Baseline Health Status

Suriname

Managing Partner, Suriname Gold Project CV

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WORLDWIDE REACH. HUMAN TOUCH.

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Acronyms

A/H1N1	Influenza A virus subtype H1N1
A/H3N2	Influenza A virus subtype H3N2
ACT	Amazon Conservation Team
AFOLU	Agriculture, Forestry and Other Land Use
AIDS	Acquired Immunodeficiency Syndrome
ALCOA	Aluminum Company of America
AMI	Amazon Malaria Initiative
Anti-HBs	Hepatitis B Antibody
API	Active Pharmaceutical Ingredient
ARI	Acute Respiratory Infection
AZP	Academisch Ziekenhuis
BGVS	Bedrijf Geneesmiddelen Voorziening Suriname (government-owned drug supply company in Suriname)
BMI	Body Mass Index
BOG	Bureau Openbare Gezondheidszorg (Bureau of Public Health)
CAREC	Caribbean Epidemiology Centre
CARICOM	Caribbean Community
CARPHA	Caribbean Public Health Agency
CBO	Community-Based Organization
CEDAW	Convention to End all Discrimination against Women
CHIKV	Chikungunya Virus
CO_2	Carbon Dioxide

CL	Cutaneous Leishmaniasis
CVD	Cardiovascular Disease
DALY	Disability-Adjusted Life Year
DC	District Commissioner
DHF	Dengue Hemorrhagic Fever
DPT	Diphtheria, Pertussis (Whooping Cough), and Tetanus
DOTS	Directly Observed Treatment, Short Course
EHA	Environmental Health Area
EML	Essential Medicines List
EPI	Expanded Program of Immunization
ESIA	Environmental And Social Impact Assessment
EW	Epidemiological Week
GBS	Guillain–Barré Syndrome
GEF	Global Environmental Finance
GHG	Greenhouse Gas
GP	General Practitioner
GSHS	Global School Health Survey
GYTS	Global Youth Tobacco Survey
Hb	Hemoglobin
HBsAg	Hepatitis B Antigen
HBV	Hepatitis B Virus
HCPS	Hantavirus Cardiopulmonary Syndrome
HCV	Hepatitis C Virus

HDL	High-Density Lipoprotein
HELISUR	Healthy Life In Suriname
HFRS	Hemorrhagic Fever with Renal Failure Syndrome
Hib	Hemophilus Influenza Type B
HiAP	Health in All Policies
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
HPS	Hantavirus Pulmonary Syndrome
ICU	Intensive Care Unit
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IPV	Inactivated Polio Vaccine
IV	Intravenous
JE	Japanese Encephalitis
JTV	Stichting Jeugdtandverzorging Suriname (Youth Dental Services)
KAP	Knowledge, Attitudes and Practices
LF	Lymphatic Filariasis
LH	Lands Hospital
MCL	Mucocutaneous Leishmaniasis
MetS	Metabolic Syndrome
MDG	Millennium Developmental Goal
MCV	Measles Antigen-Containing Vaccines
MDR-TB	Multidrug-Resistant Tuberculosis

MICS	Multiple Indicator Cluster Survey
MMR	Measles, Mumps, And Rubella
MOF	Ministry of Finance
MOH	Ministry of Health
MSA	Ministerie van Socia le Zaken en Volkshuisvesting (Ministry of Social Affairs)
MSM	Men Who Have Sex With Men
MZ	Medische Zending
NaPCP	Sodium Pentachlorophenate
NBG	National Bureau Gender
NCD	Non-Communicable Disease
NE	Nephropathia Epidemica
NGO	Non-Governmental Organization
NH	Ministerie Van Natuurlijke Hulpbronnen (Ministry of Natural Resources)
NHIS	National Health Information System
NIMOS	National Institute For Environment And Research
NIP	National Implementation Plan
NTD	Neglected Tropical Disease
OH	Occupational Health
OOP	Out of Pocket
PAHO	Pan American Health Organization
PBDE	Polybrominated Diphenyl Ether
PCDD	Polychlorinated Dibenzo-Para-Doxin
PCDF	Polychlorinated Dibenzofuran

PCR	Polymerase Chain Reaction
PCS	Psychiatric Center Suriname
PFOS	Perfluorooctanesulfonic Acid
PM	Particulate Matter
PNC	Post-Natal Care
POP	Persistent Organic Pollutant
PPNG	Penicillinase-Producing Neisseria Gonorrhoeae
PS	Performance Standard
RCV	Rubella Containing Vaccine
RGD	De Regionale Gezondheidsdienst (Regional Health Services)
RSV	Respiratory Syncytial Virus
ROTA C	Rotavirus Vaccine
SDOH	Social Determinants of Health
SOR	Surinaamse Ongevallen Regeling (Suriname Accident Insurance)
SSM	Small-Scale Mining
STH	Soil-Transmitted Helminths
STI	Sexually Transmitted Infection
SWM	Suriname Water Company
SZF	Staatsziekenfonds (State Health Insurance Fund)
TB	Tuberculosis
TEQ	Toxicity Equivalent
UNAIDS	Joint United Nations Program on HIV and AIDS
UNDP	United Nations Development Programme

UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
UN	United Nations
UPOPS	Unintentionally Produced Persistent Organic Pollutants
US	United States
VCT	Voluntary Counseling Testing
VOV	Vuilophaal En Verwerking (Solid Waste Collection and Disposal Division)
VL	Visceral Leishmaniasis
WHO	World Health Organization
YFV	Yellow Fever Vaccine
YLD	Years Lived with Disability
YLL	Years of Life Lost
ZIKV	Zika Virus

Glossary

Term	Definition
Birth Rate	The birth rate (also known as crude birth rate) is the annual number of live births per 1,000 population.
Death Rate	The death rate (also known as crude death rate) is the annual number of deaths per 1,000 population.
Health	A state of complete physical, mental, social and spiritual well-being and not merely the absence of a disease or infirmity.
Health Determinants	The range of personal, social, economic and environmental factors that determine the health status of individuals or populations.
Health Impacts	A health impact can be both, positive and negative. It refers to changes in community health that are attributable to a *policy*, *program* or *project.*
Health Impact Assessment (HIA)	A combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a project on the health of a population and the distribution of those effects within the population. An HIA identifies appropriate actions to manage those effects.
Health Needs Assessment	A systematic method of identifying unmet health and health-care needs of a population and making changes to meet these unmet needs.
Health Outcomes	Health outcomes are measurable changes in the health status of an individual, group or population that can be attributed to an intervention or series of interventions.
Health Area	A smallest division within the health zone where primary health care should be provided covering a population of approximately 10,000 inhabitants. Each health area should have 1 health center.
Health Center	The first point of contact of the population with the health system offering a minimal package of activities of primary health care.
Incidence Rate	Incidence rate refers to the occurrence of new cases of a disease or injury in a population over a specified period of time.
Multiple Indicator Cluster Surveys (MICS)	MICS is an international household survey initiative developed by the UNICEF to assist countries in filling data gaps for monitoring human development in general and the situation of children and women in particular.

Term	Definition
Primary Health Care	Affordable and practical methods of delivering essential health care that are scientifically sound and socially acceptable.
Prevalence Rate	Prevalence, sometimes referred to as prevalence rate, is the proportion of people in a population who have a particular disease or attribute at a specified point in time or over a specified period of time. Prevalence differs from incidence and includes all cases, both new and pre-existing, in the population at the specified time, whereas incidence is limited only to new cases.
Sexually Transmitted Infections (STIs)	STIs include gonorrhea, chlamydia, syphilis, etc.. These infections increase the risk of HIV virus transmission.
Social Determinants of Health	The social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between the countries.
Stunting	Moderate and severe - below minus 2 standard deviations from median height for age of reference population.
Underweight	Moderate and severe - below minus 2 standard deviations from median weight for age of reference population; severe - below minus 3 standard deviations from median weight for age of reference population.
Wasting	Moderate and severe - below minus 2 standard deviations from median weight for height of reference population.

1 Introduction

1.1 Methodology

The description of baseline information about the environmental, social, economic and health conditions existing in the project area is one of the key objectives of an impact assessment. The present baseline focuses exclusively on the health information and it is organized around the 12 environmental health areas (EHAs) according to the International Finance Corporation (IFC) performance standard (PS) 4. The health baseline is a document developed as part of the rapid HIA carried out for the Sabajo extensions project in Suriname. This project should be read in support with other baseline information collected for the Environmental and Social Impact Assessment (ESIA).

The document is based on multiple sources of information and data collection methods, and mainly includes:

- A formal literature review of all accessible documents, reports, peer-reviewed articles, published by Surinamese health authorities, Surinamese and international universities and research centers, United Nations (UN) agencies and programs, non-governmental organizations (NGOs), and other health actors.
- Additional information obtained through key informants' interviews carried out during the field visit in August 2017 by the HIA program director.
- A review of all health data performed by Medische Zending (MZ), the main public health provider in the geographical area of interest and mainly Brokopondo district and Amerindian communities.[1]
- A health facility assessment of the health centers active in the geographical area of interest.

No primary data in the form of epidemiological surveys with biological samples was obtained.

The health team has also contributed inputs to other social studies. Additionally, the health information collected by the social and environmental studies will be used in triangulation in the impact assessment, but it will not be reproduced in the present document.

[1] MZ is not providing any medical service to the small-scale miners communities as such. There is no clinic located in the 2 settlements providing medical services to these groups.

1.2 Project Location (from TOR Sabajo ESIA)

The Sabajo Gold Project is located in the Para district of northeastern part of Suriname, 30 km west of Merian and about 20 km northeast of the Afobaka Dam. Access to the site is from existing roads. Most construction materials and operational supplies (e.g., construction vehicles and supplies) will be purchased in Suriname or imported via the Nieuwe Haven port in Paramaribo and transported to Sabajo, via the paved road to the Afobaka Dam and then a dirt access road, or, alternatively via the Carolina Bridge and then following a dirt access road. Once operations begin, access to the project will also be available via the Merian site. The options for site access will be assessed during the ESIA after which a decision will be made with regard to the most optimal routing.

All planned mine facilities, including the transportation corridor, are located in the Commewijne watershed. The closest inhabited settlements are near Brokopondo, which is in the Suriname River watershed. There are no permanent settlements in proximity to the project, though there has been extensive disturbance in the area due to small-scale mining (SSM). The area has also been accessed for different logging concessions.

1.3 Focus of Health Baseline

The health baseline document is a general description of the health system and status in Suriname, with a special attention to the communities described in table 1.

Road Communities in District Brokopondo	Amerindian Communities	Small-Scale Mining (SSM) Areas
1. Afobaka Centrum	1. Redi Doti	1. Santa Barbara
2. Asigron	2. Casipora	2. Margo
3. Balingsula	3. Powakka	
4. Brokopondo Centrum	4. Klein Powakka	
5. Boslanti	5. Pierre Kondre/Kombassi	
6. Compagnie Kreek (Compagniekreek)		
7. Drepada		
8. Tapoeripa		

Table 1 Area of interest for the health baseline

1.4 Limitation of the Health Baseline

The collection of baseline information on the health status and determinants of the population residing in the project footprint should rely on both qualitative and quantitative data methods, and the collection methods should be specifically designed to satisfy project information requirements. Furthermore, the baseline should focus on the relevant aspects that are likely to be affected by the proposed project and the information should generate indicators that can be used to monitor and communicate about project implementation[1].

The current health baseline, which is part of a rapid HIA, is limited in its scope and generalizability. It relies on existing information, and mainly: analysis of national documents, secondary data derived from official reports and journal articles, and grey literature obtained in country. Furthermore it has been integrated with the health data obtained by the Medical Mission for the communities in the project areas, mainly Brokopondo and Carolina Bridge. These data have some limitations and should be used with caution as baseline line for monitoring purposes. First, the Medical Mission is only providing medical care to the people registered and residing in the interior, and therefore they do not provide any medical assistance to the small scale miners. Secondly certain diseases or symptoms are most likely treated by local healers and therefore not included in the number of visits or complaints recorded by the Medical Mission. Finally the local data have some limitations as “baseline” information, and mainly:

- Not all indicators could be disaggregated by age group or gender;

- Prevalence for some diseases is based on diagnostic confirmation (malaria), while for others is based exclusively on syndromic management (this could mean a under or over reporting of disease burden)

- Certain diseases, such as Tuberculosis and Cancer, have no local data as all cases are handles in different locations in Paramaribo

- No data on exposure to pesticides, fertilizers, mercury spill, solvents paints, etc.

- No data on occupational health and safety information available

2 Suriname Health Context

2.1 General

The Ministry of Health (MOH) centrally coordinates the national health system in Suriname. The health-care provision is fragmented but coordinated, and it is organized around 3 main geographical areas that include Paramaribo, urban coastal and interior regions of the country. A primary health service caters to the population in both the interior (Medical Mission) and the urban coastal area (Regional Health Services (De Regionale Gezondheidsdienst (RGD)).[2] Suriname has limited medical facilities and has been experiencing a shortage of imported medication due to limited financial resources.[2]

The 2 key policy areas identified by the MOH in the National Developmental Plan from 2017 to 2021 are:[3]

- Prevention and reduction of morbidity and mortality.
- Availability and accessibility of quality health care for the entire population.

A comprehensive health-care law was implemented in 2014 that guarantees health-care access to those under 16 and above 60 years, whereas the working population is insured through employers' health insurance programmes.[3] Suriname also supports the "Health in All Policies" approach to reduce the risk factors associated with non-communicable diseases (NCDs) and to address social determinants of health.[4] However, there is an increased burden on the national health system and service delivery due to inflation, rising expectations, increasing demands, inequalities in access coverage and economic crisis; these have led the government to restructure and reorient the health-care sector.[2] Efforts have been made to streamline the 2030 agenda for sustainable development within the MOH in Suriname.[4]

2.1.1 General Disease Description in Suriname

Suriname is categorized as an upper middle-income country according to the World Bank, which is undergoing a rapid epidemiological and demographic transition and experiencing dual burden of both communicable and NCDs.[4] In addition, there is a significant burden of diseases from road traffic accidents, depression disorders and suicidal attempts.[3] Vector-borne diseases are also prevalent in coastal, as well as interior areas of Suriname. With an attempt to eradicate all the diseases and problems related to the health of the population, Suriname's government has started with various NCDs and communicable diseases' awareness, and vector controlling programs. The Bureau of Public Health is responsible for the country's public health programs, including environmental health and sanitation, and for overseeing the operations of a public health laboratory.[5]

According to the Institute of Health Metrics and Evaluation, NCDs are the main cause of mortality in Suriname. According to the 2015 data, cerebrovascular disease ranks 1st and is the most common cause of deaths, followed by ischemic heart disease and diabetes (figure 1).[6, 7] Among communicable diseases, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and lower respiratory infections are the most common diseases responsible for mortality in Suriname. According to the 2009 data, the percentage of cardiovascular disease (CVD) mortality in Brokopondo is lowest as compared to other districts in Suriname.[8]

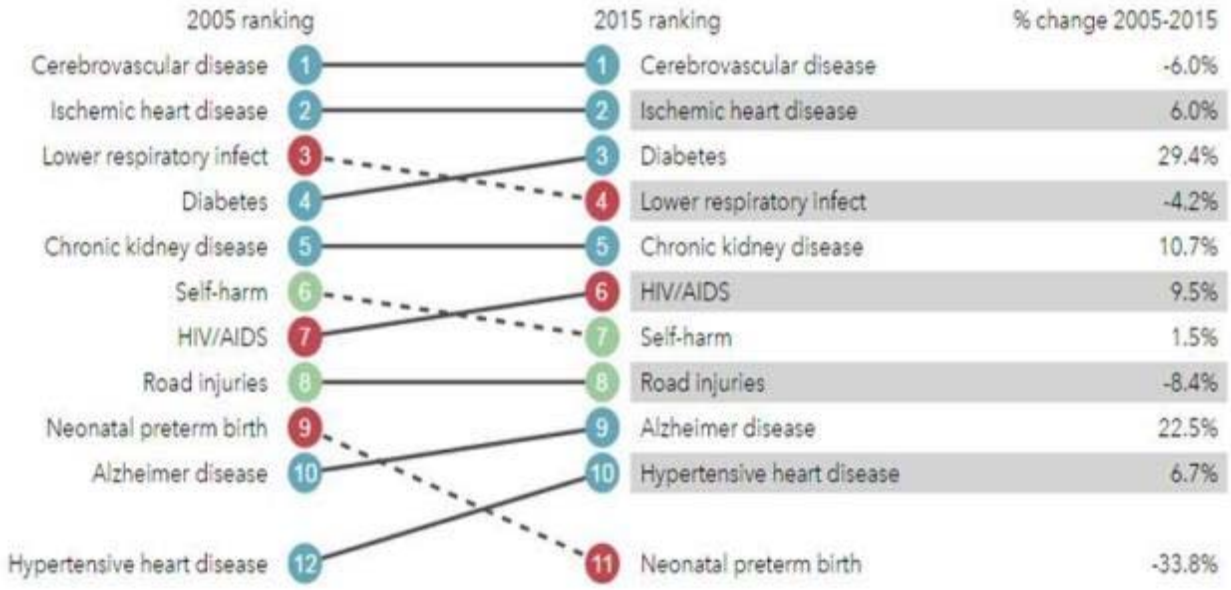


Figure 1 Top 10 causes of death by rate in 2015 and percentage change, 2005 to 2015 in Suriname[6]

In regard to injury rate, self-inflicted injury, mainly suicides, is the primary cause of mortality followed by road traffic accidents and other unintentional injuries. In the last few years, there has been an increase in suicidal attempts in Sipaliwini, Brokopondo and Wanica.[9]

Apart from NCDs, communicable diseases and injuries, Suriname's social, economic and health sector is impacted by vector-borne diseases. The recent outbreaks of Zika and chikungunya highlighted the need for an integrated approach toward the prevention and control of these diseases.

2.1.2 Medical Care Provision

The core health institutions include the MOH central office, the Bureau of Public Health (Bureau Openbare Gezondheidszorg (BOG)) and inspectorate.[10] The central office and inspectorate are responsible for standard setting, inspection and monitoring, and BOG is responsible for public health and preventive care program development. There is a shortage of medical professionals, particularly nurses. Suriname has suffered considerably due to the emigration of skilled health-care workers to other countries.

Medical care provision in the interior areas is limited as there are no hospitals. There are 4 hospitals in Paramaribo with different level of capabilities and a district hospital in Nickerie. The Medical Mission (MZ Primary Health Care Suriname) is responsible for providing primary health care in the interior, operating 56 rural health centers and clinics, among others, in Brokopondo district. While the RGD provides the first level of care to Suriname's coastal areas through 43 health-care facilities.

The National Basic Health Insurance Law came into effect on October 9, 2014, and implies that all residents of Suriname, including foreigners who live in Suriname, are required to have at least a basic health insurance and pay the premium for this insurance. Initially, everyone of Surinamese nationality in the age group from 0 to 16 years of age and older than 60 years was exempt from the premium payment as the premium was paid by the government. At present, any financially strong person from this group, who can afford it, must pay the premium by himself/herself. Every employer is obliged to pay at least 50% of the premium to his employee. The rest is paid by the worker himself/herself.[11] It is clear that not everyone is insured according to this law. Especially in the interior, a large part of the population is not insured.

The main types of health-care financing are as follows:

- The State Health Insurance Fund (Staatsziekenfonds (SZF)), with a comprehensive package of health benefits for 60% of the population (civil servants and their dependents).
- The Ministry of Social Affairs (Ministerie van Socia le Zaken en Volkshuisvesting (MSA)) pays the insurance premium for the poor and near poor so that they have access to the basic health-care package covering about 20% of the population.
- Private firm insurance plans and private health insurance plans covering about 20% of the population.

2.1.3 Public Health Services/Health Promotion

There are multiple health promotion activities and national strategic plans as organized by Pan American Health Organization (PAHO) and other developmental sectors in Suriname.[12] Various development programs, control measures and surveys were conducted by PAHO and other development agencies (Global Fund, IDB (Inter-American Development Bank) and Joint United Nations Program on HIV and AIDS (UNAIDS)) in collaboration with MOH in order to reduce the disease burden in Suriname. The national health concerns and related programs in Suriname have been mentioned below:[13]

- **Control and prevention of NCDs and lifestyle-related diseases**[14] (obesity, diabetes mellitus, cancer, cerebrovascular, CVDs and chronic respiratory diseases)

    - Chronic disease is the main concern in Suriname, as NCDs are the main cause of mortality in Suriname; CVD ranks among the 1st cause of adult morbidity and mortality among all NCDs. CVDs, malignancies and diabetes are among the 10 leading causes of mortality in Suriname. Apart from these, accidents, violence and mental health are also significant health problems. According to the Medical Mission, in Brokopondo and Carolina region, diabetes and hypertension are more prevalent in females as compared to males.

    - Lifestyle and behavioral risk factors contribute to the NCDs epidemic. Additionally, unhealthy diet, physical inactivity, tobacco and alcohol abuse are the major concerns in Suriname. Various surveys have reported that children aged 13 to 15 years have less physical activity (Global School Health Survey, 2009). The data from the 2009 Global Youth Tobacco Survey (GYTS) reported that among 927 students aged 13 to 15 years, 19.2% of students were current users of tobacco products. Also, results from the 2009 Global School-Based Student Health Survey indicated that among the 1,698 students, 73.8% (1,253) of children aged 13 to 15 years had their first drink before the age of 14, while 32.6% (554) consumed alcohol at least on 1 or more occasions in the past month. Among adults, a higher proportion of alcohol consumption was observed in the age group of 26 to 34 years (36.8%), followed by the age group of 35 to 64 years (33.9%).

    - Various initiatives have been taken by the Suriname government to reduce the burden of NCDs and these include:

        - In 2011, Suriname government initiated an NCD plan 2012-2016 at the UN-level meeting with a priority to develop a national action plan for the prevention and control of NCDs.[15]

- The MOH, in collaboration with other developmental sectors, developed a plan to combat NCDs in Surinamese population mainly focusing on 4 main areas, including public policy and advocacy, health promotion and disease prevention, integrated management of chronic diseases and surveillance, to affectively address NCDs in Suriname.

- Chronic diseases' risk factors, such as unhealthy diet, physical inactivity and lack of awareness among population, lead to high mortality due to CVDs, malignancies and diabetes among Surinamese population.

- In addition, alcohol prevention, substance abuse and tobacco control[16],[17] plans were also developed in order to reduce the overall impact of NCDs among the population. Additionally, a national anti-tobacco campaign was initiated to increase awareness among Surinamese and to strengthen communities for taking significant steps in order to maintain and promote their own health.

- **Vector-borne control and communicable diseases (HIV/AIDS, STIs and malaria)**:

  - With the ongoing epidemiological shift toward NCDs, there are some communicable diseases, such as HIV/AIDS, tuberculosis (TB) and dengue that are still a major national concern in Suriname. As per UNAIDS,[18] since 2010, there was a reduction of HIV infections by 6% but AIDS-related deaths have increased by 17%. In 2016, new HIV infections were reported to be <500 and AIDS-related deaths was <200. Around 4900 (4400 to 5600) people living with HIV and 48% among them were accessing antiretroviral therapy. In case of pregnant women living with HIV, 89% (32% - 41%) were accessing treatment or prophylaxis to prevent transmission of HIV to their children. The key affected groups in Suriname are: sex workers with a prevalence of 5.8% and MSM with 6.7%.

  - The estimated TB incidence in 2016 was 0.14/1.000. To strengthen the TB control program, an agreement on the TB Global Fund proposal was signed with the MOH with the introduction of a quality-assured directly observed treatment, short course (DOTS) strategy.[2] The agreement focuses on strengthening TB/HIV collaborative activities, targeting TB control activities for high-risk groups, building capacity for appropriate multidrug-resistant tuberculosis (MDR-TB) prevention and management, and developing community DOTS, in order to reduce TB on the national level.

  - For vector-borne diseases, dengue, malaria, chikungunya, Zika and leishmaniasis cases are now under control due to various control and elimination programs. For dengue, a particular sharp increase was noted during 2004 to 2007 with a peak in 2006, approximately double the size as compared to 2000 to 2001. A vector control program is being strengthened to reduce the number of dengue cases; to further strengthen the program, health education, environmental sanitation and rational use of pesticides need

to be promoted. For malaria cases, Suriname has controlled malaria prevalence and marked an achievement in malaria elimination rate.

- In 2014, Suriname reported its 1st local transmission coinciding with large outbreaks of the chikungunya disease. Within 3 months, the transmission was at peak along with a 90.4% attack rate.[19] Since 2014, the Medical Mission has added chikungunya syndrome to the regular weekly surveillance reports. By mid-2017, in the interior areas, chikungunya cases showed a marked decrease and are almost on the verge of elimination.

- The Zika outbreak started in 2015 in Suriname but in 2017, there were no cases of Zika in the interior areas as reported by the Medical Mission. Both cutaneous leishmaniasis (CL) and visceral leishmaniasis (VL) are present in Suriname with cutaneous being the most common form. In the interior, as reported by the Medical Mission, CL was reported through monthly surveillance by health centers and severe cases are being treated by a dermatologist. However, the prevalence of CL is low in the interior areas.

- In order to achieve the sustainable development goals, Suriname has also initiated a national health action plan 2011-2018 for reducing the burden of communicable diseases, such as HIV/AIDS, TB, dengue, malaria and other vector-borne diseases.[2,20,21,22] Timely monitoring, surveillance and intervention are the key strategies to combat vaccine-preventable diseases, emerging and re-emerging diseases, neglected tropical diseases (NTDs), zoonotic diseases and other key communicable diseases. Through the National AIDS Program, there has been a significant reduction in the transmission of HIV from mother to child with considerable reduction in the newly registered HIV cases in Suriname. The country aims at malaria elimination by 2020 and most cases these days are imported.**Error! Bookmark not defined.**

- **Maternal and Child Health**[2,] **Error! Bookmark not defined.** (breastfeeding, immunization and early child development):

  - In order to achieve Millennium Developmental Goals (MDGs), maternal mortality ratio decreased, between 2000 and 2009, from 153/100,000 live births to 122.5/100,000 live births. Although the national fertility rate declined from 7.10 in 1964 to 5.51 in 1972, 3.57 in 1980 and 2.52 in 2004, there are significant differences between socioeconomic and ethnic groups. Infant mortality rate (IMR) remained stable from 20.2 in 2000 to 20.3 in 2009 per 1,000 live births.[23]

  - In order to reduce the global burden of disease in children and mother, the MOH has initiated the expanded program of immunization (EPI) to bring a complete package of safe and timely vaccination to its population, specifically to protect the target groups against vaccine-preventable diseases. As per 2016 data, the immunization coverage increased gradually over the past years, reaching a national

average of 91% for DTP-3, 97% for MCV1, 91% for polio 3.[24] The below table shows the full vaccines' coverage.

Vaccines	Vaccination coverage in % (2016)
DTP1	92
DTP3	91
Hep B3	91
HepB_BD	65
Hib3	91
IPV1	96
MCV1	97
MCV2	44
PCV3	NA
Pol3	91
RCV1	97
RotaC	NA
YFV	79

Table 2 WHO vaccine-preventable disease's vaccination coverage in Suriname

- **Mental diseases' control:**[25] The burden of mental illness and depression disorders in Suriname is increasing; 1 in 10 people, both men and women, in Suriname suffer from one of the common mental health problems, such as depression, anxiety disorders, and mood affecting disorders.[26] According to the national health action plan, Suriname has initiated multiple objectives to control mental disorder. Also, the World Health Organization (WHO) has initiated a mental health policy in Suriname that provides centralized services in a psychiatric hospital in Paramaribo.[25]

- **Environmental policies**:[27] In the interest of Suriname's sustainable development, the National Institute for Environment and Development in Suriname has initiated the development of a national legal and institutional framework for environment policy and management. There are multiple environmental policies and acts for preserving natural resources in Suriname, e.g., Natuurbeschermingswet (Nature Conservation Act), Hinderwet (Hindrance Act), Wet Bosbeheer (Forest Management Act), and Houdende voorzieningen tot

bescherming en behoud van de in Suriname aanwezige natuurmonumenten (provisions for the protection and preservation of the natural heritage in Suriname).

2.2 Project Area[2]

This project will be partially executed in the communities of Carolina and Brokopondo. Primary health care in both the regions is provided by the Medical Mission through 5 health centers. Brokopondo has 3 health centers that include Brokopondo (Brokopondo Centrum, Afobaka centrum, Boslanti, Compagnie Kreek (Compagniekreek), Drepada and Tapoeripa villages), Asigron (Asigron and Victoria villages) and Balingsula (Balingsula village), whereas the Carolina region includes 2 health centers, Powakka (Groot Powakka and Klein Powakka) and Redi Doti (Redi Doti, Pierre Kondre and Cassipora).

According to the latest data, the population comprises mainly Maroons and Amerindians. The occurrence and prevalence of diseases is based on both the abovementioned regions. The population of the Carolina region is less (967) as compared to Brokopondo (2,864). The age distribution of 0 to 10 years is greater than other age groups in the Brokopondo region. In the Carolina region, greater proportion of children and adolescents/young adults was seen in the age group of 0 to 20 years. In total, the registered population living in both areas is 3,831.

A high number of cases of vector-borne diseases, respiratory illnesses, soil-related diseases, NCDs, such as hypertension, and other CVDs were observed in the Brokopondo region as compared to the Carolina region. The number of health clinic visits in 2015 was higher in the Brokopondo region followed by the Carolina region; however, it recently got reduced in mid-2017.

2.2.1 Diseases Reported in the Project Area

Nationally, there are many diseases prevalent in Suriname; however, according to the data given by the Medical Mission, only few are prevalent in the community and project area. The occurrence of these diseases is timely monitored by the Medical Mission during surveys and same has been presented below for both, Brokopondo and Carolina regions.

Vector-borne diseases:

[2] Local area information has been obtained from the Medical Mission team

- *Chikungunya*: In 2014, there was a chikungunya outbreak in Suriname; it was concentrated in the coastal areas and spread in the interior of Suriname by mid-2014. As reported by the Medical Mission, the number of chikungunya cases was highest in 2016 in the Medical Mission area (1,792 cases), followed by the Brokopondo (315 cases) and Carolina areas (12 cases in 2012 and no case in 2016).

- *Zika*: Zika outbreak was reported at the end of 2015. The Medical Mission carried out a serological survey in January 2016 and conducted surveillance. A total of 16 cases were reported in the Carolina region and 1 in Brokopondo in 2016. There was no Zika case reported in any of the regions in 2017.

