid Post	300	1	Torba	102	Ureparapara	108	Ureparapara	TOR02b	Community	Rural	-13.54520	167.33635	2018 Master List	Unknown
6201	Dorig	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.36665	167.54542	2018 Master List	Unknown
6209	Gamalna	Aid Post	Aid Post	300	1	Torba	105	Mota	114	Mota	TOR02a	Community	Rural	-13.84820	167.70702	2018 Master List	Unknown
6219	Kerepeta	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.90615	167.47975	2018 Master List	Unknown
6216	Leimaily	Aid Post	Aid Post	300	1	Torba	102	Ureparapara	108	Ureparapara	TOR02b	Community	Rural	-13.52501	167.29564	VNSO Village 2009	Unknown
6212	Rah	Aid Post	Aid Post	300	1	Torba	103	Motalava	111	Rah	TOR02a	Community	Rural	-13.71495	167.62688	Google Maps	Moderate
6202	Saika	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.28548	167.59227	2018 Master List	Unknown
6203	Santa Maria	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.29273	167.59812	2018 Master List	Unknown
6204	Sirity	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.24580	167.59330	2018 Master List	Unknown
6208	Tasmat	Aid Post	Aid Post	300	1	Torba	107	Merelava	117	Mere Lava	TOR04	Community	Rural	-14.45836	168.02153	2018 Master List	Unknown
6214	Toga	Aid Post	Aid Post	300	1	Torba	101	Torres	106	Toga	TOR01	Community	Rural	-13.43137	166.70212	2018 Master List	Unknown
6206	Tormeryau	Aid Post	Aid Post	300	1	Torba	101	Torres	101	Hiu	TOR01	Community	Rural	-13.12631	166.58381	VNSO Village 2009	Unknown
6205	Vaget	Aid Post	Aid Post	300	1	Torba	106	Gaua	115	Gaua	TOR04	Community	Rural	-14.27817	167.60130	2018 Master List	Unknown
6210	Vateil	Aid Post	Aid Post	300	1	Torba	103	Motalava	110	Mota Lava	TOR02a	Community	Rural	-13.67133	167.70823	2018 Master List	Unknown
6220	Vatop	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.72448	167.47903	2018 Master List	Unknown
6221	Vatrata	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.89238	167.42830	2018 Master List	Unknown
6222	Wasaga	Aid Post	Aid Post	300	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	Community	Rural	-13.95963	167.45022	2018 Master List	Unknown
2661	Hanington (Vetuboso)	Dispensary	Dispensary	2000	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	MOH	Rural	-13.90695	167.45129	Google Map	Moderate
2664	Lehali	Dispensary	Dispensary	2000	1	Torba	102	Ureparapara	108	Ureparapara	TOR02b	MOH	Rural	-13.52542	167.29540	Google Map	Moderate
2660	Robul (Lequel)	Dispensary	Dispensary	2000	1	Torba	107	Merelava	117	Mere Lava	TOR05	MOH	Rural	-14.44003	168.03922	Google Map	Moderate
2663	Sarawia	Dispensary	Dispensary	2000	1	Torba	105	Mota	114	Mota	TOR02a	MOH	Rural	-13.83613	167.68576	Google Map	Moderate
2665	Womal - Dolap	Dispensary	Dispensary	2000	1	Torba	106	Gaua	115	Gaua	TOR04	MOH	Rural	-14.30691	167.43116	Google Map	Moderate
2642	Loh	Health Centre	Health Centre	5000	1	Torba	101	Torres	105	Loh	TOR01	MOH	Rural	-13.33475	166.63412	Google Map	Moderate
2641	Mataka	Health Centre	Health Centre	5000	1	Torba	106	Gaua	115	Gaua	TOR04	MOH	Rural	-14.21123	167.57182	Google Map	Moderate
2640	Pemisas	Health Centre	Health Centre	5000	1	Torba	103	Motalava	110	Mota Lava	TOR02a	MOH	Rural	-13.70853	167.62474	Google Map	Moderate
2643	Wings of Hope	Clinic	Health Centre	5000	1	Torba	106	Gaua	115	Gaua	TOR04	NGO	Rural	-14.22148	167.59042	Google Map	Moderate
2662	Qaet Vaes	Provincial Hospital	Provincial Hospital	10362	1	Torba	104	Vanua Lava	112	Vanua Lava	TOR03	MOH	Rural	-13.86728	167.54113	Google Map	Moderate

Annex 6 – List of commercial airports and emergency airfields considered in the present study

