

OSLOMET

Aleksander Krokeide

**Challenges With the Immunization
Program in a Remote Area in Papua
New Guinea**

Master's thesis in Social Welfare and Health Policy
Oslo Metropolitan University
Faculty of Social Science

Oslo Metropolitan University, Faculty of Social Science
Oslo 2022

Abstract

This thesis uses the framework for rural and remote health (Bourke et al., 2012) to analyze the child immunization program in a rural remote part of Papua New Guinea. This is done using an analogic approach supplemented with available literature on a global, national, and local level.

The Schouten Island is a small island group located at the shore of the East Sepik Province in Papua New Guinea (PNG). Coverage of basic vaccines in the routine immunization program is low in PNG in general, but particularly low in this province. PNG has a diverse topography with a wealth of different cultures in their many rural and remote communities. 87 % of the population lives in rural areas, and there are over 800 languages spoken.

Based on experience from working with the Youths With a Mission (YWAM) Medical Ship in remote parts of PNG, I wanted to investigate the immunization program performance in this kind of environment. There are many studies on isolated problems related to the health service delivery in remote areas, but little is viewed from a community-based perspective. The framework for rural and remote health provides a holistic and people-centered approach to discuss this specific health outcome in a remote community.

There are several interrelated aspects resulting in the outcome of the immunization program in this remote setting. Low availability of health workers and closure of many health facilities in the district has made the accessibility of the service difficult. There is low evidence of cooperation and communications with the local rural and remote communities in the literature. In addition, communication systems between local health facilities and health authorities at district-, provincial-, and national level is fragile. Strategies for a holistic people- and community centered approach is implemented in the national policies, but seems to be difficult to implement at the local community level.

Table of content

Abstract	iii
1.0 Introduction.....	1
Setting the stage for a rural remote community in Papua New Guinea	2
A brief introduction to Papua New Guinea	4
Deliverance of primary health care services and the immunization program in PNG.....	6
Background.....	8
Research topic and research question	10
2.0 Theory – Health services in a rural remote community.....	11
Framework for rural health	11
Central terms used in the literature.....	16
3.0 Method	17
4.0 Results	20
Included literature.....	20
Findings from the included literature through the framework of rural health	24
Geographical isolation.....	24
Rural locale	25
Local health response.....	26
Broader health system	28
Broader social structures.....	29
Power.....	30
5.0 Discussion	31
6.0 Summary and implications	40
Strength and limitations:.....	41
Ethical considerations:	41
7.0 References.....	42

1.0 Introduction

According to World Health Organization (WHO) (2021) 86% of all infants born are now reached with immunizations, preventing more than 20 life-threatening diseases for these children. Measles is one of the most contagious vaccine preventable diseases and coverage rates at above 95% are expected rates to prevent outbreaks (WHO, 2021). However, there are major inequities in the immunization coverage. Globally, 20 million infants fail to receive all basic vaccines (see descriptions in Table 1), and of these there are over 13 million children who receive no immunizations through immunization programs (WHO, 2021). Reaching all children with immunizations and to reduce the prevalence of so called “zero-dose” children has through the last decades been one of the top priorities for the WHO and United Nations Children’s Fund (UNICEF). In the Immunization Agenda strategy for 2030 (WHO, 2021, p. 8), the vision of the following decade is stated “*A world where everyone, everywhere, at every age, fully benefits from vaccines for good health and well-being*”. In the Western Pacific Region, the average coverage of Measles is at 91% (WHO, 2022). Within this region, Papua New Guinea had an estimated national coverage at 42% for the BCG-vaccine and at 38% for the Measles vaccine in 2021 (WHO, 2022), meaning that the population of PNG should be a top priority for the Immunization Agenda 2030.

Children in the rural and remote parts of Papua New Guinea (PNG) are among the least vaccinated children in the world (WHO, 2022). Why are children living in these communities “hard-to-reach” with immunizations? To discuss this issue in my master project, I will set the scene by introducing a community from the rural and remote parts of PNG. I will not be able to understand and present all aspect of this certain community, but I will discuss aspects related to the primary health care service and child immunization coverage. The aspects presented from this community cannot be generalized to all rural and remote communities in PNG, and certainly not in the world, but there will be similarities that can be applicable both to rural and remote communities within the country, and other places in the world. By looking at aspects of this particular community, I can say something in general about the factors influencing the immunization programs in rural remote areas. The location and situation described below are based on one of the islands I visited while working with the Australian-based organization “Youths With a Mission Medical Ship (YWAM Medical ship)” in 2019. Because of privacy concerns, it is not the same island, and the

specific community is not specified. I will use this community as an analogy to discuss the performance of the immunization program in this specific community. Based on the rural and remote health framework developed by Bourke et al. (2012), I will discuss challenges both on the delivering and demander side of the health service.

Setting the stage for a rural remote community in Papua New Guinea

The Schouten Islands are located at the shore of the Wewak and Angoram districts in the East Sepik Province in PNG. From the Schouten Islands to the district center in Wewak there is about a 100 km travel distance in the Bismarck Sea. Health centers in Angoram district are located closer to these islands (Figure 1), but the islands are administratively a part of the Wewak district. There are some few remote communities on these islands, and there is also a considerable distance between the islands making communication between them difficult to maintain. It is possible to travel to larger villages and even cities by boat, where Wewak is the provincial capital of East Sepik with an airport and a regional referral hospital. But the route is long and potentially dangerous, in open water where few people in these communities possess boats suitable for the journey. Among rural households in PNG, only 1.8% possess a boat with a motor (NSO & ICF, 2019, p. 21). Into recent time there was a local community health post that served this island and others close to it. It was managed by two Community Health Workers (CHW) in cooperation with some lay health workers in this community and the communities in the surroundings. The community health post was serving the population fixed services, and occasionally villages residing far from the health center through outreach service. The smaller villages in the surrounding islands had lay health workers in PNG defined as Village Health Volunteers (VHV). Due to lack of human resources (the community health workers were needed in the health center in Angoram and at the hospital in Wewak), the local health center was closed for service. There were still VHV in some of the communities, providing basic first aid and emergency response.

The children in the Schouten Islands now face a considerably longer and much more dangerous travel route (on open water) to the nearest health facility to get their immunizations. The caregivers are made through prioritizations for their children to get immunized. Travel time, travel risk, travel costs, loss of income because of the travel time, time spent at the clinic, the risk of not getting the immunizations scheduled because of

missing stock or lack of other resources, are all considerations that the caregivers now have to take into account before bringing their children to the immunization service. The people living on these islands might feel forgotten by the local-, provincial- and national Government. Their health center is closed, making availability and accessibility of health services difficult. What about their access to education, information, social services or labor? According to the national Demographic and Health Survey from 2016-2018, the net attendance to elementary (6-8 years) and primary (9-14 years) school in the East Sepik Province is currently at 39.7% and 40.9% respectively. 38.6% of women and 43% of men are employed, most within agriculture, working on their own land. The exposure to mass media and internet use is generally low in the whole province (NSO & ICF, 2019). Findings from (UNICEF, 2015) and WHO (2016) indicates problems, especially mentioned in the East Sepik Province, with harassment from the local populations towards the local health workers, making the health workers leave their duty station.

This is just an example of how prioritization from the local level- and provincial governments (to prioritize the health workers to other health facilities) can influence the decisions made on a community level. Closure of aid posts and health centers is a common problem in rural remote parts of PNG (Grundy et al., 2019; National Department of Health, 2020; UNICEF, 2015). The considerations mentioned affect the caregivers' decisions in the Schouten Islands in major ways. What is the Government's ability to provide solutions for this primary health care service on a local level? Bourke et al. (2012) calls for a conceptual understanding of the local rural and remote communities to understand health related behavior in these kinds of communities. According to Bourke et al. (2012), research on rural and remote health issues tend to focus on problem areas connected to different levels (micro and macro), without acknowledging the interactions between these levels and the diversity of rural and remote health. The goal of the framework is to provide researchers, health practitioners, students, managers, policymakers a basis to understand the specific rural and remote context they are working in.

I imagine myself coming to this island community working as a health planner for the immunization program. Through the lens of Bourke et al. (2012), using the included literature as my database, I will discuss the interrelationship of the factors resulting in the child immunization coverage at the Schouten Islands. To discuss the immunization program

performance at the Schouten Islands in East Sepik province, I need to present the major structures of this country and the deliverance of the immunization program in PNG.

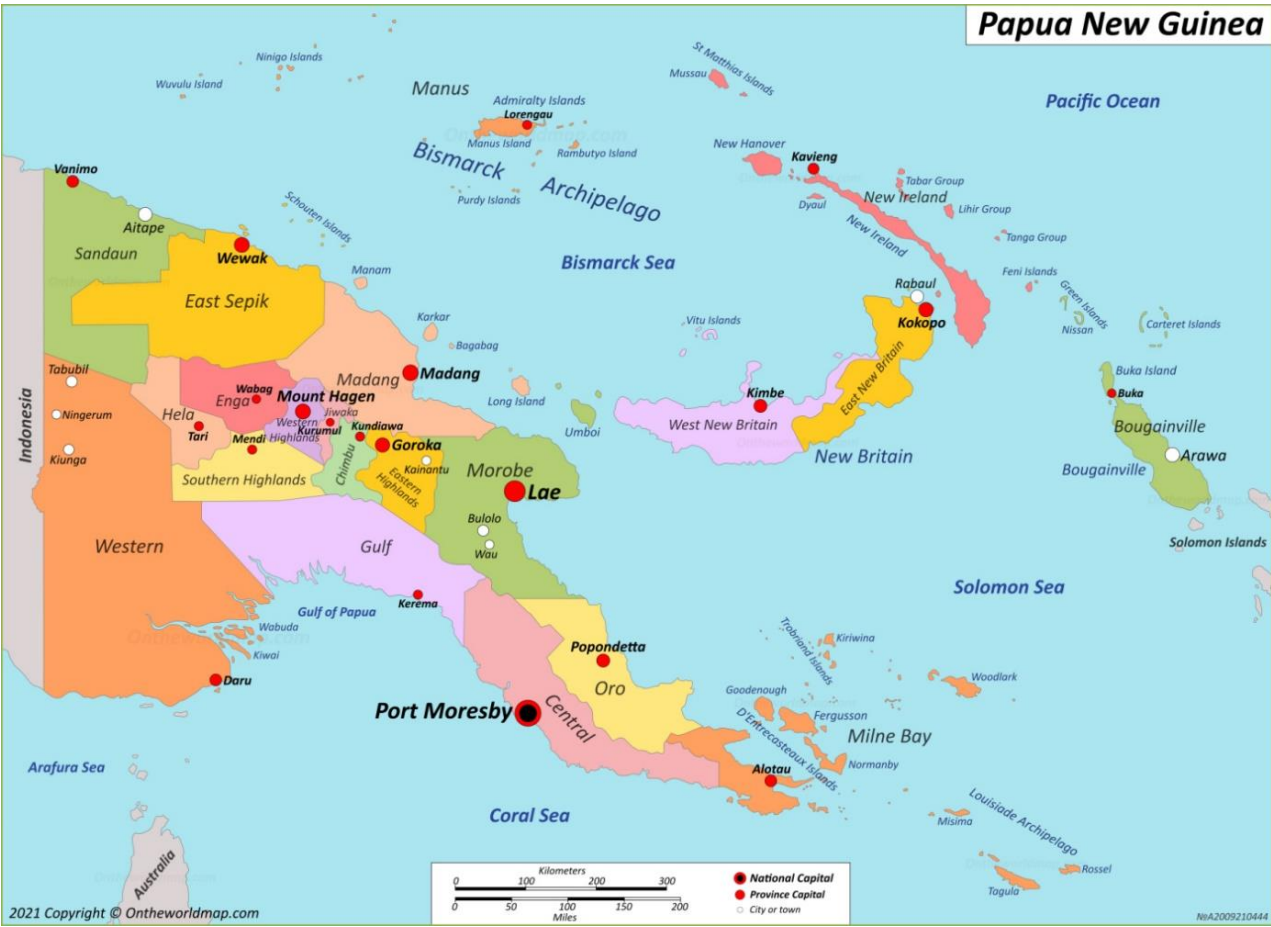
A brief introduction to Papua New Guinea

