Progress Report
Partnership in Health Project
January 2014–June 2014

Papua New Guinea Institute of Medical Research

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Progress Report of Partnership in Health Project

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Abbreviations

ACD	Active Case Detection
AFB	Acid Fast Bacilli
AIDS	Acquired Immune Deficiency Syndrome
ALRI	Acute lower respiratory infections
ANC	Ante natal care
BCG	Bacillus Calmette-Guérin
BMI	Body Mass Index
CFU	Colony forming units
CHIKV	Chikungunya virus
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
CP	Central Province
CRF	Study-specific case record forms
CVD	Cardiovascular Disease
DENV	Dengue virus
DNA	Deoxyribonucleic acid
DOTS	Directly Observed Therapy - Short Course
DSS	Demographic Surveillance Survey
DST	Drug Sensitivity Test
DTP	Diphtheria, tetanus and pertussis
DWU	Divine World University
EEDU	Environmental and Emerging Diseases Unit
EHP	Eastern Highland Province
EMPNG	ExxonMobil PNG Ltd.
EPEC/ETEC	Enteropathogenic E. coli /Enterotoxigenic E. coli
EPI	the Expanded Program on Immunization
EPTB	Extra Pulmonary Tuberculosis
GCP	Good Clinical Practice
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
HAdV	Human Adenovirus
HepB	Hepatitis B
Hib	Haemophilus influenza type B

HIV	Human Immunodeficiency Virus
HNB	Hydroxynaphthol blue
HP	Hela Province
HPS	HIV, HPV and other STIs
HPV	Human Papilloma Virus
HR-HPV	High-risk sub-types of human papilloma virus
HRSV	Human Respiratory Syncytial Virus
HRV	Human rhinovirus
HSV-2	Herpes simplex type-2
IEC	Information, education and communication
iHDSS	Integrated Health and Demographic Surveillance System
ILI	Influenza like illness
IMR	Institute of Medical Research
IRB	PNG Institute of Medical Research Institutional Review Board
LAMP	Loop-mediated isothermal amplification
LBW	Low birth weight
LLG	Local Level Government
LNG	Liquefied Natural Gas
MCH	Maternal and Child Health
MDG	Millennium Development Goals
MDR/TB	Multi-drug resistant tuberculosis
MGIT	Mycobacteria Growth Indicator Tube
MMR	Maternal mortality ratio
MP	Madang Province
MRAC	The PNG Medical Research Advisory Committee
MTB	Mycobacterium Tuberculosis
N/A	Not applicable
NCD	Non-Communicable Diseases
NDoH	National Department of Health
NMR	Neonatal mortality rate
OPV	Oral Polio Vaccine
ORS	Oral rehydration salts
PCD	Passive Case Detection
PCR	Polymerase chain reaction
PICT	Provider-initiated HIV counselling and testing

PiHP	Partnership in Health Project
PNG	Papua New Guinea
PNG Med J	Papua New Guinea Medical Journal
PNG IMR	Papua New Guinea Institute of Medical Research
PNG LNG	Papua New Guinea Liquefied Natural Gas
POM	Port Moresby
PPAQ	Papua New Guinea Physical Activity Questionnaire
PSI	Population Services International
PTB	Pulmonary Tuberculosis
QMLR	Queensland Mycobacterial Reference Laboratory
RIF	Rifampicin
RNA	Ribonucleic acid
RRV	Ross River virus
RSV	Respiratory syncytial virus
SG	SYBR® Green I
SOP	Standard Operating Procedures
SS	Sentinel Surveillance
STI	Sexually Transmitted Infections
TB	Tuberculosis
TBA	Traditional Birth Attendant
UNICEF	United Nations Children's Fund
UNSW	The University of New South Wales
UPS	Urinary pregnancy test
UQ	The University of Queensland
VA	Verbal Autopsy
VBA	Village birth attendant
VCT	Voluntary counselling and testing
VDS	Vaginal discharge syndrome
WASH	Water, Sanitation and Hygiene
WHO	World Health Organisation
WPR	Western Pacific Region
ZN	Ziehl-Neelsen stains

Executive summary

In this report, PNGIMR presents its biannual technical progress update for the Partnership in Health Programme (PiHP). The work presented in this report includes new data and results covering the period of January 2014 – June 2014. In addition, selective data from past reports is also shown so that there is a longitudinal perspective. Preliminary observations and findings are discussed in the current report.

The October 2014 report is structured in ten chapters that cover:

- New demographic, in/out migration and household level socio-economic data collected since January 2014 at the four integrated Demographic Surveillance Sites (iHDSS), Hiri, Hides, Asaro and Karkar Island; and
- An update of the sponsored programmes covering tuberculosis, sentinel surveillance of respiratory and diarrheal diseases, maternal and newborn health, non-communicable diseases, clinic morbidity statistics and mortality.

As an interim deliverable of the PiHP, the report does assume a basic understanding of the overall effort and does not fully reiterate well-known background information of either the PNG LNG Project or the PiHP. Whenever possible, the overall focus is on new results developed since the March 2014 Report. The results of these efforts are presented in detail in interlinked chapters of the report. New findings and observations are emphasized but are put in longitudinal perspective based on data from previous reports.

The PiHP is a longitudinal effort; therefore, the presentation of certain types of time sequence information is critical. Health and demographic indicators and socio-cultural determinants do not typically change rapidly. Rather, they evolve over a period of several years. This is the power of the integrated Health and Demographic Surveillance System (iHDSS), i.e. revealing trends so that there is objective scientific data that can be utilized to inform public health decision-making.

Key findings and observations of the October 2014 report:

Demography and key Socio-economic indicators

Population

- Over 54,000 individuals are under continuous demographic surveillance at four locations.
- Site locations include two PNG LNG impact sites, Hiri and Hides and two comparison locations Karkar Island and Asaro.
- There continues to be a marked male: female sex ratio difference across all four sites, especially among working age groups.

Population data for Hiri iHDSS is under a review at time of writing this report and an additional data analysis will be provided going forward after QA/QC review completed.

Education

- Educational attainment is improving in PNG, particularly for the younger generation, ages 5-24.
    - There are marked improvements in overall early educational attainment for all four iHDSS locations (Hides, Hiri, Asaro, Karkar) age 5-24 year cohort versus the >age 24 group. Females are significantly closing the previously documented "education attainment gap"
        - Overall all sites, both sexes combined age 5-24 no school- 15%%; age >24, 28%; some primary school- age 5-24 67%%; age >24, 41%
        - Historically there has been an overall persistent male versus female attainment gap but has significantly improved in the 5-24 year old cohort across all sites.
            - Hides female "no education" improved from 71% in the >age 24 cohort to 53% in the age 5-24 cohort; "some primary" improved 20% female >age 24 to 41% female age 5-24;
            - Hiri "some primary" female age >24 28% to 60% age 5-24; the no education age >24 and age 5-24 are very similar;
            - The comparison sites, Karkar and Asaro educational attainment data are under analysis.
        - There has been a significant PNG LNG Project effort on education, at both Hides and Hiri, particularly for women.
            - Improved employment and income could be potential explanatory variables but this requires further investigation.

Employment

- The PNG LNG project had a marked impact on the occupational structure of Hiri and Hides versus the comparison sites
    - Significantly higher levels of unskilled and skilled male and female employment in Hiri and Hides versus Karkar and Asaro;
    - Unskilled employment levels in men were 30 times higher in Hiri versus Karkar and ten times higher Hides (men) versus Asaro.
        - Unskilled employment refers to jobs that do not require advanced and or high technical educations, i.e., basic construction work, catering, cleaning, etc.

In/Out Migration

- In/out migration data are undergoing further QA/QC evaluation and longitudinal analysis.
- Hides and Hiri populations may be in the initial phases of a "re-equilibration" as PNG LNG construction activity has demobilized and moved into operations.
    - Overall longitudinal Hiri and Hides in-migration appears to be consistent with expected trends, i.e., PNG LNG project induced in-migration but at levels anticipated and observed at other large development projects
        - Hiri overall population and at an individual village level are undergoing further review and field verification studies;
        - Hides Division 3 (HGCP area) has experienced net in-migration and growth in the study period. This reverses a trend of out-migration reported in March 2014, which was likely linked to local clan fighting in the hides area at the time and short term movement of people in the area during the survey period;
    - Out-migration is strongly occurring in Karkar, i.e., 20 times more than in-migration;
        - Karkar outmigration is likely driven by adults seeking employment opportunities in Madang where there is a surge of mining activity;
    - Out-migration is also observed in Asaro.

Tuberculosis

- An extremely high prevalence and incidence of TB is documented in Kikori
  - Observed TB rates are "epidemic;"
  - Drug resistant strains of TB (MDRTB) is documented at very high rates (10%).
- Karkar Island has a high TB prevalence (738/100,000) and incidence rate that is significantly higher than Hiri. (510/100,000)
- PNGIMR TB study rates for Karkar, Hiri and Kikori are markedly higher than 2013 published National Department of Health incidence rates.
  - Hiri IMR 458/100,000; NDOH 165;
  - Kikori IMR 1290/100,000; NDOH 815;
  - Karkar IMR 630/100,000; NDOH (2012 data) 276;
- A silent epidemic of TB is occurring at the study sites with serious public health implications and potential consequences.
  - The current findings confirm and extend (Hiri and Kikori) observations that were made during initial pre-PNG LNG baseline review studies in 2006 and 2008, i.e., there is a significant and likely growing burden of TB in PNG.
  - The PNG LNG Project in conjunction with NDOH and IMR held a workshop in April 2014 where TB findings were presented and a call to action was issued by all attendees.

Febrile, Diarrhoeal, Respiratory Disease (Sentinel) Surveillance

- PNGIMR has developed and activated over 60 real-time PCR assays for febrile, diarrheal and respiratory diseases.
  - These assays allow for accurate and rapid determination of the potential causative agent(s) of symptomatic individuals who present to target health centres.
  - Acute lower respiratory infections is the most common cause of hospitalizations in children under age 1 in PNG.
    - Historically Hides has one of the highest burdens of respiratory disease in the world, an observation made over 40 years ago and which still continues;
    - Circulating respiratory pathogens are felt to be well understood and characterized by IMR with many recent publications in the peer-reviewed scientific literature.
  - Diarrhoeal and febrile illness characterization is ongoing and will be reported in future reports.
- Sample collection is ongoing for Hiri, Asaro and Karkar Island; however, Hides sample collection has been disappointing and additional effort is underway.

Maternal and Newborn Health

- Key findings of Vaccination Coverage at iHDSS Sites has previously been reported:
  - Compared to WHO standard of 90% coverage (global) iHDSS site rates are well below international norms
    - Hides rates are 2-3 fold below international norms and 50% worse than Asaro levels;
    - Hiri vaccination rates are also well below international standards although better than the other iHDSS;
    - Measles coverage of all required doses is extremely poor with 2nd dose coverage as low as 16% at all locations.
  - Post-IMR survey outbreaks of measles epidemics in Hides were not unexpected and confirm the problem of vaccination coverage.
  - Recently, mass vaccination campaigns have been initiated in many PNG locations, including Hides.
    - The PiHP studies confirm the ongoing vaccination coverage issues and the need for aggressive public education and emphasis on service delivery and support.

- Almost 500 women were surveyed regarding their most recent pregnancy at Hiri, Karkar and Asaro iHDSS locations.
    - Pregnancy (antenatal) care does not meet minimum standards as outlined by the National Department of Health;
    - Numerous opportunities to monitor for risk factors in pregnancy were missed at all sites;
    - Danger signs of pregnancy occurred in one third of all pregnancies
    - Almost 50% of the women experienced a problem during pregnancy or childbirth;
    - Women's knowledge of danger signs for pregnancy, childbirth and for newborns was extremely variable (overall Hiri women had better knowledge of danger signs, access to functioning clinics);
        - Hiri is closer to Port Moresby, more urbanized and has a significantly higher female educational attainment level than the other sites.
    - Significant numbers of women deliver without attendance of a health professional;
- Study results are consistent with the extremely high maternal mortality rate observed in PNG (733/100,000) and illustrate that a severe ongoing problem in maternal care delivery is present.

Sexually Transmitted Infections (Healthy Pregnancy Study)

- A large cross-sectional bio-behavioural survey has been successfully executed across the Hiri, Asaro and Hides iHDSS locations, i.e., approximately 250 women per site.
    - Chlamydia (CH), Gonorrhoea (GC), Trichomonas (T), Herpes 2, HIV, Syphilis (SY) and Human Papilloma Virus (HPV) infection were studied;
        - PNG STI prevalence rates are among the highest in the Asia-Pacific region:
            - Asaro- CH (24%); GC 6.7%; T (19.7%); SY (4.3%)
            - Hides-CH (21.3); GC (6.1%); T (17.7%); SY (0.6%)
            - Hiri – CH (23.8%); GC (25%); T (32.7%); SY (0.5%)
        - Herpes rates were also strikingly high:
            - Asaro- 47.4%
            - Hides- 14.5%
            - Hiri - 20.5%
        - HIV rates are generally consistent with observed PNG national urban and rural rates (0.5-1.5%):
            - Asaro- 1.5%
            - Hides- 0.5%
            - Hiri - 1.6%
    - The study is providing the first geographical, age and type-specific prevalence data on HPV infection in PNG:
        - HPV is a significant cause of cervical cancer; cervical cancer is the most common cancer among women in PNG and a leading cause of death for PNG woman;
        - The prevalence of high –risk HPV infection was 43% (all types combined);
            - Only extremely limited prevalence data have previously been available for PNG (33% prevalence) in a small study of 114 women in Eastern Highlands Province).
- There are significant public health implications for the study, particularly regarding the potential introduction of the HPV vaccine in PNG.
    - The current findings suggest that the available and highly effective HPV vaccines have the potential to significantly reduce the burden of HPV-related cervical cancer in PNG if distribution and cost issues can be resolved.

Non-Communicable Diseases (NCDs)

- The study is establishing baseline prevalence for selected NCDs, associated lifestyle risk factors, dietary habits and food security at three iHDSS locations, Hiri, Karkar, and Asaro; target recruitment of 300 per site. Hides data have not been collected due to clan fighting and other security issues affecting IMR staff during the study period.
- There is a marked difference in body mass index (BMI) observed across the different survey locations:
    - Hiri- Underweight (6%); Normal (56%); Overweight (24%); Obese (14%);
    - Karkar- Underweight (13%); Normal (81%); Overweight (5%); Obese (1%);
    - Asaro- Underweight (4%); Normal (83%); Overweight (10%); Obese (3%).
- Significant levels of hypertension, elevated cholesterol/triglycerides and glucose are documented.
    - Hypertension- Hiri (18%); Karkar (5%); Asaro (16%);
    - Elevated lipids- 24-49% with marked elevation in Hiri; Karkar (28%) Asaro (29%);
    - Elevated glucose—(pre-diabetes + diabetes) - Hiri (21%; Karkar (9%); Asaro (12%).
- Significant levels of NCD markers are observed particularly in the more urbanized and affluent Hiri area.
- There are significant public health implications for the study findings.
    - The PNG LNG Project in conjunction with NDOH and IMR held a workshop in April 2014 where NCD data were presented and PNG School of Medicine Dean Sir Isi Kevau issued a strong call to action to raise the profile and need for action on NCDs.

Mortality

- A longitudinal mortality study using verbal autopsies (VA) is ongoing across all four iHDSS locations.
    - 1252 VA have been completed and cover almost six years of effort;
    - Evolving mortality patterns are observed at all four iHDSS locations.
        - Rise in NCDs in Hiri, Karkar and Asaro;
            - Cervical cancer is a major issue and consistent with the high rates of HPV documented in the PiHP "Healthy Pregnancy/STI Study".
        - Hides is still dominated by a pattern of infectious respiratory diseases, particularly pneumonia, accidents and violence; however, total case numbers lag behind the other sites. VA report for HIV/AIDS numbers in Hides appear to be increasing however:
            - Total Verbal Autopsy data numbers in Hides are small and HIV/AIDS numbers should be cautiously interpreted;
            - The Verbal Autopsy study does not include HIV contact tracing therefore the place of acquiring infection is unknown;
            - Antenatal clinic HIV prevalence has been consistently stable at 0.6%.
        - Infectious diseases, particularly TB in Hiri is a major concern;
        - Malaria burden is falling rapidly in Hiri, likely due to a combination of improved diagnosis, treatment and bed-net distribution.

Morbidity

- Local clinic based morbidity trends are followed at all iHDSS locations
    - Data collection utilizes National Department of Health collection forms and protocols;
    - There is marked variability in how diagnoses are recorded, i.e., clinical versus laboratory confirmed;

    - Morbidity data available during initial pre-PNG LNG baseline review continue to be observed with reduction in some cases (i.e., malaria).
- Respiratory diseases dominate the observed morbidity pattern at all iHDSS locations.
- Confirmed malaria cases have rapidly fallen, particularly in Hiri:
    - The rollout of rapid diagnostic tests (RDTs) has had a profound impact by increasing the accuracy of clinical diagnosis of malaria;
    - The use of RDTs across PNG where malaria is presumed to be prevalent and essential.
- Skin diseases and diarrhoea are still prominent at all iHDSS clinics, e.g., Hides (Malanda and Para Clinics), Hiri (Papa and Porebada clinic) and Karkar and Asaro.
- Poor sanitation and hygiene are likely important causal factors in the burden of skin and diarrhoeal disease.
- Continues emphasis on sanitation and hygiene education and provision of secure water supplies is also extremely important.
- NCDs are infrequently diagnosed at all clinics:
    - The clinic data severely under report the NCD burden documented by the PNGIMR NCD study, e.g., cases of diabetes, hypertension;
    - Diagnosing NCDs requires both health care worker educations, e.g., always measuring blood pressure at each patient encounter and patient education, understanding early warning signs of NCDs, e.g., shortness of breath walking, etc.

Overall, there continues to be significant scientific progress across all major scientific studies. Demographic and socio-economic changes, particularly at PNG LNG Project impact sites versus comparison locations are ongoing. Positive employment and educational attainment changes are observed. Important discoveries regarding NCDs, sexually transmitted infections (particularly HPV infection), TB and changes in mortality and morbidity patterns are being made as a result of the PiHP. There are significant public health policy implications of these PiHP studies. The Government of PNG and international donors, including NGOs, can build upon the PiHP study results in order to better direct and focus aid and intervention programmes. Ideally, the iHDSS would become a core service of the PNG National Department of Health.

1. CHAPTER 1SOCIO-ECONOMIC DEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION

Abstract

This Chapter reports key findings and observations on socio-demographic characteristics of the study population in four iHDSS sites, namely Asaro, Hiri, Hides and Karkar. The data of approximately 54,633 population were extracted from the iHDSS Household Database, updated by the end of June 2014, providing longitudinal and updated data on the population, household and individual over the reporting period.

The data analysis focuses on key socio-demographic indicators such as the age and sex structure of the population, LNG employment status, marital status of the population aged 15 or above, and educational status (school grade and highest educational level) among population of schooling age, 5-24, and population who have finished school age, above 24.

This Chapter presents key findings from the analysis of data on 54,633 population, which were extracted from the iHDSS database by the end of June 2014, covering the reporting period of health and demographic data updated by the end of June 2014. The socio-demographic data from four iHDSS sites: Asaro, Hides, Hiri and Karkar were analysed and reported in this Chapter. These sites are designed in pair for comparison purpose: Hides vs. Asaro (highlands area) and Hiri vs. Karkar (coastal area) as shown in Figure 1-1.

Population changes, including births, deaths, in-migration and out-migration were recorded in the iHDSS. Updated data on the population study were collected by village-based data collectors and entered into the system by the data entry and management team, based in the main office of PNG IMR in Goroka town, the Eastern Highlands Province of PNG.

Village-based data collectors were recruited by PNGIMR from the villages under the coverage of the PiHP. These data collectors are trained to carry out the census updates of the iHDSS twice a year. These people have attained at least a grade ten of education and are recommended by the community leaders in their respective villages. Hence, the data collectors have good knowledge about the changes in their community as well as relationship to the people in their villages.

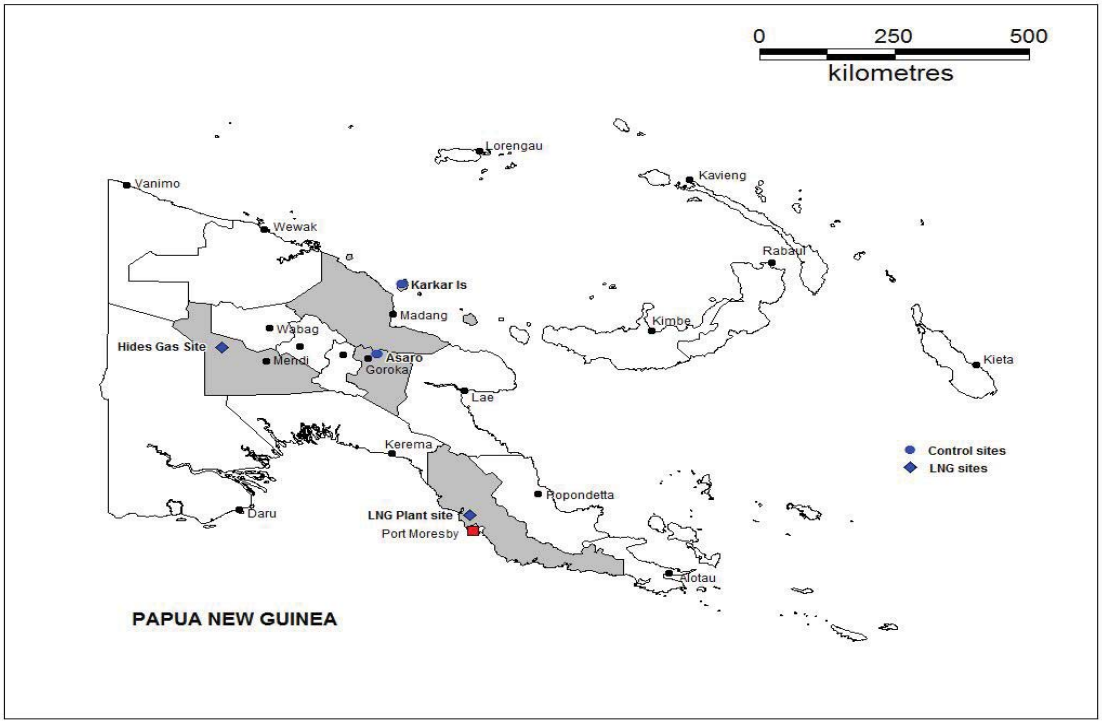

Figure 1-1iHDSS sites: Asaro vs. Hides and Karkar vs. Hiri sites, PNG IMR PiHP, 2014

Data management and quality control:

Data collection forms, including the Household Update Book and Change Status Forms were checked by the assigned Data Editors upon arrival in the office. Identified mistakes were highlighted and cross-checked with the Field-work Coordinators for clarifications and corrections.

The information was then entered into the PiHP central database, using MySQL template by data entry clerks, who are based in the PNG IMR main office in Goroka. Ten percent of the responses were randomly cross-checked by the data managers in the second round of quality control during the data entry process.

Data sets were extracted from the PiHP iHDSS Household Database and again cleaned by the data managers for the final round of quality assurance before they are released to the Principle Investigator and data analysts for the data analysis and report writing.

After data cleaning processes, 54,633 populations were included in the data analysis. Statistical Package for Social Study (SPSS) was used for the descriptive data analysis.

Results

Age and sex population structure of the study population

Table 1-1 Population distribution by age and sex, iHDSS four sites, Asaro, Hiri, Hides, Karkar, 2014

	Male		Female		Total		Sex ratio
Age group	N	%	N	%	N	%	M:F
0-4	2620	9.8	2523	10.2	5143	10.0	104
5-9	3662	13.7	3377	13.7	7039	13.7	108
10-14	3101	11.6	2807	11.4	5908	11.5	110
15-19	2841	10.6	2444	9.9	5285	10.3	116
20-24	2477	9.2	2289	9.3	4766	9.3	108
25-29	2193	8.2	2192	8.9	4385	8.5	100
30-34	2107	7.9	2113	8.5	4220	8.2	100
35-39	1765	6.6	1557	6.3	3322	6.4	113
40-44	1735	6.5	1644	6.6	3379	6.6	106
45-49	1121	4.2	972	3.9	2093	4.1	115
50-54	1067	4.0	992	4.0	2059	4.0	108
55-59	665	2.5	527	2.1	1192	2.3	126
60-64	585	2.2	504	2.0	1089	2.1	116
65-69	344	1.3	295	1.2	639	1.2	117
70-74	254	0.9	239	1.0	493	1.0	106
75-79	112	-	105	0.4	217	0.4	107
80+	142	-	150	0.6	292	0.6	95
Total	26791	100.0	24730	100.0	51521	100.0	108

	Male		Female		Total		Sex ratio
Age group	N	%	N	%	N	%	M:F
0-14	9383	35.0	8707	35.2	18090	35.1	108
15-64	16556	61.8	15234	61.6	31790	61.7	109
65+	852	2.2	789	3.2	1641	3.2	108
Total	26791	100.0	24730	100.0	51521	100.0	108

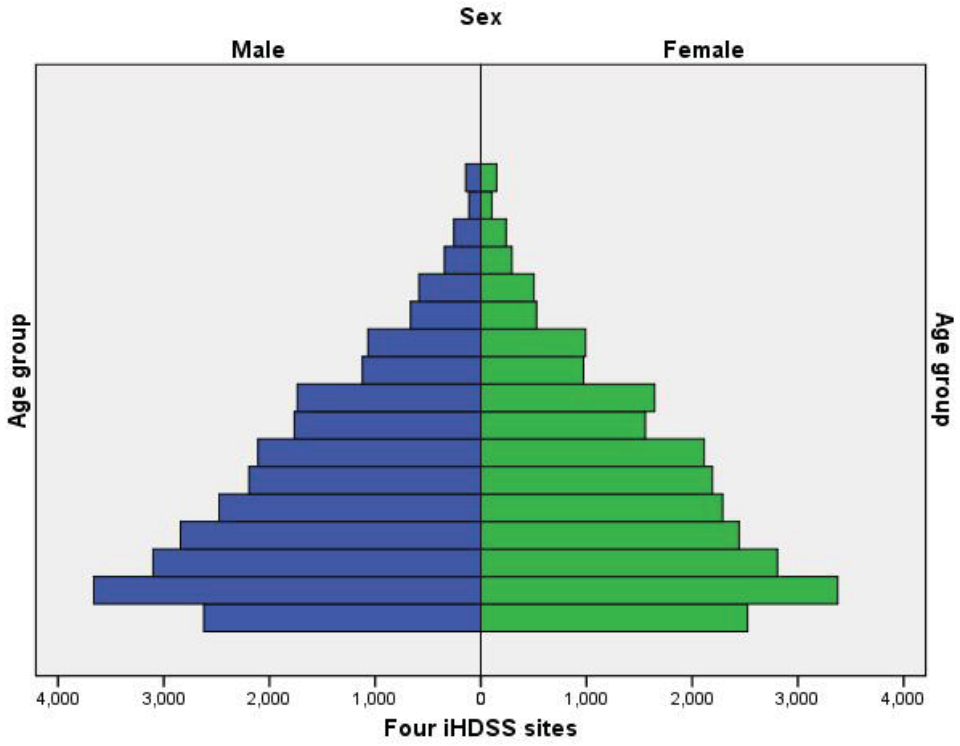

Figure 1-2 Population pyramid of iHDSS four sites: Asaro, Hiri, Hides, Karkar, iHDSS, 2014[1]

Table 1-1 and Figure 1-2 shows the age and sex population structure of the population study in four iHDSS sites: Asaro, Hiri, Hides, and Karkar[2]. The population pyramid shows the study population of the four iHDSS sites are very young, with longer bars at the bottom. The total population of the four sites was about 54,633 and the overall sex composition of the population is balance.

As highlighted in the previous report, a couple of observations should be re-emphasised in this population pyramid. Firstly, the shorter bars of the population in age group of 0-4 at the bottom of the population pyramid suggest fewer children were born in the last four years. Secondly, the population in age group of 35-39 was a relatively smaller than other age groups, reflecting a lower fertility of the population (few children were born) in the period 1975-1980.

[1] Population pyramids were built, using the SPSS version 15 Evaluation Please see details of age groups in Tables on Population Distribution by age and sex for more description.
[2] This population pyramid was built for four iHDSS sites based on a total population of approximately 50,000 recorded in the system by the end of June 2014.

Employment status with LNG among study population

Table 1-2 Proportion of population of working age 15-64 reported ever work for LNG by site, iHDSS, 2014

LNG Employment	Asaro		Hides		Hiri		Karkar		Total	
	n	%	n	%	n	%	n	%	n	%
Yes	21	0.4	2,224	22.7	1,039	17.7	17	0.2	3,301	10.6
No	5,299	99.6	7,560	77.3	4,820	82.3	10,224	99.8	27,903	89.4
Total	5,320	100.0	9,784	100.0	5,859	100.0	10,241	100.0	31,204	100.0

Table 1-2 shows the proportion of people of working age, 15-64, reported ever working for LNG. Among 31,204 people of working age 15-64 captured in the iHDSS, around 10% reported ever being employed by LNG. The proportion of population reported working for LNG were significantly higher in Hides and Hiri, 22.7% and 17.7%, compared to Asaro and Karkar, 0.4% and 0.2%, respectively.

Age and sex population structure of each **iHDSS** site is presented in the following sections. The following sections will present key findings in each iHDSS site. Further data analyses in other following Chapters will provide more insights into the social changes over this period.

Education of the study population

Table 1-3compares the school grade attended by two groups of population: one of schooling age, 5-24 (17,193 persons, including 9,024 males and 8,169 females) and another group of people who have finished their schooling age, above 24 (21,293 people, including 10,995 males and 10,298 females). Generally, the data show that there has been considerable progress in education in PNG over the last 20 years. The population of schooling age, 5-24 have much better education than their older population aged 24 above, who are supposed having finished their schooling age. Indeed, the proportion of older population with no school was doubled than the young population, 26.5% and 13.8%, respectively. Furthermore, the proportion of females aged 5-24 currently attending Grades 1-12 was lower than males with the number of males attending Grade 12 almost double that of females. In addition, more females than males aged above 24 have had no schooling. However, most people aged above 24 had attended up to Grade 6 and Grade 10 schooling, 23.2% and 15.1%, respectively. The data also showed that the proportion of males attending Grade 1-12 is comparatively higher than females.

There is a remarkable difference between the young cohort, 5-24 and the older cohort, above 24 on completion of grades 10-12. That is because the young population are still going to school and there are a

substantial proportion of this cohort are schooling at the primary and secondary levels, while the population aged 24+ have finished their schooling age. It is therefore, a higher proportion of older population reported attaining the grade 10-12 than the young cohort. The separation of these two groups in education analysis has provided better understanding of the educational picture in the past (who have finished school age) and at the present (who should be currently going to school) in PNG.

Table 1-3 School grade attending among the study population by age and sex at the survey time, iHDSS, 2014

	Population of schooling age, 5-24						Population finished schooling age, >24					
	Male		Female		Total		Male		Female		Total	
School Grade	n	%	n	%	n	%	n	%	n	%	n	%
No school	1,198	13.3	1,182	14.5	2,380	13.8	2,414	22.0	3,238	31.4	5,652	26.5
Grade 1	1,092	12.1	963	11.8	2,055	12.0	177	1.6	171	1.7	348	1.6
Grade 2	1,049	11.6	999	12.2	2,048	11.9	284	2.6	281	2.7	565	2.7
Grade 3	909	10.1	873	10.7	1,782	10.4	493	4.5	445	4.3	938	4.4
Grade 4	819	9.1	733	9.0	1,552	9.0	410	3.7	397	3.9	807	3.8
Grade 5	679	7.5	644	7.9	1,323	7.7	341	3.1	368	3.6	709	3.3
Grade 6	816	9.0	774	9.5	1,590	9.2	2,482	22.6	2,451	23.8	4,933	23.2
Grade 7	511	5.7	440	5.4	951	5.5	276	2.5	258	2.5	534	2.5
Grade 8	701	7.8	687	8.4	1,388	8.1	981	8.9	832	8.1	1,813	8.5
Grade 9	373	4.1	269	3.3	642	3.7	363	3.3	228	2.2	591	2.8
Grade 10	551	6.1	403	4.9	954	5.5	1,999	18.2	1,225	11.9	3,224	15.1
Grade 11	123	1.4	88	1.1	211	1.2	171	1.6	109	1.1	280	1.3
Grade 12	203	2.2	114	1.4	317	1.8	604	5.5	295	2.9	899	4.2
Total	9,024	100.0	8,169	100.0	17,193	100.0	10,995	100.0	10,298	100.0	21,293	100.0

Table 1-4 shows the highest educational level attained by the study population of 17,349 people aged 5-24 (9,086 males and 8,263 females) and 21,608 people aged above 24 (11,102 males and 10,506 females). The data once again confirm the improvement of PNG education over the last 20 years. Looking at the "No school" and the primary school level (grade 1-5), the data showed much improvement for the young cohort, compared to the older. Indeed, the highest educational level attainment is in par with the school grade attendance. However, the educational disparity between males and females are still great concern. That is, the number of females aged 5-24 attending primary to tertiary level is less than males and more females than males aged above 24 have had no education. The majority of people who have finished schooling had attained ‘some primary’ and ‘some secondary’ education, 40.3% and 13.6%, respectively. Evidently, the data indicated that the study population had relatively low education level, but males attained higher educational level than females. As shown in the data, males consistently reported attainment of higher educational level than females, at secondary and tertiary educational levels.

Table 1-4 Highest educational level attained by the study population by sex and age, iHDSS sites, 2014

Educational Level	Population of schooling age, 5-24						Population have finished schooling age, >24					
	Male		Female		Total		Male		Female		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
No Education	1,353	14.9	1,320	16.0	2,673	15.4	2,606	23.5	3,495	33.3	6,101	28.2
Some Primary	6,037	66.4	5,563	67.3	1,1600	66.9	4,443	40.0	4,268	40.6	8,711	40.3
Completed Primary	472	5.2	469	5.7	941	5.4	974	8.8	884	8.4	1,858	8.6
Some Secondary	896	9.9	695	8.4	1,591	9.2	1,800	16.2	1,141	10.9	2,941	13.6
Completed Secondary	227	2.5	153	1.9	380	2.2	831	7.5	509	4.8	1,340	6.2
Vocational	50	.6	41	.5	91	.5	131	1.2	57	.5	188	.9
Tertiary	51	.6	22	.3	73	.4	317	2.9	152	1.4	469	2.2
Total	9,086	100.0	8,263	100.0	17,349	100.0	11,102	100.0	10,506	100.0	21,608	100.0

Marital Status of the study population

Table 1-5 Marital status of the study population aged 15+ by sex, iHDSS, 2014

Marital Status	Male		Female		Total	
	n	%	n	%	n	%
Single	6,454	39.2	3,666	23.9	10,120	31.8
Married/In Union	9,230	56.1	10,024	65.3	19,254	60.5
Separated/Divorced	392	2.4	742	4.8	1,134	3.6
Widowed	381	2.3	930	6.1	1,311	4.1
Total	16,457	100.0	15,362	100.0	31,819	100.0

Table 1-5 shows the marital status of the study population of 31,819 people aged 15 or above (16,457 males and 15,362 females). The data show a large gap between males and females in term of marital status. It was once again noticeable that a large proportion of males are single than female counterparts, 39.2% compared to 23.9%. In contrast, females are more likely getting married or in union than males, 65.3% and 56.1%, respectively. More females were also reported as being divorced, separated and widowed than males. It has been observed that among 10,120 single people, single males were 6,454 compared to 3,666 females. This suggests a relative shortage of single females in the population.

The following sections of the Chapter will present findings on the age and sex population structure and results of data analysis of the main occupation and structure of labour force in each study site, aiming at figure out the impact of the recent economic development activities on the social changes in the study sites.

ASARO

The main industry of Asaro is farming and agricultural production. Growing coffee is the main agricultural activity. Major languages are spoken by people living in Asaro are *tokples,* Gahuku, Siane and Dano/Tokano, apart from *pidgin*(officially called 'tok pisin') that is also regularly spoken. There are four health facilities, where local people can access to basic health services. Asaro has more than 10 schools where local children attend at the primary and secondary educational levels.

The iHDSS of the Asaro Valley was re-established by the PiHP in 2011 and is located approximately 40-45km in the Northeast of Goroka town. The site is designed as an iHDSS comparison site to Hides, an intervention site in the highlands. There are currently 26 field reporters working in Asaro iHDSS site and villages as shown in Figure 1-3.

Map of Asaro

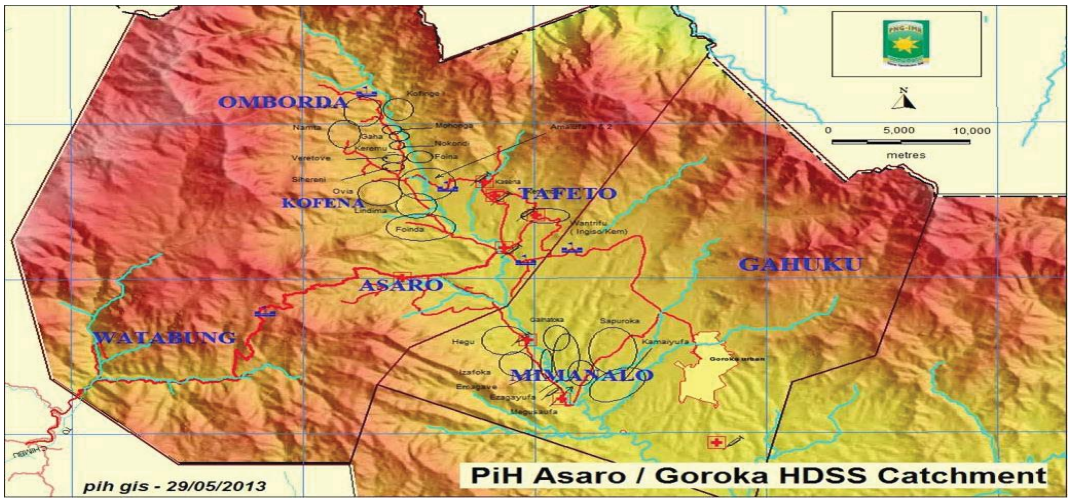

Figure 1-3 Map of Asaro iHDSS site and villages, iHDSS, 2014

Table 1-6 Population distribution by sex and age groups, Asaro, iHDSS, 2014

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-4	485	9.8	443	9.2	928	9.5	109:100
5-9	661	13.3	625	13.0	1286	13.2	106:100
10-14	529	10.6	544	11.4	1073	11.0	97:100
15-19	530	10.7	399	8.3	929	9.5	133:100
20-24	413	8.3	386	8.1	799	8.2	107:100
25-29	358	7.2	382	8.0	740	7.6	94:100
30-34	330	6.6	408	8.5	738	7.6	81:100
35-39	314	6.3	316	6.6	630	6.5	99:100
40-44	317	6.4	378	7.9	695	7.1	84:100
45-49	222	4.5	199	4.2	421	4.3	112:100
50-54	217	4.4	202	4.2	419	4.3	107:100
55-59	160	3.2	110	2.3	270	2.8	145:100
60-64	165	3.3	145	3.0	310	3.2	114:100
65-69	120	2.4	102	2.1	222	2.3	118:100
70-74	84	1.7	72	1.5	156	1.6	117:100
75-79	29	0.6	30	0.6	59	0.6	97:100
80+	37	0.7	51	1.1	88	0.9	73:100
Total	4,971	100.0	4,792	100.0	9,763	100.0	104:100

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-14	1,675	33.7	1,612	33.6	3,287	33.7	104:100
15-64	3,026	60.9	2,925	61.0	5,951	61.0	103:100
65+	270	5.4	255	5.3	525	5.4	106:100
Total	4,971	100.0	4,792	100.0	9,763	100.0	104:100

Table 1-6 shows the population distribution and structure of Asaro. The Asaro iHDSS covers 9,763 people. Sex ratio of the whole population was balance at the level of 104 males per 100 females. However, the sex ratios were relatively high among populations in age groups of 45-74. In contrast, the sex ratios were very low in age group 25-44 (81-99 males per 100 females). The variations of sex ratios across age groups could have been biased, due to age and sex specific migration rates. Further analysis of the migration flows and

reasons for migration could provide insights into this observation on the population pyramid of Asaro (Figure 1-4).

It is noted that population of working age, 15-64, accounts for 61.0% of the population in Asaro. The total dependency was 39.1%, including 33.7% of child dependency and 5.4% of elderly dependency. The population is very young as reflected in the Population Ageing Index of 16% only[3]. The population pyramid of Asaro show the fertility has been declined fast over the last 4 years, as reflected in shorter bottom bars of the population aged 0-4.

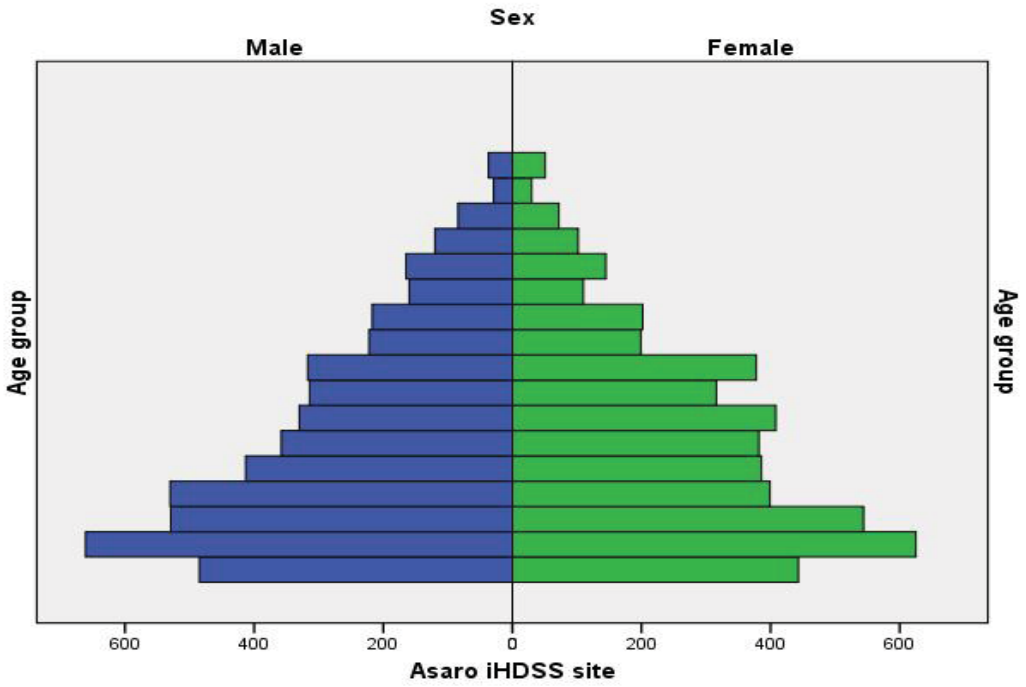

Figure 1-4 Population pyramid of Asaro, iHDSS, 2014

Employment

Table 1-7 shows the employment status and main occupation of the population of working age, 15-64 reported in Asaro. A total of 5,847 people of working age, 15-64 were included in the analysis. The majority of the population (73.8%) works in 'subsistence' category, including farming, gardening and fishing. Females are more likely than males to participate in this category, 83% compared to 64.9%, respectively. It was followed by proportion of students, 17.8%.

[3] PAI is measured by the ratio between proportion of the elderly aged 65+ and proportion of the children aged 0-14. Some countries calculate proportion of population aged 60+.

Table 1-7 Employment status and main occupation of population of working age of 15-64 by sex, Asaro, iHDSS, 2014

Occupation type	Male		Female		Total	
	n	%	n	%	n	%
Professional	115	3.9	58	2.0	173	3.0
Skilled	66	2.2	18	0.6	84	1.4
Unskilled	100	3.4	18	0.6	118	2.0
Military	24	0.8	2	0.1	26	0.4
Student	682	23.0	356	12.3	1,038	17.8
Subsistence	1,923	64.9	2,392	83.0	4,315	73.8
DK/ NA	54	1.8	39	1.4	93	1.6
Total	2,964	100.0	2,883	100.0	5,847	100.0

Observations of occupation structure of female worker are similar to that of males. However, male students were much larger than females, 23% and 12.3%, respectively. On the other hand, females are more likely than males to work in 'subsistence' category (83%) and they also tend to participate earlier than males partners in this work.

The occupation structure was also different between Asaro and Hides when we compared the two sites. The proportion of population working in 'subsistence' in Asaro is much higher than that in Hides, 73.8% and 61.3%, respectively. Asaro had very few people are under the categories 'skilled', compared to Hides, 1.4% and 5.3%, respectively. Additionally the number of people working as 'unskilled' is also very low, 2%. The proportion of population working as professionals and skilled workers is lower in Asaro, 4.4% compared to 6.8% in Hides. However, Asaro has more people reported as students than Hides, 17.8% compared to 9.6%, respectively. Further analysis of educational data would provide explanations of this observation.

HIDES

Hides iHDSS is an intervention site of the PiHP in the highlands, located in Hela Province. Geographically this iHDSS site is very remote and difficult to access. Tribal cultural norms and practices are an integral part of the local people' lives, formulating close structure of the society. People live in clans and sub-clans, and maintain a traditional tribal lifestyle. Most of the houses are traditionally built with very few semi-permanent buildings. The main *tokples* language spoken is Huli, which is also the common name given to people from that region. Other languages include *pidgin* (Tok Pisin) and a small number of English speakers. The two main health facilities are Mananda Health Centre and Para Clinic, which are run by the Evangelical Church of PNG (EC-PNG). There are elementary and primary schools, but no evidence of high school.

Three main divisions the iHDSS concentrates on are Haliago, Hibiria and Gigiria (see Figure 1-5). There have been substantial economic activities due to the PNG LNG construction, which in turn induced immigration of people looking employment opportunity, leading to an increase in the population count for each division, particularly for Division 3. It is noted that the PNG LNG construction has recently wound down and moved in the production phase. It is also recognition that Mananda School has registered itself as a Flexible Open Distance Education (FODE) centre whereby high school equivalent correspondence is being offered at the moment. The following Chapter on Migration will provide further detailed analysis of migration situation and migration flows into and out of Hides.