- *Leishmaniasis*: Though monthly surveillance is conducted by the health centers, a case of CL was reported in the interior areas of Suriname, where a higher number (110 cases) of cases were seen in the Medical Mission areas in 2014, which recently got reduced in 2017 (9 cases). A total of 3 cases were reported over the years in Brokopondo and 1 in Carolina.

- *Malaria*: The incidence of malaria cases has reduced significantly in all interior regions; a higher number of cases were observed in the Medical Mission area in 2016. However, no cases were reported in Carolina area and only 1 in Brokopondo in 2016.

Respiratory issues:

- *Influenza*: The Medical Mission performs weekly surveillance for monitoring the occurrence of the disease, and this is the biggest respiratory problem in the area. This occurs on the seasonal basis in the project area.

- *Other respiratory infections*: In Brokopondo area, the number of cases of lower respiratory infections was 94, 170 and 97 in 2015, 2016 and mid-2017, respectively. While in Carolina area, the number of cases was 74, 45 and 32 for the same time period.

Sexually transmitted infections (STIs):

- *HIV/AIDS*: The estimated prevalence of HIV/AIDS in the Brokopondo region is 0.59% and in the Carolina region is 0.72%. The Medical Mission provides treatment to prevent its transmission from mother to child, if any pregnant woman is tested positive for HIV. Teen pregnancy was also reported in both Brokopondo (33%) and Carolina region (27%).

- *Other STIs*: The Medical Mission has a syndromic treatment[3] for other STIs, such as gonorrhea. Monthly surveillance is performed by reporting the number of patients who have visited different health centers. The number of cases reported in Brokopondo was 14, 16 and 10 in 2015, 2016 and mid-2017, respectively. While in Carolina area, the number of cases was 13, 6 and 6 for the same time period.

Soil, water and sanitation-related diseases:

- *Diarrhea:* This is the most common disease in the interior regions and Medical Mission conducts a weekly surveillance on it. Diarrhea cases were higher in the Brokopondo area in 2016, but have shown significant reduction in 2017 with fewer cases in a year. It was also reported that health education is imparted in the community for awareness and knowledge. The topics mainly covered by the Medical Mission are hygiene, cooking practices, use of drinking water and hand washing techniques.

Non-communicable diseases (NCDs):

- *Hypertension and diabetes:* In the interior, hypertension and diabetes mellitus is found in both the Maroon and the Amerindian populations. The prevalence of hypertension is higher as compared to diabetes mellitus in both the Medical Mission and Brokopondo areas. The prevalence of hypertension in the entire Medical Mission area is 4.33%, while it is 3.91% in the Brokopondo area and 5.79% in the Carolina area. The prevalence of both hypertension and diabetes mellitus is higher in the Carolina area. Apart from this, there is no data on cancer, mental health and other major chronic diseases as the data presented is dependent on the health visits due to chronic diseases.

2.2.2 Health Clinic Visits

The number of visits to the health clinics in the Brokopondo region was higher as compared to the Carolina region in 2015 due to chronic diseases. In the Brokopondo region, the clinics are visited more for hypertension; and in Carolina, the clinics are visited more due to diabetes and hypertension.

The referral cases in both the regions were reported to be higher by mid-2017, where women have referred more frequently than men in all age groups for both Brokopondo (81% women and 19% men in 2017) and Carolina

[3] The diagnosis is done by the doctors according to the symptoms without relying on a laboratory diagnosis.

regions (62% women and 38% men in 2017). There are different reasons for referral cases which mainly includes pregnancy, vision problem, burns, mental retardation, scabies and hernia umbilical.

The health clinics in Powakka, Redi Doti and Asigron need small renovations, such as cleaning of tiles, adjusting hanging doors, replacing door locks, replacing window shutters and cleaning drainage.

Additionally, the health clinics in Brokopondo and Balingsula need major renovations.

2.2.3 Vaccination Coverage

In the interior, every child is vaccinated against yellow fever at the age of 1 year. Apart from this, higher vaccination coverage for yellow fever, pentavalent vaccine and measles, mumps, and rubella (MMR) vaccine was also observed in 2015. The vaccination coverage was high in both the regions till 2015, but significantly reduced by mid-2017; this could be due to low availability of vaccines and logistics problems in the health clinics.

All the pregnant women are vaccinated with diphtheria and tetanus vaccine, depending on her vaccination status on the card. There was no maternal mortality reported from 2015 to mid-2017 in both Brokopondo and Carolina; only 1 neonatal death was reported in 2016 in Carolina for which the cause is not known.

2.2.4 Road Traffic Accidents

The road traffic accidents appear mostly on the paved Afobaka road in the Brokopondo region. From 2015 to mid-2017, a total of 40 road traffic accident cases were recorded in the Brokopondo region and 2 road traffic accidents were recorded in the Carolina area. About 70% of people involved in road accidents comprise males with an average age of 35 years. Females involved in road accidents have an average age of 29 years. The cases of accidents are mainly due to erratic driving and high speeding.

3 Environmental Health Areas (EHAs)

This chapter presents an overview of the health status of Suriname, with a special focus on the Brokopondo area where the project will be partially executed. The chapter is organized around the 12 EHAs in accordance with IFC PS 4 and the IFC HIA guideline.

3.1 Vector-Borne Diseases

Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 1 million deaths annually[28] worldwide. Increasing population, demographic changes, globalization of travel and trade, unplanned urbanization and environmental challenges, such as climate change, are having a significant impact on disease transmission in recent years.

Figure 2 Vector-borne diseases transmission[29]

3.1.1 American Trypanosomiasis (Chagas disease)

Disease

American Trypanosomiasis, also known as Chagas disease, is a potentially fatal illness caused by a parasite *Trypanosoma cruzi* (*T. cruzi*).[30] It is transmitted by a blood-sucking bug (insect vector) called triatomine, also known as the "kissing bug".[30] Local swelling may appear at the site of inoculation. The initial stages of the infection may go unnoticed or be accompanied by the signs of brain and/or heart involvement. No vaccine is available.

Transmission

The "kissing bugs" are generally found in wooded areas, as well as in the cracks and holes of substandard housing, typically those made of mud, adobe or palm thatch. These bugs are most active at night.

Chagas disease is transmitted in a number of ways. The most common way is when an infected bug feeds and deposits its feces on the victim's skin, often at night. Infection occurs when feces or urine is rubbed into the bite, an open cut, the eyes or the mouth. Chagas disease is also transmitted through unscreened blood transfusions or organ donations from infected donors. It can also spread from mother to child during pregnancy or childbirth. Food and drink contaminated with the infected bug or bug feces can also cause infection. Reported incidents have occurred after the consumption of contaminated fruit juices, such as acai palm, guava and sugarcane.

Occurrence

The triatomine species of Suriname are *Panstrongylus geniculatus* (coastal area, except Sipaliwini District), *P. rufoturbicalutus* (Wanica district), *Rhodnius pictipes* (coastal area) and *Eraturus mucronatus* (coastal area).

According to the Bureau of Public Health (BOG), 9 species of Triatominae, representing 3 tribes and 5 genera, are currently known in Suriname.[31] There were 3 acute cases of Chagas disease reported in 2001, 2012 and 2013. One of them was a male infant who had not been outside the capital, Paramaribo. He was the 1st documented case of acute Chagas disease in Suriname.[32] All 3 cases were considered autochthonous. Over the last 2 decades, 2 chronic cases were detected serologically.[33] More recent serological surveillance of the blood bank revealed 5 new chronic cases. So far, there are no known cases of Chagas disease in the Brokopondo area.

An estimated 6 to 7 million people living mostly in Latin America are infected with *Trypansosoma cruzi*, the parasite that causes Chagas disease.[34] Most infections are associated with insect bites. The foodborne risk of Chagas disease has been documented across several countries, particularly in Venezuela and Brazil. The vector Rhodnius prolixus is present in rural areas, but the extent of the infection is undetermined. Recent studies did not find positive cases in blood donors.

3.1.2 Chikungunya

Disease

Chikungunya is a mosquito-borne disease. Chikungunya infection is usually symptomatic, causing fever, debilitating joint pain, and often a rash. The virus emerged in the Americas in late 2013, on the island of St. Martin, and quickly spread across the Caribbean.[29]

Transmission

People can get chikungunya if they are bitten by a mosquito carrying the arbovirus (chikungunya virus (CHIKV)).[30]

Occurrence

Since 2013, a total of 548 cases have been reported against chikungunya fever in the Americas.[35] Prior to 2013, CHIKV outbreaks had only been reported in Africa, Asia, Europe and the Indian and Pacific Oceans.[36] In 2014, Suriname reported its 1st local transmission coinciding with large outbreaks of the disease. The transmission reached its peak within 3 months along with a 90.4% attack rate. This compares to 41% for the Dominican Republic. A total of 17 cases of the mosquito-borne chikungunya disease were confirmed by the Suriname Bureau of Public Health (BOG) in 2014 with widespread infection expected[37]; a Paramaribo-based man was reported with symptoms of the illness upon his return from St Maarten. It has been consistently present in Suriname ever since.[37]

In Suriname, the highest CHIKV incidence has been detected in the long dry season, which is strongly associated with the increased number of water-filled storage objects, positively influencing mosquito breeding and thus, CHIKV transmission.[38]

Chikungunya is concentrated in several problem coastal areas (Albina, Groot Henar, Zanderij, 5e Rijweg) and neighborhoods (Latour and Geyersvlijt) in Paramaribo.[39]

Since 2014, the Medical Mission has added chikungunya syndrome to the regular weekly surveillance reports.

3.1.3 Dengue

Disease

Dengue is a mosquito-borne infection found in tropical and subtropical regions. There are 4 strains of dengue. A person who contracts the disease multiple times is more susceptible to the potentially fatal dengue hemorrhagic fever (DHF). The spectrum of clinical manifestations of dengue varies from a mild febrile self-limiting illness to a severe, potentially fatal disease.

Transmission

Dengue is a viral disease transmitted by *Aedes aegypti* mosquito.

Occurrence

Dengue fever is present throughout Suriname.[40] In 2005, there were 1,966 cases of dengue reported nationally.

It mainly affects coastal areas and is the predominant vector-borne disease. The changes in incidence have been attributed to climate characteristics and increase in the areas with environment that is favorable for *Ae. aegypti*.[41] The annual mortality rate per 100,000 people from dengue in Suriname has increased by 59.7% since 1990, an average of 2.6% a year. In Suriname, the annual mortality rate (per 100,000 people) was 0.3 in 2013.[42]

The fatalness of dengue for men in Suriname peaks at the age above 80 years.[42] Men die from dengue at the lowest rate at the ages between 25 and 29 years. The highest rate of women dying from dengue in Suriname is the age above 80 years. It is least fatal for women of the ages between 65 and 69 years. At 1.7 deaths per 100,000 women in 2013, the peak mortality rate for women was higher than that of men, which was 1.5 per 100,000 men.[42]

According to PAHO's Zika - Epidemiological Report 2016, 6 probable dengue cases (2 cases per 100,000 population), including 1 laboratory-confirmed case, were reported in Suriname up to epidemiological week (EW) 46.[43] In 2015, 15 probable cases (3 cases per 100,000), including 6 laboratory-confirmed cases, were identified up to EW 52. In 2014, 197 probable cases (36 cases per 100,000), including 13 laboratory-confirmed cases, were reported up to EW 53.[43] As per 2012 data, annually, there were 18.8% of dengue cases, 19.3% of both dengue fever and dengue haemorrhagic fever (DHF).[44]

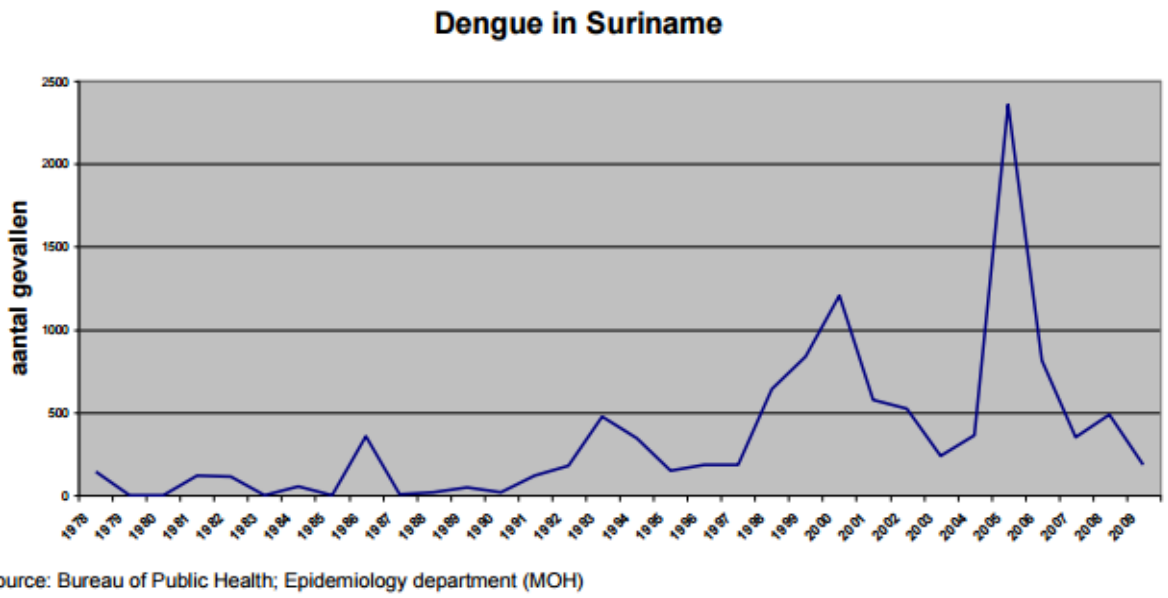


Figure 3 Number of dengue cases, 1978-2009

3.1.4 Filariasis

Disease

Lymphatic filariasis (LF), sometimes called "elephantitis", is a parasitic disease caused by microscopic, thread-like worms. The disease is spread by mosquitoes and mainly affects the lymphatic system. Common symptoms include cough, fever, headache and redness of the skin. Occasionally, filariasis can cause severe lung damage.[30]

Transmission

The disease is caused by roundworms like *Wuchereia bancrofti*, *Brugia malayi* or *Brugia timor*. Mosquitoes carry infected larvae, and can inject them into a person's skin when biting the person. The larvae travel to the lymph nodes, where adult worms develop. The offspring of these adult worms (microfilaria) then migrate further in the person's body tissues and circulate in the blood causing a variety of symptoms.

Occurrence

In a study conducted in 2000 on school children from 6 communities in Guyana, 5 communities in Suriname and 3 communities in Trinidad, the prevalence of *W. bancrofti* antigen ranged from 1.7% to 33.2% in Guyana, 0.22% overall in Suriname and 0.0% in Trinidad.[45] The data suggested, contrary to the reports of the endemic nature of LF from the WHO, that LF may no longer be present in Trinidad and of very low prevalence in Suriname. Another

study showed that a very low prevalence, 0.06% microfilaremia, was detectable among 51,097 Surinamese.[46] LF was mainly concentrated in Paramaribo at the beginning of the 20th century.

From 1949 onward, a systematic control of LF was started in Suriname, which resulted in a decrease in the microfilaria index from 17.4% to 0.06% in 1981. The program was based on mass screening and treatment using polyclinics and encouraging citizens to participate via health education campaigns. The activities also monitored the sanitary environment and the sewer system, especially in the capital, as well as distributed nets and sprayed periodically for mosquitoes (though this was mostly done via other disease prevention programs, such as the dengue program; it was not specifically for Culex mosquitoes). In an immunochromatographic (ICT) card survey of schoolchildren in 2001, no cases of LF were found. In 2006, there was another survey in Nickerie in the west and found 2 cases, of which both were considered “imported” from Guyana as the children traveled there frequently. Both children were treated with Hetrazan.

LF is not present in metropolitan areas or in the interior of the country; there are only a few isolated cases in the west. LF transmission is under control in Suriname; it is not occurring among children. Culex breeding sites have been reduced in large cities. Cross-border cooperation with Guyana is needed, as the support for and financing of surveillance and monitoring activities.[47] Suriname is presently in the stage for the certification of elimination. Worldwide, LF is present in Africa, Central and South America, South Asia and the Pacific Islands.[16]

3.1.5 Japanese Encephalitis (JE)

JE is not present in Suriname.

3.1.6 Leishmaniasis

Disease

Leishmaniasis is a disease caused by protozoa. It has 3 principal clinical manifestations, namely, CL, mucocutaneous leishmaniasis and VL. The cutaneous form characteristically causes skin ulcers, the mucocutaneous form manifests as lesions of skin, mouth and nose. Additionally, the (potentially lethal) visceral form affects the internal organs, such as spleen and liver, and also invades the bone marrow. The skin ulcer is the most common form and skin lesions can resemble those of other diseases, including cutaneous TB, syphilis, leprosy, skin cancer (basal cell carcinoma) and fungal infections.

Transmission

Leishmaniasis is most commonly transmitted by sand fly bite. It can also be anthroponotic (human to human) or zoonotic (vertebrate animal to human) through mammalian reservoirs, such as dogs and rodents.

Occurrence of different species

The global prevalence of leishmaniasis exceeds 12 million cases; each year more than 2.5 million new cases are diagnosed and the estimated disease burden is 2.4 million disability-adjusted life years (DALYs).[48] As a result, the WHO has classified leishmaniasis as a category 1 disease – an emerging and/or uncontrolled disease.

Both CL and VL are present in Suriname with cutaneous being the most common form.[49] The first cases of CL in the country were reported in 1911. Since then, CL has become an increasing public health problem and it is generally considered an endemic disease. The last reported numbers available on the occurrence of this disease in Suriname show an annual detection rate of 5.32 to 6.13 per 1,000 inhabitants for the forested interior, and 0.64 to 0.74 per 1,000 for the entire country.[50] The actual number of infections is likely to be higher, with some at-risk groups not accounted for in reported numbers, such as the Brazilian Garimpeiros who work illegally in the southern parts of Suriname, of whom many are thought to have introduced other Leishmania species, such as *L. (V.) braziliensis*, in Suriname. For a long time, *Leishmania (Viannia) guyanensis* was believed to be the only Leishmania species causing CL in the country. In the past decade, however, a number of patients presented clinical forms of the disease that behaved differently from that associated with this Leishmania species, i.e., *L. (V.) lainsoni*, *L. (L.) amazonensis*, *L. (V.) naiffi* and *L. (V.) braziliensis*.[51]

Similar to the Brazilian Garimpeiros mentioned above, many gold diggers from the northern part of Brazil work and travel in Suriname and are familiar with CL. In the Brazilian State Pará, a region bordering Suriname in the South, the infection rate with *L. (L.) amazonensis* is high (34.8%).[52] It is thus conceivable that infected gold diggers from that area have introduced *L. (L.) amazonensis* in Suriname. It is also well-known that the migration of laborers is associated with an increased risk for CL infection. The zymodeme MON-41 is widespread in Central America and the northern part of South America, and has been reported in Venezuela, Brazil, Panama, French Guiana and Colombia.[53]

3.1.7 Malaria

Disease

Malaria is an infectious disease, caused by the blood parasite Plasmodium. These parasites are transferred in the blood of humans and large mammals by Anopheles mosquitoes. The most common parasites which cause malaria in Suriname are *Plasmodium falciparum* and *P. vivax*. The symptoms include fever, headache, shivers, joint pains, repeated vomiting, diarrhea and others. The infection can lead to damage of the organs, such as the

brain, lungs, kidneys and blood vessels. Cerebral malaria is the most serious complication and can lead to death of the patient.

Transmission

Malaria is spread to humans via the bite of an infected mosquito. The parasite lives in the Anopheles mosquito, which usually bites at night (from dusk until dawn). Malaria cannot move from person to person, except from a mother to her baby during pregnancy or via a blood transfusion using infected blood.

Occurrence

The annual number of cases is nearing the elimination level of 1 case per 1,000 people at risk and therefore, the disease is targeted for elimination in Suriname by 2020.[54] The malaria program reported 335 overall malaria cases in 2016, of which 78 cases were diagnosed in Suriname nationals. The main parasite found is *P. vivax* (Pv) in 223 cases, and 102 *P. falciparum* (Pf) cases and 10 mixed Pf/Pv infections. The most recent data for the current year reported 25 cases in Suriname till August 2017,[4] of which 3 are in the stable population serviced by the Medical Mission.

Historically, the coastal belt and the interior were plagued by malaria. However, after successful campaigning, malaria was eliminated along the coastal belt in 1968. At present, there is low to negligible risk in Paramaribo city and other coastal districts. However, malaria is still present in the interior of the country that include Brokopondo and Sipaliwini districts and, in particular, Tapanahony municipality. Malaria in Suriname has decreased to less than 90 autochthonous (nationally transmitted) cases a year. The hospital admissions for malaria have decreased enormously (by 97%) from 377 in 2003 to 11 in 2015. Deaths due to malaria have dropped from 24 in 2000 to 1 in 2013. From 2014 onward, no deaths were recorded.[55]

At present, malaria occurs predominantly in migrants and people living/or working in areas with gold mining operations.[56] SSM areas are the centers of transmission of malaria and other tropical diseases.[57] The open pits of standing water created by miners are excellent breeding places for mosquitoes and other disease-spreading organisms. Meanwhile, the mobility of miners and the general absence of public health care in the mining areas have prevented the effective treatment or containment of malaria. Poor adherence to antimalarial medication and use of illegally acquired antimalarial drugs are also the risk factors contributing to the transmission of malaria in the mining environment. Finally, miners' frequent travel stimulates the transmission of malaria beyond mining camps, especially among gold miners' families.

[4] Information obtained through personal communication from the malaria program team in Suriname

As part of the elimination program, the Malaria Program Suriname is providing passive and active surveillance to this at-risk population that is estimated to be around 80,000, mostly living in and around the gold mining areas. There are 2 studies (baseline and follow-up after interventions) about knowledge, attitudes and practices toward malaria[58] that have been carried out for these groups. Slightly less than half (47.3%) of the respondents in the 3 sampled areas have the knowledge of the cause, symptoms, preventive measures and treatment of malaria, and this was an improvement as compared with the baseline level in 2009 (33.1%). What is important to highlight is that 75% of the respondents had been ill with malaria at least once in their lives reinforcing the vulnerability of this group. While they reported using the impregnated bed nets to protect themselves against mosquitoes and/or malaria, only slightly more than half of them have a net. The Malaria Program Suriname is scheduled to carry out an additional distribution of 20,000 bed nets in the 2nd half of 2017.[59]

Below is the table for number of positive cases detected in the small-scale miners' population through active surveillance of the malaria program in 2016, and no positive cases were observed in the month of April, May, August and October.[5]

Period	Test Place	Number Tested	Number of Positive Cases
January	Lawa	411	2
February	Benzdorp	217	4
March	Benzdorp	105	2
June	Apoera	30	1
	Lawa	220	4
	Snesiekondre	84	1
July	Lawa	31	1
September	Vila Brasil	556	1
November	Lawa	116	5

3.1.8 Schistosomiasis

Disease

[5] Information obtained through personal communication with the malaria program team in Suriname

Schistosomiasis (*Schistosoma spp*.) is an intestinal parasitic infection that causes anemia, stunted growth, impaired cognition and decreased physical fitness among other pathological effects.[60]

Occurrence

It is endemic in Suriname and was first confirmed in 1911.[61] According to PAHO, schistosomiasis was predominantly found in the urban and coastal areas.[35] In 1974, prevalence rates were as high as 45% in Saramacca. At present, although at low prevalence rates, schistosomiasis is still endemic in Suriname.

Prevalence varies between certain areas and age groups. General prevalence ranges from 0.3% to 4.7% and is significantly higher in the age group of 15 to 40 years. High prevalence is also associated with occupational activities, such as mining, fishing and agriculture. In a recent study in 2015, biomphalaria glabrata was present in the brackish, swampy, calcium-rich waters of the northern coast, where the majority of the country's population resides.[62] This strip of land is the only region in the country in which *S. mansoni* is endemic. Conversion of swamps to rice paddies in the region has led to increased transmission.

3.1.9 Yellow Fever

Disease

Yellow fever is a mosquito-borne virus in the genus Flavivirus. The family Flaviviridae is related to dengue virus, ZIKV, tick-borne encephalitis virus and West Nile virus. Yellow fever is a potentially fatal viral disease and is one of the viral hemorrhagic fevers. There is no specific treatment available; hence, prevention through vaccination and avoiding mosquito bites is critical.

Transmission

Yellow fever is spread through mosquito bites. Sporadic infection of humans with sylvatic yellow fever vaccine (YFV) can occur when unprotected humans enter the habitats where the viruses circulate. The subsequent introduction of a viremic human case to urban areas with high population densities and presence of *Ae. aegypti* mosquitoes can initiate an urban transmission cycle.

Occurrence

YFV is endemic in (sub) tropical areas of South America and Africa. In South America, the risk for YFV infection is the highest in tropical regions and during the rainy season (January to May) when mosquito population densities peak. In 2011, the WHO identified Suriname as one of the 14 South American countries at risk for YFV

transmission based on the current and historic reports of yellow fever plus the presence of competent mosquito vectors and animal reservoirs.

The1st case in 45 years was of a Dutch tourist who was hospitalized back in the Netherlands in March 2017.[63] The follow-up epidemiological investigation reported that the person traveled in the interiors and the most likely place of infection was Brokopondo (Brownsberg). Suriname introduced the yellow fever vaccination into the routine program for all children aged 1 year old in 2014. Prior to 2014, vaccination was provided only in the interior of the country by the Medical Mission in its immunization program. The estimate of national immunization coverage is 86% and only includes children aged 1 year.[64] In addition, Suriname shares borders with Brazil, which has been experiencing yellow fever outbreaks since January 2017.[65] This is considered to be the largest outbreak of yellow fever in the Americas in the past 3 decades.

Vaccination is required by the WHO for all travelers to Suriname.

3.1.10 Zika Virus (ZIKV)

Disease

ZIKV is a mosquito-borne virus and belongs to the Flaviviridae family. It frequently does not cause any symptoms or, if symptoms occur, they are usually mild. Neurological complications occasionally occur and a strong association with medical complications, such as microcephaly and Guillain–Barré Syndrome (GBS) exist. Zika can cause severe and irreversible birth defects in babies of women infected with the virus during pregnancy. There is no specific treatment available; hence, prevention through vaccination and by avoiding mosquito bites is critical.

Transmission

It spreads to humans via the bite of an infected mosquito, but can also be transmitted sexually. The virus is primarily transmitted by infected daytime biting female *Ae. aegypti* and *Ae. albopictus* mosquitoes, which are typically active from dawn to dusk. There is evidence that ZIKV is also transmitted by other mosquitoes belonging to the Aedes genus.

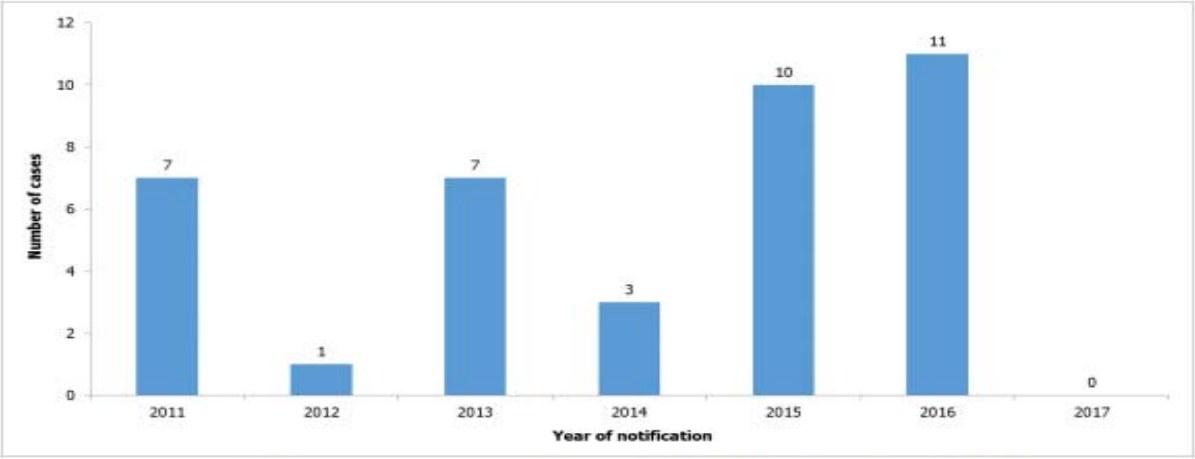
Occurrence

In May 2015, ZIKV appeared in Brazil and most likely, the occurrence was linked to an outbreak in French Polynesia. Since then, it has spread over 45 countries and territories in the Americas and a further 22 countries and territories in the Oceania region prompting the WHO to declare ZIKV as a Public Health Emergency of

International Concern in February 2016. In Suriname, the first locally transmitted cases were reported in November 2015 and during the outbreak, 3 patients were diagnosed with GBS.[66] The disease is considered to be an ongoing risk.[30]

The Zika Epidemiological Report for Suriname reports Zika cases since late 2015.[67] Most cases were detected between EW 1 to EW 11 of 2016, with an average of 249 cases per week. Since then, there has been a steady decrease in the weekly number of suspected and confirmed cases. A weekly average of 1 case has been reported in the 8 weeks from December 2016 to the beginning of February 2017 (EW 49 of 2016 to EW 5 of 2017).

Between EW 39 of 2015 and EW 5 of 2017, health authorities in Suriname have reported 16 cases of GBS, of which 4 have been laboratory-confirmed for ZIKV infection.



Source: Data provided by the Suriname Ministry of Health and reproduced by PAHO/WHO

Figure 4 Number of Zika cases in Suriname (2011 to 2017)

A total of 3 atypical lethal cases associated with acute ZIKV infection in Suriname were confirmed with polymerase chain reaction in adult patients with some comorbidities.[68] The patients showed rapid clinical deterioration with hemorrhagic and septic shock and exaggerated, acute and innate inflammatory responses with pronounced coagulopathy, and died soon after admission to the hospital. It remains unclear whether the fatal outcomes were due to acute ZIKV infection alone or a combination of the virus with an exacerbated underlying prior disease or coinfection. The Medical Mission introduced the Zika syndrome in the weekly surveillance.