PNG is located the WHO-region of Western Pacific. It shares borders with Indonesia in the west, the Solomon Islands over the Pacific Ocean in the east, and Australia over the Coral Sea in the south. The country is divided into 4 regions, 22 provinces and 89 districts. Districts are further subdivided into local-level-governments (LLG) (Grundy et al., 2019). The geography in PNG is diverse, involving over 600 islands. New Guinea, the main island, is characterized by high peaks and rugged ridges in the Highlands region, but also swampy river deltas in the areas surrounding. Only 3% of the roads in the country is paved, most in the areas surrounding the capital city (Porte Moresby) (Grundy et al., 2019). East Sepik province, where the Schouten Islands is located, have mountain ranges in the south and the Sepik River flowing from west draining in the Bismarck Sea east in the province. The Schouten Islands is and island group consisting of small volcanic islands at the shore of this province (Figure 1).

Among a total population of 9 million people, 87% lives in rural areas (WHO, 2016; World Bank, 2022). With the massive degree of rural populations, people live in scattered populations spread around in this country with such a diverse topography. Many of the communities in the remote and rural areas can only be reached by foot, boat, or air supported travel (helicopter), demanding considerable time and resources for the health services providers, and making the accessibility for health services in these communities difficult. The child mortality have decreased each year since the 1960s, but is still the highest in the Western Pacific with a current rate at 44 per 1000 live births (World Bank, 2022).

With all these remote communities, PNG in flourished with a range of different cultures. There are over 800 different languages spoken and a distinct culture connected to the different language groups. Even within provinces, there are large sociocultural differences (Grundy et al., 2019, pp. 5-6). In East Sepik Province alone, there are over 100 different languages. People at the Schouten Islands speaks a different language than people in the small villages at the mainland across the sea (SIL International, 2015). English and Tok Pisin are considered as official languages and are spoken in most parts of PNG, in addition to their local language (Grundy et al., 2019).

Figure 1: Map of Papua New Guinea with districts.



(On the World Map, 2021)

With 96% practicing, Christianity is central in the Papua New Guineans life, coexisting with traditional beliefs (Grundy et al., 2019, p. 7). The basic social support system in PNG is normally based on the extended family (common language, geographic area of origin, common kinship, social or religious groups), which is defined as the “wantok system” (Grundy et al., 2019, p. 7). Through the wantok system (“one talk” in Tok Pisin), individuals are entitled their basic needs of food, water and shelter, and their belonging in the community. Most key decisions within the family are made by men, although women in general have the traditional responsibilities of cooking, gardening, and childcare (bringing to immunizations) (Grundy et al., 2019, p. 8).

Large sociocultural differences between districts and provinces are also evident for domestic and gender-based violence. Two thirds of women in PNG have experienced physical or sexual violence, but there are major differences between provinces (NSO & ICF, 2019, pp. 259-314). In some provinces, high degree of gender-based or domestic violence

The immunization program is provided through community level facilities defined as aid post and sub-/health centers (Grundy et al., 2019; WHO, 2016). The immunization services in these facilities are either fixed to the facility or delivered through patrol outreach service. The outreach service is typically used to reach communities that do not easily access their closest health facility, such as the community at the Schouten Islands (Grundy et al., 2019). The rural health facilities consist of governmental and church-based health services. Both are mainly financed by the government, backed with external assistance from Australian Aid, World Bank, the global vaccine alliance (GAVI), among others. In some districts, employer related health services are delivered, mainly through the mining industry. Each Provincial- and Local Level Governments (LLG) are responsible, by law, for the distribution of health services through district hospitals, sub-/health centers, aid/community health posts and outreach service. The National Department of Health (NDoH) is responsible for providing essential commodities and provide technical advice and support for the health facilities (Grundy et al., 2019, pp. 31-33). The presence of church-based health facilities is strong, particularly in some remote and rural areas, where they provide most of the PHC service. The church-based health facilities are managed by church organizations but are funded by the government. They provide the same service as the Government-based facilities, such as immunizations. The churches are also responsible for five out of eight nursing schools and 12 training facilities for CHW in PNG (Grundy et al., 2019). Policies for a fee-free PHC service in PNG has been suggested, but according to Grundy et al. (2019, p. 158) health facilities are still charging user fees for primary health care services. Due to the mining industry and investments in the oil and gas sector, PNG have experienced economic growth the last decade. Estimated Gross Domestic Product (GDP) per capita is at 2900 USD in 2021-numbers, increased from 500 USD in 2001 (World Bank, 2022). Although there is an increased funding for health services in most provinces, there is still insufficient funding to the rural health services, such as outreach immunization service (WHO, 2016, p. 5). In 2014, the health sector was provided 10% of the total Government spending, of which the rural health service received 3.2% (Grundy et al., 2019, p. 83).

In the Table 1 below, the current immunization schedule in PNG, implemented through SIREP plus in 2015 (Morgan et al., 2020; WHO, 2022) is listed.

Table 1: Current routine immunization schedule for children aged 0-18 months in PNG (WHO, 2022).

Vaccine	Administration	Birth	1 month	2 months	3 months	6 months	9 months	18 months
BCG		X						
HepB		X						
Pentavalent			X	X	X			
OPV			X	X	X			
IPV					X		X	
PCV			X	X	X			
MR							X	X
Vitamin A						X		X

BCG: Bacillus Calmette-Guérin. **HepB:** Hepatitis B. **Pentavalent:** Diphtheria, tetanus, pertussis, Hemophilus influenzae type b, and Hepatitis B. **OPV:** Oral Polio Vaccine. **IPV:** Inactivated Polio Vaccine (as injection), **PCV:** Pneumococcal Conjugate Vaccine. **MR:** Measles and Rubella. **All basic vaccinations include (NSO & ICF, 2019):** One dose of BCG, three doses of Pentavalent, three doses of OPV and one dose of MR.

Background

The idea for this master thesis started from experiences working as a nurse in remote areas of Papua New Guinea (PNG). Through the Australian organization “Youths With A Mission, Medical Ships Australia and Papua New Guinea” (YWAM MS), I was working together with a team of international health volunteers and local health professionals. Together with this organization, I was visiting villages in the remote parts of the Central Province in 2017 and Morobe Province in 2019. The YWAM MS (2019, pp. 14-15) has been operating in the Southern Region and the Morobe Province in PNG since 2009. The Medical Ship is one of many religious organizations working collectively with the National Department of Health, provincial health authorities, and district and local level health systems in PNG (Grundy et al., 2019). The medical ship was invited by the national government and provincial health authorities to join the local health systems in these rural and remote areas. The shared goals of the medical ship and the national and provincial health authorities is to deliver Primary Health Care (PHC) services to rural and remote

communities in partnership with local health workers (YWAM Medical Ships, 2019, p. 11). The PHC teams of the Medical Ship travels from the “motherships” with small boats to reach remote villages around the coastal line. Some villages are also reached by outreaches on foot or supported by helicopter (YWAM Medical Ships, 2019). The teams involve local health workers and international professional volunteers, such as doctors, nurses, midwives, and other medical professions. Main aspects of the PHC teams are treating infections, wound care, malaria diagnostics and treatment, screening for tuberculosis, family planning, antenatal care, and immunizations for children under the age of five (YWAM Medical Ships, 2019, p. 28). As a nurse, one of my primary tasks was the immunization of children up to school age. In the 2019 (before the Covid-19 pandemic), 23.400 patients from “hard-to reach” locations in PNGs Southern Region and Morobe Province were receiving PHC services from the YWAM MS cooperation. In the same area, a total of 31.561 single childhood immunizations were administered (the children can receive up to 4 vaccines per session) (YWAM Medical Ships, 2019, pp. 28-35).

Based on my experiences from working in this setting, the members of the communities were positive to the immunization program. Local health workers (nurses especially) had spread the word about the service in advance of our arrival, and many caregivers were present with their children on the day of the PHC session. We had some short presentations and opened for questions in advance of the service, but this presentation was made in English, with pictures and texts in Tok Pisin (official language of PNG). The days providing PHC services was busy, with few opportunities to ask the caregivers about their output of the presentation and their thoughts about the service. I knew that there was a high degree of illiteracy in these communities, so I was wondering about the actual awareness for the childhood immunization program. Children of all ages were present in the clinic, and we could observe a vast diversity in the immunization coverage in the different villages. In PNG Child Health Books are used for health related documentation, often given to caregivers if the child is born in a health facility or given during the child’s first visit to a health facility (UNICEF, 2015). Some children we visited were up to date on many, or all of their immunizations according to their Child Health Books. Other children had no recordings for earlier immunizations, only mother’s recall or scars from the BCG-vaccine (this vaccine is given intracutaneously, often leaves a specific scar that

can be recognized). My travels to PNG, both in 2017 and in 2019, made me curious about this special and fascinating country. I was curious about the actual immunization coverage, especially in the rural and remote areas that we were visiting. I was wondering about which strengths and limitations the child immunization program met in these areas, and which methods the local health workers used to bring awareness to the public.