Map of Hides

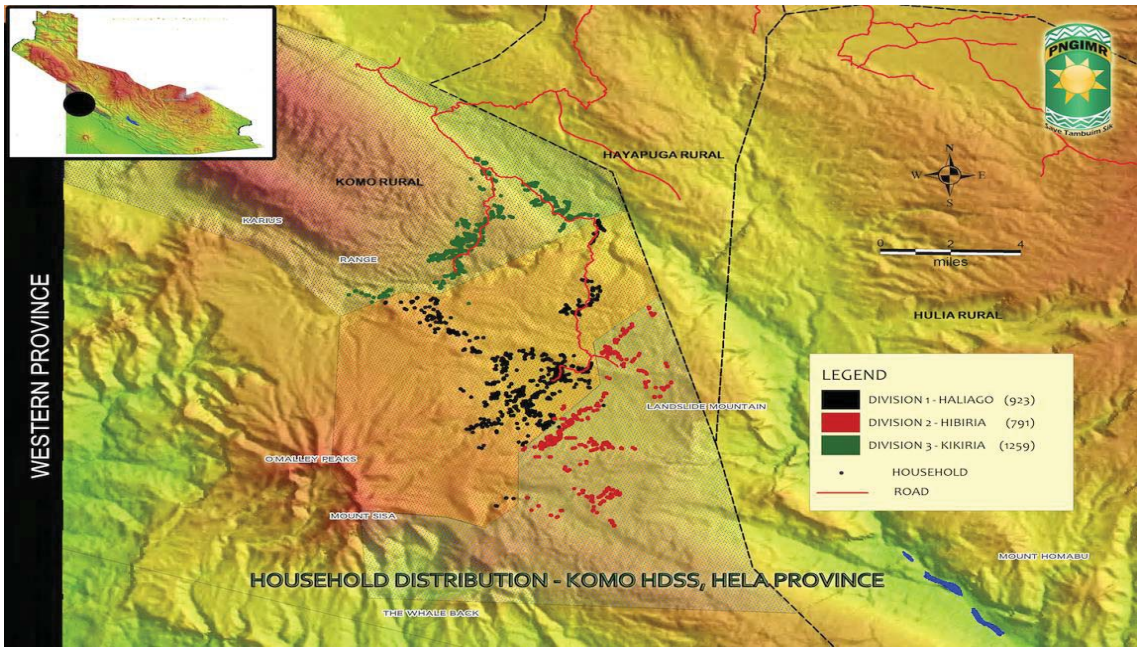

Figure 1-5 Map of Hides and household distribution, Hides, iHDSS, 2014

The Population

Table 1-8 shows the population data of Hides. The Hides iHDSS recorded 13,831 people in the last update. Sex ratio of the entire population is of 106 males per 100 females. The sex ratios tend to increase in higher age groups i.e. age groups 65+. However, the population size of this age group is relative small that do not allow for further analysis of age-specific mortality rate to identify the cause underlying this observation. It is obvious that small number of population aged 65 and above suggest higher mortality rate for both sexes among this age group.

Table 1-8 Population distribution by sex and age groups, Hides, iHDSS, 2014

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-4	737	10.3	739	11.0	1,476	10.7	100:100
5-9	940	13.2	885	13.2	1,825	13.2	106:100
10-14	819	11.5	819	10.5	1,519	11.0	117:100
15-19	757	10.6	653	9.8	1,410	10.2	116:100
20-24	614	8.6	633	9.5	1,247	9.0	97:100
25-29	636	8.9	701	10.5	1,337	9.7	91:100
30-34	716	10.1	751	11.2	1,467	10.6	95:100
35-39	459	6.4	431	6.4	890	6.4	106:100
40-44	609	8.5	550	8.2	1,159	8.4	111:100
45-49	280	3.9	203	3.0	483	3.5	138:100
50-54	262	3.7	210	3.1	472	3.4	125:100
55-59	102	1.4	50	.7	152	1.1	204:100
60-64	76	1.1	95	1.4	171	1.2	80:100
65-69	39	0.5	34	0.5	73	0.5	115:100
70-74	29	0.4	21	0.3	50	0.4	138:100
75-79	7	0.1	5	0.1	12	0.1	140:100
80+	42	0.6	35	0.5	77	0.6	120:100
Total	7,124	100.0	6,696	100.0	13,820	100.0	106:100

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-14	2,496	35.0	2,324	34.7	4,820	34.9	107:100
15-64	4,511	63.3	4,277	63.9	8,788	63.6	105:100
65+	117	1.6	95	1.4	212	1.5	123:100
Total	7,124	100.0	6,696	100.0	13,820	100.0	106:100

By contrast, sex ratios are relatively low in younger age groups of 20-34. This could be biased due to age and sex specific migration rates among these population groups. In contrast, it was relatively high in older population aged 65+. This could be resulted from higher female mortality than male mortality in this older

population.[4] However, more in-depth analysis presented in the following chapter on migration will provide better understanding of this observation.

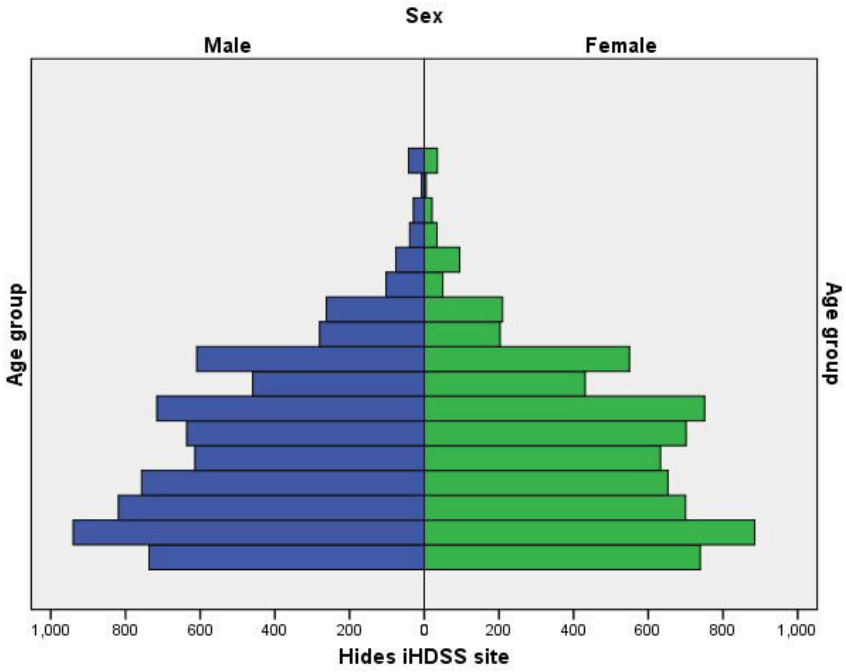

Figure 1-6 Population pyramid of Hides, iHDSS, 2014

The population pyramid of Hides is distorted as shown in Figure 1-6, probably due to the migration flows as reflected in larger populations of working age, particularly 30-34. However, this hypothesis cannot explain the larger population of 40-44 in Hides. This observation could be due sampling error, and selection of study site/ population could be playing a role. Another factor could be the LNG is now being exported and the population within that age bracket were moving back home to ensure they are counted as recipient of royalties (clan vetting process). But this hypothesis has to be validated. The shorter bar of population aged 0-4 is a result from the declined fertility in Hides in the last few years.

Education

Table 1-9 shows the educational level of the study population in Hides by age and sex. The data showed that the education in Hides has been considerably improved in the last 20 years when we compare the educational level attainment between the young cohort (5-24) and older cohort (above 24). Indeed, the proportion of population reported as 'no school' was 51.4% in the young age group, compared to 62.9% in the older group. By contrast, the proportion of people reported attaining "some primary educational level"

[4] Similar observations on distorted sex ratios have been reported and discussed in previous reports. The PNG IMR PiHP March 2104 Report provides further explanations and possible reasons underlying this phenomenon.

was 42% in young population, much higher than that (22.8%) of the older population. However, the data indicate that the overall educational level was very low among the population in Hides with around 93% of the population of schooling age (5-24) and 85% of population having finished schooling age reported as 'no school' or 'some primary education' only.

Table 1-9Highest educational level attainment of study population by sex and age, Hides, iHDSS, 2014

Educational Level	Population of schooling age 5-24						Population have finished schooling age >24					
	Male		Female		Total		Male		Female		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
No Education	1,063	49.7	1,035	53.2	2,098	51.4	1,650	55.1	2,027	71.1	3,677	62.9
Some Primary	926	43.3	787	40.5	1,713	42.0	751	25.1	581	20.4	1332	22.8
Completed Primary	33	1.5	43	2.2	76	1.9	148	4.9	98	3.4	246	4.2
Some Secondary	99	4.6	70	3.6	169	4.1	301	10.1	107	3.8	408	7.0
Completed Secondary	11	0.5	8	0.4	19	0.5	113	3.8	31	1.1	144	2.5
Vocational	2	0.1	2	0.1	4	0.1	6	0.2	3	0.1	9	0.2
Tertiary	3	0.1	0	0.0	3	0.1	24	0.8	2	0.1	26	0.4
Total	2,137	100	1,945	100	4,082	100	2,993	100	2,849	100	5,842	100

Employment

Table 1-10 shows the data on employment status and main occupation of the population of working age in Hides. A total of 8,554 people of working age 15-64, who are currently living in the defined Hides iHDSS catchment, were included in the analysis of employment status and occupation. The majority of the population (61.3%) reported working in 'subsistence' category. Females are twice as likely as males to be involved in gardening, farming and fishing, around 82% and 41%, respectively. On the other hand, males are more employed in 'unskilled' labour than females, 30.7% and 5.1%, respectively.

Comparing between Asaro and Hides, the data on employment showed that the proportions of population reported as 'student' and 'subsistence' were much higher in Asaro (17.8% and 73.8%) than in Hides (9.6% and 61.3%). These figures again suggest the LNG economic development activities could have impacted on the change in the occupational structure of the population in Hides. Again, the LNG Project is now in the production phase. The data suggest that people are moving back to 'subsistence' living, but as stated earlier, this could also reflect the data in the past around the construction phase period.

Table 1-10Employment status and main occupation of population of working age 15-64 by sex, Hides, iHDSS, 2014

Occupation type	Male		Female		Total	
	n	%	n	%	n	%
Professional	103	2.4	24	.6	127	1.5
Skilled	419	9.6	32	.8	451	5.3
Unskilled	1,341	30.7	212	5.1	1,553	18.2
Military	10	0.2	4	0.1	14	0.2
Student	478	11.0	344	8.2	822	9.6
Subsistence	1,817	41.7	3,430	81.8	5,247	61.3
DK/NA	193	4.4	147	3.5	340	4.0
Total	4,361	100.0	4,193	100.0	8,554	100.0

To better understand possible reasons underlying the large population aged 40-44, further analysis of main occupation was conducted among this age group. Results are shown in Table 1-11. The data showed that around 15.5% of males in age group reported as ‘professional’ and ‘skilled’, compared to 43.7% reported as ‘unskilled’ and 38.6 were ‘subsistence’. By contrast, 91.5% of females of this age group reported as ‘subsistence’.

Table 1-11Employment status and main occupation of population aged 40-44 by sex, Hides, iHDSS, 2014

Occupation type	Male		Female		Total	
	n	%	n	%	n	%
Professional	23	3.9	4	0.7	27	2.4
Skilled	69	11.7	5	0.9	74	6.5
Unskilled	258	43.7	25	4.6	283	25.0
Military	1	0.2	0	0	1	0.1
Student	1	0.2	1	0.2	2	0.2
Subsistence	228	38.6	497	91.5	725	64.0
DK/NA	10	1.7	11	2.0	21	1.9
Total	590	100.0	543	100.0	1,133	100.0

HIRI

The Hiri iHDSS covers the four villages Porebada, Boera, Papa and Lealea located about 20km in the north west of Port Moresby, the National Capital of PNG. The iHDSS covers four coastal villages, including Porebada, Boera, Papa and Lealea, with the total population of 12,228 (see Figure 1-7). Most inhabitants are either *Motu* or *Koitabu* speakers. Hiri iHDSS can be reached by road in less than one hour from Port Moresby. Despite road access to and from Port Moresby, basic services are lacking, and public infrastructure including roads, education, health and water supplies are in need in Hiri.

Map of HIRI

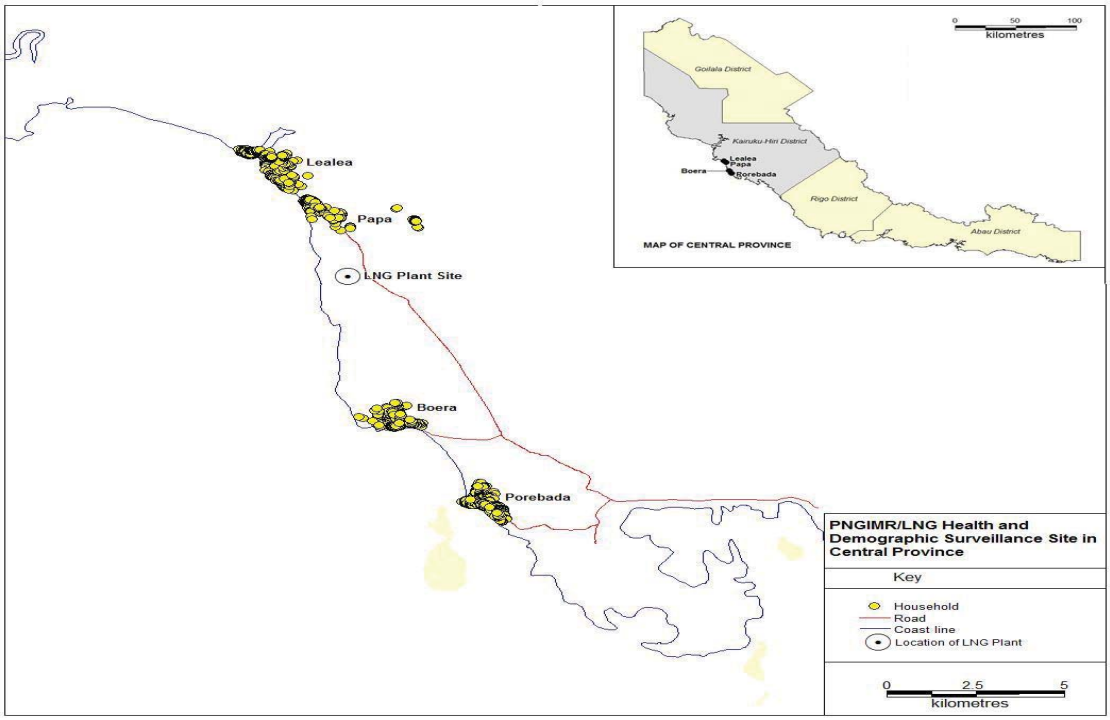

Figure 1-7 Map of Hiri and villages covered by iHDSS, 2014

The Population

Population data for Hiri iHDSS is under a review at time of writing this report and an additional data analysis will be provided going forward after QA/QC review completed.

Education

Table 1-12 shows the data on highest educational level attainment among the population in Hiri. The data show a considerable improvement of education in Hiri in the last 20 years as reflected in the significantly higher proportion of young population of schooling age, 5-24 reported 'some primary' than that of the older population, 57.7% compared to 23.6%. Furthermore the differentials in education level attainment were relatively small between males and females, suggesting males and females have almost equal access to education.

Table 1-12Highest educational level attainment of study population by sex and age, Hiri, iHDSS, 2014

Educational Level	Population of schooling age 5-24						Population who have finished schooling age >24					
	Male		Female		Total		Male		Female		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
No Education	43	2.7	35	2.3	78	2.5	14	0.7	26	1.4	40	1.1
Some Primary	895	55.6	894	60.0	1,789	57.7	374	19.7	502	27.7	876	23.6
Completed Primary	156	9.7	143	9.6	299	9.6	211	11.1	258	14.2	469	12.6
Some Secondary	323	20.1	284	19.1	607	19.6	571	30.1	507	27.9	1,078	29.0
Completed Secondary	143	8.9	104	7.0	247	8.0	473	24.0	355	19.6	828	22.3
Vocational	34	2.1	23	1.5	57	1.8	81	4.3	45	2.5	126	3.4
Tertiary+	16	1.0	7	0.5	23	0.7	173	9.1	122	6.7	295	7.9
Total	1,610	100.0	1,490	100.0	3100	100.0	1,897	100.0	1,815	100.0	3,712	100.0

Employment

Table 1-13 shows the data on employment status and main occupation. There was a sharp decline in number of population of working age 15-64 over the reporting period, from 7,208 people reported in the 2014 March Report to 4,824 people captured in this report (2,343 males and 2,481 females). This could be related to the current demobilisation of PNG LNG Project in Hiri. Further analysis and discussion of this observation will be presented in the Chapter on Migration.

People mostly reported working under the category of 'subsistence', 39.7% of the respondents reported working in category. 17.2% of the males compared to 60.9% of females reported working in this category. There was a large gender differential in 'Unskilled' category, including farming, gardening and fishing industries, with 33.8% of males compared with only 8.7% of females. There have been a number of initiatives on sponsored employment in PNG e.g. the Plant Site Agriculture Program which is currently under implementation, but they are obviously beyond the scope of this report.

It is obvious that the PNG LNG economic activities have great impact on the employment and occupational structure of the population in Hiri. Indeed, Hiri has the highest proportion of people reported working in 'professional' and 'skilled' categories. The construction work of PNG LING has also attracted a large volume of male and female workers working in the category of 'unskilled'.

Table 1-13 Employment status and main occupation of population of working age 15-64 by sex, Hiri, iHDSS, 2014

Occupation type	Male		Female		Total	
	n	%	n	%	n	%
Professional	223	9.5	103	4.2	326	6.8
Skilled	220	9.4	115	4.6	335	6.9
Unskilled	793	33.8	215	8.7	1,008	20.9
Military	28	1.2	2	0.1	30	0.6
Student	540	23.0	425	17.1	965	20.0
Subsistence	404	17.2	1,510	60.9	1,914	39.7
DK/NA	135	5.8	111	4.5	246	5.1
Total	2,343	100.0	2,481	100.0	4,824	100.0

KARKAR

Karkar district is a volcanic island located 30km off of the PNG coast in the Bismarck Sea and is part of the Madang Province, with the total population approximately 60,000. The island's soil is known for its fertility and large plantations produce the island's main exports of cocoa and coconut and provide a large amount of the local employment opportunities. Inhabitants of the island come from one of two language groups: Waskia in the North half of the island and Taskia in the South. Most inhabitants are either Lutheran or Catholic.

One main road runs around the coast of the island and provides access to the three available health facilities. Gaubin Hospital is the largest of the facilities and is a Lutheran run institution.

Karkar has been unaffected by the extensive and intensive mining activity that has occurred in Madang; hence, Karkar is considered as an appropriate location for control site in comparison with the coastal impact villages located in Hiri.

Map of KARKAR

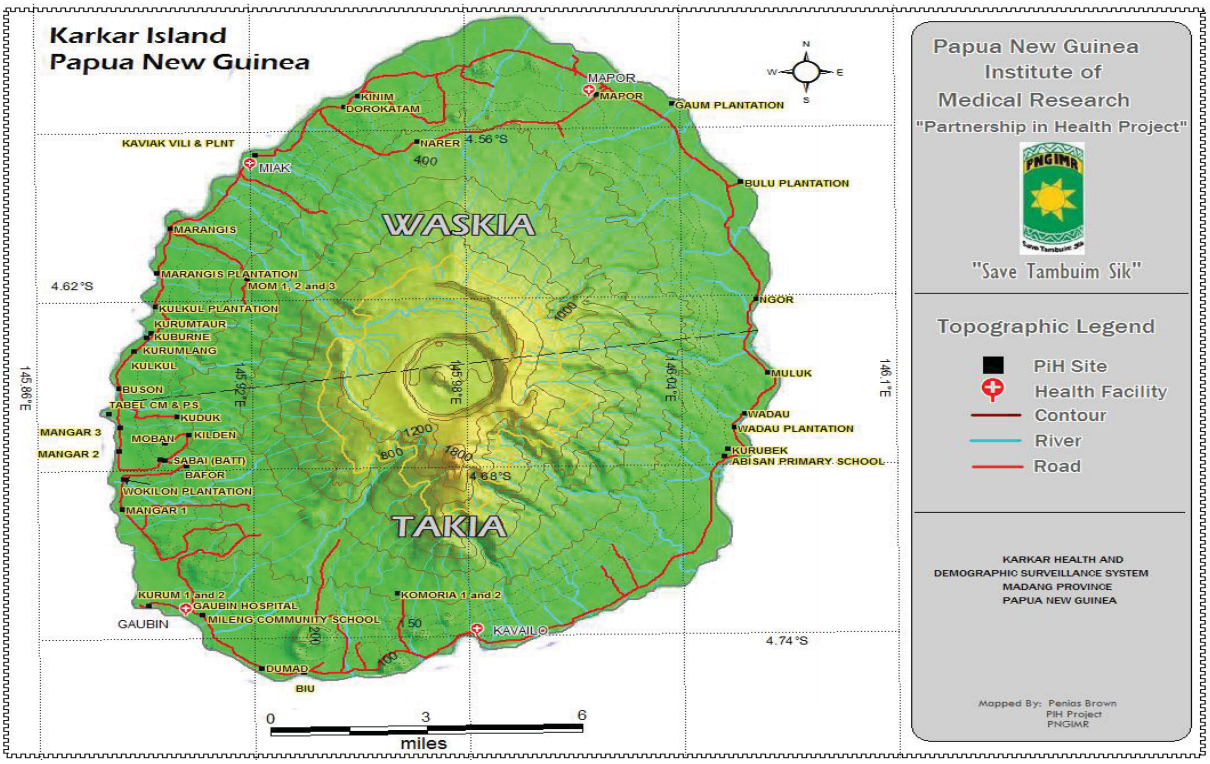

Figure 1-8 Map of Karkar, iHDSS, 2014

Table 1-14 Population distribution by sex and age groups, Karkar, iHDSS, 2014

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-4	812	8.6	807	9.5	1619	9.0	101:100
5-9	1390	14.7	1185	14.0	2575	14.4	117:100
10-14	1185	12.5	1062	12.5	2247	12.5	112:100
15-19	1057	11.2	976	11.5	2033	11.3	108:100
20-24	922	9.8	797	9.4	1719	9.6	116:100
25-29	751	8.0	665	7.8	1416	7.9	113:100
30-34	686	7.3	625	7.4	1311	7.3	110:100
35-39	577	6.1	503	5.9	1080	6.0	115:100
40-44	496	5.3	454	5.4	950	5.3	109:100
45-49	403	4.3	363	4.3	766	4.3	111:100
50-54	401	4.2	381	4.5	782	4.4	105:100
55-59	241	2.6	206	2.4	447	2.5	117:100
60-64	224	2.4	168	2.0	392	2.2	133:100
65-69	113	1.2	106	1.2	219	1.2	107:100
70-74	105	1.1	111	1.3	216	1.2	95:100
75-79	53	.6	49	.6	102	.6	108:100
80+	27	.3	26	.3	53	.3	104:100
Total	9443	100.0	8484	100.0	17927	100.0	111:100

Age group	Male		Female		Total		Sex Ratio
	n	%	n	%	n	%	M:F
0-14	3387	35.9	3054	36.0	6441	35.9	111:100
15-64	5758	61.0	5138	60.6	10896	60.8	112:100
65+	298	3.2	292	3.4	590	3.3	102:100
Total	9443	100.0	8484	100.0	17927	100.0	111:100

Table 1-14 shows the population distribution in Karkar. A total of 18,413 people recorded in the iHDSS in Karkar over the reporting period. The age structure of Karkar population is typical for a young population with

the larger proportions of younger age groups and smaller proportions of higher age groups i.e. the proportion of population was highest at age group of 5-9 (15%) and declined gradually to 1% for the age group 65-69.

Sex ratio of the entire population of Karkar is moderately high, 111 males per 100 females, i.e. 111/100 for children age 0-14, 112/100 for population of working age 15-64. However, the sex ratio of the elderly population age 65+ was only 102/100. Further study on sex ratio of the population could provide more insights into this differential.

The population of working age accounted for 60.8%, with a total dependency of 39.2% and the total dependency ratio was only 64.5%, meaning that there are only 65 dependents for every 100 people of working age. This implies great potential of the labour force in Karkar.

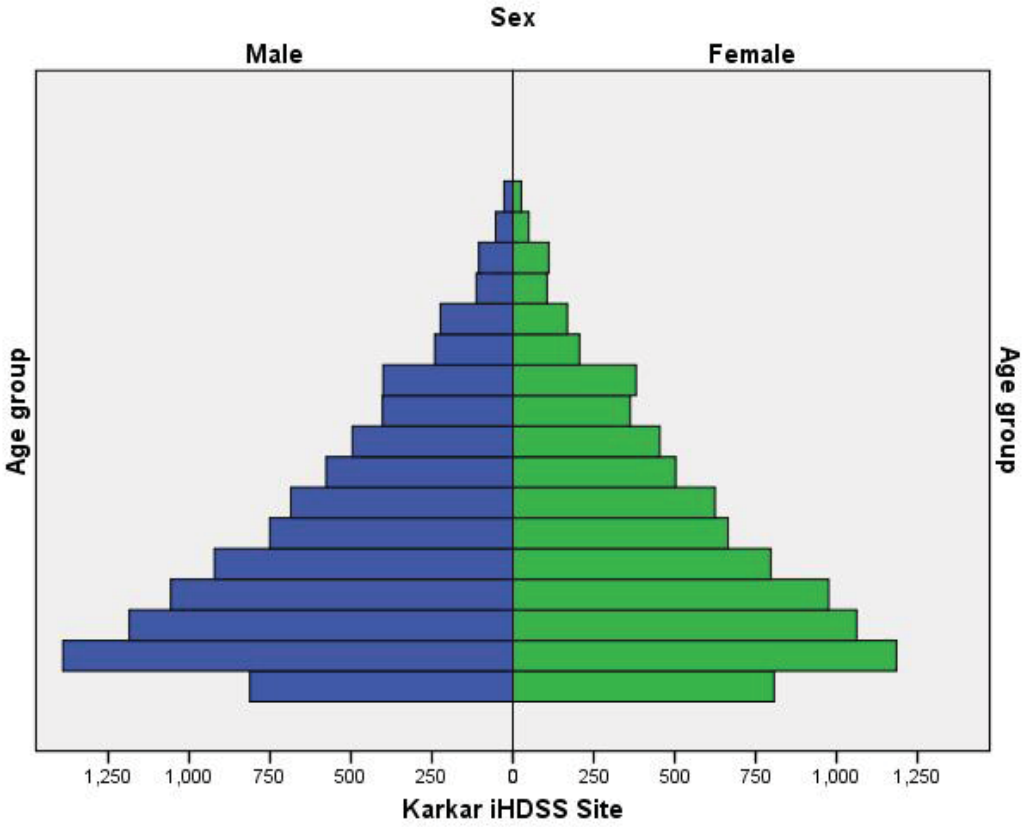

Figure 1-9 Population pyramid of Karkar, iHDSS, 2014

Figure 1-9 is the population pyramid of Karkar, which is a typical for a young population and similar to that for the whole population of the four iHDSS sites. However, it is markedly shorter bar of the children in age group 0-4, reflecting a sharp decline in fertility in the Karkar in the last 4 year.

Employment

Table 1-15 show the employment status and main occupation of the population of working age 15-64 in Karkar. A total of 10,364 people of working age were included in the analysis of employment status and main occupation.

Table 1-15 Employment status and main occupation of population of working age 15-64 by sex, Karkar, iHDSS, 2014

Occupation type	Male		Female		Total	
	n	%	n	%	n	%
Professional	111	2.0	71	1.4	182	1.8
Skilled	215	4.0	37	0.7	252	2.4
Unskilled	71	1.3	23	0.5	94	0.9
Military	5	0.1	3	0.1	8	0.1
Student	1,525	28.2	1,134	22.9	2,659	25.7
Subsistence	3,435	63.4	3,645	73.7	7,080	68.3
DK/NA	54	1.0	35	0.7	89	0.9
Total	5,416	100.0	4,948	100.0	10,364	100.0

The majority of the population (68.3%) reported working in the areas of farming, fishing and gardening. Females are more likely than males involving in this occupation, 74% compared with 63%, respectively.

Students account for the second large proportion of the population, nearly about one quarter of the population are currently students. Again, numbers of people working in ‘professional’ and ‘skilled’ categories are only around 4.2%, much lower than that in Hiri, 13.7%.

Conclusion

The iHDSS data have highlighted some key population changes in the study sites over the reporting period. The overall population data show that study population are very young. Further study of the impact of socio-economic development on fertility behaviour of the population is required to determine trends.

The high male-to-female sex ratio phenomenon in the study population, particularly among people of working class has been well captured in the iHDSS, and reported in the previous reports. This phenomenon has been observed, not only in Hiri and Hides, where economic activities are attracting more young males to move in, but also in Karkar and Asaro, where the majority of the population working in farming, gardening and fishing.

There is noticeable differential in marital status with 39% of single males compared to 24% of single women in the study site. By contrast, the proportion females reported as married and in-union was relatively higher than the male counterparts, 65% compared to 56%, respectively. More in-depth analyses are needed to provide insights into this phenomenon for effective solutions for sustainable socio-economic development of PNG.

The recent development of LNG activities in PNG has obvious impacts on the labour market, particularly in Hides and Hiri, where the 22.7 and 17.7 % of the study population of working age reported being employed over the reporting period. Job opportunities clearly acted as an in-migration driver, pulling a large number of young males and female workers migrating in Hides and Hiri. The social impact of such economic activities have also reflected in the occupational structure of labour force, with higher proportion of professionals, skilled and unskilled workers in Hides and Hiri than those in other comparative sites.

The construction phase of the PNG LNG Project has ended. The demobilization of much of the work force has started. The following Chapter on Migration will provide in-depth analysis of the population movement in all iHDSS sites.

References

[1] PNG Institute of Medical Research. Partnership in Health Project. Goroka: 2010

[2] PNG Institute of Medical Research. Progress Report of Partnership in Health Project September 2013. Goroka: 2013

[3] PNG Institute of Medical Research. Progress Report of Partnership in Health Project: March 2014. Goroka: 2013

[4] INDEPTH. Integrated Health and Demographic Surveillance System. 2014. Available online: http://www.indepth-network.org/index.php. Access on 30 August 2014

2. CHAPTER 2 MIGRATION

Abstract

Using data from the iHDSS surveys, the in-migration and out-migration for Hiri, Hides, Karkar and Asaro iHDSS areas are analysed. The Hides Division 3 (HGCP area) has experienced net in-migration and growth in the study period. This reverses a trend of out-migration reported in March 2014, which was likely linked to local clan fighting in the hides area at the time and short term movement of people in the area during the survey period;

There are a significant number of residents in Hides that both out-migrated and were never employed by the PNG LNG Project. The role of the PNG LNG Project for these residents is uncertain; however, clan and household drivers, e.g., benefit stream claims and improved access to services (schools, health care, etc.) may have played a role.

Methods

Both in-migration and out-migration data is collected by the iHDSS. These data are then analysed by looking at the age, sex, education, of the relevant cohorts. The analysis for education, marital status, occupation and PNG LNG employment status is done only for adults, defined as those people age 15 and older.

Hiri

Hiri data is under review pending additional QA/QC. The data will be re-examined in either the end of the year longitudinal report or the March 2015 biannual update.

Hides

Figure 2-1 shows the number of in-migrants and out-migrants recorded during the 2014 in Hides iHDSS. There are approximately 50% more in-migrants than out-migrants, 355 compared to 236, respectively.

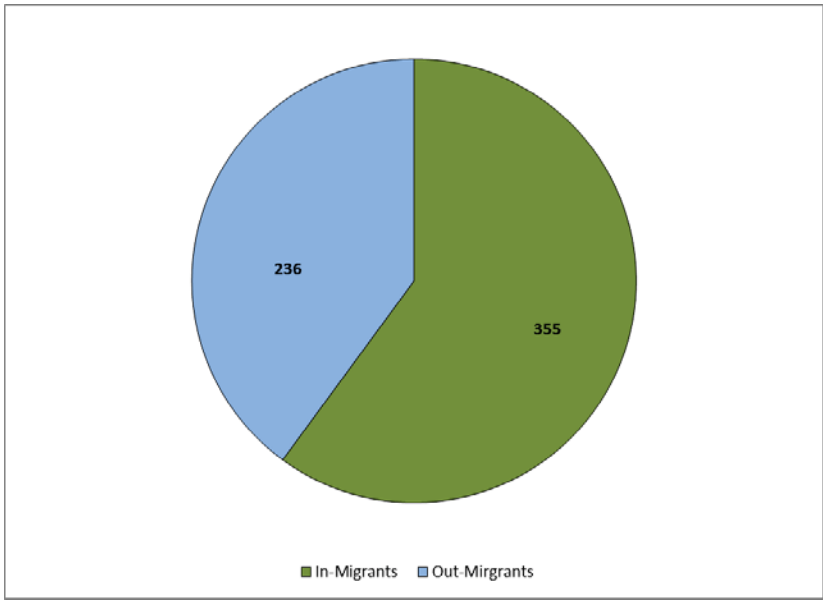

Figure 2-1 Hides In-Migration vs. Out-Migration, iHDSS, 2014

In-migration

The age breakdown for the Hides in-migrants is seen in Figure 2-2 There were 42% more female in-migrants than male in-migrants (208 females vs. 146 males)[5]. Not surprisingly, there are more females than males in most of the age groups. Fifty percent of the in-migrants were between the ages of 20 and 44.

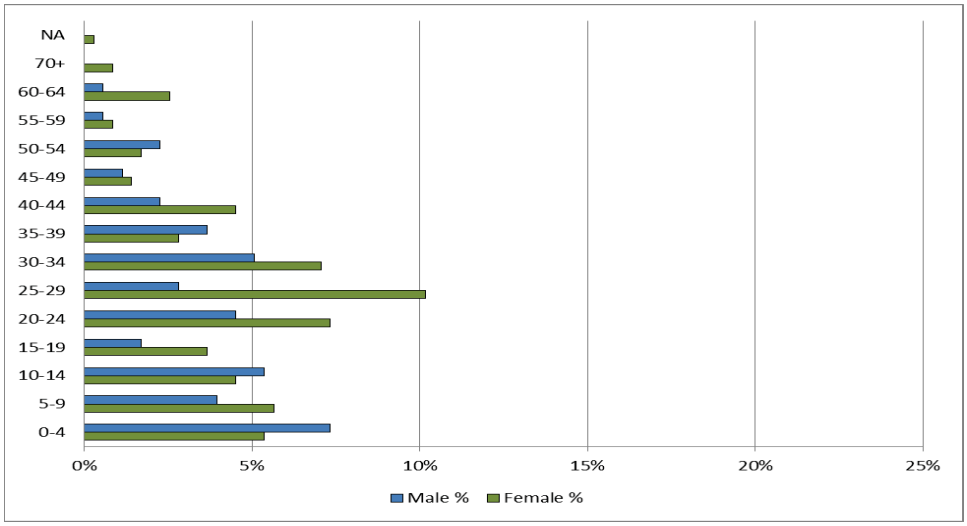

Figure 2-2Hides In-Migrants by Age and Sex, iHDSS, 2014

Educational attainment is shown in Figure 2-3. Similar to the Hides population as a whole, most in-migrants had little to no education. Seventy-nine percent of males and 88% of females were reported to have either

[5]Plus one is missing value on gender.

'Some Primary' or 'No education' As was also the case with the overall population of Hides, the men tended to be report a slightly higher level of educational attainment compared to the in-migrating women.

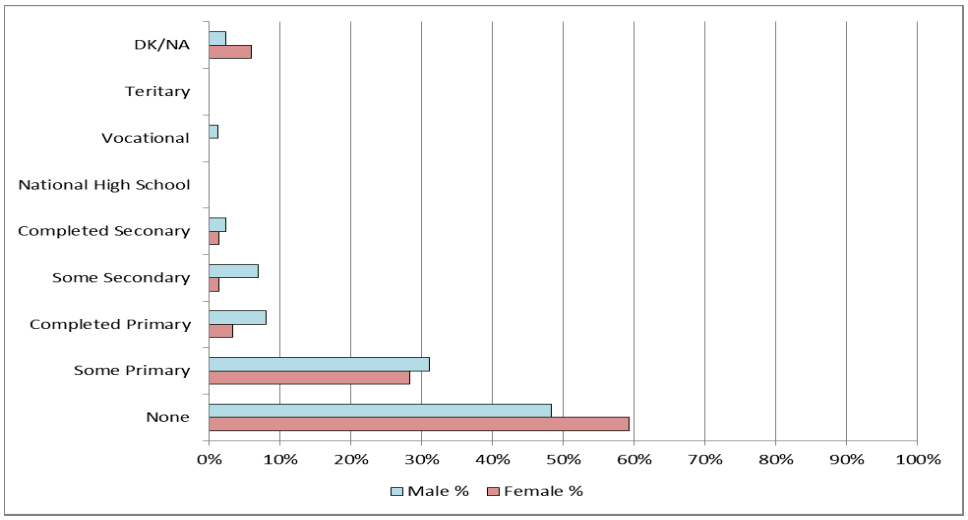

Figure 2-3Hides In-Migrants by Education Level and Sex among population aged 15+, iHDSS, 2014

Marital Status of the 2014 in-migrants is shown in Figure 2-4. Most in-migrants of both genders were reported to have been married. There were over twice as many single men as women from the out-migrant population. The bulk of out-migrants stated that they were born in either Komo or Tari. The percentage difference between men and women within the 'Never Married' category, coupled with the near equal amount in the 'Married' category, suggests that many of the in-migrant males may have had multiple wives.

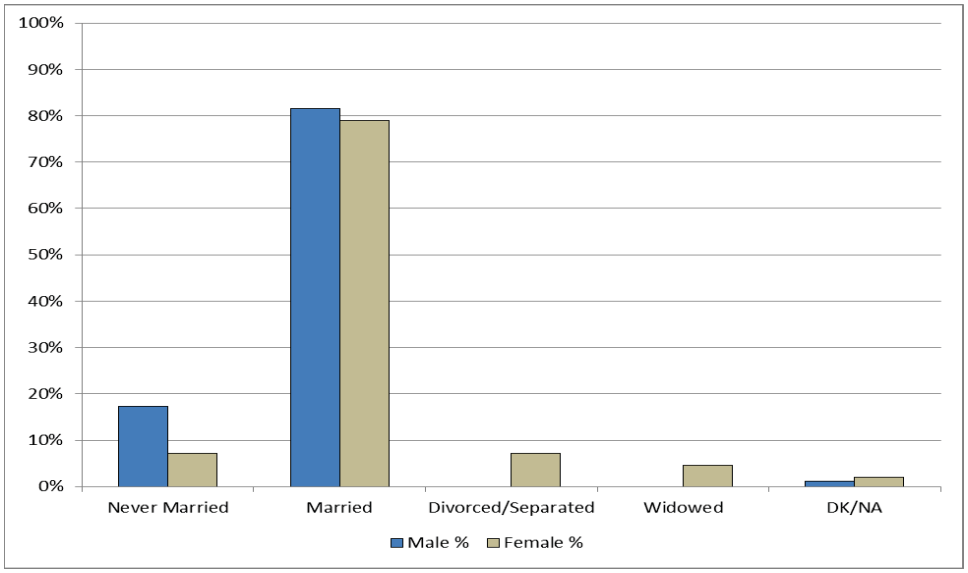

Figure 2-4 Hides In-Migrants by Marital Status and Sex among population aged 15+, iHDSS, 2014

Figure 2-5 shows the occupation of the Hides in-migrants. The vast majority of in-migrants were either unskilled or subsistence workers. There were no women in the Skilled/Professional category and only 6 men.

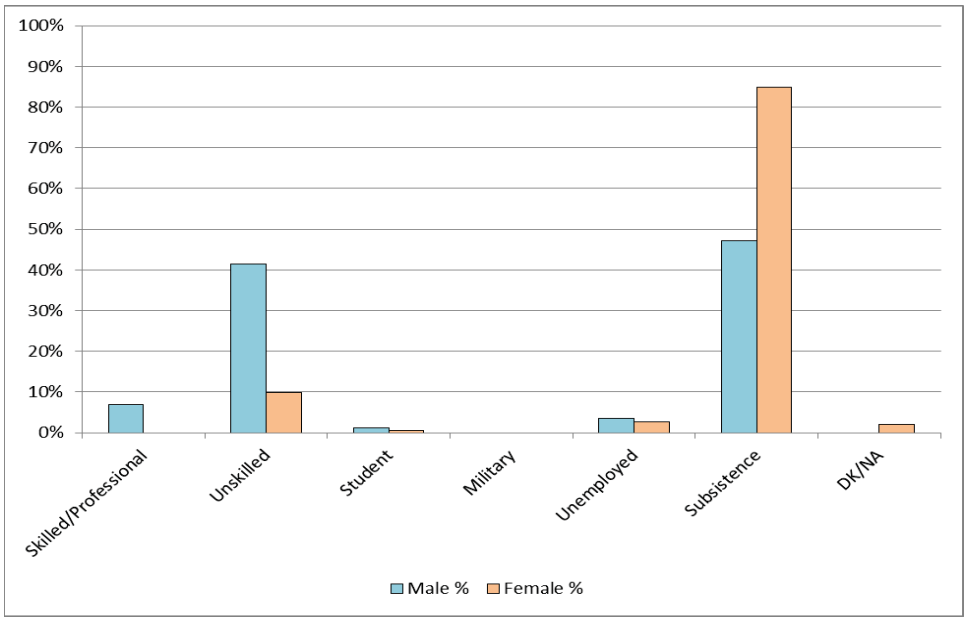

Figure 2-5 Hides In-Migrants by Occupation Status and Sex among population aged 15+, iHDSS, 2014

Figure 2-6 shows the PNG LNG employment status for the in-migrants. Nearly 50% of men had worked for the PNG LNG project suggesting movement within the 3 divisions of Hides. Given that there were only 6 skilled/profession in-migrants, most of the LNG employment would have been as unskilled labourers.

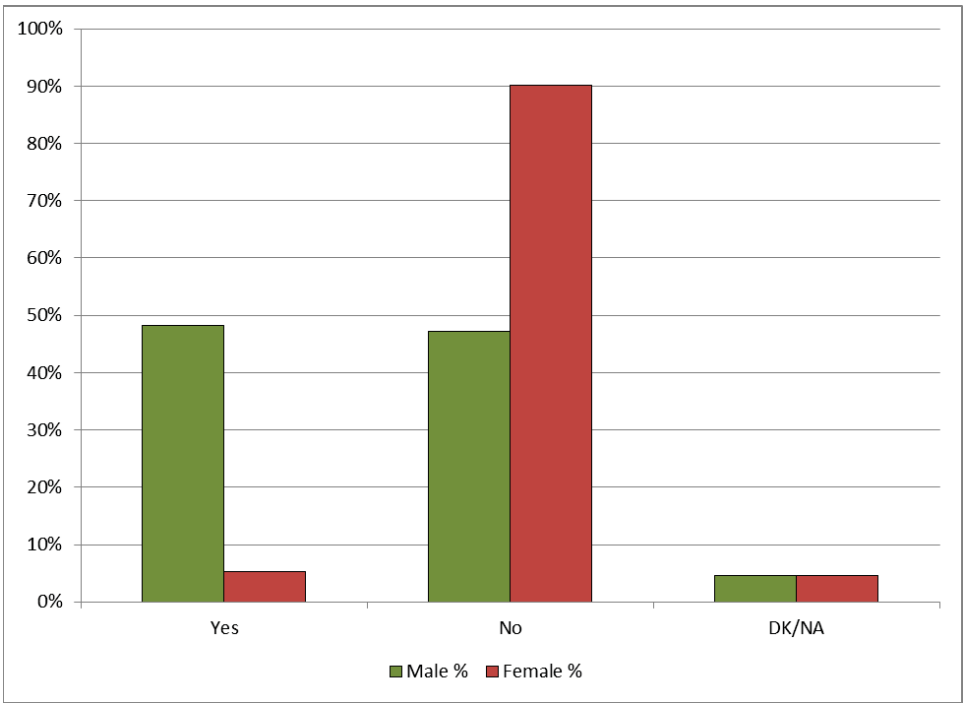

Figure 2-6 Hides In-Migrants by LNG Employment Status and Sex among population aged 15+, iHDSS, 2014

Out-Migration

Figure 2-7 shows the Hides out-migration by age and sex. Overall, men counted for 52% of out-migrants (91 males vs. 83 females, and one of unknown sex). There are significantly more males in the 35-44 population, while there are significantly more females in the age group of 25-34. This may be the result of Huli males marrying younger women and having multiple wives. Children under age 15 only make up 20% of the out-migrating population showing that most out-migrants tended to be adults without children.

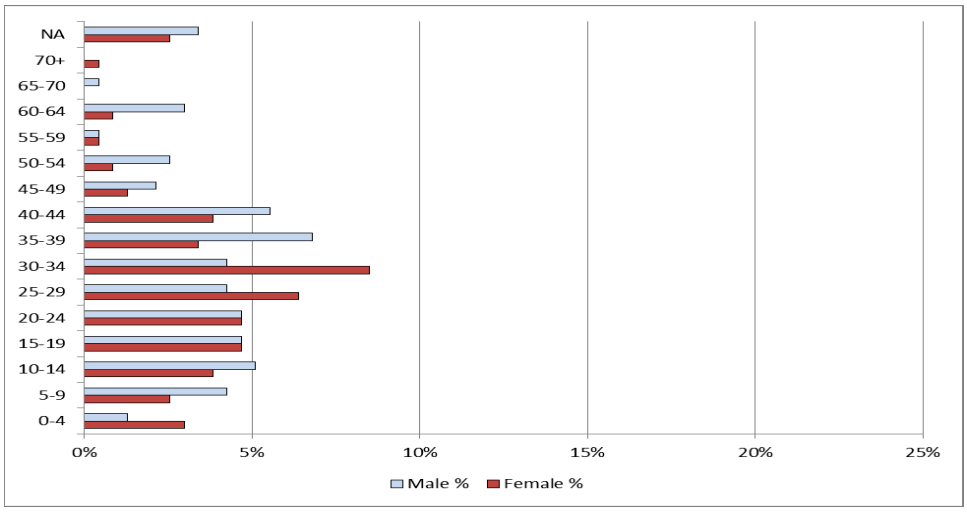

Figure 2-7Hides Out-Migration by Age and Sex, iHDSS, 2014

The education status of the out-migrants is shown in Figure 2-8. The distribution of educational attainment is generally similar to the overall Hides population in that most females have little to no education. Out-migrating males have a higher percentage of 'Completed Secondary' or 'Some Secondary' then their counterparts who remained in the Hides area. There is also a large number (about 10%) of 'DK/NA' responses for the education status category.