3.1.11 National and Regional Programs for Vector-Borne Diseases

- In Suriname, there are different departments and organizations dealing with vector-borne diseases.
- The Vector Control Department of the Bureau for Public Health is responsible for controlling the vector and environmental side of the transmission. The main activities are removal of breeding grounds, educating the community, killing vectors by means of spraying chemicals and placing poisons, and enforcing the anti-litter regulations.[69] There are also private enterprises that render vector control services.
- The Malaria Program Suriname is responsible for the testing and treatment of the cases across the country.[70] The program is active in the interior where the team carries out passive and active surveillance in the small-scale miners. They have trained miners as health volunteers who carry tests and drugs and provide these services to other miners. This program is also responsible for leishmaniasis and the field supervisor can conduct tests. Otherwise, tests are conducted in Paramaribo and cases are treated by the dermatology clinics.
- The Medical Mission's health education department provides health information about the prevention of vector-borne diseases in the villages where the stable population of the interior lives. The health education centers promote the use of impregnated bed nets and repellents, and educate on water and sanitation.
- Schools provide an important contribution to public health by educating the children on the dangers of vector-related diseases, implementing preventive measures and being an example for safe, clean environments that are free of breeding and hiding places of vermin.

The establishment of the National Malaria Board has led to many successful initiatives resulting in a near 90% decrease in malaria. The country was awarded Malaria Champion in 2008 by PAHO.

- Suriname is a part of the Amazon Malaria Initiative, which is a 7 country regional program that began in 2001 and "malaria control programs in the Amazon Basin subregion substantially incorporate selected best practices" is its objective.[71]
- The Global Programme to Eliminate Lymphatic Filariasis has called for the elimination of LF by 2020.[72] The interruption of LF transmission has been successful in Costa Rica, Suriname, and Trinidad and Tobago. Within the first 8 years of the worldwide elimination program, 1.9 billion treatments for LF were delivered to more than 570 million people in 48 countries.
- The health authorities in Suriname have implemented several measures to investigate and respond to a potential outbreak of yellow fever,[73] for example, by enhancing vaccination activity to increase vaccination coverage among residents, enhancing epidemiologic and entomologic surveillance, including strengthening

laboratory capacity. The measures also include implementing vector control activities in the district of Brokopondo, carrying out an assessment of dead monkeys in the suspected areas, conducting social mobilization to eliminate *Ae. aegypti* breeding sites by, for example, covering water containers/ barrels, and issuing a press release to alert the public.

- For Zika prevention and control, PAHO has issued 5 epidemiological alerts since May 2015.[74] These epidemiological alerts provide updated information on the ZIKV situation, as well as recommended public health measures on surveillance, including laboratory testing, case management, risk communications and vector control.

- PAHO and the European Centre for Disease Prevention and Control have developed a framework and preparedness plan for CHIKV outbreak control in the Caribbean subregion.[75, 76]

3.2 Respiratory and Housing Issues

3.2.1 Tuberculosis (TB)

Disease

TB is an airborne bacterial infection caused by *Mycobacterium tuberculosis*. TB can be acquired by breathing contaminated air droplets coughed or sneezed by a person nearby who has active TB. Humans can also get infected with TB by ingesting unpasteurized milk products contaminated with *M. bovis*, also known as bovine TB. The most common form of the infection is pulmonary TB, which affects the lungs. In some cases, the bacteria can also attack the lymphatic system, central nervous system, urogenital area, joints and bones.

Transmission and risk

M. tuberculosis is present worldwide and typically spreads in cramped, overcrowded conditions. There is no evidence that pulmonary TB is more easily transmitted in airplanes or other forms of public transportation. Those with a weakened immune system in communities with active TB are at increased risk.

Occurrence

In Suriname, TB was detected in Amazonian Indians, being relatively common among Trio-Indians, clustering in certain families.[77] This isolated tribe may have a genetic predisposition for TB, but their lifestyle and limited access to health care certainly play a role.

A study from 2014 has observed that TB occurs mostly in tropical areas and in immigrants. Approximately 95% of cases and 98% of deaths due to TB occur in tropical countries while, in temperate low incidence countries, a disproportionate portion of TB cases is diagnosed in immigrants.[78] Immigrants are exposed to additional risk factors for acquiring or reactivating TB infection, such as poverty, stressful living conditions, social inequalities, overcrowded housing, malnutrition, substance abuse and limited access to health care. Some tropical countries, such as Haiti, Peru, Bolivia and Suriname, have the highest incidence of TB in the Americas (between 100 and 200 per 100,000 population).

The estimated rate of TB in 2016 is 0.14 (0.11–0.18) per thousands.[79] Urbanization, poverty, poor housing conditions and ventilation, poor nutritional status, low education level, HIV co-epidemic, and the growing impact of chronic conditions, such as diabetes, are the main determinants of the current TB epidemiology in the tropical areas. The percentage of those tested positive with rapid diagnostics at the time of diagnosis was 66%. Total cases of TB that were tested with pulmonary were 85% and bacteriologically confirmed among pulmonary were 82%. Around 80% of population was covered under universal health coverage for TB treatment in 2016. In Suriname, the incidence rate for Multidrug resistant/Rifampicin resistance (MDR/RR-TB) was 1.9 per 100,000 of population. The estimated percentage of TB cases with MDR/RR-TB was 6.1%. WHO data also reported that TB estimates was higher in males as compare to females. [80]

3.2.2 Influenza

Disease

Influenza, sometimes called "the flu", is a highly contagious and common disease.[30] The illness can be mild to severe in nature, and sometimes leads to serious complications or even death. Flu kills thousands of people around the world each year.

"Seasonal influenza" refers to the influenza outbreaks that usually occur each winter in both the northern and the southern hemispheres (and year-round in the tropics). A number of different flu strains regularly circulate in humans (A/H1N1, A/H3N2 and influenza B).

In 2009, a new flu virus named “influenza A(H1N1)pdm09” that had never infected humans before began circulating. It is now considered as one of the circulating seasonal flu strains.

Transmission

Flu virus spreads from person to person through respiratory droplets.[30] These droplets are expelled when an infected person coughs, sneezes or talks. Droplets can spread about 1 to 2 meters (3 to 6 feet) before they fall.

If they get into a healthy person's nose or mouth, then that person can become infected with the flu. Someone who has the flu may pass the illness to others even before they show signs of being sick. People are usually contagious, or able to spread the infection, about a day before they feel unwell and remain contagious for about 5 to 7 days after becoming sick. Children may remain contagious for a longer period.

Occurrence

A study assessed the trends of influenza infection in Suriname from February 2010 to February 2011.[81] The testing of 393 patients with symptoms of acute respiratory infection (ARI) revealed that there are 15.3% patients with influenza B, while 18.6% patients were identified to be influenza A positive, consisting of 56% influenza A(H1N1)pdm09 and 44% seasonal A(H3N2). All 3 types of influenza affected young children as the primary population. The annual incidence of A(H1N1)pdm09 was 6.88 per 100,000 inhabitants. The influenza spread could not be linked to tourist flow from the Netherlands or to contact rates related to school schedules.

Suriname exhibited substantial background influenza activity throughout the year, but the availability of data from only 1 year limited the conclusions on seasonality. The absence of A(H1N1) influenza in Suriname suggests that similar to most other countries, the novel A(H1N1)pdm09 strain seems to have displaced the prior circulating seasonal A(H1N1) influenza virus. The low morbidity and mortality of the pandemic influenza A(H1N1) (2009) cases in Suriname is in contrast to the observed severity in countries, such as Mexico and Guatemala. For Suriname, Caribbean Epidemiology Centre (CAREC) reported the 1st laboratory-confirmed case of influenza A(H1N1)pdm09 infection on June 22, 2009, and the 1st fatal case on August 2016.[52]

3.2.3 Other Respiratory Infections and Effects from Housing Conditions and Overcrowding

In Suriname, the mortality rate due to chronic lower respiratory tract diseases is 6.9 per 100,000.[82] Although there are known factors that contribute to these types of diseases, e.g., air pollution, housing conditions, smoking, etc., there are limited diagnostic capabilities that can establish links between exposure and disease incidence.

Inadequate shelter and overcrowding in communities are major factors in the transmission of diseases with epidemic potential, such as acute respiratory infections. Outbreaks of disease are more frequent and more severe when the population density is high.[83] Household crowding is also a risk factor for various infectious, lower tract, respiratory diseases, such as pneumonia, respiratory syncytial virus (RSV) bronchiolitis, Hemophilus influenza type b (Hib) disease and TB.

The prevalence of allergic airway diseases, such as asthma and rhinitis, has increased dramatically to epidemic proportions worldwide. Besides air pollution from industry-derived emissions and motor vehicles, rising trends are also prevalent in damp, wet indoor environments. The tropical subregion of South America, comprising 10 countries (Colombia, French Guiana, Suriname, Guyana, Venezuela, Ecuador, Peru, Bolivia, Paraguay and Brazil), represents the greatest concentration of tropical rainforest in the world. There is a cumulative body of evidence demonstrating a highly consistent association between home dampness and respiratory symptoms. Indoor dampness may not only aggravate pre-existing respiratory conditions, but also increase the risk of new respiratory infections, depression and asthma.[84]

Indoor Air Pollution

In developing countries, the traditional use of household energy poses a serious threat to health. Cooking and heating with biomass fuels (such as crop residues, dung, straw and wood) and coal produces high levels of indoor air pollution.[85] The indoor smoke comprises a variety of health-damaging pollutants, such as particle mixtures of chemical in solid form and droplets, carbon monoxide, nitrous oxides, sulfur oxides (mainly from coal), carbon monoxides, formaldehyde and carcinogens.

The studies from Asia, Africa and the Americas have shown that indoor air pollution levels in households reliant on biomass fuel or coal are extremely high.

The WHO assessed the contribution of a range of risk factors to the burden of disease and revealed that indoor air pollution is responsible for 2.7% of the global burden of disease.

3.2.4 National Program to Promote Sustainable Human Settlement Development:[86]

A low-income shelter program is being implemented in Suriname. It is financed by IDB and executed by the Ministry of Social Affairs (MSA). The main objectives of the program are to:

- Improve the housing conditions of low and moderate-income households.
- Harness Suriname's most capable private finance institutions, NGOs and community-based organizations (CBOs) to assist under-served households in lower and middle-income neighborhoods to improve or construct a house.
- Make shelter policies and subsidies more efficient, equitable and transparent.

3.3 Veterinary Medicine and Zoonotic Issues

3.3.1 Brucellosis

Brucellosis is not endemic to Suriname. This country is officially considered 'brucellosis-free'.[50]

3.3.2 Bovine Tuberculosis (TB)

Disease

Bovine TB is a chronic disease of animals caused by bacteria called *M. bovis* that is closely related to the bacteria that causes human and Avian TB.[87] This disease affects practically all mammals causing a general state of illness, coughing and eventual death.

Transmission

The disease is contagious and spreads by contact with infected domestic and wild animals. The infection is transmitted to humans through unpasteurized or raw milk and milk products or, more rarely, by inhalation of the causative agent (Mycobacterium His) during exposure to infected cattle or their carcasses. The usual route of infection is by inhaling infected droplets that are expelled from the lungs by coughing. As the course of disease is slow, taking months or years to kill an infected animal, an animal can spread the disease to many other herd mates before it begins to manifest clinical signs. Therefore, movement of undetected infected domestic animals and contact with infected wild animals are the major ways of spreading the disease.

Occurrence

Bovine TB in Suriname has been traced to imported cattle from Guyana.[88] It is estimated that 4 million animals may be infected in South America, representing significant potential economic loss, as well as a threat to human health. Almost 8,000 human cases of *M. bovis* infection occur each year throughout the region.[89]

3.3.3 Rabies

Disease

Rabies is a preventable viral disease. The viruses associated with rabies belong to the Lyssavirus genus. It is a zoonosis, an animal disease that can spread to humans, transmitted by saliva through bites and scratches of

infected mammals.[90] The infection circulates primarily among domestic, feral and wild dogs, cats, monkeys, foxes, bats, raccoons and skunks, although all mammals are at risk. The virus attacks the central nervous system targeting the brain and the spinal cord and, if untreated, is fatal.

Transmission

It is transmitted to humans from domestic and wild animals. People can get infected when they are bitten or scratched by an infected or "rabid" animal, most frequently a dog. Bats transmit rabies in the Americas, Australia and Western Europe. Bites of other animals can also cause rabies, including coyotes, jackals, mongooses and other carnivore species; however, human death following such exposure is unknown.

Occurrence

Rabies occurs in more than 150 countries worldwide. In Suriname, the last reported human desmodin-type rabies epidemic was in 1975 and a bat-transmitted case was declared in 1998.[91] Rabies virus is widespread in Latin American bat species; 22.5% of bat species have been confirmed rabies positive. Suriname is reported as a rabies-positive country but bat rabies records are lacking.

The unpublished data of the Medical Mission showed that during the period from April 20 to May 2, 1998, 5 patients, all children under the age of 12, died in Diakonessenhuis in Paramaribo with the clinical picture of rabies. They were all living in the Maroon village, Brownsweg, in the Brokopondo region. Although, the source of infection has not fully been proven, enough epidemiological data shows that vampire bats are the most likely way of transmission and were responsible for the typical clinical picture of rage. In 3 patients, pathological and/or serological investigation supported the diagnosis of rabies. Epidemiologically, this outbreak is the most well-studied outbreak of rabies in the region and illustrates the importance of clinical observation of a patient to declare the suspicion of rabies infection.

3.3.4 Ebola

Transmission

Initial infections in humans occur after close contact with wild animals. The disease spreads within a community following human-to-human transmission. It is not clear how the Ebola virus actually gets from animals or the environment into humans. The virus most probably resides in bats. It may infect an intermediate species, such as non-human primates like monkeys and gorillas that eat the infected, partially eaten fruit that bats drop.

Humans are infected following direct contact with the secretions, blood or bodily fluids of infected animals. These include chimpanzees, gorillas, fruit bats, monkeys, forest antelopes and porcupines. Human outbreaks then begin with the virus spreading to those in direct contact with the blood and/or secretions of the infected person that may happen when caring for a sick person or through certain funeral practices, such as communal washing of the body. This is why the virus often spreads within families, friends and to health-care providers. Humans can also get infected by consuming the meat of a dead "intermediate" animal.

Occurrence

No Ebola cases have been recorded in the country.

3.3.5 Hantavirus

Disease

Hantaviruses are a group of viruses that belong to the bunyaviridae family. They can cause 2 different types of illnesses in humans that include hemorrhagic fever with renal failure syndrome (HFRS) and hantavirus pulmonary syndrome (HPS), also known as hantavirus cardiopulmonary syndrome (HCPS).

HFRS can cause a spectrum of illness from severe to mild.

Transmission

Mice, rats and other rodents carry hantaviruses. They shed the virus in their urine, feces and saliva, and most human infections result from breathing contaminated air. Humans rarely become infected from the bite of a sick rodent. Some scientists believe transmission can take place by touching a contaminated object with own fingers and then touching one of the self-mucous membranes, such as the eyes, nasal passage or mouth. People can also get sick if they consume food contaminated by rodent excreta. It is not generally passed on from person to person; there is only 1 such recorded instance, in Argentina in 1996. Hantaviruses can be transmitted anywhere rodents live, including residential housing. Pet rodents, such as gerbils and mice bought in pet stores, do not generally carry the disease.

Occurrence

The 1st serological indication of hantavirus infections in symptomatic patients in Suriname was reported in 2008-2012 and 2014 by the Bureau of Public Health in Suriname.[92,93] The circulation of hantavirus was also reported in the areas neighboring Suriname.

The HFRS strain primarily occurs in Europe and Asia with the more severe form tending to occur in Asia, while the milder form (nephropathia epidemica/NE) usually in Europe.

3.3.6 Leptospirosis

Disease

Leptospirosis is an infection caused by the bacteria *Leptospira*. It is present worldwide but more common in tropical climates. Infection usually occurs through contact with or swallowing contaminated water. The infection can be mild to severe and can cause death if left untreated.

Transmission

A variety of animals carry the bacteria that cause leptospirosis, including rodents, cattle and dogs. The animals usually do not have any signs of disease, but their bodily fluids (including urine) contain the disease. Leptospirosis bacteria shed by the animal can last for weeks or months in the environment, contaminating water and soil.

People are infected when the bacteria enters the body through cuts in the skin or through mucous membranes (eyes, mouth, nose). This may occur when working with animals, participating in activities in contaminated water, drinking contaminated water or eating contaminated food. Person-to-person transmission is possible but rare.

Occurrence

Over 2004 to 2009, the number of suspected cases of leptospirosis declined from 136 to 110, respectively.[94]

Leptospirosis is a neglected zoonosis of worldwide importance and is considered endemic in Suriname; however, supporting epidemiological and clinical data is scarce. In a study conducted on clinical and laboratory-confirmed cases of leptospirosis between January 1, 2013 and June 30, 2015, retrospectively, the incidence of severe leptospirosis in Suriname was found to be lower than the 1st suspected case but still remains significant.[95] People acquiring the disease have a high chance of dying as evidenced by almost 1/4th of patients under study admitted to the intensive care unit (ICU) due to serious manifestations, such as Weil's syndrome and pulmonary hemorrhage. The presence of hypotension, increased creatinine, hemorrhages, conjunctival suffusion and decreased thrombocytes on admission were independent predictors of ICU admission and could have been helpful in allowing early treatment at the ICU, thereby reducing mortality.

In 2011, there were 25 cases reported in Suriname.[96] The principal reservoirs were rats, pigs, dogs and cattle. The principal species were *Leptospira serovars, icterohaemorrhagiae*, *pyrogenes*, *australis*, *mini* and *pomona*.

3.3.7 Onchocerciasis

There is no evidence of onchocerciasis in Suriname.

3.3.8 Neglected Tropical Diseases (NTDs)

NTDs are a diverse group of communicable diseases that prevail in tropical and subtropical conditions in 149 countries and affect more than 1 billion people, costing developing economies billions of dollars every year.[97] They mainly affect populations living in poverty, without adequate sanitation and in close contact with infectious vectors and domestic animals and livestock.

The prevalence of NTDs present in Suriname, namely, Chagas disease, leprosy, leptospirosis, schistosomiasis, soil-transmitted helminths (STH), is low. The MOH in Suriname has indicated its commitment to the elimination of NTDs - see section 3.1.1 on Chagas disease, 3.1.4 on LF, 3.1.8 on schistosomiasis, and 3.3.6 on leptospirosis. For leprosy, the elimination target of 1 new case per 10,000 people set by the adopted resolution at the 1991 World Health Assembly has been reached. In 2009, 38 new cases were detected (0.7 per 10,000). For STH, an overall prevalence of 2.1% for STH (egg count), similar in sexes and lower than the elimination target, were found in 2009/2010 randomized study among 6th grade primary school children (median age 12 years) in 7 districts in Suriname. Brokopondo (7.1%) and Saramacca (3.9%) were the ones with the highest prevalence for STH. Further research is needed to identify the underlying factors of the remaining low transmission to eliminate STH in Suriname.

In the school health program of the Medical Mission, screening of all schoolchildren is achieved twice per school year with the aim of early discovery and treatment of health problems among schoolchildren of the nursery and primary schools in the interior. Hemoglobin (Hb) research is part of the screening. During the 1st screening of the school year, all kids are dewormed regardless of the Hb-value. If abnormalities are found in Hb research of children, they are further investigated and treated. They are also advised to eat more fruit and vegetables, and to use the necessary vitamins and minerals to support a healthy and high-fiber diet.

3.4 Sexually Transmitted Infections (STIs)

STIs include a group of infections that can be predominantly, although not exclusively, transmitted sexually, such as HIV/AIDS, syphilis, gonorrhea, chlamydia, hepatitis B, etc.

The identified risk behaviors include unprotected sex, sex with multiple partners, and use of the same piercing or injecting equipment. The groups at risk include men who have sex with men (MSM), female sex workers and their clients, and injecting drug users.

NGOs and CBOs in Suriname play an important role in the fight against HIV/AIDS, especially with the most-at-risk populations. These organizations are sources of important information in preventing the spread of the virus and in providing care and support for men and women. In light of this, the UN has supported the key NGOs working in the field of HIV/AIDS with most-at-risk populations by providing training in the project management, and result-based monitoring and evaluation to enhance their technical capacity.

3.4.1 HIV/ AIDS

Diseases

AIDS stands for "acquired immunodeficiency syndrome" and is caused by HIV. There is currently no cure - once a person is infected he/she has it for life. HIV progressively damages and ultimately destroys the immune system, which normally protects the body from infections and cancers. The rate at which the disease progresses varies from one individual to another. Progression also depends on the strain of HIV and whether anti-HIV (anti-retroviral) drugs are used.

Transmission

The HIV is contained in blood and other body fluids and secretions. Transmission can occur by:

- Sexual transmission: Unprotected sexual intercourse (vaginal or anal).
- Mother-to-child transmission: Before or during birth or by breastfeeding.
- Blood: Shared syringes and needles, transfusion with contaminated blood components, and acupuncture, tattooing and ear piercing when the instruments have not been sterilized.

A person cannot contract HIV through casual contact. It is safe to share a room with, hug, kiss and touch an infected person.

Occurrence

The estimated HIV prevalence for the adult population (15 to 49 years) is 0.9%; however, the prevalence among the groups at risk is higher than the general population and was estimated to be 6.7% for MSM in 2005 and 5.8% for commercial sex workers in 2012.**Error! Bookmark not defined.**

The absolute number of people living with HIV/AIDS (adults and children) is around 3,800.[98] In total, AIDS is the 12th most common cause of death and is responsible for 13.5% of all deaths in Suriname.[99]

From 2000 to 2013, 7,090 new cases of HIV were diagnosed.**Error! Bookmark not defined.** New cases peaked in 2006 with 781. Since 2007, there has been a steady decline in the number of new cases, approximately 500 per year.

Awareness and knowledge of HIV prevention among the population is minimal. According to a Multiple Indicator Cluster Survey (MICS 4), only 43% of women were found to have comprehensive knowledge of HIV prevention. Women in urban areas scored markedly higher (47%) than in rural coastal areas (37%) or the rural interior (20%). While 93% of women know that HIV can be transmitted from mother to child, the percentage of women who know all 3 ways of mother-to-child transmission is 52%.

The MOH provides testing and treatment for free regardless of the insurance coverage; however, the treatment of opportunistic infection and the management of chronic conditions require an insurance coverage. At-risk groups, such as sex workers and small-scale miners, might not have an insurance coverage. CD4 count and viral load measurement are available only in Paramaribo and in the interior; the Medical Mission has to transport blood samples to Paramaribo by “Laboratorium missions” for blood testing. The national HIV program is mainly active in Paramaribo and in the coastal area, but does not have the capacity to reach in the interior. However, in order to reach small-scale miners and other hard-to-reach group in the interior, the HIV program collaborates with the malaria program that is a more structured outreach program.**Error! Bookmark not defined.**

The youth is another important targeted group. Studies conducted in 2012 and 2013 among 15 to 24 years old found that 80% were sexually active and 15 years is the average age of the first sexual intercourse. The highest percentage of sexually active teens was found in the interior (33.4%), compared with 6.8% of urban population. Additionally, the level of knowledge about HIV transmission and condom use in the youth is low, with a national average of 42% of systematic knowledge on HIV transmission and only 24% in the interior (Sipaliwini and Brokopondo).**Error! Bookmark not defined.**

All pregnant women in the interior are tested on HIV by the Medical Mission. In case they are positive, they are then treated to prevent mother-to-child transmission.

3.4.2 Hepatitis B and C

Diseases

The hepatitis B virus (HBV) can cause acute and chronic liver infections.[100]

The hepatitis C virus is a blood-borne virus and the most common modes of infection are through exposure to small quantities of blood.

Transmission[101]

The hepatitis B and hepatitis C virus are transmitted through contact with blood, blood products or body fluids. The modes of transmission include:

- Unprotected sexual intercourse
- Infected blood transfusions
- Needle sharing by intravenous (IV) drug users
- Use of unsterilized needles, syringes or medical and dental equipment
- From mother to child during childbirth

Occurrence

There is routine hospital-based surveillance for viral hepatitis in Suriname.[102] The surveillance system registers all patients who have a diagnosis of hepatitis (acute or chronic).

The government has established the goal of eliminating hepatitis B, and a national policy specifically targeting mother-to-child transmission of hepatitis B exists. No information was available on the percentage of newborn infants nationally receiving the 1st dose of hepatitis B vaccine within 24 hours of birth; however, 86% of 1 year olds and children of ages between 12 and 23 months received 3 doses of hepatitis B vaccine.

According to a study of male blood donors from different ethnic groups in Paramaribo, 5% carried hepatitis B antigen (HBsAg) and 33% hepatitis B antibody (anti-HBs).[103] Among these ethnic groups, only blood donors of Indonesian origin had a higher prevalence of both HBsAg and anti-HBs.

All pregnant women are tested for hepatitis B by the Medical Mission. In case of a positive HBsAg and HBeAg rapid test, the woman should be giving birth in the hospital in Paramaribo. The baby gets antibodies shortly after birth and the 1st vaccination is administered.

3.4.3 Syphilis

Disease

Syphilis is a sexually transmitted bacterial infection. If left untreated, it can lead to some serious complications, such as brain damage, and abnormalities of unborn babies of pregnant women. People infected with syphilis also have an increased risk of developing HIV infection.

Transmission

Syphilis is spread through skin-to-skin contact, during unprotected sexual activity, and when a person comes in direct contact with active lesions of an infected partner. These lesions, commonly called “sores”, are highly infectious. They develop wherever the bacteria enter the skin, such as the external genitals, anus and lips, and internally in the rectum, vagina or cervix.

Pregnant women can pass the infection to their unborn child.

Occurrence

In 2013, the annual mortality rate from syphilis in Suriname was 0.3 per 100,000. This represents a 62.1% decrease since 1990, an average of 2.7% a year.[104] The fatality rate for men with syphilis peaks at the age above 80 years and the lowest rate at ages between 40 and 44 years in Suriname. Women die at the highest rate from syphilis in Suriname at the age above 80 years and the lowest rate at ages between 25 and 29 years. At 2.3 deaths per 100,000 women in 2013, the peak mortality rate for women was higher than that of men, which was 1.3 per 100,000 men.

3.4.4 Gonorrhea

Disease

Gonorrhea is an STI. Both men and women can be infected in their urethra (urine canal), rectum, mouth, throat or eyes. Additionally, in women, the cervix (opening to the womb), uterus (womb) and fallopian tubes can be impacted.

Transmission

Gonorrhea is caused by the bacteria *Neisseria gonorrhoeae*. It can grow and multiply easily in warm and moist areas, such as the urethra or a woman's reproductive tract, and is often transmitted from person to person through

sexual contact. Vaginal, oral and anal intercourse can all spread the infection, and it can also move from mother to baby during childbirth. When this happens, it usually infects the baby's eyes.

Occurrence

According to BOG (2012), there were total 13.099 cases of genital discharge cases that tested positive for gonorrhea culture.**Error! Bookmark not defined.**

3.4.5 Chlamydia

Disease

Chlamydia is a bacterial disease that spreads through sexual contact. It is a common illness and is usually mild with few or no symptoms.[30] If left untreated, it can lead to serious complications, including infertility.

Transmission

Chlamydia is caused by the bacterium, *Chlamydia trachomatis*.[30] It is transmitted during unprotected vaginal, anal or oral sex and affects both men and women. Although people of all ages may be affected, young women or teenage girls may be more prone to infection. The infection may also be transmitted from an infected mother to the baby during a vaginal delivery.

Occurrence

Chlamydia prevalence in Suriname is high and targeted prevention measures are required.[105] The prevalence of chlamydia in Suriname is very high, with 10% in a low-risk population and up to 23% in a high-risk population. This prevalence is high overall in all ethnic groups (>7%), but higher in the Creole and Javanese groups compared with the Indian population.[105] The Creole and Javanese groups seemed more affected by chlamydia as compared to the Indians.

3.5 Soil, Water and Sanitation-Related Diseases

Adequate supply of safe drinking water is universally recognized as a basic human need.[106] However, more than 1,000 million people in the world do not have access to adequate, safe water supply. A variety of physical, chemical and biological agents render many water sources less than wholesome and healthy.

The diseases associated with water and sanitation can be classified according to their relationship with water. Oostburg (1993) in his study of freshwater ecosystems of Suriname stated the following water-related diseases in the country:

Water-borne diseases

- Water-borne diseases are caused by organisms that can survive in water and are ingested when contaminated water is drunk. Some examples of water-borne diseases include:
    - Dysentery caused by Shigella
    - Acute diarrhea that can be caused by Rotavirus, Giardia lamblia, *Escherichia coli*, Campylobacter and others
    - Typhoid fever and cholera - in 1991, 1 case of cholera occurred in the country

Water-shortage diseases

- Many kinds of infections, such as diarrhea, contagious skin and eye infections, are more frequent when scarcity of accessible water supplies makes washing and personal cleanliness difficult and infrequent.

Water-based diseases

- Some parasitic helminths spend part of their life cycle in intermediate host organisms that live in fresh water. Humans can be infected when in contact with this water; the best example is schistosomiasis (see section 3.1.8).

Water-associated vector-borne diseases

- These diseases occur when water provides a habitat for arthropod vectors. Some examples are malaria, filariasis, yellow fever and dengue (see section 3.1 on vector-borne diseases).

Chemical constituents

- Some rivers in the hinterland of Suriname are contaminated with mercury from the gold mining. There is contamination by pesticides in the irrigation water in the area of rice plantation in the coastal zone.

Transmission

In many of the diseases indicated above, water is not the only means of contamination. Contaminated food, contaminated hands with fecal matter, and some helminthic worm infections directly through the skin are also possible modes of transmission. Most transmission modes relate to poor sanitation conditions.

In the interior of Suriname, open defecation is still the most common practice, in particular, among Maroon communities (MICS 2010).[107] While the open defecation rate in the rural interior overall is 49.1% (MICS 2010), the pre-intervention knowledge, attitudes and practices (KAP) survey identified an open defecation rate of 89% in target villages, much higher than the national average.

Most households in Suriname (94.8%) have access to an improved source of drinking water[6], with access in urban areas being higher than in rural areas (98.1% and 88.4%, respectively).[107]

3.5.1 Diarrhea

Disease

Diarrhea is an infection resulting in having more frequent, loose and watery stools.

Transmission

It is mainly caused by bacterium E. coli, which is spread through contaminated food and water. Between 5% and 30% of cases are caused by other bacteria, especially salmonella, Shigella and campylobacter. Viruses, such as rotavirus and calicivirus, and parasites are other common causes.

[6] An improved source of drinking water includes, in addition to water piped into the dwelling, yard or plot, water available from a public tap or standpipe, a tube well or borehole, a protected dug well, a protected spring, and rainwater.

