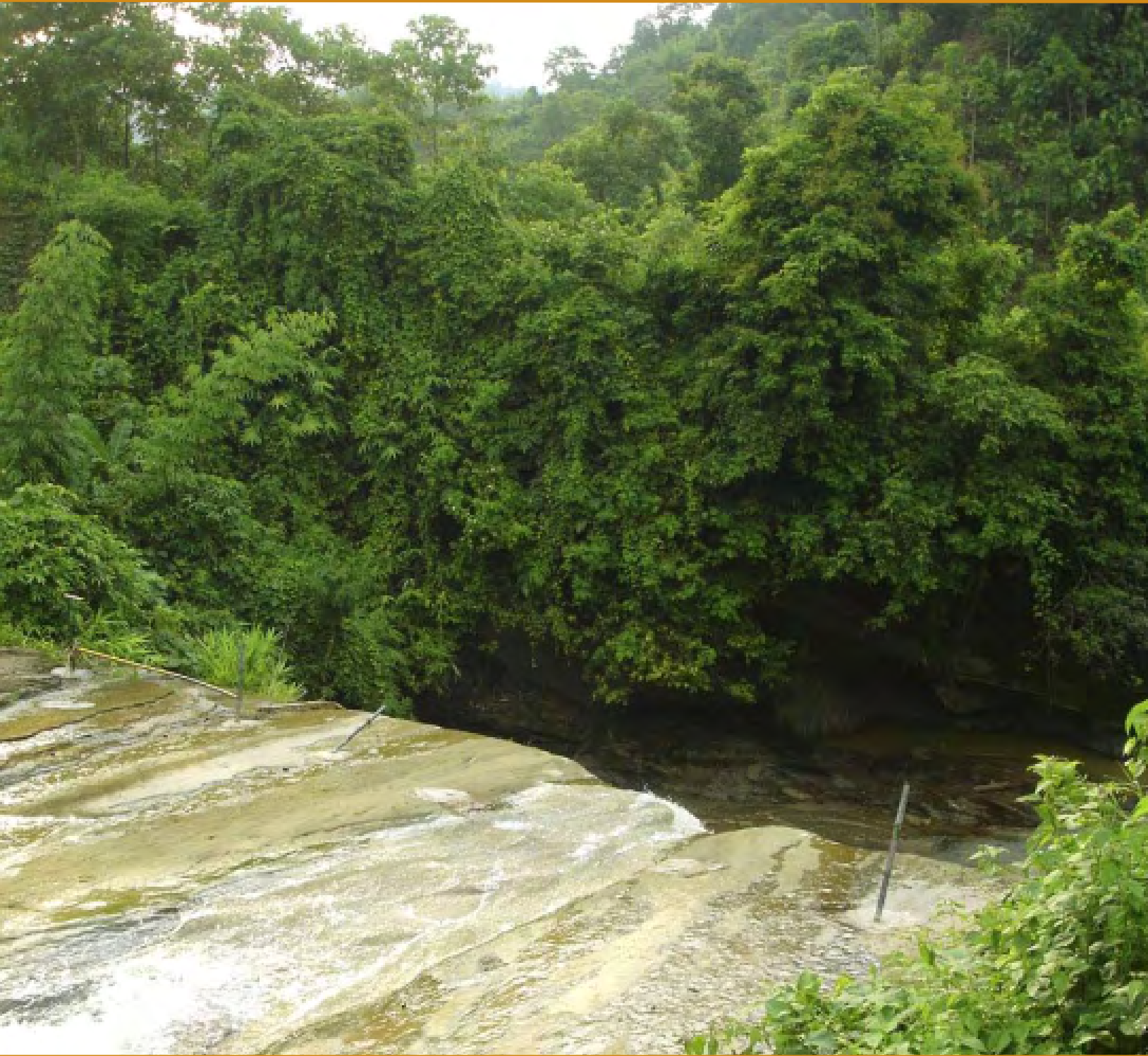


Initial Demographic Surveillance System Report for the icddr,b Bandarban Field Site



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Introduction

Malaria is a serious public health problem affecting 300 million people and causing one million deaths annually (1). 90% of malaria mortality occurs in Africa, while Southeast Asia accounts for another 9% (1). High population density makes Bangladesh particularly susceptible to the impact of endemic malaria (1). In 2006, Bangladesh had an estimated 2.9 million malaria cases and estimated 15,000 deaths (2). Combating malaria is part of the Millennium Development Goals that many countries, including Bangladesh, have pledged to achieve (3).