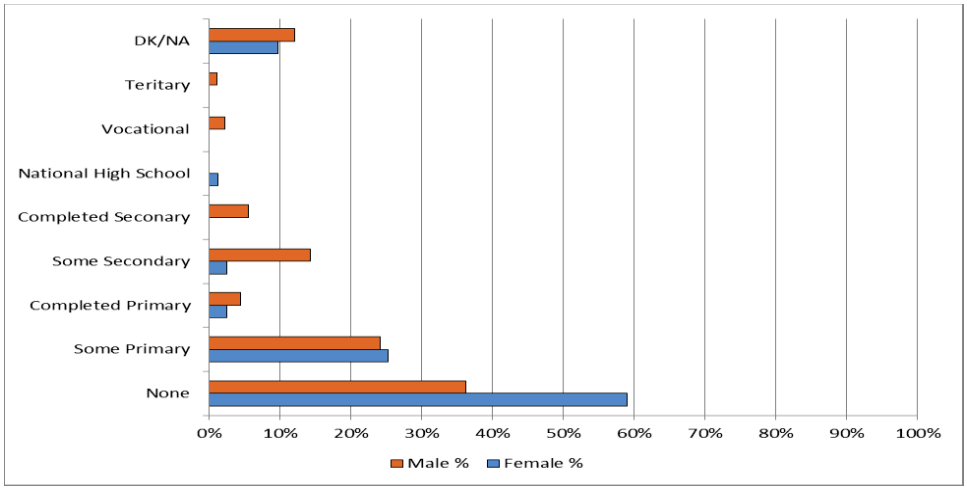

Figure 2-8Hides Out-Migration by Education Level and Sex among population aged 15+, iHDSS, 2014

Marital status for out-migrants is shown in Figure 2-9. Compared to the men remaining in Hides, out-migrating males were slightly more likely to have never been married. The proportion of out-migrating females who have never been married was 4.5 percentage points higher than that of the women who remained in Hides (29% vs. 24.5%). Unlike the Age and Education questions, there are significantly fewer DK/NA responses.

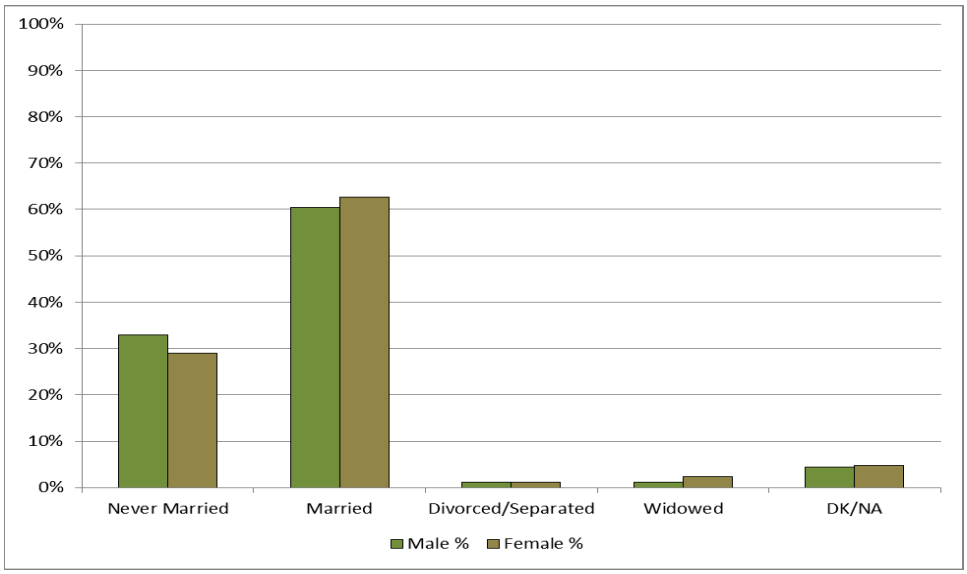

Figure 2-9Hides Out-Migration by Marital Status and Sex among population aged 15+, iHDSS, 2014

Figure 2-10 shows the occupation type of out-migrants. A significant percentage of out-migrating males were classified as skilled/professional. This is likely to be PNG LNG Project related employment as outside of the project, there are few areas were skilled/professional labour would be required. As has been seen previously, most female are in either in the ‘Student’ or ‘Subsistence’ category, reflecting strong bias amongst the Huli preferring women not to be employed but to have them doing domestic and subsistence chores instead.

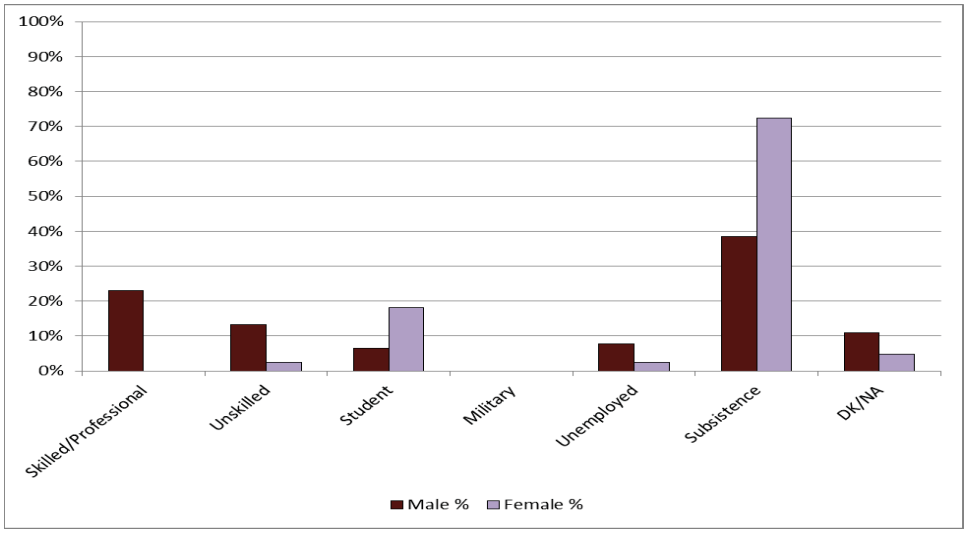

Figure 2-10Hides Out-Migrants by Occupation Status and Sex among population aged 15+, iHDSS, 2014

PNG LNG employment status is shown in Figure 2-11. Out-Migrating males are less likely to have worked for the PNG LNG project that those who have remained in the Hides area (32% vs. 42%). Very few female out-migrants (3 in total) have ever worked for the PNG LNG project.

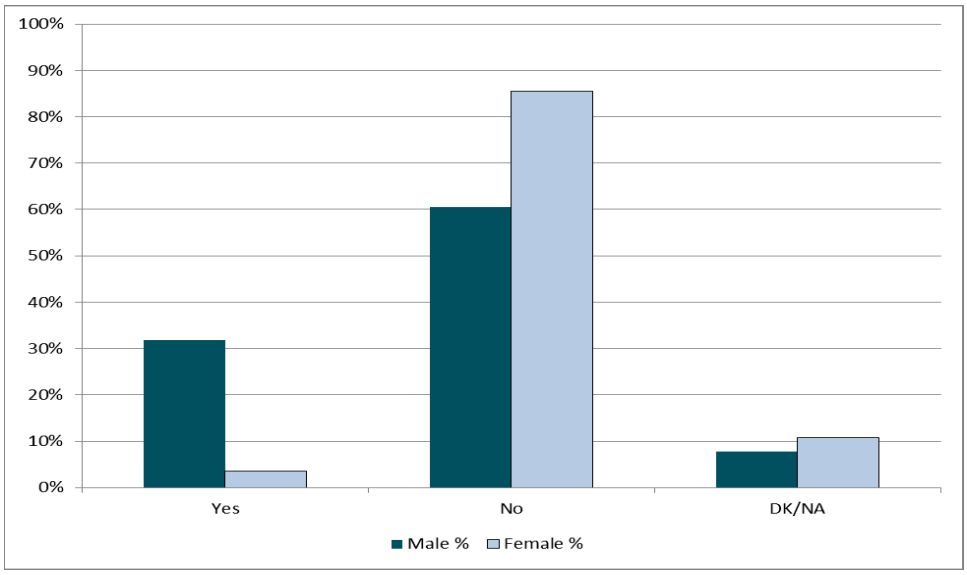

Figure 2-11Hides Out-Migrants by LNG Employment and Sex among population aged 15+, iHDSS, 2014

Karkar

The "In vs. Out-migration" comparison for Karkar residents age 15+ is shown in Figure 2-12. Out-migration is almost 20 times higher than in migration. There are no available data describing the reasons for out-migration. Given the observed high levels of out-migration in both Hiri and Hides, including those residents who have never worked for the PNG LNG Project, further investigation and ground truthing would be needed in order to further investigate the non-PNG LNG drivers of out-migration. Given the low sample size of in-migrants, only out-migration is examined for Karkar.

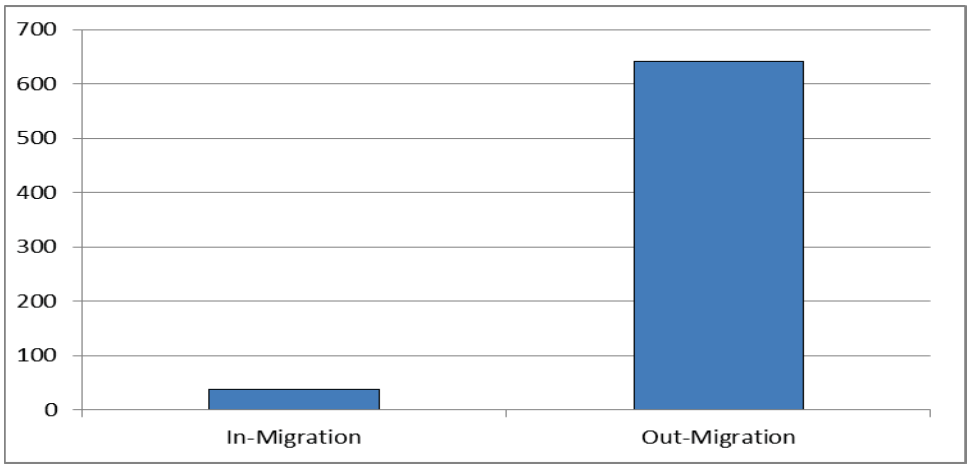

Figure 2-12Karkar In vs. Out-Migration among population aged 15+, iHDSS, 2014

The age and sex distribution for the Karkar out-migrants is shown in Figure 2-13. Nearly 55% of the total out-migrants were female and when broken down by age, female out-migrants outnumber males in all but the 35-39, 60-64, and 70+ age groups.

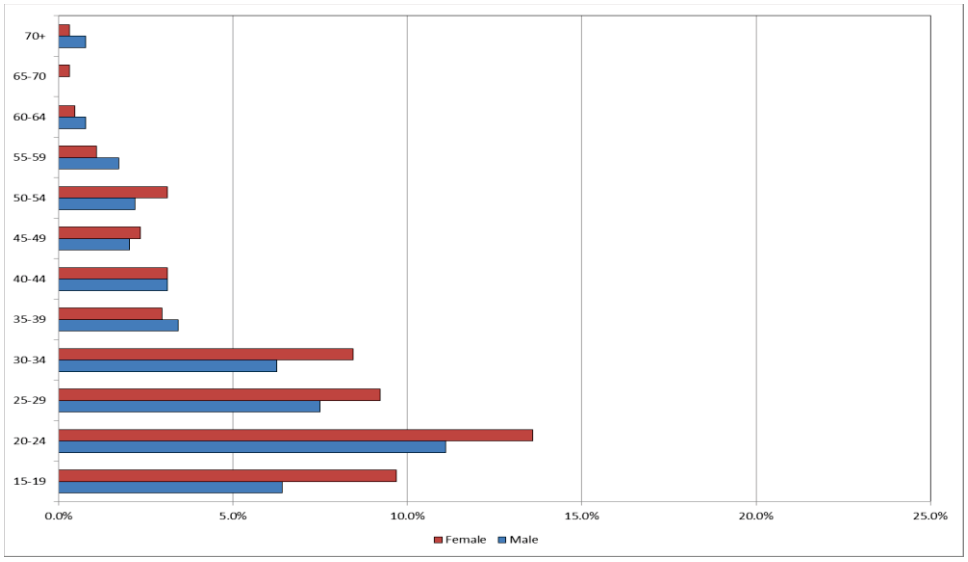

Figure 2-13Karkar Out-Migration by Age and Sex among population aged 15+, iHDSS, 2014

The education levels of the Karkar out-migrants are shown in Figure 2-14. Over 50% of respondents have only some primary or no education. As the total out-migrant distribution skews towards females, they comprise most of the 'Some Primary,' 'Completed Primary' and 'Some Secondary' categories. Males are disproportionately represented in the 'Completed Secondary,' 'Vocational,' and 'Tertiary' categories.

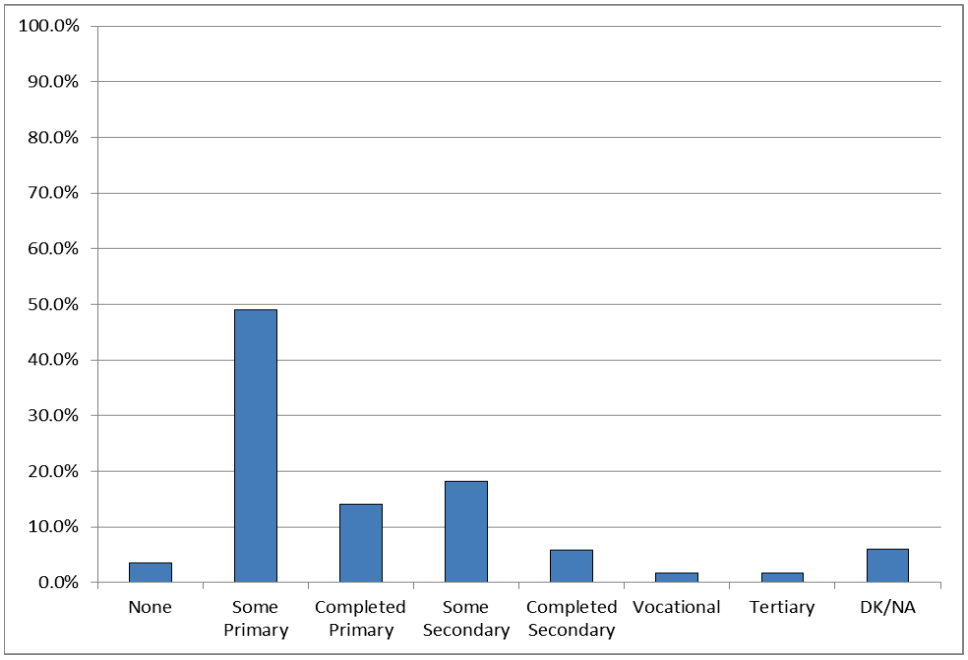

Figure 2-14Karkar Out-Migrant Education Levels among population aged 15+, iHDSS, 2014

The marital status of Karkar out-migrants is shown in Figure 2-15. Out-migrants tended to be single and this was split evenly between men and women. More women were married than men, and those in the 'Divorce/Separated' category were three times as likely to be a woman.

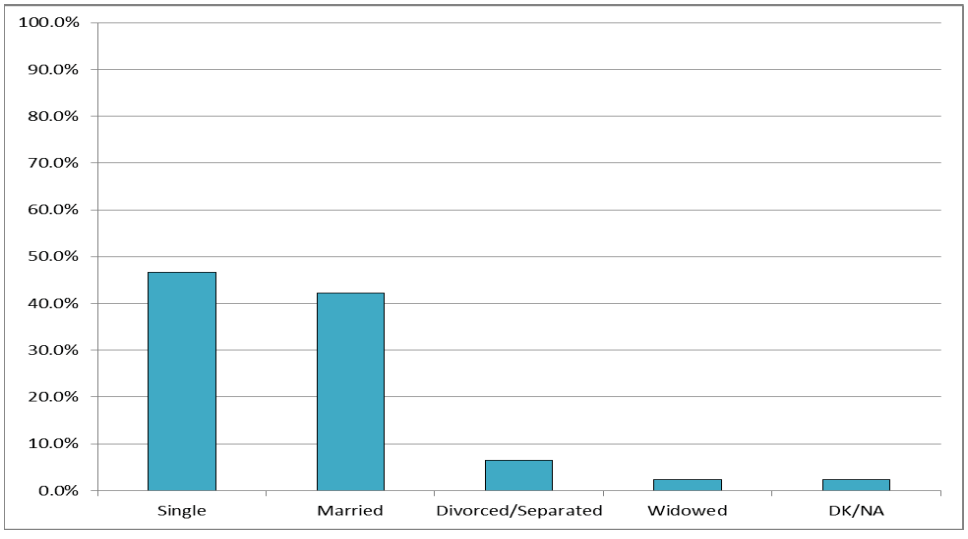

Figure 2-15Karkar Out-Migrant Marital Status among population aged 15+, iHDSS, 2014

The occupations of Karkar out-migrants are shown in Figure 2-16. The bulk of out-migrants are either subsistence workers, who tended to be female, or students who were equally male and female and split between the age groups 15-19 and 20-24. Males were disproportionately higher for the 'Skilled' and 'Professional' occupation categories.

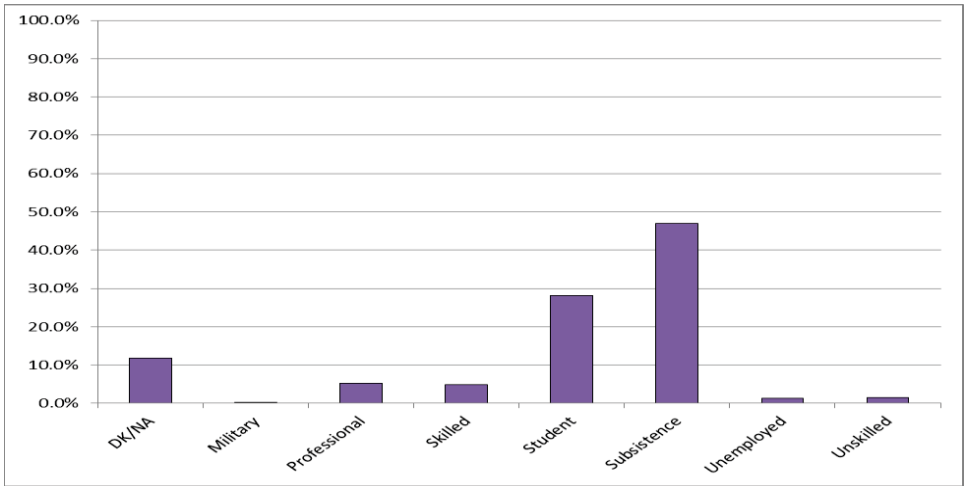

Figure 2-16Karkar Out-Migrant Occupation Status among population aged 15+, iHDSS, 2014

Asaro

The total migration for Asaro, both in and out, is shown in Figure 2-17. The total number of in-migrants and out-migrants is relative similar from an absolute standpoint (with a difference of only 43), but quite substantial when looking at percentages, where out-migration is about 30% higher than in-migration.

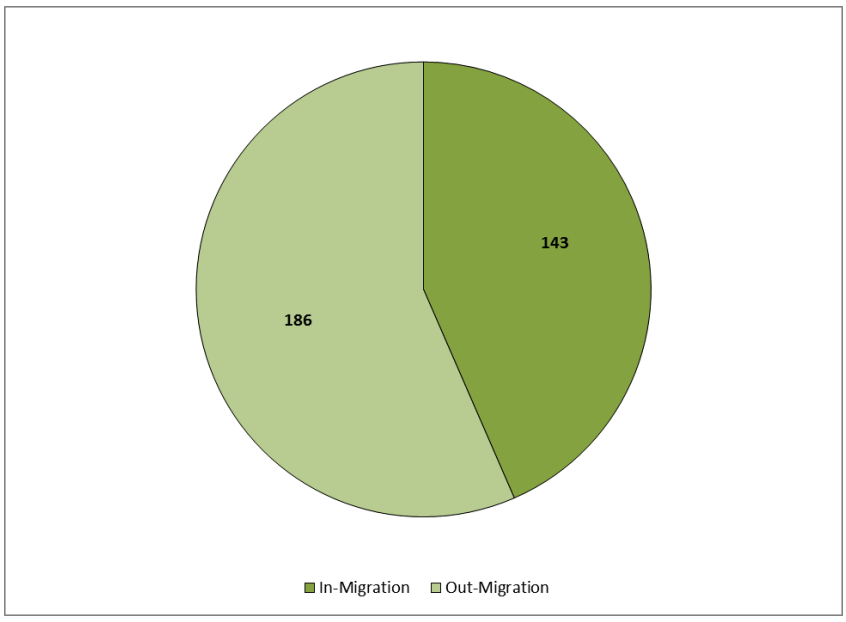

Figure 2-17Asaro In-Migration vs. Out-Migration, iHDSS, 2014

The age and sex breakdown of Asaro in-migrants is given in Figure 2-18. Children under age 15 appeared to be an even split between male and female. There are more males age 35+ than females, and more males age 25-34 than males.

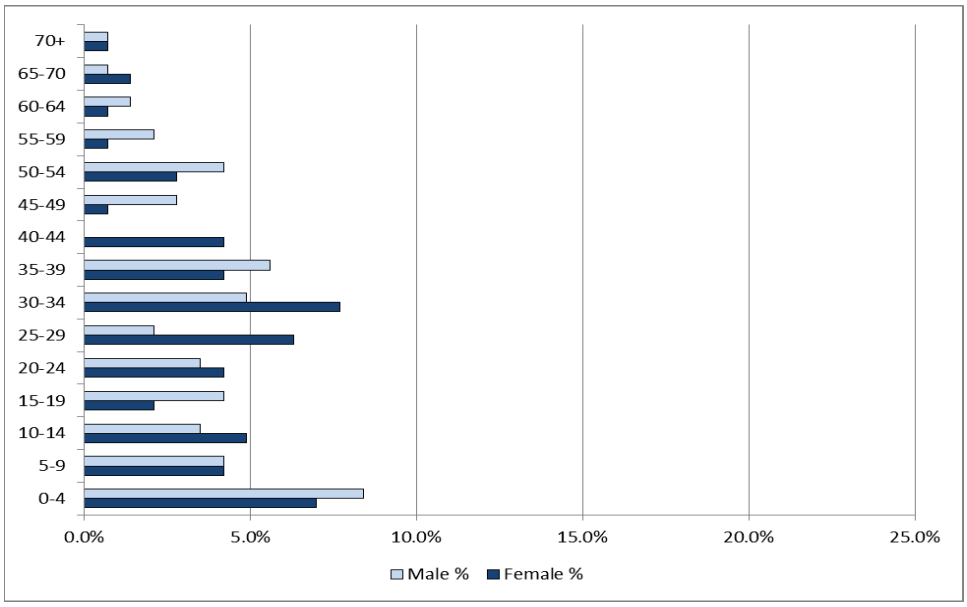

Figure 2-18Asaro In-Migration by Age and Sex, iHDSS, 2014

The education level for Asaro in-migrants age 15 and above is shown in Figure 2-19. The in-migrant population's education level is similar to the population as sampled by the iHDSS. Like the Asaro population as a whole, males are also more likely to have higher educational attainment than females.

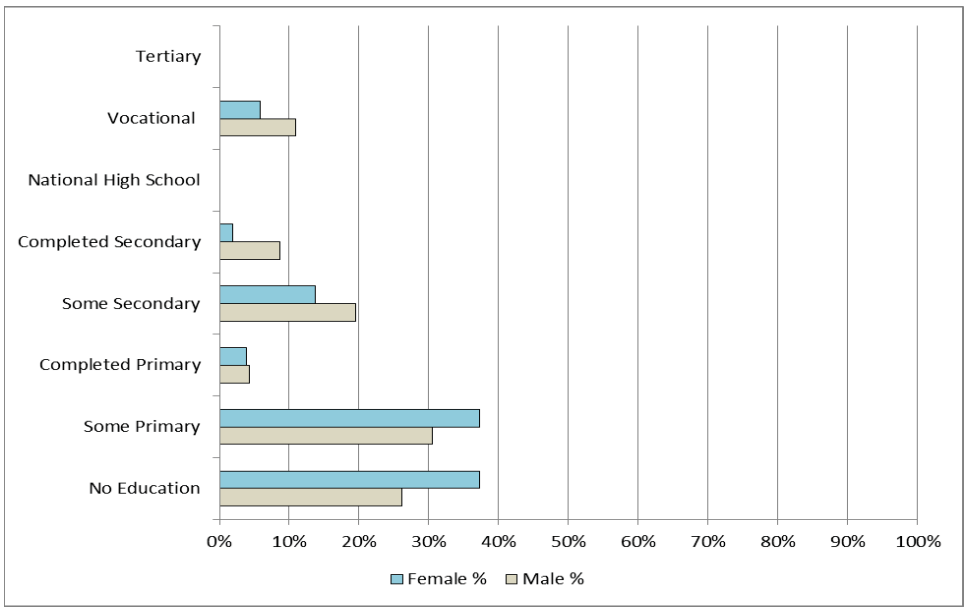

Figure 2-19Asaro In-Migrants by Education Level and Sex among population aged 15+, iHDSS, 2014

The marital status of the Asaro in-migrants is shown in Figure 2-20. The female in-migrants tended to be married whereas many of the males responded as being 'Never Married.' This would indicate that most of the in-migration was either single men, or women with their husbands.

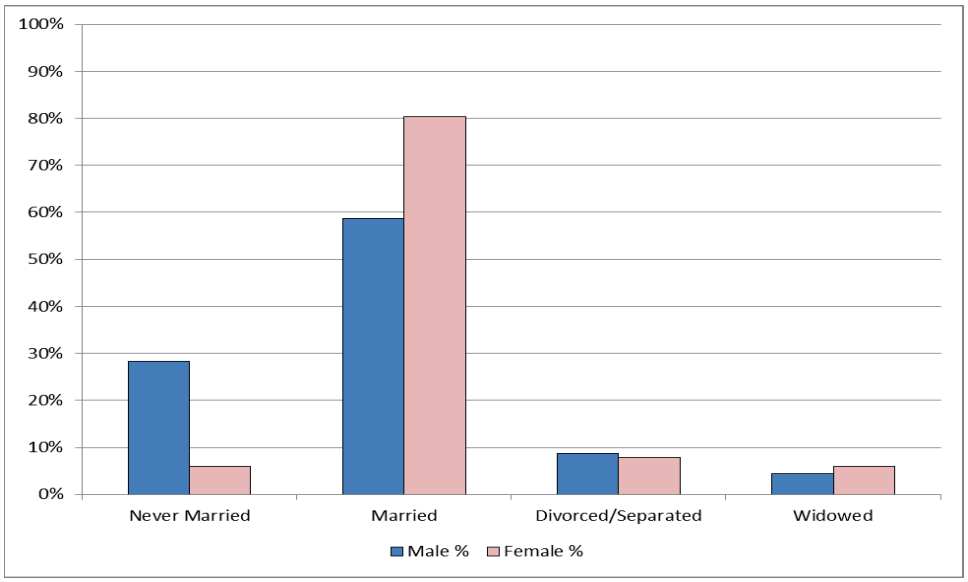

Figure 2-20Asaro In-Migration by Marital Status and Sex among population aged 15+, iHDSS, 2014

The in-migrant occupation status is shown in Figure 2-21. Nearly every woman was reported to be a subsistence worker (there were only 4 skilled/professional females). Males were also generally subsistence workers, though there were a limited number of skilled and unskilled workers who in-migrated as well (4 skilled/professional workers, 3 unskilled workers).

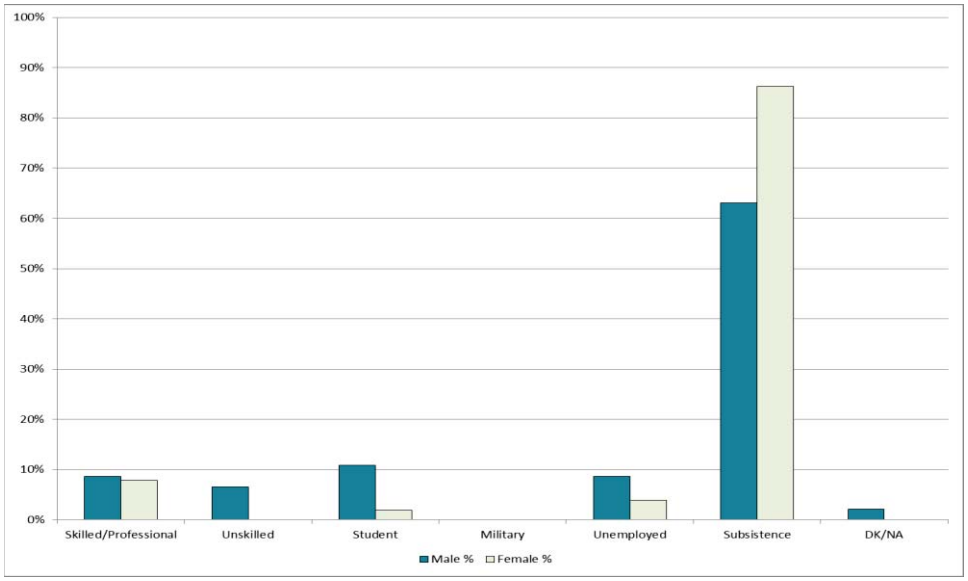

Figure 2-21Asaro In-Migration by Occupation Status and Sex among population aged 15+, iHDSS, 2014

Out-Migration

The age and sex breakdown for Asaro out-migrants is given in Figure 2-22. There were 86 males and 98 females (plus 2 of unrecorded gender) who left Asaro in 2014. Females tend to have larger percentages in each category in part due to having a larger out-migrant count. However, the unusually large number of females age 20-24 may not be just a product of a relative sample size, though the reason for such a large proportion of out-migrants in this category is unknown. Approximately 27% of the total out-migrants were children under 15.

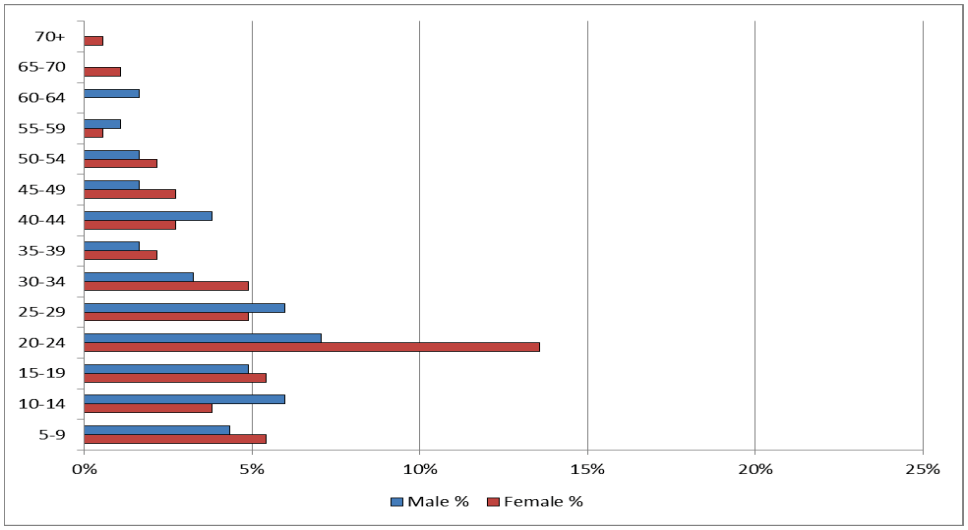

Figure 2-22Asaro Out-Migrants by Age and Sex, iHDSS, 2014

The educational level of out-migrants age 15 and above is shown in Figure 2-23. Like the overall population of Asaro, and the population of the in-migrants, Asaro out-migrants tended to be relatively uneducated, with the bulk of the cohort being recorded as having no or only some primary education. Males also tended to be slightly more educated than females.

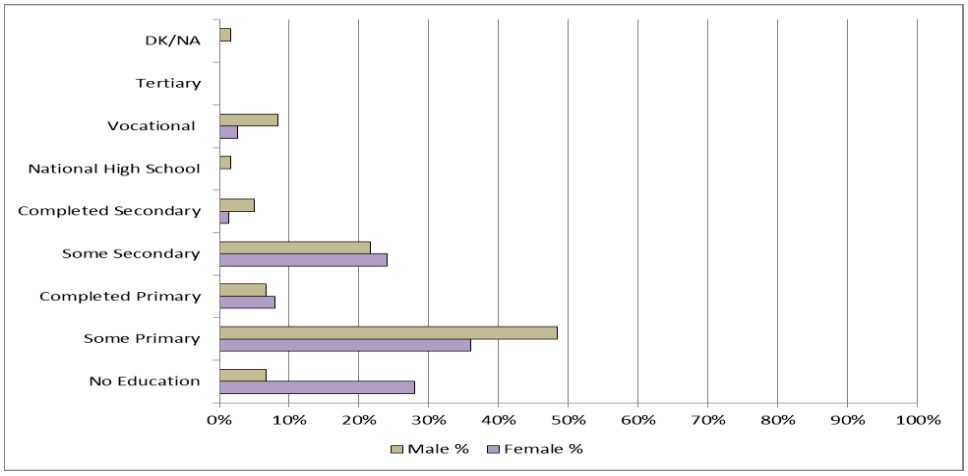

Figure 2-23Asaro Out-migration by Education Level and Sex among population aged 15+, iHDSS, 2014

Asaro out-migrant marital status is shown in Figure 2-24. For both male and females, there are a substantially higher percentage of people responding the 'Never Married' category then compared to the general population. The percentage of 'Never Married' males is nearly 20 percentage points higher for male out-migrants then the overall Asaro population and 10 percentage points higher for women.

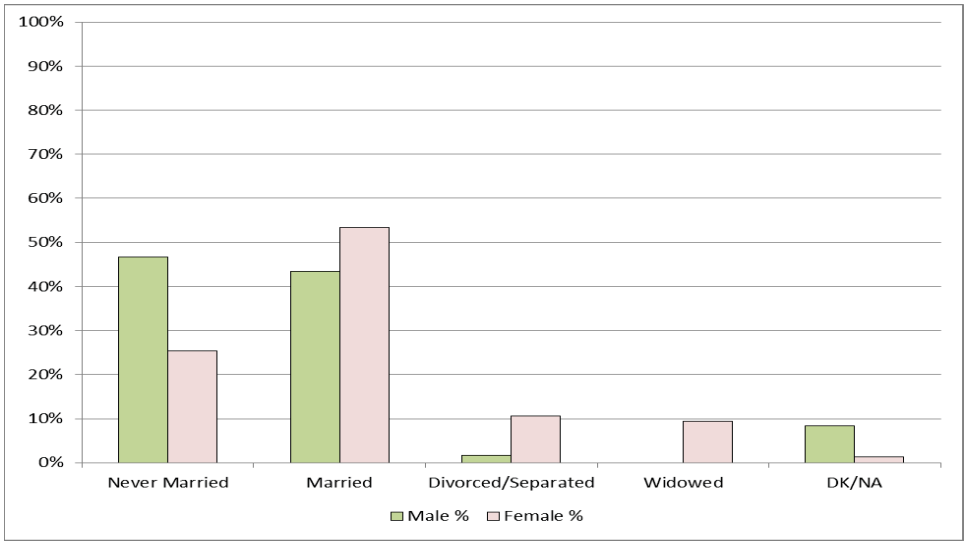

Figure 2-24 Asaro Out-Migration by Marital Status and Sex among population aged 15+, iHDSS, 2014

Figure 2-25 shows the Occupation type of the out-migrating population. Students represent approximately 22% of the total out-migrating population. The proportion of out-migrating males in the Skilled/Professional category was approximately 3 times higher than that of the Asaro male population as a whole. The proportion of out-migrating male students was also 10 percentage points higher than that of the general population.

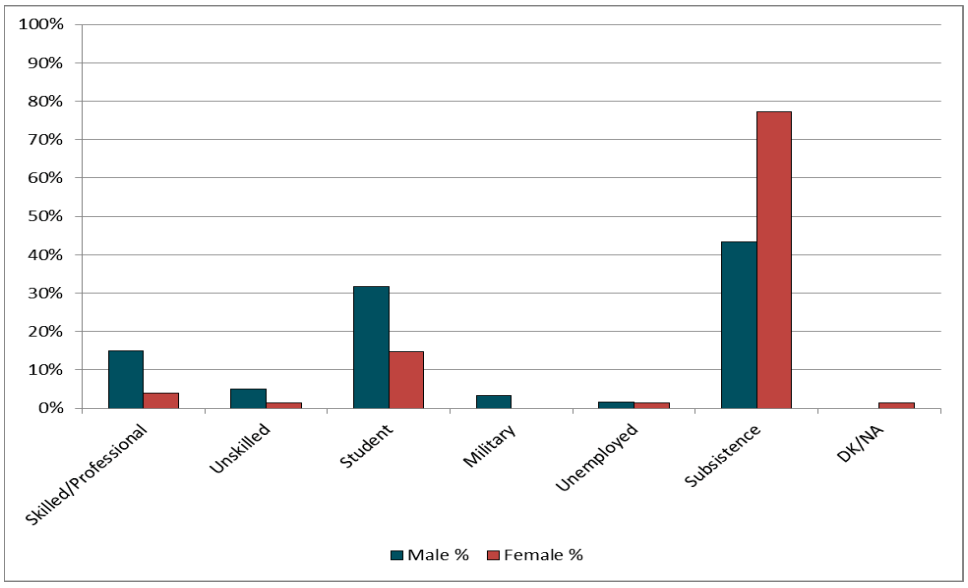

Figure 2-25Asaro Out-Migration by Occupation Status and Sex among population aged 15+, iHDSS, 2014

Conclusion

The Hides area has not experienced significant out-migration from the 2013 to 2014 period as expected, with Division 2 & 3 still experiencing significant population gains. Future analysis will need to be done to see if this trend continues despite PNG LNG demobilization, or if it eventually reverses.

3. CHAPTER 3 COMPARATIVE ANALYSIS OF SOCIO-ECONOMIC STATUS

Abstract

This chapter looks at the trends from Hides Socio-Economic Survey (SES) over the 2012-2014 period. Using the iHDSS surveys, a comparative analysis was done for Hides survey areas. The educational attainment, occupation, marital status, and PNG LNG employment for residents 15 years of age and older was examined to look at the effects that the PNG LNG Project potentially has had on the affected populations. Based on the data, it appears that the PNG LNG Project did have significant positive impact on the socio-economics of the populations during the construction phase. However, as the project has moved from construction to operations, the data suggest that many of the trends seen during the construction phase are returning to pre-project levels.

Hiri data is going under additional review and will be examined in future reports.

Materials and Methods

Previous iterations of the PiHP report have relied on the integrated Health and Demographic Surveillance survey (iHDSS) data for socio-economic data analysis. The iHDSS survey is a census level survey that, among other things, captures information about age, sex, marital status, and occupation, education, and PNG LNG employment status. This survey has occurred for the past three years for both the Hiri and Hides areas (occurring in late-2011/early-2012, March 2013, and March 2014).

Hiri

Hiri data is under review pending additional QA/QC. The data will be re-examined in either the end of the year longitudinal report or the March 2015 biannual update.

Hides

Population

The change in the population for all three divisions in the Hides area is shown in Figure 3-1. Divisions 1 saw a decrease from 2013 to 2014, whereas Divisions 2 and 3 saw increases over the 2012 to 2014 time period. This variation in population cannot be fully explained by the rise and fall in Hides area PNG LNG construction activities as significant demobilization occurred in 2014, particularly in Division 3. Division 2 (Komo Airfield area) construction activities would have peaked in 2012/13 and subsequently declined. There is significant uncertainty if the apparent population increase is due to in-migration or increased accuracy in identifying household in the Hides area as previous reports have shown suspected households, detected by remote sensing imagery, that were not recorded by the iHDSS. Future surveys will be necessary to further explore the observed population changes, particularly the possible impact of education interventions that were conducted during the PNG LNG construction period on the improvement in education of the population.

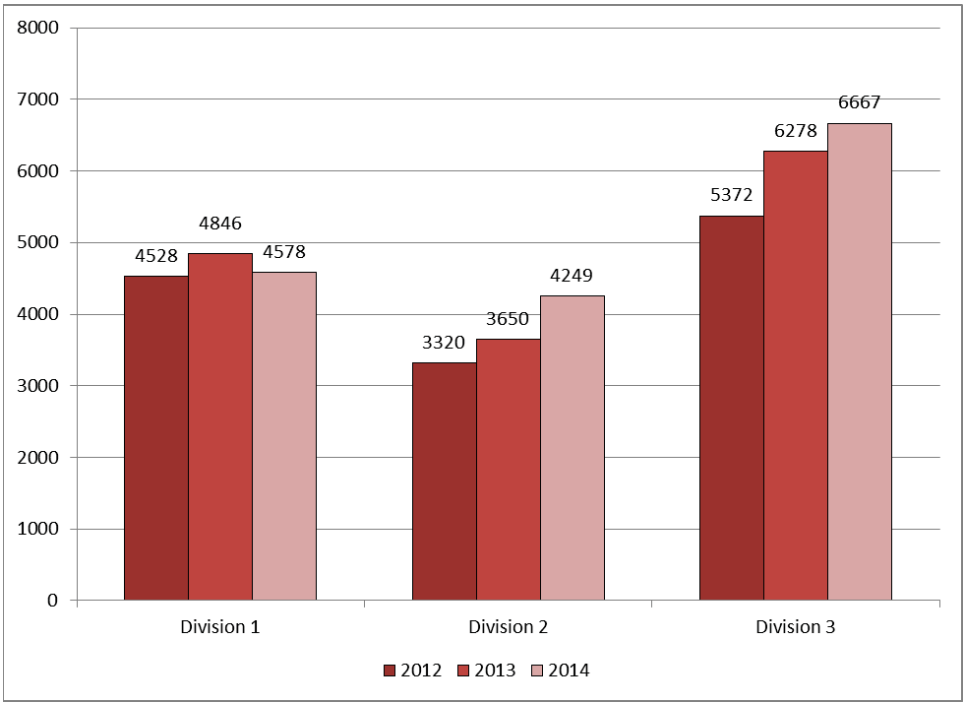

Figure 3-1Population aged 15+ recorded by division, Hides, 2012-2014, iHDSS, 2014

Marital Status

The marital status for the residents of Hides age 15+ is shown in Figure 3-2 and Figure 3-3. Figure 3-2 shows that the marital status of males has remained similar from 2012 to 2013. In contrast, Figure 3-3 shows a near 12 percentage point increase in married women, alongside a 13.1% decrease in those reported to have never been married. Polygamy is common among the Huli; hence, the increase in married females paired with a stable married rate for males confirms anecdotal evidence that the Huli men may have potentially used their increased employment income to pay customary "bride wealth" and added additional wives to their household. There was no additional increase in married women from 2013 to 2014, indicating that the initial surge in marriage was potentially due to a sudden influx of PNG LNG related income.

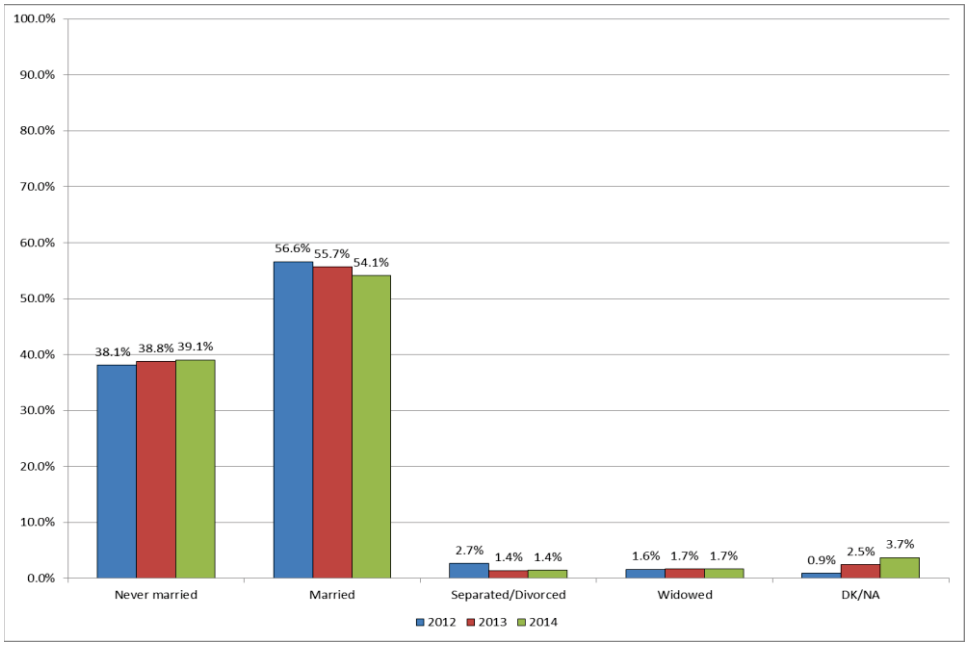

Figure 3-2Marriage status of males aged 15+, Hides, 2012-2014, iHDSS, 2014

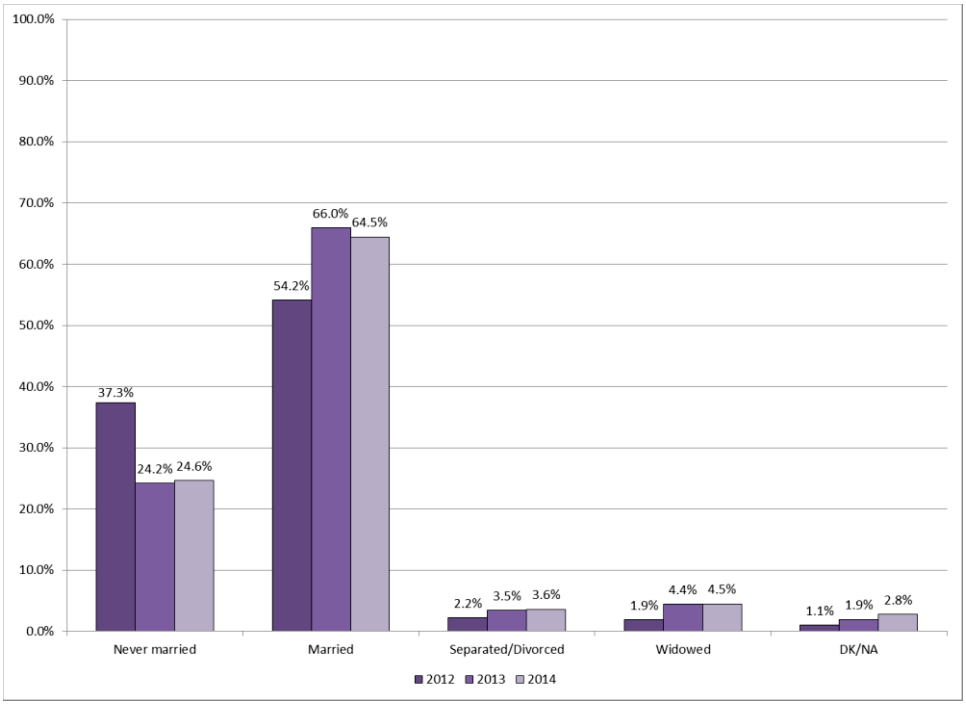

Figure 3-3Marriage status among females aged 15+, Hides, 2012-2014, iHDSS, 2014

Education

Figure 3-4 shows the educational attainment for Hides males age 15+ over time. There appears to be an increase in males receiving more education from 2012 to 2014, as (i) the number who responded 'No Education' has dropped 10 percentage points over the 2-year period; (ii) the number who have completed either 'Some Secondary' education or 'Completed Secondary' education have both increased; and (iii) the number reporting 'No Education' decreased by almost 11% in the same 2-year period. Further ground assessment is needed to determine if: a) this is due to an increased emphasis on schooling; b) if this is because of the out-migration of a disproportionate number of males who had previously reported 'No Education,' or; c) some combination of points a and b. The total number of males who have completed secondary education has decreased while the number of males who have some secondary education also decreased from 419 to 357. These findings likely indicate that there is likely a combination of both an increased emphasis on schooling as well a possible an out-migration effect.