Occurrence

The most serious health problem related to water and sanitation in Suriname is diarrhea that can be caused by many infectious agents.[106] The final consequence of a very serious case of diarrhea is death by gastroenteritis, which is the 5th leading cause of death in the country. In Suriname, there has been an increase in the number of cases of death due to gastroenteritis from 171 in the period from 1986 to 1988 to 280 in 1989-1991 to 377 in 1992-1994. During the period from 1988 to 1993, gastroenteritis was responsible for 12% of the deaths of children under 5 years old.

Diarrheal diseases are the 25th most common cause of death in Suriname, accounting for 0.4% of all deaths.[99] Under-5 deaths caused by Diarrhea in Suriname are 7%.[108]

3.5.2 Cholera

Diseases

Cholera is an acute diarrheal disease caused by the intake of contaminated food or water infested by the bacteria *Vibrio cholerae*. The disease is endemic in many countries.

Cholera outbreaks are caused by 2 serogroups of V. cholera – O1 and O139.

Transmission

The bacterium that causes it is spread through food and water that has been contaminated by the feces of an infected person.

Occurrence

Although there is no cholera in the country at present, there is an increased risk due to frequent migration within the region with active cholera cases.

3.5.3 Typhoid

Diseases

Typhoid fever is a serious infection caused by a species of salmonella bacteria.

Transmission (fecal-oral transmission route)

The bacteria spreads through food or water - raw fruit, vegetables and shellfish are foods that are commonly responsible. Occasionally, transmission is through direct contact with someone who is infected. Contamination occurs with the feces or urine of an infected person.

In developing nations, where typhoid fever is endemic, most cases result from contaminated drinking water and poor sanitation.

Occurrence

The annual mortality rate per 100,000 people from typhoid fever in Suriname has increased by 50.2% since 1990, an average of 2.2% a year. In 2013, the annual mortality rate is 0.6 per 100,000 people.[109] For men, mortality from typhoid fever in Suriname peaks at the age of 1 to 4 years and the lowest rate at the age of 60 to 64 years. At 2.1 deaths per 100,000 men in 2013, the peak mortality rate for men was slightly higher than that of women at 2.0 per 100,000 women. Women die at the highest rate from typhoid fever in Suriname at the age of 1 to 4 years and at the lowest rate at the age of 75 to 79 years. The 3 most deadly, intestinal infectious diseases in Suriname during 2013 were typhoid fever, paratyphoid fever and other intestinal infectious diseases, respectively.

3.5.4 Polio

Diseases

Polio (poliomyelitis) is a highly infectious viral disease of the nervous system. It can have serious complications, including paralysis and death. It mostly infects children under 5 years, but can affect people at any age, including adults. The WHO continues with its efforts to eradicate the disease that remains endemic (consistently present) in 3 countries, including Afghanistan, Nigeria and Pakistan.

Transmission

An infected person has the polio virus in his/her feces and nose and throat secretions. In the areas of poor sanitation, polio-containing feces can contaminate water and food supplies.

People can contract polio if the virus enters their mouth. This happens through direct contact with an infected person (even if that person has no symptoms), or through eating or drinking contaminated food or water.

Occurrence

The 1st recorded wild virus poliomyelitis case occurred in Suriname in 1929. Till date there was no polio cases were recorded for decades.[2]

3.5.5 Giardiasis

Diseases

Giardiasis is an infection of the intestine caused by the parasite Giardia lamblia. It is a common illness all over the world.

Transmission

Giardia spreads via the fecal–oral route. Food and water contaminated by the feces of an infected person will transmit the disease. People can become infected if they get the parasite on their hands, for example, when changing an infant's diaper, and then inadvertently transfer the parasite to their mouth. People can also become ill from contact with infected animals or through swimming in contaminated water.

Occurrence

Giardia duodenalis infection (and malnutrition) is still considered a public health problem in many developing countries, especially among children in rural communities. A significant association between the chronic infection, poor cognition and adequate sanitation facilities are the main predictor for acquiring intestinal infections (and hookworm-like larvae) in human fecocultures in Suriname.[110]

3.5.6 National Water Management and Waste Treatment

Water Resources and Supply

Suriname is rich in hydrologic resources.[111] The abundance of water is considered ‘white gold’. Due to the lack of proper waste disposal throughout the country and mercury contamination in the surface water, the water is in danger of becoming unusable in areas. The lack of a national water sector and water law exacerbates this problem. Saltwater intrusion in coastal area wells is also contributing to water supply contamination. The urban

areas rely on ground water for their water supply, with a high percentage of residents having access. The overall quality is good, but saltwater intrusion in the wells from over pumping is increasing. Most rural areas use surface water for their water supply. However, mercury pollution from gold-mining processes in the interior, and the lack of sanitation services contaminate the surface water. The abuse of the uncontrolled use of mercury in gold mining processes is a serious problem in Suriname. There is very little effort being made to control or monitor this very grave threat to the health of the country's rivers (also see section 3.8 Exposure to Potentially Hazardous Materials).

Urban Areas

Paramaribo is the national capital and main urban center of the country. Roughly, half of the country's population lives in Paramaribo. Suriname Water Company (SWM) provides water supply services to the urban areas, including Paramaribo and part of Wanica, Nieuw Nickerie and Albina. Ground water is used for water supply. In Paramaribo, the SWM laboratory and the Environmental Control Division of the Bureau of Public Health conduct water quality monitoring. At the end of 1998, about 90.6% of the people in urban areas were connected to the public supply.

Rural areas

Most land area is rural, most of which is the interior of the country. However, the interior is very sparsely inhabited, with only about 15% of the country's total population. The coastal areas are also considered rural, with about 15% of the country's total population. There is no long-term planning for water supply and sanitation in the rural areas. Surface water is mostly used in rural areas and in the interior. However, in northern areas (mainly coastal areas), ground water is used. Where piped water is scarce, domestic wells are sometimes used. The water is sometimes contaminated by seepage of septic tank effluent or pit latrines nearby.

The Ministry of Natural Resources, Water Supply Service (NH/DW) provides water supply coverage to the rural population, and manages 20 water plants in the interior. Also, many coastal aquifers are being over pumped, and thus many wells have had to be abandoned due to saltwater intrusion. A main concern is the contamination of surface water due to uncontrolled mercury contamination originating from gold mining processes. Little regulation exists and enforcement is limited due to a lack of resources. There is also very little (if any) monitoring of mercury in the surface water in the interior. Water-quality sampling is done on an ad hoc basis (see section 3.8 Exposure to Potentially Hazardous Materials).

Water treatment in coastal areas consists of aeration, rapid filtration (for heavy metals) and shell filtration (for pH) for ground water. There is no chemical treatment. In Moengo, however, much surface water is used, so chemicals are used in water treatment. In the future, Moengo will probably use ground water for its water supply. When

treated, surface water is chlorinated. Brownsweg is an exception where slow sand filtration and chlorination is used for water from Lake Brokopondo.

Surface and ground water quality

The quality of drinking water delivered to the population is questionable. The water should be monitored regularly in the coastal areas, as well as the interior. The determination of the concentration of heavy metals, such as mercury and cyanide in drinking water, should be considered particularly in the interior.

Surface water quality in urban, as well as rural areas is under severe stress due to poor sanitary practices and industrial and mining activities. A greater risk also exists for pollutants entering the streams in the northern quarter because this region has the major population, agricultural and industrial centers of the country. The Coastal Plain province is the industrial center of the country. The bauxite mining and aluminum refinery near Paranam has created areas contaminated by heavy metals and alkaline-rich effluent from the use of caustic soda in the refinement process (also see section 3.8 Exposure to Potentially Hazardous Materials).

It is situated in an area with a lot of industrial activities (paints, wood, rice and washing powder), and is consequently strongly polluted. The Kanal is also used for some domestic water supply. The Corantijn Kanaal carries fresh water from the Corantijn River to coastal areas for rice irrigation.

A major concern regarding water quality is the mercury contamination of the shallow aquifers from illegal gold mining activities. Treatment of fresh ground water by a simple sand and shell filtration method and of saline ground water by reverse-osmosis desalination is necessary to ensure water is suitable for human consumption.

Critical issues in water services and water quality

Water resources and water supplies are the responsibilities of many agencies. The uneven distribution of the population causes water supply and sanitation service hardships. Biological, mercury and pesticide contamination, as well as excessive chlorides compromise water quality in many areas of the country. Saltwater intrusion is affecting some of the water supply wells in the urban areas due to overuse. Some factors contributing to the problems associated with water resources and supply are as follows:

- No national water authority or water law
- Uneven population distribution
- Improper sewage and solid waste disposal and nonexistent wastewater treatment
- Pollution of surface water from gold mining processes in the interior

- Inadequate and insufficient water and sanitation services in rural areas
- Old and poorly maintained distribution network in Paramaribo
- Inadequate drainage and structures to control flooding in the urban areas
- A lack of trained personnel in the water agencies

In summary, the main critical issues are the lack of access to safe water and sanitation, particularly in the rural areas, the lack of a national water sector, and a comprehensive and enforceable water law. Solutions to these issues present significant challenges to the managers of the water resources. The lack of a water policy and the lack of a water law constitute one of the largest weaknesses in managing water resources. This results in uncontrolled exploitation and use of water. Another major critical issue is the uncontrolled use of mercury in the gold mining processes, which is threatening the health of the nation's waterways (also see section 3.8 Exposure to Potentially Hazardous Materials).

3.6 Food and Nutrition-Related Issues

Adequate nutrition is critical to child development. The period from birth to 2 years of age is important for optimal growth, health and development. At this age, children are particularly vulnerable to growth retardation, micronutrient deficiencies and common childhood illnesses, such as diarrhea and ARIs.

3.6.1 Stunting, Wasting, Anemia and Micronutrient Deficiency Diseases

The root causes of malnutrition are multiple and range from low dietary intake and inequitable distribution of food within the household to infectious diseases and a lack of appropriate care.

The Suriname MICS supported by the United Nations Children's Fund (UNICEF) was carried out as part of the 4th round of the global MICS household survey program.[7] The MICS report confirmed the disparities in the situation of children and women between the rural interior (the principal spatial domain of the Maroons and indigenous peoples of Suriname) and the urban and rural coastal region.

Underweight, stunting and wasting

Almost 6% of children under age 5 are moderately or severely underweight (5.8%) and 1.3% are classified as severely underweight. Just under 1/10 of children (9%) are moderately or severely stunted (too short for their age) and 5% are moderately or severely wasted (too thin for their height).[98] A higher prevalence of being overweight appears to be consistent with children whose mothers have higher levels of educational attainment. Whether underweight, stunted, wasted or overweight, the data point to higher prevalence rates among boys when compared to girls.[98]

The trend for under-5 stunting in Suriname is falling – between 2000 and 2010, there was a sharp decline in stunting prevalence in children from 15% to 9% as reported in Global Nutrition Report (2015).

[7] The 6th round of the MICS survey is still ongoing and data is awaited.

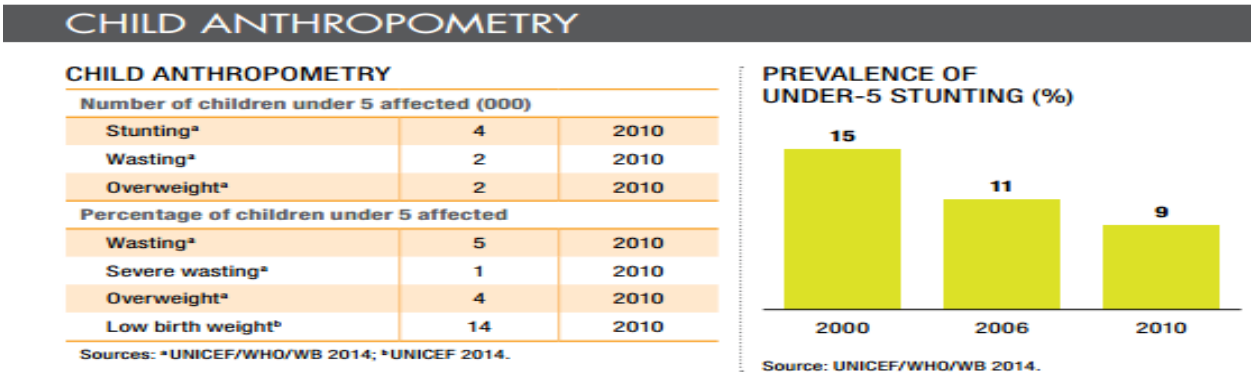


Figure 5 Child Anthropometry[8] statistics and Prevalence of Stunting under 5 in Suriname[112], Global Nutrition Report 2014

Through proper care and intervention, stunting, wasting and micronutrient deficiencies are preventable in a population.

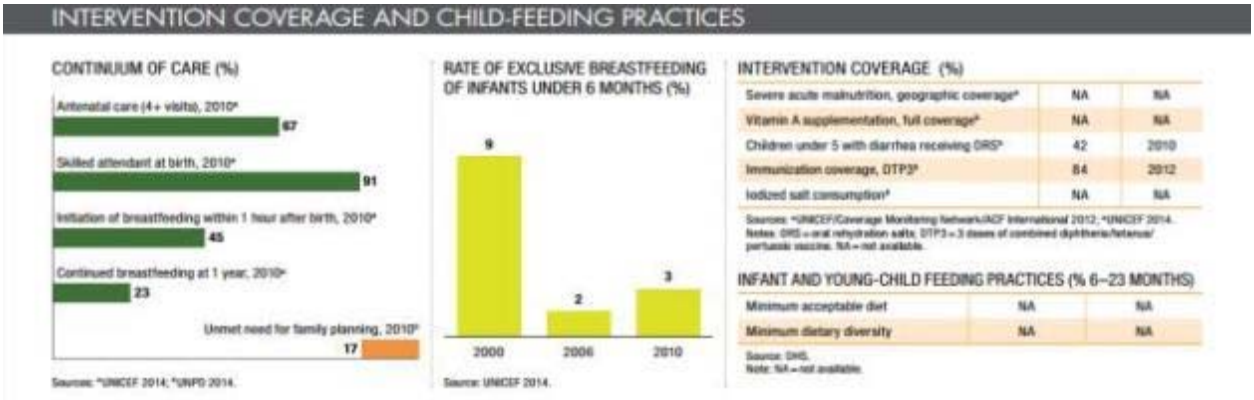


Figure 6 Intervention coverage and child-feeding practices in Suriname[112]

Figure 6 shows that the rate for exclusive breastfeeding for children under 6 months continues to be low (2.8% in 2010) in Suriname, revealing a worrisome situation.

8 The study of human body measurements

Obesity

Figure 7 on prevalence of adult overweight and obesity in Suriname (WHO 2015) shows that 26.1% of adults in Suriname, both male and female, were found to be obese according to 2014 estimates.[113] Adiposity (fat under the skin and surrounding major organs) is found to be higher in females and data shows that 63% females were found to be overweight having body mass index (BMI) > 25 kg/m^2 compared to 54% males. Additionally, 33% of females were found to be obese compared to only 19% males, showing a progressive rise in over nutrition among women in the reproductive age group, thus posing challenges to the community and policy makers.

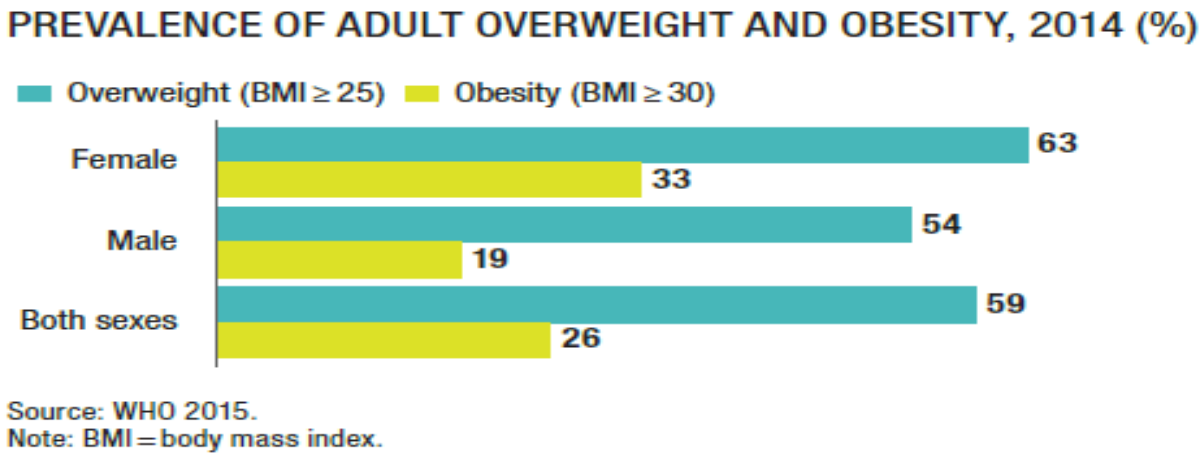


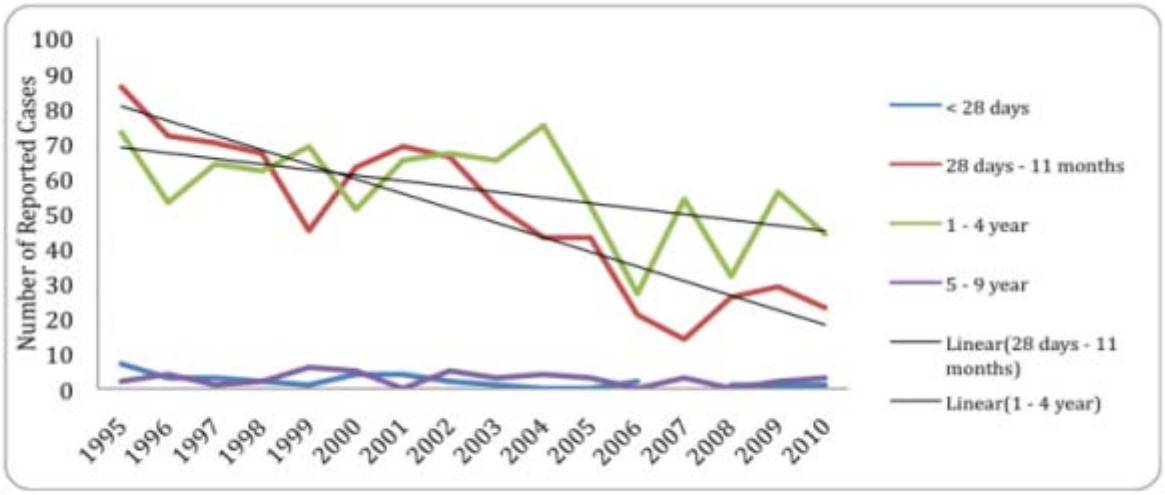
Figure 7 Prevalence of adult overweight and obesity in Suriname (WHO 2015)

Shifting from under nutrition to over nutrition, data shows an increase in the prevalence of obesity among the population. The Global Health Report 2015 data reveals that 19% of the adolescents are overweight while 9% fall in the obesity category having BMI >25 kg/m^2.[9]

Malnutrition and hospitalization

The data on malnutrition and hospitalizations for children aged <28 days to 10 years, from 1987 to 1995, showed increasing number of cases, peaking in 1994 to 1995 (183 to 185 cases). Currently, a downward trend has been noted in the number of cases, from 1995 to 2010, in all age groups but mostly in children aged 28 days to 11 months and 1 to 4 years. Overall, admission of children under 5 decreased in the last 15 years. The 2009 Global School Health Survey (GSHS) among children aged 13 to 15 years (n=1698), shows that approximately 7.5% are underweight and 26% are overweight or obese.[114] This indicates a double burden of malnutrition and obesity in children in Suriname.

Severe malaria and hypoglycemia are also directly related and associated with high mortality in children if not treated on time. The complication is dependent on the prolonged fasting, severity of infection, young age and malnutrition. A study[115] reported that infection with *plasmodium falciparum* resulted in an increase in glucose production in both severe and non-severe *P.falciparum.* In children, as glycogen stores are limited and a period of prolonged fasting could be a major risk factor for hypoglycemia. Systematic review has also shown significant evidence associating malaria and malnutrition.[116] With decreased malarial cases in Suriname, there could be a possibility of lower cases of malnutrition due to malaria. More scientific evidence is required to report low malaria incidence and nutritional deficiencies that may influence *Plasmodium* infections. Undernutrition and malaria are important morbidities with relevance to public health; thus, coordinating the actions of malaria control programs and nutrition programs could substantially impact these morbidities among children.



Source: Epidemiology department, BOG

Figure 8 Hospitalization due to malnutrition in Suriname (BOG)[114]

Anemia

Anemia affects mostly preschool age children, pregnant and lactating women. The most common cause is the deficiency of iron.

In 2013, the annual mortality rate of iron deficiency anemia in Suriname is 4.2 per 100,000 people.[117] The annual mortality rate in Suriname has decreased by 21.7% since 1990, an average of 0.9% a year. According to a study conducted on prevalence of anemia in young children living in the interior of Suriname comparing age, nutritional status and ethnicity,[118] the prevalence of anemia in children aged 1 to 5 years is high (63%) compared to similar-aged children in Latin America and the Caribbean (4% to 45%). Children aged 1 to 3 years were more affected

than those aged 4 to 5 years, as were Maroon children compared to Amerindian children. Nutritional status and gender were not the influence factor.

3.6.2 Food Security

Suriname is prone to flooding, particularly in the coast and some parts of the interior that can affect food security due to the loss of crops and inaccessibility. In 2007, a food security assessment identified vulnerable groups in the urban, rural and interior areas. The key factors influencing food security were low education level, a decrease in the risk management capacities, frequent flooding of farmland and limited financial capital. Addressing the needs of vulnerable groups is essential in preventing further deterioration of the food security situation.

3.6.3 Agriculture and Subsistence

The loss or degradation of forests can generate a number of impacts on its inhabitants, such as a reduction in water availability, scarcity of basic supplies needed to subsist, a reduction to their forest communities' income and resources, and forced migrations both out and into the forest.

The agriculture sector is of great importance for the socioeconomic development of small farmers in rural areas and in the interior of Suriname.[119] Amerindian women produced food and other crops in a primitive way, using only self-made manual tools, for subsistence. The men are responsible for land clearing, hunting and fishing. Maroon women were more responsible for food production, generally at subsistence level.

In Suriname, organic farming is currently driven by NGOs' actions toward more sustainable agricultural practices. Although organic agriculture as such (i.e., certified products) does not exist yet, significant steps toward organic farming have been made over the last years.[120] For instance, the Caribbean Institute, funded by the UNDP-GEF Small Grants Program, the Alcoa Foundation and the IDB, has been leading a number of successful projects and initiatives toward organic farming, making significant progress in engaging with communities throughout Suriname.

A case study on Maroon village in Suriname shows that the Amerindian villages are also surrounded by natural resources and depend on them heavily for subsistence and livelihood activities, primarily agriculture. Tourism is small scale, with a few accommodation facilities (mainly guest houses) and some villagers may sell craft to visitors in the community and in the city.[121]

3.7 Accidents and Injuries

The main types of injuries causing death among the general population in Suriname are self-inflicted injuries, road traffic accidents and other unintentional injuries (falls, struck by/against an object), which are the 7th, 8th and 13th most common causes of death among all ages.

3.7.1 Transport and Road Traffic Accidents

Road conditions are poor in Suriname and there is limited road access to the interior and neighboring countries. Suriname has a relatively high road traffic mortality rate compared to the regional average.[122]

Road traffic accidents are the 8th leading cause of death in Suriname and account for approximately 3.9% of all deaths in Suriname. The highest occurrence of traffic accidents is among young adults aged 20 to 24 years, followed by those 15 to 19 and 25 to 29 years old.

Fatalities from road traffic accidents are estimated at 19.6 per 100,000.[123,124] Contrary to this high ranking, road traffic victims, both injured and deceased, have shown a downward trend since 2009 in Suriname. The highest rate of road traffic fatalities are among riders of motorized 2-wheeled or thr3ee-wheeled vehicles.

The goal of the Government of Suriname is to reduce fatalities by 50% by 2020 in accordance with the Global Plan for the Decade of Action for Road Safety 2011-2020 and to mitigate the social and economic dislocation resulting from serious road traffic accidents.

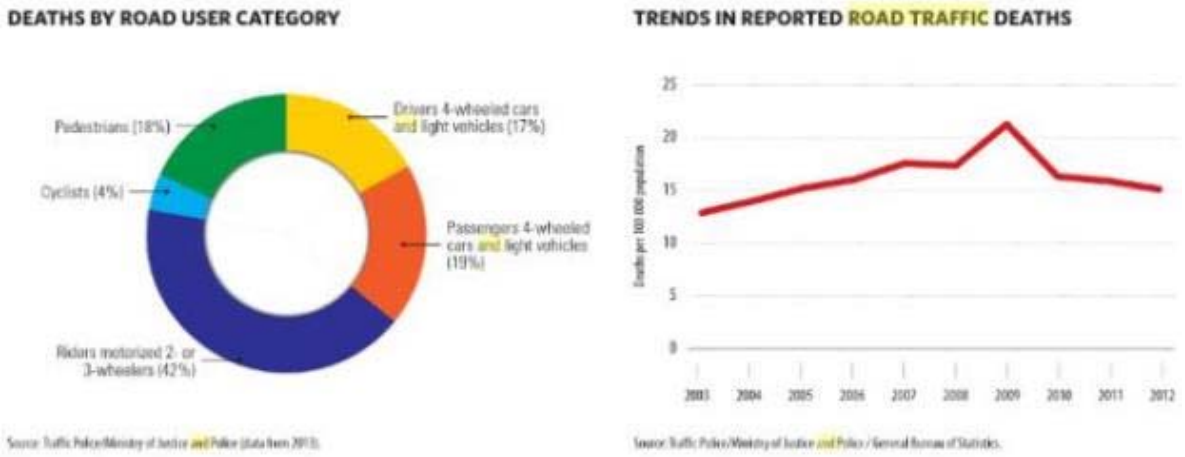


Figure 9 WHO Global Status Report on Road Safety 2015, Suriname[125]

3.7.2 Drowning

Drowning is the 3rd leading cause of unintentional death worldwide, accounting for 7% of all injury-related deaths.[126]

There are an estimated 372,000 annual deaths from drowning worldwide. The death rate from drowning in Suriname is 2.37 (WHO 2014), which accounts for 0.5% of deaths.[127] The annual mortality rate per 100,000 from drowning in Suriname has decreased by 6.6% since 1990 to 6.3% in 2013. For men, the fatality rate from drowning in Suriname peaks at the age above 80 years and is at its lowest rate at the age of 5 to 9 years.[128] At 22.8 deaths per 100,000 men in 2013, the peak mortality rate for men was higher than that of women, which was 6.3 per 100,000 women. Women die at the highest rate from drowning in Suriname at the age above 80 years and at the lowest rate at ages between 40 and 44 years.

3.7.3 Occupational Health (OH) and Safety

OH and safety issues are outside the scope of the present HIA; however, general information is helpful to contextualize other data. Occupational risk factors in different occupational sectors in Suriname include safety hazards (falls, unsafe machinery related issues, road traffic injuries, etc.), physical hazards (exposure to noise, etc.), biological factors (in the health-care sector exposure to HIV and hepatitis B), chemical hazards in agriculture, mining and industry, exposure to dust in the wood sector, ergonomic hazards and stress.[129] The

surveillance of the occupational risk factors is extremely weak. In 2009, 18 deaths were attributed to occupational accidents, showing a fatality rate of 1% of reported injuries. Very few occupational or work-related diseases are diagnosed or reported, thus hiding the true nature and magnitude of the problem.

The Ministry of Labor has an occupational safety and health program and is mainly focused on large and medium-sized enterprises; small enterprises and the informal economy attract less attention. The Bureau of Public Health currently has no programs in place regarding workers' health. The coordination mechanism that was set up several years ago to address workers' health is presently not operational. There are very few experts on occupational safety and health in Suriname, with the majority of them employed by a few large companies.

According to the guide on labor legislation in Suriname[9] and the Industrial Accidents Act (Surinaamse Ongevallen Regeling (SOR)), "the worker, spouse, parents and children, depending on the employee as well as the employer, are indemnified against financial consequences of industrial accidents and occupational diseases.[130] These are accidents related to or in the course of employment, including fatal injury (article 4), and also the more gradual development of a sickness because of the performed labor."

9 produced by Glenn Piroe

3.8 Exposure to Potentially Hazardous Materials

Hazardous materials are substances which, because of their chemical, biological or physical nature, pose a potential risk to life, health or property if they are released.[131] Potential hazards can occur during any stage of use, from production and storage to transportation, use or disposal. Production and storage occurs in chemical plants, gas stations, hospitals and many other sites. Accidents from hazardous materials can range from a chemical spill on a highway, groundwater contamination by naturally occurring methane gas, to a household hazardous materials accident.

3.8.1 Pesticides and Fertilizers

The deleterious effects of pesticides on human health have started to grow due to their toxicity and persistence in the environment and their ability to enter into the food chain.[132] Pesticides can enter the human body by direct contact with chemicals, through food especially fruits and vegetables, contaminated water or polluted air. Pesticides can generate acute and chronic conditions, and can also induce epigenetic changes.

Pesticides have been directly linked to causing fish mortality worldwide. In Suriname, pesticide pentachlorophenol (NaPCP) has caused large numbers of fish to die in the rice fields.

A study was conducted in rice fields of Suriname to examine the effects of pesticides, pentachlorophenol (NaPCP) on birds. NaPCP was sprayed for the purpose of killing Pomacea snails. A large number of sick or dead egrets, herons and jacana birds were found during the period of pesticide application. Pentachlorophenol and endrin levels in these birds suggested that ingestion of contaminated food was the probable cause of sickness and mortality.

3.8.2 Outdoor Air Pollution, Greenhouse Gas Emissions, Aerosols and Road Dust

Outdoor air pollution

Outdoor air pollution is a mix of chemicals, particulate matter and biological materials that react with each other to form tiny hazardous particles. It contributes to breathing problems, chronic diseases, increased hospitalization and premature mortality.[133]

The concentration of particulate matter (PM) is the key air quality indicator since it is the most common air pollutant that affects short-term and long-term health. Two sizes of PM are used to analyze air quality; fine

particles with a diameter of less than 2.5 µm or PM2.5 and coarse particles with a diameter of less than 10 µm or PM10. PM2.5 particles are more concerning because their small size allows them to travel deeper into the cardiopulmonary system. The WHO's air quality guidelines recommend that the annual mean concentrations of PM2.5 should not exceed 10 µm/m^3 and 20 µm/m^3 for PM10.