The initial idea for this thesis was to interview the local health workers through focus groups about their work to bring awareness about immunizations, and their interpretations about the public's general attitude towards this program. To arrange this, I needed help from the networks of YWAM to get in touch with the local health workers. Due to the Covid-19 pandemic and following a massive workload to an already fragile health service, this was difficult to arrange. I still wanted to investigate the routine childhood immunization program in rural and remote parts of PNG. With this standardized immunization program, performance can be compared and experience from the implementation can be shared. Findings of the immunization program performance in rural and remote parts of PNG will be of interest both in PNG and in other countries and regions with similar and unique challenges in hard-to-reach populations.

Research topic and research question

My main interest was to understand challenges with the implementation of the immunization service in the remote and rural parts of PNG, both from the delivering side, and the user/caregiver side of the health service. On the basis of the situation explained above, the following research questions will be explored:

- Which factors influence a sustainable immunization service at the Schouten Islands?
- Why are the children in the communities at the Schouten Islands particularly hard-to-reach with immunizations?

I will use the real, but anonymized community at the Schouten Islands when discussing the childhood immunization program in this kind of environment in PNG. This master project is a qualitative literature-based study, using literature on the immunization program performance in rural and remote parts of PNG to understand my research topic in light of the framework from Bourke et al. (2012). The literature consist of structural quantitative surveys and reports (Grundy et al., 2019; NSO & ICF, 2019; Toikilik et al., 2010), and available

qualitative literature on a provincial-, district- and local level (Field et al., 2018; Morgan et al., 2020; UNICEF, 2015).

2.0 Theory – Health services in a rural remote community

Implementing health related policies, like the immunization program and different means to strengthen the performance of this program in different societies, needs an understanding of the social relations and structures in these societies. Given the wide disparities of communities and cultures in rural remote PNG, I was looking for a theoretically understanding of the implementation of health-related services in different rural and remote settings. Because of this lack of knowledge, I needed to create analogies. As rural and remote communities are present in other places in the world, research on such communities could be used to analyse the communities in PNG. Based on international research on health-related interventions in rural and remote areas, and the structuration theory of Anthony Giddens, Bourke et al. (2012) developed a conceptual framework of rural and remote health. This framework was developed to provide health workers, health managers, researchers, and students an understanding of the remote and rural context of their work. Based on research from the rural health community, the framework was initially developed for rural health in Australia, but given the diversity of the rural and remote context, the concepts of the framework should be applicable in other remote and rural places in the world (Bourke et al., 2012). I will use this framework when analyzing factors that influence the immunization program performance at the Schouten Islands.

Framework for rural health

Rural and remote health is in Bourke et al. (2012b, p. 492) referred to as:

“...not only the health status of individuals and communities in rural and remote areas, but also the organisational, social and cultural arrangements that create the health of individuals and communities in rural and remote areas. This includes individual actions, the service provided, social networks and support, and local cultures”.

The caregiver’s utilization of the immunization service is based on the individual action (choice) to utilize the service, but this choice is also based on the service provided, support from the social network and the health-related culture of the society. When the accessibility of the service declines (closure of the health center in the Schouten Islands), it becomes

harder for the caregivers to utilize the service. If the community has developed a mistrust to the providers of the service, this will also influence the choice of the actors (caregivers). The framework explains through structuration theory how rural health can be manifested in geographical isolated places, but also be a product of connections between actions in the remote and rural area with the macro level policies, health systems, and other broader social structures. The rural health outcome is the product of interactions between the isolated concept which is presented below.

a. Geographical isolation

Geographical isolation is naturally a key feature in a rural and remote context. This concept refers to the isolation and proximity to other places, which in turn affects the accessibility of health services for the demanders and other health workers for the providers. There is no specific definition of the boundaries of what is rural or remote in the framework. Distance, travel time, travel form, access to health professionals within the community, and which services that are provided in the nearest community, are all relevant aspects when considering the health responses in a specific community. Particularly important in the framework is that “Geographical isolation embraces location by virtue of where a particular place is relative to others without homogenizing or assuming sameness” (Bourke et al., 2012, p. 499). We cannot understand the concept of geographical isolation without the context of the community’s location. People at the Schouten Islands have to travel with boats on open water to their nearest health center. This is something else than traveling the same distance on trails in the Highlands. Considerations mentioned above are made differently for remote communities in the Highlands than remote island communities, making the geographical isolation and the access to their local health responses different. Geographical isolation becomes more problematic within more specialized health interventions. For the immunization program, which can be conducted in a village aid post or through an outreach patrol, with relatively few health professionals needed, the problems with geographical isolation could be more easily targeted.

b. The rural locale

According to Bourke et al. (2012, p. 499), it is a general understanding that there is an interrelationship between place and health. The complex interactions between health

services, health behaviors and needs are the results of social processes within the rural locale and its connection with others. Certain behaviors or attitudes towards health-related questions, for example utilization of the immunization program, are produced over time by the interplay of social processes within the community and the community's connection with others. Reproduction of certain behaviors, for example not utilizing the immunization program, can be constraining for the rural locale, resulting in inequalities in health. Issues with harassment towards health workers mentioned in the introduction, resulted in health workers leaving their station, which in turn led to closure of aid posts and less accessible service for the demanders. Bourke et al. (2012, p. 499) mentions conversations, individual behavior, actions of community groups, network between individuals and the information that is shared, and the power relations within the community, as social interactions creating the rural locale. These interactions will over time, result in distinct local norms that shape the actions of the residents. The social relations in the rural locale are also infiltrated by forces from the broader social community. Such as social relations to non-local people (stories from other communities), historic events (earlier experience with the immunization service) and social hierarchies (community leaders). Remote communities in PNG tends to be very isolated, with little or no contact with their surroundings. Strong cultural and traditional beliefs may have been produced/reproduced and reinforced in these communities' rural locale. Expecting the trust of the modern medicine and the immunization program, might just be too large of a request.

When implementing health-related interventions, like the immunization program, it is crucial to understand the rural locale, the social relations and interactions, important social forces that are produced and reproduced within the community and in the community's interaction with others. The specific rural locale might have another anticipation of the immunization program than the western medicine. How does the providers of the immunization program acknowledge the locals' opinions when implementing strategies for strengthening the immunization program performance in the remote and rural parts of PNG? This will be discussed later in this thesis.

c. Health responses in rural locales

According to the framework, local health responses are produced and reproduced in the rural locale to support the needs of the local community. They are shaped by the broader

health systems (protocols, funding, resources made available), and the actions of individuals and groups in the rural locale, and their perception of need (Bourke et al., 2012, p. 500). Some rural locales create innovative solutions when health services are constrained by the broader health systems, while other rural communities might struggle to meet challenges with lack of support from the broader health systems or normative beliefs in the community. The Primary Health Care (PHC) model, which the immunization service in PNG is a part of, is adopted and used in most remote and rural settings around the globe (Bourke et al., 2012). The philosophy and goal of the PHC model is to provide a service that prioritize the local context, is people-centric and involves the local community in planning. The model is committed to increase health equity for the rural community. It is important to emphasize that since all rural locales are different, the health responses in the rural locale must be understood in the context of the specific community. The local health response is essential for the immunization service. It's in the aid post, health center, or through the outreach services the immunizations are given. The service needs organizational support from, and are to some degree shaped of, the broader health systems, but they also need to be welcomed and utilized by the local communities. At the Schouten Islands the local health center is closed, the communities here are not dependent of health facilities in Angoram or Wewak to be met with their needs for immunizations.

d. Broader health systems

The local health responses are, as mentioned, shaped and sometimes constrained by the broader health systems. Political debate and decision (budgeting and funding of service), the voice of the local community and health professionals, coverage from media and other complex social structures, all influence the priority of health structures in rural health services (Bourke et al., 2012). An equitable health service is “always” stated as the main goal within macro health policies. Because of smaller populations with less political influence (power), undersupply of health workers, less investments for private health care, rural and especially remote areas tend to be disadvantaged compared to more urban areas. Rural health systems are influenced by macro health systems in terms of the macro health policies (funding and deliverance of services), national and international support (e.g., from WHO, UNICEF, SIA). The broader health systems for the community at the Schouten Island is the Local Level Government in Wewak district and the Provincial Health Authorities in East Sepik

Province. They have the responsibility for planning and delivering primary health care services in this remote area, with support from the national government and international cooperations.

e. Broader social structures

Structures at the societal level interrelates with the rural health. Bourke et al. (2012) claims that the broader social structures tend to stereotype rural areas as backward, homogenous, and political conservative, which creates an undesirable image of the rural community, especially for health professionals. The immunization coverage, as many other health outcomes, is much lower among the rural population in PNG, compared to the urban areas (NSO & ICF, 2019). Inequalities in health are often explained by the social determinants of health (Bourke et al., 2012, p. 501). How level of education, income, housing, and number of children in the household will determine individuals' attitude and utilization of health care services. At the same time, the accessibility of the social structures resulting in these determinants, will always be constrained in rural and remote communities, compared to urban areas. According to Bourke et al. (2012, p. 501), existence of structural constrains results in systematic inequalities in health in rural and remote areas. The social determinants of health act to reproduce and reinforce the constrains for the rural and remote community. Individuals and groups within the community tend act according to views from the outside communities. Health outcomes in rural and remote areas are interrelated with broader social structures on all levels. Social structures in PNG are influenced by regional and global cultures, medical paradigms and political discourse, which again influence decisions made on the community level. The broader social structures often fail to acknowledge the fact that all communities are different. In PNG this is particularly important, with the variety of different cultures, languages and rural locales. There is over 100 different language in the East Sepik Province (SIL International, 2015). People in the Schouten Islands speaks a different language than people in the mainland of East Sepik.

f. Power

The concept of power is present in all social interactions. The framework views power as a resource, to be used by individuals and groups within the community to create and maintain systems and challenge the ways they are used. Power can also be a limitation, constrained in

terms of lack of funding, support from the local community, the broader health systems or broader social structures (Bourke et al., 2012, p. 501). Power works both at the individual and the structural level and interrelates all the concepts above. The power of decisions made from Government (central, provincial or LLGs) interferes with life in the remote and rural settlements (e.g., budgeted constrains resulting in less resources available for the immunization service). Idealistic individuals or groups with powerful relations in the community might work for innovative solutions, improving the accessibility of health services in these communities (e.g. Private Partnerships models). The health center in the Schouten Island was closed because the health workers were needed in service in Wewak. The power of this decision, from the provincial health authorities and the LLG, directly influenced the accessibility of the immunization service in this remote community.