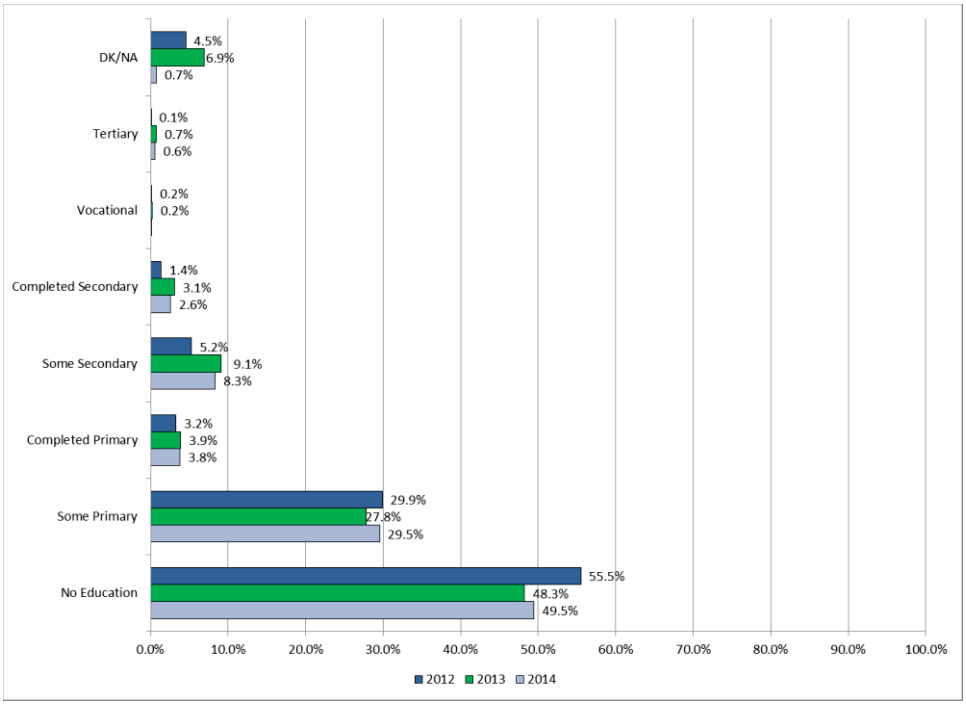

Figure 3-4Educational Attainment among Males aged 15+, Hides, 2012-2014, iHDSS, 2014

Figure 3-5 shows the educational attainment for females age 15+ in the Hides area. There does not appear to be any clear trends regarding female education. However, there is a marked decrease in DK/NA responses in 2014. This observation likely indicates better data collection procedures and may help explain the lack of any significant trends, i.e., the previous high levels of DK/NA responses may mask any trends, as they likely skew towards the 'No Education' category.

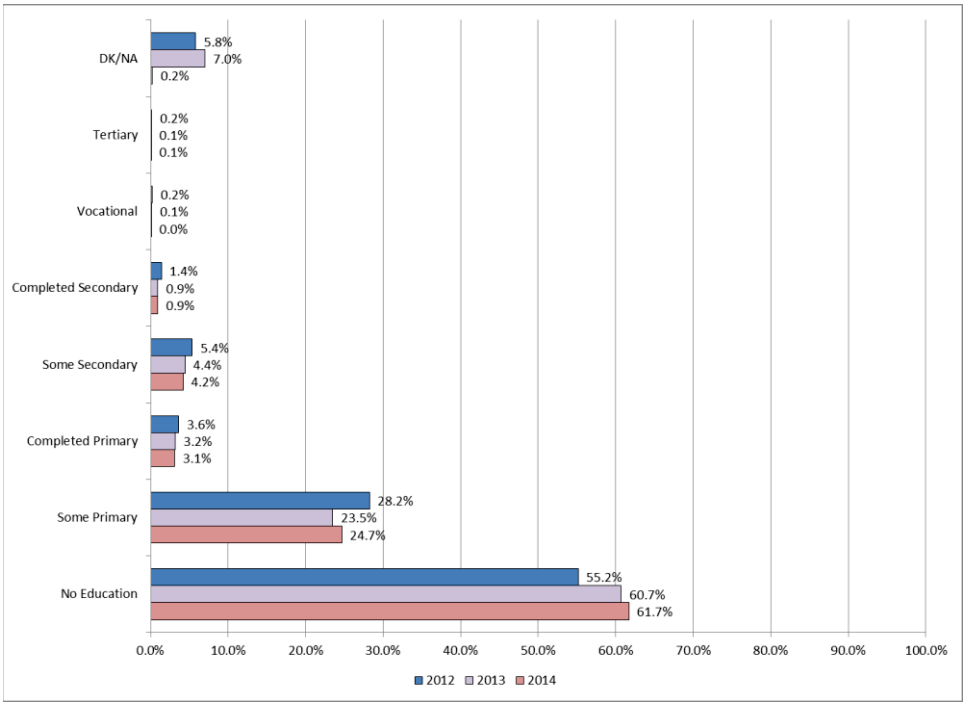

Figure 3-5Educational Attainment among Female population aged 15+, Hides, 2012-2014, iHDSS, 2014

Occupational Status

The occupational status for males age 15+ over time is shown in Figure 3-6. The effects of the HGCP construction phase can be seen when comparing 2013 and 2014 data (The large number of DK/NA in 2012 makes analysis of that year difficult). The increasing number of subsistence workers and students, accompanied by the decreasing number of unskilled labourers illustrates the impact that the ending of the active construction phase may be beginning to have on Hiri males. The continued elevated level in professional/skilled labour probably reflects the permanent personnel of the HGCP plant.

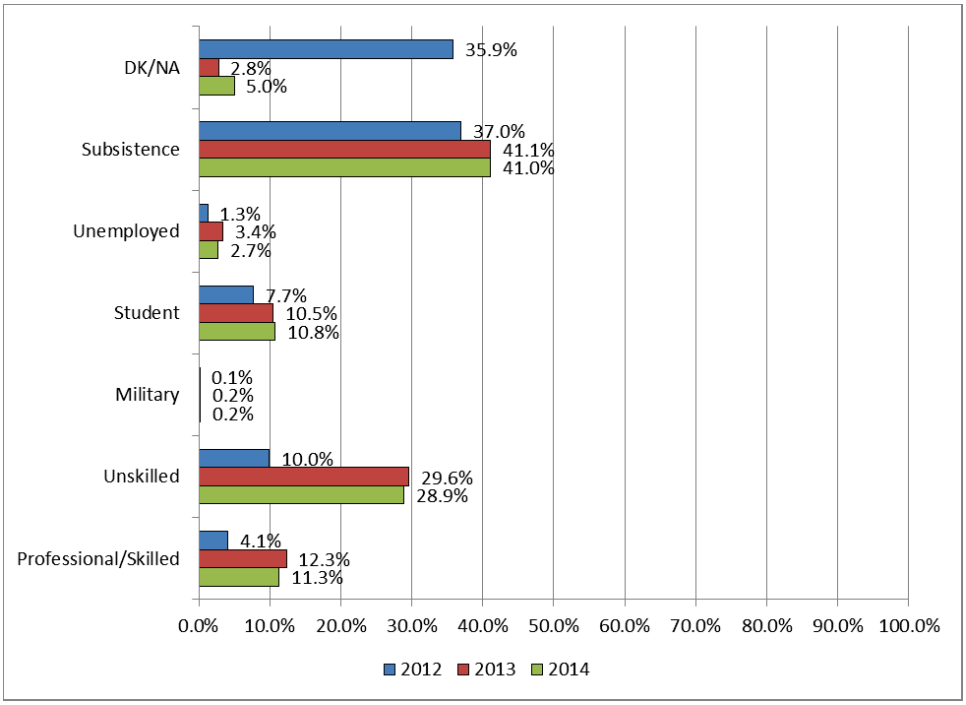

Figure 3-6 Main Occupation of Male population aged 15+, Hides, 2012-2014, iHDSS, 2014

Figure 3-7 shows the occupation types for females over time. Like Figure 3-6, there is a large number of DK/NA in the year 2012. The high number of women in the subsistence category could be culturally driven within Huli society, where women are not encouraged to participate in the labour force in the workplace. Hence, the ending of the construction phase had little effect on the employment status of Huli women.

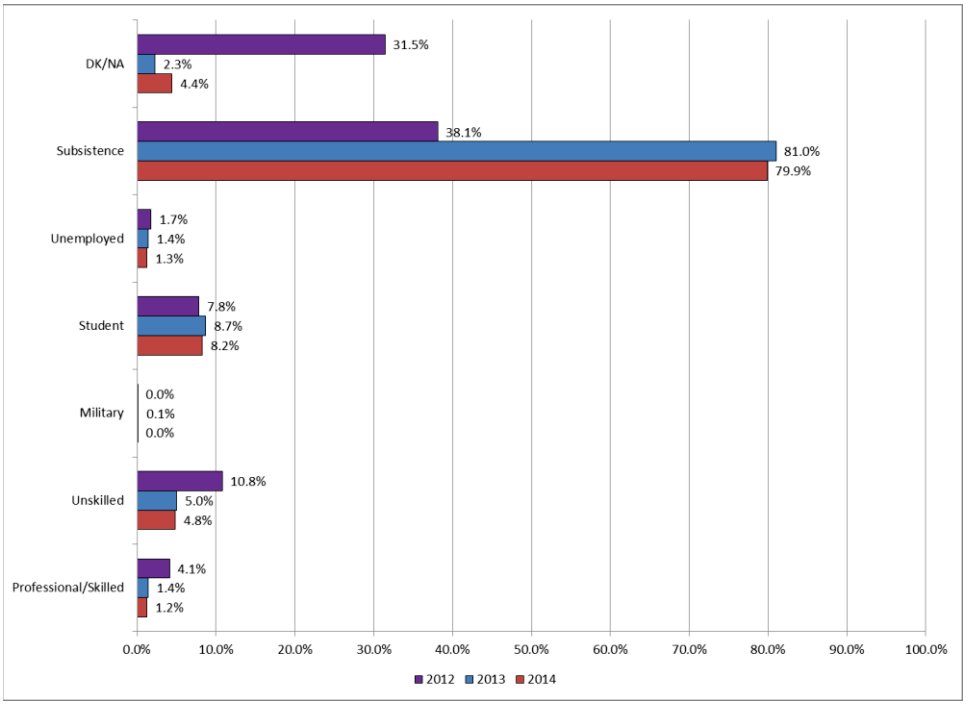

Figure 3-7Main Occupation of Female population aged 15+, Hides, 2012-2014, iHDSS, 2014

Figure 3-8 presents the LNG employment status over time for the Hides area. As illustrated by Figure 3-6 and Figure 3-7, the bulk of those employed in the Hides area by the PNG LNG were males. There has been no significant drop in respondents who have reported to have ever had PNG LNG employment. As previously discussed, this lack of employment trend is likely artificial and due to the wording of the census question, which does not ask about current PNG LNG employment status, but rather if one has ever been employed by the PNG LNG project. If significant out-migration of ex workers was occurring this statistic would be reducing and this is not evident.

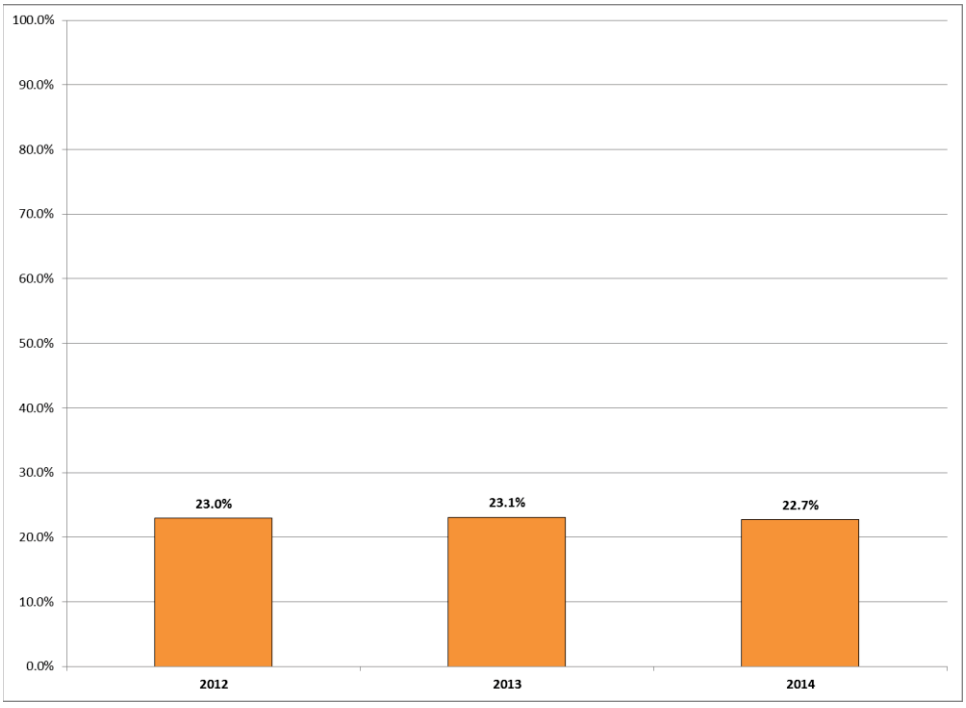

Figure 3-8 Proportion of population aged 15+ reported ever working for the LNG Project, Hides, 2012-2014, iHDSS, 2014

Karkar

Population

The population for Karkar over the 3-year survey period is shown in Figure 3-9. From 2012 to 2013, the population growth mirrored the national average of 2.8% (range 2.7-3.0%). This was reversed when comparing 2013 to 2014 which saw a 2.5% population decline.

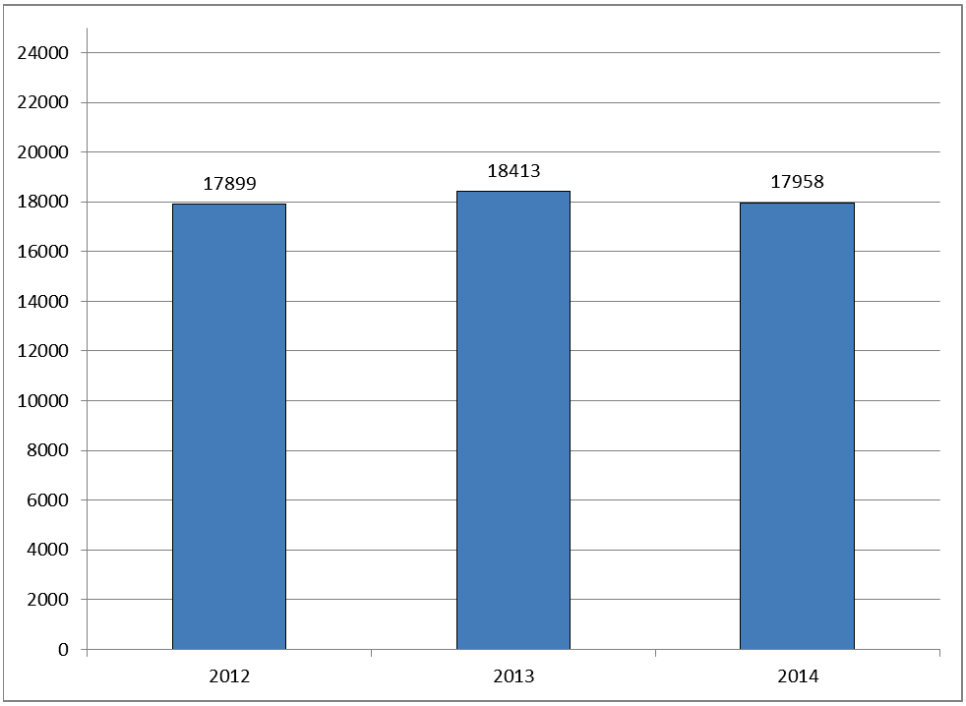

Figure 3-9Karkar population change recorded over the period 2012-2014, iHDSS, 2014

The male population for 2012-2014 for the Karkar area is shown in Figure 3-10. The female population is shown in Figure 3-11. For both men and women, there appear to be two trends: an increase in the proportion of adult males age 15+ from 2013 to 2014, and a decrease in children age 14 and below. The percentage increase in adults is likely proportional and reflects a disproportionate decrease in children rather than any increase in the adult population, as the overall population did decline from 2013 to 2014. As will be seen in the out-migration analysis, there was significant out-migration of females from Karkar in the 2013-2014 period. The decrease in children likely reflects this as the children are leaving with their mothers. There is also an unusually large decrease in females age 25-29 from 2012 to 2013. The explanation for this observation is unknown at this time.

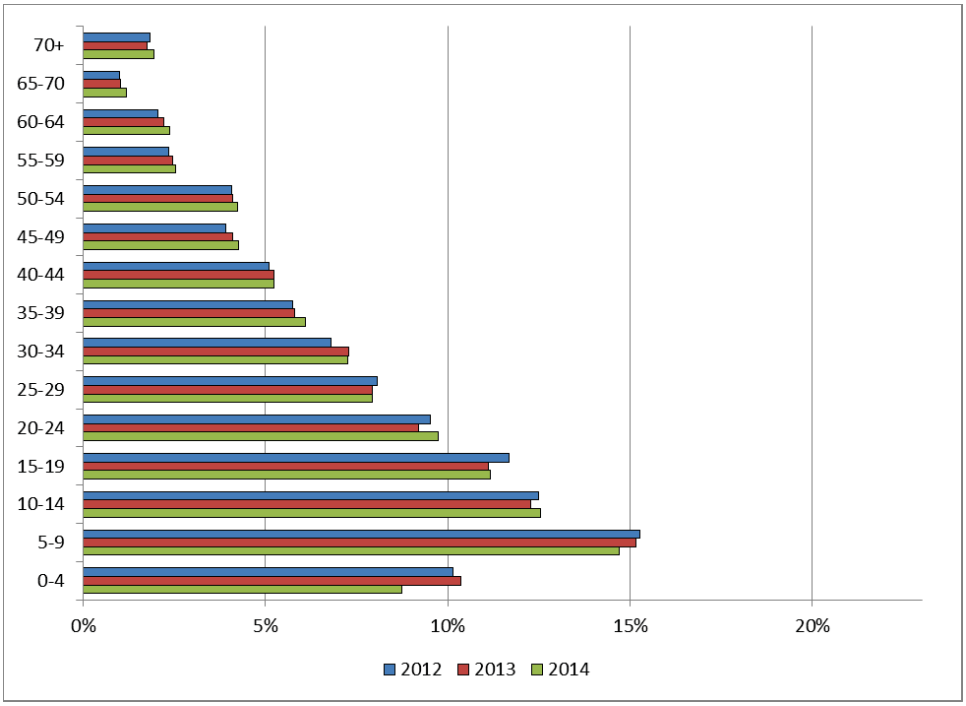

Figure 3-10Karkar Male Population changes, 2012-2014, iHDSS, 2014

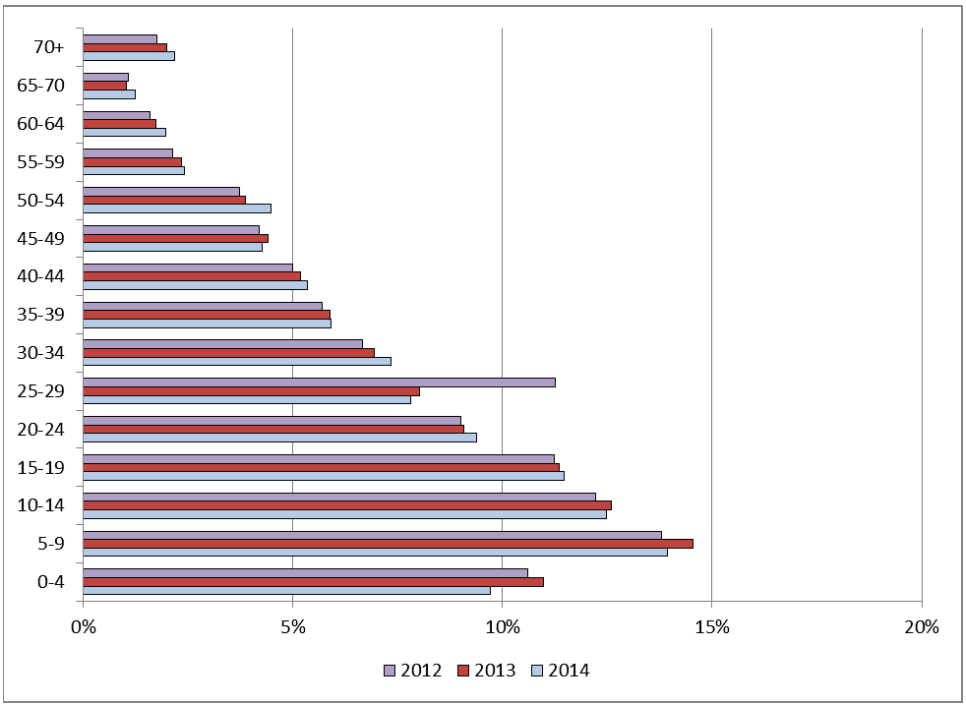

Figure 3-11Karkar Female Population changes, 2012-2014, iHDSS, 2014

Education

Figure 3-12 and Figure 3-13 show the educational status over time for males and females. There has been little change in educational attainment over the three-year period. Males tend to be slightly more educated than females, as there is a higher proportion of males with 'Some Secondary,' 'Completed Secondary,' 'Vocational,' and 'Tertiary' status.

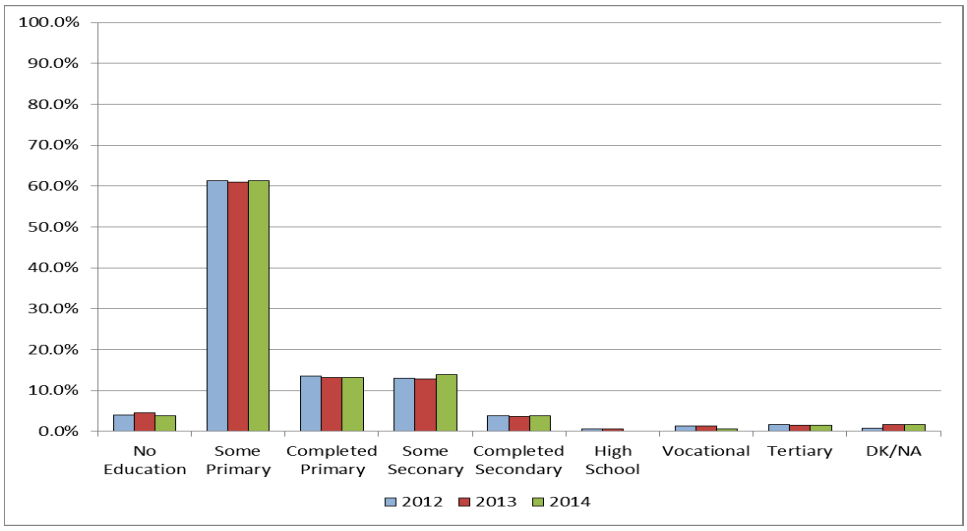

Figure 3-12Education level among Male population aged 15+, Karkar,2012-2014, iHDSS, 2014

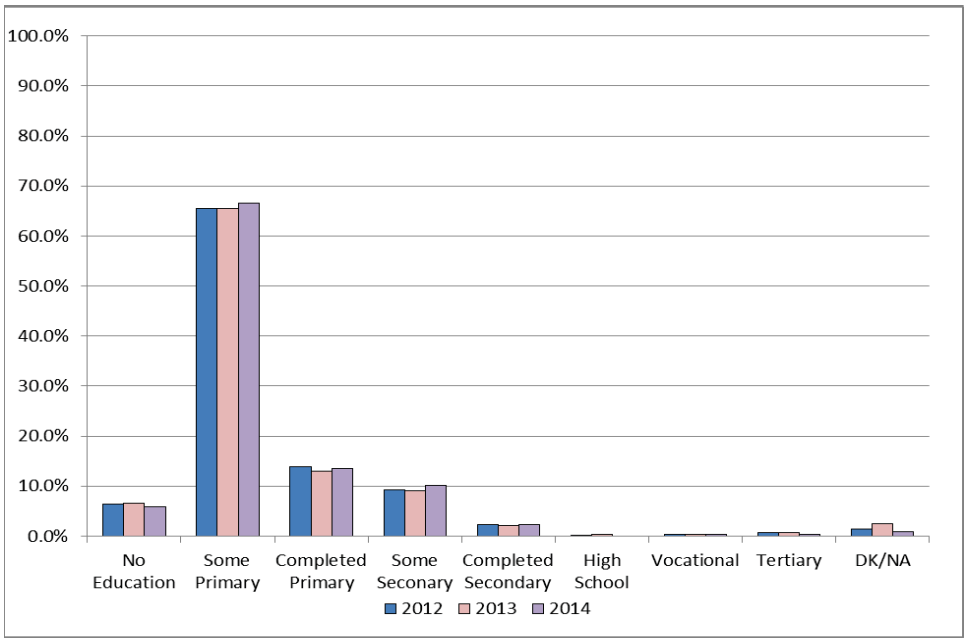

Figure 3-13 Educational level among Female population aged 15+, Karkar, 2012-2014, iHDSS, 2014

Marital Status

Marital Status is shown in Figure 3-14 and Figure 3-15. No significant trend can be found for either men or women. Overall, there are more married women than married men. Women are also more likely to be separated/divorced or widowed.

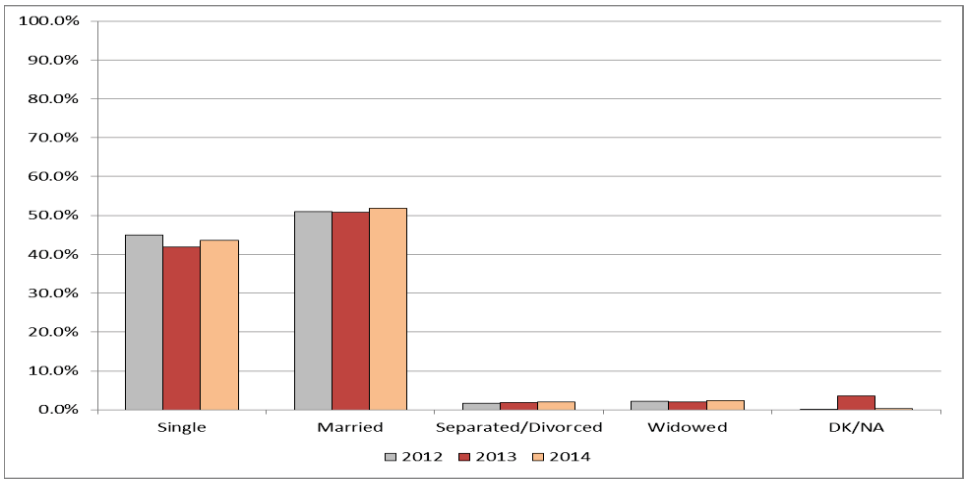

Figure 3-14 Marital status among Male population age 15+, Karkar, 2012-2014, iHDSS, 2014

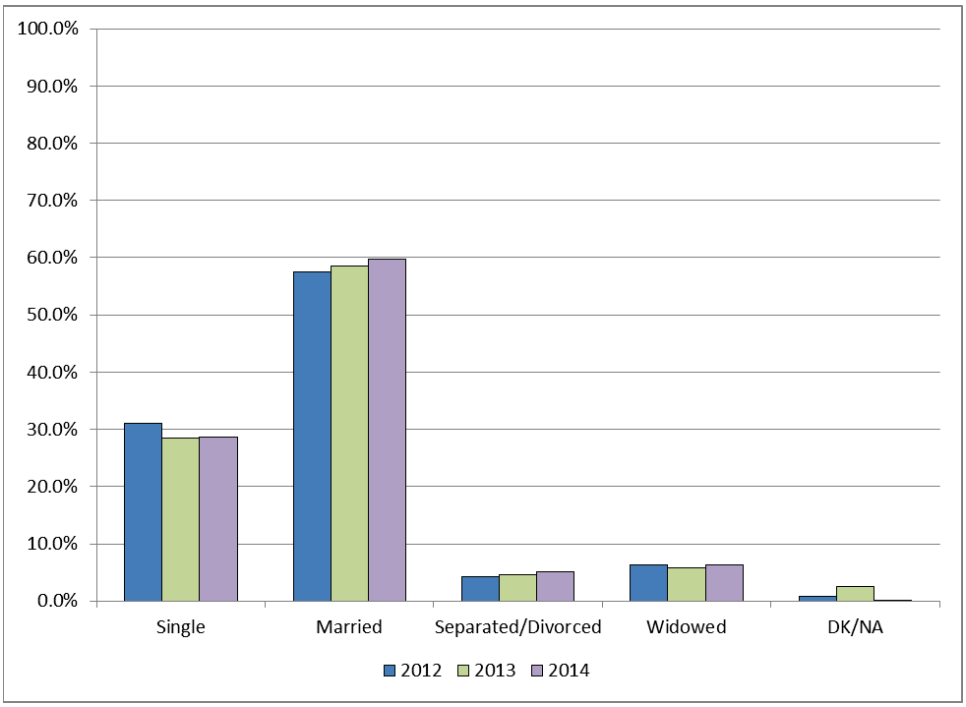

Figure 3-15Marital status among Female population age 15+, Karkar, 2012-2014, iHDSS, 2014

Employment Status

Employment status over time is shown in Figure 3-16 and Figure 3-17. From 2012 to 2013, both men and women saw a significant decrease in the proportion of people classified as 'Student.' This is likely due to a decrease in the number of children below age 15. Both male and female cohorts saw a small, but significant decrease in the percentage of adult who classified themselves as 'Unskilled.' Given job opportunities available on shore in the Madang area, employment induced out-migration may be the cause of this decline in unskilled workers.

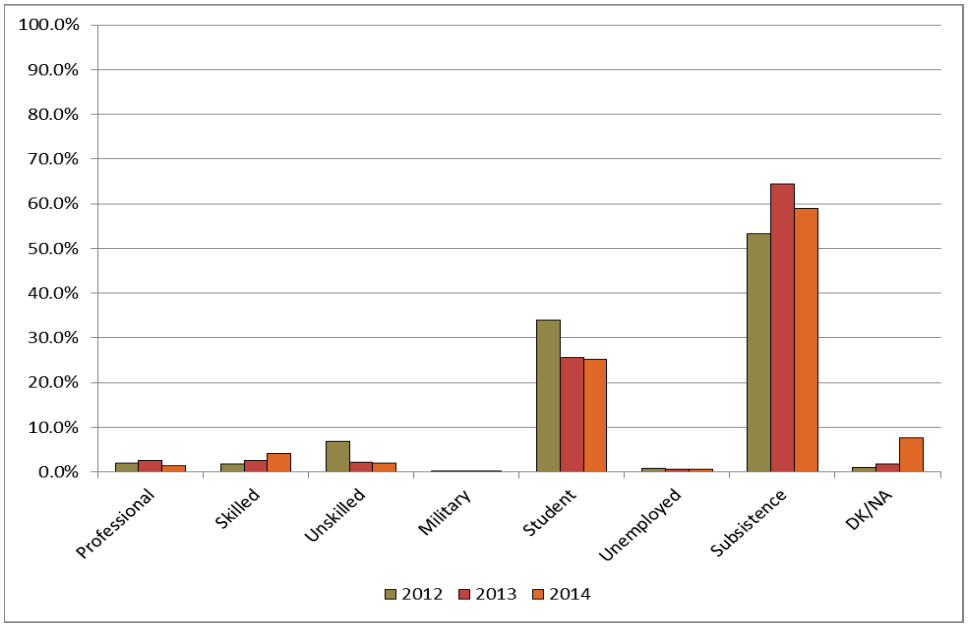

Figure 3-16 Main occupation among Male population aged 15+, Karkar, 2012-2014, iHDSS, 2014

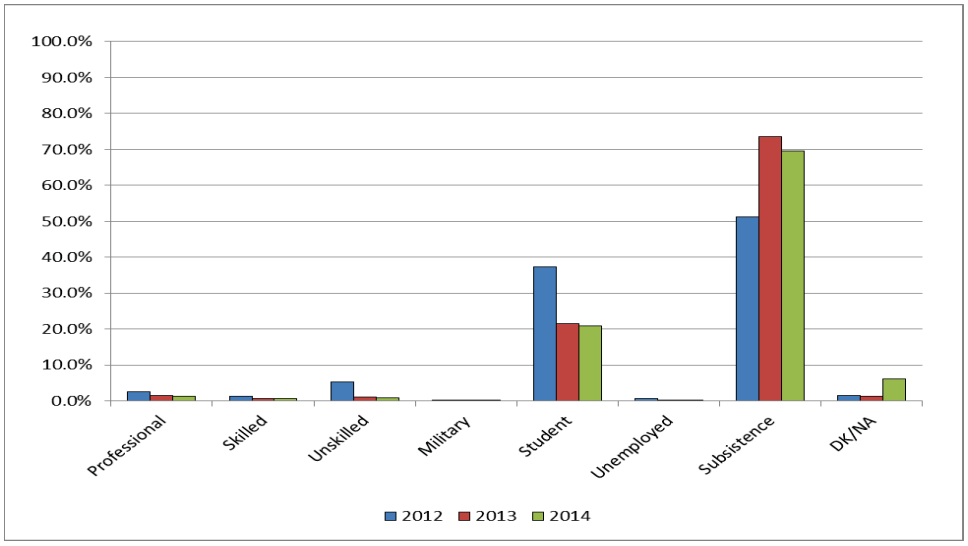

Figure 3-17Main occupation among Female population aged 15+, Karkar, 2012-2014, iHDSS, 2014

Asaro

Population

Figure 3-18 shows the sample sizes from the 2012-2014 iHDSS for the Asaro area. Only the 2012 data was census level data, whereas 2013 and 2014 were sample data. Hence, differences in population from year to year should not be construed as increases or decreases in the overall Asaro population. All years have large enough sample sizes such that meaningful observations on the relative proportions of age/sex, education level, marital status and occupation type can be made.

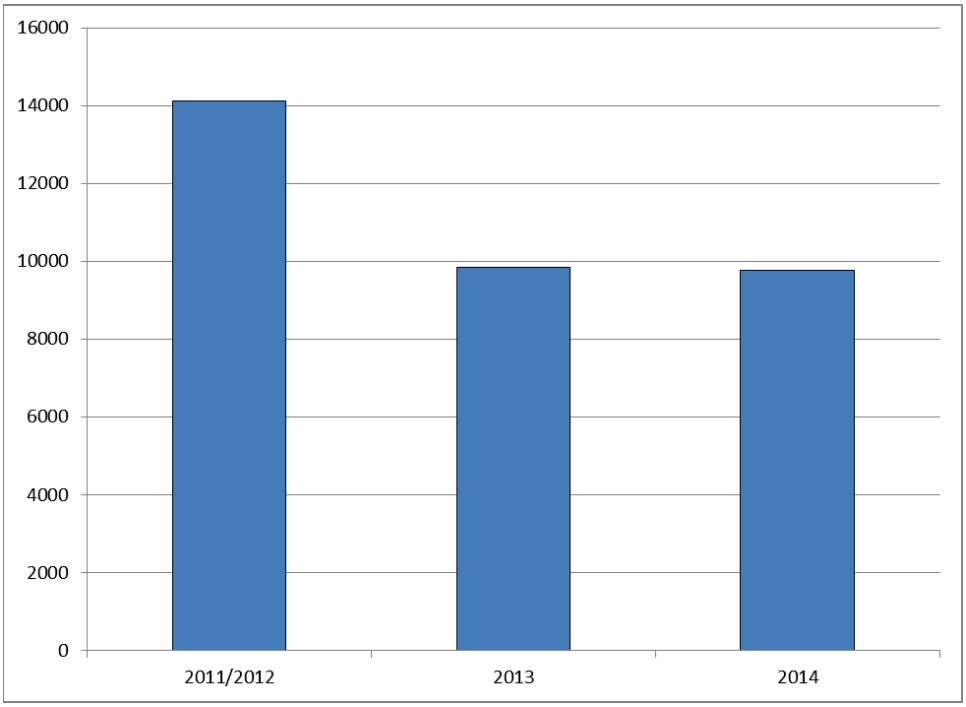

Figure 3-18Population change recorded over the period 2011-2014, Asaro, iHDSS, 2014

Education

The education status for Asaro is shown in Figure 3-19(males) and Figure 3-20 (females). Like their counterparts in Hides, male residents appear to be better educated than female residents. There do not appear to be any significant changes in education status from 2013 to 2014 for either male or females.

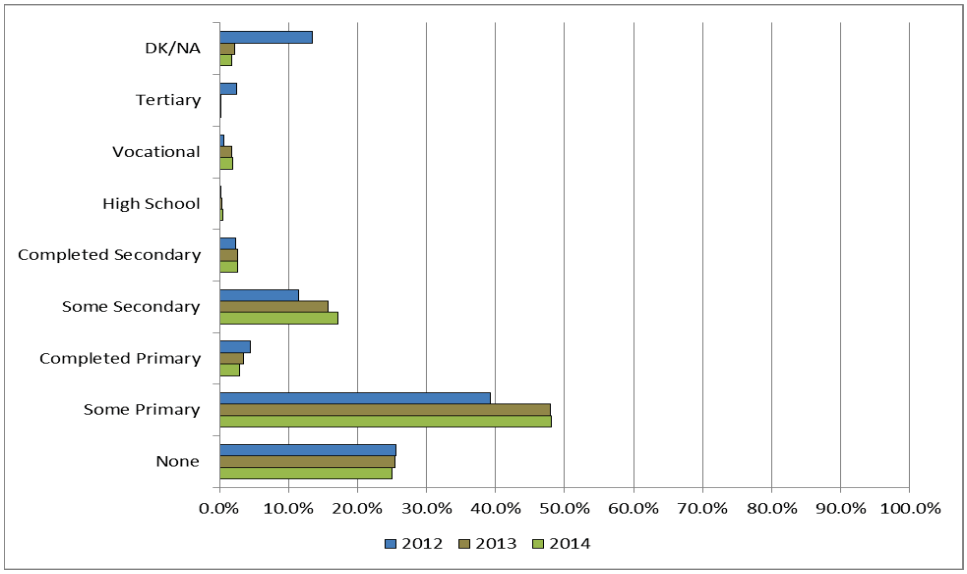

Figure 3-19Education level among Male population aged 15+, Asaro, 2012-2014, iHDSS, 2014

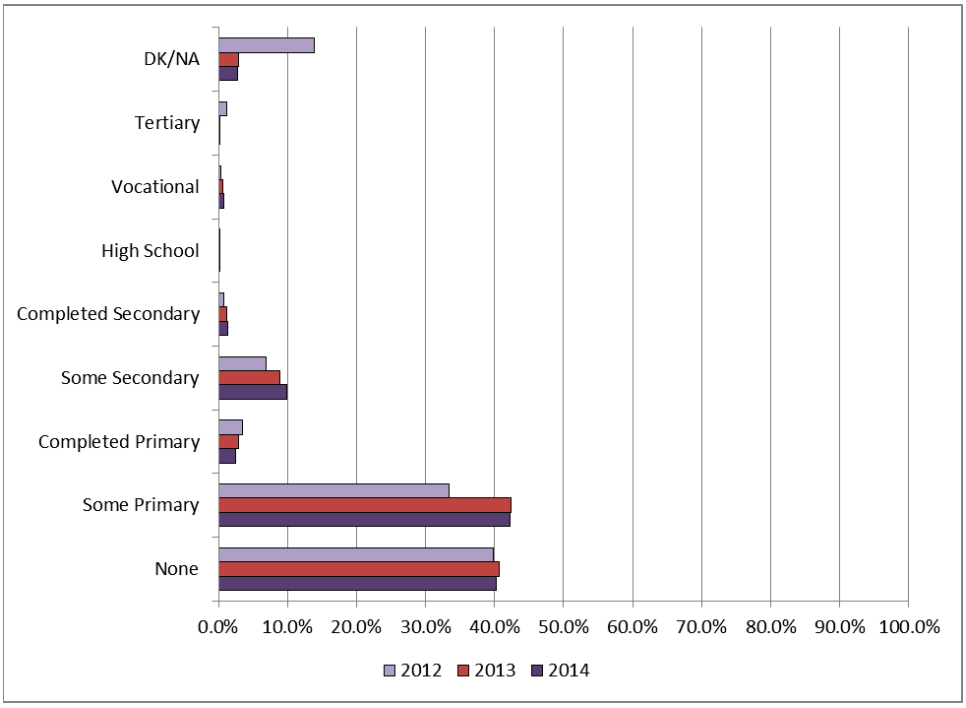

Figure 3-20Education level among Female population aged 15+, Asaro, 2012-2014, iHDSS, 2014

Marital Status

Marital status for the Asaro region is shown in Figure 3-21and Figure 3-22. Men are more likely to be single than women, which similar to Hides may be related to polygamous relationships. There have been no changes in marital status from 2013 to 2014 for either male or females.

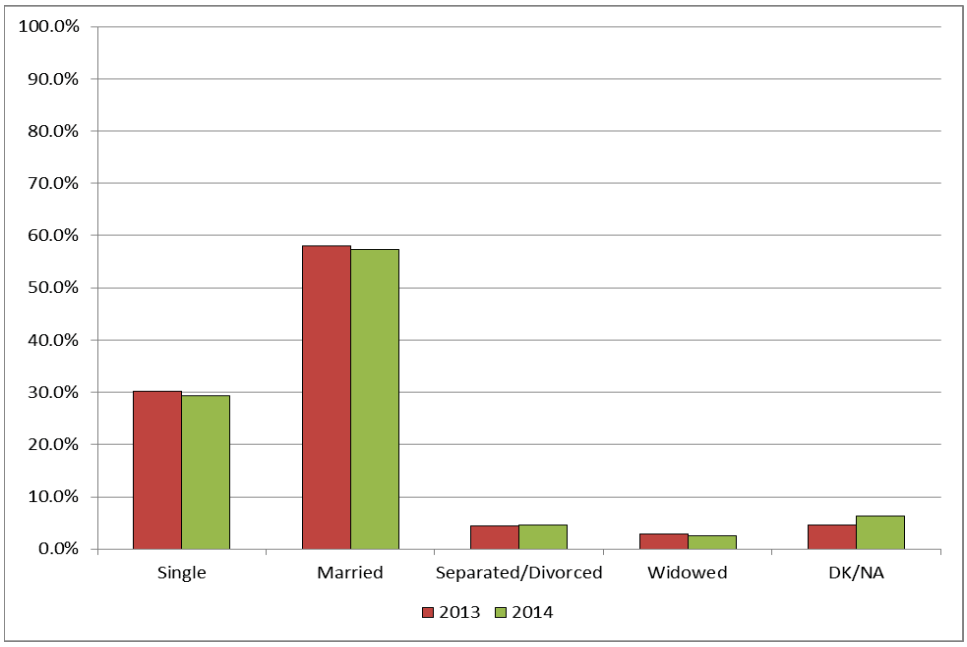

Figure 3-21Marital Status among Male population aged 15+, Asaro, 2013-2014, iHDSS, 2014

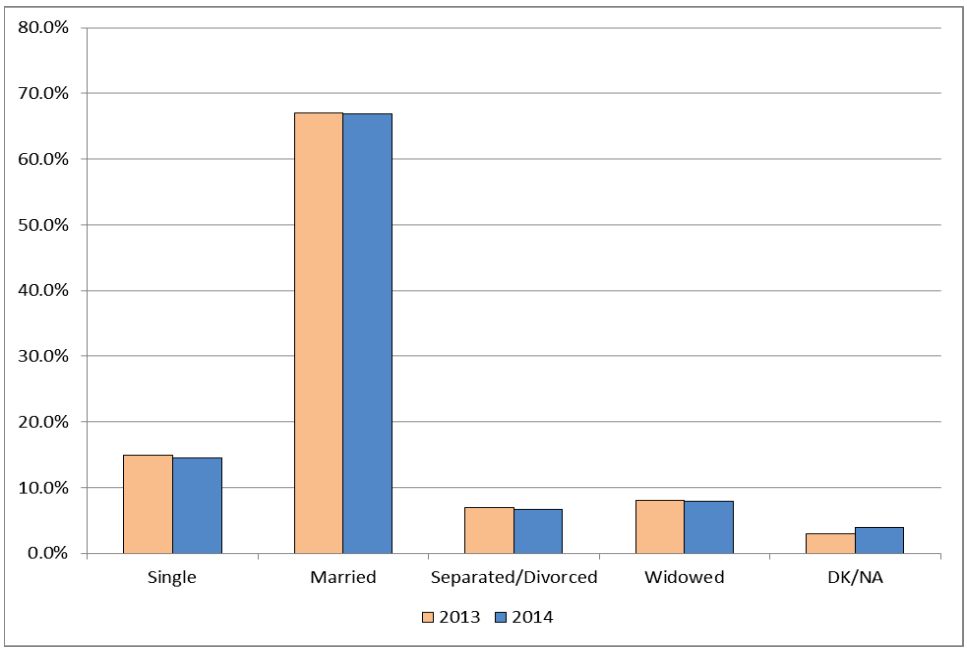

Figure 3-22Figure 3 27 Marital Status among Male population aged 15+, Asaro, 2013-2014, iHDSS, 2014

Occupation

The occupations of Asaro men and women, age 15 and above are shown in Figure 3-23 and Figure 3-24.The 2011/2012 had classified the response 'Home Duties' as unskilled labour whereas this was changed in 2013 and 2014 to belong with the 'Subsistence' category, hence, the unusual spike and decrease in the two categories. Both men and women are primarily subsistence workers, with few other (outside of students) being either skilled or unskilled workers. There are no apparent changes from 2013 to 2014.