Greenhouse gas

Carbon dioxide accounts for the greatest percentage of emitted greenhouse gases (GHGs) in Suriname. The total GHG emissions for the inventory year 2008 equals to 6,365.75 CO_2 eq. The energy sector, with an emission of 3,788.15 CO_2, is the largest GHG source, contributing over 59% of the total GHG emission. Parts of the Agriculture, Forestry and Other Land Use (AFOLU) sector act as a sink, with an absorption of -8,243.05Gg of CO_2 eq, making Suriname a net sink for CO_2 (-1,883.09Gg CO2 eq). In 2007, Suriname ranked 86 in terms of CO_2 emissions with per capita emissions of 4.8 metric tons of CO_2.[134]

In the 2017 Suriname Review Report, the total GHG emissions are 1.0 Mtc.[135]

3.8.3 Spills and Releases

A hazardous material is any substance or agent (biological, chemical, radiological and/or physical) that is capable of posing an unreasonable risk to humans, environment and property.[136]

Chemical management – use, stock and removal

Suriname's chemical industry is poorly developed.[137] Most chemical use is in the agriculture, mining, food and pharmaceutical sectors, as well as in the household. The lack of policy and regulation for chemical management results in poor data collection – unreliable data on imports and exports show an average increase from 2006 to 2009 and data on chemical waste is insufficient.

The priority concerns for chemical management are divided into 2 geographical areas:

- The hinterland or interior, where chemicals, such as sodium hydroxide, mercury and cyanide, are used in mining operations, form a threat, e.g., in a press release, the National Institute for Environment and Research (NIMOS) disclosed that a gold mining company in Suriname accidentally spilled some 20,000 liters of diesel in the Suriname River close to the Bakaliba village.[138]
- The coastal area, where the agricultural and industrial sectors threaten local ecosystems with inadequate use, stock and removal of pesticides, and excessive use of mercury and other chemicals.

The National Oil Spill Contingency Plan has been developed to demonstrate how the combined resources of the republic of Suriname and industry will work together to combat any incidence of an oil spill resulting from oil operations.[139]

3.8.4 Mercury

Methylmercury is known to disrupt the regular function of the neurological system, and results in numbness of the limbs, muscle exhaustion, paralysis, coma and death. Mercury poisoning is known as Minamata disease.[140]

The Minamata Convention on Mercury was formally adopted on October 10, 2013, as a global response to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The convention embodies both voluntary and compulsory measures that aim to reduce the impact of mercury on health and the environment, through various provisions related to extraction, usage, releases, trade, storage and waste management. Suriname is a signatory national party of the Minamata Convention;[141] however, it has not ratified the convention yet. The national assembly is expected to approve the current draft legislation; the plan is to carry out a consultation with the interested parties before adopting it. The key issue of discussions is the development of a national plan to deal with small-scale miners, as well as the associated challenge of cyanide use in mercury contaminated area (annex C).

The NIMOS has composed a policy document and roadmap concerning the Minamata Convention for the government to help revise the mining law and policies regarding phasing out mercury. NIMOS states that the analysis of statutory regulations shows that the current legislation is regulated by the sector and that a comprehensive law to regulate the use, import, export and handling of mercury is missing (NIMOS, Advies Document Betreffende het Minamata Verdrag, 2014).

All forms of mercury have been established as toxic to both humans and animals, with no biological benefits and causing deleterious health impacts. They also result in serious contamination to the natural environment. The chemical is used in a range of sectors, including the industrial, commercial, health, domestic and waste sectors. Suriname banned the import of mercury in 2006. Nevertheless, the toxic substance is still excessively used in the field as there is no legal ban against the use of mercury. In Eastern Suriname, recent measurements show that high levels of mercury exist in the atmosphere and affect the fish, the land and the indigenous villagers. Indigenous villagers consume large amounts of fish as compared to other communities, so if the fish is contaminated then they are more susceptible to the adverse effects of mercury.

The greatest mercury discharge is done by the small-scale miners. The SSM primarily uses mercury for the amalgamation process to recover gold from other soil particles. The number of SSM areas in the country is increasing and a recent survey[142] suggests a population between 10 and 15 thousand individuals. Around 2/3rd

of these miners are not Surinamese and the majority are Brazilian garimpeiros. Mining is nevertheless also an important component of the livelihood of some Surinamese families, especially the Maroon groups that are often the traditional owners of the land where the gold is located and it has been severely affected by the war. According to the abovementioned study, women are also present in the area, although in a reduced number (around 20%) and the majority is active in the service sector. Young children can also be present; however, they move out when they reach the school age.[143]

All bauxite mining activities have ceased due to the closure of operations in-country by BHP Billiton and later by Aluminum Company of America (ALCOA), whose subsidiary in Suriname is known as Suriname Aluminum Company, L.L.C. (Suralco L.L.C.).[144]

3.8.5 Solvents, Paints, Oils or Cleaning Agents

There are only 2 paint producers in Suriname, namely, Esuverfa and Varrosieau.[144] Both companies have indicated that no mercury is present in their paint. Other paint companies, such as John Ziel and Benjamin Moore, import their paint from Trinidad and Tobago and the United States (US) and do not contain mercury or lead.

3.8.6 Unintentionally Produced Persistent Organic Pollutants (UPOPS)

A dioxin inventory of UPOPs was compiled in 2010 using the methodology of the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases.[145] The total contemporary release from all source categories is estimated to be 21.33 g toxicity equivalent (TEQ) of polychlorinated dibenzo-para-doxins (PCDDs)/polychlorinated dibenzofurans (PCDFs) per year. This high persistence of PCDD/PCDF poses a serious health hazard - the impact on biota and the accumulation in the food chain is a contemporary threat to human health.

The improvement of waste management is a priority since controlling open waste burning is a measure used to reduce a major source of PCDD/PCDF release. Additionally, new persistent organic pollutants (POPs), such as polybrominated diphenyl ethers (PBDEs) and perfluorooctanesulfonic acid (PFOS) found in electronic waste, car shredder residues, synthetic carpets, flame retarded or surface treated textiles, furniture, mattresses, etc., are increasingly present in several waste streams. Suriname does not have any waste destruction capacity and high costs prevent Suriname from exporting hazardous waste material, so POPs are increasingly being stockpiled.

3.8.7 National Programs to Support Waste and Chemical Management[146]

Suriname has started the process of ratifying the Stockholm Convention on POPs; a National Implementation Plan (NIP) on POPs and an updated chemicals profile were produced in 2011 with the UNDP assistance.

The aim of the NIP is to manage the phase out of POPs in Suriname. The NIP describes the background issues and current situation of POP substances, an inventory baseline. The NIP also details all strategies and actions that need to be undertaken in order to meet the obligations of the Stockholm Convention.

A National Assessment Report on Waste Management was drawn up in 2013. This report gives recommendations to improve waste management and establishes a monitoring and evaluation mechanism with indicators to measure progress. Waste management regulation is contained in sector-specific legislation. The country does not have a waste management policy or a plan.

- Waste management in Suriname is in a developmental stage, and currently, existing systems can hardly cope with the waste generated. There is little or no regulation for the operations of the country's dumps (Ministry of Foreign Affairs, 2013).

- For Suriname, a distinction should be made between the services in Greater Paramaribo and those in the remaining districts. In Greater Paramaribo, the collection and disposal of solid waste are the responsibility of the Ministry of Public Works.

- The Solid Waste Collection and Disposal Division (Vuilophaal En Verwerking (VOV)) of the sub-directorate of services of this ministry is responsible for the operational execution of this task. In the districts, the district commissioner (DC) coordinates the solid waste management tasks (PAHO, 2003).

- The Solid Waste Collection and Disposal Division (VOV), which is in charge of waste disposal in Greater Paramaribo, is only able to collect about 70% of solid waste generated within the city. This institute, charged with the responsibility of providing municipal solid waste management services, has found it increasingly difficult to play this role. The difficulty has been aggravated by the lack of effective legislation, inadequate funds and services, and inability of this institute to provide the services cost-efficiently (Zuilen, 2006).

3.9 Social Determinants of Health (SDOH)[10]

The SDOH are the economic and social conditions and their distribution among the population that influence individuals and groups differs in health status. Article 36 of the Constitution of the Republic of Suriname states that everyone has the right to health and that it is the responsibility of the government to promote health by systematically improving living and working conditions and to give information on the protection of health.[129]

General	
Total population (2012)	541,638 (ABS, 2013a)
Land area	161,471 km²
Economics	
GDP (current euro)	€ 4.02 billion (World Bank, 2013)
Annual GDP growth	4.4% (World Bank, 2013)
Per capita national income (as of 2012)	€ 6,692 (ABS, 2013c)
% of population in severe poverty	2.0% (UNDP, 2013)
Hourly minimum wage (as of 2014)	€ 1
Unemployment rate, strict definition (only Paramaribo and Wanica districts) (2011 data)	8.0% (ABS, 2014)
Health	
Infant mortality rate	27.07 per 1,000 (UNDP, 2013)
Life expectancy at birth (as of 2013) • Male • Female	 67.9 (UNDP, 2014) 74.3 (UNDP, 2014)
% of rural population with access to improved water source	88% (World Bank, 2013)
Fertility rate (births per women)	2.3 (World Bank, 2012)
Education	
Net enrolment rate (NER)* in primary schools (as of 2013) • Boys • Girls	 96 (MINOV, 2014) 99 (MINOV, 2014)
Adult literacy (2012 data)	94.7% (UN, 2013)
Expected years of schooling (2012 data) • Male • Female	 11.2 (UN, 2013) 12.9 (UN, 2013)
Gender equity	
Gender inequality rank, out of 187 countries	95 (UNDP, 2014)
Gender parity index (GPI) primary school (ratio of girls to boys) (2012)	1.32 (MINOV, 2014)
Migration	
Total migrant stock in Suriname, foreign-born and foreign citizens	41,670 (UN, 2013)
Total number of Surinamese (first-generation) living abroad	261,578 (UN, 2013)
Total number of persons of Surinamese descent (first- and second-generation) living in the Netherlands (as of 2013)	347,631 (CBS, 2014)
Annual remittances flow to Suriname	114 million (Multilateral Investment Fund, 2012)

Note: *NER = enrolment of the official age group for a given level of education (6–11 years), expressed as a percentage of the corresponding population.

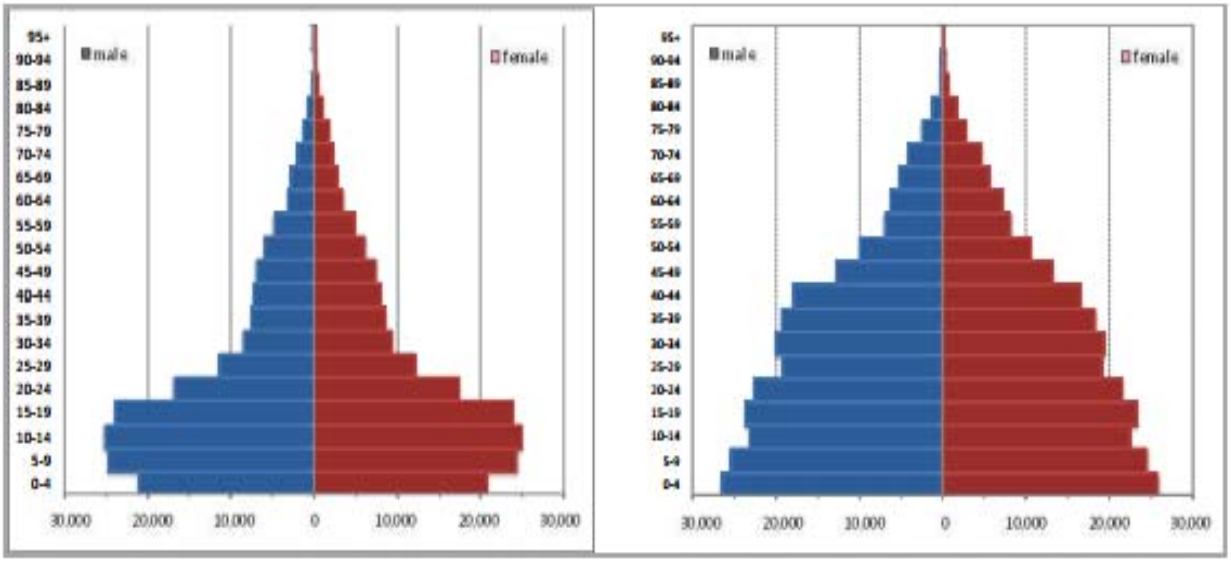
[10] This section exclusively describes the general trends that might have a more direct health relationship. The detailed socioeconomic data are included in the social baseline of ESIA.

Figure 10 Facts and figures in Suriname[147]

3.9.1 Demographic Profile and Population Characteristics

Suriname is in full demographic transition, with moderate birth and death rates, decreasing fertility rates, increasing life span and moderate-to-low natural growth. The mid-year population in 2009 was 5,241,433 and the overall 2007 life expectancy at birth was 71.9 years for females and 67.7 years for males. In 2008, the crude death rate was 8 per 1,000 and the crude birth rate was 19 per 1,000. The 2007 average total fertility rate was 2.4 births per woman. The population annual growth rate was 1.3% in 2009 (up from 1.2% for 2006 to 2008).

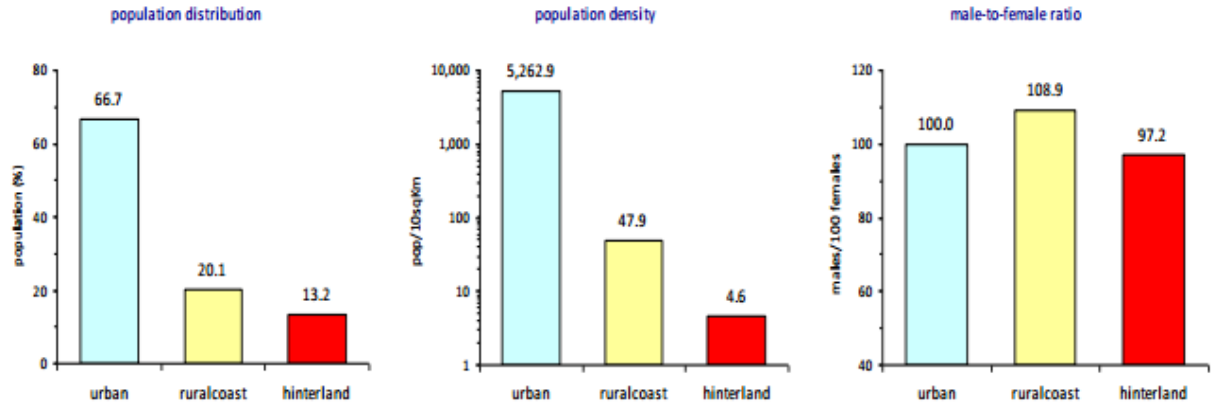
This structural change in age dependency may bring a demographic window of opportunity that can potentially generate economic growth through an increase in the ratio of working age to dependent population, the so-called demographic dividend. In this scenario, job generation and employment, therefore, acquire particular relevance in the public policy.



Sources: Demografische gegevens van Suriname integraal; Central Bureau voor Burgerzaken; N° 4 Feb 1997.
Zevende Algemene Volks-en Woningtelling in Suriname. Landelijke Resultaten Volume I: Demografische en Sociale Karakteristieken; Algemeen Bureau voor de Statistiek Censuskantoor; Suriname in Cijfers N° 213-2005/02E. Aug 2005.

Figure 11 Population age structure in Suriname

A major facet of the demographic transition is improvement in the survival and therefore, a steady increase in life expectancy in both the genders. While this improvement in survival has positively affected all ages in the life span, it has particularly affected those at extreme, the youngest and the oldest in the population.



Source: Zevende Algemene Volks-en Woningtelling in Suriname. Geselecteerde Census variabelen per district . Algemeen Bureau voor de Statistiek. Censuskantoor 2004.

Figure 12 Population age structure in Suriname by geographical area

The last census, in 2004, showed that the dynamics of this demographic transition is concentrated mostly in the populous urban area of the country and, to a lesser extent, in its rural coastal area, whereas the rural interior still exhibits a pre-industrial demographic profile. A marked contrast among these 3 areas emerges when examining other demographic variables, such as population share, population density and male-to-female ratio.

In addition to urbanization and aging, migration is another important trend in shaping the demographic dynamics and the population structure, particularly the segment under 30 years of age.

3.9.2 Mobility and Migration

Suriname's interior is home to indigenous tribal communities and to the Maroon population.[35] Historically, the region has been isolated, accessible only by air or river; however, with gold prices at near-record high and 21st century gold-extraction technologies at play, the country's interior region is becoming an employment magnet. In addition to Maroons, who claim traditional rights to the land, many undocumented migrant workers, mainly from Brazil, flock to the region in search of employment and revenue.

In Suriname, lack of employment, basic services and infrastructure in the interior has contributed to rural and urban migration, in particular among men. This has disrupted traditional family structures, led to a rapid worsening of poverty, and increased the exposure of women to domestic violence, HIV/AIDS and sexually transmitted diseases. Internal migration rates have remained fairly stable, but circular migration continues to persist between urban and rural interior areas, particularly related to mining.

In 2016, the net migration rate was 0.6 per 1,000 population,[148] reflecting an excessive outmigration. The outmigration of skilled professionals has resulted in a shortage of human resources and placed pressure on the provision of public services, particularly health and education services.

The international borders that pass through the country's rainforest do not have reliable controls, and there are unofficial reports of considerable undocumented immigration from neighboring countries, particularly from Brazil.

3.9.3 Violence

The total number of registered homicides and aggravated assaults has increased since 2006. During 2009, there were 6,256 homicides and aggravated assaults and 643 sexual offenses registered, compared to 5,072 and 437 registered during 2006. Currently, no formal national registration system exists for domestic violence and its determinants in Suriname.

The MICS indicated that 13.2% of the women surveyed believe that a husband or partner is justified in beating his wife or partner for any reason. Women with no or only primary education (32.7% and 20.4%, respectively) and those that comprised the poorest quintile of the population (26.7%) believed that men were justified in beating their wife or partner if she went out without telling him, neglected the children, argued with him, refused sex with him, or if the food was burnt.

3.9.4 Gender

Gender disparities exist, not only in health, in all sectors and at all levels of society. The Government of Suriname recognizes its international commitment to the pursuit of gender equality, and has ratified and regularly reported on the International Convention to End all Discrimination against Women (CEDAW) since March 1993.[149] Article 35 of the Constitution states that "men and women are equal by law". The National Bureau Gender (NBG), residing under the Ministry of Home Affairs, is responsible for gender mainstreaming[11] at the national level. The

[11] A strategy to achieve gender equality

Integral Gender Action Plan 2006-2010 was the main tool to achieve that goal. The gender focal points at all 17 ministries are also part of the mechanism of the NBG. These focal points were trained more than once, but the output is still not satisfactory, due to their limited mandate and the weak positioning of gender issues within the ministries. The government also shows their commitment through the separate chapter on gender in the Multi-Annual Development Plan 2006-2011.

Policies and programs are not yet systematically screened through a gender lens in their development, implementation, monitoring and evaluation, and also there are no existing policies that are gender-responsive and institutionalized. There are some strong NGOs with a focus on gender equality and are often consulted by the NBG. The civil society participation is not yet realized at all levels (national, regional and local).

The gender inequalities are documented in various health outcomes, such as life expectancy, prevalence of communicable and NCDs, sexual and reproductive health, and gender-based violence.

3.9.5 Race or Ethnicity

Suriname's population is among the most varied in the world, comprising the indigenous Amerindians, the original inhabitants. They are descendants from:

- Enslaved Africans imported between the 17th and the 19th century (called Maroons and Creoles).
- Contract workers from China, India (called Hindustanis), and the island of Java, Indonesia (called Javanese) between the 2nd half of the 19th century and the 1st half of the 20th century.
- Settlers from a number of European and Middle Eastern countries.
- More recently, immigrants from various Latin American and Caribbean countries, including Brazil, Guyana, French Guiana, Haiti and Cuba.[150]

The largest ethnic groups are the Maroons and Creoles, as well as the Hindustanis and Javanese, comprising approximately 22% and 16%, and 27% and 14%, respectively, of the total population.

3.9.6 Substance Misuse

Substance use (i.e., alcohol, drugs and smoking) and substance use disorders cause a significant public health burden. In 2012, 3.3 million deaths, 5.9% of all deaths worldwide, were attributable to alcohol consumption, with

a significant proportion of alcohol-attributable deaths from NCDs and injuries. Worldwide alcohol consumption in 2015 was projected to be 6.3 liters of pure alcohol per person aged 15 or above. In Suriname, total alcohol per capita (>15 years of age) consumption, in liters of pure alcohol, is projected to be 6.5 in 2016.[151] In a 2007 household survey on illegal drug use, 3.1% of the total population reported that it currently uses marijuana, 2.8% reported that it uses tranquilizers, 0.5% uses stimulants, and 0.3% uses cocaine. Men consistently reported the highest use of marijuana, cocaine and stimulants, while women reported the highest use of tranquilizers. The highest use of marijuana and tranquilizers was among 19 to 25 years old, and the highest use of cocaine was in the age group of 35 to 44 years.

In 2007, nearly a quarter of the population smoked cigarettes. The reported use was higher in men (38.4%) than in women (9.9%). Smoking prevalence by age group was 8% among 12 to 18 year olds, 28% among 35 to 44 year olds.

The use of alcohol is another factor of concern.[152] The results from the 2009 GSHS indicated that among the 1,698 Surinamese student respondents aged 13 to 15 years, 73.8% (1,253) had their 1st drink before the age of 14, and 32.6% (554) consumed alcohol at least on 1 or more occasions in the past month. Among adults, a higher proportion of alcohol use was observed in the age group of 26 to 34 years (36.8%) followed by the group of 35 to 64 years (33.9%). At present, Suriname has a National Drug Master Plan in place which addresses substance abuse, including tobacco and alcohol consumption; however, financial and human resources are required to support further implementation.

3.10 Cultural Health Practices

3.10.1 Traditional Herbal Medicine

Traditional medicinal knowledge and healing practices of indigenous people throughout the world continue to play an important role in health care, both in parallel and in some cases in conjunction with international medicine.[153] In Latin America, this situation exists in a context of larger socioeconomic and political processes, including state-controlled health systems, economic instability, constitutional and health reforms, and the marginalization of indigenous medicine and cultural identity.

According to a study, 2/3rd of urban Surinamers have used herbal medicine in the past 12 months.[154] Of those respondents, 144 medicinal plant species were mentioned, most frequently *Gossypium barbadense*, *Phyllanthus amarus* and *Quassia amara*,[155] and at least 22% combined herbs with prescription medicine. The use was highest among those who suffered from cold, fever, hypertension, headache, uterus and urinary tract problems. Instead of age, gender, nationality, rural background, education, employment, income, insurance, and doctor's or government's opinions, the plant use was predicted by the health status, plant knowledge, and health status combined with plant knowledge. Other predictive variables included religion, marital status, attitude of medical personnel, religious opinion on traditional medicines, and number of children per household. People's main motivation to use TMs was their familiarity with herbs. Given the frequent use of self-collected, home-prepared herbal medicine and the fact that illness and traditional knowledge predict the use of TMs rather than poverty or a limited access to modern health care, the potential risks and benefits of TMs should be prominently placed on the national public health agenda of Suriname. The popularity of self-medication with herbal medicine in urban areas in developing countries and among migrants in Europe and the US suggests that the predictive variables for the use of TMs presented in this study might be more universal than just Suriname.

Medical pluralism flourished in the 18th century in the Dutch colony of Suriname.[156] International physicians and surgeons, who are trained in European medicine, existed along with indigenous priest/healers and herbalists, slave priest/diviners and healers of African origin, whose diverse practices have played out on the plantation itself. While decrying the "superstition" of slave healers, physicians began to take note of their plant remedies, such as the local bark used to reduce fever discovered by the celebrated diviner Quassie. Some slave healers were trained in European surgical practices. The Suriname government acted against the slave "poisoners," who were also feared by slaves, but they did not act against other non-European healers.

In a study done on Maroons,[157] it showed that traditional medicine plays an important role in the primary health-care practices of Maroons living in the interior of Suriname. Large numbers of medicinal plants are employed to maintain general health and cure illnesses. In total, 110 medicinal plant species were recorded, with 302 different health uses, mostly related to general health concerns (42%), diseases of the digestive system (10%), musculoskeletal system and fever (each 7%). Bathing was the most important mode of application. Most health-

care reports are related to cure (58%) and health promotion (39%), while disease prevention played a minor role. Traditional medicine not only treated cultural illnesses, but also health concerns that could be treated with locally available modern medicines. The knowledge of medicinal plant species is not only strictly kept within families, but also shared with friends. Certain recipes and applications, however, may be specific family knowledge.

It was also reported that non-biomedical chemical substances, such as battery acid, chlorine, herbicides and insecticides, were used in the treatment of CL in Suriname.[158] In a study on Surinamese migrants, more than 75% of the respondents used herbal medicine, and 66% did the same in the past year.[159] Herbs were more frequently employed for health promotion (39%) than for disease prevention or cure (both 27%). Almost half of the respondents who had been ill in the last year had used herbal medicine. More than 140 herb species were mentioned during the interviews. Plant use was often related to certain culture-bound health beliefs. Spiritual baths were the most popular traditional practice, followed by genital steam baths, bitter tonics and the consumption of bitter vegetables. Afro-Surinamese more frequently used herbal medicine than Indians. Age, gender, income and education had no significant effect on the use of traditional medicine. Surinamese stated that they used medicinal herbs as they grew up with them; herbs were more effective and had fewer side-effects than conventional therapies.

Young children are vulnerable to a range of illnesses and evil forces.[160] The ethnobotanical folk remedies often play a major role in combating these afflictions. A total of 178 plant species were used in child care for different purposes. Preventive practices were preferred over curing remedies and plants were most frequently used to keep young children strong and healthy. Child care had a strong magical connotation. Bathing proved to be the most important type of application, often combined with drinking small quantity of bathwater.

3.10.2 Traditional African Medicine

In Suriname, doctors and nurses working in remote areas were quite open to collaboration with traditional medicine. Many Maroon and Creole traditions have their roots in the early period of African dominance and Egyptian leadership before 3200 BC, when North Africa was home to many skilled practitioners who had developed a comprehensive medicinal system.[150] This holistic discipline was spread throughout the continent, and was carried to Suriname by the enslaved Africans. The traditional African medicine assumes that disease results from imbalances in social circumstances and spiritual perceptions. This would hold true for “physiological” diseases ranging from venereal diseases to cancer and even Ebola, but also for psychiatric disorders, such as depression and anxiety. The diagnosis is often reached through spiritual means, and the treatment is usually derived from the comprehensive herbal pharmacopeia and would accomplish both physical and spiritual healing. Due to the relatively small number of university-trained physicians and the relatively high costs of allopathic medicines, as much as 86% of the inhabitants of Sub-Saharan Africa rely on traditional African medications. For

this reason, many African countries have expressed the commitment to develop safe, efficacious, quality and affordable traditional medicines accessible to the majority of their inhabitants.

3.10.3 Traditional Medical Providers[150]

Based on these ancient African medicinal concepts, Afro-Surinamese have developed Winti ("wind" or "spirit"), a nature-oriented religion in which the spiritual world is consulted by music, singing, trances and rituals in order to create and maintain a harmonious balance between humans and the visible and invisible powers of nature. Winti is one of the most distinctive characteristics of Maroon and Creole culture and is mainly based on the abovementioned beliefs and magical rituals of the enslaved Africans and influenced by indigenous traditions. The invisible powers are several gods called wintis, as well as the spirits of ancestors.

Specialized practitioners called Winti priests, males or females, serve as intermediaries between man, specific wintis and the spirits of ancestors, and can evoke the spirits by special rituals to solve physical, psychological or social problems. The condition may be diagnosed during a special Winti ritual and is treated by medicinal and spiritual therapies consisting of specific herbs, special rituals or both. The Winti priests are referred to as lukuman ("the one who looks", i.e., performs the diagnosis), dresiman ("the one who cures", i.e., prepares and administers the medication) or duman ("the one who accomplishes", i.e., treats and cures) to distinguish them from obiaman, bonuman and wisiman who are in general associated with black magic practices.

As a result of its fascinating and tumultuous history, Suriname has become a treasure chest of traditional medicinal approaches and rituals based on plants. Traditions and rituals from every continent on Earth have found their way in the country and have largely been preserved. This is illustrated by the various examples given in this overview about Maroons and Creoles, as well as Hindustanis and Javanese. However, the same applies to the rich indigenous South American cultures, traditional Chinese medicine, and the cultures brought over by many other ethnicities in the country. Gradually, many of these traditions are finding their way to other ethnicities. This is likely to result in a unique and even richer traditional medical culture in the country.

For instance, the use of kowru dresis, as well as many remedies and rituals against evil eye has its origin in Africa, but is not anymore restricted to Maroons and Creoles and has become common practice in all ethnic groups in Suriname. The neem plant *A. indica*, the turmeric *C. longa*, and the bitter melon *M. charantia* have presumably been introduced in Suriname by Hindustanis but are now widely used throughout the country against a variety of conditions. Additionally, the broad use of the cat's whiskers *O. aristatus* for treating kidney stones and renal colic is attributable to the Javanese. This ethnic group is also responsible for the presence of many medicinal Zingiberaceae species in Suriname and the general use of the laos A. galanga against the skin disease lota. Some plants, such as the African rice Oryza glaberrima Steud. (Poaceae) and the Bambara groundnut Vigna

subterranea (L.) Verdc. (Fabaceae), also crops that originated from Asia, such as the taro Colocasia esculenta (L.) Schott (Araceae) and the banana Musa sp. L. (Musaceae), were grown in Suriname from leftovers of the food provided to the slaves or from seeds they had smuggled during their trans-Atlantic journey.

Contributing to this pool are the traditional medicinal customs of the indigenous that already had a profound influence on Maroon culture, and traditional Chinese medicine that has become, similarly to Indian Ayurveda, a form of complementary and alternative medicine that is worldwide respected. It is foreseeable that these cultural fusions, meetings of the mind, will lead to the development of a distinct form of herbalism in Suriname that will generate a unique array of medicines.

In 1999, the Medical Mission engaged in a memorandum of understanding with Amazon Conservation Team (ACT), which has been involved in the implementation of a Shamans and Apprentices program in South Suriname, related to the preservation and promotion of traditional medicine. In this MoU, a structural cooperation and coordination was established that resulted in a best practice using indigenous knowledge, as described by UNESCO. The Medical Mission appears to have a very efficient management model for providing international-style medical services to isolated areas. The fact that it engages in a positive working relationship with the traditional medicine clinics seems to further increase their efficiency. The traditional clinics also appear to work well as a model that simultaneously responds to the community needs while being able to exchange knowledge and experiences across villages and generate external support.[161] Also, with the Maroon community, in particular the Foundation "Sreka Bonjo", the Medical Mission signs a letter of intent that aims to promote the homeopathic health in Suriname and this contributes to the spiritual formation of the Surinamese residents and those of the interior in particular, through support of traditional medicine. The Medical Mission offers support to the outpatient clinics of Sreka Bonjo, specialist in bone setting.