Implications of the framework: It should be emphasized that this framework was developed for the context of rural and remote areas in Australia, which unlike PNG is a high-income country, with much more resources and opportunities to invest in health-related interventions in their rural and remote areas. Nonetheless, the rural and remote health issues discussed in the framework (e.g., shortage of workforce, access to and fundings of health services, discrepancies in the rural locales) are relevant and should be applied in other rural and remote contexts. Based on the structuration theory from Giddens, the framework explains how microlevel aspect are produced and reproduced from broader social structures, and how systems at macrolevel are shaped by the interactions with individuals at the local rural and remote community level. Further, this framework helps me analyze challenges with the implementation of the immunization program from the community perspective.

Central terms used in the literature

Before describing the process of finding literature for this thesis, I will present central terms used related to the immunization program in this thesis.

EPI: Expanded Program on Immunizations. Introduced by WHO in the 1970s and implemented in lower-income countries for technical assistance and guidance with the routine immunization program. Goals of the program is more self-sufficiency and less reliance on supplementary programs (WHO, 2001).

RED/C: Reaching Every District/Community. Launched by WHO and UNICEF in 2002 as a strategy for developing a more resilient health service in remote and underserved areas. The goal was mainly to increase immunization coverage and help districts planning for the health services, making a more equitable service for the population (Vandelaer et al., 2008; WHO, 2009). Main features of the approach is the re-establishment of regular outreach services, supportive supervisions, community links with service delivery, monitoring and use of data for action, and better planning and management of human and financial resources (Vandelaer et al., 2008). The RED approach can be used at a structural level, using coverage data to estimate populations with low immunization coverage, and at the community level, guiding the local health services in reaching their populations with the immunizations.

SIREP: Special Integrated Routine EPI Strengthening Program. Introduced to PNG in 2015 with support from UNICEF and WHO to improve the immunization program and reduce reliance of the global community (Ichimura et al., 2022; Morgan et al., 2020). The program sought to improve planning and implementation based on the local conditions (as in the RED/C), as well as staff training and support from the GAVI-alliance (Morgan et al., 2020).

VPD: Vaccine Preventable Diseases. When coverage of an immunization drops below a certain level, the prevalence of the disease that the immunization is preventing will increase.

SIA: Supplementary Immunization Activity. Activated as an “emergency” response when clusters of VPDs occurs. Implemented in PNG during outbreaks of Measles in 2005 and 2014-15 and during an outbreak of Polio in 2018 (Grundy et al., 2019).

Immunization program: Throughout the literature, several terms for a certain series of immunizations are used, like a “routine immunization program”. This thesis will discuss the performance of the routine childhood immunization program in remote parts of PNG. The term “immunization program” will be used referring to vaccines in the routine childhood immunization program. This program consists of the vaccines listed in Table 1.

3.0 Method

This thesis uses the framework for rural and remote health to discuss the immunization program in a remote rural community in PNG that is hard to reach with immunization. This community is based on a community I visited working with the YWAM Medical Ship, described in the introductions as a community at the Schouten Islands. I use

this hard-to-reach community as a thought experiment to describe a certain very special, but not unlikely community in the rural remote parts of PNG. The child immunization coverage in the East Sepik Province is among the lowest in the country, meaning the children living in remote communities in this district are among the least vaccinated in the world (NSO & ICF, 2019; WHO, 2022). Being unable to do fieldwork locally because of constrictions related to the Covid-19 pandemic, I chose to work through analogies, by identifying information from the literature on different levels. There are no studies with specific ethnographic and health-behavior knowledge from the Schouten Islands, so I needed to create analogies as means to approach this island community and to provide the information I needed to analyze the immunization service through the framework from Bourke et al. (2012). The specific health outcome, which is the immunization program in this very specific community, can be seen as the result of complex interactions on both the micro community level and the macro structural level. Bourke et al. (2012) provided me a method to identify the complex interactions between these different levels, that play into the health outcome of immunization coverage among the children at the Southern Islands. I want to understand why this community in particular is among the hardest to reach with immunizations in the world. Through the lens of this framework, and findings from the included literature, I am able to discuss the complex interactions between the deliverance and the utilization of the immunization program at the Schouten Islands. This is possible because of the ethnographic and topographic difference which exists in the different regions and provinces of PNG. Therefore, I can create an analogous approach to this community based on similarities and differences with other communities. In this way, I am able to say something in general and something particular about the community at the Schouten Island. By relying on the framework of Bourke et al. (2012), I made the following categories for identifying relevant information:

- Reliable coverage data from WHO (2022) to provide information on the actual immunization coverage in the country, and through these data find differences in coverage between different regions.
- Important structures of the broader health system in the country, related to the deliverance of health services and important health policies.

- Local ethnographic material enlightening health related behavior and culture, referred to as the rural locale in the framework.

The immunization program is delivered through the primary health care services in PNG. To gain information on this service, I searched in the country profiles for PNG in the databases of WHO and UNICEF, and in the profile of the Regional Office of Western Pacific (WHO, 2016). In these databases, I filtered for publications of reports and strategies about the primary health care service in general and the immunization program in particular. I also snowballed on relevant articles, many of them referring to earlier demographic and health surveys and analysis of the immunization program performance on a provincial and local level (National Department of Health, 2020; NSO & ICF, 2019; UNICEF, 2015). Further, I searched for studies providing local ethnographic material on health behavior and culture, enlightening my rural and remote community. To avoid missing important research, I did a broad search on the immunization program in PNG. In PubMed I used the search terms “vaccines”, “vaccinations”, “immunizations” and “Papua New Guinea”, and looked through titles and abstracts for research on knowledge and attitudes towards the immunization program in rural and remote areas. The search provided 817 results in PubMed. I excluded articles before year 2000, articles about vaccines and diseases outside the immunization program (Covid-19, HPV, and Malaria), studies from urban areas, and filtered for full text available and articles in English. This search gave approximately 150 results in PubMed. I used the framework to filter for the information I needed to make sense of why this specific community of the Schouten Islands is particularly difficult to reach with immunizations, with issues related to the deliverance and utilization of this service. I imagine myself working on this isolated island, trying to make sense of the rural and remote health in this community, through Bourke’s (2012) framework. I will not fully understand the rural health of this community through this master thesis, this will require a lot more time, resources, and interaction with the local community and the local and broader health systems. But, through the framework, and identified literature, I have some examples on how this model can be used understanding the health-related context of which I, as a health worker, is trying to understand. The included articles provided information I needed about:

- Deliverance of immunizations in rural and remote areas of PNG, both on a structural (broader health systems) and a local (local health response) level.

- Articles about local health behaviors and health related culture, the rural locale of rural and remote communities in PNG.

My material consists of national, regional, and provincial immunization coverage data, national health deliverance and health policies, analysis of health service deliverance and utilization on the provincial level of the East Sepik Province, and features from the local community level in this region. I have consulted this material to get an overview of the local factors that come into play in the depressed deliverance of immunization on the Schouten Islands. I use this material to make sense of the different concepts in Lisa Bourke and her colleagues (2012) model. The included material will be presented briefly in the next section.

4.0 Results

In this section, I will first briefly present the included literature and the type of information these reports, surveys and articles provided towards an analysis of the factors influencing the deliverance of immunization program at the community level of the Schouten Islands.

Included literature

To investigate the immunization coverage in my imagined community at the Schouten Islands in PNG, I used data from the East Sepik Province surveyed in the **Papua New Guinea Demographic and Health Survey (NSO & ICF, 2019)**. The survey was conducted in PNG from 2016-18 in collaboration with the PNG National Statistical Office (NSO) and the international Inner City Fund (ICF), with fundings from the government of PNG, the Australian Government Department of Foreign Affairs and Trade, the United Nations Population Fund, and the United Nations Children's Fund (UNICEF) (NSO & ICF, 2019). The survey was the first demographic and health survey done in PNG with technical assistance and support from the ICF, which has implemented standardized demographic and health surveys in countries all over the globe (NSO & ICF, 2019). Women and men aged 15-49 who were usual members of the household, or spend the night before the survey in the selected household, were selected for individual structured interviews. Women were asked closed-ended questions about the coverage of their children's immunizations. In addition, mothers were asked to provide child health books with documented vaccines, if these were available (NSO & ICF, 2019, pp. 413-415). 4.785 women and men from the East Sepik Province were included in the survey (NSO & ICF, 2019, p. 17). The survey provided province specific

information about the estimated child immunization coverage among children aged 12-23 months in the province. In addition, the survey brought information about the population in this province and their interactions with others, such as access to education, jobs and other broader social structures.

John Grundy and his colleagues (2019) did an independent “health systems in transition” review of the health systems in PNG. Policy initiatives in progress or under development, such as the National Health Plan, 2011-2020, were also described. The review was produced by country experts in collaboration with international editors. Grundy et al. (2019) provided detailed information about the primary health care deliverance in PNG, such as structures of the supply chain and reporting systems, available resources (commodities and human resources), and availability of the service in rural and remote areas.

A team from **UNICEF (2015)** did an assessment of the immunization coverage in the East Sepik Province in PNG. The team used a modified version of the Tanahasi method, a method developed by WHO and often used in low-income countries to identify reasons for stagnation and important bottlenecks for sufficient health system coverage (Kiwauka Henriksson et al., 2017; UNICEF, 2015). In the model, health system is classified into different coverage determinations on the demander (utilization) and the provider (availability and accessibility) side of the health service. Coverage data was based on a demographic and health survey from 2006, and other estimates of immunization coverage in the country (UNICEF, 2015, p. 8). Data collection from the service delivery level was based on interviews with health workers and observations from 15 health facilities in the Angoram and Wosera Gawi districts in East Sepik Province from July to September in 2015. East Sepik is among the poor performing provinces on immunization coverage in the Momase region, with many remote and rural areas, as the Schouten Islands referred to in this master project. This source provided important area specific information on deliverance and utilization of the immunization program in the East Sepik Province. Relevant information on the geographical isolation, rural locale, local health response, power and broader health systems was discussed in this report.

Toikilik et al. (2010) did a household survey in the four different regions in PNG, with a total sample of 210 infants from each region. Immunization status was based on a household survey conducted by the National Department of Health (NDoH) in 2005, and

through vaccines recorded in the Child Health Books. For those not fully immunized (definitions defined in Toikilik et al. (2010, p. 4675)), mothers were asked to nominate the principal reason for failure in immunization. The responses for inadequate immunization was matched with reasons in a standard WHO-form and categorized into the groupings: “lack of knowledge or misconception”, “issues with the health service”, “transport and travel challenges” and “family issues” (Toikilik et al., 2010, p. 4674) . A total 783 children in 113 clusters across the four regions were surveyed. The census units were classified in rural areas (76/113), urban (22/113), and hard-to-reach communities (12/113). The Momase region, which includes East Sepik province and the Schouten Islands, included caregivers of 111 (16 clusters) children in rural areas and 7 (1 cluster) children in hard-to-reach communities. Rural clusters were defined to be outside province capitals, but located within 5 kilometers to a health center, and hard-to-reach communities were defined to be located in a rural area and more than 5 kilometers from a health center (Toikilik et al., 2010, pp. 4674-4675). This study brought information, from a national and a regional level, about the rural and remote caregivers’ anticipation of why their children were not fully immunized.