Malaria is caused by the human parasites *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi* (4). In Bangladesh, *P. falciparum* and *P. vivax* cause the majority of malaria infections, with ~70% and ~15% of cases caused by mono-infections with these respective species (4). Mono-infections with *P. ovale* and *P. malariae* account for less than 2% of malaria cases each, while mixed infections account for the balance of cases in Bangladesh (4). Malaria parasites are transmitted to humans by female *Anopheles* mosquitoes. In Bangladesh, there are 7 *Anopheles* species known to transmit malaria (2).

Currently, no licensed vaccine for malaria exists, and antimalarial drug resistance has become a major public health problem (5-7). Resistance to antimalarial drugs can be generated in the parasites by drug treatment with ineffective dosing and scheduling. In Bangladesh, as much as 40-50% of people access malaria drugs from drug vendors without diagnosis (8, 9). Additionally, mosquitoes are capable of efficiently distributing these drug-resistant parasites over relatively long distances. The Thai-Cambodia border is a well-documented center of antimalarial drug resistance. From here, drug resistance has spread to Myanmar and Bangladesh (5). In Bangladesh, nearly all malaria infections are resistant to chloroquine (CQ) and sulfadoxine/pyrimethamine (SP) combination therapies (5, 7). In 2004, artemisinin-based combination therapy (ACT) was introduced in Bangladesh as a first-line treatment for confirmed *P. falciparum* infection, but it was not implemented in rural areas until late 2007 (5). Meanwhile, CQ + SP continues to be commonly used for the treatment of “presumptive malaria” (5). A recent report has shown that a geographical gradient of artemisinin-resistance already exists from Cambodia (3%) and Thailand (2-3%), where the drugs are widely used, to Bangladesh (1%) (6). This suggests that malaria resistance to artemisinin may also occur.

DDT was banned in Bangladesh in 1971, and since then, there has been a steady increase in malaria cases (10). 13 of the 64 districts of Bangladesh have endemic malaria (10). In 2007, BRAC and icddr,b carried out the first blood-based prevalence study of malaria in 9,750 people in the 13 endemic districts, and found the overall weighted prevalence to be 4% (10). The parasite prevalence was significantly higher in children at 8.5% in 0-4 year-olds, and 6.6% in 5-14 year-olds (10). In the 8 northeastern districts with endemic malaria, the weighted prevalence was 0.4%, while the 5 endemic southeastern districts had a weighted prevalence rate of 6% (10). The three districts with the highest malaria prevalence are Rangamati (7%), Bandarban (11%) and Khagrachari (15%) (10). In fact, these three districts, collectively referred to as the Chittagong Hills Tracts (CHTs), account for 80% of the cases reported in Bangladesh each year (11). The southeast, mountainous CHT region borders Myanmar and contains 45% of all forests in Bangladesh, but only 10% of the land (12). A study for environmental risk

factors in a CHT district showed that a <3-km household proximity to the forest was the largest factor for malaria infection risk (13). Surprisingly, <3-km proximity to water was actually protective against malaria infection, which may be due to risk awareness and compensatory, protective health behaviors (13). In the CHTs, malarial “hot spots” have been documented where prevalence exceeds 20% (13).