3.11 Health System Infrastructure and Capacity

3.11.1 Health Policies and Legislation

The Constitution of the Republic of Suriname, article 36, guarantees the right to health to everyone; so, the government should ensure this by creating a better health system, and by providing proper living and working conditions. The government should also promote health by making information accessible on preventing health problems.[162] To maximize health gains, the MOH actively promotes the inclusion of health considerations in all policies and advocates implementation of health policies across all sectors.

Suriname is promoting health through the implementation of the Health in All Policies (HiAP) agenda. HiAP is an approach to public policy that systematically takes into account the health implications of decisions, seeks synergies and avoids harmful health impacts in order to improve population health and health equity.[162]

The priorities established by the MOH primarily focus on primary health care with an emphasis on the prevention and control of non-communicable and communicable diseases, improved vaccination coverage and progress on the social determinants of health.

The MOH is committed to implementing the International Health Regulations (2005) and the Framework Convention on Tobacco Control (2003).

3.11.2 Organization of the Health System

The MOH is the main governing entity responsible for health through the development of policy and a regulatory framework, inspection and coordination of the services offered by multiple subsystems and partners, epidemiological surveillance, and implementation of vertical programs.

Primary level of care

The provision of preventive and medical health care is organized around 3 subsystems:

- Regional Health Services (RGD)
- Medical Mission (MZ)
- Private providers

These systems are functionally different with separate modes of financing, membership and delivery of health-care services. These subsystems cater to different population segments based on the geographic location, employment, income level and social status.

Regional Health Services (RGD)

Regional Health Services is a state foundation that provides first level of care to Suriname's coastal areas. These services can be utilized by people classified as "the poor and near-poor" by the Ministry of Social Affairs (MSA); however, the State Health Insurance Fund (SZF) enrollees may choose an RGD doctor as their general practitioner (GP). There are 43 health-care facilities with about 64 GPs managed by RGD. Of these health-care facilities, 3 have beds.

Medical Mission

In Suriname, the Medical Mission[12] provides the primary level of care or first point of consultation in the rural areas in the interior. The MZ consists of a group of government-funded faith-based NGOs whose mission is to promote and secure the physical, mental, social and emotional well-being of the population residing in the interior of Suriname.

- Health-care facilities are coordinated by the Jan van Mazijk Coordination Center located in Paramaribo. The service provided by these health-care facilities is the basic health services package of the Medical Mission emergency care
- Maternal and child care
- Family planning
- School health plan
- Preventive programs
- Communicable diseases
- NCDs
- Dental care

[12] MZ is the Dutch translation of Medical Mission

The MZ runs 56 primary care clinics and health posts handling an average of 90,000 patient visits annually. The provision of health services is based on health teams of local health-care workers. Health-care workers include health-care assistants, who are trained by MZ over a 4-year period and their task is comparable with nurse practitioners, and the clinic heads who are supervised by resort physicians and auxiliary departments in the coordination center by the means of regular radio communication, telephone contacts and supervisory visits.

The health-care law implemented in 2014 that guarantees health-care access to those under 16 and over 60 years of age also requires all citizens of the interior, who cannot afford to pay health insurance programs, to register with the Ministry of Social Affairs (MSA) in Paramaribo in order to get free medical insurance. However, most residents in the interior have not registered yet because of the distance to the capital. This poses a major obstacle during the referral from a health center managed by Medical Mission, where they can still get free treatment, to a hospital in the capital where they need an insurance to cover all the expenses.

Private clinics

Most GPs in Suriname are in private practice. These private clinics mainly operate in the urban areas and are accessible through private insurance schemes or out-of-pocket (OOP) money.

Secondary and tertiary health care

There are a total of 5 hospitals that operate in the country and 4 of these are in Paramaribo.

The table below summarizes the services offered by the different subsystems.

Level of Service	Coastal Area Population	Interior Population
Preventive care health education	• BOG: Provides health-care education and preventive care • RGD: Provides family planning services, vaccination, nutrition education, breastfeeding, basic sanitation together with the post-natal care (PNC)	MZ: Provides vaccination, health education on nutrition, breastfeeding and basic sanitation. Screening programs (early detection of cervical cancer and breast cancer)

Level of Service	Coastal Area Population	Interior Population
First level of care	• RGD clinics and private practitioners provide ambulatory services to: o Patients subsidized by MSA and affiliated to State Health Insurance Fund (SZF). o Patients with private insurance and those paying out of pocket.	• MZ: Provides publicly subsidized services, such as: o Medical care for illnesses o Pre-natal care o Safe delivery o Emergency care o Health care for under-5 children o Dental care
Secondary care	Inpatient and ambulatory procedures by specialists are provided by 3 general public and 2 general private hospitals and 1 psychiatric hospital.	MZ patients are referred to Diakonessen Hospital in Paramaribo while in some cases, patients may go to Academisch Ziekenhuis (AZP) and the "Lands Hospital" (LH).
Tertiary care	The Academic Hospital in Paramaribo is the only hospital in the country, with full and high level emergency capabilities. The hospital has a new ICU, CCU and Cardiothoracic center, and operates according to international standards with highly trained medical specialists In some aspects, especially when it comes to the critical care departments, it can stabilize and treat highly complex cases.	
Other	A range of services, including sexual and reproductive health care, health education, preventive care, and primary health care for targeted audiences, is provided by NGOs, such as Lobi Foundation.	

Figure 13 Organization of health services in Suriname (National Health Sector Plan, 2011-2018)

3.11.3 Health Infrastructure

The hospital bed density is 3.1 beds per 1,000 population.[148] The current infrastructure in the country is:[163]

- 56 MZ primary health clinics and health posts
- 43 RGD health-care facilities

- 146 private clinics
- 5 hospitals, including 2 private and 3 public, and 1 psychiatric hospital
- 40 dental units located in 26 RGD clinics
- 3 private medical laboratories and 1 medical laboratory in every hospital
- 1 national referral and public health laboratory (Central Laboratory of BOG)
- 10 retirement homes and 2 small nursing homes

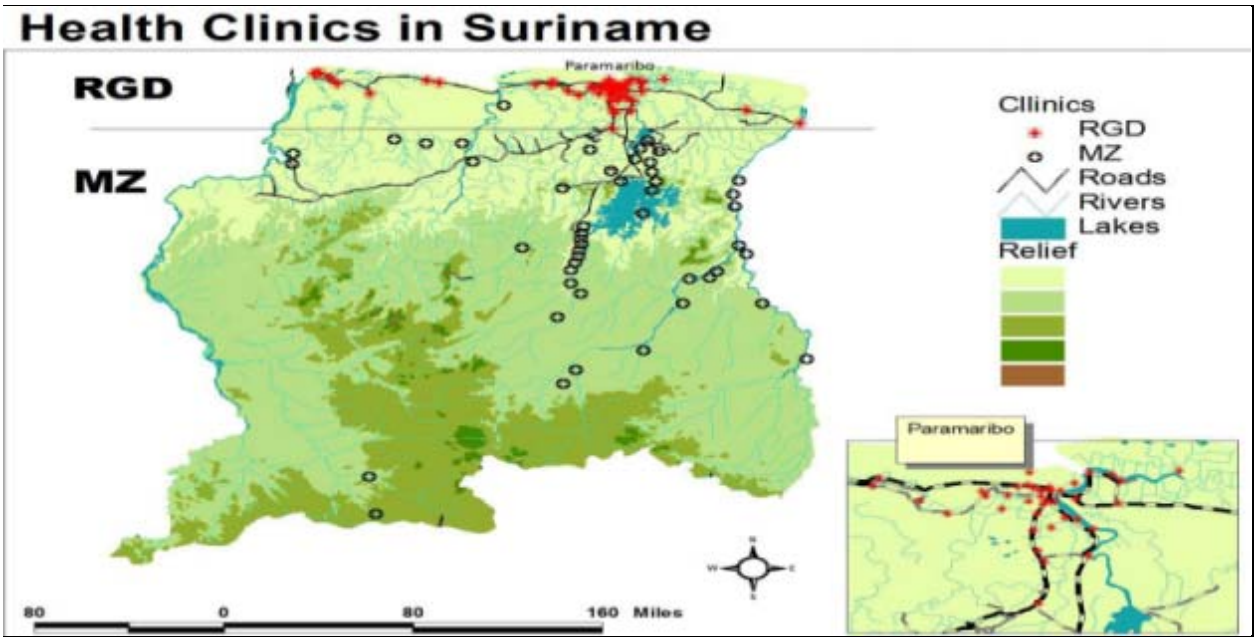


Figure 14 Distribution of RGD and MZ clinics in Suriname[164]

To meet the increasing demand of health care, the government has planned and initiated the 1st and 2nd phase of upgrading health-care facilities by constructing new buildings, expanding existing hospitals and renovating a few hospitals.

3.11.4 Health-Care Human Resources

The density of health workers in Suriname is significantly lower as compared to other countries in the subregion. According to PAHO/WHO, special attention is given to environmental health in Suriname through the training of 100 environmental inspectors.[165]

The coastal urban areas have the majority of health-care workers, particularly in Paramaribo. There is a disproportionate distribution of human resources between urban and rural areas with 5 GPs per 10,000 in the coastal areas and 1 GP per 10,000 in the interior.[135] Below is the distribution of human resources:

- Coastal area: 43 primary health-care clinics managed by 64 GPs who work for Regional Health Services (RGD).
- Interior areas: 56 primary health clinics are being supervised by 11 GPs who work for Medical Mission.
- Around 146 private clinics are managed by 191 private GPs, mostly located in Paramaribo and Wanica.
- The majority of registered nurses (83%) work in secondary care facilities located in the 2 main urban centers, whereas the remaining (28%) are employed in primary care, teaching, nursing homes and public health. Only 1.4% of the nurses are associated with the Medical Mission with its primary care program.

3.11.5 Health Financing

The allocation of budgets to the MOH and the State Health Insurance Fund (SZF) are managed by the Ministry of Finance (MOF). The MOF collects taxes, allocates budgets and manages the contribution for each sector.[165] Additionally, the MOH provides subsidies to various institutions, such as Regional Health Services (RGD), Medical Mission Primary Health Care (MZ), and Psychiatric Center Suriname (PCS), as well as funding to public health programs, including Youth Dental Services (Stichting Jeugdtandverzorging Suriname (JTV)).

The National Health Accounts of Suriname (2006) reported that the MOF provides the major contribution (37.5%) to the health sector, followed by private firms (34.1%) and household out-of-pocket expenditure (20%).

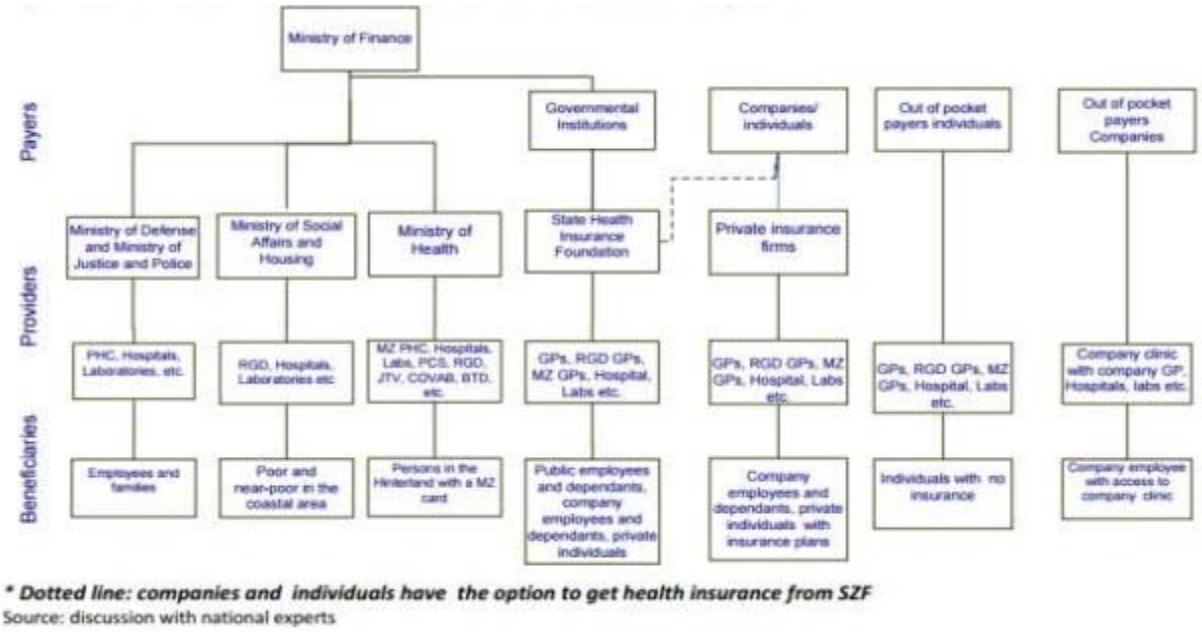


Figure 15 Overview of payers and providers in the health system, Suriname (National Health Sector Plan, 2011-2018)

3.11.6 Health Insurance

There are 3 main health insurance schemes in Suriname, including State Health Insurance Fund (SZF), programs from the Ministry of Social Affairs (MSA) and private insurance.

All government employees (40,891 civil servants and their dependents) are covered under the SZF scheme. It is also available to the local public and is responsible for paying claims to providers for all insured services received by the SZF-covered population.

MSA is the largest government funder of health care (SRD$107 million) and caters to the marginalized section of the population by ensuring that the economically disadvantaged population has access to health care. Prior to the health-care law of 2014, this group was receiving a health-care card that granted it free access to government hospitals and clinics. At present, the Ministry of Social Affairs (MSA) pays the insurance premium for this group for a basic health package at the State Health Insurance Fund (SZF).

The secondary level of care is mostly funded by MSA. Primary health care is funded by MOH and provided by RGD and the Medical Mission.

Those families and individuals who do not have access to health care through MSA or do not choose SZF as their insurance company can pay through a private insurer, a company health clinic, or pay OOP in private health services. However, the law states that everyone needs to be insured.

Most interior population in Suriname is not yet covered by any health insurance and it utilizes MZ services, which are subsidized by the MOH.

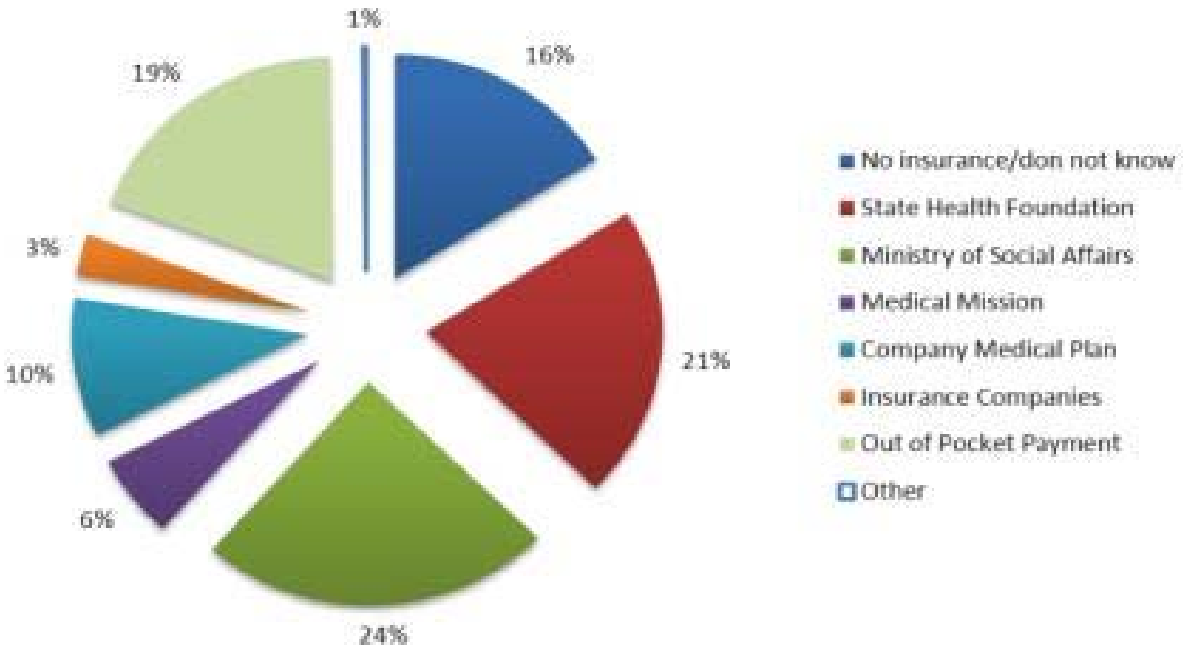


Figure 16 Percentage of population insured by the plan in Suriname (National Health Sector Plan, 2011-2018)

3.11.7 Health Information Systems

The National Health Information System (NHIS) unit within the MOH is responsible for collecting, processing and analyzing the health statistics and official national health data of the Surinamese population.

Most health information reaches the NHIS unit through:

- Surveillance reports from the BOG, RGD, MZ, professional health associations and the medical registry of the hospitals.
- Monitoring and evaluation of the reports from different programs, such as malaria, HIV/AIDS and TB.

- Surveys, such as MICS and tobacco surveys

There are a total 25 to 30 sentinel stations in Suriname.[166] These sentinel surveillance sites report to the CAREC[13] that provides epidemiological, laboratory and diagnostic support to 23 member countries, including Suriname.[167]

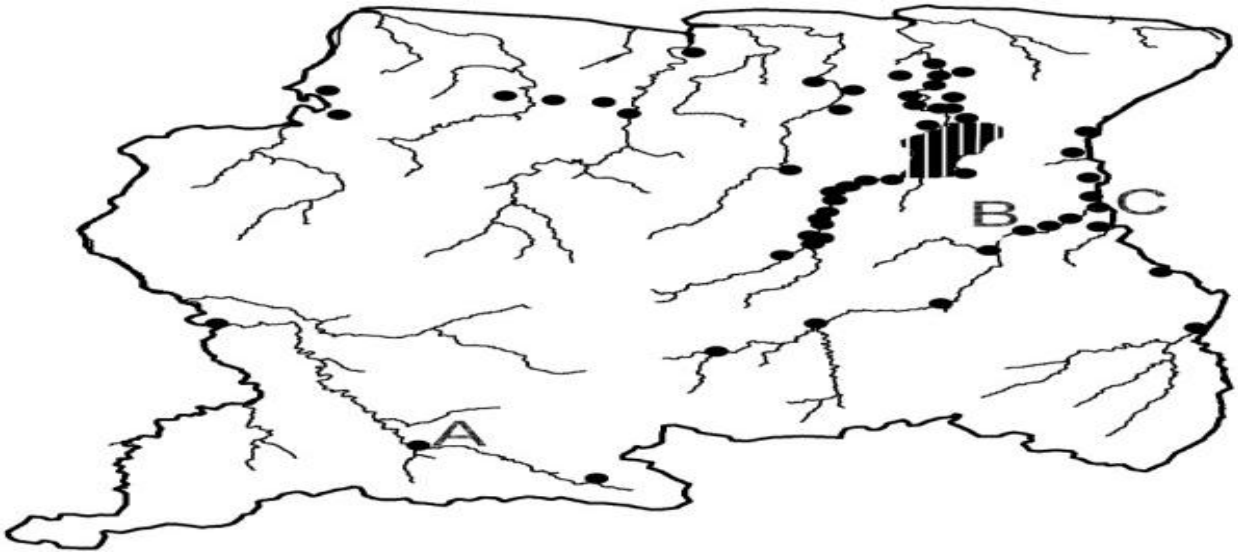


Figure 17 Medical Mission clinics (black dots) and the sentinel sites for entomological surveillance (A: Kwamalasamutu, B: Drietabiki, C: Stoelmans-island) in Suriname.[168]

3.11.8 Medical Products and Technologies

Laboratories

Almost all hospitals have laboratories to carry out clinical analyses. There are also 3 private laboratories, including Medlab, My Lab, and Health Control, operating in the country. Medical laboratories have only recently come under the regulation of national authorities based on the final report on the Preparation of Model Legislation for Medical Laboratories in the Caribbean, prepared by CAREC in December 2006.

There is 1 public health laboratory at BOG that opened its new facility in 2010 with upgraded technological capacity. The Central Lab is the referral lab in the country for malaria, TB and HIV/AIDS, and provides quality

[13] CAREC is the institution that lies under Caribbean Public Health Agency (CARPHA), which was established in July 2011 with a mission to provide strategic direction in response to public health priorities of the Caribbean community (CARICOM)

control and confirmation of tests conducted by other labs. This laboratory can also conduct test for heavy metals, such as mercury and lead, in the environmental and human population.

Pharmaceuticals

The MOH, the Pharmaceutical Inspectorate and the Bureau of Public Health manage the pharmaceutical policies, inspections, monitoring and program development. Around 90% of all drugs are imported and 10% are manufactured internally in Suriname.

There are 3 licensed pharmaceutical manufacturers in Suriname and 26 licensed pharmaceutical importers, the largest being the government-owned drug supply company in Suriname (Bedrijf Geneesmiddelen Voorziening Suriname (BGVS)).[169] All drugs should have the approval of government committee on drug registration, while the Pharmaceutical Inspectorate manages the inspection of pharmaceutical manufacturing and pharmacies.

There are a total of 31 pharmacists and 28 licensed pharmacies.[169] These pharmacies operate in the public, private sector, and Regional Health Services. Most retail pharmacies are situated in the urban areas of Paramaribo, Nickerie and Commewijne. Most drugs are available in these pharmacies, which are easily accessible to clients registered with the State Health Insurance Fund (SZF), who are also covered under the government hospital pharmacies and Regional Health Services' clinics. They pay a fixed co-payment for prescriptions, less than a percentage of the actual price of the drug.[170] Apart from this, there are dispensaries (e.g., Military Hospital, Regional Health Services and the Medical Mission clinics) and drug stores authorized to sell a limited number of non-prescription medicines. Individuals who are not covered under any governmental schemes, prefer to pay (OOP) for the prescribed drugs.

The medicine regulation responsibilities are currently under 2 entities that include Pharmaceutical Inspectorate and Registration Committee.[169] However, there are no established and comprehensive regulatory authorities that carry out all standard regulatory functions.[169]

In a report, around 500 items, including different strength and dosage levels, have been included in the national essential medicines list (EML).[171] In terms of the rational use of medicines, around 60% of essential medicines have been prescribed by health practitioners in Suriname, followed by antibiotics and injectable drugs.[172, 173]

Under the National Medicine Policy, registered medicines are quality assured under BGVS quality check labs and are easily available, but improvement is still needed.[172]

In Suriname, research and development capacity is limited for discovering new active substances and the production of active pharmaceutical ingredients (APIs), but there is capacity for the production of formulations from pharmaceutical starting material and for the repackaging of finished dosage forms. Due to high prices, patented medicines cannot be imported into Suriname.

The BGVS is responsible for importing, stocking and distributing essential pharmaceuticals that are sanctioned by the Board for Essential Pharmaceuticals.

3.11.9 Development Cooperation and Partnerships[129]

There has been an increased presence of development cooperation partners in Suriname over the last few years, including bilateral partners, such as China, who have supported the road rehabilitation project, as well as the development of low-cost housing in Paramaribo. Similarly, India has become an important development partner in Suriname focusing on the steel mill, rice breeding and construction of solar-powered traffic signal system. There has been an increased presence of new partners in the health sector. The development partner agencies focusing on health include Caribbean community (CARICOM), Global Fund and IDB, as well as bilateral donors from France and Brazil.

UN agencies

- UNICEF focuses on maternal and child health in Suriname, especially in the interior areas.
- UNFPA focuses on gender, youth/adolescent health and education that mainly includes gender-based violence, population dynamics, sexual and reproductive health, teenage pregnancies and HIV transmission.
- UNDP's work in Suriname focuses on democratic governance, poverty reduction, HIV/AIDS, crisis prevention and recovery and energy and environment.

Bilateral collaboration on health

The following countries, including Brazil, China, Cuba, France, Guyana, India, Indonesia, the Netherlands, Venezuela, the US, and the European Union, have a functional representation in Suriname.

The Brazilian approach has focused on providing materials for reducing the burden of HIV/AIDS, linking malaria experts to develop health projects, reducing mother-to-child transmission of syphilis, and mitigating the spread of Chagas disease. Additional activities include supporting the provision of lunches in schools and supporting food safety measures, such as improving the packaging and conservation of food products.

The Global Fund to fight AIDS, TB and malaria is an important partner and its latest grants are mentioned below in Figure 18.

Grant type	Round	Grant title	Principal Recipient	Signed grant agreement (US$)	Grant phase	Grant duration
HIV/AIDS	3	Extending and improving the quality of live of Persons Living With HIV/AIDS	MOH	5,271,393	Phase II – In progress	01 Feb 2005 – 31 Jan 2012
Malaria	4	Decreasing the incidence of malaria in the populations of the interior of Suriname	Medical Mission	4,857,904	Phase II – In Closure	01 Feb 2005 – 31 Oct 2010
HIV/AIDS	5	Reducing the spread and impact of HIV/AIDS in Suriname through expansion of prevention and support programs	MOH	3,838,706	Phase II- In progress	01 Feb 2007 – 31 Jan 2012
Malaria	7	Looking for gold, finding malaria	MOH	2,375,500	Phase I – In progress	01 April 2009 – 31 March 2011
Tuberculosis	9	Doing what it takes to stop tuberculosis in Suriname – DOTS Suriname Project	MOH	2,055,216	Phase 1 – In progress	01 Nov 2010 – 31 Oct 2012

Source: (Global Fund, 2011)

Figure 18 Global fund grants approved for Suriname

3.12 Non-Communicable Diseases (NCDs)

NCDs are the main cause of mortality in Suriname.[6] According to the 2015 data, cerebrovascular disease ranks 1st and is the most common cause of deaths, followed by ischemic heart disease and diabetes.[6] The key risk factors for NCDs include smoking, obesity, high cholesterol and hypertension.

These chronic diseases dominate the health-care needs of the population and therefore, place the highest burden on the Suriname health-care system.[152] Even with the emergence of HIV/AIDS as a major cause of mortality and morbidity in the past decade and the consequent resurgence of TB, NCDs remain the main causes of death in the country, as is the case globally.

In Suriname, NCD-related mortality has been reported to be the main cause of death in Suriname, with CVDs reported to be the leading mortality cause in the past decade.[174] The majority of CVDs and diabetes cases are among the Hindustani population and to a lesser degree within the Creole and Javanese populations. However, cancer is seen primarily among Creoles, followed by Indian, Javanese and Marrons.[14]

Socioeconomic differences, such as income, education and physical environment, add to the high chronic disease burden and mortality, especially affecting vulnerable groups leading to ill health and restrictions within their living and working conditions.

3.12.1 Cardiovascular Disease (CVD) and Hypertension

CVDs are still the leading cause of death worldwide and thus, a major public health issue. In Suriname, CVD is also the leading cause of morbidity and mortality.[175] Ethnicity is also a main factor to determine CVD in Surinamese populations, i.e., South-Asian Surinamese had a significantly higher percentage of abdominal obesity, CVD and diabetes as compared with Javanese Surinamese after adjustment for age and sex.[176]

In 2009, the cardiovascular mortality rate was 155.5 per 100,000 populations.[82] Morbidity data for CVDs correspond closely to mortality rates. In 2009, the percentage of deaths due to CVDs was 26.9%. Urban populations registered higher death rates due to CVDs (urban: 175.1 per 100,000, coastal: 186.1 and interior: 84.4), and men had a higher cardiovascular mortality rate than women (164.4 per 100,000 and 146.5 per 100,000, respectively).

Ethnicity

According to 2009 data, the highest cardiovascular mortality rates are among the individuals of Creole (250.2 per 100,000), Indian (191.4) and Javanese descent (151.7). The mortality rate from malignant neoplasms was 67.0 per 100,000 population; the most frequently recorded was neoplasm of the rectum (13.6%) followed by neoplasm of the lung (12.5%).

Another study (2015) that was conducted across all 6 major ethnic groups in Suriname (Indian, Creole, Javanese, Maroon, Chinese, Amerindians and mixed) reported the highest prevalence of hypertension among Creoles, Indian and Javanese, while the lowest was in the mixed and maroons groups.[177,178] An additional study has also shown higher mean blood pressure levels in Javanese and Indian adolescents as compared to their African descent peers.[179]

According to the gender, the prevalence of hypertension was higher in Indian men and in Javanese and Maroons females. The metabolic syndrome (MetS), another risk factor for CVDs and type 2 diabetes,[180] was reported to be the highest among Indians and lowest in Maroons. In the same study, it was also reported that gender, education, living areas, income and marital status are associated with MetS and it differs widely among different ethnic groups. The prevalence of MetS is higher in women and increases with age; central obesity and low high-density lipoprotein (HDL) cholesterol is reported to be highest in women. However, the overall prevalence of MetS was higher in Indians, Amerindians and Javanese.[180] Another study also reported the prevalence of MetS to be higher in women than in men, around 40% of both indigenous women living in the interior and in coastal rural areas had MetS.[181]

The Healthy Life in Suriname (HELISUR) study is a cardiovascular review of the population in Suriname and part of the Caribbean community.[182] The HELISUR study provides data on risk factors and prevalence of CVD in the multiethnic population, which mainly consists of African and Asian descent. The rapid increase in urbanization in these countries creates lifestyle changes, with greater consumption of fat, salt and sugar, and less physical exercise. In-line with these changes, health projections suggest that CVD burden will increase even further in these regions (from 33% in 2002 to 45% in 2030), with potentially devastating effects on personal and family incomes, and on the national economy. In this study, total 68 participants were included, of which 16.2% of participants were reported to be involved in smoking, whereas, 14.7% reported to be fit, corresponding to intensive exercises.[183] Self-reported hypertensive individuals were higher in South-Asian population followed by Javanese and Africans. Hypercholesterolemia and diabetes were higher in African ethnicity.

3.12.2 Diabetes

Diabetes ranks 5th among the 10 leading causes of death (2005 to 2009) and is the most prevalent disease among the chronic illnesses, according to a 2001 study.[152,184] Diabetes has become a leading cause of death and disability in the region of the Americas, and if the current trends continue, the burden of the disease will increase substantially over the next 2 decades, according to experts at the PAHO/WHO.[185] Diabetes has reached epidemic proportions in the Americas. Latin America and especially the Caribbean have now the highest diabetes rates in the world.