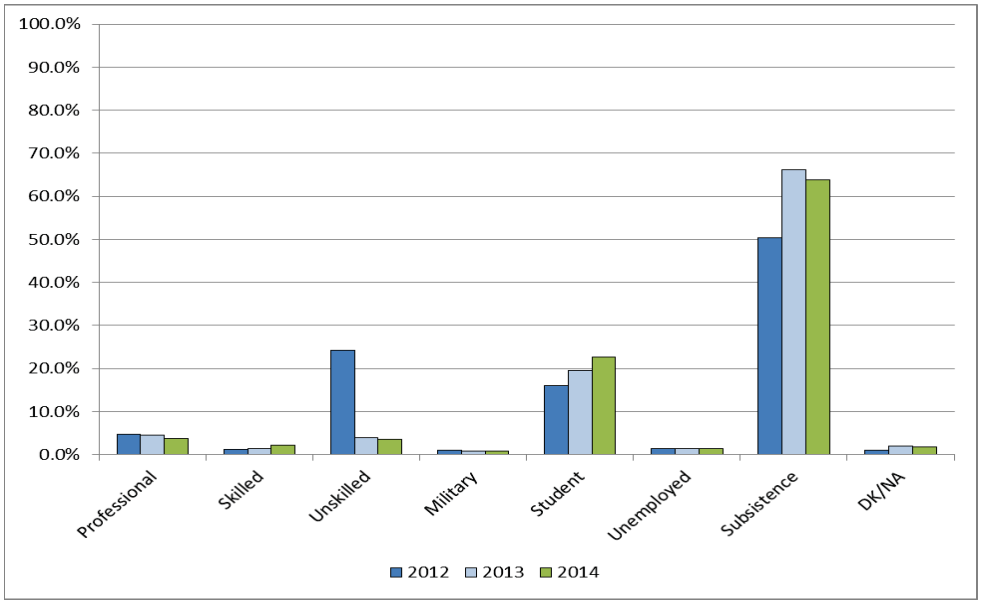

Figure 3-23 Occupational status change among Male population aged 15+, Asaro, 2012-2014, iHDSS, 2014

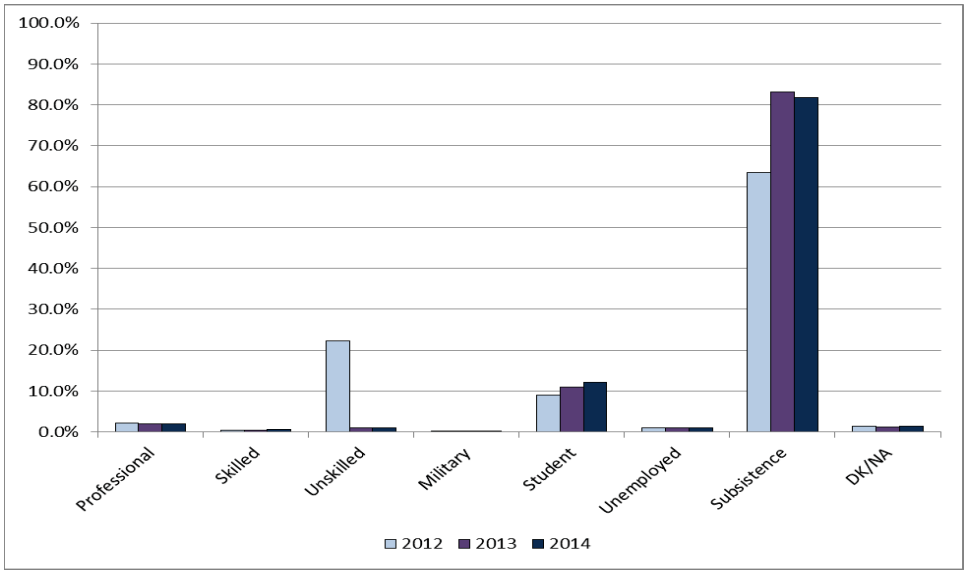

Figure 3-24Occupational status change among Female population aged 15+, Asaro, 2012-2014, iHDSS, 2014

Conclusion

The rise and fall of the construction phase of the PNG LNG project can be seen when examining the iHDSS SES questions over time. Hides site has shown in increase in population despite construction phase demobilization but it is unknown if this is “true” in-migration or related to increased survey accuracy. Hides iHDSS site continues to show changes in the overall population and relevant characteristics such as education, occupation and marital status when compared to its counterpart Asaro. The increase in educational status, likely due to project income and infrastructure improvements, is a promising trend that should be further monitored and documented.

4. CHAPTER 4 TUBERCULOSIS ACTIVE CASE DETECTION SURVEY IN KIKORI AND KARKAR

Abstract

This Chapter reports key findings of the Tuberculosis Active Case Detection Study conducted in Kikori and Asaro. High rate of TB detected in rural villages in Kikori with the TB incidence of 1290/100,000 pop, higher than incidence rates estimated by the NDOH (Gulf 785/100,000population). However, only 40% of PTB cases had negative AFB results but being confirmed TB by GeneXpert. It appears that TB patterns varied from locations to locations in PNG. PTB cases were more dominant in Karkar (67%) than in Kikori (32%). Despite long distance to health facilities, 61% of prolonged cough patients in Kikori sought diagnosis and care at health facilities. The Passive Case Detection in Kikori and Karkar had detected most of TB cases (86% Kikori, 84% Karkar), which successfully reached the PNG National TB control Plan of 70% of TB case detection.

Material and Methods

Objectives: In PNG, the TB has extremely high burden and is the number one cause of reported hospital deaths [1]. To-date no active case finding (i.e. actively screen and diagnose targeted populations or high risk groups) studies have been carried out in either the Gulf Province or at the Karkar iHDSS. Therefore, PNGIMR conducted an active case detection survey to determine the actual burden of TB illness in both rural villages in Kikori, Gulf Province, and Karkar iHDSS, Madang Province. The Karkar iHDSS is a PNG LNG comparison site (matched to Hiri villages. Kikori had an active construction phase during the PNG LNG Project. Kikori continues to have a very small PNG LNG operations workforce.

Study sits: This study was a cross-sectional survey conducted into rural locations in PNG: (1) Kikori district in Gulf province; and (2) Karkar iHDSS in Madang province.

Sampling: Twenty-one villages out of a total 50 villages in Kikori district were randomly selected, and included in the study. The survey was conducted in April 2013. The survey at the Karkar iHDSS, covered all 21 villages in iHDSS, and was conducted in October 2013.

Survey: A house-to-house survey covering all ages was performed in order to detect individuals with cough for more than three weeks or/and who identified themselves as suffering from TB in each household. Those individuals identified as TB patients should have been undergoing TB treatment; therefore, their health books

were reviewed for their TB treatment record and compliance. PNGIMR also checked the individual treatment records held in the TB registration books at the relevant health facilities.

During the survey in the Kikori villages, an IMR physician (Dr. P Harino) also examined those individuals who presented with the signs and symptoms of extra pulmonary TB.

Two morning sputum samples were collected from prolonged cough participants on two consecutive days. The specimens were delivered to these IMR/TB laboratories: (i) Kikori to IMR/TB lab at Kikori hospital; and (ii) Karkar iHDSS to IMR/TB lab at Para medical building at Divine World University (DWU) in Madang.

PNGIMR performed Acid Fast Bacilli (AFB) microscopy and reading. All slides were doubly read by lab-qualified staff. The slides in which both results were not agreed upon were sent to the PNGIMR TB lab in Port Moresby for a third confirmatory reading.

All sputum samples were decontaminated according to Petroff's method [4] and GeneXpert assays utilizing the Xpert MTB/RIF kit (Cepheid, Sunnyvale California USA) were performed. The results were recorded in the TB registration book (TB05 form) a reporting system of the PNG National TB control program. The TB register records at health facilities were reviewed to validate the survey results and to confirm that TB treatment cases that had been diagnosed prior the survey in 2013 and 2014.

Data analysis

All data were doubly entered in Microsoft Access database and STATA 12 (Stata Corp. College Station, TX) was used for data analysis.

Study approval: The Medical Research Advisory Committees granted the approval (MRAC, No. 10/17) and PNGIMR informed the Health authority and the community leaders in study villages. Informed consent was obtained from participants prior to sputum collection and interviews. Results of AFB tests and GeneXpert were made available to all participants who submitted the specimens. Participants with positive results were referred to nearby health facilities or a functioning hospital for registration and initiation of TB treatment.

Results

Kikori

Table 4-1 Summary of TB survey results in Kikori, 2014

Kikori district	**Number**
Number of villages	21
Total population survey	9670
Pulmonary TB	
Cough for more than 3 weeks during the survey	144
Number of TB suspected cases submitted sputum	109
PTB diagnosed from this ACD survey	6 (4 new cases)
PTB cases diagnosed by microscopy vs. GeneXpert	2 vs. 4
PTB rate from ACD in 2013	62/100000
PTB number from PCD in 2013	45
Prevalence of PTB in 2013	527/100000
Extra Pulmonary TB	
Extra PTB from ACD survey in 2013	16 (16 new cases)
Extra PTB from PCD in 2013	92
Prevalence of Extra PTB in 2013	1116/100000
Active case detection	
Total TB cases from Active case finding in 2013	PTB 6 + EPTB 16, Total =22
TB rate from active case detection in 2013	**227/100000**
Passive case detection	
Total TB cases from Passive case finding in 2013	PTB 45 + EPTB 92, Total =137 (104 new cases)
TB rate from passive case detection in 2013	**1417/100000**
TB Prevalence	
Total TB cases (all forms)	PTB 51+ EPTB 108=159
TB prevalence rate in 2013	1644/100000
TB newly-detected case	
Total new TB cases	Passive 104 +Active 20 =124
TB incidence rate in 2013	1290/100000
Possible MDR	
RIF + from GeneXpert	2 (died 1)
Proportion of PTB vs. EPTB (%)	32 vs. 68
Health care seeking	
Total cough more than 3 weeks	394
Cough more than 3 weeks coming to hospital	250 (63%)

PNGIMR covered the active case detection (ACD) survey in 21 remote villages in Kikori with total population of 9670. The TB rate from the ACD survey is presented in the Table 4-1. PNGIMR detected 6 PTB cases from the ACD survey (62 or 9/9670*100,000) and 16 Extra PTB cases (7 lymph node, 3 abdomen, 6 with malnutrition).

PNGIMR reviewed the TB records at Kikori hospital, 137 TB cases (45 PTB and 92 EPTB cases) from the study villages were diagnosed and treated. Total cases were 159 TB cases in study areas with the prevalence rate of 1644/100,000 pop. The passive case detection (PCD) had detected137 cases or 1417/100,000 population or 86% of total TB cases. The Extra PTB was predominant in this setting and accounted for 68% of all TB cases.

Reviews of the clinic/hospital TB registration demonstrated that there were 104 newly diagnosed TB cases in 21013. The active case detection survey detected 20 new TB cases. The total number of newly diagnosed TB in 2013 was 124. For the TB incidence rate, the denominator to calculate the incidence rate was from the number of population at risk (total population – previous TB cases = 9640-35= 9605). The previous TB case is from the total of TB cases subtracted by number of new TB cases (159-124=35).As in Table 4-1, the TB incidence rate in Kikori was much higher (1282/100,000 pop) than the incidence rate for Gulf province (785/100,000 pop) reported by NDOH in 2012 [5].

The study also detected 2 cases (1.4% or 2/146*100), which were RIF positive from GeneXpert, and indicated MDR status. PNGIMR sent the samples for further testing to the Queensland Mycobacterium Reference Laboratory in Brisbane to perform more detailed drug resistance profile. One case had died soon after the survey and another case was referred to POM General Hospital.

In 2013 at Kikori Hospital, a total of 248 suspected TB cases were seen at the outpatient TB clinic. The total number of the prolonged cough was 408 of which 248 visited the TB clinic and accounted for 63% of the prolonged cough cases that sought diagnosis and health care.

Karkar

Table 4-2 shows the active case detection survey covered 21 villages in Karkar iHDSS with a total population of 18413. We detected 22 PTB cases from the ACD survey (119 or 22/18413*100,000). Of the 22 cases, 13 were new cases. This survey did not detect any MTB/RIF positive case.

Table 4-2 Summary of TB surveillance survey results in Karkar, iHDSS, 2014

Karkar iHDSS	Number
Number of villages	21
Total population survey	18413
Pulmonary TB	
Cough for more than 3 weeks during the survey	258
Number of TB suspected cases submitted sputum	258
PTB diagnosed from this ACD survey	22 (13 new cases)
PTB cases diagnosed by microscopy vs. GeneXpert	13 vs. 9
PTB rate from ACD in 2013	119/100000
PTB number from PCD in 2013	70 (61 new cases)
Prevalence of PTB in 2013	70+22= 92 or 499/100000
Extra Pulmonary TB	
Extra PTB from ACD survey in 2013	N/A (Not conducted in this survey)
Extra PTB from PCD in 2013	44 (42 new cases)
Prevalence of Extra PTB in 2013	239/100000
Active case detection	
Total TB cases from Active case finding in 2013	PTB 22 + EPTB N/A, Total =22
TB rate from Active case detection in 2013	**119/100000**
Passive Case detection	
Total TB cases from Passive case finding in 2013	PTB 70 + EPTB 44, Total =114
TB rate from Passive case detection in 2013	**619/100000**
TB Prevalence	
Total TB cases (all forms)	Active 22+Passive 114=136
TB prevalence rate in 2013	738/100000
TB newly-detected case	
Total new TB cases (Passive) +(Active)	(PTB=61+ EPTB=42) + 13 = 116
TB incidence rate	630/100000
Possible MDR	
RIF + from GeneXpert	0
Proportion of PTB vs. EPTB (%)	67 vs. 33

Reviews of TB records held at key health facilities (Gaubin hospital and health centres) were performed. There were 114 TB cases already diagnosed and treated; therefore, there were 136 TB cases in study areas. The calculated prevalence rate was 738/100,000 pop. The passive case detection has detected 619/100,000 pop or 84% of the total TB cases. In the Karkar iHDSS, PTB is the predominant form and accounted for 67% of all TB cases. The calculated TB incidence rate was 630/100,000 pop. The number of population at risk as a denominator for calculating TB incidence is (total of population – previous TB = 18413-20) 18393.The summary data presented in Table below illustrates that the TB incidence rates across the three sites (Hiri iHDSS, Karkar iHDSS and Kikori), were significantly higher than the figures reported by the NDOH.

Interestingly, the passive case detection in Kikori district and Karkar iHDSS found significantly more cases than the PCD in Hiri HDSS. The survey detected more TB with possible MDR cases (RIF+ from GeneXpert) in Hiri, than other sites.

Table 4-3Summary of TB surveillance survey results in 2013, iHDSS, 2013

	Hiri	Kikori	Karkar
Number of villages	4	21	21
Total population survey	13310	9670	18413
TB diagnosed from Active case detection	16	22	22
% of TB detection by ACD	23%*	14%	16%
TB rate from ACD (per 100000)	120	227	119
TB diagnosed from Passive case detection	34	137	114
% of TB detection by PCD	50%*	86%	84%
TB rate from PCD (per 100000)	255	1417	619
TB prevalence (per 100000)	510**	1644	738
TB incidence (per 100000)	458	1290	630
TB incidence rate reported by NDOH (2013)	165	815	276***
RIF+ from GeneXpert	4	2	0
Proportion of PTB vs. Extra PTB	72 vs. 28	32 vs. 68	67 vs. 33
Prolonged cough seeking health care	29%	63%	N/A

* These percentages were calculated from the total number of TB cases (n=68; 16 from ACD + 34 from PCD + 18 from the PNGLNG plant site)
** The numerator calculated in this prevalence rate was 68; included 18 TB cases diagnosed by ISOS from the PNGLNG project.
***This rate was for the year 2012

Discussion

In 2013, PNGIMR conducted the first active case detection surveys in order to investigate the burden of TB illness in rural villages in PNG: Hiri iHDSS, Central province; Kikori district, Gulf province and Karkar iHDSS, Madang province. The active case detection survey in Hiri iHDSS was presented in the previous PiHP Scientific Report [3].

PNGIMR detected an extraordinarily high rate of TB (Incidence rate of 1290 and prevalence rate of 1684) in the Kikori study villages. The TB rates were similar to those in the previous PNGIMR study [2]. The current study shows that the incidence rates (per 100,000 population)estimated by the NDOH are approximately two times

lower than the rates PNGIMR found in the 2013 study(Kikori 1290 vs. Gulf 815; Karkar 630 vs. Madang 276; Hiri 458 vs. Central 165) [5]. The levels of TB in Kikori are “epidemic” and require urgent intervention by the PNG National TB Control Programme. Levels in Karkar are also seriously elevated and clearly need a sustained TB control programme and intervention.

The sensitivity of AFB microscopy was 60% in this study. GeneXpert has greatly increased the sensitivity of TB diagnosis, by detecting an additional 40% of PTB, in the set of AFB “negative” microscopy results. The survey in Hiri showed higher PTB detection by GeneXpert (54%) than AFB microscopy [3].

TB illness patterns in PNG varied from locations to locations. The proportions of PTB and EPTB were different between two sites; PTB was more dominant in Karkar (67%) than in Kikori (32%). A previous survey in Hiri showed the similarly higher proportion of PTB (72%) than EPTB (28%) [3]. Four TB cases with RIF+ from GeneXpert (possible MDR TB) were found in Hiri, higher number than other sites. This outcome warrants the further investigation, if this is due to the high defaulted rate and/or primary drug resistance (infected with TB bacilli, already resistant to treatment).

Despite the long distance needed to travel to the Kikori hospital, 61% of prolonged cough patients sought diagnosis and care. In contrast, at the Hiri iHDSS located near Port Moresby and readily accessible by public transport, only 29% of prolonged cough cases sought health care [3]. While the existing health system in Hiri iHDSS detected only half of all TB cases [3], we found that the passive case detection (PCD) in Kikori and Karkar had detected most of the TB cases (86% Kikori, 84% Karkar), which exceeded the PNG National TB Control Plan of 70% of TB case detection. These results suggested that proper diagnosis of TB at Kikori hospital and health facilities in Karkar Island is crucial and needs to be maintained.

To be able to effectively control TB in Hiri, low utilisation of health care facilities indicated the need for the active case detection to be conducted and integrated into the TB control program. Functioning DOTS programme are needed to ensure TB cases complete their treatment as well as the operationalresearch will be especially important in designing effective health promotion interventions for promoting health seeking behavior among chronic cough group and adherence to treatment for the TB patients.

References

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[4] Petroff SA. A New and Rapid Method for the Isolation and Cultivation of Tubercle Bacilli Directly from the Sputum and Feces.J Exp Med 1915; 21:38-42.

[5] WPRO. 2nd External Review of the TB programme of Papua New Guinea, PowerPoint Presentation. Port Moresby. 7-21 Feb 2014

5. CHAPTER 5SENTINEL SURVEILLANCE

Abstract

The Environmental and Emerging Diseases Unit (EEDU) at PNGIMR have been leading the sentinel surveillance of febrile, diarrhoeal and respiratory diseases at the four iHDSS sites as part of the Partnership in Health Programme.

We are continuing to expand on our diagnostic capacity. We currently have 60 real-time PCR assays available for use, but seek other febrile, diarrhoeal and respiratory diseases, especially assays for diseases that are termed "neglected" e.g., soil transmitted helminths, enteric protozoa. Optimisation of the new assays is currently being performed and will bring the number of assays to more than 80 by late 2014.

Sample collection is ongoing in three sites: Karkar, Asaro and Hiri. No samples from Hides were received during the period covered by this chapter. Analysis of these samples is on-going. Results of testing for this reported period is currently still being analysed and will be included in the final report for the entire project, planned for in 2015.

Five manuscripts related to the work done with PiHP were accepted for publication during the reporting period of January and July 2014.

Introduction

Diarrhoeal Illness

Diarrhoeal illness is a serious challenge to developing nations worldwide. Papua New Guinea (PNG) is not exempt from the impact of diarrhoeal illness. Diarrheal diseases are a major cause of morbidity and mortality in PNG. Most diarrhoeal illness is easily preventable with simple hygiene measures and treated with inexpensive treatment regimes. However, with only 40% of people in PNG having access to safe water supply and adequate sanitation (18), and access to treatment in some regional and remote areas of PNG limited, the burden of diarrhoeal diseases is high.

Recent work by the EEDU, including efforts supported by the PiHP, has increased our understanding of diarrhoeal aetiology in PNG (3-5, 7-11, 14). However much still needs to be done to fully understand diarrhoeal aetiology in Papua New Guinea, especially in young children. Sustainable build-up of capacity to provide accurate diagnosis and assist health workers in providing care and education to communities nation-wide is essential and is a critical output of the PiHP sponsored effort.

Febrile Illness

Febrile illness is one of the most common presenting symptoms among patients in hospitals and health centres in tropical developing countries, including PNG. Due to the large range of causes of febrile illness, diagnosis can be a challenge especially for poorly equipped health facilities. In locations where malaria is endemic, such

as PNG, febrile cases are usually tested for malarial parasites by either a rapid diagnostic test (RDT) or microscopy. Malaria is given priority due to its severity, especially in children. However, the use of either RDTs and/or microscopy is inconsistent in many PNG Aid Posts. Often fever is attributable to malaria regardless of whether objective diagnostic testing has been performed. However, there are many causes of fever, particularly in low-income tropical countries. Thus, PNGIMR continues to investigate the aetiology of febrile illnesses and in order to better understand and expand the knowledge base on febrile illnesses in Papua New Guinea (1, 6, 12, 13, 17).

Respiratory Illness

Respiratory illnesses in the form of acute lower respiratory infections (ALRI) continue to be the leading cause of mortality and morbidity worldwide. This is reflected in PNG, where ALRI is the most common cause of hospitalizations in children under 1 year of age (16).

Respiratory illness in Papua New Guinea has been well characterised by recent publications (2, 15).

Methods and Materials

Continued testing of retrospective samples using new assays

Retrospective samples have been used to set up assays for the detection of various pathogens. These samples continue to play a critical role and will be used for the set-up of new assays currently under development by PNGIMR. Assays that will be tested for include soil transmitted helminths, enteric protozoa and various other neglected pathogens.

Development of new assays

New assays are continuously being developed and include expanding the PNGIMR panel for detection of febrile illnesses and enteric parasites, e.g., soil transmitted helminths (hookworms, roundworms, tapeworm, *Strongyloides*) and enteric protozoa (*Giardia* and *Cryptosporidium*).

Collection and testing of samples from iHDSS sites

Samples were collected from health clinics participating in the PiHP iHDSS. Patients presenting to the clinics with febrile illness over 38°C were tested for malaria using a commercial RDT. Regardless of the result, a blood sample was taken for further analysis. If the febrile patient was also showing respiratory symptoms, a nasal swab sample was taken for respiratory pathogen screening. Patients presenting to the health clinics with a

diarrhoeal illness were asked to provide a faecal sample. If a patient presented with a combination of symptoms (e.g. febrile illness with diarrhoeal and respiratory symptoms) then multiple samples were requested. All of the required sampling materials were provided by PNGIMR including detailed information sheets that health-care practitioners were asked to complete.

Collection and transport of stool samples

Case definition of diarrhoea - the passing of three or more loose stools, which take the shape of the container, in a 24-hour period.

Self-collected stool specimens were obtained from patients presenting to participating iHDSS clinics with acute diarrhoea meeting the case definition. Specimens were labelled appropriately and linked to the iHDSS Morbidity Case Forms for identification of clinical history. Samples were stored at 4°C and transported to the PNGIMR laboratories for further analysis.

Bacterial stool culture and microscopic examination for parasitic pathogens were conducted according to standard procedures. Nucleic acids were extracted from the stool samples using the Qiagen Stool kit and molecular analysis using real-time PCR was conducted for the enteric pathogens listed in Table 5-1.

Collection and transport of blood samples

Case definition of a febrile illness - a current fever of ≥38°C, OR reports a fever over the past 2 days (but not more than 2 weeks).

Blood samples (8-10ml for adults; 1-5ml for children) and blood culture bottles were collected from patients presenting to participating iHDSS clinics who met the case definition of a febrile illness. Specimens were labelled appropriately and linked to the iHDSS Morbidity Case Forms for identification of clinical history. Blood samples were stored at 4°C and inoculated culture bottles at room temperature. Both samples and culture bottles were transported to PNGIMR laboratories for further analysis.

Blood culture samples were analysed using standard procedures in the BACTEC. Serum was removed from blood samples and nucleic acids were extracted using the Qiagen DNeasy Blood and Tissue kit. Molecular analysis using real-time PCR was conducted for the febrile pathogens listed in Table 14.

Collection and transport of respiratory samples

Case definition of an acute lower respiratory illness - a history of fever OR measured fever of ≥38°C, AND cough, AND shortness of breath or difficulty breathing. Nasopharyngeal swabs were collected from patients presenting at participating iHDSS clinics meeting the case definition of an acute lower respiratory illness. Specimens were labelled appropriately and linked to the iHDSS Morbidity Case Forms for identification of clinical history. Samples were stored at 4°C and transported to PNGIMR laboratories for further analysis. Nucleic acids were extracted from the nasopharyngeal samples using the QIAamp Viral RNA Minikit and tested by real-time PCR for the respiratory pathogens listed in Table 1-6.

Table 5-1 Real-time PCR assays adopted and evaluated for Sentinel Surveillance, iHDSS, 2014

Disease	Pathogens	Sample type
Enteric illnesses		
Cholera	Vibrio cholerae	Stool sample
Shigellosis	Shigella spp	Stool sample
Salmonellosis	Salmonella spp	Stool sample
Campylobacteriosis	Campylobacter spp	Stool sample
Travellers' diarrhoea/ Paediatric diarrhoea	Pathogenic *E. coli* (EPEC/ETEC)	Stool sample
Rotavirus	Rotavirus	Stool sample
Other enteric viruses	Adenovirus, Norovirus (GI and GII), Astrovirus, Sapovirus	Stool sample
Febrile illnesses		
Dengue fever	Dengue viruses (DENV1-4)	Blood sample
Murray Valley encephalitis	Murray Valley encephalitis virus	Blood sample, CSF
Japanese encephalitis	Japanese encephalitis virus	Blood sample, CSF
Chikungunya fever	Chikungunya virus	Blood sample
Ross River fever	Ross River virus	Blood sample
Typhoid fever	Salmonella typhi	Blood sample
Leptospirosis	Leptospira spp	Blood sample
Scrub typhus	Orientia tsutsugamushi	Blood sample
Influenza	Influenzavirus A and Influenzavirus B	NP swab
Other viral respiratory pathogens	Respiratory syncytial virus, parainfluenza virus, metapneumovirus, coronavirus, adenovirus, rhinovirus	NP swab
Vaccine preventable diseases		
Measles	Measles virus	Blood sample
Mumps	Mumps virus	Blood sample
Rubella	Rubella virus	Blood sample
Chicken pox	Varicella zoster virus	Blood sample
Diphtheria	Corynebacterium diphtheriae	Throat swab
Whooping cough	Bordetella pertussis	NP swab

Results

Diarrheal illness

Asaro

A total of 20 samples were collected from Asaro between January and July 2014. Sample testing by real-time PCR has not been completed at the time of report preparation. Microscopy analysis of stool samples showed some had presence of parasites; five samples had *Strongyloides* spp., three had *Ascarislumbricoides* and four had *Schistosoma* spp. Parasite co-infection observed were one *Strongyloides* spp./*Schistosoma* spp., and one *A. lumbricoides*/*Schistosoma* spp. Total number of stool samples collected since collection started in Asaro up to July 2014 is 35.

Hides

Sample collection in Hides started in September 2013.No samples were received at the Port Moresby laboratory between January and July 2014. Total number of samples collected up to July 2014 from Hides stands at 21.

Hiri

Sample collection in Hiri started in September 2013. A total of 33 stool samples were collected from the study site. Of the 33 samples, nine (27.3%) had rotavirus, seven (21.2%) had norovirus genotype 2, two (6%) had adenovirus, 14(42.4%) had *Shigella* spp., one (3%) had *Salmonella Typhi*, seven (21.2%) had *Campylobacter* spp. and two (6%) had *Vibrio cholerae*. Co-infections observed were four *Shigella* spp./*Campylobacter* spp. one norovirus genotype 2/adenovirus/*Shigella* spp., one *Shigella* spp./*Vibrio cholerae*, one rotavirus/*Shigella* spp., one *Shigella* spp./*Campylobacter* spp., one norovirus genotype 2/*Shigella* spp./*Campylobacter* spp., one norovirus genotype 2/Shigella spp., one rotavirus/norovirus genotype 2/*Vibrio cholerae* and two rotavirus/norovirus genotype 2. Total number of samples collected in Hiri since collection began up to July 2014 is 51.

Karkar

Sample collection on Karkar Island started in December 2013. Seven stool samples were collected from Karkar Island for diarrhoeal illness between January and July 2014.Samples from Karkar Island will be batch tested.

Febrile illness

Asaro

Forty-four blood samples were collected from Asaro for febrile illness between January and July 2014. The total number of febrile illness samples collected from Asaro since the start of the project is 99. Sample testing by molecular assay is still ongoing.

Hides

Sample collection started in September 2013. One blood sample was collected from Hides and was negative for all pathogens tested. No additional samples collected up to July 2014.

Hiri

Sample collection started in September 2013. Ninety blood samples were collected in Hiri between January and July 2014 bringing the total of samples collected to 102 samples. Sample testing by molecular assay is currently ongoing.

Karkar

Sample collection on Karkar Island started in December 2013. Total of 96 samples were collected between January and July 2014. Total of 101 samples collected from Karkar Island up to January 2014. Sample testing is currently ongoing.

Respiratory illness

No respiratory samples were collected from the sites between January and July 2014. As reported in previous reports, respiratory sample collection has been stopped as the current carriage rates and circulating respiratory pathogens are well understood in PNG. Current surveillance work on respiratory pathogens by EEDU, as part of the National Influenza Centre effort, is focused more on outbreak prone respiratory pathogens.

Discussion

Sample collection had increased significantly for febrile surveillance (serum). All sites except for Hides will achieve the minimum of 100 samples per site by closure of the sub study at end of 2014. However stool sample

collection remains low due to (i) lack of proper toilet facilities at Gaubin hospital on Karkar Island and (ii) cultural taboo of giving away body waste.

Sample collection in Hides has completely stopped since the beginning of the year. However, a trip to Hides for sample collection over a 2-week period in the second half of 2014 was conducted to facilitate disease surveillance at this site. Samples collected from this trip will be reported on in the next SS report for August to December 2014, which will also be the final report to be submitted for the sub-study.

Sample collection will continue until 31st October 2014. This is to allow for all samples to arrive at their respective testing laboratories before December 2014 and enough time for testing and analysis to happen before PiHP funding concludes.

Testing for January to July 2014 is still ongoing for all sites. PNGIMR does not feel it is advisable to report partial, small sample size findings as it would not give a true representation of the actual disease aetiology(ies) being investigated. The reporting of test results and ensuing analysis will be done at end of the study together with the samples still to be collected between August and November 2014.

Vibrio cholerae detected in Hiri were determined to not be carrying the cholera toxin (CTX pro-phage). The significance of this is that the *V. cholerae* detected are dissimilar to the strain that caused the outbreak in PNG in 2009 to 2011. They can however cause diarrhoea in individuals.

Publications

A total of five new papers were submitted and currently in press since the start of the year. A sixth paper listed in the last report as in press, Kono et al, was published this year.

Soli KW, Maure T, Kas MP, Bande G, Bebes S, Luang-Suarkia D, Siba PM, Morita A, Umezaki M, Greenhill AR, Horwood PF. Detection of enteric pathogens associated with paediatric diarrhoea in Goroka, Papua New Guinea. *Int J Infect Dis*. In Press.doi: 10.1016/j.ijid.2014.02.023.

Greenhill AR, Guwada C, Siba V, Michael A, Yoannes M, Wawarie Y, Ford R, Siba PM, Horwood PF. Antibiotic resistant *Shigella* is a major cause of diarrhoea in the Highlands of Papua New Guinea. *J Infect Dev Ctries*. In Press.

Benny E, Mesere K, Pavlin B, Ford R, Yoannes M, Kisa D, Abdad M, Greenhill A, Horwood P. A large outbreak of shigellosis commencing in an internally displaced population, Papua New Guinea. Submitted to *Western Pac Surveill Response J*. In Press.

Horwood PF, Karl S, Mueller I, Jonduo MH, Pavlin BI, Dagina R, Ropa B, Bieb S, Rosewell A, Umezaki M, Siba PM, Greenhill AR. Spatio-temporal epidemiology of the cholera outbreak in Papua New Guinea, 2009-2011. Submitted to *BMC Infectious Diseases*. In Press.

Roth A, Hoy D, Horwood PF, Ropa B, Hancock T, Guillaumot L, Rickart K, Frison P, Pavlin B, Souares Y. 2014. Preparedness for threat of chikungunya in the Pacific. *Emerging Infectious Diseases.* 20(8): online report - http://wwwnc.cdc.gov/eid/article/20/8/13-0696_article

Kono J, Jonduo MH, Omena M, Siba PM, Horwood PF. 2014. Viruses associated with influenza-like-illness in Papua New Guinea, 2010. *Journal of Medical Virology*.86(5): 899-904.

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3. Greenhill, A, Rosewell, A, Kas, M, Manning, L, Latorre, L, Siba, P and Horwood, P (2012) Improved laboratory capacity is required to respond better to future cholera outbreaks in Papua New Guinea. *Western Pacific Surveillance and Response*,**3;** 016.

4. Greenhill, AR, Guwada, C, Siba, V, Michael, A, Yoannes, M, Wawarie, Y, Ford, R, Siba, PM and Horwood, PF Antibiotic resistant *Shigella* is a major cause of diarrhoea in the Highlands of Papua New Guinea. *Journal of Infection in Developing Countries***;** In Press.

5. Horwood, P and Greenhill, A (2012) Cholera in Papua New Guinea and the importance of safe water sources and sanitation. *Western Pacific Surveillance and Response*,**3;** 014.

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7. Horwood, PF and Greenhill, AR Cholera in Papua New Guinea: observations to date and future considerations. *Papua New Guinea Medical Journal***;** In Press.

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6. CHAPTER 6 MATERNAL AND NEWBORN HEALTH

Abstract

The rates of maternal and neonatal mortality are high in Papua New Guinea (PNG).In the country, 60-78% of women receive antenatal care butonly37% of births are supervised by a skilled birth attendant. Unsupervised, non-health facility birth is a contributory factor towards poor health outcome of both the mother and her infant. The overall aim of the Maternal and Infant Health survey was to (i) estimate the prevalence and causes of maternal morbidity; (ii) the uptake of maternal and infant health services; and (iii) to investigate women's perceptions and experiences of pregnancy and childbirth in three of the four iHDSS locations, i.e., Hiri, Asaro, and Karkar. Study activities in Hides could not be executed due to a combination of security, logistics and cost issues.

Findings 482 women were surveyed about their most recent pregnancy in Hiri, Karkar and Asaro. Almost three-quarters (71%) of women presented for care in their second trimester and 69% of all women attended antenatal care for the recommended minimum of four visits. Overall, the antenatal care received did not meet the minimum standard requirements, as outlined by the PNG National Department of Health guidelines for antenatal care. Opportunities to monitor for risk factors in pregnancy were missed, including the opportunity to monitor for anaemia, test for HIV and syphilis and provide preventative health care including provision of mosquito nets and tetanus toxoid immunization. In total, 64% of women gave birth at a health facility, but only 89% of these were attended by a health care worker; 8% gave birth assisted by a relative or friend and 3% of women gave giving birth alone at the health facility. Of the women who gave birth out of a health facility, 52% chose to do so with the remainder doing so because they were unable to reach a health facility due to labour progressing too quickly or because of financial and transport difficulties. One third of women mentioned danger signs in pregnancy with fever, swelling of the lower limbs and bleeding the most frequently mention problems. Almost two-thirds (60%) of women knew any danger signs in the newborn, with fever being the most commonly mentioned danger sign followed by infant crying too much. The majority of neonates (72%) were breast fed either immediately or within the first two hours following birth, a practice important for a safer outcome for the neonate, especially given the high proportion of low birth weight infants.

Background

Maternal health refers specifically to the health of women surrounding pregnancy and childbirth, i.e., antenatal care and care during childbirth and the postnatal period. Provision of antenatal care and births attended by skilled birth attendants impacts the survival of both the mother and her infant [1].

Despite a global decline in the maternal mortality ratio (MMR), every year an estimated 292,982women die as a result of pregnancy and childbirth [2] - 99% of these deaths occur in developing countries, the majority in rural areas with the poorest and most remote areas bearing the burden. It is estimated that 88-98% of all maternal deaths could be avoided [3] with many deaths occurring due to poor service provision and lack of access to and use of available services. An estimated 50%-70% of all maternal deaths occur in the postpartum period6- 45% within the first 24 hours following birth [3]. Postpartum haemorrhage is the leading cause of maternal mortality [3].

A maternal death is frequently accompanied by either a stillbirth or early neonatal death. Every year an estimated 2.6million infants are stillborn [4]; nearly one million of these stillbirths occur during labour [5]. Four million newborn babies die – 3million within the 1st week of life; 1million within the first 24hours after birth [6,7]. Preterm birth7and low birth weight (LBW8) are important risk factors for neonatal mortality. The majority of the 13million preterm births that take place every year, occur in low-middle income countries; 16% of infants in the developing world have LBW. LBW infants are 20 times more likely to die than heavier babies; 60-80% of all neonatal deaths occur in LBW infants.

Factors associated with maternal death are well documented and there is widespread agreement of the clinical interventions that could avert many maternal and peri-natal deaths. If the MMR in developing countries is to be reduced there is a need for increased attention to improved health care for women, including provision of high quality care during pregnancy and childbirth, including emergency obstetric care[8]. There is a critical need to ensure that all births are attended by skilled health professionals working within a functional health system. Timely management and treatment can make the difference between life and death. In many developing countries, the health system is weak and cannot adequately respond to the health needs of mother and neonate due constraints including inadequate skilled attendants, lack of equipment, medications and supplies and a poor referral system.

Poor women in remote areas are the least likely to receive adequate health care during pregnancy and childbirth. These women are more likely to give birth at home, often in rural settings, and are largely assisted by a family member or a traditional birth attendant (TBAs).

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[6]The postpartum period: the period of time from approximately one hour after delivery of the baby up to 42 days after the birth of the infant.

[7] Pre-term delivery - delivery before 37 completed weeks of pregnancy

[8] Birth weight less than 2.5 kg at delivery

Maternal and infant health in PNG

The social and geographical diversity, together with poor infrastructure can mean substantial barriers and constraints, especially in terms of provision of health care for many people in Papua New Guinea (PNG). Accurate estimations of morbidity and mortality in PNG are hampered by insufficient surveillance and reporting systems[9]; the overall health status of Papua New Guinean people is reported to be the lowest in the Pacific region.

Health indicators for maternal and neonatal health in PNG are poor. Between 60-78% of women receive any antenatal care (ANC) from a health professional[10,11] with just over half of all women receiving the recommended four antenatal visits [12]. Tetanus Toxoid coverage for pregnant women is 69%[10] which is a reflection of poor health service provision[9], leaving a large proportion of women and their unborn infants unprotected against tetanus.

PNG has the second highest MMR in the Asia-Pacific region and one of the highest in the world with an estimated 584 deaths per 100,000 live-births[2], a figure attributable to deterioration in rural health services coupled with poor uptake of available health services[9]. Only 37% of births are attended by a health professional[13]; 7% of women giving birth at home are attended by a relative; 4% by a village birth attendant and 7% report giving birth alone. Complications during childbirth, including prolonged labour, excessive bleeding and convulsions are high[10]. Unsupervised, non-health facility births are a certain contributor to the poor health outcomes for both the mother and her infant[14].

While improvements have been seen in the Under-5 mortality rates in PNG, the neonatal mortality rate (NMR) remains relatively unchanged and high at 29 per 1,000 live births[10]. In rural facilities, neonatal sepsis is one of the leading causes for admission accounting for 3.3% of all admissions; it is also one of the leading causes of mortality, accounting for 7.8% of all deaths in rural facilities in 2008 [12]. In PNG, 10% of infants are of low birth weight, a significant risk factor for poor neonatal outcome, including mortality.

PNG is a signatory to the Millennium Development Goals (MDGs). While indicators towards MDG4 (reduce child mortality) are slowly improving, MDG5 (improve maternal health) is lagging behind and PNGs commitment to achieving progress towards MDG5 is clearly under threat[9]. There is an urgent need to focus and prioritise maternal and child health (MCH) in PNG to work towards achieving the MDGs. While the wider issue of health systems is addressed, there is a need to address what can be done for women and their infants at the local level. Considering the geographical and cultural diversity in PNG and access, uptake and availability of professional skilled health care during pregnancy, childbirth and the postpartum period, research that

highlights specific constraints and problems women experience could add valuable information to this much needed area of health.

One of the overarching aims of the PNG LNG Partnership in Health Project (PiHP) is to monitor the impact of the PNG LNG project on the health of the population in four sites – the two impact and two control communities. The PiHP has provided an ideal platform for further research allowing the opportunity to gain specific information relating to maternal and infant health in each of the four study sites. The opportunity has allowed the research team to obtain information relating to barriers in accessing maternal and child health services and provides insight into current beliefs, practices and experiences surrounding pregnancy, childbirth and the postpartum period.

As a sub-study of this wider PiHP, the overall aim of the Maternal and Infant Health survey is to estimate the prevalence and causes of maternal morbidity; the uptake of maternal and infant health services; and to investigate women's perceptions and experiences of pregnancy and childbirth at three sites in Papua New Guinea (PNG).The primary and secondary objectives of this study are detailed below.

Primary Objectives

1. To estimate the prevalence of maternal morbidity (adverse health outcomes during pregnancy, labour, birth and the postnatal period);
2. To estimate the proportion of women who have births supervised by a skilled birth attendant.

Secondary Objectives

1. To identify women's experiences of antenatal care and their adherence to the advice and treatment provided;
2. To identify where women give birth and the decision-making processes relating to place of birth;
3. To explore women's experiences, perceptions and beliefs surrounding place of birth;
4. To identify factors that hinder women's access to health care services during pregnancy, labour and birth, and the postnatal period;
5. To identify women's experience and knowledge regarding care of the newborn.

Methodology

A sampling framework was developed following the completion of the demographic and health survey in three of the four surveillance sites (Central, Eastern Highlands and Madang). This cross sectional survey was conducted among 482 women aged 15–44 years in the three demographic surveillance sites: Hiri district

(Central Province), Karkar, (Madang Province) and Asaro (Eastern Highlands Province). The survey took place following the baseline demographic surveillance, and subsequent follow-up survey phase. The survey was conducted among women who have given birth within the time frame of the PiHP (2010 to 2014) and who are registered in the census with individual identity numbers within the PiHP demographic surveillance database. In order to reduce the risk of recall bias, we initially identified women based on their report of being pregnant at the most recent demographic update, that is, those reporting being pregnant during late 2012 and early 2013.In order to reach our sample size it was necessary to extend the sample size to women who had given birth during 2011 and 2010, but who still met the criteria for having individual identity numbers within the PiHP demographic surveillance database.

Women selected for inclusion were visited in the community by a trained member of the IMR research team who gained consent following completion of study-specific informed consent procedures. Participants were interviewed in *Tok-Pisin*using a piloted, study-specific semi-structured questionnaire. Interviews took place in the women's own home, unless they requested for it to be undertaken elsewhere. Each interview took between 20-40 minutes to complete. Data collection took place between September2013 and May 2104.

All surveys were completed using the iHDSS identity number. No subject names or other identifiers were recorded or stored in the same database as the completed survey forms. All surveys were entered into an MS Access database by members of the PiHP project data entry team. All data were cleaned by the data manager prior to extraction in an excel spreadsheet for analysis.

This report highlights the key findings from this survey. A brief description of the data is provided, by each site and all sites combined. Detailed analysis will be available for the next progress report in March 2015.

This study was approved by the Medical Research Advisory Committee (MRAC) in Papua New Guinea and from the Behavioural & Social Sciences Ethical Review Committee (BSSERC) at the University of Queensland (UQ) in Australia.

Findings

A total of 541 women were identified in Hiri (200); Karkar (216) and Asaro (125) and 482 women were surveyed: Hiri (173); Karkar (204) and Asaro (105). The 59 women were excluded due to refusal to participate, lack of study identity number or incomplete data collected.

Socio-demographic history

Just over half of the women surveyed (58%) were aged between 20-29 years; 26 women (6%) were aged 15-19 years (Table 6-1) Seventeen women (3%) did not know their age. Most women (93%) were married or living as married and89% of women reported their occupation as housewife/ carrying out house hold duties. Twenty-two women(12%)from Hiri district reported being in paid employment, the majority of these employed either through the PNG LNG project or the PiHP/PNG IMR programme. In Karkar and Asaro only two women (1%)– one at each site reported being in paid employment. In Hiri,54% reported secondary education compared to 19% in Karkar and 12% in Asaro. Twelve women (2.5%) reported having attended technical college, vocational or tertiary level education or university; the three women who reported having attended university were all from Hiri. No women in Asaro reported higher than a secondary education (Table 6-1).

Obstetric history

Just over half of the women (51%) had given birth once or twice previously; 17.5% had given birth five times or more. Most women had given birth in either 2013 (41%) or 2012 (31%); 3.5% had given birth in 2010 (Table 6-2). The data presented in this chapter relates to each woman's most recent birth experience.

Antenatal care

Overall, 459 (95%) of women reported that they attended for antenatal care during their most recent pregnancy. Karkar had the highest proportion of women not attending for ANC – 16 women (8%) did not attend for any antenatal care compared to 2 (1%) and 5 (5%) respectively for Hiri and Asaro.