Airport/ Airfield ID	IATA Code	ICAO Code	Airport/ Airfield name	Province code	Province name	Island code	Island name	Airport type	Maximum plane size	Latitude	Longitude	Source of the coordinates	Coordinates accuracy
3	CCV	NVSF	Craig Cove	4	MALAMPA	420	Ambrym	Commercial	Small	-16.26500	167.92400	OSM	High
11	LPM	NVSL	Lamap	4	MALAMPA	401	Malekula	Commercial	Small	-16.45665	167.82879	OSM	High
14	NUS	NVSP	Norsup	4	MALAMPA	401	Malekula	Commercial	Small	-16.08058	167.40256	OSM	High
15	PBJ	NVSI	Paama	4	MALAMPA	421	Paama	Commercial	Small	-16.43195	168.23577	Google Map	High
19	SWJ	NVSX	SW Bay	4	MALAMPA	401	Malekula	Commercial	Small	-16.48364	167.44614	OSM	High
23	ULB	NVSU	Ulei	4	MALAMPA	420	Ambrym	Commercial	Small	-16.32984	168.30062	OSM	High
9	LNE	NVSO	Lonorore	3	PENAMA	303	Pentecost	Commercial	Small	-15.86471	168.17142	Google Map	High
10	LOD	NVSG	Longana	3	PENAMA	302	Ambae	Commercial	Small	-15.30537	167.96840	Google Map	High
13	MWF	NVSN	Maewo	3	PENAMA	301	Maewo	Commercial	Small	-14.99455	168.07848	OSM	High
18	SSR	NVSH	Sara	3	PENAMA	303	Pentecost	Commercial	Small	-15.47080	168.15199	OSM	High
26	WLH	NVSW	Walaha	3	PENAMA	302	Ambae	Commercial	Small	-15.41216	167.69163	OSM	High
28	RCL	NVSR	Redcliffe Airport	3	PENAMA	302	Ambae	Emergency	Small	-15.46958	167.83226	OSM	High
17	SON	NVSS	Santo-Pekoa International	2	SANMA	201	Santo	Commercial	Big	-15.50571	167.22136	Google Map	High
5	EAE	NVSE	Emae	5	SHEFA	506	Emae	Commercial	Small	-17.09030	168.34300	OSM	High
8	LNB	NVSM	Lamen Bay	5	SHEFA	501	Lamen	Commercial	Small	-16.58420	168.15900	OSM	High
21	TGH	NVST	Tongoa	5	SHEFA	503	Tongoa	Commercial	Small	-16.89092	168.55025	OSM	High
24	VLI	NVVV	Bauerfield International	5	SHEFA	514	Efate	Commercial	Big	-17.69889	168.31843	Google Map	High
25	VLS	NVSV	Valesdir	5	SHEFA	502	Epi	Commercial	Small	-16.79610	168.17700	OSM	High
29	UIQ	NVVQ	Quoin Hill Airport	5	SHEFA	514	Efate	Emergency	Small	-17.54081	168.44219	OSM	High
30		NVVJ	Forari Airport	5	SHEFA	514	Efate	Emergency	Small	-17.70030	168.52720	OSM	High
1	AUY	NVVA	Aneityum	6	TAFEA	606	Inyeuc	Commercial	Small	-20.24886	169.77125	Google Map	High
2	AWD	NVVB	Aniwa	6	TAFEA	603	Aniwa	Commercial	Small	-19.23478	169.60031	OSM	High
4	DLY	NVVD	Dillons Bay	6	TAFEA	601	Erromango	Commercial	Small	-18.76991	169.00319	Google Map	High
6	FTA	NVVF	Futuna	6	TAFEA	604	Futuna	Commercial	Small	-19.51627	170.23225	Google Map	High
7	IPA	NVVI	Ipota	6	TAFEA	601	Erromango	Commercial	Small	-18.85617	169.28295	Google Map	High
20	TAH	NVVW	Whitegrass	6	TAFEA	602	Tanna	Commercial	Big	-19.45872	169.22804	Google Map	High
12	MTV	NVSA	Mota Lava	1	TORBA	110	Mota Lava	Commercial	Small	-13.66600	167.71201	OSM	High
16	SLH	NVSC	Sola	1	TORBA	112	Vanua Lava	Commercial	Small	-13.85537	167.53832	OSM	High
22	TOH	NVSD	Torres	1	TORBA	105	Loh	Commercial	Small	-13.32759	166.63812	Google Map	High
27	ZGU	NVSQ	Gaua	1	TORBA	115	Gaua	Commercial	Small	-14.22089	167.58978	OSM	High
31			Mota	1	TORBA	114	Mota	Emergency	Small	-13.84616	167.70870	Google Map	High
32			Toga	1	TORBA	106	Toga	Emergency	Small	-13.43450	166.68801	Esri/Bing	High
33			Vanua Lava	1	TORBA	112	Vanua Lava	Emergency	Small	-13.73295	167.42622	Esri	High
34			Mere Lava	1	TORBA	117	Mere Lava	Emergency	Small	-14.44538	168.06655	Esri	High

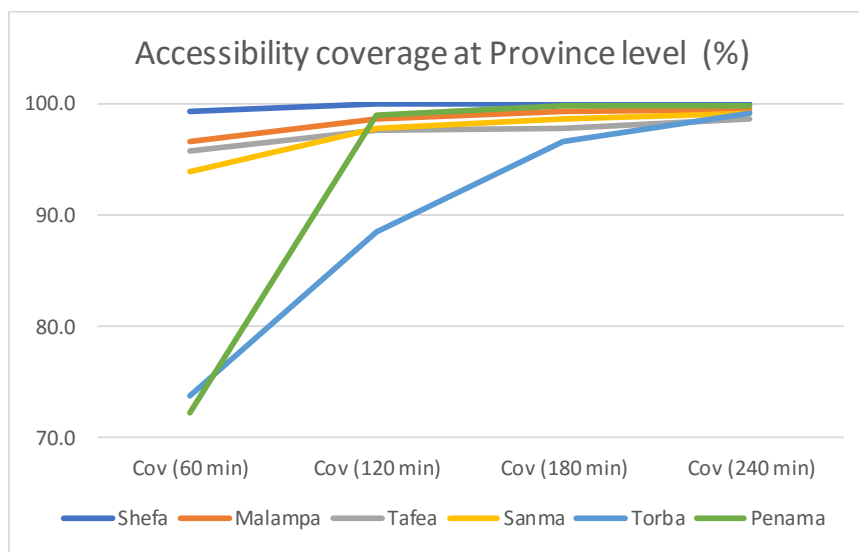## Annex 7 – Original and simplified land cover classification used in the analysis

Old class ID	Old class label	New class ID	New class label
1	Airstrip	1	Bare area
2	Banana	5	Medium density vegetation
3	Barren Land	1	Bare area
4	Cassava	5	Medium density vegetation
5	Coconut Crops	5	Medium density vegetation
6	Coconut Forest	5	Medium density vegetation
7	Coconut Plantation	4	Low density vegetation
8	Cultivated Land	4	Low density vegetation
9	Forest	6	High density vegetation
10	Yams	4	Low density vegetation
11	Legumes	4	Low density vegetation
12	Limestone	3	Limestone/Reef/Rock Shelves/Sand bay
13	Navel Nut Tree	4	Low density vegetation
14	Noni Tree	4	Low density vegetation
15	Open Land	1	Bare area
16	Pine Plantation	5	Medium density vegetation
17	Plantation	5	Medium density vegetation
18	Reef	3	Limestone/Reef/Rock Shelves/Sand bay
19	Rice	7	Water
20	Rock Shelves	3	Limestone/Reef/Rock Shelves/Sand bay
21	Sand Bay	3	Limestone/Reef/Rock Shelves/Sand bay
22	Settlement	2	Buit up area
23	Shrubs	4	Low density vegetation
24	Sugarcane	5	Medium density vegetation
25	Unknown Crops	5	Medium density vegetation
26	Volcanic Ash Plain	1	Bare area