A study reporting the main reasons for visits to a PHC clinic among people aged 60 years or above showed that diabetes accounted for 13.2% of visits, while hypertension accounted for 26.4% of visits. When observing visits due to comorbidity, diabetes and hypertension accounted for 12.5%, and a combination of diabetes, hypertension and CVDs accounted for 11%.

In addition, analysis of registered visits to PHC clinics indicates that diabetes and hypertension are the most common reasons for seeking care and shows a steady increase in the percentage of registered patients with diabetes, hypertension or a combination of both. Women are twice more likely than men to visit the clinics for diabetes and 3 times as likely for hypertension or a combination of diabetes and hypertension.

The data from the Academic Hospital (AZP) from 2005 to 2008 indicates 15 amputations annually in patients with diabetes, with more men affected than women (60% vs. 40 %). Between 1997 and 2007, the number of dialysis patients and the number of dialysis have increased, with a steady trend of approximately 1.4% annually. Among the patients undergoing dialysis, 60% are men and 40% are women.

A study about diabetes in Suriname found a national prevalence of 13% diabetes and 7% prediabetes.[186] Over 1/3rd of the cases (39.6%) had not been diagnosed with diabetes before; therefore, highlighting the possible underestimation of diabetes burden in the communities. The study found gender and ethnic variations, and the group with the highest prevalence is the Hindustanis (23%), while the other ethnic groups range between 4.7% and 14.2% as shown in Figure 19. In another study, the high prevalence of diabetes mellitus has been observed in Indian Surinamese and less in African Surinamese.[187] There was a differential distribution of risk factors among the ethnic groups and this could partially explain the difference, although further research is needed to explain these variations.

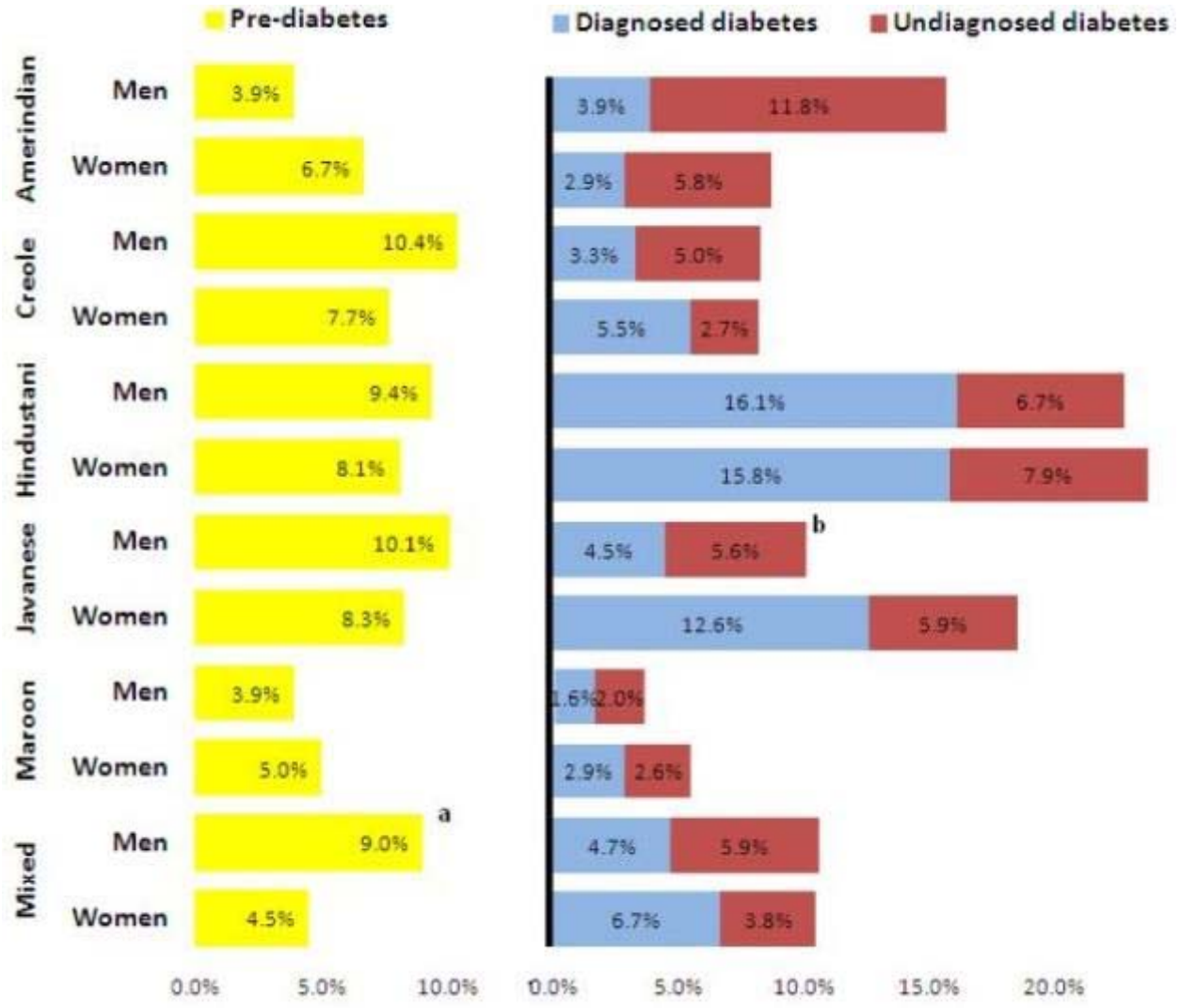


Figure 19 Prevalence of prediabetes, diagnosed and undiagnosed diabetes for males and females per ethnic group[188]

3.12.3 Cancer

Malignant neoplasms are the 3rd leading cause of death. Cancer is among the 10 leading causes of death and shows an increasing trend from 6.4% in 1996 to 11.6 % in 2009.[152]

In 2009, most cancer deaths were caused by cancer of the rectum (13.6%), followed by lung cancer (12.5%). However, cancers that were common in females were breast, vulva, vagina, cervix, corpus uteri, uterus and ovaries that accounted for 20.3% of all cancer deaths.[152] Male-specific cancers were prostate and penis cancers that accounted for 9.4 % of all cancer deaths.

Majority of women die of breast and cervix cancer than from maternal conditions and women die much younger than men due to sex-specific neoplasms. For women, the average age of death due to breast and cervical cancer is approximately 56 years, while the average age of death for men due to prostate cancer is approximately 77 years, indicating that women lose more years of life as a result of these cancers than men.

When considering ethnicity, Creole and Javanese show high mortality rates for neoplasms.[114] The data from the National Pap Smear Project (1998 to 2000) revealed that the highest prevalence rates of pre-malignant cells are among women between the ages of 30 to 40 years; specifically among the Maroons (Afro-Surinamese) and Creole/mixed women. Sexual practices, low prevalence rate of contraceptive use, and cultural and traditional beliefs among the Maroon population might increase the vulnerability for sexually transmitted diseases and partially explain the high prevalence of pre-malignant cells.

The systematic review (2017) reported proportions and incidence rates (per 100,000 per year) of breast cancer[189] in different ethnic Surinamese group, which include Creole (37.2%, 35.7), Maroons (1.9%, 2.2), Hindu (29.4%, 18.2), Javanese (17.9%, 20.8), Chinese (1.9%, not given), mixed (7.4%, 10.1), Dutch (1.4%, not given) and other (2.9%, not given).

3.12.4 Mental Health

In Suriname, mental health services are highly centralized and not widely available to the entire population. A primary health-care doctor has the authority to prescribe and/or to continue psychotherapeutic medicines according to the primary care prescription regulations. According to PAHO (2015), major depressive disorders are among the top 15 largest contributors to the burden of disease, and represent the 6th largest cause of the burden of diseases. Self-harm, including suicide, represents the 5th largest cause of the burden of diseases.[190] Suicide rates in Commewijne, Nickerie, Saramacca and Wanica are between 4 and 6 times higher than in Paramaribo and Brokopondo.

The majority of primary health-care doctors and nurses have not received official in-service training on mental health within the last 5 years.[191] The majority of primary health-care clinics have no officially approved manuals on the management and treatment of mental disorders. There is also no provision of referral procedures from primary care to secondary/tertiary care or vice versa.

The mental health services currently available are highly centralized and are primarily offered by psychiatrists at the PCS. The most frequent diagnoses of admission to PCS are substance abuse (50%), mood disorders (20%), schizophrenia (12%) and personality disorders (11%). A study was conducted in 2016 and data was collected from 12 Paramaribo districts. The study reported psychological complaints of anxiety, depression and alcohol

use to a certain extent in 58% of women and 42% of men, aged 16 to 64 years. Of these, only 3% respondents seek or receive assistance and guidance via E-Mental health.[192]

An indication of the severity of this mental problem is increase in the number of suicides since 2000, which more than doubled by 2009. Among ethnic group, Hindustanis had the highest rate of suicide in 2008, at 66.2%, followed by Creoles at 11.5%; the figures were 72% and 10%, respectively, in 2009. Suicide data disaggregated by gender shows that more men (104 cases) commit suicide compared to women (34 cases). Many suicides were self-poisoning with pesticides.

Suriname has launched a mental health policy that includes decentralization of psychiatric care, integration of mental health in primary care, and strengthening the mental health information system.[193] However, it is unclear how this will be rolled out in the interior of the country.

3.12.5 Disability-Adjusted Life Years (DALYs)[194]

DALYs quantify both premature mortality (years of life lost (YLLs)) and disability (YLDs) within a population. In Suriname, the top 3 causes of DALYs in 2010 were HIV/AIDS, cerebrovascular disease and preterm birth complications. The causes that were among the 10 leading causes of DALYs in 2010 and not 1990 were HIV/AIDS, road injury, diabetes mellitus and low back pain.

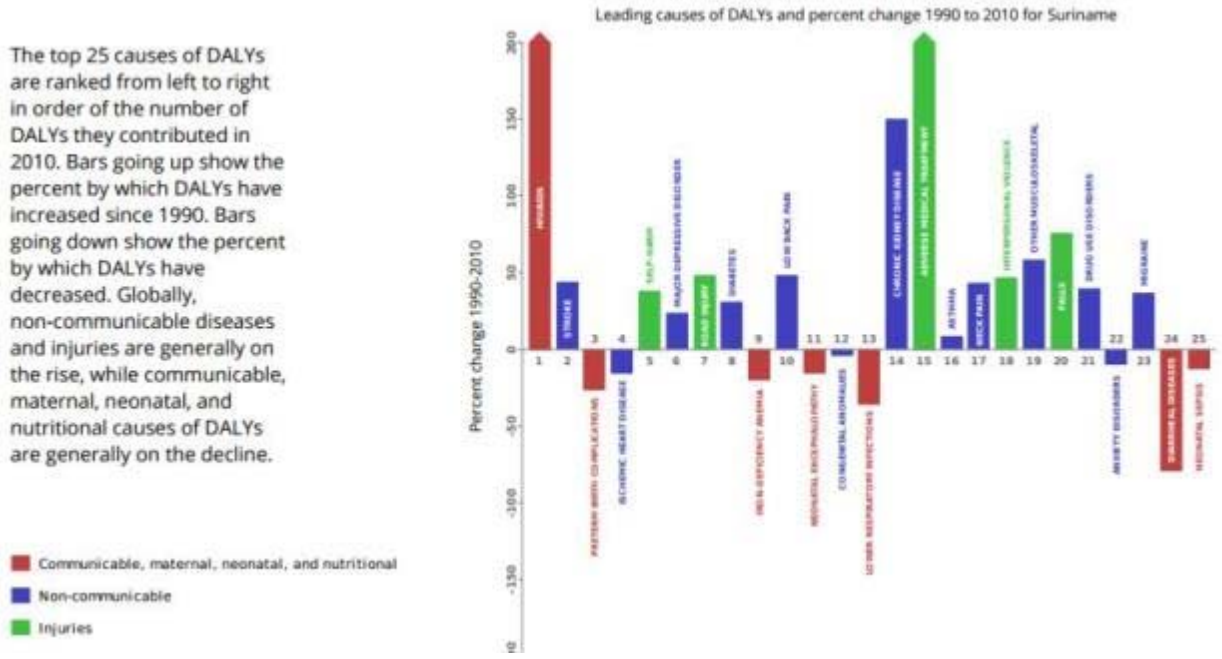


Figure 20 Leading causes of DALYs and percent change from 1990 to 2010 for Suriname

Overall, the 3 risk factors that account for the most disease burden in Suriname are dietary risks, high blood pressure and high BMI. The leading risk factors for children under 5 and adults aged 15 to 49 years were suboptimal breastfeeding and occupational risks, respectively, in 2010.

4 Local Communities/Information about local area

4.1 Project Area

This chapter presents an overview of the health status of the communities in the Brokopondo and Carolina area, where the project will be partially executed. The Medical Mission is responsible for all health-care activities in the community, in terms of diseases surveillance, surveys, vaccination, health awareness programs, health education, etc. Based on the information given by the Medical Mission, there are many under-reported cases of diseases and data is extremely limited. This could be due to infrastructure problem, logistics issue, unavailability of resources, lack of awareness, reachability of village members to the health clinic or associated problems that need further investigation.

Information gathered was focused on 12 EHAs and associated problem in the project area. The reported diseases and prevalence in both adults and children have been taken into account for some of the diseases occurring in the community.

The Medical Mission provides primary health care in both the regions through 5 health centers. Brokopondo has 3 health centers that include Brokopondo (Brokopondo Centrum, Afobaka centrum, Boslanti, Compagnie Kreek (Compagniekreek), Drepada and Tapoeripa villages), Asigron (Asigron and Victoria villages) and Balingsula (Balingsula village), whereas the Carolina region includes 2 health centers, Powakka (Groot Powakka and Klein Powakka) and Redi Doti (Redi Doti, Pierre Kondre and Cassipora).

Health Center	Health Center	Villages
Brokopondo	**Brokopondo**	Brokopondo Centrum Afobaka centrum Boslanti Compagnie Kreek (Compagniekreek) Drepada Tapoeripa
	Asigron	Asigron Victoria
	Balingsula	Balingsula

Health Center	Health Center	Villages
Carolina	**Powakka**	Groot Powakka Klein Powakka
	Redi Doti	Redi Doti Pierre Kondre Cassipora

4.1.1 Demographic Profile

The Medical Mission, as shown in table 1, presented detailed demographic data. Most population comprises Maroons (in the Brokopondo region) and Amerindians (Carolina region). Carolina has less population (967) as compared to Brokopondo (2,864). The registered population living in this area is 3,831. The table below shows the gender-wise population in different villages.

Health Center with Surrounding Villages	Male	Female	Total
Brokopondo Region (2,864)			
Asigron	**154**	**190**	**344**
Victoria	61	55	116
Asigron	93	135	228
Balingsula	**304**	**321**	**625**
Balingsula	304	321	625
Brokopondo	**857**	**1,038**	**1,895**
Brokopondo	187	221	408
Compagnie Kreek (Compagniekreek)	168	203	371
Boslanti	95	114	209

Health Center with Surrounding Villages	Male	Female	Total
Tapoeripa	254	301	555
Drepada	53	62	115
Afobaka	100	137	237
Carolina Region (967)			
Redi Doti	**111**	**112**	**223**
Pierre Kondre	25	23	48
Redi Doti	54	51	105
Cassipora	32	38	70
Powakka	**381**	**363**	**744**
Groot Powakka	324	309	633
Klein Powakka	57	54	111
Total (Brokopondo and Carolina)	**1,807**	**2,024**	**3,831**

Table 3 Population distribution of both Brokopondo and Carolina region

The age distribution in this specific area is shown in Table 4 Age distribution in this specific area (in numbers) below. The population in the age group from 0 to 10 years is higher as compared to other age groups in both the regions.

Region	Age Category (Years)	Male	Female	Total
Brokopondo	0 to 10 years	496	468	964
	11 to 20 years	306	299	605
	21 to 30 years	187	245	432

Region	Age Category (Years)	Male	Female	Total
	31 to 40 years	137	236	373
	41 to 50 years	79	116	195
	51 to 60 years	66	101	167
	>60 years	44	84	128
	Total	**1,315**	**1,549**	**2,864**
Carolina	0 to 10 years	116	114	230
	11 to 20 years	117	103	220
	21 to 30 years	82	87	169
	31 to 40 years	51	61	112
	41 to 50 years	54	47	101
	51 to 60 years	41	33	74
	>60 years	31	30	61
	Total	**492**	**475**	**967**

Table 4 Age distribution in this specific area (in numbers)

4.1.2 Birth Rate and Death Rate

The crude birth rate for Carolina and Brokopondo regions was 21.71 per 1,000 and 32.12 per 1,000 population, respectively, in 2016. The crude death rate for Carolina and Brokopondo regions was 2.06 per 1,000 and 2.09 per 1,000 population, respectively, in 2016.

In both the regions, there has not been any maternal mortality from 2015 to 2017.

In the Carolina region, there was 1 (early) neonatal death in 2016, of which the cause was unknown; in other years, there was no neonatal death.

4.1.3 Diseases Reported in Project Area

Vector-borne diseases

- *Chikungunya*: In 2014, there was a chikungunya outbreak in Suriname; it was concentrated in the coastal areas and spread in the interior of Suriname by mid-2014. As reported by Medical Mission, the number of chikungunya cases was highest in 2016 in the Medical Mission area (1,792 cases), followed by the Brokopondo (315 cases) and Carolina areas (12 cases in 2012; 0 case in 2016). There was no outbreak in 2017.

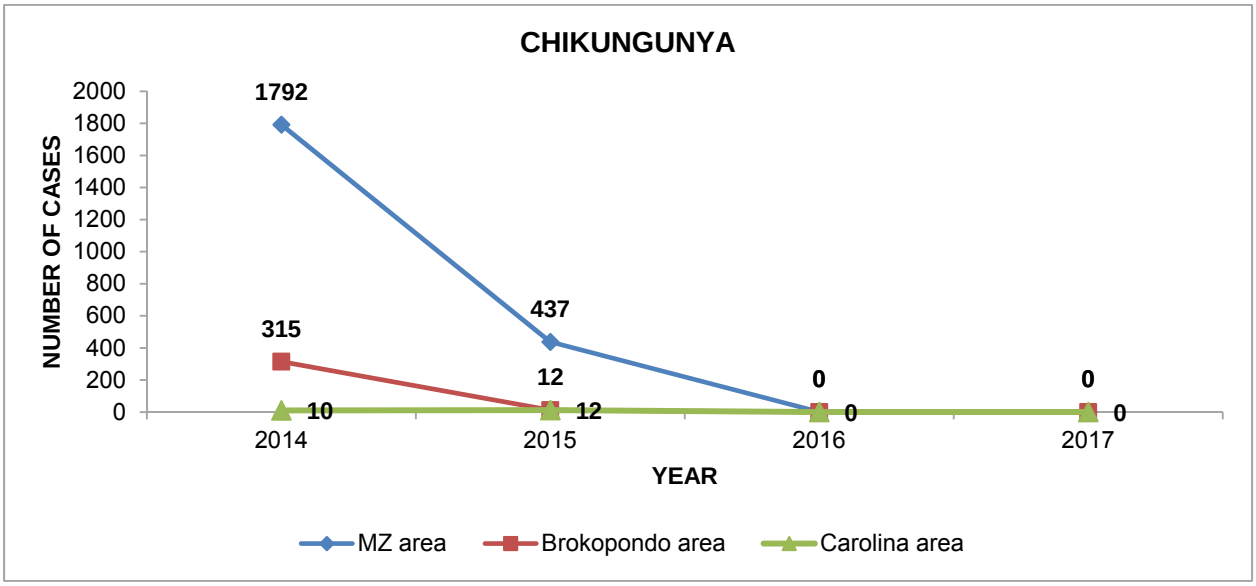


Table 5 Chikungunya outbreak in Brokopondo and Carolina region

- Zika outbreak was reported at the end of 2015. The Medical Mission carried out a serological survey in January 2016 and has conducted surveillance. A total of 17 cases were reported in the Carolina region and 1 in Brokopondo in 2016. There were no Zika cases reported in any of the regions in 2017.

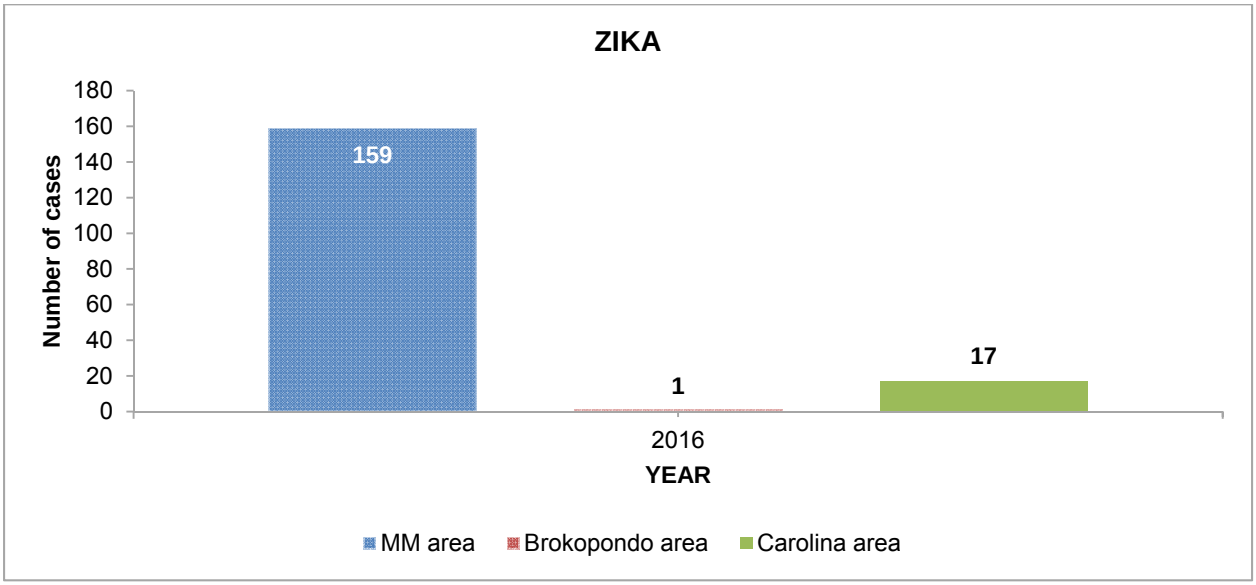


Table 6 Zika outbreak in both the regions (2016)

- *Leishmaniasis*: Through monthly surveillance by health centers, CL was reported in the interior areas of Suriname, where a higher number (110 cases) of cases were seen in the Medical Mission areas in 2014, which recently got reduced in 2017 (9 cases). There were 3 cases reported over the years in Brokopondo and 1 in Carolina.

Year	Brokopondo Area	Carolina Area	Medical Mission area
2013	0	0	37
2014	0	2	110
2015	0	1	70
2016	1	0	90
2017	0	0	9

Table 7 Number of leishmaniasis cases over the years (2013 to 2017)

- *Malaria:* The incidence of malaria cases has reduced significantly in all interior regions; a higher number of cases were observed in the Medical Mission area in 2016. However, no cases were reported in Carolina area, whereas only 1 case was reported in Brokopondo in 2016. These cases are treated at the Medical Mission health centers, but are referred to the dermatologist in Paramaribo if the case gets complicated

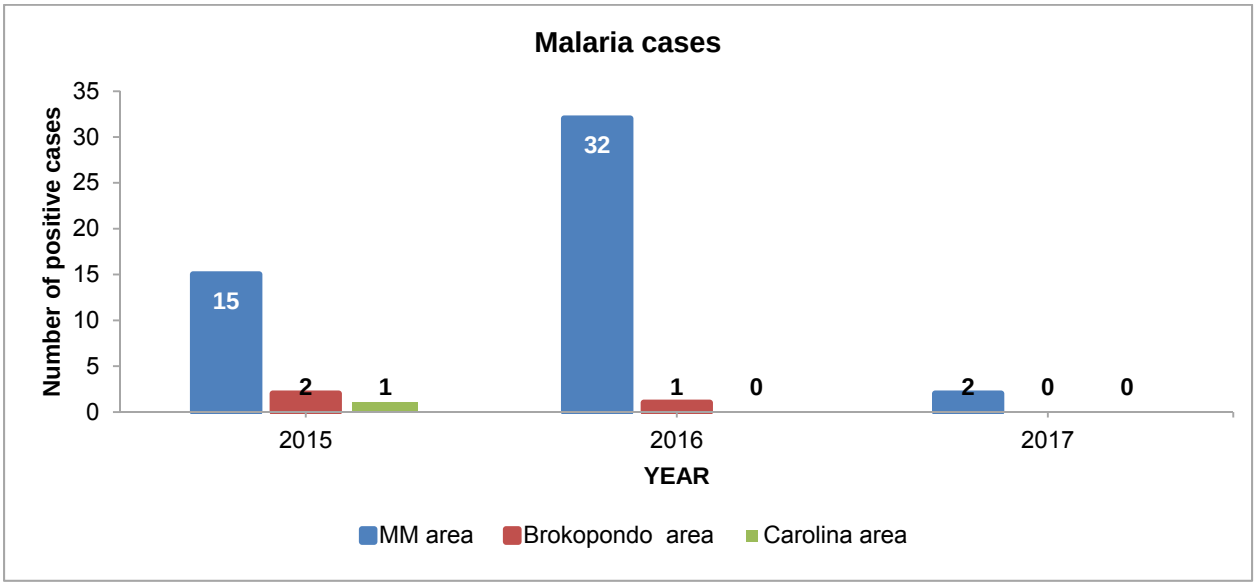


Table 8 Malaria cases over the years (2015 to 2017)

4.1.4 Respiratory issues

- *Influenza:* The Medical Mission performs weekly surveillance for monitoring the occurrence of the disease, and this is the biggest respiratory problem in the area. It was reported that throughout the year, there had been a seasonal occurrence of influenza. The number of cases in children and adults from 2015 to mid-2017 was higher in both Brokopondo and Carolina regions, but significant reduction has been noticed in both children and adults in both the regions by mid-2017. There was no data whether the respiratory issues were due to pollution or any toxic fumes.

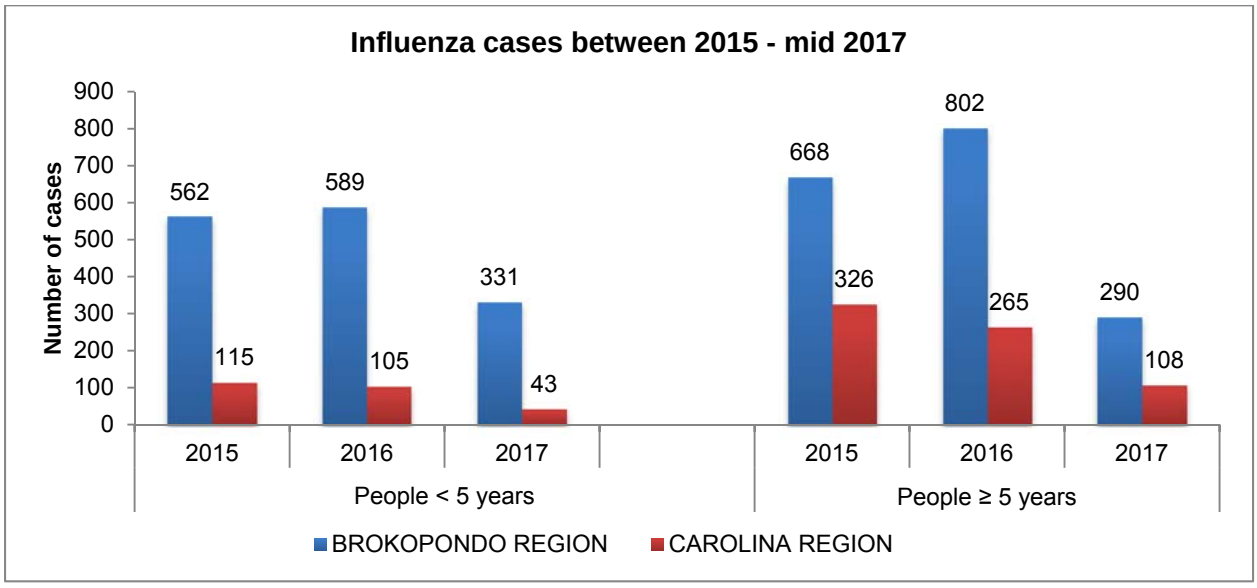


Figure 21 Influenza cases between 2015 to mid-2017 [Medical Mission data]

- *Other respiratory infections:* In Brokopondo area, the number of cases of lower respiratory infections was 94, 170 and 97 in 2015, 2016 and mid-2017, respectively. While in Carolina area, the number of cases was 74, 45 and 32 for the same time period.

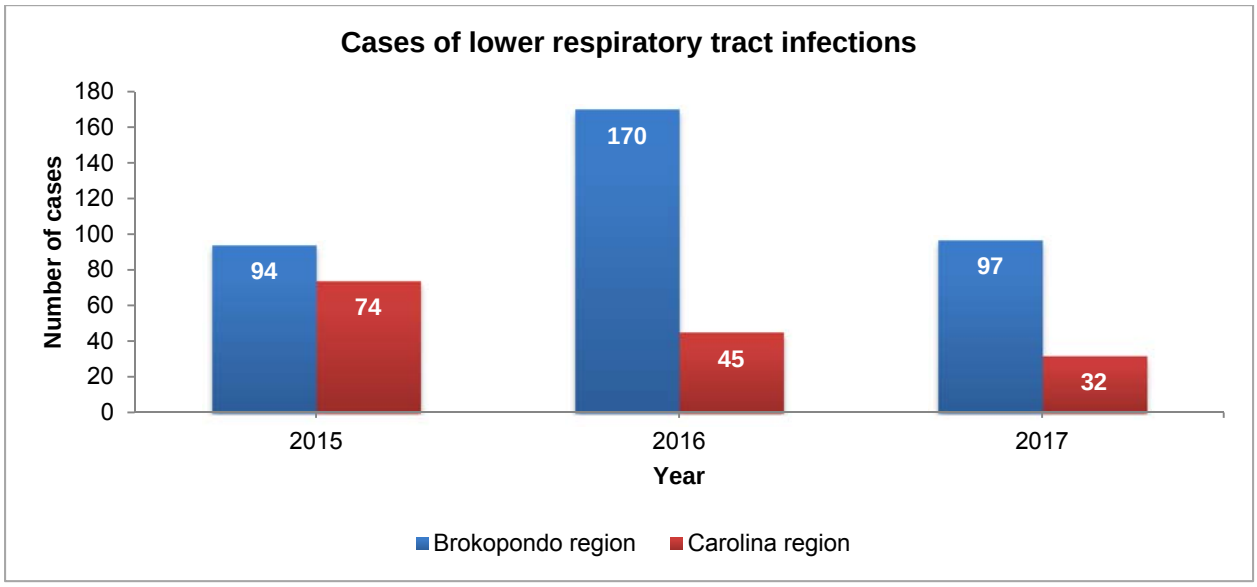


Table 9 Total number of cases of lower respiratory infections (2015 to 2017)

4.1.5 Sexually Transmitted Infections (STIs):

- *HIV/AIDS:* The estimated prevalence of HIV/AIDS is comparatively lower in the Brokopondo region (0.59%) and higher in the Carolina region (0.72%), as it has a smaller population. In Carolina, 1 HIV-positive woman was reported and in Brokopondo, 2 positive cases of hepatitis B were reported. The Medical Mission provides treatment to prevent its transmission from mother to child, if any pregnant woman is tested positive for HIV. The Medical Mission has a treatment to prevent mother-to-child transmission.