Morgan et al. (2020) did a cross-sectional assessment of the PHC immunization service (health facilities, staff and clients) performance after the implementation of SIREP in 2015, and after a massive outbreak of polio in 2018. Aims were to assess the health workers anticipation of their role in the service, and to identify opportunities for improvement of the service. The study was conducted in rural and remote areas in East New Britain (Morgan et al., 2020, p. 2). Twelve health facilities were included, nine providing fixed and tree providing outreaches service, where two of the outreach sites were on foot. Data was collected through semi-structured interviews (with staff), focus groups (with caregivers) and observations (of clinics). The data was analyzed through aspects in the SIREP framework (microplanning) and WHO standards for program monitoring (Morgan et al., 2020, p. 3). The topography of this province is different than in East Sepik, which includes more accessible fixed health facilities, only some of the populations were reached through outreach service. Although in a different community than the Schouten Islands, this study provides data on the deliverance of the immunization program from health workers perspective. The health workers perspectives on the outreach service can be translated to the service delivery at the

Schouten Islands. In addition, the focus group discussions with caregivers brought additional information of the service from their perspective.

Marie Ishida and her colleagues (2022) used data from NSO and ICF (2019) to do an analysis of the association of travel time to health facility and immunization coverage among children up to 23 months. Travel time to health facilities is often associated with incomplete immunization coverage in the rural and remote parts of PNG (Ishida et al., 2022, p. 5557). Other social-economic variables (e.g., income, mothers' education) that could influence the immunization uptake was included. This study provided quantitative data on whether travel time to a health facility was correlated to child immunization coverage in PNG.

Field et al. (2018) did a mix-methods evaluation of the health sector performance in a remote rural setting. This is one of few studies discussing the partnership, or potential partnership with the governmental health services, church-based health services and the private sector (Field et al., 2018). Other studies (Grundy et al., 2019; WHO, 2016) and the NHP 2011-2020, have reported a need of public-private partnership to increase the access of health services in the remote and rural areas. In such models, the Government are still able to take part in decision makings, but the services are provided by partners, in contrast to contracting out, where the Government takes less part in the decision making of the services (Field et al., 2018). The mining industry is the biggest industry in PNG, with many investments in rural and remote parts of the country. The Health Program referred to in Field et al. (2018) was funded by a private foundation (local mining company with significant investments in health services in the province) and implemented in 2013 as a five-year program. Field et al. (2018) did a mix-methods evaluation of this program 2-years after implementation. Data was collected through interview with health workers, and performance of health facilities before and during implementation. The catchment area of the program was along the Fly River in the Western Province. This area has similar challenges with access as areas in East Sepik, with most travels conducted with boats on the river or via foot trails from the river to the villages (Field et al., 2018, p. 926). It should be of the companies and the government interest to strengthen the health services in these areas. This study is investigating the possibility of this partnership, in the whole primary health care sector, which the immunization program is a part of.

Findings from the included literature through the framework of rural health

In this section I will present findings on the immunization program from the included literature, which I have chosen to organize along the concepts in Bourke et al. (2012). The findings will be presented with relevance to my community at the Schouten Islands.

Geographical isolation

Going to the framework, it is important to view the local structures in light of the geographical isolation of rural and remote communities (Bourke et al., 2012). After the closure of the health center and the surrounding aid posts, the community at the Schouten Islands have a considerably longer travel route to the nearest health facility in the mainland of East Sepik Province. If they are not provided outreach service from health facilities in Wewak or Angoram, they will have a travel time of several hours on open water, very exposed to various weather conditions. UNICEF (2015) reported major challenges with accessibility to immunization services in both Angoram and Wosera Gawi districts. In Angoram, the district located closest to the Schouten Islands, 8 out of 9 health facilities had not conducted immunization service at all in the last 2 months prior to the survey. Three of the health facilities had not conducted immunization services in the last 2 years. This was because of either lack of human resources, refrigerators (for keeping vaccines cold), or vaccine stock outs (UNICEF, 2015, p. 17). The main health center in Angoram had immunization session on a weekly basis, and only two catchment areas had received outreach service during the last month prior to the survey (UNICEF, 2015, p. 19). The poor accessibility for immunization service in the East Sepik Province reflects in the coverage from the National Demographic and Health survey (2016-2018). According to the survey, the coverage of all basic vaccination (descriptions mentioned above) among children aged 12-23 months were 21.8%. Only 12.2% of the children in this province received all age appropriate vaccinations (NSO & ICF, 2019, p. 176).

According to Ishida et al. (2022, p. 5559), there was a significant relationship between travel time to a health facility and the vaccination coverage among children aged 12-23 months. Children residing more than 3 hours away from a health facility had 16% less chance of completing their basic vaccinations than those living within 30 minutes away from a health facility. This study finds that there is a correlation between distance to a health facility and immunization coverage, but as the authors (2022, p. 5560) brings up in the

discussion, geographical isolation cannot explain lower immunization coverage alone. In Toikilik et al. (2010, p. 4678) the anticipated barrier to utilization of the immunization program was difficulties in reaching the health facilities, while the survey found that relatively few mothers, even in hard-to-reach areas, cited travel challenges as principal reason for immunization failure.

The Schouten Islands does not have any health centers or aid post. Despite policies in the National Health Plan (2011-2020) that each ward should have an aid post open and available, there were zero aid posts open in the East Sepik Province in 2019 (Grundy et al., 2019; National Department of Health, 2020). The SIREP approach calls for intensifying outreach service (Morgan et al., 2020). As the included studies reports, with the lack of human- and other essential resources, outreach service cannot be prioritized (Field et al., 2018; Morgan et al., 2020; UNICEF, 2015). With the long travel to health facilities that are not certain to be open, and the fragility of outreach service, the community at the Schouten Islands is clearly geographically isolated for accessing immunizations.

Rural locale

The geographical isolation of the Schouten islands is quite clear. Under the concept of rural locale, according to Bourke et al. (2012), the interaction within a community and the community's interactions with others, will produce and reproduce specific beliefs and norms. These local social norms and the reproduction of behaviors can be constraining for the community, resulting in inequities in health. The rural locale at the Schouten Islands cannot be understood through the literature. This requires interactions with and involvements of local people. But the communities' interaction with others, can say something about the production and reproduction of the rural locale. Features from the Demographic and Health Survey (NSO & ICF, 2019) provided information on the population from East Sepik Province and its interaction with others. School attendance among the children declined from around 40% among male and females at elementary and primary level, to a school attendance ratio at 11.6 % among males and 17.1% among females at secondary level (NSO & ICF, 2019, pp. 32-33). In addition, exposure to mass media and internet use was very low in the province. Employment rates are generally low in the province, where most of the labor-force have occupations within agriculture, working on

their own land (NSO & ICF, 2019). These findings indicate that the communities in East Sepik Province have little interactions with the broader social structures.

Little interaction with the broader social structures influences the rural locale. How is the knowledge and attitude towards health interventions such as the immunization program in this region? The health workers in the Angoram district (East Sepik Province) had experienced **frequent harassment and threats by the local population**, scaring them for staying in their duty station and resulting in closure of the service (UNICEF, 2015, p. 20). However, it was not mentioned in this report about reasons for these harassments, or whether they were towards health professionals or towards village health volunteers (VHV). The many closures of aid posts from the district, reported by UNICEF (2015), and the claim from National Department of Health (2020) that there were no aid posts open in the East Sepik Province in 2019, indicates problems with recruitment of Community Health Workers (CHW) and VHV in this province.

The included literature did not provide specific information about the knowledge and attitudes towards the immunization program in East Sepik Province. Findings from Toikilik et al. (2010) were from hard-to-reach areas from all regions in PNG, all with difference in their rural locale. Some of the caregivers from hard-to-reach areas implied lack of knowledge or mistrust in the immunization program. Four of the census units listed “unaware of need for immunization”, five listed “not faith in immunizations” and six census units listed “place/time of immunization unknown” as the principal reason for why their children was not fully immunized (Toikilik et al., 2010, p. 4677).

Local health response

The health center in the Schouten Islands is closed for duty. To get their immunizations, the children in this island community must travel to their nearest health center in Wewak or Angoram, or they need to be reached through outreach patrol service.

Since the health facility at the Schouten Islands is closed, the community here becomes dependent on other health facilities to be provided with immunizations for their children. The nearest health center must make plans for reaching these children with immunizations. Keeping records of catchment areas (number of children scheduled for immunizations) is a general problem in PNG. According to the National Demographic and

Health Survey from 2016-2018, birth registration in the country is almost absent, with only 13% of children under five registered with the civil authorities (NSO & ICF, 2019). Nursing officers at the health centers must make plans for the number of health workers, vials for immunization and medical equipment needed for fixed or outreach service. This is difficult without knowledge about the number of children due for immunizations. In the East Sepik Province, 4.5% (n = 655) of children under five were registered at the time of the survey (NSO & ICF, 2019, p. 27).

Some of the health facilities surveyed in UNICEF (2015) had innovative solutions for keeping record of children in their catchment area. In Kunjingini (Wosera Gawi district), they had routines during immunization sessions for asking mothers to inform missing mothers to come to the next village scheduled for immunizations. Missing mothers were also invited to come to the health facility to get their children immunized. In addition, they had list of expected children for immunizations, to be able to identify missing children more easily. If some were missing, a village health volunteer were asked to sensitize the mothers to come to the next clinic (UNICEF, 2015, p. 23). At the time of the survey for the UNICEF (2015) report, over 90% of the children in Angoram and Wosera Gawi who were immunized, were reached through outreach services (UNICEF, 2015, pp. 10-11). According to the National Department of Health's (2020) review of the National Health Plan (NHP), only 10 outreach per 1000 children were conducted in the East Sepik Province in 2019. This was a decrease from 17 outreach per 1000 children in 2015, despite policies in the NHP to increase outreach service in this province (Grundy et al., 2019).

Many health facilities had been closed for months up to years prior to the survey, leaving the children that earlier accessed these health facilities reliable on outreach service. Due to issues with availability of human resources (harassment towards health workers) and commodities (lack of vaccines and cold chain equipment), several of the health facilities that remained open had not conducted any outreach immunization services to their surrounding villages (UNICEF, 2015, p. 17).