Annex 8 – Results of the accessibility coverage analysis (Province level)

8.1 Population traveling to the nearest operational Dispensary or Health Centre (ACC 1)

8.1.1 Combined scenario (walking + motorized vehicle)
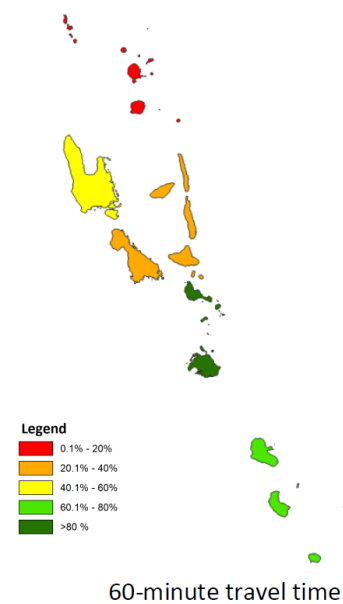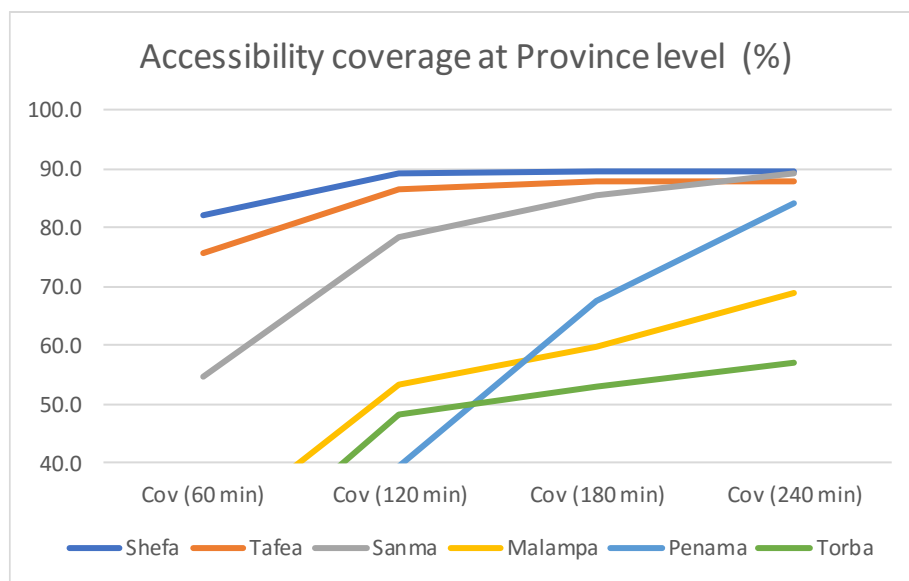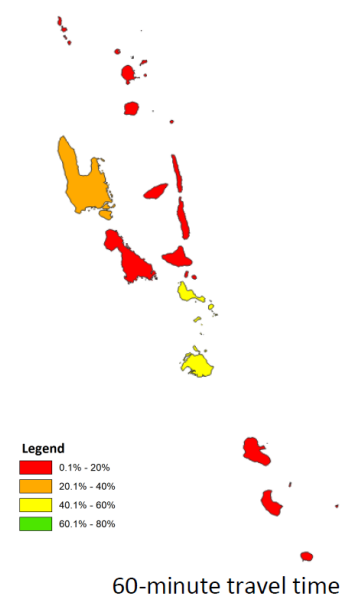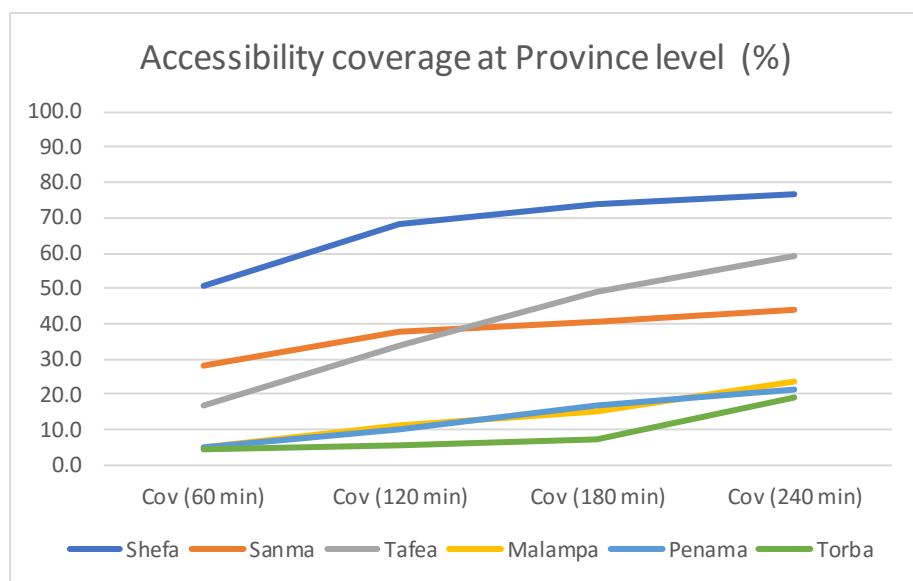
PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	107,633	99.4	108,315	100.0	108,315	100.0	108,315	100.0
4	Malampa	42,664	41,244	96.7	42,131	98.8	42,364	99.3	42,476	99.6
6	Tafea	39,338	37,712	95.9	38,429	97.7	38,504	97.9	38,839	98.7
2	Sanma	58,519	54,991	94.0	57,269	97.9	57,742	98.7	58,023	99.2
1	Torba	10,362	7,638	73.7	9,179	88.6	10,015	96.6	10,283	99.2
3	Penama	34,304	24,804	72.3	33,956	99.0	34,267	99.9	34,267	99.9
	Country total	**293,522**	**274,022**	**93.4**	**289,279**	**98.6**	**291,206**	**99.2**	**292,204**	**99.6**

Accessibility coverage at Province level (%)