Of those who attended for antenatal care, 440 (96%) reported when they first attended antenatal clinic. Of these women, 74%attended antenatal clinic for the first time during their second trimester of pregnancy. Only 3% attended in the first trimester. Women in Karkar were more likely to present for antenatal care in the third trimester, compared with the other two sites (Table 6-3). Of the 430 (94%) women who reported on the number of antenatal visits they attended, 72% attended antenatal clinic four or more times. A slightly higher proportion was seen in the women from Hiri, compared to Karkar and Asaro. Most women attended antenatal clinic at the health centre or aid post (data not shown).

No woman received the full range of antenatal care at any site. Most women had their blood pressure checked (89%), an abdominal palpation (95%) and auscultation of the fatal heart (94%) with similar rates seen in all three sites. Only half of all women reported having any blood test Table 6-4. Women were more likely to be

tested for HIV and Syphilis than to have haemoglobin estimation. Of the women who had a blood test, 40% reported that they did not know what the blood test was for.

Coverage for tetanus toxoid, malaria prophylaxis and provision of iron supplements was around 80% for all sites. Women in Karkar were less likely to receive a tetanus toxoid immunization compared with Hiri and Karkar. Women frequently stated that they did not take all the tablets provided, often because they did not feel they were necessary or because the tablets made them feel nauseated (data not shown). Just over half (53%) of all women received a mosquito net, but only 47% of the women in Karkar reported receiving one. Most women were asked about their general health during their antenatal consultation (79%); 80%were advised about where to give birth Table 6-5.

Last birth experience

Most women (98%) reported a normal, vaginal birth; two had caesarean sections and two had assisted vaginal births. Nine women gave birth to twins; one from Hiri, five from Karkar and three from Asaro. There were a total of 489 live births among the study population. Two women reported stillbirths –one each from Hiri and Karkar. Both women gave birth in the home; both infants were born at full-term, that is, between eight and nine months gestation. There were two early neonatal deaths reported in Asaro – one home birth and one born at hospital following a cord prolapsed.

Overall, 308 women (64%) gave birth in a health facility; 59% in hospital and 40% in a health centre. There was one birth at an aid post. Of the 308 women who gave birth in a health facility, 89% were assisted during their birth by a health care worker; 20 women (6%) were assisted by a relative or friend at the facility; and 10 women (3%) gave birth alone. A small number of women (8/173;7%;) who gave birth at hospital gave birth alone, a health care working tending them after the birth of the baby, to cut the umbilical cord.

Of the 174 (36%) women who gave birth in the community, 84% gave birth in their own home (Table 6-6). Most women (73%) were assisted by a female family member or a friend; 11% were assisted by a village birth attendant. About half of the women who gave birth at home chose to do so. Many women stated that they gave birth at home because it was convenient and their choice. However, for some women there was more than one reason to give birth at home, including: things were progressing too quickly; not enough time to get to a facility; lack of money for hospital fees and transport; lack of transport. A few stayed at home because they were afraid of the health care workers- either because of a fear of exposing their body or because they had not attended antenatal care and were afraid of being scolded. Other women mentioned they did not have a guardian to take care of them at the facility or there were no relatives to take care of other children in the home, hence their

reason for staying back. Eight women (4.5%) gave birth while trying to reach a health facility; two gave birth in vehicles, one gave birth on the beach while waiting for a vehicle; one gave birth just outside the family home; two gave birth on the roadside and two gave birth outside the health centre.

Problems experienced during pregnancy and childbirth

Overall there were 217 reported problems among the 482 women. Some women reported more than one problem. There were 116 (53%) reports of a problem during the pregnancy; 55 (25%) problems occurred during labour and 46 (21%) postpartum problems were reported. The most commonly reported problems were headache, oedema and dizziness; prolonged labour and excessive bleeding postpartum (Table 6-7).

Knowledge of danger signs in pregnancy and childbirth

One third of women (160; 33%) mentioned 283 danger signs in pregnancy and childbirth; some knew two or more danger signs. Many women knew these signs from personal experience or had been told by a female relative (usually an aunty). Some had learnt them through attending the antenatal clinic. Fever was the most frequently mentioned danger sign, followed by swelling of the limbs and bleeding in pregnancy (Figure 6-1).

Neonatal outcome and care

There were 489 live births. Gestation at birth was reported for 475 of the pregnancies (98%). Most infants were born after 8-9 months of completed pregnancy; 7% were born between 6-8 months of completed pregnancy. Birth weights were only available for 340 (70%) infants. Most births weights were missing among the infants born at home. Of the 340 infants for whom birth weight was recorded, 13.5% were of low birth weight; 148 (43.5%) weighed between 2.5-3 Kg (Table 6-8). In relation to breast-feeding, data were not recorded for 29 (6%) infants and 5 infants (1%) were never breast-fed. Of the remaining 455 infants, nearly half (49%) were breast fed immediately following birth. A further 133 (29%) were breast fed within 1-2 hours after birth. 41 (9%) infants were not fed for more than 6 hours after their birth.

Recognising danger signs in the newborn

Overall 297 (66%) women knew some danger signs in the newborn; 78% of these knew two or more danger signs. The most frequently mentioned danger sign was fever, followed by ‘crying too much’. Overall, women’s knowledge of danger signs was frequently due to past experience of sick infants.

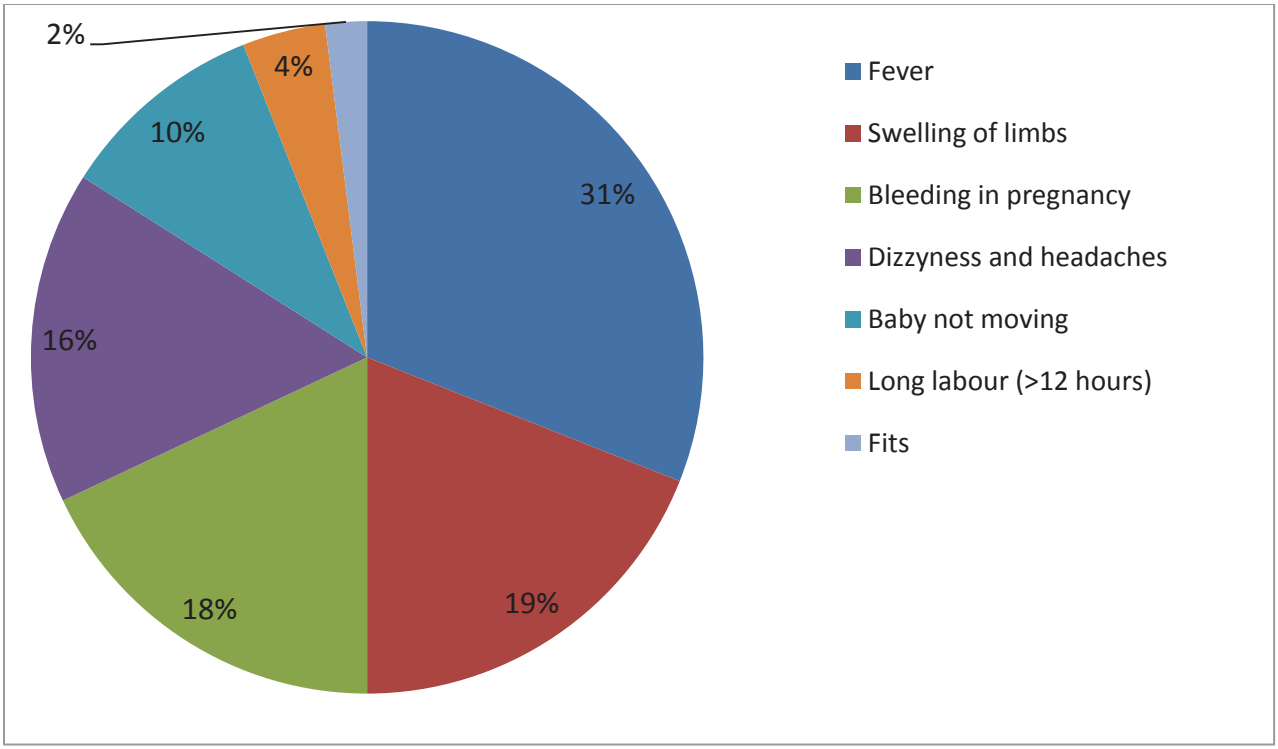

Figure 6-1 Women's knowledge of danger signs in pregnancy and childbirth (n=283)

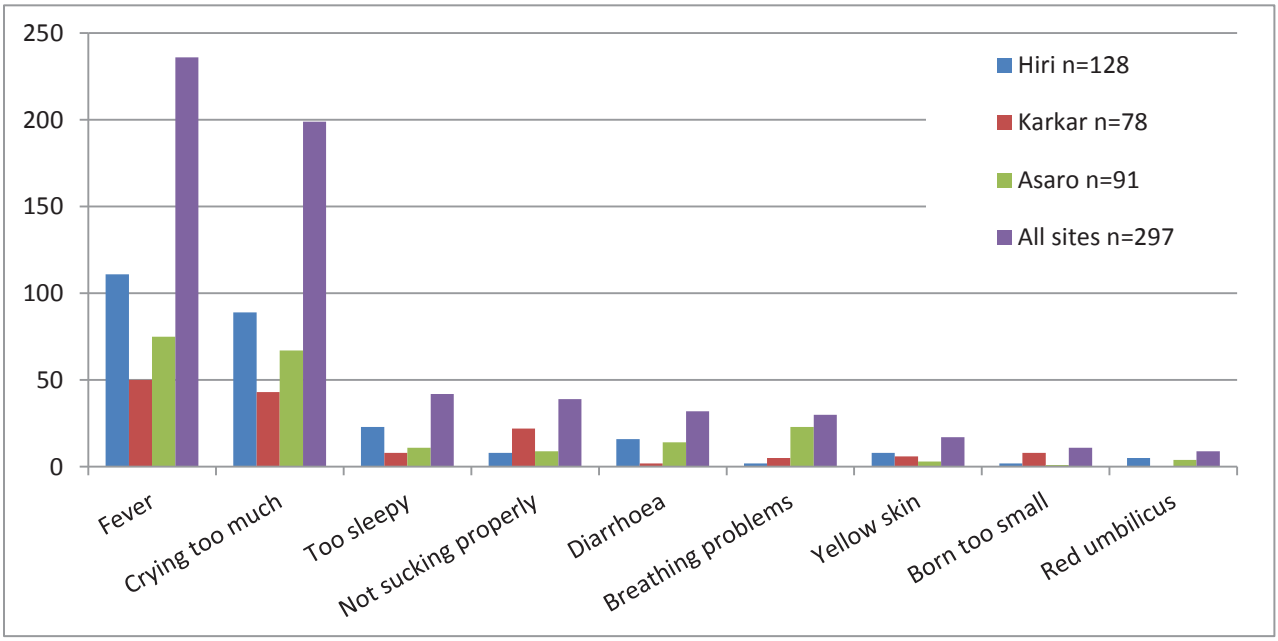

Figure 6-2 Newborn danger signs, by site, iHDSS 2014

Discussion

The majority of women who participated in this survey had given birth in the previous year to 18 months. While the study highlights that most women do attend for some antenatal care (96%),the majority do attend for the

recommended minimum of 4 visits (72%),but nearly one quarter of women present late for their first antenatal visit. There are differences noted between the three sites for both presentation for first antenatal visit and subsequent visits, with more women in Hiri reporting an earlier presentation for antenatal care and more visits compared with the other two sites. This may be due to their overall education level or due to access to the health facilities. Further analysis of this data set is required to identify any significant factors and differences relating to these areas of antenatal care.

Overall the standard of antenatal care does not meet the minimum standard requirements, as outlined by the PNG National Department of Health National guidelines for antenatal care. Across the various areas of care, our findings suggest that women are not receiving the full range of antenatal care services in these three sites. The opportunity to monitor for risk factors in pregnancy, including pre-eclampsia, anaemia, HIV and syphilis are being missed. In addition, women and their unborn infant are at increased of pregnancy complications, such as malaria, due to limited issuing of mosquito nets and anti-malarial medications. The opportunity to provide women and their families with valuable health education about the importance of supervised births is also not being exploited fully.

Conclusion

Nearly two thirds of women (64%) are choosing to attend a health facility to give birth. However, some are giving birth alone in those facilities or with only the support of a family member. Many women giving birth in the community wished for a health facility birth but were hindered from reaching the facility because the labour progressed too quickly or because of financial and transport difficulties.

Nearly half of all women surveyed (45%) reported having experienced a problem during their last pregnancy or during childbirth. Most women experienced these problems during the pregnancy. Further analysis of the data is required to identify these complications and compare to uptake of antenatal care and place of birth.

Women’s knowledge relating to both danger signs in pregnancy and childbirth and danger signs in a newborn infant tended to relate to personal experience, or was learnt from a family member.

Women were more likely to know danger signs in a newborn than in pregnancy and childbirth. Fever was the danger sign most frequently reported for both infants and pregnant women. Further analysis of the data could highlight differences between women’s educational level, parity, and knowledge of danger signs.

Three quarters of neonates were breast fed within the first couple of hours following birth, a practice important for a safer outcome for the neonate, especially given the proportion of low birth weight infants. Higher rates of low birth weight were noted in Karkar and Hiri when compared to Asaro.

Table 6-1 Socio-demographic data (n= 482 women), iHDSS, 2014

		Hiri N=173		Karkar N=201		Asaro N =91		All sites N= 465	
		n	%	n	%	n	%	n	%
Age n= 465	15-19	12	7	14	7	-	-	26	6
	20-24	50	29	54	27	29	32	133	28
	25-29	59	34	58	29	21	23	138	30
	30-34	32	18	39	19	27	30	98	21
	35-39	16	9	24	12	6	6	46	10
	40+	4	2	12	6	8	9	24	5
Marital status n = 480		Hiri N=173		Karkar N=202		Asaro N =105		All sites N= 480	
		n	%	n	%	n	%	n	%
	Married	165	95	181	89	100	95	446	93
	Single	7	4	3	1	-	-	10	
	Separated	1	1	16	8	4	4	21	4
	Widow	0	0	2	1	1	1	3	0.5
Employment n=482		Hiri N=173		Karkar N=204		Asaro N =105		All sites N= 482	
		n	%	n	%	n	%	n	%
	No paid job	6	3	1	0.5	-	-	7	1.5
	Subsistence farmer	-	-	21	10	2	2	23	5
	HH duties/housewife	145	84	181	89	102	97	428	89
	Teacher	1	1	1	0.5	-	-	2	0.5
	Security guard	1	1	0	-	-	-	1	0.5
	Health care worker	-	-	0	-	1	1	1	0.5
	Other	20	12	0	-	-	-	20	4
Educational level n=482		Hiri N=173		Karkar N=204		Asaro N =105		All sites N= 482	
		n	%	n	%	n	%	n	%
	No formal education	1	1	2	1	14	13	17	3.5
	Primary school only	71	41	158	77	78	74	307	64
	Secondary school	94	54	39	19	13	12	146	30
	Technical college	-	-	5	2	-	-	5	1
	Tertiary/ vocational level	4	2	-	-	-	-	4	1
	University level	3	2	-	-	-	-	3	0.5

Table 6-2 Obstetric history (n=482 women), iHDSS, 2014

		Hiri N=173		Karkar N=204		Asaro N =105		All sites N= 482	
		n	%	n	%	n	%	n	%
Previous pregnancies	1	51	29.5	59	29	21	20	131	27
	2	49	28	48	23.5	20	19	117	24
	3	30	17	35	17	22	21	87	18
	4	18	10.5	28	14	18	17	64	13
	5	12	7	18	9	12	11	42	9
	>5	13	7.5	16	8	12	11	41	8.5
Year of most recent birth	2014	0	-	0	-	7	6.5	7	1.5
	2013	74	43	88	43	37	35	199	41
	2012	53	31	53	26	43	41	149	31
	2011	44	25	50	24.5	16	15	110	23
	2010	2	1	13	6.5	2	2	17	3.5
Location of most recent birth	Health Centre/Hospital	116	67	118	58	74	70	308	64
	Village	57	33	86	42	31	30	174	36
Type of birth	Normal/ Vaginal	167	97	202	99	105	100	474	98
	Caesarean section	5	3	1	0.5	-	-	6	1.2
	Other- vacuum extraction	1	1	1	0.5	-	-	2	2
Outcome of infant	Live births	173*	-	208*	-	108*	-	489	-
	Stillbirths	1	1	1	0.5	-	-	2	0.5
	Neonatal deaths	-	-	-	-	2	2	2	0.5
*Twin births – 1 set Hiri, 5 sets Karkar, 3 sets Asaro									

Table 6-3 ANC last pregnancy (n= 459/482; 95%)

		Hiri N=170		Karkar N=179		Asaro N=91		All sites N=440	
		n	%	n	%	n	%	n	%
Gestation at 1st ANC	< 3 months	5	3	1	1	9	10	15	3
n=440 (96%)	3-6 months	135	79	121	67	70	77	326	74
	6-9 months	30	18	57	32	12	13	99	23
Number AN visits		Hiri N=168		Karkar N=177		Asaro N=85		All sites N=430	
n=430 (94%)		n	%	n	%	n	%	n	%
	1	7	4	8	4	2	2	17	4
	2	10	6	17	9	4	4	31	7
	3	22	13	36	19	12	12	70	16
	4	29	17	57	31	13	13	99	24
	>4	100	60	59	32	54	54	213	48
Care received at ANC		Hiri N= 171		Karkar N=188		Asaro N= 100		All sites N=459	
n=459		n	%	n	%	n	%	n	%
	Blood Pressure checked	156	91	162	86	90	90	408	89
	Urine test	37	21	24	13	8	8	69	15
	Any blood test	91	53	64	34	79	79	234	51
	Palpation	162	95	181	96	93	93	436	95
	Auscultation of fetal heart	161	94	176	94	93	93	424	92
	Checked for oedema	109	64	133	70	86	86	322	70
	Asked about general health	135	78	138	74	93	93	360	78
	Tetanus Toxoid given	151	88	145	77	84	84	373	81
	Malaria prophylaxis received	132	77	155	82	83	83	363	79
	Worm tablets	47	27	75	40	45	45	164	36
	Iron tables provided (fefol)	142	83	154	82	92	92	377	82
	Mosquito net provided	109	64	89	47	46	46	240	52
	Advised where to give birth	117	68	162	86	91	91	366	80

Table 6-4Blood tests at ante natal clinic (n=233/459)

	Hiri N=91		Karkar N=63		Asaro N=79		All sites N=233	
	n	%	n	%	n	%	n	%
Hb	5	5.5	1	1.5	2	2.5	8	3
HIV	13	14	20	32	3	4	36	15
HIV, syphilis	28	31	4	6	18	23	50	21
HB, HIV, Syphilis	17	18	-	-	20	24	37	15
HB,HIV	2	2	2	3	5	6.5	9	4
HB, syphilis	-	-	-	-	2	2.5	2	1
Don't know what the test was	26	32.5	36	57	29	37	91	40

Table 6-5 Health Facility births and supervision during childbirth(n= 308/482)

	Hiri N=116		Karkar N=188		Asaro N =74		All sites N= 308	
	n	%	n	%	n	%	n	%
Hospital	91*	79	60	51	33	44.5	184	59
Health centre	25	21	57	48	41	55.5	123	40
Aid Post	-	-	1	0.5	-	-	1	0.5
Assisted by Health worker	96	83	109	92	68	92	273	89
Assisted by other	9	7.5	8	7	3	4	20	6
Gave birth alone	8	7	-	-	2	3	10	3
Not known	3	2.5	1	1	1	1	5	2

*Includes one birth at a private hospital

Table 6-6 Births in the community (n= 174/482)

	Hiri N=57		Karkar N=86		Asaro N =31		All sites N=174	
	n	%	n	%	n	%	n	%
Gave birth in own home	49	86	71	82.5	27	87	147	84
Gave birth in others home	2	3.5	8	9	-		10	6
Other	2*	3.5	2**	2	4***	13	8	5
Not known	4	8	5	6	-		10	6
Assisted by female family member/ friend	36	63	67	78	24	77	127	73
Assisted by Village birth attendant	12	21	7	8	-	-	19	11
Assisted by husband	2	3	2	2	-	-	4	2
Assisted by nurse in community	1	2	2	2	-	-	3	1
Gave birth alone	1	2	8	9	7	23	16	9
Not known	5	9	-	-	-	-	6	3

*One gave birth in a truck on the way to the health facility/ one gave birth on the beach waiting for transport
**One gave birth outside the house/ one gave birth in a truck on the way to the health facility
***Two gave birth on the roadside on the way to the health centre/ 2 gave birth outside the health facility

Table 6-7Reported problems during pregnancy and childbirth – last pregnancy (N=217)

	Hiri N=86		Karkar N=104		Asaro N =27		All sites N= 217	
	n	%	n	%	n	%	n	%
Problems in pregnancy	58	67	42	40	16	14	116	53
Headaches, dizziness or oedema lower limbs	22	38	12	28.5	2	13	36	31
Abdominal or back pain	9	15.5	8	19	4	26	21	18
Malaria	6	10	7	17	4	26	17	15
Fever	4	7	5	12	1	6.5	10	9
Nausea and vomiting	2	3.5	7	17	-	-	9	8
High blood pressure	6	10	-	-	-	-	6	5
Other*	9	15.5	3	7	5	31	17	15
Problems in labour	17	20	33	32	5	5	55	25
Labour >12 hours	8	47	13	39	2	40	23	42
Breech	1	6	7	21	1	20	9	16
High Blood pressure	4	24	2	6	-	-	6	11
Obstructed labour	2	12	2	6	1	20	5	9
Bleeding before baby	1	6	3	9	1	20	5	9
Fits	-	-	5	15	-	-	5	9
Premature rupture membranes	1	6	-	-	-	-	1	2
Dizziness	-	-	1	3	-	-	1	2
Problems post-partum	11	13	29	28	6	6	46	21
Excessive bleeding after baby	6	55	17	59	4	66	20	43
Placenta took too long	3	27	9	31	-	-	8	17
Retained placenta	-	-	1	3	-	-	1	2
Other**	-	-	2	6	1	16	3	6.5
Not specified	2	18	-	-	1	16	3	6.5

*PV discharge (3), dysuria (5), anaemia (1), typhoid (2), PV bleeding (1), infected nipples(1),ovarian cyst (1), vomiting blood (1), diarrhoea (1), APH(1)

**Dizziness, prolapsed rectum

Table 6-8 Last born Infant(n=489 live births)

		Hiri N=173		Karkar N=197		Asaro N =105		All sites N= 475	
		n	%	n	%	n	%	n	%
Gestation at birth n=475	<6 months	1	0.5	-	-	-	-	1	0.5
	6-8 months	15	8	11	6	9	8.5	35	7
	8-9 months	152	87.5	169	86	91	87	412	87
	>9months	6	4	16	8	5	4.5	27	5.5
		Hiri N=165		Karkar N=116		Asaro N =59		All sites N= 340	
		n	%	n	%	n	%	n	%
Birth weight* n=340	<2.5 kg	19**	11.5	20**	17	7**	6	46	13.5
	2.5-3.0 kg	77	47	57**	49	14	13	148	43.5
	3.05-3.5kg	52	31.5	29	25	21	19	102	30
	3.05-4 kg	14	8	7	6	11	10	32	9
	> 4kg	3	2	3	3	6	5.5	12	4
		Hiri N=163		Karkar N=191		Asaro N =101		All sites N= 455	
		n	%	n	%	n	%	n	%
Breast feeding n=455	Immediately	113	69	86	45	23	22.5	222	49
	1-2 hours	14	8	66	35	53	52.5	133	29
	2-6 hours	17	10	27	14	15	14.5	59	13
	6-12 hours	4	2	5	3	5	4.5	14	3
	>12 hours	15	9	7	3	5	4.5	27	6

* Birth weight is based on all births, including twin birth; excludes the 2 stillbirths
**includes one set twins in each fie

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7. CHAPTER 7 HEALTHY PREGNANCY STUDY

Abstract

Preliminary findings from this study indicate that pregnant women experience an unacceptably high burden of sexually transmitted infections (STI) in Papua New Guinea. The burden of curable STIs (chlamydia, gonorrhoea and trichomonas) was particularly high. Overall, 44% of women attending antenatal clinics in Hiri, Hides and Asaro had one or more of these infections, with the highest burden observed in Hides (53% prevalence). More than 80% of these infections were asymptomatic and therefore would not have been identified and treated based on current national syndromic management guidelines. Prevalence of syphilis and HIV infection were also high (2.2% and 1.2% respectively for the three sites combined), and confirm the country's place among the highest burden nations worldwide for maternal syphilis infection. This study is also providing the country's first general population level estimates of human papillomavirus (HPV) type prevalence, and is expected to inform national policy on HPV vaccination and cervical cancer prevention.

Study Aims and Objectives

The overall Aim of this study is to investigate the epidemiology of HIV, human papillomavirus(HPV) and other sexually transmitted infections (STIs) among pregnant women attending antenatal clinics at three sites in Papua New Guinea.

The study has the following Research Objectives:

To provide the first robust estimates of *C. trachomatis, N. gonorrhoeae, T. vaginalis* and *Herpes simplex* type-2 (HSV-2) prevalence among pregnant women in PNG;

To provide the first general population estimates of human papillomavirus (HPV) prevalence among women in PNG in order to inform national policy on HPV vaccination;

To validate estimates of antenatal HIV and syphilis prevalence obtained through national antenatal surveillance;

To investigate the demographic and sexual behavioural correlates of HIV, HPV and STI risk among women attending antenatal clinics at these sites.

Introduction

Papua New Guinea (PNG) has among the highest prevalence of HIV, syphilis and other sexually transmitted infections (STIs) in the Asia-Pacificregion[1-8]. The HIV epidemic in PNG is primarily linked to heterosexual transmission, with over half of reported HIV diagnoses coming from three of its 22

provinces[5, 9]. Adult HIV prevalence is currently estimated at 0.9%[5], however prevalence of 12-17% have been reported among women and men who sell and/or exchange sex[10, 11] and antenatal HIV prevalence around 2.0% have been reported from several Highland provinces[9]. PNG is among 12 high-burden countries selected by the World Health Organization (WHO) for intensified support for the elimination of mother to child transmission of syphilis[2]. PNG also has one of the highest estimated burdens of cervical cancer globally, with an age-standardized incidence of 23.7/100,000, compared to 5.0/100,000 in Australia[12].

Sexually transmitted infections (STIs) are associated with significant adverse reproductive health outcomes, particularly among women[13-15]. In pregnant women with untreated early syphilis, 25% of pregnancies result in stillbirth and 14% in neonatal death[15, 16]. Up to 35% of pregnancies among women with untreated gonorrhoea are estimated to result in spontaneous abortion and premature deliveries, and up to 10% in peri-natal death[15, 16]. In the absence of prophylaxis, 30 - 50% of infants born to mothers with untreated gonorrhoea and up to 30% of infants born to mothers with untreated chlamydia will develop ophthalmianeonatorum, which can lead to blindness if not diagnosed and treated promptly[15]. Untreated chlamydia or gonorrhoea can result in chronic salpingitis leading to infertility or ectopic pregnancy.

In addition to their direct effects on reproductive health, many STIs have been shown to biologically enhance the transmission and acquisition of HIV[17-24], so that their effective management may play an important role in HIV prevention, particularly in resource-limited settings[25-29].

As is the case with many developing countries, PNG could benefit from better information on the extent of STIs to inform national prevention and control strategies. This study will provide the first robust estimates of STI prevalences among pregnant women, including the first estimates of HPV and HSV-2 infection.

Sexually transmitted infections in the Asia-Pacific region

In a recent six country study among 1678 pregnant women attending urban and rural antenatal clinics in Fiji, Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu, the prevalence of chlamydia was 6.4-29.0% (mean 18.0%); gonorrhoea, 0.0-2.5% (mean 1.7%); and syphilis, 0.0–10.0% (mean 3.0%) in the period 2004-2005[30]. None of the 1618/1678 clinic attenders who underwent voluntary counselling and confidential HIV testing (VCT) were HIV sero-positive[30, 31]. Chlamydia was the most prevalent STI, particularly in Fiji (29.0%) and Samoa (26.8%). Chlamydia was more prevalent in younger women in all locations[11]. For example, in Tonga, prevalence among women <25y was 27.5%, compared to 8.3% among women >25y; in Samoa prevalences of 40.7% and 17.5% were observed in these age-groups respectively[31]. Only 1.5% of the 1678 antenatal clinic attenders reported transactional or commercial sex in the previous 12-months, but these women were six times more likely to have chlamydia infection[31].

High rates of STIs among pregnant women, including chlamydia (21.5%), gonorrhoea (5.9%), HSV-2 (30.0%), syphilis (2.4%) and trichomonas (27.5%), have also been reported previously in Vanuatu[32-34] and similar rates observed in Fiji[35] and Samoa[36]. Among 451 antenatal clinic attenders in Cambodia, the prevalence of chlamydia was 2.8%; gonorrhoea, 0.0%; syphilis, 1.3%; and trichomonas 2.7%[37]. In a general population survey among 2550 women and 1350 men in the Philippines, the prevalence of chlamydia was 5.7%, gonorrhoea 0.8%, and syphilis 0.2% among women; and 4.4%, 1.1% and 0.2% among men, respectively[38].

Sexually transmitted infections in Papua New Guinea

High prevalences of HIV, STIs and genital infections have been reported among men and women in PNG in comparison to other countries in the Asia-Pacific region[39-65]. A recent systematic review and meta-analysis of HIV/STI prevalences in community and clinic-based settings in PNG[11] however, identified only 3 epidemiological studies conducted to date among pregnant women; a combined total of 206 antenatal clinic attenders[47] and 736 women presenting in labour[50, 57] (Table 7-1).

Table 7-1Summary of published data on antenatal HIV/STI prevalences in PNG

Author	Klufio et al., 1995[47]	Mgone et al., 1997[50]	Suarkia et al., 1999[57]
Study population	206 pregnant women attending first antenatal clinic visit at Port Moresby General Hospital	155 women presenting in labour to Goroka Base Hospital	581 women presenting in labour to Goroka Base Hospital
Bacterial vaginosis	23.3 (17.7, 29.7)	-	-
C. trachomatis	17.7 (12.4, 24.0)	36.8 (29.2, 44.9)	34.1 (30.2, 38.1)
N. gonorrhoeae	-	-	-
Syphilis	-	-	-
T. vaginalis	18.9 (13.8, 25.0)	-	-
HIV	-	-	-
HSV-2	-	-	-

Periodic syphilis and HIV sero-surveys are conducted by the National Department of Health (NDoH) in PNG to support routine antenatal surveillance. In 2010, estimated antenatal syphilis prevalence was 6.9%, and HIV prevalence 0.7% in urban areas (N=4623), and 4.2% of syphilis prevalence and 0.5% of HIV in rural areas (N=3180) (*NDoH, personal communication*). No prevalence estimates of HSV-2 or HPV have previously been reported among pregnant women in PNG[11].

The reasons for the differences in the epidemiology of HIV and STIs in PNG compared to other countries in the Asia-Pacific region are unclear, but felt likely to be the result of locally-specific interactions between the behavioural determinants, socio-cultural dimensions and structural contexts that frame sexual agency, sexuality and sexual health in PNG compared to other settings[66-75]. These include gender power

disparities, sexual violence and the societal roles of men and women[66-69, 72, 74-76]; low levels of male and female condom use[53, 61, 77], and of male circumcision[67, 76, 78, 79]; limited access to STI treatment services due to poor transport and health systems infrastructure[80, 81]; and limited success in the design and implementation of culturally-relevant behaviour change interventions among both general population and at-risk groups, such as truck drivers, male and female sex workers and their clients[67, 79, 82]. These factors may also explain the high HIV/STI prevalences observed in Tanah Papua Province in Eastern Indonesia, which is experiencing a generalised HIV epidemic that has many parallels to that of neighbouring PNG[83].

HPV and cervical cancer in PNG

Cervical cancer is the most common cancer among women in PNG and a leading cause of premature death[8, 84]. An estimated 1500 women die every year in PNG due to cervical cancer. Despite this burden of disease, no large-scale surveys have been conducted to establish the prevalence of HPV among general or at-risk populations of women. The only survey published to date was conducted among 114 women in Eastern Highlands Province, which reported a 33% prevalence of HPV-16/18[85]. More recently, cervical biopsies obtained over the period 2006-09 from 70 women in PNG with cervical cancer were analysed for HPV infection[4]. HPV-DNA was found in all cases with HPV-16, 18, 33 and 31 the most prevalent HR types (57%, 26%, 10% and 4% respectively). These findings suggest that the currently available and highly effective vaccines against HPV types 16 and 18 have the potential to significantly reduce the burden of HPV-related cervical cancer in PNG, if distribution and cost issues can be resolved.

PNGIMR collaborative research program in sexual and reproductive health

The PiHP Healthy Pregnancy Study is part of a broader program of research being undertaken by the PNGIMR collaborative research group in sexual and reproductive healththat has been led by A/Prof Vallely (PNGIMR/UNSW) since 2007. This program includes research on the epidemiology, prevention and control of HIV, HPV and other STIs, and interventions research in cervical cancer and maternal and neonatal health.

Complimentary research among 1000 women attending well woman and sexual health clinics in Eastern and Western Highlands Province is also being conducted by our group under a separate funding mechanism, and will provide data on HPV genotype prevalence among women at different levels of sexual risk. These studies will together provide the necessary policy-relevant evidence required to inform locally-appropriate and effective interventions for the prevention of cervical cancer in PNG.

Methods

The PiHP Healthy Pregnancy Study is a cross-sectional bio-behavioural survey among pregnant women attending antenatal clinics in Central, Eastern Highlands and Hela Provinces. A target recruitment total of 250 women per site were selected in order to enable the study to estimate STI prevalences with adequate precision at site-level, in addition to providing robust estimates of prevalence across all sites. For example, this sample size enables a chlamydia prevalence of 18% across all sites combined to be estimated with around 2.4% precision (i.e. 95% CI: 15.6, 20.4), and a prevalence of 18% at a single site to be estimated with around 4.8% precision (i.e. 95% CI: 13.2, 22.8).

The study was approved by the Medical Research Advisory Committee (MRAC) of the National Department of Health (NDoH) in Papua New Guinea; and the Health Research Ethics Committees of the University of New South Wales (UNSW) and the Alfred Hospital in Australia.

Findings

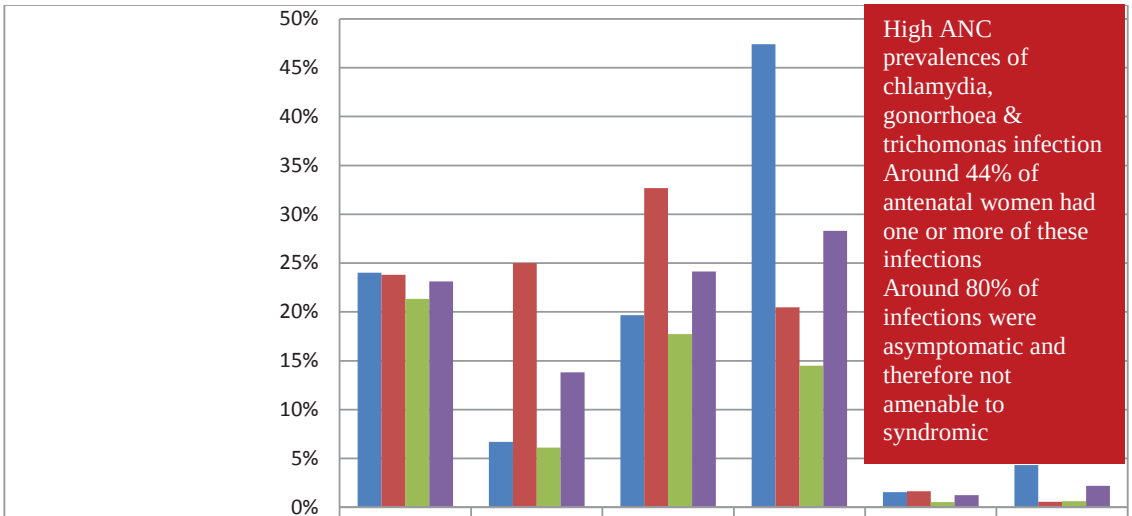
Recruitment and sites

At end-August 2014, recruitment into the study had been completed at all three sites (Hiri, n=255; Asaro, n=258;Hides, n=252), with a total of 765 participants recruited overall. As a result of funding and logistics constraints, a decision was made in early 2014 not to go ahead with a fourth study site in Karkar. Laboratory analyses are expected to be completed by mid-September and all test results provided to participants by end-September 2014.

Prevalences of HIV and sexually transmitted infections

Preliminary findings based on laboratory data from 731 study participants from 3 sites indicate high prevalences of HIV, syphilis, chlamydia, gonorrhoea and trichomonas in this setting (Figure 7-1). The prevalences of syphilis and HIV infection were 2.2% and 1.2% respectively for the three sites combined. Overall, 44% of women attending antenatal clinics in Hiri, Hides and Asaro had one or more of chlamydia, gonorrhoea and trichomonas infections, with the highest burden observed in Hides (53% prevalence). More than 80% of these infections were asymptomatic and therefore would not have been identified and treated based on current national syndromic management guidelines. Similar STI prevalences were reported in malaria in pregnancy trial conducted by the PNGIMR and international collaborators in Madang, in which over 60% of antenatal women with an STI were found to be asymptomatic (*Wangnapi et al 2014, submitted*).

The prevalences of HIV and syphilis observed in Hiri, Hides and Asaro are broadly consistent with routine National Department of Health antenatal surveillance data. HIV estimates from the Healthy Pregnancy study need to be interpreted with caution particularly at the level of individual sites however, due to the modest sample size per site and the low prevalence of HIV in the general population, which mean that the confidence intervals around these estimates will be relatively broad compared to estimates of more prevalent infections such as chlamydia or trichomonas.



	Chlamydia	Gonorrhoea	Trichomonas	HSV-2	HIV	Syphilis
Asaro ANC (n=254)	24.0%	6.7%	19.7%	47.4%	1.5%	4.3%
Hiri ANCs (n=252)	23.8%	25.0%	32.7%	20.5%	1.6%	0.5%
Hides ANCs (n=225)	21.3%	6.1%	17.7%	14.5%	0.5%	0.6%
All sites combined (n=731)	23.1%	13.8%	24.1%	28.3%	1.2%	2.2%

Figure 7-1Prevalences of HIV and other STIs among 731 women attending 6 antenatal clinics at 3 sites in PNG

Prevalence of human papillomavirus (HPV) infection

The prevalence of HPV infection was high in this population compared to prevalences among women attending sexual health or well woman clinics in this setting, reflecting the younger median age of antenatal women compared to other clinic attendees (24 years, 33 years and 36 years respectively) (Figure 7-2).

The prevalence of high risk HPV infection (all types combined) was 43% overall (Hides=26%; Hiri=44%; Asaro=49%) and that of HPV types 16 or 18 was 13% across all sites (Hides=3%; Hiri=10%; Asaro=18%). Among women with an HPV infection, the most prevalent high risk HPV types were HPV 16, 39, 52, 58 and 33 (Figure 7-3).

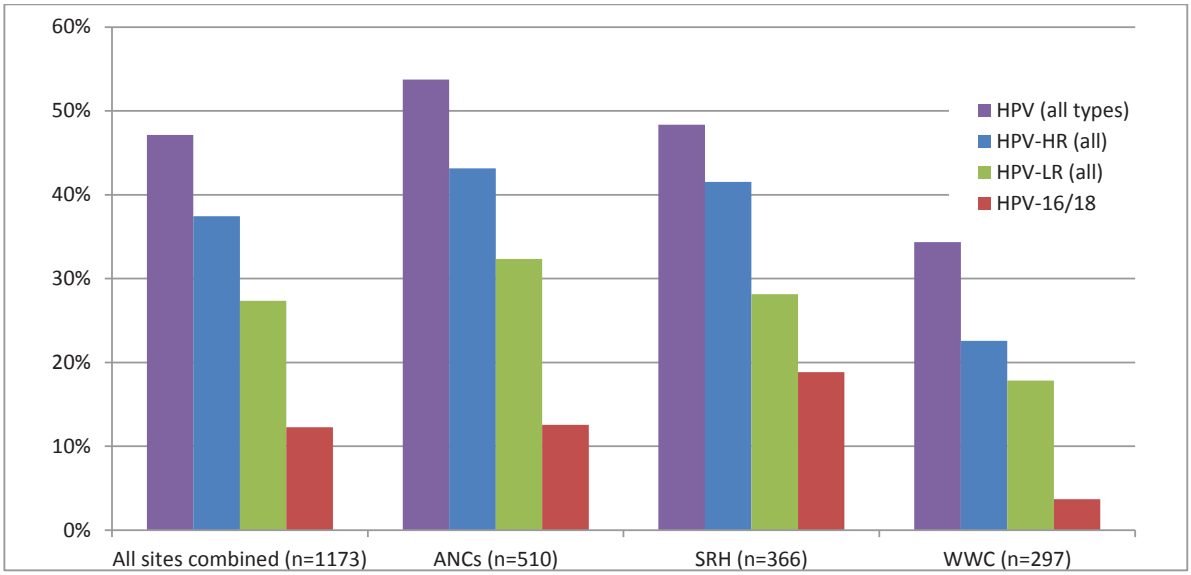


Figure 7-2Prevalences of HPV among 1173 women attending antenatal, sexual health and well woman clinics in PNG

ANC: antenatal clinic; SRH: sexual & reproductive health clinic; WWC: well woman clinic

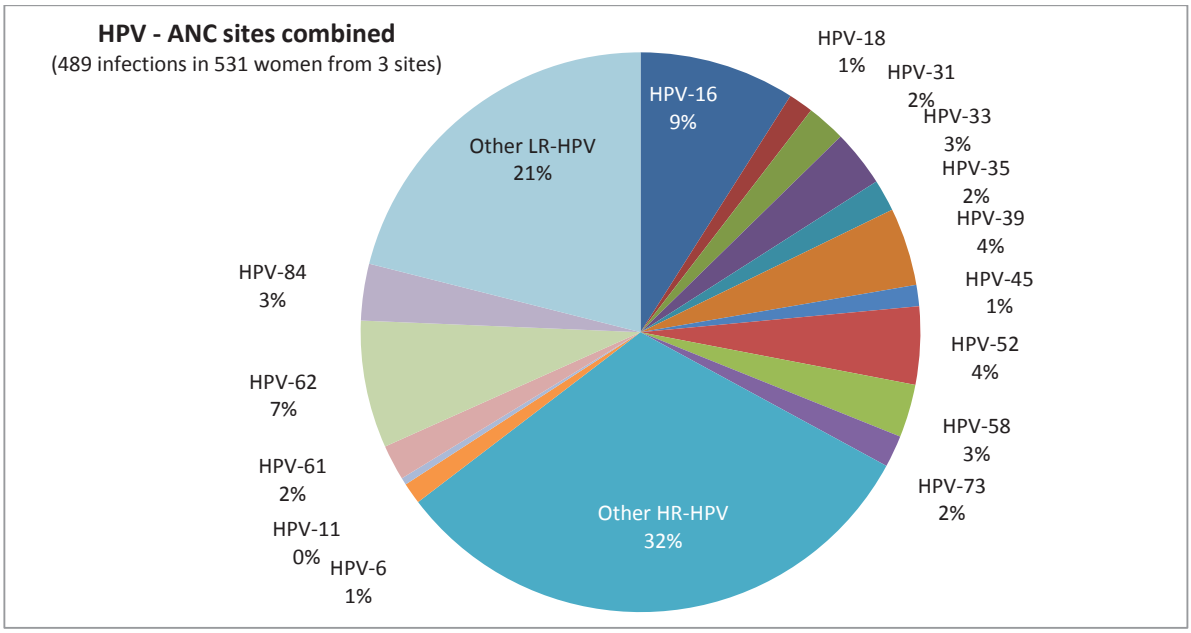


Figure 7-3HPV types among HPV positive women attending antenatal clinics at three sites in PNG

Discussion

Preliminary findings from the PiHP Healthy Pregnancy Study indicate that pregnant women experience an unacceptably high burden of sexually transmitted infections (STI) in Papua New Guinea. The burden of curable STIs (chlamydia, gonorrhoea and trichomonas) appears to be particularly high and this health need is currently unmet through existing syndromic management approaches due to the majority of pregnant

women having no clinical symptoms. These findings suggest that new strategies are needed to control STIs and their associated adverse maternal and neonatal health outcomes in this population. Arising from this research, the PNGIMR collaborative research group started a pilot intervention study among antenatal women in August 2014 that is investigating the operational feasibility and potential public health impact of newly available, robust and highly accurate point-of-care STI tests for the diagnosis and treatment of STIs in pregnancy. This study is being funded through an NHMRC Program Grant and will inform future field trials and public health interventions research being planned by our collaborative group.

Conclusion

The Healthy Pregnancy Study is providing the first geographical, age and type-specific prevalence data on HPV infection in PNG. Together with data from women attending sexual health and well woman clinics, these findings suggest that polyvalent HPV vaccines could have a significant impact in preventing cervical cancer in PNG, one of the highest burden settings globally. Discussions between the PNGIMR collaborative research group, the National Department of Health, and key development partners (including WHO, GAVI and Rotary International) regarding the conduct of robust district and provincial level HPV vaccine pilot intervention studies are on-going. The successful conduct of these studies will be critical to the successful wide-scale introduction of HPV vaccine in PNG.

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8. CHAPTER 8 NON-COMMUNICABLE DISEASE AND ASSOCIATED RISK FACTORS

Abstract

This Chapter reports updated preliminary findings from a general population prevalence survey of non-communicable diseases (NCDs) in three PiHP iHDSS (Hiri, Asaro, Karkar). Hides data is not captured in this report. The broad aims of the survey are to: 1) establish baseline prevalence of selected NCDs, associated lifestyle risk factors, dietary habits and food security; and 2) establish a surveillance system for longitudinal monitoring of NCD prevalence and risk. The recruitment target is 300 adults (15-65 years old) per iHDSS, resulting in a final sample of 900 participants. A total of 644 Adults had been recruited as of July 31st, 2014 (71.6% of target). Further recruitment is ongoing. Preliminary data analysis found that the prevalence of high blood pressure was between 40.6% and 58.7% of participants across the three sites. High blood glucose was detected in between 8.7% to 34.7% of participants, elevated cholesterol between 27.9% and 44.3% and elevated triglycerides between 23.8% and 48.9%. The current data indicate an immediate need for screening and intervention programs within Hiri iHDSS and NCD prevention and health promotion programs across all iHDSS sites. The data from Asaro and Karkar iHDSS are most likely to be representative of NCD burden (and NCD risk) in rural communities across PNG, underlying their value as longitudinal surveillance sites.