Western Province has similar challenges as many districts in East Sepik with accessing their many remote communities. The Health Program plan was implemented in remote settings along the Fly River in the province. The program was a cooperation between the Provincial Health Office, District Health Services, church-based health facilities and a local

mining company (Field et al., 2018). This partnership model between the government, church, and the private marked, gave an increase in outreach services provided to the remote communities. In 2015, 27 outreach sessions per 1000 children were conducted in the program area (remote areas connected to the Fly River) compared to 9.3 per 1000 children prior to the program period (Field et al., 2018, p. 929). This program gave also significant increase in coverage of Pentavalent, measles and OPV (Field et al., 2018, p. 929). According to newer estimates from NDoH (2020), 7 outreaches per 1000 children were conducted in 2019 in the Western Province, a decline from 22 per 1000 children in 2015.

Many of the clinics surveyed by Morgan et al. (2020) saw relatively few children. The SIREP strategy under implementation in this district, sought to strengthen planning of catchment areas in cooperation with the local community and lay health workers (VHV). Through this cooperation, intensify outreach clinics and engagement with the local community (health education). According to (Morgan et al., 2020, p. 7) involvement of the local community in planning of immunization services has improved deliverance in similar setting in sub-Saharan Africa.

Broader health system

The immunization coverage in the Schouten Islands is interrelated with the broader health systems (Bourke et al., 2012, p. 500). The provincial and local level governments are, by law, mandated to provide Primary Health Care (PHC) services, including immunizations, for their citizens. How the service is coordinated, delivered and funded, is decided by each provincial government (Grundy et al., 2019, p. 37). With this structure, many provincial and local level health authorities struggle with making available resources for the PHC service in their province. With less than a third of provinces using electronic systems for data collection (children immunized and stock-records for vaccines), the reporting system in PNG in general is fragile. Health workers inoculating children on outreach patrols brings tally sheets back to their health facility, where they are summarized in monthly reports. These reports are opportunistically brought to the district health officer, or directly to the provincial health authorities (Grundy et al., 2019, pp. 65-66). From the provincial office, the reports, including number of children immunized and needs of supplies, are sometimes reviewed (no documented procedures for reviewing) and sent to the national level (Grundy et al., 2019, p. 66).

In East Sepik, insufficient fundings have resulted in stock-out of vaccines, lack of cold chain equipment, lack of human resources and eventually closure of many health facilities. According to the report from UNICEF (2015, p. 21) there were important lack of coordination between local level governments (district health manager) and the different health facilities. The district health manager in the two districts had little information about the immunization program performance at the community level. Coverage data was reported directly from health facilities to the provincial level. According to local leaders, fundings from government level to provincial level did not reach the districts and their health facilities (UNICEF, 2015, p. 31).

Broader health systems are interrelated with the other concepts in this framework. The local health response (outreach service) on the Schouten Islands is dependent on the broader health systems for fundings and support. Broader health systems are dependent on reports and feedbacks from the local health response, and utilization of the service from users of the service. Governmental cooperation with local health workers, lay health workers at the Schouten Islands, and other people within the remote community is essential.

Broader social structures

The broader social structures say something about views from the society outside the remote and rural community. How does the broader social structures view the communities at the Schouten Islands? What knowledge does the broader social structures have about the culture, the history, the people, and the social life at these isolated islands? The views from the broader social structures influence outcomes of the immunization program at the Schouten Islands. Bourke et al. (2012) talks about how understanding, perceptions and myths about the rural life can impact the recruitment of health workers.

To immunize the children at the Schouten Islands, health workers are needed. There is no accurate data on available health workers in PNG. Based on estimates, the country is in major lack of health workers, with ratios at 5.3 nurses/midwives per 10 000 people, well below other countries in the region. The overall health workforce consists of 52% community health workers (CHW) and 40% nurses. Despite 87% of the population being rural, only 48% of total health staff are working in the rural areas (Grundy et al., 2019, pp. 106-109). The situation does not seem to improve over the coming years, with over half of the workforce in the rural areas expected to retire within the next decade, and problems

with migration of health workers to other sectors and overseas (Grundy et al., 2019, p. 111). To facilitate immunization service, especially outreach immunization service, certain experience in management is required. According to UNICEF (2015, p. 17), 69% of the health workers in Angoram and 75% in Wosera Gawi were CHW, many of them missing qualifications and training on the management of the immunization program. Five of the fifteen health facilities included, did not have any educated nurses, with CHWs functioning as leaders of the facility.

Lay health workers, in PNG known as Village Health Volunteers (VHV) have strong traditions in PNG in general and East Sepik in particular (Grundy et al., 2019, p. 117). The training programme for VHV have met limited investment since early 2000s. Still, lay health workers provide basic first aid and health education in the communities (Grundy et al., 2019, p. 177).

Power

The community on the Schouten Islands will be both constrained and empowered from decisions made at the structural level. According to Grundy et al. (2019, p. 110), there is no policy for a minimal availability of health workers. Provincial governments are responsible for the recruiting and distribution of health workers, making huge disparities within and in between provinces. Power of decisions made at the provincial level, influence the accessibility of the immunization service for the children at the Schouten Islands.

The community-based mining company foundation in the Fly districts in Western Province developed a partnership model governmental- and church-based health services to increase access to primary health care service for their population Field et al. (2018). Development of primary health care services through partnerships with private markets, church-based health organizations or other non-governmental organizations requires cooperation and empowerment from local individuals and groups. These individuals and groups will also need the right connections and resources to develop such services. In East New Britain, local health staff and community members were invited to describe local strengths and suggest improvements of the immunization program (Morgan et al., 2020). More personnel, reliable vaccine-supply, outreach transport support, more community engagement, including male caregivers was listed from the staff. The community listed a more frequent on demand service, specially outreach service (Morgan et al., 2020, p. 6).

All these aspects, presented through the concepts of the framework for rural and remote health, will influence the immunization program in the Schouten Islands. These aspects will be summarized and discussed in the section below.

5.0 Discussion

The issue that initially reflects as the most prominent for the communities at the Schouten Islands is the accessibility of the immunization service. Could intensification of outreach service increase immunization coverage at these isolated islands? The framework from Bourke et al. (2012) brings important considerations when developing this service. Rural and remote health is something more than just providing health care in a different location. Specific reasons, in UNICEF (2015) defined as bottlenecks, for inadequate immunization coverage cannot be used separately to explain the problem. The geographical isolation of the Schouten Islands, and their problems with accessibility are not alone explaining the low immunization coverage in this specific area. Prior to the study from Toikilik et al. (2010, p. 4678) the anticipated barrier to utilization of the immunization program was difficulties in reaching the health facilities. This survey found that relatively few mothers, even in remote areas, cited travel challenges as principal reason for immunization failure. Other concerns, such as lack of knowledge about the immunization session, issues related to the health service or family concerns were more reported among these mothers.

The health workers cooperation with local people and reception of the health service in the rural locale are potential barriers for accessing the immunization service. Some districts in East Sepik had experienced harassment from the local community towards health workers (UNICEF, 2015). The report did not specify reasons for this harassment. Social structures leading to these social actions is often various and complex. Maybe individuals or groups in these communities have bad experiences with the health workers providing the service? Or perhaps normative beliefs, or cultural and religious understandings within the rural locale did not relate to the ways health services was delivered. These harassments may also be alleged from relatively few people within the community, depressing the accessibility for others. This example illustrates that problems with accessibility cannot be explained isolated as a problem at the delivering or the demanding side of the service. Increasing

outreach service or opening a new community health post at the Schouten Islands is only a part of the towards higher immunization coverage.

Cooperation with local community is something that is emphasized in global strategies from WHO and national strategies in PNG. Both the National Department of Health and WHO (2021) calls for a “back-to-basic approach” with the primary focus of strengthening the primary health care service in the rural and remote areas. According to Grundy et al. (2019, p. 177) such approach is included in national strategies for PNG: “A back-to-basic approach that fully accounts for contextual realities at the local levels should be extended to policy decisions”. Key of the national strategies (NHP 2011-2020) was to increase outreach services, improve reliability and management of supplies, and establish new community health posts (Grundy et al., 2019, p. 141). Some results have been seen in rural and remote areas after these strategies. The Rural Primary Health Service Delivery Project was lanced from 2011-2019 from NDoH and partners to increase access to PHC services in rural and remote areas. East Sepik with Wewak and Maprik district was included in this project. 32 community health posts (CHP), as replacement for the aid posts, were planned for implementation across 16 district (Grundy et al., 2019, p. 101). According to this projects own report, none of the CHP in East Sepik were finished in April 2018, but four CHP were expected to be completed within December 2018 (Maharjan, 2018). I have not been able to find any reports about the realization of these new CHP. Furthermore, new CHP will not automatically increase the immunization coverage among children at the Schouten Islands.

To achieve the goals of the back-to-basic approach, actions at many different levels is required. Health management at national-, provincial- and district level needs to be strengthened. Recruitment and investment in human resources for health needs to be increased. The problem, as seen throughout this thesis, is to translate these plans into to actions in the local communities. If the CHP are finished and available for children at the Schouten Islands, how is the service managed? Plans for and organizations of outreach services will still be needed for these children. In the Immunization Agenda for 2030 (2021, p. 33) terms such as people-centered, country-owned and partnership-based immunization program is used describing the principles for an immunization service that is accessible for all people. The agenda suggests partnership with public and private organization to strengthen

the deliverance, as seen with the cooperations with church-based health organizations in PNG. But most of all, the service needs to be designed and tailored meeting the needs and the social and cultural preferences of the local community (WHO, 2021). Involvement of the local community in planning for immunization service is also emphasized in the national SIREP approach. In Morgan et al. (2020), both health workers and community members were invited to discuss the deliverance of immunization service and the implementation of this new approach. Health workers and community members were invited to suggest solutions for strengthening the service. Health workers sought, among other suggestions, more community engagement. Caregivers sought a more frequent and on-demand service, especially outreach service. Mothers also called for more integration of other Primary Health Care (PHC) service in the immunization program (Morgan et al., 2020, p. 6). This discussion was conducted in East New Britain. The rural locale, local health response, broader health systems and power relations are different here from the community at the Schouten Islands. But there are also remote communities in East New Britain. And the study shows that involvement of the local community is possible. Morgan et al. (2020) is one of few studies involving the local community in immunization service planning in PNG. This should be possible in other remote areas. People from the Schouten Islands must be invited to meet with local health workers, nursing officers at the nearest health facilities, member of the local level government and members from the provincial level (provincial health authorities) to suggest solutions for reaching the children at the Schouten Islands with immunizations.