Legend
- 60.1% – 80%
- >80 %

60-minute travel time

8.1.2 Walking only scenario

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	82,730	76.4	92,426	85.3	98,011	90.5	102,547	94.7
2	Sanma	58,519	40,753	69.6	52,186	89.2	55,865	95.5	56,349	96.3
4	Malampa	42,664	27,152	63.6	34,582	81.1	37,686	88.3	39,458	92.5
3	Penama	34,304	21,412	62.4	24,966	72.8	25,419	74.1	25,932	75.6
6	Tafea	39,338	24,322	61.8	35,515	90.3	38,116	96.9	38,606	98.1
1	Torba	10,362	5,795	55.9	6,876	66.4	7,562	73.0	8,050	77.7
	Country total	293,522	202,164	68.9	246,550	84.0	262,659	89.5	270,942	92.3

Accessibility coverage at Province level (%)

Legend
- 40.1% - 60%
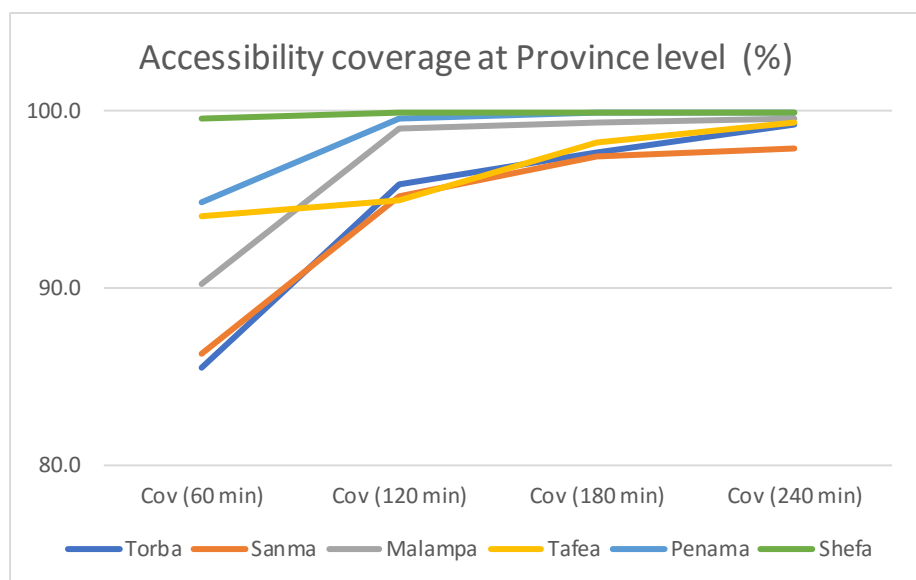- 60.1% - 80%
- >80 %

60-minute travel time
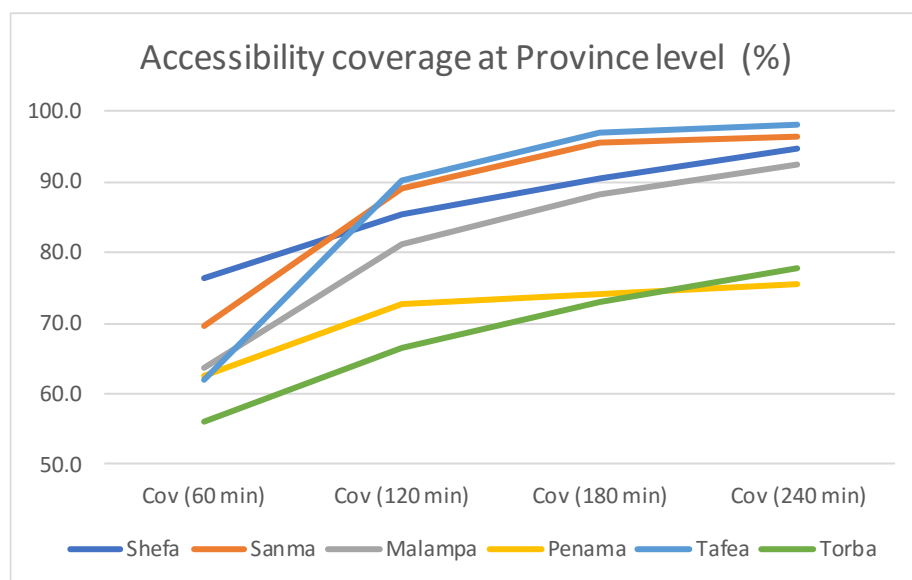
8.2 Population traveling to the nearest operational Health Centre (ACC 2)

8.2.1 Combined scenario (walking + motorized vehicle)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	104,633	96.6	106,737	98.5	106,774	98.6	106,774	98.6
2	Sanma	58,519	49,789	85.1	54,610	93.3	55,813	95.4	56,621	96.8
6	Tafea	39,338	28,957	73.6	34,131	86.8	34,590	87.9	34,590	87.9
4	Malampa	42,664	27,539	64.5	39,229	91.9	42,215	98.9	42,342	99.2
3	Penama	34,304	22,122	64.5	31,907	93.0	33,671	98.2	34,166	99.6
1	Torba	10,362	4,173	40.3	5,723	55.2	8,160	78.7	9,433	91.0
	Country total	293,522	237,213	80.8	272,337	92.8	281,223	95.8	283,926	96.7