Introduction

This chapter presents the second report of preliminary findings from a general population prevalence survey of selected non-communicable diseases (NCDs) and associated risk factors in the Hiri, Asaro and Karkar iHDSS. The reasons for excluding Hides are explained on the next page. The rationale, aims and methodology of this NCD survey have been described in a previous report on the PiHP Project [1] as were initial preliminary findings[2]. To briefly recap here, the original aims of the NCD survey were to:

1. Establish a baseline data set to determine among people living in two diverse study sites across PNG that are directly impacted by the PNG LNG project, and also in two non- impacted comparison sites:

a. the prevalence of selected NCDs (namely diabetes mellitus type 2, hypertension, acute coronary syndrome, stroke, chronic lung diseases and cancers) and associated lifestyle risk factors;

b. dietary habits and food security; and

2. Establish a surveillance system for longitudinal monitoring to detect any changes in the prevalence of NCDs and associated lifestyle risk factors, and also any changes in dietary habits and food security, among the four study sites.

However, due to funding and operational constraints the NCD survey was subsequently discontinued in the Hides iHDSS (A total of 25 questionnaires were completed, but we were not able to collect biological samples due to inadequate laboratory facilities in Hides), leaving only one project impact site (Hiri iHDSS). Further revisions to the original methodology included the indefinite suspension of child recruitment (6mths – 5yrs) due to low parental consent rates and a reduction in the recruitment target for adult participants (15-65yrs) from 1200 to 300 per iHDSS. A sample of this size will remain sufficient to reliably calculate the prevalence of target NCDs and associated risk factors at the population level (combined iHDSS samples) and between iHDSS.

Recruitment Progress

Table 8-1 presents the number of participants recruited per iHDSS as of July 31st, 2014. As shown, recruitment targets were 71.6% (644/900) achieved by July, 2014. Data collection is scheduled to conclude on October 31st, 2014. The study team anticipate achieving the target recruitment of 300 adults per participating iHDSS by this time.

Table 8-1 Participant recruitment in the PNG NCD Study by iHDSS site, 2014

HDSS	Date Commenced	No. Recruited
Hiri	April, 2013	239
Asaro	May, 2013	203
Karkar Island	June, 2013	202
Total	----------	644

Results

The PNG NCD Study involves the collection of a wide range of anthropometric, biological and self-reported lifestyle and health data as outlined in a previous report [1]. It is anticipated that multiple analyses, inclusive of inferential statistics examining the relationship between relevant individual, household and community level variables and NCD risk, will be conducted at the completion of data collection. In the meantime, what follows is a preliminary descriptive analysis of selected variables. The analyses were conducted on incomplete and uncleaned datasets available as of July, 2014. The findings may not be reflective of the general adult populations at each iHDSS and should be interpreted with some caution.

Sample Characteristics

The age and sex characteristics of the preliminary adult sample are presented in Table 8-2. As shown, the sex ratio is relatively even (except in Hiri iHDSS), but participants in the 15-29 years of age category are currently underrepresented and participants in the 45-65 years of age category somewhat overrepresented

(according to sample stratification). The percentage of participants in each age and sex category by iHDSS and overall should be equal at the conclusion of the study.

Table 8-2 Age and sex characteristics of preliminary sample by iHDSS site and overall, 2014

Characteristic		No. (%) by iHDSS and Overall			
		Hiri (n=239)	Asaro (n=203)	Karkar (n=202)	Overall (n=644)
Age	15 - 29 yrs	68 (28.5)	51 (25.1)	54 (26.7)	173 (26.9)
	30 – 44 yrs	79 (33.1)	69 (34.0)	67(33.2)	215 (33.4)
	45 – 65 yrs	92 (38.5)	83 (40.9)	81 (40.1)	256 (39.8)
Sex	Male	92 (38.5)	102 (50.2)	92 (45.5)	286 (44.4)
	Female	147 (61.5)	101 (49.8)	110 (54.5)	358 (55.6)

Food consumption and substance use

The self-reported frequency of specified food consumption by iHDSS and overall is presented in Table 8-3. When answering, all participants were asked to consider food consumed during a typical week over the month prior to survey.

Table 8-3 Self-reported frequency of specified food consumption by iHDSS site, 2014

During a typical week, on how many days do you eat/drink…	Median No. of days consumed			
	Hiri (n=239)	Asaro (n=203)	Karkar (n=202)	Overall (n=644)
Root vegetables/banana	2	7	7	7
Greens or other vegetables	1	6	7	6
Fruit	1	2	0	1
Fresh meat	5	1	3	2
Tinned meat	4	2	0	2
Fried food purchased from shop	0	1	0	0
Fried food cooked at home	2	3	0	2
Soft drinks	1	1	0	0
Salt added to food	7	7	0	5

Variation in diet is evident across the three iHDSS reported. In particular, vegetable consumption is low in Hiri iHDSS relative to Asaro and Karkar whereas protein consumption is low in Asaro and Karkar compared to Hiri. It is worth noting that the inter-quartile range for salt consumption in the Karkar iHDSS was seven, indicating participants reported either nil salt use or salt use every day.

The self-reported frequency of tobacco, buai and alcohol consumption by iHDSS and overall is presented in Table 8-4. Reference periods varied by substance type including current and daily use for tobacco, use over 30 days prior to survey for buai and use over prior 12 months and 30 days for alcohol. The tobacco, buai and alcohol questions were introduced approximately three months after the survey commenced; thus, the sample sizes are lower. As shown, self-reported tobacco use was highest in Karkar and buai and alcohol use highest in Hiri. Alcohol use expected to be higher in a higher income iHDSS. Central province is also known as a prominent buai growing area with a long history of buai use.

Table 8-4 Self-reported frequency of tobacco, buai and alcohol consumption by iHDSS site, 2014

Substance	Measure	No. (%) of participants reporting use			
		Hiri (n=127)	Asaro (n=121)	Karkar (n=150)	Overall (n=398)
Tobacco	Current	52 (40.9)	56 (46.3)	79 (52.7)	187 (47.0)
	Daily	47 (37.0)	52 (43.0)	77 (51.3)	176 (44.2)
Buai	Past 30 days	122 (96.1)	67 (55.4)	111 (74.0)	300 (75.4)
Alcohol	Past 12 months	67 (52.8)	45 (37.2)	29 (19.3)	141 (35.4)
	Past 30 days	53 (41.7)	25 (20.7)	11 (7.3)	89 (22.4)

History of non-communicable disease (NCD) and experience of NCD-related symptoms

Table 8-5 presents the self-reported history of selected NCDs by iHDSS and overall. All questions pertained to lifetime history of disease. Overall, few participants reported having received any form of NCD diagnosis from a health worker especially in the Asaro and Karkar iHDSS. Among those that had, diagnoses of high blood pressure/hypertension and chronic lung disease, COPD or asthma were most commonly reported.

Table 8-5 Self-reported history of selected non-communicable diseases (NCDs) by iHDSS site, 2014

Have you ever been told by a health worker that you have/had…	No. (%) of participants responding 'yes'			
	Hiri (n=239)	Asaro (n=203)	Karkar (n=202)	Overall (n=644)
A stroke	2 (0.8)	0 (0)	0 (0)	2 (0.3)
Heart disease	4 (1.7)	0 (0)	0 (0)	4 (0.6)
High blood sugar or diabetes	6 (2.5)	0 (0)	0 (0)	6 (0.9)
Chronic lung disease, COPD or asthma	10 (4.2)	3 (1.5)	1 (0.5)	14 (2.2)
High blood pressure or hypertension	17 (7.1)	3 (1.5)	1 (0.5)	21 (3.3)
High cholesterol	0 (0)	0 (0)	0 (0)	0 (0)
Cancer	1 (0.4)	0 (0)	1 (0.5)	2 (0.3)

Table 8-6 presents self-reported experience of specified NCD-related symptoms. Pain or discomfort in the chest when walking, hurrying or walking uphill is indicative of heart disease. Ankle oedema or swelling is indicative of lung disease as is shortness of breath during rest, coughing or wheezing for greater than 10 minutes or coughing up sputum/phlegm most days during a three month period. These symptoms remain indicative of specified NCDs, are used as screening questions in gold standard NCD surveys (e.g. WHO STEPS). Their main implication in terms of this study is how infrequently they are reported given the clinical data.

Table 8-6 Self-reported experience of NCD-related symptoms by iHDSS site, 2014

Symptom	No. (%) of participants responding 'yes'			
	Hiri (n=239)	Asaro (n=203)	Karkar (n=202)	Overall (n=644)
Pain in chest when walking	59 (24.7)	13 (6.4)	2 (1.0)	74 (11.5)
Pain in chest when hurrying/walk uphill	51 (21.3)	26 (12.8)	1 (0.5)	78 (12.1)
Ankle oedema or swelling	0 (0)	0 (0)	0 (0)	0 (0)
Shortness of breath whilst resting	17 (7.1)	5 (2.5)	0 (0)	22 (3.4)
Coughing/wheezing for 10+ minutes	27 (11.3)	9 (4.4)	1 (0.5)	37 (5.7)
Cough sputum/phlegm most days/3months	15 (6.3)	1 (0.5)	1 (0.5)	17 (2.6)

As shown, participants from Hiri iHDSS reported the greatest number and range of symptoms whereas participants from Karkar reported the least. The most commonly reported symptoms across all sites were pain/discomfort in the chest when walking, hurrying or walking up hill.

Body Mass Index (BMI)

Table 8-7 presents a breakdown of participants' body mass index (BMI) by category. Underweight was defined as a BMI <18.5, normal weight defined as a BMI between >18.5 and <27, overweight as a BMI between 27 and <32 and obese as a BMI >32. The highest levels of overweight or obese were among adults from Hiri iHDSS, accounting for 38% of the surveyed population. Few participants from Asaro and Karkar were rated obese, although 12.9% of participants from Karkar met the criteria for underweight.

Table 8-7 Body-Mass Index (BMI) by iHDSS site and overall, iHDSS, 2014

Site	Sample No.	Body Mass Index			
		Underweight	Normal	Overweight	Obese
		n (%)	n (%)	n (%)	n (%)
Hiri	200	12 (6.0)	112 (56.0)	48 (24.0)	28 (14.0)
Asaro	203	9 (4.4)	168 (82.8)	20 (9.9)	6 (3.0)
Karkar	202	26 (12.9)	163 (80.7)	11 (5.4)	2 (1.0)
Overall	605	47 (7.8)	443 (73.2)	79 (13.1)	36 (6.0)

Blood pressure

Table 8-8 presents participants' blood pressure readings based on the average of three consecutive measurements taken at least one minute apart. Hypotensive was defined as an average systolic/diastolic rate of <110/<70, normal as a rate of 110-120/70-80, pre-hypertensive as a rate >120-139/>80-89 and hypertensive as a rate 140+/90+. As shown, a large percentage of participants from all sites – ranging from to 40.6% (Karkar) to 58.7% (Asaro) were either pre-hypertensive or hypertensive. Fewer than 30% of participants across all sites had a blood pressure in the normal range and 29.7% of participants from Karkar were hypotensive. Worth noting that the majority of measurements were taken in participants homes by a field nurse in 'plain clothing' in a relaxed and familiar environment.

Table 8-8 Blood pressure ratings by iHDSS site, 2014

Site	Sample No.	Blood Pressure			
		Hypotensive	Normal	Pre-hypertensive	Hypertensive
		N (%)	N (%)	N (%)	N (%)
Hiri	239	50 (20.9)	63 (26.4)	83 (34.7)	43 (18.0)
Asaro	203	25 (12.3)	59 (29.1)	87 (42.9)	32 (15.8)
Karkar	202	60 (29.7)	60 (29.7)	72 (35.6)	10 (5.0)
Overall	644	135 (21.0)	182 (28.3)	242 (37.6)	85 (13.2)

Haemoglobin A1c

Haemoglobin A1c (HbA1c) is a measure of the percent of glucose in the blood stream. A HbA1c result of less than 5.7% is considered 'normal', 5.7% to 6.4% is considered pre- diabetic (i.e. 'at risk' of developing diabetes mellitus type 2) and 6.5% or more is considered diagnostic of diabetes. Table 8-9 presents the HbA1c results by iHDSS site and overall. As shown, 20.5% (101/493) of adult participants randomly recruited from the Hiri, Asaro and Karkar iHDSS had blood glucose levels in the pre-diabetic (15.6%) or diabetic (4.9%) range. Prevalence was highest in the Hiri iHDSS where 34.7% (69/199) of adult participants tested in the pre-diabetic (24.1%) or diabetic (10.6%) range and lowest in Karkar iHDSS at 6.1% and 2.6%, respectively. No participants from Asaro had blood glucose levels diagnostic of diabetes.

Table 8-9 HbA1c results by iHDSS site, 2014

Site	Sample No.	HbA1c Result*		
		Normal	Pre-Diabetes	Diabetes
		n (%)	n (%)	n (%)
Hiri	199	130 (65.3)	48 (24.1)	21 (10.6)
Asaro	179	157 (87.7)	22 (12.3)	0 (0)
Karkar	115	105 (91.3)	7 (6.1)	3 (2.6)
Overall	493	392 (79.5)	77 (15.6)	24 (4.9)

Lipid profile

Elevated cholesterol and triglycerides are known risk factors for cardiovascular disease. The number and percentage of participants with normal and elevated levels of these respective lipids are presented in Table 8-10. As shown, 35% of all participants had elevated cholesterol levels and 40.4% elevated triglyceride levels. Again, elevated levels of these lipids were highest in Hiri at 44.3% and 48.9%, respectively.

Table 8-10 Lipid profile by iHDSS site, 2014

Site	Sample No.	Cholesterol Normal	Elevated	Triglycerides Normal	Elevated
		n (%)	n (%)	n (%)	n (%)
Hiri	219	122 (55.7)	97 (44.3)	112 (51.1)	107 (48.9)
Asaro	179	129 (72.1)	50 (27.9)	105 (58.7)	74 (41.3)
Karkar	122	87 (71.3)	35 (28.7)	93 (76.2)	29 (23.8)
Overall	520	338 (65.0)	182 (35.0)	310 (59.6)	210 (40.4)

Discussion

The findings reported in this chapter are preliminary and should be interpreted with some caution. The datasets remain incomplete and age, sex and other variables relevant to NCD disease and risk were not accounted for in the limited analyses presented. Furthermore, additional and equally important questionnaire, anthropometric and biological data are yet to be reported. Nevertheless, the reported findings do provide an initial insight into the NCD burden – or potential for NCDs – in the three study sites.

The findings presented in this second preliminary analysis remain largely consistent with those presented in the initial preliminary analysis [2]. The data continue to suggest an existing high NCD burden in the general adult population of the Hiri iHDSS or, in the very least, a population at serious risk of developing a high NCD burden. Objective, clinical measures of cardiovascular disease-, heart disease- and diabetes-risk factors continue to be highest in participants from the Hiri iHDSS relative to other iHDSS, ranging between 34.7% (elevated blood glucose) and 48.9% (elevated triglycerides) of surveyed participants. However, these figures were somewhat lower than those presented in the initial preliminary analysis; most likely as a result of a greater proportion of participants in the 15-29 year age category in this chapter as compared to the previous (26.9% vs. 24.4%). As the proportion of participants in each age category (15-29 yrs. 30-44 yrs and 45-65 yrs) should be equal (33.3%) at the conclusion of the study, then it is possible that the reported prevalence data may further reduce (although this remains unknown at this stage).

As previously discussed, poor dietary indicators, especially low consumption of fruit and vegetables and higher relative consumption of alcohol and buai, combined with relatively high experience of NCD- related symptoms and few reported health worker defined NCD diagnoses indicate low NCD- risk awareness and minimal clinical screening/intervention in the Hiri iHDSS adult population. We anticipate exploring the relationship between buai use and DM, CVD in quite some detail at the conclusion of the study, but will be presented in future reports. Higher prevalence in this population is likely to be the result of a number of factors including genetic susceptibility and proximity to Port Moresby (i.e. a peri-urban versus rural population). Thus, the previous tentative recommendation that the preliminary findings indicate an immediate need for NCD prevention, screening and intervention programs in this project impact site remains valid.

Conclusion

Findings from the Asaro and Karkar iHDSS' continue to be less alarming relative to the Hiri iHDSS and are likely to be more reflective of NCD prevalence and risk in rural communities across PNG. Nevertheless, it continues to be a concern that between 27.9% and 41.3% of all adult participants in these two iHDSS had elevated cholesterol and/or triglycerides, 8-12% had high blood glucose levels and many – if not most - of the recorded blood pressures were in the pre-hypertensive or hypertensive range. Few participants (and even fewer than Hiri) reported having received an NCD diagnosis further suggesting current screening and intervention programs may be inadequate or potentially non-existent in these rural populations. As previously discussed, the reported prevalence of NCDs and associated risk factors were substantially higher than those reported in earlier studies from the same or comparable communities [4-9]. For example, Scrimgeour et al (1989) found no cases of elevated cholesterol or triglycerides in a randomised cross sectional survey conducted in the Asaro valley in the late 1980s [4], and Boyce at al reported no cases of hypertension in a cross sectional survey conducted on Karkar island in the late 1970s [5]. The findings from Asaro and Karkar iHDSS' reported in this second preliminary analysis, when viewed in the light of these earlier studies, continue to be suggestive of a generalised increase in NCD burden and risk across the country.

The need for prevention, screening and intervention campaigns may be less urgent in these areas relative to Hiri; however, complacency will only exacerbate the future cost of the NCD burden to PNG. Thus (again, as previously recommended), NCD prevention and health promotion campaigns should be prioritised in the short-term across all iHDSS – and ideally countrywide – with more intensive screening and intervention programs targeted towards Hiri iHDSS (and potentially other high risk urban and coastal communities in PNG). The particularly high rates of elevated cholesterol and triglycerides as well as hypertension further suggest that cardiovascular disease prevention and treatment may warrant a priority focus.

The Asaro and Karkar iHDSS continue to present as especially valuable longitudinal surveillance sites in which the NCD burden and associated risk factors may be closely monitored over time. As suggested, NCD prevalence in these sites is likely to be reasonably representative of rural communities across PNG. The same is not true of the Hiri iHDSS (which already has an exceptionally high burden). Such long-term NCD surveillance in the Asaro and Karkar iHDSS would afford some assessment of the impact of NCD prevention campaigns and provide advance warning for the need to scale up screening and intervention programs.

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9. CHAPTER 9 CAUSES OF DEATH

Abstract

This chapter presents an updated summary of key findings from the cause of death study, using the Population Health Metrics Research Consortium (PHMRC) Verbal Autopsy instrument to follow up on deaths in the integrated Health and Demographic Surveillance System Sites (iHDSS) under the Partnership in Health Project. Here we present all deaths, reviewed by a physician and ascribed a probable cause of death as a preliminary analysis of the cause-specific mortality trends. Ascribing the probable cause of death can be an iterative process whereby further information can be sought from the interviewee or from hospital records that may be collected retrospectively. Physician reviews also undergo regular review by more senior physicians and diagnoses may therefore change over time.

Findings from this analysis continue to build the evidence for an epidemiological transition from a mortality structure dominated by infectious diseases to one where deaths a largely caused by non-communicable diseases (NCD). This transition is likely to be developing and progressing at different rates across the country. While many of these diseases, such as cardiovascular diseases and diabetes, are indicative of a change in lifestyles, other conditions most likely due to indoor air pollution like chronic obstructive pulmonary diseases and asthma, significantly contribute to this burden in some locations. Of all the sites presented here Hiri is the most developed population in terms of urbanisation and exhibits the highest rates NCDs. This is particularly evident when chronic obstructive pulmonary disease is excluded from the analysis in other sites. This data supports the recommendation for immediate NCD intervention programs across all sites and in Hiri in particular.

Mortality surveillance data from the Hides iHDSS is currently incomplete and interpretation of cause of death results must be conducted with caution. The small numbers of deaths data collected thus far, , reveal emerging mortality patterns dominated by pneumonia HIV/AIDS and homicide. Further research is recommended to better understand the social determinants in Hides that may be contributing to these deaths.

Background

Most deaths in the Pacific region are not medically certified (Mathers, 2005;Tangcharoensathien, 2006). Causes of death data are crucial for informing policy debates about priorities to reduce premature mortality and improve population health. In the absence of routine medical certification of deaths, Verbal Autopsies (VAs) are the only proven means of providing reliable data about COD patterns at the population level (Amuna and Zotor, 2008). Previous reports have described the verbal autopsy instrument and methodology

in detail. Here we use the Population Health Metrics Research Consortium (PHMRC) VA instrument to follow up on deaths in iHDSS. VAs are routinely used in Demographic and Health Surveillance Systems around the world such as the International Centre for Diarrheal Disease Research (ICDDR, B) Matlab site in Bangladesh (Chowdhury, 2010) and the KEMRI/Centre for Disease Control (CDC) site in Kenya (Odhiambo, 2012).

The aims of the Partnership in Health Project (PiHP) are to compare changes over time in two impact sites where the PNG-LNG project is active (Hides in Hela Province and West Hiri in Central Province) and two comparison sites (Asaro in the Eastern Highlands and Karkar an island that is part of Madang Province). The cause of death study aims to provide the following to the PiHP:

To follow up on every reported death in the iHDSS and where –possible conduct a verbal autopsy interview with a relative of the deceased;

To assign a probable cause of death to each death using physician review

This Chapter presents total number of deaths as recorded in the iHDSS over the reporting period, as well as the results of preliminary analyses of specific causes of deaths, which were reviewed and verified by qualified and trained physicians taking part in the PiHP. As the numbers of deaths recorded in each year in the study site are relatively small, the presented analyses are longitudinally shown as all years combined.

Methods

Households in the iHDSS are followed up every three months by local reporters. During these visits the reporters record any in or out migrations, pregnancies, births and deaths. Identified deaths are listed and given to the verbal autopsy team. Trained field staff coordinates with reporters to arrange a household visit at a time and location that suits the respondent. The interviews usually take place soon after the mourning period has come to an end. VA interviews can be emotional. After consent is obtained the respondent is ensured that they can stop the interview or resume it at any time if they wish.

We have employed the Population Health Metrics Research Consortium (PHMRC) VA instrument in this study. Aside from asking questions about the signs and symptoms the deceased experienced prior to death, the standardised questionnaire also collects information on basic demographic and socio-economic covariates as well as some health care utilisation data. VA interviewers also ask to see and copy any information on health records that might be available. All VA forms are checked by independent members of the VA team for accuracy and consistency. Any forms with problems are sent back to the field for correction prior to data entry. VA forms, and where possible any health records included with the form, are then reviewed by a trained physician who ascribes a probable cause of death.

Causes of death were coded according to the International Classification of Disease-10 and data analyses were conducted using Stata12.0.

The VA forms are then entered into an Access database. The VA data collected will also be analysed using computer-based analytical software developed at the Institute of Health Metrics and Evaluation (IHME) in Seattle and results will be compared with those of the physicians.

Results

To date, 1252 VA have been conducted on deaths from the four iHDSS sites. Of these a total of 1191 (83.4%) have been through physician review and have been assigned a probable cause of death (Table 9-1).

Table 9-1 Physician reviewed verbal autopsies by site

iHDSS site	Asaro		Hides		Hiri		Karkar		Total
	n	%	n	%	n	%	n	%	n
VA completed	461	36.8%	138	11%	285	22.8%	368	29.4%	1252
COD completed	416	34.9%	135	11.3%	278	23.3%	362	30.4%	1191

VA Verbal Autopsy
COD Cause of death

The deaths collected by the PiHP and presented in this chapter occurred over a period of six years. Table 9-2 shows the distribution of deaths analysed by verbal autopsy for which a year of death is available.

Table 9-2 Number of deaths collected by year of death and site[9]

	Asaro	Hides	Hiri	Karkar	Total
2009	0	0	15	0	15
2010	53	3	54	50	160
2011	133	6	70	59	268
2012	134	50	62	113	359
2013	71	66	60	101	298
2014	25	10	17	39	91
Total	416	135	278	362	1,191

In order to capture all deaths, during the first census at each site reporters asked if any deaths had occurred in the household since the first of January 2010. In most locations the collection of deaths began before the demographic surveillance officially commenced. Indeed, the verbal autopsy project started in Hiri a number

[9] Slight changes in numbers over analyses may result from on-going data cleaning efforts

of months before the demographic surveillance; hence, verbal autopsies were conducted on deaths beginning in 2009.

Table 9-3 Total number of deaths by site and age group (N and %), iHDSS, 2014

	Asaro	Hides	Hiri	Karkar	Total
Adults 15+	344 (82.7)	88 (65.2)	239 (86)	282 (77.9)	953 (80)
Children 0-14	38 (9.1)	44 (32.6)	24 (8.6)	41 (11.3)	147 (12.3)
Neonates	34 (8.2)	3 (2.2)	15 (5.4)	39 (10.8)	91 (7.6)
Total	416	135	278	362	1,191

The deaths that have been physician reviewed and presented here are distributed across age groups differently in each of the sites. On average 80% of deaths collected from each site are adults and about 12% are children and 8% are neonates (Table 9-3). The numbers of deaths collected from Hides are relatively smaller than that of other sites. However, death data in Hides and Karkar indicate a greater proportion of deaths in neonates and infants (children under one year of age).

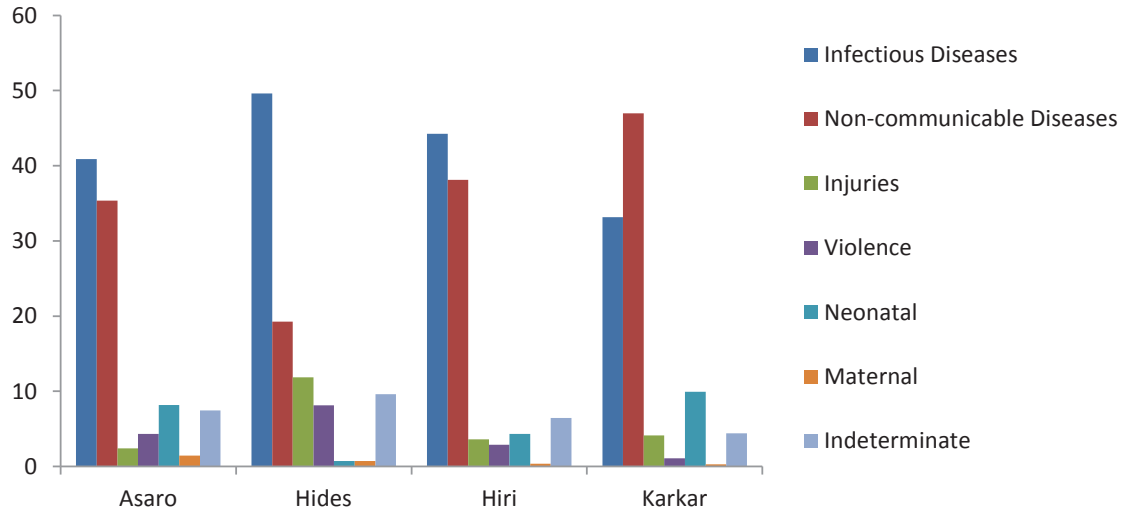

Figure 9-1 Probable cause of death (grouped disease) by site[10]

Figure 9-1 presents the proportion of deaths by site and the different major groups of diseases; infectious diseases[11], non-communicable diseases (NCD), injuries, violence and neonatal deaths. Those deaths for which no cause of death could be assigned are known here as indeterminate. Amongst adults, there were more male deaths in all disease groups except for infectious diseases in Hiri where females and males make

[10] Neonatal deaths include stillbirths
[11] Includes malnutrition

up almost equal proportions. Equal numbers of males and females were represented amongst neonatal deaths in Hides and Karkar but in both Hiri and Asaro males made up more than 60% of neonatal deaths.

The overall mortality patterns by site have not changed substantially. Hides iHDSS continues to demonstrate a mortality pattern dominated by infectious diseases which make up more than 50% of deaths in that population. The majority of deaths in Asaro and Hiri are also infectious in nature but non-communicable diseases like cardiovascular diseases and cancers are a very close second. Injuries and violence continue to be the cause of especially higher number of deaths in Hides, reaching almost 20% of all deaths. The previous report presented leading causes of death by site. In the next section, the analysis mortality is differentiated by adult and child deaths.

Hides

Figure 9-2 shows the leading cause of death among adults in Hides. Pneumonia, HIV/AIDS and Homicide are the leading causes of death as a percent of the total cases, however the verbal autopsy small sample size data must be interpreted very cautiously. Antenatal clinic data has consistently shown that the HIV prevalence rate in Hides is less than 1%[12]and historically respiratory illness particularly Pneumonia has been the leading cause of morbidity and mortality during recent and past years. Non-communicable respiratory conditions, i.e. asthma and chronic obstructive pulmonary disease (COPD), together make up 16% of adult deaths. Additionally, homicide is also a major contributor to the death toll (11%) amongst adults in this area.

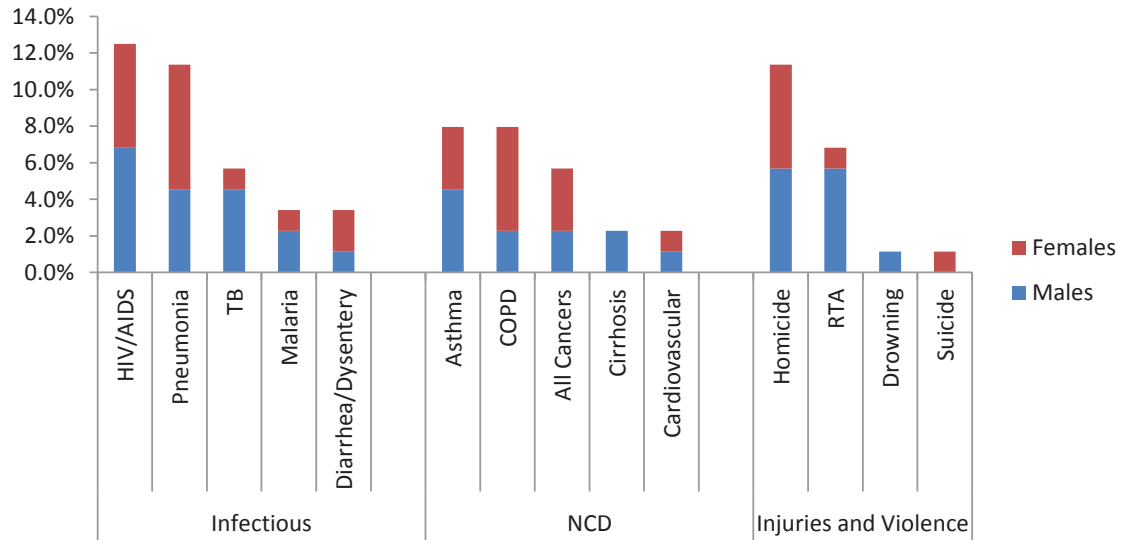

Figure 9-2 Leading causes of adult death in Hides iHDSS
COPD Chronic obstructive pulmonary disease

[12] VA interviews have identified 11 adult deaths were due to AIDS and 10 adult deaths due to Pneumonia, among 88 adult deaths in Hides. These numbers are small, it requires the use and interpretation of these figures with highly cautious.

HIV/AIDS Human Immunodeficiency Virus/ Acquired Immunodeficiency Disorder Syndrome
NCD Non-communicable diseases
RTA Road traffic accidents

Asaro

Chronic obstructive pulmonary disease (COPD) makes a major contribution to the total number of deaths particularly in Asaro where it was responsible for 15.7% of all adult deaths (Figure 9-3). Almost 40% of cancers in Asaro are thought to be cervical, while 21% are liver. A total of nine maternal deaths were identified in all four sites but the majority of these deaths took place in Asaro (6 out of 9) (data not shown). Further analysis of cervical cancers and maternal deaths are presented in following Chapters on Maternal and Newborn Health, and Health Pregnancy.

External causes of death play a significant role in mortality trends in both Asaro and Hides. Almost 60% of all external deaths in Asaro are attributed to homicide while homicide and road traffic accidents make up 70% of all external deaths in Hides.

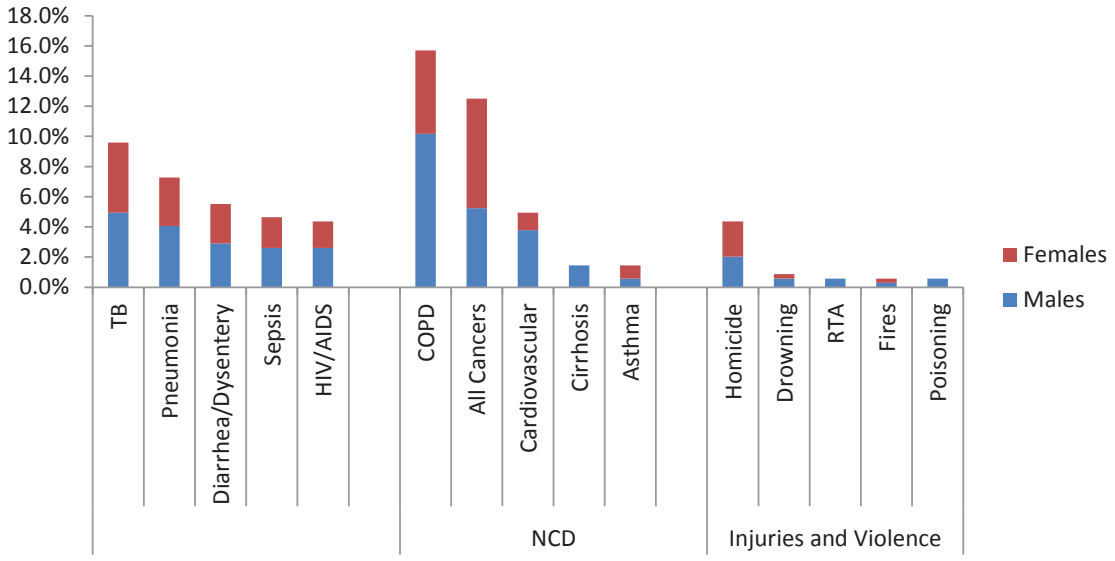

Figure 9-3 Leading causes of adult death in Asaro iHDSS, 2014

COPD Chronic obstructive pulmonary disease
HIV/AIDS Human Immunodeficiency Virus/ Acquired Immunodeficiency Disorder Syndrome
NCD Non-communicable diseases
RTA Road traffic accidents

Hiri

Hiri provides a uniquely distinct mortality pattern compared to the other three sites. Unlike the other iHDSS populations, diabetes features in the top five causes of death and is the leading cause of NCD deaths in Hiri (Figure 9-4). TB is the leading cause of infectious disease deaths in the Hiri iHDSS followed by HIV/AIDS

and malaria. However, it noticeable that malaria might have been probably over assigned as a cause of death by physicians in Hiri. This point will be further discussed in the following Chapter on Morbidity.

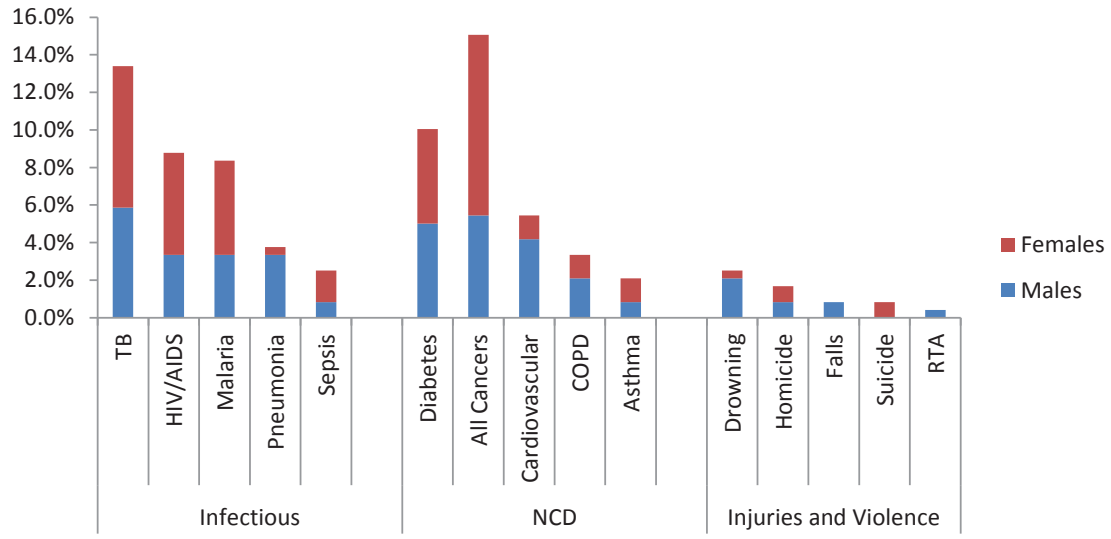

Figure 9-4 Leading causes of adult death in Hiri iHDSS, 2014

COPD Chronic obstructive pulmonary disease
HIV/AIDS Human Immunodeficiency Virus/ Acquired Immunodeficiency Disorder Syndrome
NCD Non-communicable diseases
RTA Road traffic accidents

Karkar

Figure 9-5 presents the leading causes of adult deaths in Karkar iHDSS. High levels of NCDs are evident in this population but like in Asaro and Hides, this is largely dominated by COPD. Deaths caused by cancers are also highly prevalent, predominantly amongst males. Most of these cancers originate from the liver (15.4% of all adult cancer deaths) and mouth (28% of all adult cancer deaths). Further analysis of NCD is conducted and presented in the following Chapter on NCD of the report.

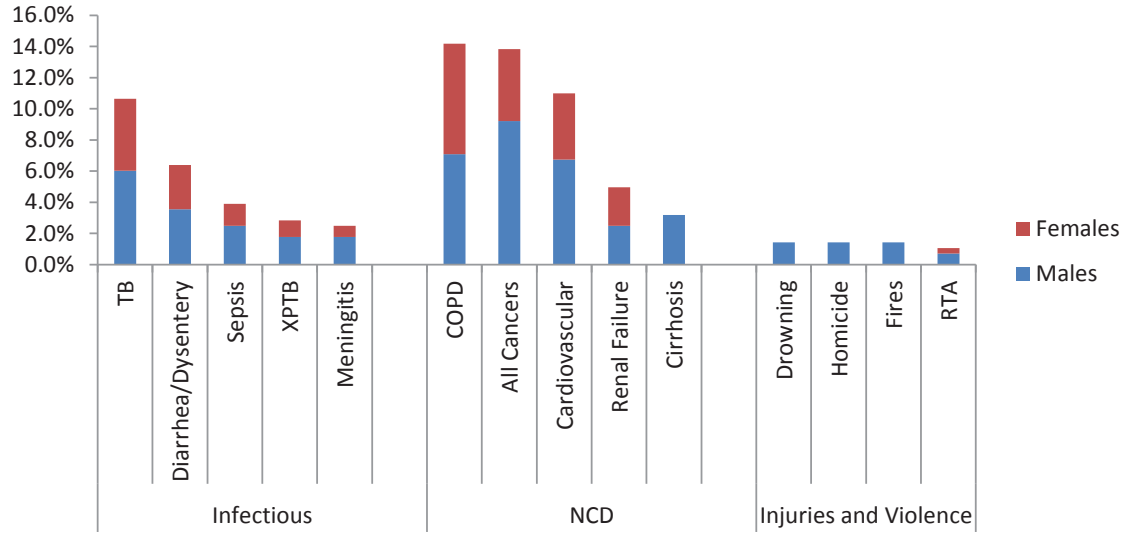

Figure 9-5 Leading causes of adult death in Karkar iHDSS

COPD Chronic obstructive pulmonary disease
HIV/AIDS Human Immunodeficiency Virus/ Acquired Immunodeficiency Disorder Syndrome
NCD Non-communicable diseases
RTA Road traffic accidents
XPTB extra-pulmonary TB

Child leading causes of death

Figure 9-6 shows the leading causes of deaths among children by study site. The data indicated that diarrhoea/dysentery and pneumonia remain the major killers for children under the age of 15 across all sites.

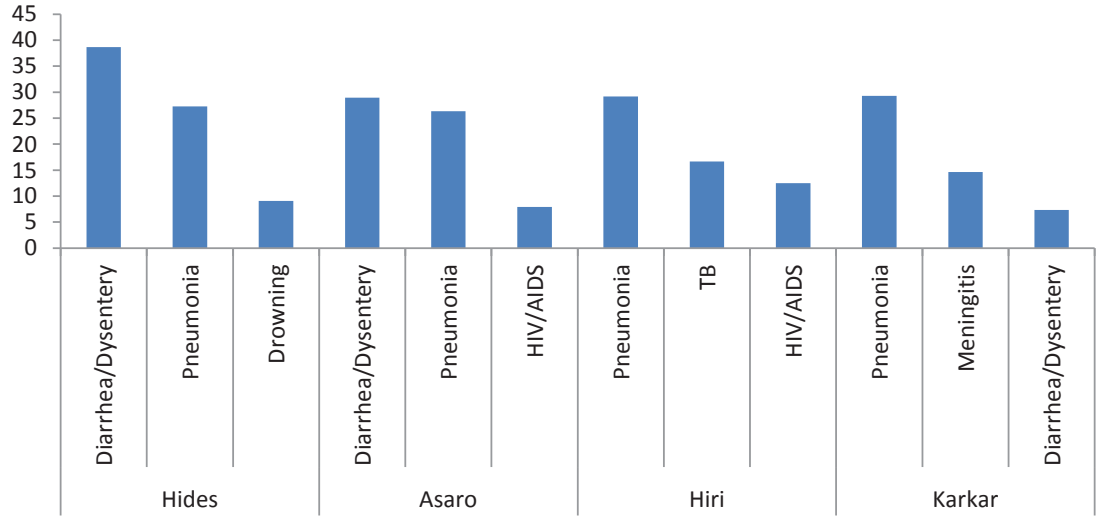

Figure 9-6 Leading causes of child deaths by site, iHDSS, 2014

Adult leading cause of death

Table 9-4 shows the leading causes of death by age groups. The structure of cause of deaths we have conducted verbal autopsies on has not substantially changed since the last report. Approximately 50% of the

causes of deaths in age groups 15-34 were attributable to infectious diseases. In contrast, NCDs accounted for 50% or more of cause of deaths among population in age groups of 35+. Many deaths among adults were also due to external causes such as violence, which attributed for 15%of death among adult aged 35+.

In addition, injuries were responsible for about one third of deaths amongst children, 0-14.

Table 9-4 Causes of death across all iHDSS sites by age group

	Infectious diseases		NCDs		Injuries		Violence		Neonatal		Maternal		Indeterminate		Total
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	
<1	50	33.6	6	4.0	5	3.4	1	0.7	82	55.0	0	0.0	5	3.4	149
1-4	50	80.6	3	4.8	7	11.3	0	0.0	0	0.0	0	0.0	2	3.2	62
5-14	29	64.4	7	15.6	8	17.8	0	0.0	0	0.0	0	0.0	1	2.2	45
15-24	46	56.1	19	23.2	2	2.4	8	9.8	0	0.0	2	2.4	5	6.1	82
25-34	57	47.9	33	27.7	9	7.6	8	6.7	0	0.0	6	5.0	6	5.0	119
35-44	46	36.8	55	44.0	8	6.4	11	8.8	0	0.0	1	0.8	4	3.2	125
45-54	46	33.8	73	53.7	5	3.7	5	3.7	0	0.0	0	0.0	7	5.1	136
55-64	58	36.7	84	53.2	2	1.3	6	3.8	0	0.0	0	0.0	8	5.1	158
65+	98	31.1	169	53.7	5	1.6	2	0.6	0	0.0	0	0.0	41	13.0	315
Total	480	40.3	449	37.7	51	4.3	41	3.4	82	6.9	9	0.8	79	6.6	1,191

Four years is too short a time period to observe major trends in causes of death but an initial analysis of findings thus far would indicate a potential increase in NCDs over the four sites (Figure 9-7). Infectious diseases exhibit some fluctuations but have remained attributable for about 40% of all causes of deaths.

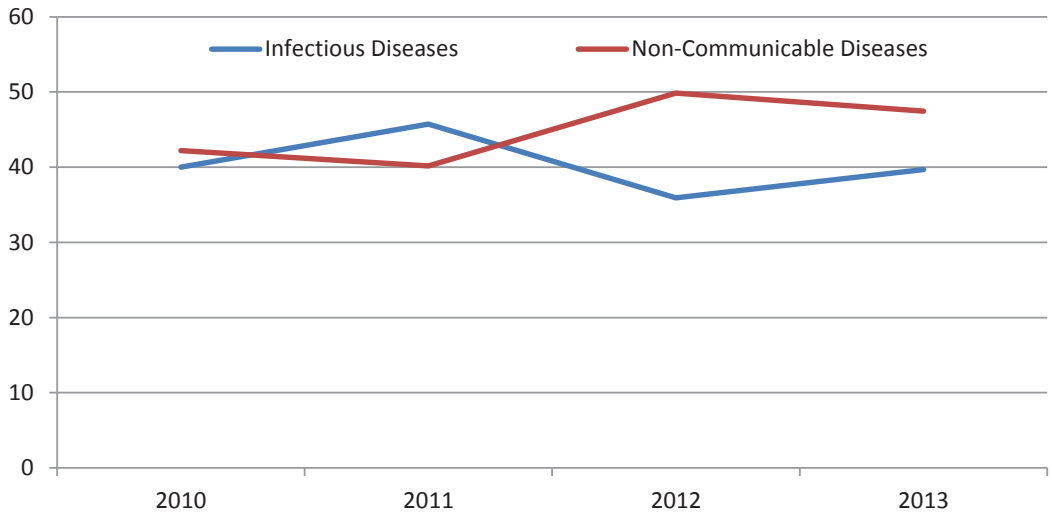

Figure 9-7Trends of Infectious Diseases and NCDs, iHDSS, 2010-2013

Discussion

Progress on the cause of death study has been slow but steady. Limited access to iHDSS sites, particularly Hides due to the internal instability could affect the safety and security of field staff has substantially affected to the fieldwork in the last six months, resulted in slowed progress. Despite this, all other sites have kept up with the deaths identified through the iHDSS. Mortality surveillance in Hides is incomplete and requires review before conclusions can be made about local trends and patterns.

As discussed previously, there remain a number of limitations to this analysis. Firstly, deaths in this analysis have been presented as proportions of total deaths and not as yearly rates. The calculation of rates will soon possible when a full year of data collection has been complete and physician review on these deaths has been conducted. Data collection in Karkar and in particular Hides started later than the other two sites and full data for any given year has not yet been achieved. Therefore, interpretation of results should be done with a degree of caution.