When talking about inviting the local community in planning, communication with areas such as the Schouten Islands is difficult to maintain. There are over 100 different languages only in East Sepik (SIL International, 2015). The population at the Schouten Islands speaks a different language than people from districts in both Angoram and Wewak. This is what makes the different rural and remote communities in PNG so special. Local health workers from the same district as the Schouten Islands have a different native speech than the population they are serving. For the population at Schouten Islands, their local health workers might feel like total strangers.

How should information about the immunization services, either fixed or outreach, be delivered to the caregivers at the Schouten Islands? The community's general interaction with others is low. In East Sepik, 33% of women and 55% of men possess a mobile phone

(NSO & ICF, 2019, pp. 277-278). Less than half of the population in East Sepik Province can read a whole sentence (NSO & ICF, 2019, pp. 45-46). Providing information about the immunization program becomes difficult for the health workers in Angoram and Wewak. East Sepik Province have a history of strong recruitment and training of Village Health Volunteers (VHV), providing much help for the professional health workers in the rural and remote areas (Grundy et al., 2019, p. 117). The VHV, having their base within the community, are essential for the primary health care services in rural and remote areas. In this way, VHV at the Schouten Islands can communicate with Community Health Workers (CHW) and nurses in the health centers. Through VHV, information about the immunization program can be provided to the caregivers and they can be sensitized to utilize the service. Information of which clinics that are open for service, and when the next outreach patrol is planned is essential for the caregivers. VHV may also provide the health workers at the health centers in Wewak and Angoram critical information about catchment areas (number of children due for immunizations) and guide them in planning for outreach patrols. Maybe the closed aid post at the Schouten Islands could be used as an outreach site? Connections, through VHV or other individuals or groups within the community is essential for the health workers. Someone who speaks the native language and is trusted within the community. My experience from working with the YWAM Medical Ship, was that the population in the villages was informed about the service through the networks of local health workers in advance of our arrival. This communication had also reached out to surrounding villages. Some of the people we met during the PHC service had travel for days on foot to take use of the service. As mentioned earlier in this thesis, maintaining communications with local communities is not always easy. The harassment towards health workers reported from Angoram district could be present in different rural locales (Bourke et al., 2012; UNICEF, 2015), and communications with different communities must be based on the specific community's premises.

Planning for either fixed or outreach service needs financial resources. If children at the Schouten Islands should be reached with immunizations through outreach patrols, enough human resources and essential commodities is needed. The health center providing the outreach service must plan for number of health workers needed (enough to keep the health facility open for other patients), coolers for keeping vaccines within right

temperatures, and boats and enough fuel for transport. Both health workers from the Fly districts (Field et al., 2018) and from East New Britain Province (Morgan et al., 2020) reported issues with too few health workers and fuel needed for transport as barriers to outreach service. Outreach service was also neglected when missing resources in the Angoram and Wosera Gawi districts, even though superior amount of immunized children were reach through outreach patrols (UNICEF, 2015). With the current health deliverance structure in PNG, the LLGs are expected to develop plans according to the needs of their districts, but fundings for the realization of these needs are of the responsibility of the NDoH (Grundy et al., 2019, p. 51). But there are few available resources for making these plans at the LLG level, and few direct links with the NDoH to make budgets for these plans (Grundy et al., 2019, p. 57). In the Angoram district there were no team around the district health manager, no coordination meetings and no health program and performance reviews with the health facilities (UNICEF, 2015, p. 21). There are few direct links from the local community (catchment population at the Schouten Islands) through the local health workers in the health facilities, to the district health managers, the provincial health authorities and the NDoH. Without these links, it is difficult to plan for a sustainable immunization service at the Schouten Islands. According to Grundy et al. (2019, pp. 52-53) there is an ongoing process for a more direct linkage for the communication between the different levels, from the local community level up to the national health authorities. Developing good systems for communication with reliable data on catchment population for immunizations at district level, number of vaccines and equipment needed, is essential in this communication (WHO, 2021). More ICT (information and communication technology) solutions for communications in the health services is included in national health strategies, and under implementation in some provinces in PNG (Grundy et al., 2019, p. 68). The YWAM Medical Ship uses electronic tablets for their PHC services. Vaccines given and children immunized are registered on these tablets, and vaccine stock-records updates automatically. These data are saved and can be shared with district- and provincial health managers. Through cooperations with governmental-, national- and international stakeholders, it should be possible to implement and provide support for such electronic solutions in health facilities in East Sepik Province.

When it comes to cooperation with local, national and international governmental and non-government organizations, it is important that this cooperation is on the premises

of the local community. The YWAM Medical Ship was invited to cooperate with provincial health authorities to come and serve in the selected Southern Region and Morobe Province (YWAM Medical Ships, 2019, p. 11). Remote villages selected for service were also based on cooperation with local leaders. Recently, the organization has developed operations in partnership with remote areas in the Fly districts in Western Province (YWAM Medical Ships, 2019, p. 17). This kind of cooperation and partnership require communication channels into the local communities. This is more challenging in some areas, depending on all the aspect discussed in this thesis. Power is an important concept in the framework (Bourke et al., 2012). Local groups or individuals at the Schouten Island have the power to demand their needs of immunizations to the nearest and broader health systems. But they are dependent of communication channels to reach and be met by the broader structures, being the health facilities in East Sepik, provincial health authorities, NDoH, national and international non-governmental organizations.

To increase health service and immunization coverage in remote areas, the NDoH suggests invitation of private health care providers to deliver PHC within the communities (Grundy et al., 2019, p. 116). The Health Program plan implemented in the remote areas in the Fly districts in Western Province was a partnership with private local mining company, provincial health authorities, district health services, and evangelic/catholic health services (Field et al., 2018). There program led to many investments in rehabilitation of health facilities, and improvement in supplies for vaccines and commodities. Supervision and training were provided the health workers. According to the mid-term evaluation, the program gave an increase in outreach service and coverage of immunizations (Field et al., 2018, pp. 928-929). Involvement of the local community in the planning of this health program was not specified in the program plan, and health workers cited lack of community support and cultural barriers as preventive means for accessing the service (Field et al., 2018, p. 930). The Health Program was planned to be implemented in these districts from 2013 to 2018. The paper from Field et al. (2018) is a mid-term evaluation of the program. I have not found any end-term evaluations of PHC service or the immunization program in this district after the implementation period. According to 2019-numbers, there was a decrease in number of outreach clinics held per 1000 children at provincial level (National Department of Health, 2020, p. 15). Partnerships models with governmental and non-governmental

organizations, in addition to church-based health services might increase accessibility of PHC services in remote areas of PNG. This implies that there is a market for such services, and that the service provided connects with the specific rural remote community and the health workers providing the service.

Several measurements and indicators are used for immunization program performance. Prevalence of measles disease or coverage of the MR-vaccine is used measuring availability of service (WHO, 2021). Coverage of DTP3 or in PNG the Pentavalent 3 vaccine, is often used as a measure for utilization of the service. If there is a drop-out rate above 10% between Pentavalent 1 and Pentavalent 3, the service is considered as poorly utilized by the population (WHO, 2009, 2021). Such measurements are not always accurate, particularly at a remote community level. Health facilities in rural and remote areas of PNG are experiencing major difficulties in the supply chain of vaccines, with frequent stock-outs, both on a local health facility level, and from larger stocks at provincial level (Grundy et al., 2019). According to reports from the health facilities in Angoram and Wosera Gawi (UNICEF, 2015, p. 15), there were great differences in coverage of OPV3 and Pentavalent 3, vaccines that should be given at the same time (see immunization schedule in the introduction). Children brought to these health facilities were not immunized with Pentavalent 3 because of problems at the deliverance side of this health service. Not because of the caregiver's lack of knowledge or misconceptions towards the immunization program.

There are many quantitative studies finding significant correlations between certain social determinants and immunization coverage, also in recent studies from PNG (Budu et al., 2020). These determinants are often used to explain health-related behaviors. Most common presented correlations with the immunization program are caregivers' level of education, wealth quintile, number of children in the household, and living arrangements (Bourke et al., 2012; Budu et al., 2020; NSO & ICF, 2019, p. 35). Findings from such studies might strengthen evidence for inequities in immunization coverage and guide for strategies on a structural level. Investigating the reasons of low immunization coverage from a community level, the connections between the social determinants of health and the immunization coverage becomes a too simple explanation. As with the health services, the accessibility to the social structures resulting in social determinants (education, labor, social networks), will be constricted in remote areas of PNG. The school attendance ratio in the

East Sepik Province is low in all ages, but declines further from secondary level (grades 9-12). Median completed years of school among male and females (caregivers) in the East Sepik Province is currently at 3.7 years and 2.2 years respectively (NSO & ICF, 2019, pp. 28-29). These numbers implies that the low educational level in the province is a structural problem. If people in these areas are to improve health knowledge through increased educational level, accessibility of education is one of the problems that must be targeted.

There are few studies available on knowledge and attitudes for caregivers towards the immunization programme in PNG. Specially in remote areas. Toikilik et al. (2010, p. 4674) did interviews with mothers from rural and remote (hard-to-reach) areas from the four different regions, but relatively few from remote areas. Reasons for their child's immunization failure was listed, but not investigated further. Qualitative studies with rural and remote caregivers provide information about certain attitudes and opinions about this health-related topic in rural and remote areas in general. But, the core of framework for rural and remote health (Bourke et al., 2012) is that all these communities are different. Knowledge and attitudes towards this program in general, cannot isolated be used to explain immunization coverage rural and remote communities. Because of the major differences between remote populations, especially with the cultural and topographic diversity of PNG, people living in the Schouten Islands cannot be compared with people living in remote villages in the Highlands. General structural issues and ways to address them could be exchanged between these two very different locations, but people's knowledge and attitude in the Western Province cannot be translated to the Schouten Island communities. To understand reasons for inadequate coverage in a remote area in PNG, knowledge and understanding from that specific area is needed. Given the high degree of literacy and the many different languages in the country, such studies might be challenging to conduct.

Problems related to health service delivery were quite common in the East Sepik Province, at least according to the UNICEF (2015) report. With the lack of human resources in PNG, there is also lack of health workers with education and training in management of health facilities. In Angoram and Wosera Gawi Management training is included in education for nurses, which often managing health centers and community health posts in PNG (Grundy et al., 2019). Following years of Government underfunding for human resources for health, PNG is facing a human resource for health crisis, where rural and remote areas are

specially in need (Grundy et al., 2019, p. 100). According to Bourke et al. (2012, p. 498) professional health workers in general views rural and remote areas as “undesirable” because of heavy workload and few professional colleagues to lean upon. This opinion has not been found in the literature for this thesis.