60-minute travel time
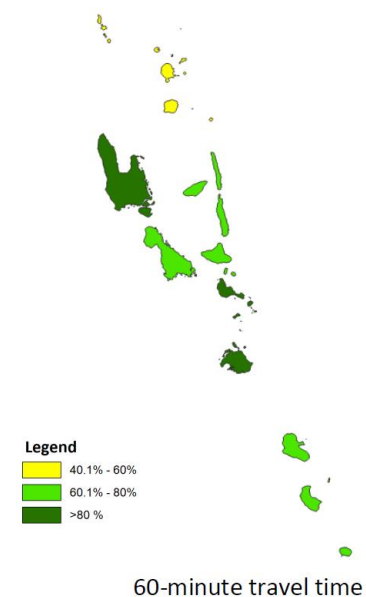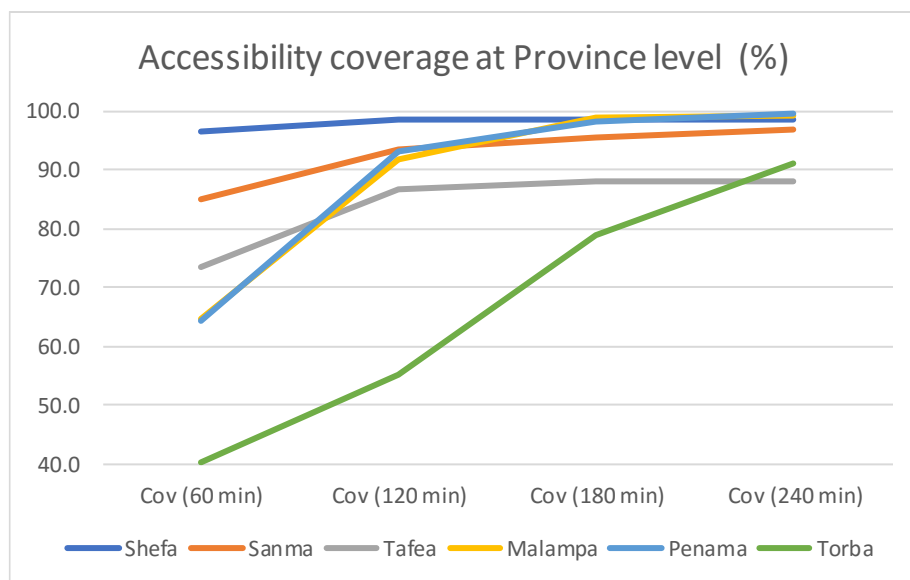
8.2.2 Walking only scenario

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	62,388	57.6	81,426	75.2	89,573	82.7	95,141	87.8
2	Sanma	58,519	27,245	46.6	40,416	69.1	44,823	76.6	48,604	83.1
4	Malampa	42,664	12,922	30.3	18,730	43.9	23,250	54.5	25,309	59.3
1	Torba	10,362	3,120	30.1	3,501	33.8	3,797	36.6	3,804	36.7
3	Penama	34,304	9,027	26.3	17,300	50.4	22,049	64.3	24,712	72.0
6	Tafea	39,338	5,346	13.6	10,904	27.7	17,994	45.7	21,908	55.7
	Country total	293,522	120,047	40.9	172,276	58.7	201,487	68.6	219,478	74.8

Accessibility coverage at Province level (%)

60-minute travel time
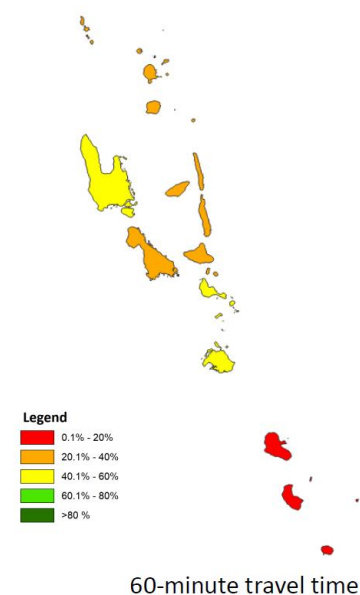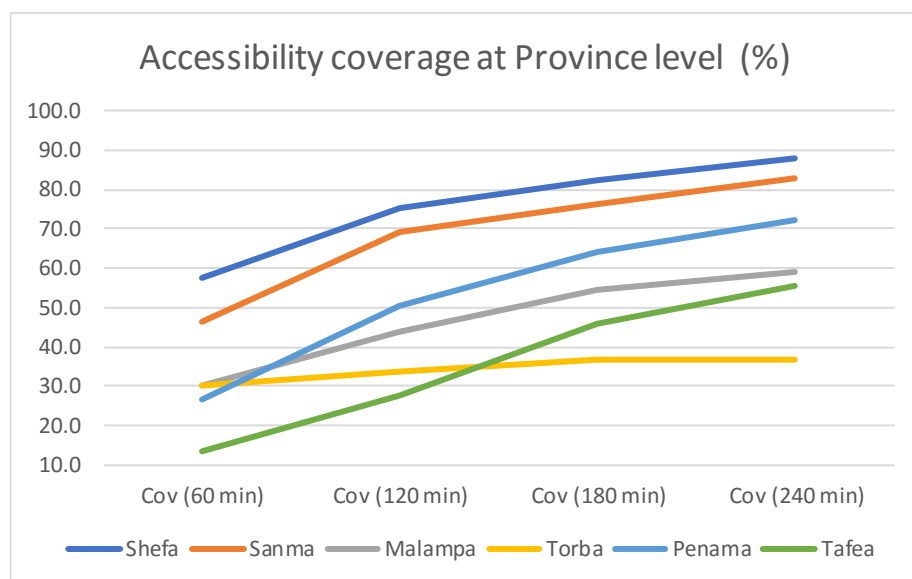
8.3 Population traveling to the nearest Hospital (ACC 3)

8.3.1 Combined scenario (walking + motorized vehicle)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	89,086	82.2	96,691	89.3	96,928	89.5	96,937	89.5
6	Tafea	39,338	29,830	75.8	33,999	86.4	34,590	87.9	34,590	87.9
2	Sanma	58,519	31,942	54.6	45,970	78.6	50,081	85.6	52,258	89.3
4	Malampa	42,664	11,699	27.4	22,755	53.3	25,526	59.8	29,345	68.8
3	Penama	34,304	7,800	22.7	13,495	39.3	23,202	67.6	28,924	84.3
1	Torba	10,362	2,023	19.5	4,990	48.2	5,501	53.1	5,926	57.2
	Country total	293,522	172,381	58.7	217,900	74.2	235,827	80.3	247,981	84.5

60-minute travel time

8.3.2 Walking only scenario

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	54,921	50.7	74,167	68.5	80,087	73.9	82,766	76.4
2	Sanma	58,519	16,572	28.3	21,966	37.5	23,557	40.3	25,680	43.9
6	Tafea	39,338	6,702	17.0	13,286	33.8	19,206	48.8	23,209	59.0
4	Malampa	42,664	2,097	4.9	4,753	11.1	6,438	15.1	10,087	23.6
3	Penama	34,304	1,674	4.9	3,439	10.0	5,855	17.1	7,337	21.4
1	Torba	10,362	453	4.4	558	5.4	759	7.3	1,997	19.3
	Country total	293,522	82,420	28.1	118,170	40.3	135,900	46.3	151,076	51.5

Accessibility coverage at Province level (%)