Secondly, no standard approach to physician review has been agreed (Joshi, 2009; World Health Organisation, 2007). In order to ensure the highest accuracy in ascribing a probable cause of death to a VA physician review some researchers recommend that reviews be conducted independently by two physicians (Kahn, 2008). Where disagreements arise a third physician might be consulted and a consensus must be achieved (Byass, 2011). At present there are only two trained physicians dedicated to the task of reviewing VA forms for the Partnership in Health project and forms have to be transported to be reviewed by those available making double review challenging. Physician review diagnoses may change over time as results are reviewed and physicians continue to receive on-going training in assigning causes of death to verbal autopsies. Verbal autopsies thus far collected will also be analysed by computer-based analytical software and results will be compared with the physician review results.

Lastly, this analysis only examines one probable underlying cause of each identified death. A number of conditions, like HIV/AIDS and TB and diabetes and TB, are often associated with one another and many deaths are likely to be due to multiple causes of death. Future analyse should consider potential methods for in-depth investigations into this subject (King, 2008).

High rates of deaths due to NCDs in Hiri and HIV/AIDS, as well as violence, in Hides warrant further investigation and demands attention by national and provincial public health authorities. The development of targeted interventions and prevention programs should be considered immediately.

PNG is entering a phase of rapid economic development and one that is likely to be characterised by major shifts in traditional social structures and therefore lifestyles. Small population studies like the Partnership in

Health Programme have the potential to provide crucial data which can supplement and enhance the understanding of this transition and inform the critical policy decisions that should be considered.

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Annex

Publications:

Serina, P., Riley, I., Stewart, A., James, S., Flaxman, A., Lozano, R., Hernandez, B., Lopez, AD., Black,R., Ahuja, R., Ali, SM., Baqui, A., Dandona, L., Dantzer, E., Das,V., Dhingra, U., Dutta, A., Fawzi, W., Gomez, S., Gouda, HN., Joshi, R., Kalter, H., Kumar, A., Kumar, V., Lucero, M., Mooney, M., Mehta, S., Neal, B., Ohno, SL., Prasad, R., Praveen, D., Premji, D., Ramírez-Villalobos, D., Remolador, H., Romero, M., Said, M., Sanvictores, D., Sazawal, S., Tallo, V., Murray, C.J.L. (2014) Tariff 2.0: Improving performance of the Tariff Method for assigning cause of death to verbal autopsies using population mortality data and the Population Health Metrics Consortium Database. BMC Medicine (submitted)

Presentations and Posters:

Gouda, H.N., Maraga, S., Rarau, P., Phuanukoonnon, S., Siba, P., Stewart, A.L., Serina, P., Ohno, S., Lorenzo, R., Murray, C., Lopez, A.D., Riley, I. (2013) Mortality in transition: Causes of death in three sites in Papua New Guinea during 2011 and 2012. Presented at the 2nd Verbal Autopsy Global Congress, Rhodes, Greece, 14th-16th October (poster)

Gouda, H.N., Maraga, S., Kelly, A., Wilson, L., Riley, I. (2013) Ethical and social issues affecting the implementation of verbal autopsy interviews in Papua New Guinea. Presented at the 2nd Verbal Autopsy Global Congress, Rhodes, Greece, 16th October

Gouda, H.N., Maraga, S, Rarau, P, Poka, H, Phuanukoonnon, S, Siba,P, Lehmann, D, Riley,I. (2013) Mortality and cause of death in four sites across Papua New Guinea. Presented at the Papua New Guinea Medical Symposium, Lae, 4th September.

10. CHAPTER 10 MORBIDITY SURVEILLANCE

Abstract

At each iHDSS site clinics are staffed by nurses who record visits by patients and collect data on the diagnoses given by the medical staff. All major clinics in the study areas are included.

Key findings from the preliminary data indicate that high levels of respiratory cases presenting at local clinics. Skin diseases and diarrhoea also contribute heavily to the clinical case loads at most sites.

Results presented here should be interpreted with a degree of caution however. Some clinics have faced significant challenges in collecting and compiling data. Furthermore, in many cases it may be that patients may bypass health clinics and sub-health clinics and go directly to hospitals. Results will be cross-checked with population surveys conducted within iHDSS populations.

Materials and results

Asaro

The 2014 March reported a lack of morbidity data from health facilities in Asaro aside from Asaro Health Centre. This Chapter presents preliminary morbidity data collected from Tafeto and Uritoka sub-health centres. The total number of visitors to Asaro health centre for the first 6 months of 2014 was doubled than that reported in the previous period, suggesting an increased demand for healthcare and a potentially over-burdened service in the reporting period (Figure 10-1).

Like Hides, Asaro clinics experience high levels of respiratory disease, skin diseases and diarrhoea. Unlike other sites, however, Asaro Health Centre and Uritoka sub-health Centre also diagnose high numbers of Sexually Transmitted Infections (STIs). This is consistent with the observations of STIs reported in previous Chapter on Maternal and Newborn Health. Note, Tafeto sub-health centre is run by the Catholic Church and does not provide family planning services, but limited sexual health consultations. As a result, none or low caseload of FP and STI was recorded in this clinic. This is due to under recorded, and does not reflect the high prevalence of STI in the site as shown in the Chapter Health Pregnancy. Cases visiting due to accidents and injuries are relatively high which reflects findings from the cause of death study.

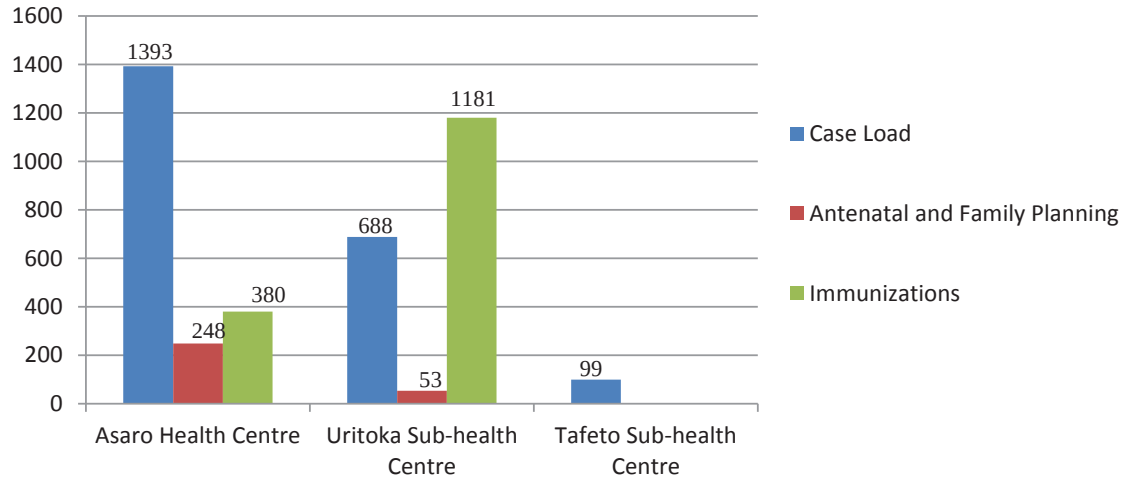

Figure 10-1 Average number of cases per month at Asaro health clinics, Asaro, iHDSS, 2014

Figure 10-2 shows the percentage of various diseases recorded in three health centres in Asaro in the reporting period. The data showed that the morbidity profile presented at the Uritoka Sub-Health Centre is relatively unique, with relatively high rate of skin infections, but lower rate of respiratory diseases and the rates of accidents and injuries were particularly high. The outbreak of measles in Asaro in early 2014 could be one of the possibilities, explaining the sharp increase in respiratory data in Asaro in the reporting period.

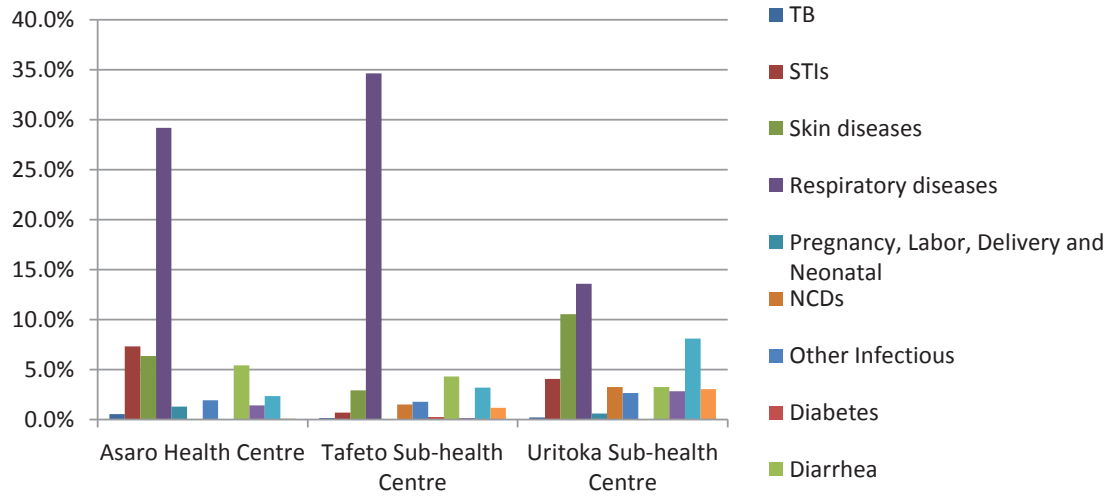

Figure 10-2Percentage of morbidity recorded in Asaro Health Centre, Tafeto Sub-health Centre and the Uritoka Sub-health Centre, Asaro iHDSS, 2014[13]

Hides

Figure 10-3 showed the average monthly caseload recorded in Mananda and Para Clinics in the Hides iHDSS catchment area. The data revealed a relatively consistent pattern of health service utilisation. Para

[13] 'Other Conditions' category removed to allow for scale – Other conditions make up about 40% - 48% of the total cases

and Mananda clinics recorded 305 and 480 visits on average per month, respectively. For Para clinic, this figure was slight higher than that reported in the last 2014 March PiHP report. By contrast, the caseload reported at Mananda Clinic was significantly decreased. The rapid PNG LNG demobilization, especially the completion of Komo Airfield construction could be a major contributor to such rapid decline.

It was also noticeable that a large number of measles vaccinations were recorded in the reporting period, particularly in June 2014. A major measles outbreak was reported in Hides, with a subsequent launch of a massive measles vaccination campaign. A low level of measles vaccination coverage has been reported in the previous PiHP 2014 March report. The report also predicted a likelihood of an outbreak of measles at that time.

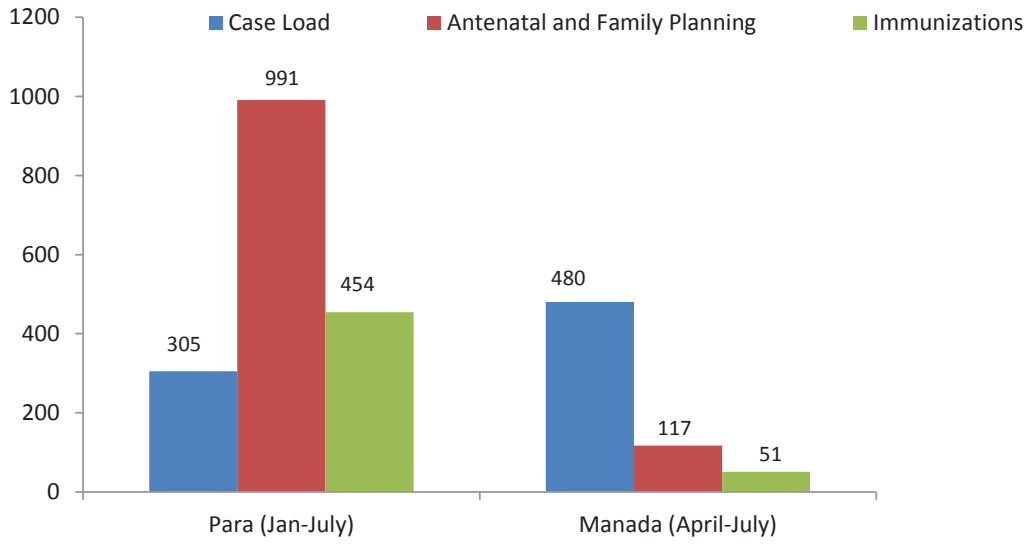

Figure 10-3Average number of cases per month reported at Para and Mananda Clinics, Hides, iHDSS, 2014

Similar to the finding reported in the 2014 March report, respiratory diseases again dominated the morbidity tallies in Hides clinics as shown in Figure 10-4. It was followed by diarrhoea and skin diseases. Accidents and injuries were remained almost unchanged at around 5% of the total tallies at both Para and Mananda clinics.

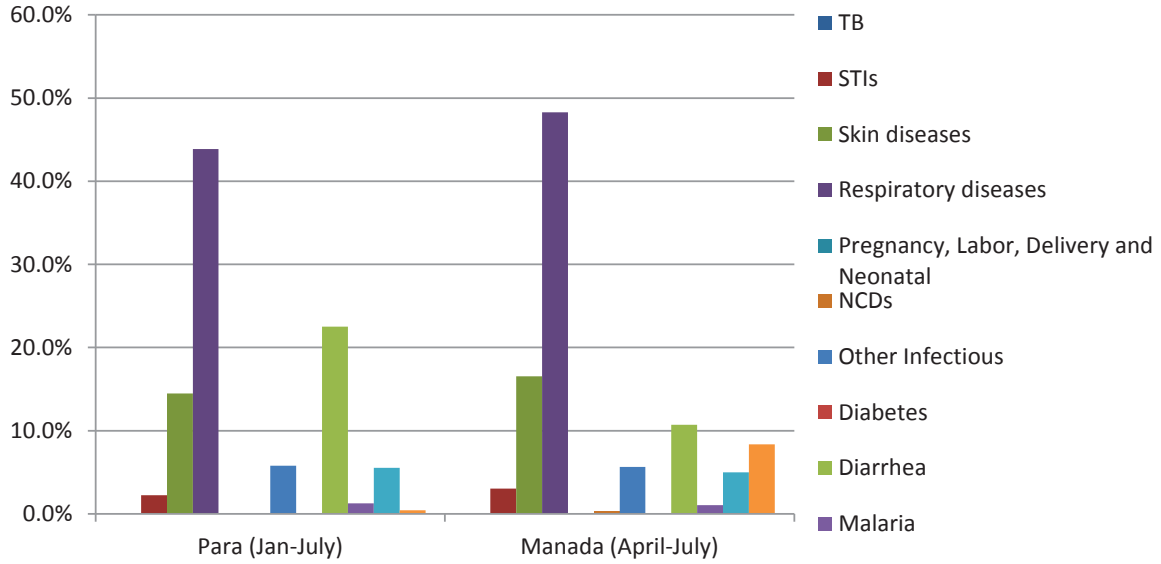

Figure 10-4 Para and Mananda Clinic Morbidity (%), Hides iHDSS, 2014

Figure 10-5 showed the trend of the monthly average caseload reported in Para and Mananda clinics over the period 2010-2014. While caseload was almost fluctuate around the level of 300 cases per month in Para clinic, the data showed a trend of declined number of cases reported in Mananda clinic, from 700 cases per month in 2011 to 490 cases in 2014. This reduction could coincide with opening new hospital in Komo and case load data from this facility should be reviewed in any future analysis.

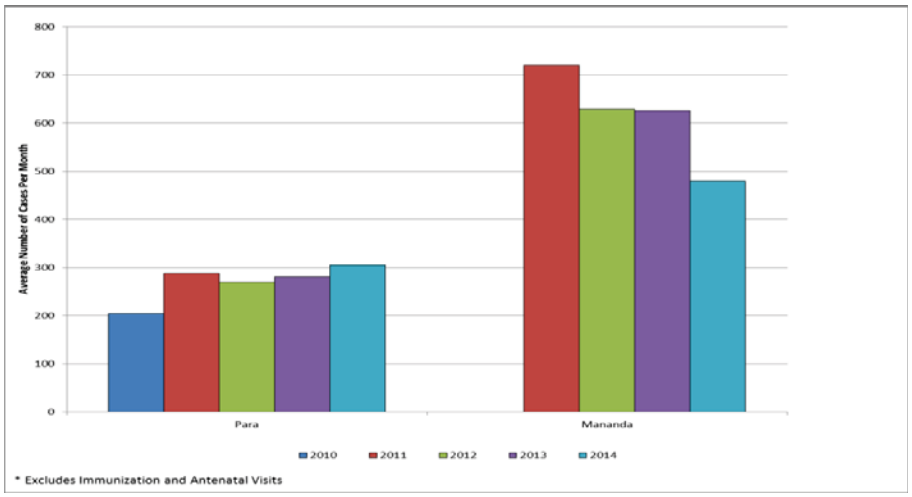

Figure 10-5Average Monthly Caseload reported in Hides, iHDSS, 2010-2014

Figure 10-6shows the proportion of caseload recorded in Para clinic by group of diseases over the five-year period 2010-2014. The longitudinal data indicated that respiratory diseases has been dominant in the morbidity data, accounted for more than 40% of the caseload, and tend to increase over the last five years. The second main group of diseases was diarrhoea, accounted for more than 20% of the caseload, and appeared no significant change in the last few years.

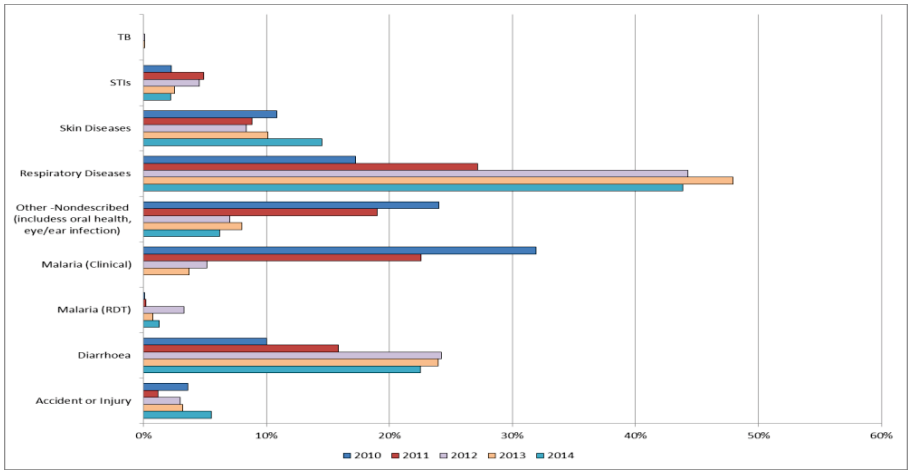

Figure 10-6Percent of caseload recorded in Para Clinic, Hides, iHDSS, 2010-2014

Figure 10-7 shows a similar trend of morbidity data recorded in Mananda clinic over the last four years, 2011-2014. Again, respiratory diseases were the most prevalent in the morbidity modality, accounted for approximately at 40% of the caseload. Diarrhoea and skin diseases stand for the second and the third common group of diseases in this clinic, accounted for 20% and 15% of the caseload, respectively.

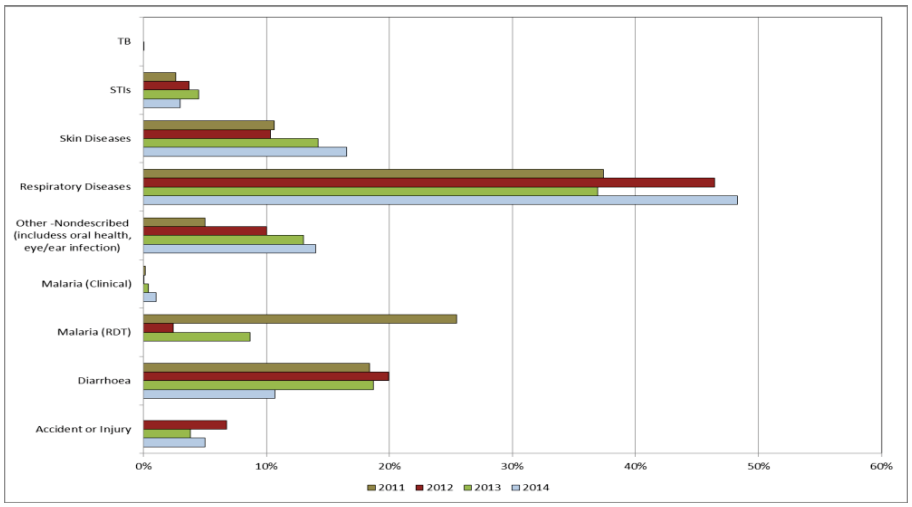

Figure 10-7Percent of caseload recorded in Mananda Clinic, Hides, iHDSS, 2011-2014

Hiri

Figure 10-8 shows the monthly average number of caseload recorded in two health centres: Papa and Porebada in Hiri in 2014. It is noticeable that the numbers of immunisation increased sharply in both clinics in the reporting period. This was mostly due to the increase in number of people visited clinics for measles vaccinations because of the recent outbreak in Hiri in the reporting period. This issue has been discussed in the previous Chapter on Sentinel Surveillance.

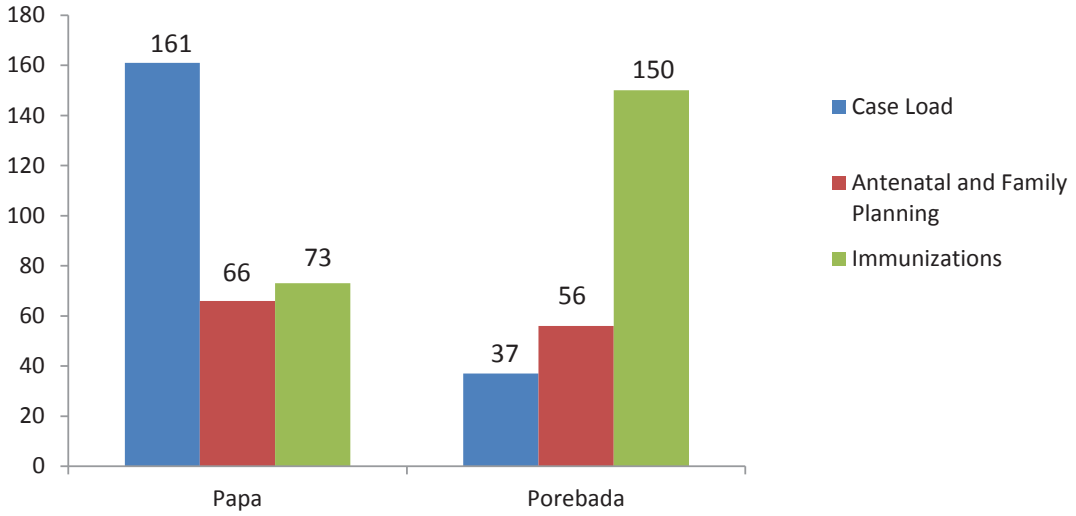

Figure 10-8Average number of cases per month reported at Papa and Porebada Health Centres, Hiri iHDSS 2014

Figure 10-9 shows the proportion of diseases recorded in Porebada and Papa Health Centres in Hiri in the first half of 2014.Like the morbidity data presented previously in other iHDSS sites, highest proportions of morbidity were reported to respiratory diseases, skin diseases and diarrhoea, ranging from 45% to 10% of the tallies reported in these clinics.

Contradictory to the high mortality data on TB, STIs, Malaria and NCDs as reported in previous chapters, these diseases were recorded at very low level, suggesting low presentation of patients seeking for treatment of these diseases at the two clinics. There are a number of potential explanations for these observations. For example, patients may prefer seeking health care at secondary and tertiary healthcare facilities such as POM general hospital.

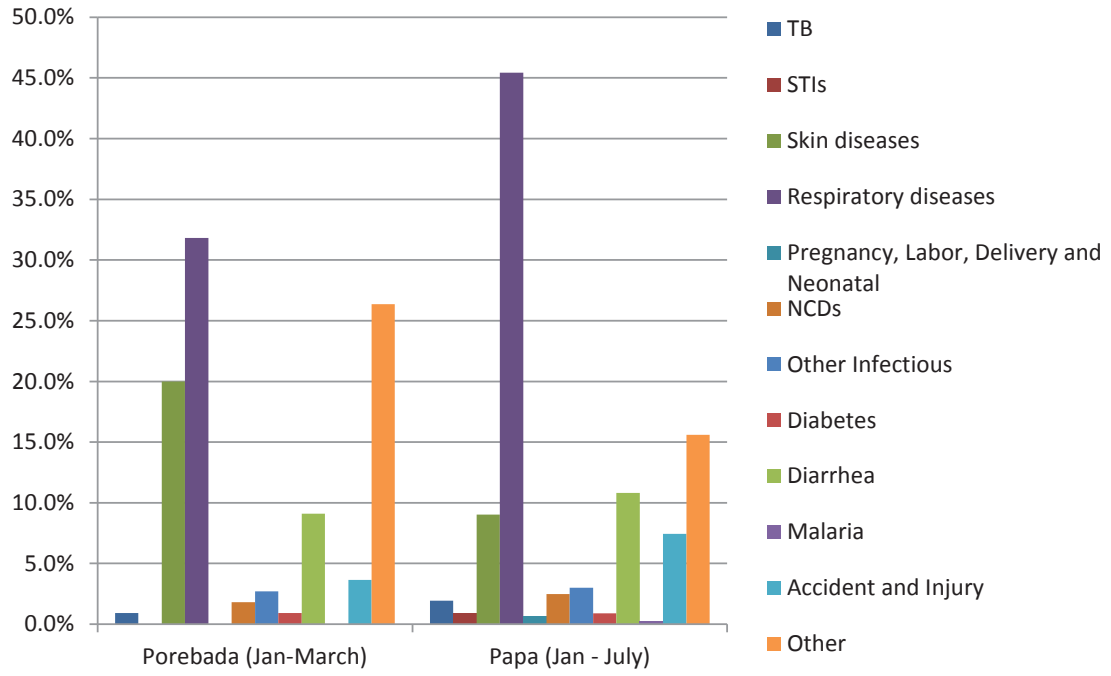

Figure 10-9Proportion of diseases recorded in Porebada and Papa Health Centres, Hiri iHDSS, 2014

Secondly, there is likely that the communities lack the knowledge of such diseases like TB, STIs, Malaria and NCDs so that they do not recognise early symptoms of such health problems to seek for consultations at the primary health centres. This could be particularly true for recognition of early symptoms associated with NCDs that may be unfamiliar to the population.

Lastly, in the absence of appropriate diagnostic tests, physicians maybe more inclined to diagnose certain conditions. This is not only true in the clinic but also in the process of assigning probably causes of death to verbal autopsy results. Symptoms associated with malaria, for example, could be due to other infections. Malaria as a cause of death may be over assigned by physicians while reviewing death data. Verbal autopsies are therefore, needed to be carefully considered in on-going work to indentify cause of death properly.

Figure 10-10 shows the average monthly caseloads presented at Porebada and Papa clinics over the period 2011-2014. The data suggested a considerable decline in the caseloads in these clinics in the past four years. Indeed, the caseload recorded in Porebada clinic has declined rapidely from around 180 cases in 2011 to approximately 25 cases in 2014. Although the caseload recorded in Papa clinic was significantly higher than that of Porebada clinic, the number of cases have been sharply declined, from the level of approximately 340 in 2011 to 160 in 2014. This could be due to the recent demobilisation of PNG LNG activities in the site, contributing to the declined caseload in these centres. However, further investigation on the caseload could be required to provide further insight into the observation.

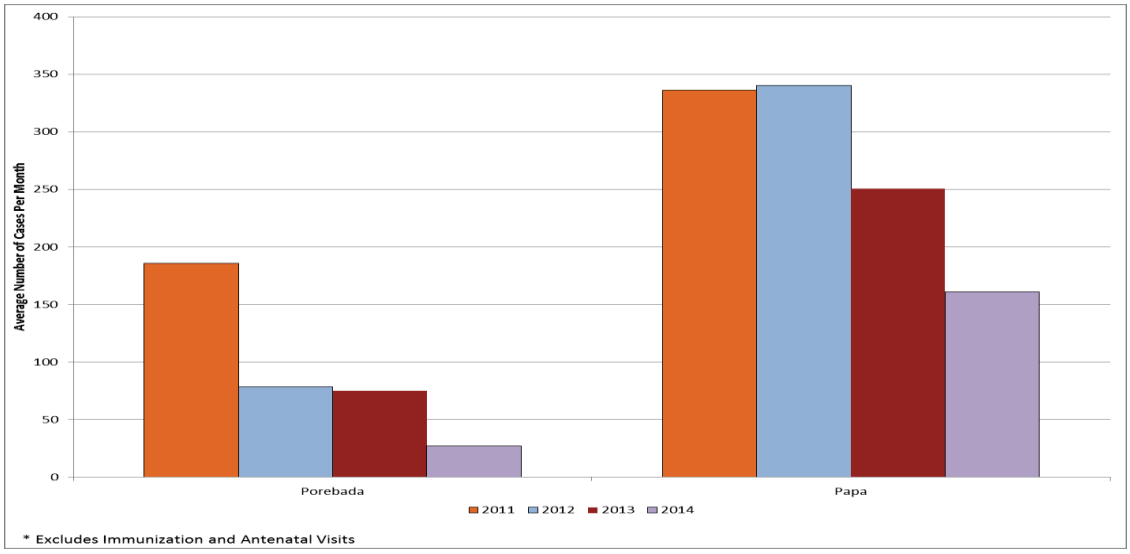

Figure 10-10Average Monthly Caseload reported in Hiri iHDSS over the period 2011-2014

Figure 10-11 shows details of morbidity data recorded in Porebada clinic over the period 2011-2014. The morbidity data once again confirmed the dominance of respiratory diseases, which accounted for around 30% of the caseload recorded each year in the clinic. However, the group of other diseases such as oral health issues and Eye-Ear infections were the second most concern as they accounted for 25-35% of the burden of diseases recorded in the clinic. It was followed by skin diseases and diarrhoea.

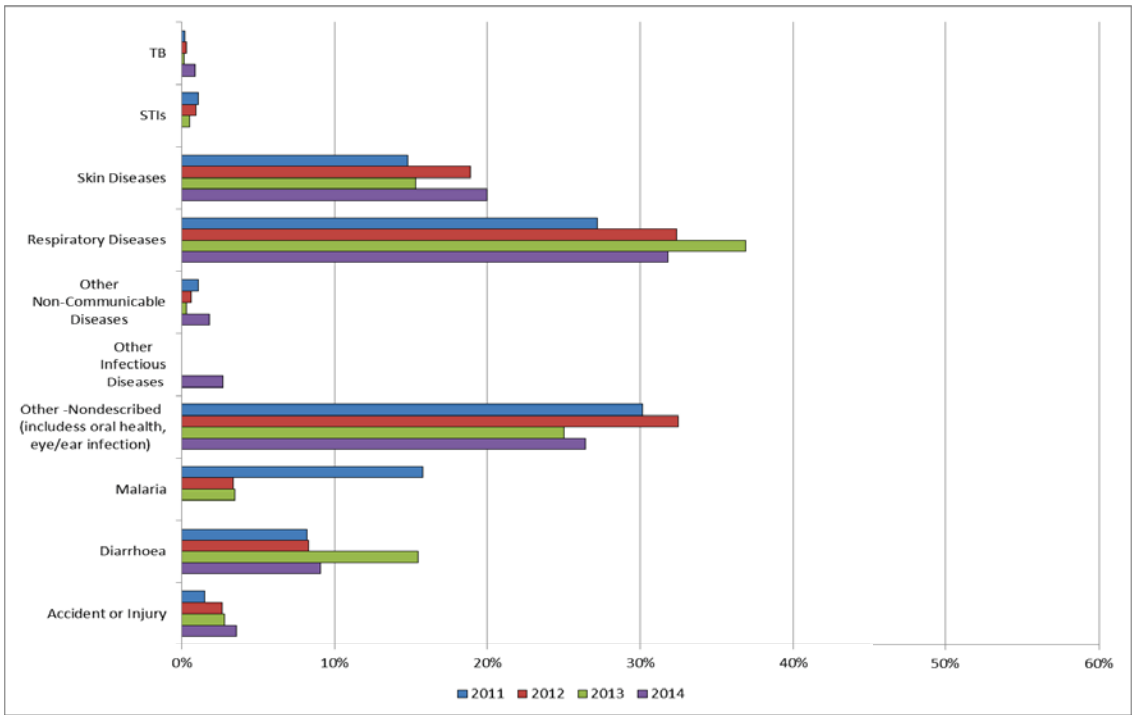

Figure 10-11Percent of caseload recorded in Porebada clinic, Hiri iHDSS, 2011-2014

Figure 10-12 shows the compositions of diseases recorded in Papa clinic over the four-year period, 2011-2014. Similar to the disease modality observed in Porebada clinic, respiratory diseases were the most common health issues, presented 40-50% of the caseload at Papa clinic. It was followed by the group of oral health and eye/ear infection (30%), and skin diseases (10%).

Other infectious diseases such as TB, STIs, NCDs, and malaria accounted for a small proportion of morbidity data, consistently across all years of the reporting period. As discussed above, these observations could be explained as patients are likely preferred to seek for health care services and treatment at higher health care facilities

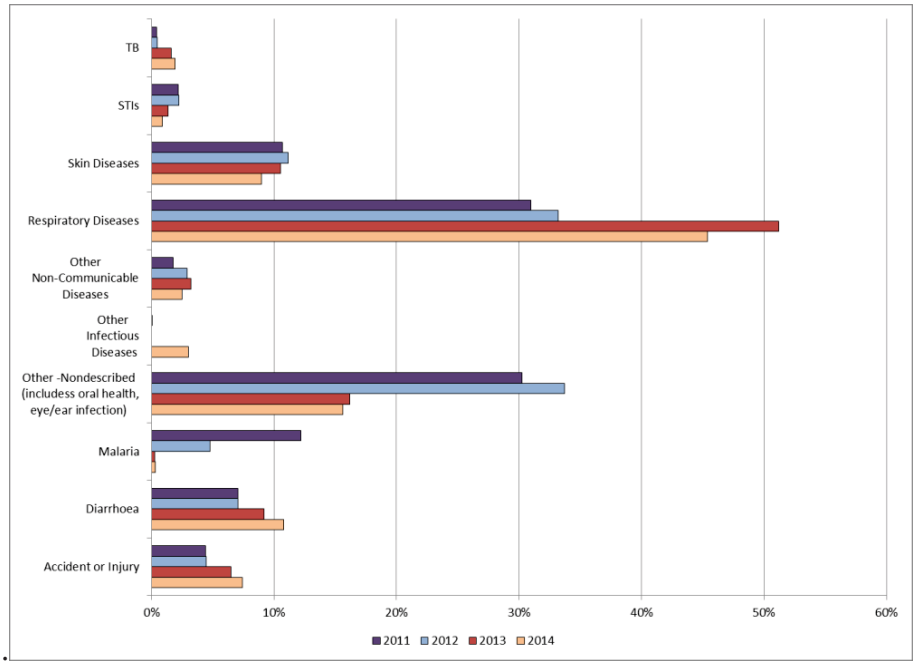

Figure 10-12Percent of caseload recorded in Papa clinic over the period 2011-2014

Karkar

Figure 10-13 shows morbidity statistics collected from Gaubin Hospital in Karkar. The data collection methods are currently undergoing in line with other sites. The average monthly caseload was reported at about 88 cases per month in 2013 and 111 per month in 2014.

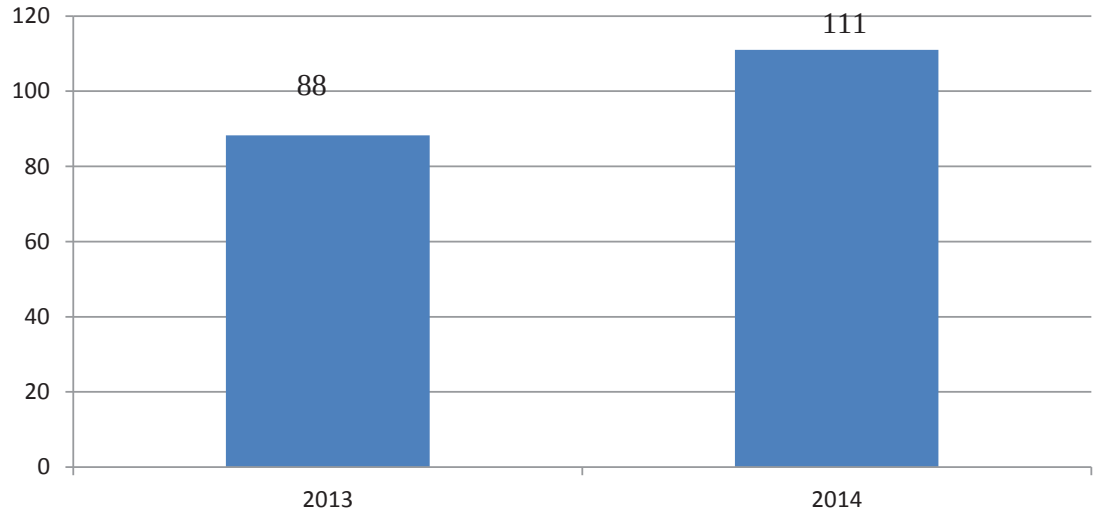

Figure 10-13 Average number of cases per month reported at Gaubin Hospital, Karkar iHDSS 2014

Figure 10-14compares morbidity data among adult patients at Gaubin hospital in Karkar in 2013 and 2014. The data indicated that respiratory diseases were the most burdens of diseases, 20-25%, followed by accidents and injuries, 7-8% in the last two years. Skin infections were reported doubled in 2014, compared to 2013, 10% and 5%, respectively. The most common of skin infections were included abscesses and yaws.

Although, malaria was recorded as the second highest diagnosis, it was mostly referred to clinical-based diagnosis, rather than lab-test confirmation. As described in the previous report, malaria diagnosis, based on only the physical symptoms and clinical signs are often considered as unreliable. Without confirmation by rapid diagnostic test (RDTs) kits, many of these cases could be misdiagnosed as respiratory infections.

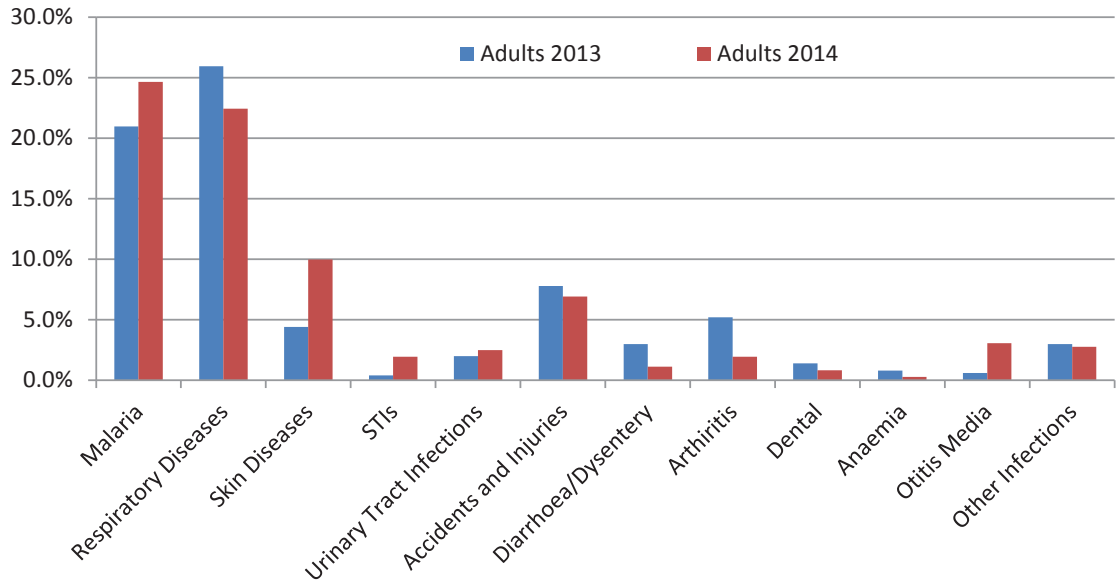

Figure 10-14Morbidity data among Adults at Gaubin Hospital, Karkar iHDSS, 2014

Figure 10-15presents further detailed morbidity data on different types of respiratory diseases that have been diagnosed at Gaubin hospital over the two year period 2013-2014. The data revealed that pneumonia, cough and asthma were the most common causes of respiratory diseases diagnosed amongst adult patients.

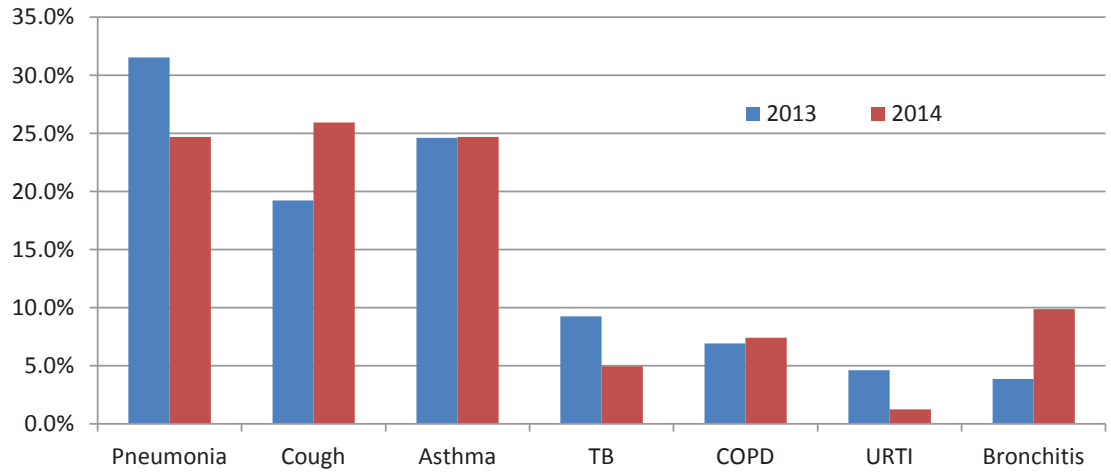

Figure 10-15Proportion of respiratory illnesses among all respiratory diseases diagnosed in adults, Gaubin hospital, Karkar iHDSS, 2014

Figure 10-16 show the morbidity data among children recorded at Gaubin hospital in 2013 and 2014. The data indicated that the most commonly diagnosed illness was respiratory diseases (mainly upper respiratory tract infections and pneumonia). Like disease pattern observed among adult patients, skin infections have been also diagnosed at high rates of 13-18% in 2013-2014.

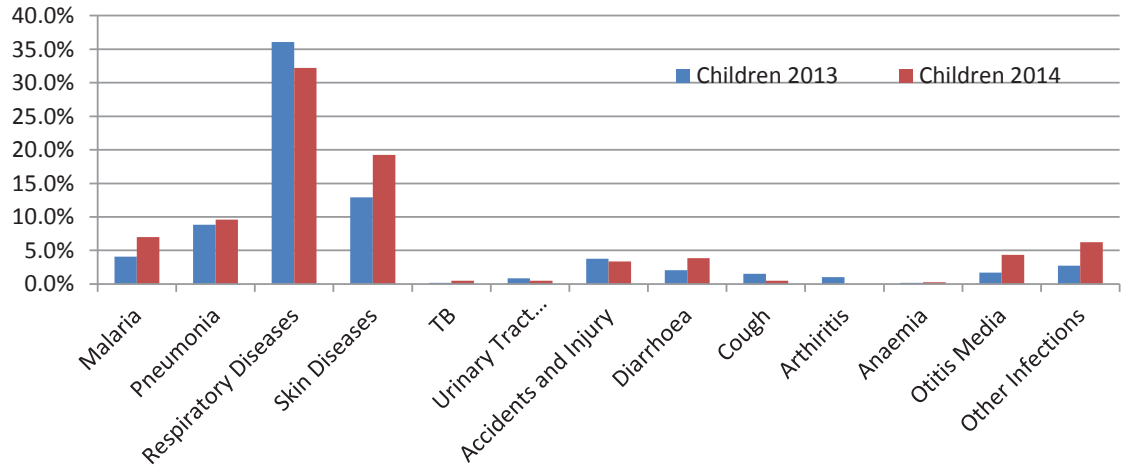

Figure 10-16 Gaubin Hospital Morbidity (%) amongst Children, Karkar iHDSS, 2014

Discussion

The morbidity data presented in the Chapter have a number of limitations. Firstly, the clinic tallies do not provide an individual identifier and therefore, it cannot be inferred to as new cases or repeated visits to the health clinics.

Secondly, while these clinics presented here would capture the population of interest to the iHDSS, it is not clear where else patients may be visiting to receive their healthcare. As noted above, the Hiri population is quite close to Port Moresby and may choose to attend clinics and hospitals in the city. Mortality data indicate that many people in Hiri die in Port Moresby General Hospital.

The presence and distance of a Goroka General Hospital may also motivate Asaro residents to bypass Asaro Health Centres and Sub-Health Centres for what may be perceived as better or more appropriate services.

Though TB and COPD are reported as the leading causes of death in Karkar, these patients are less likely to visit health clinics in the site as reflected in low records of the morbidity data. As showed in the Chapter on TB, the high TB prevalence suggests a high burden of this disease in Karkar. This data is also confirmed by the mortality data shown in the Mortality Chapter. However, the TB data is relatively low in health clinics in this island. The under utilization and/or a lack of proper expertise and/or appropriate laboratory equipments could be the reasons underlying an ineffective TB programme at the clinic level.

Conclusion

The iHDSS has outlined the overall picture of the burdens of diseases in four iHDSS sites in Asaro, Hides, Hiri and Karkar. The analysis of morbidity data in this Chapter has provided some changes in the patterns of diseases over the last few years, particularly in the impact sites, where PNG LNG has deployed large economic activities.

The preliminary results indicate that respiratory cases are still dominant at local level. It was followed by skin infection diseases and diarrhoea, which accounted for majority of the caseload in the iHDSS clinics.

However, the results presented in the Chapter should be interpreted with caution because the limitations of the data, not only in terms of sample size, but also the process to recording and reporting the morbidity data. The iHDSS clinics have faced many challenging situations in collecting, compiling, and reporting the data, particularly in Hides due to social unrest. Failure of follow-ups cases to verify the diagnosis could be another challenge to the improvement of morbidity data. Results will be cross-checked with population surveys conducted within iHDSS populations.

Further analysis of health seeking behaviour and health service utilisation at the household level are needed to shed lights onto morbidity data that would provide better understanding and interpretation for health policy decision-making and guide the country responses to new emerging health issues and trends.