Many government institutions for training health workers have been closed in PNG since the 1990s. There are currently three government universities and four church-based colleges providing a three-year Diploma in Nursing and a four-year Bachelor’s program in nursing. In addition, there is newly implemented a bachelor degree in rural health (Grundy et al., 2019, p. 114). For CHWs, there is 12 church-based schools providing a 2-year certificate program. There is limited capacity for increase school-intake to meet the lack of health workers, due to infrastructure shortages and insufficient teaching positions and teaching aids (Grundy et al., 2019, p. 113).

Implications about the framework: The framework for rural and remote health use the umbrella term “rural health” for both rural and remote health (Bourke et al., 2012). It is emphasized in the framework that since all these communities are different, this general term is used including all rural, remote and isolated areas. But there are some aspects of the framework which is difficult to relate to the remote communities. The local health response is in many remote settings, especially in remote parts of PNG, such as the Schouten Islands, almost absent. In this thesis the nearest health centers in Wewak or Angoram and the potential outreach service to the Schouten Islands was presented as the local health response. In reality, this community do not have any local health response at all. Lay health workers (VHV) in the communities might provide emergency services, and function as a point of communication to broader health *responses* at the mainland. But without an aid post, community health posts, or health center, the children on these islands do not access an immunization service. The immunization service must be brought to them. A term more suitable for the health response in this remote setting, could be defined as the *nearest* health response. Otherwise, the framework has a holistic people- and community-centered approach to understand health outcomes according to the environmental context. This method is very well suited for the complexity of the rural and remote communities of Papua New Guinea.

As the situation at the Schouten Islands is now, with a closed health center, the most suitable way of making the immunization program accessible for children is through outreach service. Outreach immunization services cannot be provided on a daily basis, such as the fixed service at the health center. In the SIREP approach increasing outreach service is one of the core strategies (Morgan et al., 2020; UNICEF, 2015), but still this service tend to be out secondary when missing resources. Morgan et al. (2020) found that interview staff mentioned lack of staff as barrier to increase outreach service, while the observations of the health centers found that the staff was seeing relatively few clients. If outreach immunization service should be delivered to the Schouten Islands on a quarterly basis (in line with the strategies in SIREP), this service cannot be constrained. Lack of health workers, stock-out of vaccines, missing cold chain equipment, lack of fuel for the boat bringing the health workers to the Schouten Islands, must be avoided in order to deliver an equitable service for children at the Schouten Islands.

6.0 Summary and implications

The framework provided me a method for a broad analysis of different factors influencing the immunization coverage at the community level at the remote area of the Schouten Islands. In order to provide the children at the Schouten Islands immunizations, there has to be a Primary Health Care (PHC) service that is available and accessible. Still, as discussed throughout this thesis with the framework for rural and remote health, this is not the entire solution. Increasing outreach service and build new community health centers will not alone increase coverage among children in remote areas. At least not in the long run. To provide a sustainable immunization service for the children at the Schouten Islands, several aspects need to be targeted. Organization, planning and deliverance of the immunization program must involve the local community. Coordination and cooperation on different levels, from the local community to the global society is needed to provide a sustainable service for these children. This is emphasized in the literature (Grundy et al., 2019; UNICEF, 2015; WHO, 2021), but it is difficult to achieve. Plans and strategies are implemented in national policies and targeted projects are being developed (Field et al., 2018; Grundy et al., 2019). On the way towards a sustainable immunization service for the children in remote areas, such as the Schouten Islands, more qualitative studies at the community level are

needed. Studies and reports bringing publicity about the inadequate coverage, as well as political will and interest, is needed for this and other rural and remote communities.

Strength and limitations:

This study provides a qualitative analysis of the immunization program in a remote setting in PNG, using the framework for rural and remote health from Bourke et al. (2012). I have not identified other studies using this model for a holistic, people-centered health care approach in this particular setting. The model is in line with the strategies for the PHC approach and implementation of this in rural and remote settings (Grundy et al., 2019; WHO, 2021).

The search for literature could be extended to more databases, and different search terms could include more studies from the field. Given PNGs unique complexity of cultures, languages and different remote settings, and that I was using analogies as my method, I could have included literature from other *similar* remote settings. There are other models for analyzing community oriented PHC. A review of such frameworks was recently published (Buse et al., 2022). Other people- and community-oriented frameworks could provide a different aspect to this thesis.

Ethical considerations:

This study use published literature to discuss the immunization program on an undefined island among the Schouten Island. The community described here is based on a community I have visited with the YWAM Medical Ship, but it is not the same. The Demographic and Health Survey from 2016-2018 (NSO & ICF, 2019) gave me demographic and health-related data from East Sepik Province but this data was based on the published data from the survey.

7.0 References

- Bourke, L., Humphreys, J. S., Wakerman, J., & Taylor, J. (2012). Understanding rural and remote health: a framework for analysis in Australia. *Health Place, 18*(3), 496-503.
<https://doi.org/10.1016/j.healthplace.2012.02.009>
- Budu, E., Seidu, A.-A., Opoku Ahinkorah, B., Agbaglo, E., Kobina Dadzie, L., & Yaya, S. (2020). Determinants of complete immunizations coverage among children aged 12–23 months in Papua New Guinea. *Children and Youth Services Review, 118*, 105394.
<https://doi.org/https://doi.org/10.1016/j.childyouth.2020.105394>
- Buse, C. G., Allison, S., Cole, D. C., Fumerton, R., Parkes, M. W., & Woollard, R. F. (2022). Patient- and Community-Oriented Primary Care Approaches for Health in Rural, Remote and Resource-Dependent Places: Insights for Eco-Social Praxis. *Front Public Health, 10*, 867397.
<https://doi.org/10.3389/fpubh.2022.867397>
- Field, E., Abo, D., Samiak, L., Vila, M., Dove, G., Rosewell, A., & Nathan, S. (2018). A Partnership Model for Improving Service Delivery in Remote Papua New Guinea: A Mixed Methods Evaluation. *Int J Health Policy Manag, 7*(10), 923-933.
<https://doi.org/10.15171/ijhpm.2018.50>
- Grundy, J., Dakulala, P., Wai, K., Maalsen, A., & Whittaker, M. (2019). *Independent State of Papua New Guinea Health System Review*. World Health Organization. Regional Office for South-East Asia. <https://apps.who.int/iris/handle/10665/280088>
- Ichimura, Y., Yamauchi, M., Yoshida, N., Miyano, S., Komada, K., Thandar, M. M., Tiwara, S., Mita, T., Hombhanje, F. W., Mori, Y., Takeda, M., & Hachiya, M. (2022). Effectiveness of immunization activities on measles and rubella immunity among individuals in East Sepik, Papua New Guinea: A cross-sectional study. *IJID Regions, 3*, 84-88.
<https://doi.org/https://doi.org/10.1016/j.ijregi.2022.03.001>
- Ishida, M., Mulou, N., & Mahal, A. (2022). Travel time to health facilities in Papua New Guinea: Implications for coverage and equity in child vaccinations. *Vaccine, 40*(38), 5556-5561.
<https://doi.org/10.1016/j.vaccine.2022.07.060>
- Kiwanuka Henriksson, D., Fredriksson, M., Waiswa, P., Selling, K., & Swartling Peterson, S. (2017). Bottleneck analysis at district level to illustrate gaps within the district health system in Uganda. *Global Health Action, 10*(1), 1327256.
<https://doi.org/10.1080/16549716.2017.1327256>
- Maharjan, N. (2018). *Rural Primary Health Service Delivery Project*
<https://www.rphsdp.org.pg/resources.php>
- Morgan, C. J., Saweri, O. P. M., Larme, N., Peach, E., Melepia, P., Au, L., Scoullar, M. J. L., Reza, M. S., Vallely, L. M., McPake, B. I., & Beeson, J. G. (2020). Strengthening routine immunization in Papua New Guinea: a cross-sectional provincial assessment of front-line services. *BMC Public Health, 20*(1), 100. <https://doi.org/10.1186/s12889-020-8172-4>
- National Department of Health, P. N. G. (2020). *2019 Sector Performance Annual Review Assessment of Sector Performance* <https://www.health.gov.pg/subindex.php?acts=1>
- NSO, & ICF. (2019). *Papua New Guinea Demographic and Health Survey 2016-18*.
<https://www.dhsprogram.com/pubs/pdf/FR364/FR364.pdf>
- On the World Map. (2021). *Papua New Guinea*. OnTheWorldMap.
<https://ontheworldmap.com/papua-new-guinea/map-of-papua-new-guinea-1400.jpg>
- SIL International. (2015). *Language Map East Sepik Province*. SIL Papua New Guinea.
<https://pnglanguages.sil.org/resources/provinces/province/East%20Sepik/map>
- Toikilik, S., Tuges, G., Lagani, J., Wafiware, E., Posanai, E., Coghlan, B., Morgan, C., Sweeney, R., Miller, N., Abramov, A., Stewart, A., & Clements, C. J. (2010). Are hard-to-reach populations being reached with immunization services? Findings from the 2005 Papua New Guinea national immunization coverage survey. *Vaccine, 28*(29), 4673-4679.
<https://doi.org/https://doi.org/10.1016/j.vaccine.2010.04.063>

- UNICEF. (2015). *Addressing inequities to strengthen immunization in PNG*. UNICEF. <https://www.unicef.org/png/reports/addressing-inequities-strengthen-immunization-png>
- Vandelaer, J., Bilous, J., & Nshimirimana, D. (2008). Reaching Every District (RED) approach: a way to improve immunization performance. *Bulletin of the World Health Organization*, 86(3). <https://doi.org/10.2471/blt.07.042127>
- WHO. (2001). *Papua New Guinea Expanded Programme on Immunization Review, Papua New Guinea* <http://iris.wpro.who.int/handle/10665.1/10688>
- <https://apps.who.int/iris/handle/10665/208628>
- WHO. (2009). *Microplanning for immunization service delivery using the Reaching Every District (RED) strategy*. World Health Organization Retrieved from <https://apps.who.int/iris/handle/10665/70450>
- WHO. (2016). *Papua New Guinea-WHO Country Cooperation Strategy 2016-2020*. <http://iris.wpro.who.int/handle/10665.1/13444>
- WHO. (2021). *Immunization Agenda 2030: A Global Strategy To Leave No One Behind*. W. H. Organization. <https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/ia2030>
- WHO. (2022). *Immunization dashboard Papua New Guinea*. <https://immunizationdata.who.int/pages/profiles/png.html>
- World Bank. (2022). *Country profile - Papua New Guinea*. World Bank. Retrieved 30.08.2022 from https://data.worldbank.org/country/papua-new-guinea?most_recent_value_desc=true&year=2020
- YWAM Medical Ships. (2019). *Annual Report 2019*. <https://ywamships.org/medical-ship/annual-reports/>