60-minute travel time

8.4 Population traveling to the nearest operational Aid Post (ACC 4)

8.4.1 Combined scenario (walking + motorized vehicle)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
1	Torba	10,362	8,861	85.5	9,929	95.8	10,122	97.7	10,283	99.2
2	Sanma	58,519	50,466	86.2	55,677	95.1	57,049	97.5	57,273	97.9
4	Malampa	42,664	38,504	90.2	42,260	99.1	42,385	99.3	42,498	99.6
6	Tafea	39,338	36,994	94.0	37,352	95.0	38,627	98.2	39,105	99.4
3	Penama	34,304	32,545	94.9	34,157	99.6	34,267	99.9	34,267	99.9
5	Shefa	108,336	107,913	99.6	108,315	100.0	108,315	100.0	108,315	100.0
	Country total	293,522	275,283	93.8	287,691	98.0	290,765	99.1	291,741	99.4

Accessibility coverage at Province level (%)

60-minute travel time

8.5 Population traveling to the nearest operational primary health care facility (Aid Post, Dispensary or Health Centre) (ACC 5)

8.5.1 Combined scenario (walking + motorized vehicle)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Pop (60 min)	Cov (60 min)	Pop (120 min)	Cov (120 min)	Pop (180 min)	Cov (180 min)	Pop (240 min)	Cov (240 min)
5	Shefa	108,336	108,088	99.8	108,315	100.0	108,315	100.0	108,315	100.0
6	Tafea	39,338	38,799	98.6	39,058	99.3	39,204	99.7	39,290	99.9
4	Malampa	42,664	41,798	98.0	42,322	99.2	42,385	99.3	42,498	99.6
3	Penama	34,304	33,566	97.8	34,233	99.8	34,267	99.9	34,267	99.9
2	Sanma	58,519	55,935	95.6	57,660	98.5	57,891	98.9	58,126	99.3
1	Torba	10,362	9,605	92.7	9,956	96.1	10,154	98.0	10,283	99.2
	Country total	293,522	287,791	98.0	291,544	99.3	292,217	99.6	292,780	99.7

Accessibility coverage at Province level (%)

60-minute travel time
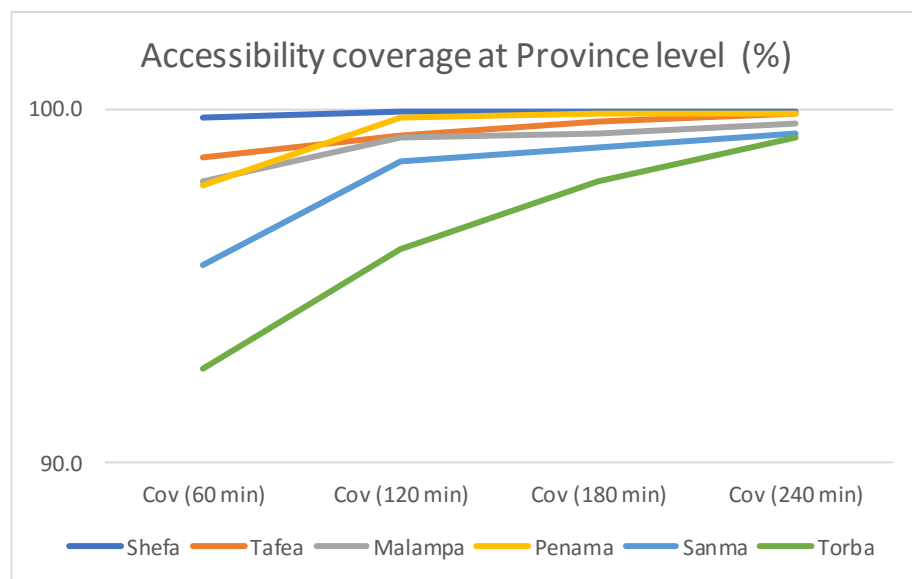
Annex 9 – Links to the complete results of the accessibility coverage analysis (All levels)

Analysis code	Travelling scenario	Tables and graphs	Maps
ACC 1	Combined	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_1_Combined_Results_081119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_1_Combined_Maps_081119.pdf
ACC 1	Walking only	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_1_Walking_Results_091119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_1_Walking_Maps_111119.pdf
ACC 2	Combined	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_2_Combined_Results_081119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_2_Combined_Maps_081119.pdf
ACC 2	Walking only	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_2_Walking_Results_091119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_2_Walking_Maps_111119.pdf
ACC 3	Combined	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_3_Combined_Results_081119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_3_Combined_Maps_081119.pdf
ACC 3	Walking only	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_3_Walking_Results_091119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_3_Walking_Maps_111119.pdf
ACC 4	Combined	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_4_Combined_Results_081119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_4_Combined_Maps_081119.pdf
ACC 5	Combined	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_5_Combined_Results_081119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/ACC/ACC_5_Combined_Maps_081119.pdf

Annex 10 - Results of the geographic coverage analysis (Province level)