- *Other STIs:* MM has a syndromic treatment for other STIs, such as gonorrhea. Monthly surveillance is conducted by reporting the number of patients who have visited different health centers. The number of cases reported in Brokopondo was 14, 16 and 10 in 2015, 2016 and mid-2017, respectively. While in Carolina area, the number of cases was 13, 6 and 6 for the same time period.

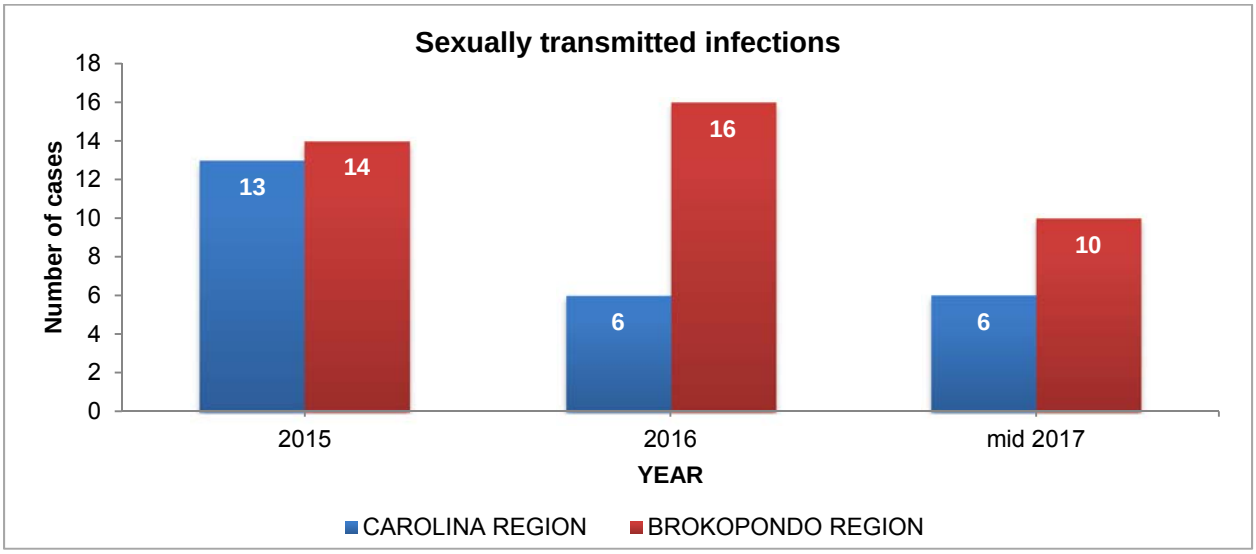


Table 10 STIs over the years (2015 to 2017) for both regions

4.1.6 Soil, Water and Sanitation-Related Diseases

- *Diarrhea:* This is the most common disease in the interior regions and Medical Mission has a weekly surveillance on it. Diarrhea cases were higher in the Brokopondo area in the 2016, but have shown significant reduction in 2017 with fewer cases in weeks by year. There are generally more cases involving children less than 5 years of age as compared to adults, as they have weaker immunity. Although, the number got reduced in the mid-2017. In order to reduce diarrhea cases, the Medical Mission imparts health education on different topics, such as hygiene, cooking practices, use of drinking water and hand washing techniques.

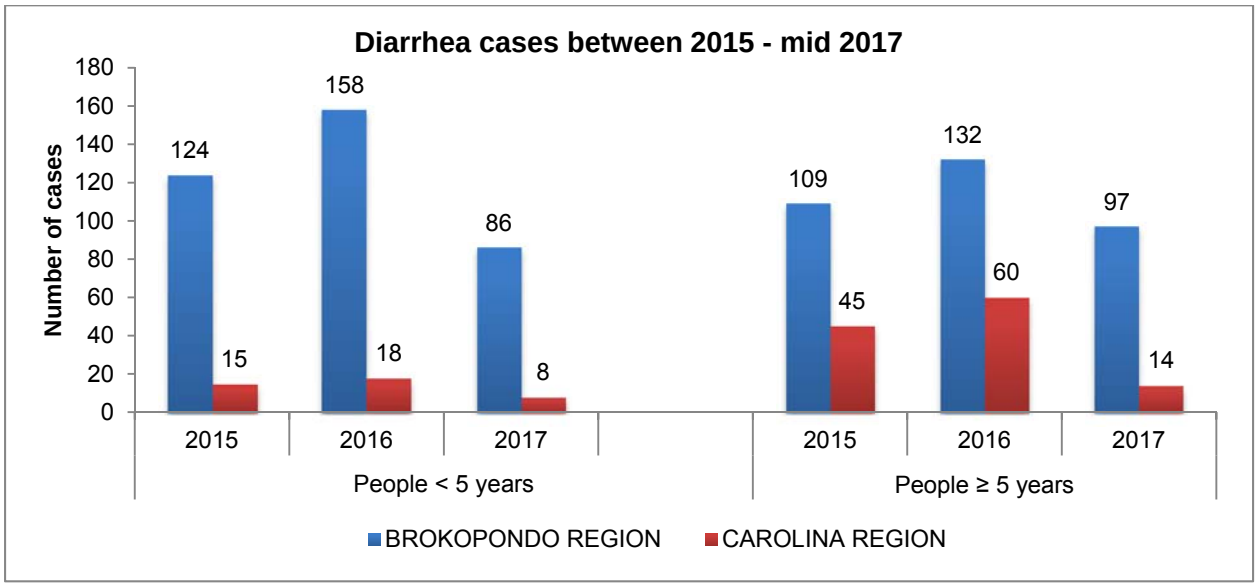


Figure 22 Diarrhea cases (2015 to mid-2017) [Medical Mission data]

4.1.7 Non-Communicable Diseases (NCDs)

- *Hypertension and diabetes:* In the interior, hypertension and diabetes mellitus occur in both the Maroon and the Amerindian populations. The prevalence of hypertension and diabetes is higher in Carolina region as compared to Brokopondo areas. The prevalence of hypertension in Brokopondo is 3.91% and 5.79% in the Carolina area.

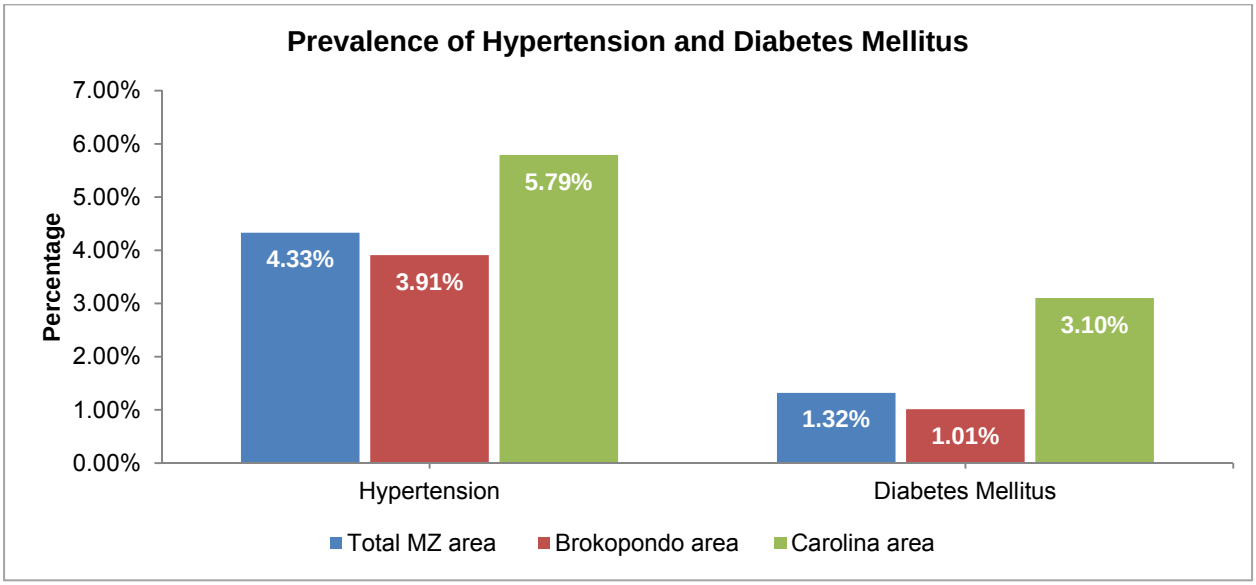


Figure 23 Prevalence of hypertension and Diabetes Mellitus [Medical Mission data]

According to the gender in Carolina, females have a higher percentage of diabetes (35% of cases were reported in the age group of 51 to 60 years) and hypertension (18% of cases were reported in the age group of 50 to 59 years). Additionally, in Brokopondo, females reported to be on a higher side as compared to males (20% of diabetes mellitus cases were reported in the age group of 81 to 90 years and 15% of hypertension cases were reported in 60 to 69 years of age).

4.1.8 Health Visits

As reported by the Medical Mission, the number of clinical visits in both the regions is due to chronic diseases, prenatal care and child consultation. For chronic diseases, visits to the clinic in the Carolina region were more due to hypertension and diabetes; whereas in Brokopondo, it was only due to hypertension. From 2015 to mid-2017, the number of cases was higher in Brokopondo and different reasons were stated that are mentioned below under referral statistics.

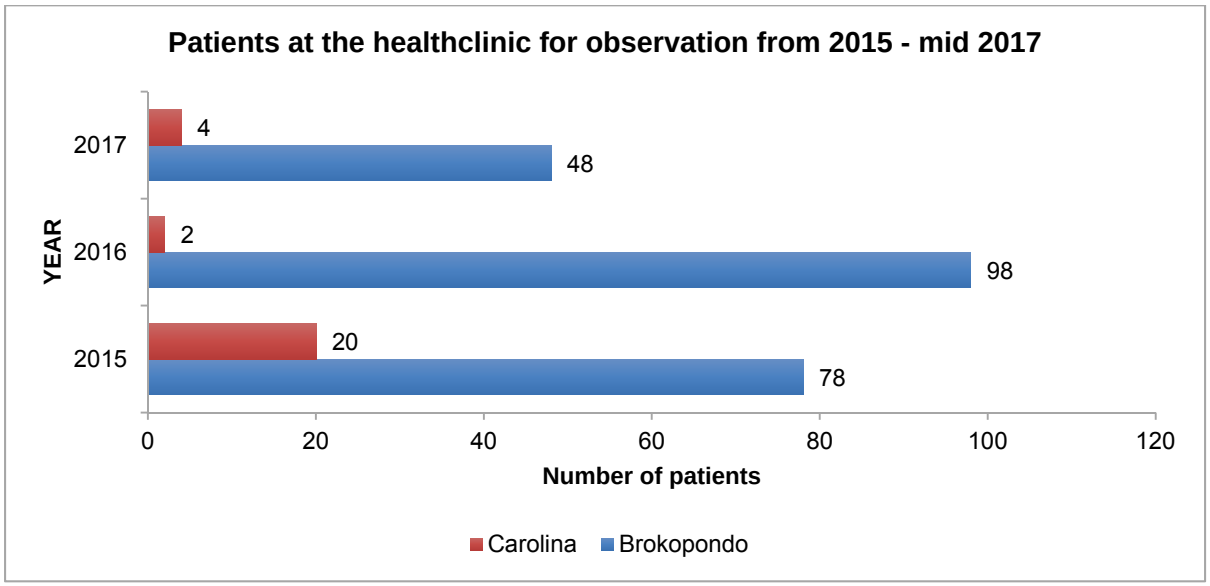


Figure 24 Patients ay health clinic for observation (2015 to mid-2017) [Medical Mission data]

4.1.9 Referral Statistics

The referral cases in both the regions were reported to be higher by mid-2017, where women have referred more frequently than men in all age groups for both Brokopondo (81% women and 19% men in 2017) and Carolina regions (62% women and 38% men in 2017).

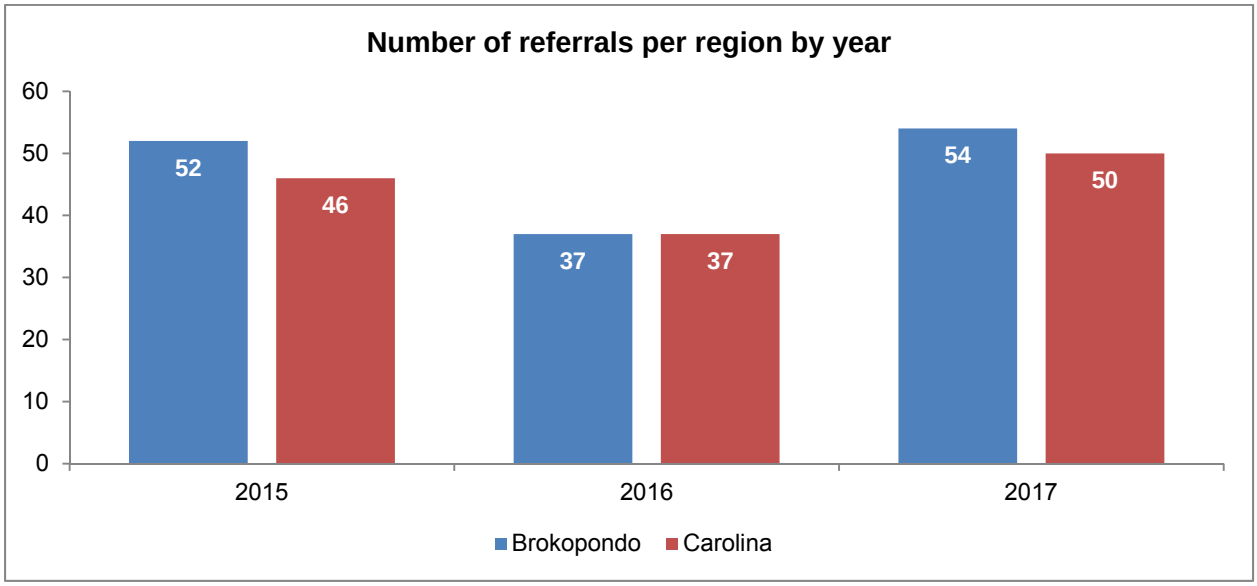


Figure 25 Number of referrals per region for both regions (2015 to mid-2017) [Medical Mission data]

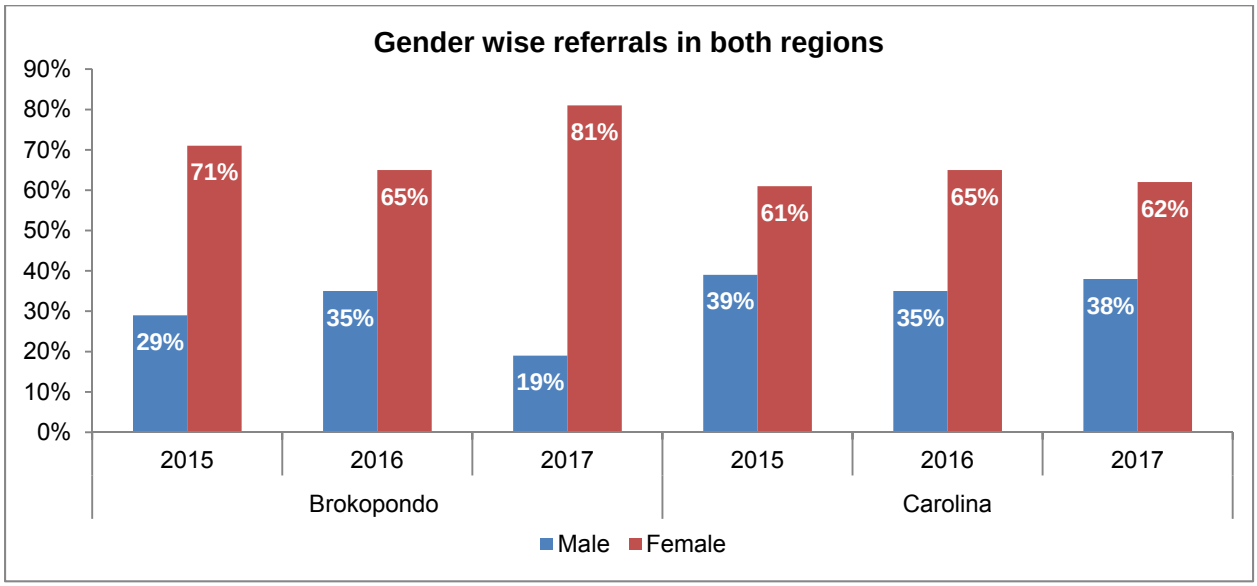


Figure 26 Number of referrals gender wise for both regions (2015 to mid-2017) [Medical Mission data]

Age wise, Brokopondo has shown more referral cases in the age group of 0 to19 years and 20 to 39 years; the trend for referral cases got increased from 21% to 45% in the age group of 0 to 4 years from 2015 to mid-2017, whereas referrals in the age group of 10 to 19 years got decreased from 64% to 45% from 2015 to mid-2017.

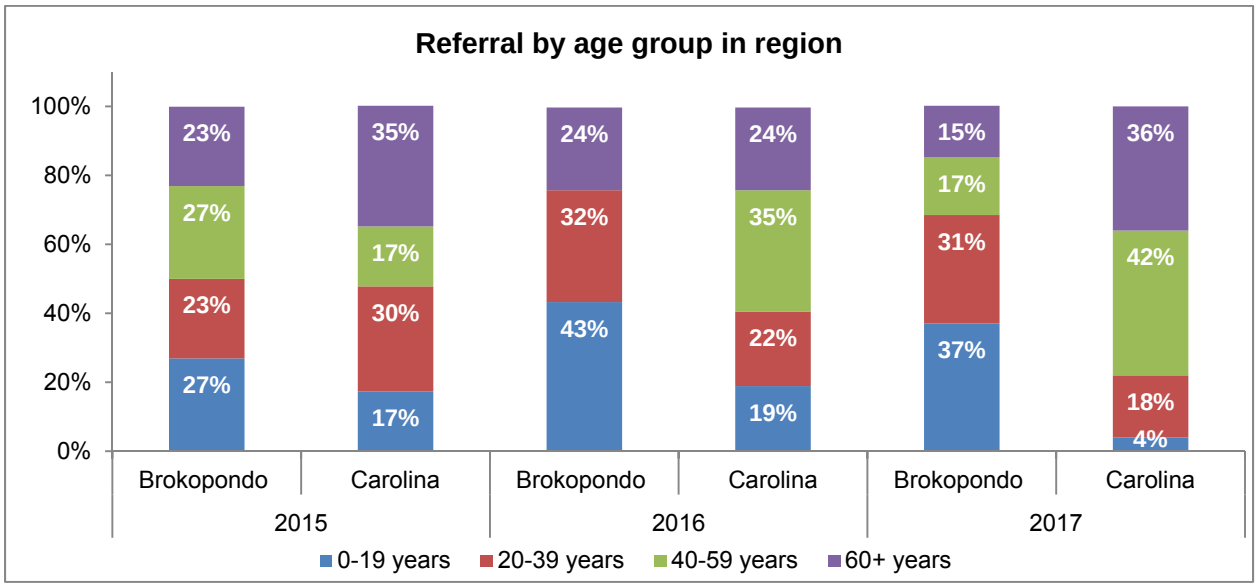


Figure 27 Age-wise referral for both the regions (2015 to mid-2017) [Medical Mission data]

The reason stated for all referral cases in Brokopondo are mentioned below:

- Pregnancy-related referral for delivery in the hospital; it was also reported that 33% of the pregnancy referrals were teen pregnancies. This could be one of the reasons why referrals statistics are higher for 0 to 19 years and 20 to 39 years. It was also reported that there are traditional midwives in the Brokopondo area but they refer all pregnant women to the MZ health clinic.
- Problem with the vision due to strabismus or refractory disorders.
- There were various diseases as reported in children, such as sickle cell crisis in children with sickle cell anemia, second-degree burns due to bathing in hot/warm water (more cases in 2017), mental retardation, scabies and hernia umbilical.
- For traditional healers and practitioners, it is present in the community mainly for snakebites and no other data and information have been reported for both the regions.

Age wise, Carolina has shown more referral cases in the age group of 20 to 39 years and 40 to 59 years; however, till mid-2017, there were no referral cases in the age group of 0 to 4 years but significant difference was observed in the age group of 5 to 9 years (13% in 2015 and 50% in 2017).

The reason stated for referral cases in Carolina are mentioned below:

- Pregnancy-related referral for delivery in the hospital; around 27% of pregnancy referrals were teen pregnancies.
- Problem with the vision, but it was not reported whether the vision problem is due to toxic fumes, pollution or any other reason.
- Skin diseases, such as eczema, referral to dermatologist, which was mostly diagnosed as atopic eczema and seborrheic eczema, as well as psoriasis as a skin disease. It is unknown if these problems are related to toxic fumes or pollution.
- Non-compliance diabetes patients, referral to the internist.

4.1.10 Vaccination Coverage

Yellow fever, pentavalent and measles, mumps, and rubella vaccine

Yellow fever vaccination coverage was higher in 2013; however, over a period of time, it got reduced due to logistics issues and other associated problems. In 2016, the vaccination coverage was only around 65%. According to the Medical Mission, the reasons include lack of awareness in the community, logistics issues and inability to reach health clinics. Additionally, with recent financial problems in 2017, no stock of vaccines on the national level and low availability of vaccines are the main issues.

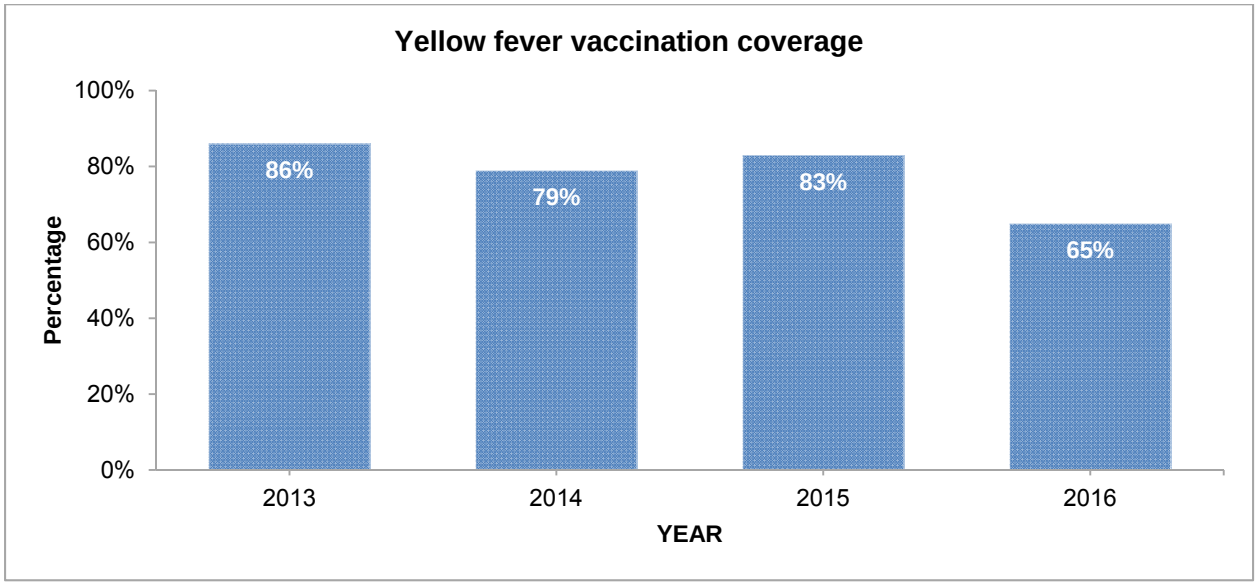


Table 11 Yellow Fever Vaccination coverage (2013 to 2016)

Likewise, Pentavalent, MMR and yellow fever vaccination coverage got reduced in 2016 and again in mid-2017 (only half year so situation might evolve). The low vaccination coverage is however an issue of concern.

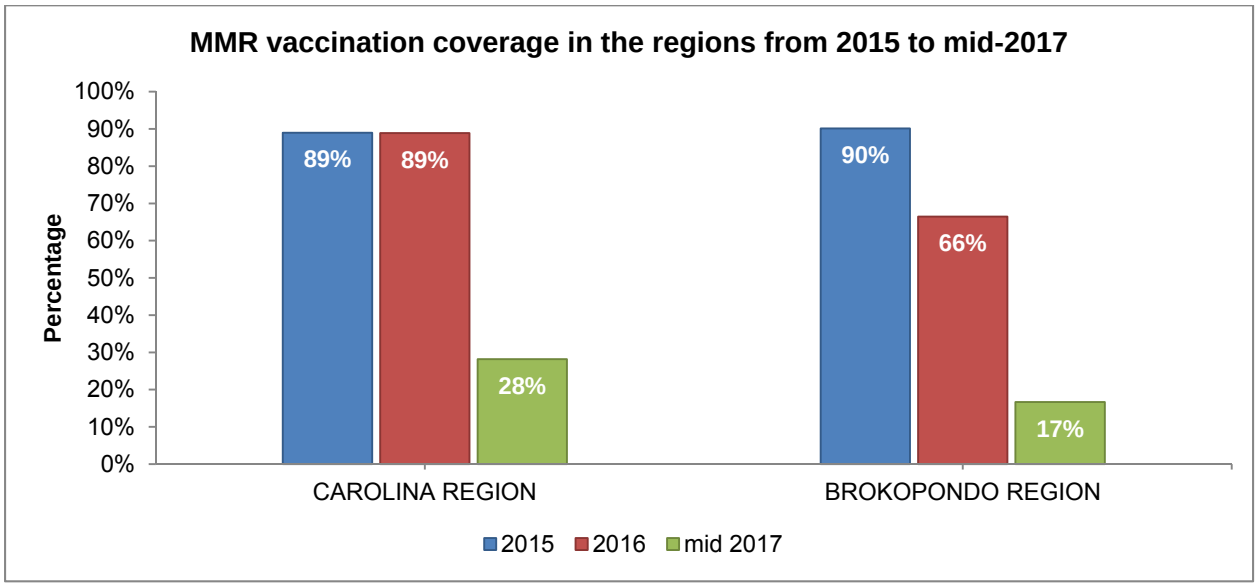


Table 12 MMR vaccination coverage in the regions from 2015 to mid-2017

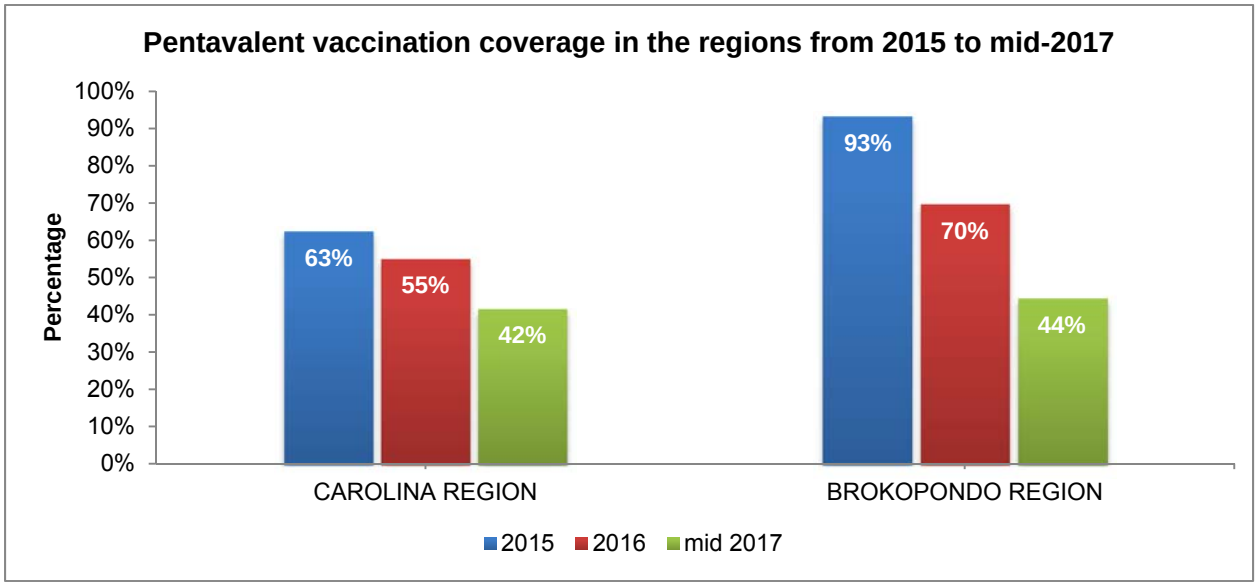


Table 13 Pentavalent vaccination coverage in the regions from 2015 to mid-2017

Maternal and child health

All the pregnant women are vaccinated with diphtheria and tetanus vaccine, depending on her vaccination status on the card. In both the regions, there was no maternal mortality reported from 2015 to mid-2017, only 1 neonatal death was reported in 2016 for which the cause is not known.

4.1.11 Road Traffic Accidents

The road traffic accidents reported were mostly on the paved Afobaka road in the Brokopondo region. For small road accidents that were not reported in the emergency room have not been taken into account. From 2015 to mid-2017, a total of 40 road traffic accident cases were recorded in the Brokopondo region and 2 road traffic accidents recorded in the Carolina area. About 70% of people involved in road accidents are male and with an average age of 35 years. Females involved in road accidents have an average age of 29 years.

The reason reported for these road accidents are mostly due to erratic driving and speeding of vehicle.

5 Appendix

5.1 Index of Figures

5.2 Index of Tables

6 References

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