10.1 Population traveling to the nearest operational Dispensary or Health Centre (GEO 1)
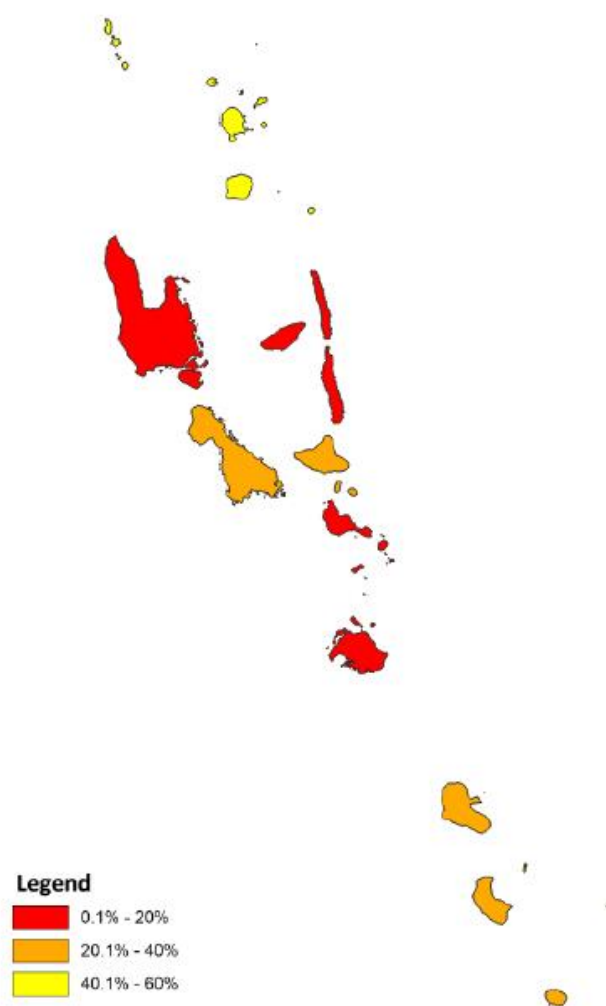
PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Population covered (60 min)	Geographic Coverage (60 min)	Accessibility Coverage (60min)		Coverage difference
4	Malampa	42,664	40,435	94.8	96.7		1.9
2	Sanma	58,519	54,991	94.0	94.0		0.0
6	Tafea	39,338	33,062	84.0	95.9		11.8
5	Shefa	108,336	85,143	78.6	99.4		20.8
1	Torba	10,362	7,632	73.7	73.7		0.1
3	Penama	34,304	24,804	72.3	72.3		0.0
	Country total	293,522	246,067	**83.8**	**93.4**		**9.5**

Legend

60.1% - 80%

>80 %

Province level

10.2 Population traveling to the nearest operational Health Centre (GEO 2)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Population covered (240 min)	Geographic Coverage (240 min)	Accessibility Coverage (240min)		Coverage difference
2	Sanma	58,519	56,546	96.6	96.8		0.1
4	Malampa	42,664	36,448	85.4	99.2		13.8
1	Torba	10,362	8,661	83.6	91.0		7.4
3	Penama	34,304	28,024	81.7	99.6		17.9
5	Shefa	108,336	52,750	48.7	98.6		49.9
6	Tafea	39,338	15,000	38.1	87.9		49.8
	Country total	293,522	197,430	67.3	96.7		29.5

Legend

- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- >80 %
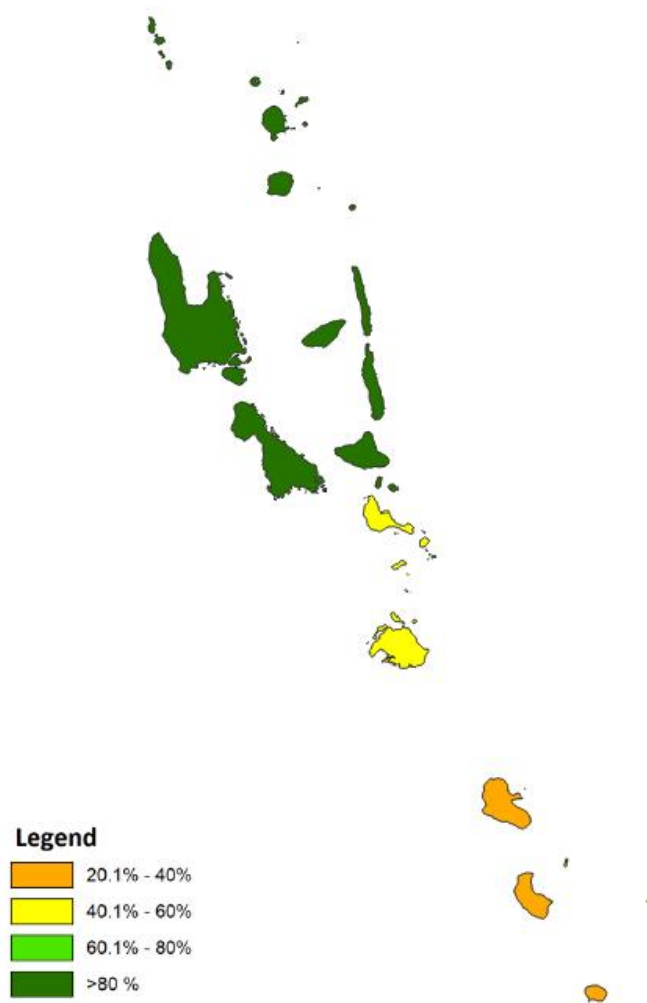
Province level

10.3 Population traveling to the nearest operational Hospital (GEO 3)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Population covered (240 min)	Geographic Coverage (240 min)	Accessibility Coverage (240min)		Coverage difference
5	Shefa	108,336	96,937	89.5	89.5		0.0
2	Sanma	58,519	52,258	89.3	89.3		0.0
6	Tafea	39,338	34,590	87.9	87.9		0.0
3	Penama	34,304	28,924	84.3	84.3		0.0
4	Malampa	42,664	29,345	68.8	68.8		0.0
1	Torba	10,362	5,926	57.2	57.2		0.0
	Country total	**293,522**	**247,981**	**84.5**	**84.5**		**0.0**

Legend
- 40.1% - 60%
- 60.1% - 80%
- >80 %

Province level

10.4 Population traveling to the nearest operational Aid Post (GEO 4)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Population covered (30 min)	Population covered (60 min)	Geographic Coverage (30 min)	Geographic Coverage (60 min)	Accessibility Coverage (60 min)		Coverage difference (60 min)
1	Torba	10,362	4,391	5,069	42.4	48.9	85.5		36.6
6	Tafea	39,338	10,130	11,099	25.8	28.2	94.0		65.8
4	Malampa	42,664	8,969	9,436	21.0	22.1	90.2		68.1
3	Penama	34,304	4,952	5,491	14.4	16.0	94.9		78.9
2	Sanma	58,519	6,919	8,748	11.8	14.9	86.2		71.3
5	Shefa	108,336	11,321	11,561	10.4	10.7	99.6		88.9
	Country total	293,522	46,681	51,406	15.9	17.5	93.8		76.3

Legend
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%

Province level

10.5 Population traveling to the nearest operational primary Health Care Centre (ACC 1)

PRO_C_VNSO	PRO_N_VNSO	Tot_Pop	Population covered (60 min)	Geographic Coverage (60 min)	Accessibility Coverage (60min)		Coverage difference
4	Malampa	42,664	41,666	97.7	99.6		1.9
6	Tafea	39,338	38,594	98.1	99.4		1.3
2	Sanma	58,519	55,935	95.6	97.9		2.3
1	Torba	10,362	9,487	91.6	99.2		7.7
5	Shefa	108,336	90,327	83.4	100.0		16.6
3	Penama	34,304	26,479	77.2	99.9		22.7
	Country total	293,522	262,489	89.4	98.0		8.6

Legend
- 60.1% - 80%
- >80 %

Province level

Annex 11 – Links to the complete results of the geographic coverage analysis (All levels)

Analysis code	Table (Health facility)	Table (Aggregated)	Maps
GEO 1	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_1_by_health_facility_111219.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_1_Combined_Results_121119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_1_Maps_121119.pdf
GEO 2	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_2_by_health_facility_111219.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_2_Combined_Results_121119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_2_Maps_131119.pdf
GEO 3	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_3_by_health_facility_121119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_3_Combined_Results_121119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_3_Maps_131119.pdf
GEO 4	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_4_by_health_facility_121119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_4_Combined_Results_131119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_4_Maps_131119.pdf
GEO 5	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_5_by_health_facility_121219.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_5_Combined_Results_121219.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/GEO/GEO_5_Maps_131119.pdf

Annex 12– Main observations from the geographic coverage analyses

Analysis code	Observation level					Health facility
	Comparison with the accessibility coverage analysis					
	Country	Province	Area Council	Health Zone	Island	
GEO 1 (1 hour)	Coverage drops by 9.5% but remains above the 80% benchmark (83.8%)	Significant differences are observed for the Provinces of Tafea (-11.8%) and Shefa (-20.8%), the later passing under 80%	49 Area Councils (74.2%) remains above 80% (-10.6). The most significant differences (54 to 99.2%) are observed for 5 Area Councils in the Province of Shefa	36 Health Zones (72%) remains above 80% (-4%). The most significant differences are observed for Health Zone SHE01 (-25.6%) followed by TAF01 (-19.1%)	43 inhabited islands (57.3%) remain above 80% (-8%). The most significant differences are observed for the islands of Ifira and Erakor (-100% for both of them)	36 health facilities could server a larger population if their capacity was to be extended. Some capacity remains unused for 109 health facilities, including 16 for which the capacity is not being used at all
GEO 2 (4 hours)	Coverage drops by 29.5% and pass below the 80% benchmark (67.3%)	Significant differences are observed for the Provinces of Penama (-17.9%), Shefa (-49.9% and Tafea (-49.8%), the last two passing under 80%	35 Area Councils (53%) remains above 80% (-36%). The most significant differences (79.6 to 100%) are observed in 8 Area Councils in the Provinces of Tafea, Shafea and Penama	29 Health Zones (58%) remain above 80% (-28%). The most significant differences are observed for Health Zones TAF03b (-100%), PEN03 (-97.8%) and TAF01 (-85.3%)	40 inhabited islands (53.3%) remain above 80% (-27%). The most significant differences are observed for 11 islands in the Provinces of Malampa and Shefa	28 health facilities could server a larger population if their capacity was to be extended. Some capacity remains unused for 14 health facilities, including 2 for which the capacity is not being used at all
GEO 3 (4 hours)	No difference in coverage					Some capacity remains unused for all 6 hospitals

GEO 4 (1 hour)	Coverage drops by 76.3% and pass below the 80% benchmark (17.5%)	Coverage drops below 80% for all the Provinces. The significant differences are observed for the Province of Shefa (-88.9%) and Penama (-78.9%)	Only 2 Area Councils (3%) remains above 80% (-83.3%). The most significant differences are observed for 25 Area Councils in the Provinces of Malampa, Penama, Sanma, Shefa and Tafea	Only 1 Health Zone (2%) remain above 80% (-78%). The most significant differences are observed for 14 Health Zones in the Provinces of Malampa, Penama, Sanma, Shefa and Tafea	11 inhabited islands (14.6%) remain above 80% (-60%). The most significant differences are observed for 24 islands across all 6 Provinces	163 health facilities could server a larger population if their capacity was to be extended. Some capacity remains unused for 24 health facilities, including 1 for which the capacity is not being used at all
GEO 5 (1 hour)	Coverage drops by 8.6% but remains above the 80% benchmark (89.4%)	Significant differences are observed for the Provinces of Penama (-22.7%) and Shefa (-16.6%), the former passing under 80%	56 Area Councils (84.8%) remains above 80% (-12.1%). The most significant differences are observed in the Area Councils of East Ambae (LungeiTagaro) (-96.6%), Eratap (-96.2%), Ifira (-85.7%) and North Ambae (VatubuleiTagaro) (-77.2)	44 Health Zones (88%) remain above 80% (-8%). The most significant differences are observed for Health Zones PEN01 (-93.1) and PEN03 (-74.9%)	58 inhabited islands (77.3%) remain above 80% (-6.7%). The most significant differences are observed for Ifira and Erakor (-100% for both of them)	77 health facilities could server a larger population if their capacity was to be extended. Some capacity remains unused for 255 health facilities, including 104 for which the capacity is not being used at all

Annex 13 - Links to the complete results for the Referral analyses

Analysis code	Table (Health facility)	Map
REF 1	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_1_Combined_Results_101119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_1_Combined_Map_111119.pdf
REF 2	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_2_Combined_Results_101119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_2_Combined_Map_121119.pdf
REF 3 (Scenario 1)	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_3_Combined_Results_101119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_3_Scenario1_Map_121119.pdf
REF 3 (Scenario 2)		https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_3_Scenario2_Map_121119.pdf
REF 3 (Scenario 3)		https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_3_Scenario3_Map_121119.pdf
REF 4 (Scenario 2 and 3)	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_4_Combined_Results_101119.xlsx	Not applicable
REF 5	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_5_Combined_Results_101119.xlsx	https://healthgeolab.net/COUNTRIES/VUT/ACCESSIBILTY/REF/REF_5_Combined_Map_121119.pdf

Travel time between each Aid Post and the nearest Dispensary or Health Center (combined scenario, no plane)

1st Quarter of 2019

Legend

Travel time (minutes)

- >240
- 180 - 240
- 120 - 180
- 60 - 120
- 30 - 60
- <30
- Island