In 2006, Bangladesh received \$36.9 million USD from the Global Fund to fight AIDS, tuberculosis, and malaria (GFATM) and implemented a malaria control program. This program began in 2007 and will continue until 2012. The scope of the program included distributing long-lasting insecticide treated nets (LLINs) to 80% of people in endemic regions, insecticide retreatment of the nets already in 40% of households, early diagnosis with rapid diagnostic tests (RDTs), ACT treatment, enhanced malaria disease and vector surveillance (8, 14). Rajasthali, a sub-district with high parasite prevalence (36%) in a pre-implementation survey, was recently reported to have reduced prevalence to 11% 2 years post-implementation (14).

The CHTs are primarily populated by the Jummas, who are 12 indigenous, tribal peoples that are culturally and linguistically distinct (12). Many of the Jumma groups are also Buddhist, in contrast to the Muslim majority faith in Bangladesh (12). The Jummas are more ethnically similar to the people of Myanmar. Although Bengalis are the majority group in Bangladesh, they comprise a minority in the CHTs, having only migrated into the region in the last 40 years (15). The people of the CHTs tend to live in ethnically homogeneous villages, with variation in the ethnic composition from region to region. For example, Marma predominate in Bandarban, while Chakma compose the largest ethnic group in Rangamati and Khagrachari (15). The Mro, in particular, tend to live high in the mountains, relatively separate from urban development (12). There has been considerable violence and hostility in the region from the time of Bangladesh’s liberation in 1971 to signing of a peace treaty in 1997 over deliberate resettlement of the region by Bengalis and inequalities in the treatment of the Jummas (15). Sporadic violence continued until recently and tension is ongoing over points in the treaty that have not been enacted.

Most of the people in the CHTs make a living through agriculture (12). In this region, 44% of the people use safe water, which is low compared to the country average of 97%, while 44% use pit or slab latrines, which is high compared to the country average of 36% (12). In 1998, a survey was conducted of 2,550 tribal group households (12). Within the ethnic groups, it was shown that there were large inter-group variations in SES measures like rates of illiteracy (e.g. 36%-88%) (12). There were also large inter-group variations in morbidity measures, like self-reported malaria symptoms (e.g. 2.1%-21%), and in health-seeking behaviors (12). Another specific biological malaria risk factor is the high rate of hemoglobinopathies amongst some ethnic groups in Bangladesh (16). Most commonly, β -thalassemia occurs in Bengalis in high frequency, and high proportions of tribal people carry hemoglobin-E mutations (17, 18).

In 2006, icddr,b began malaria field studies in Bandarban Sadar Upazila in the Chittagong Hills region (1). Because a cross-sectional study revealed large numbers of asymptomatic malaria carriers (10), it was decided that malaria surveillance was needed to determine malaria infection risk factors and assist in the development of new control measures, beyond the treatment of symptomatic malaria cases. In

2009, Johns Hopkins Malarial Research Institute and icddr,b began a collaborative project called “Mapping Malaria Epidemiology in Bangladesh.” The purpose is to conduct prospective, active malaria surveillance on a defined population of about 20,000 people in the Bandarban sub-district. The surveillance occurs every four months and includes: demographic and SES data collection; health behavior assessment; blood-based malaria diagnosis; and mosquito collection. Here, we present the first demographic characterization of the surveillance population.

Methods

Data presented here are from the baseline demographic survey of 20,558 people (4511 households and 1 orphanage). This sample comprised >95% of the population in Kuhlalong and Rajbila Unions. Initial demographic surveillance visits (IDSVs) of 2382 households was conducted in Kuhlalong from October 2009-February 2010, with additional 2 households each added in the periods of March-April and November-December 2010. In Rajbila, IDSVs of 2078 households were conducted from April-August 2010, with an additional 30 households added in September-November 2010. The data analyzed here are taken to represent Kuhlalong in December 2009 and Rajbila in June 2010.

Trained field workers conducted interviews in Marma, Bengali, or other tribal languages using a standardized questionnaire covering demographic topics, such as age, sex, ethnicity, marital status and family structure, as well as socio-economic status indicators like education and occupation. Forms were scanned using Abbyy FlexiCapture software and validated for accuracy. Data analyses were performed with Excel, Prism (Graphpad) and Stata software programs.

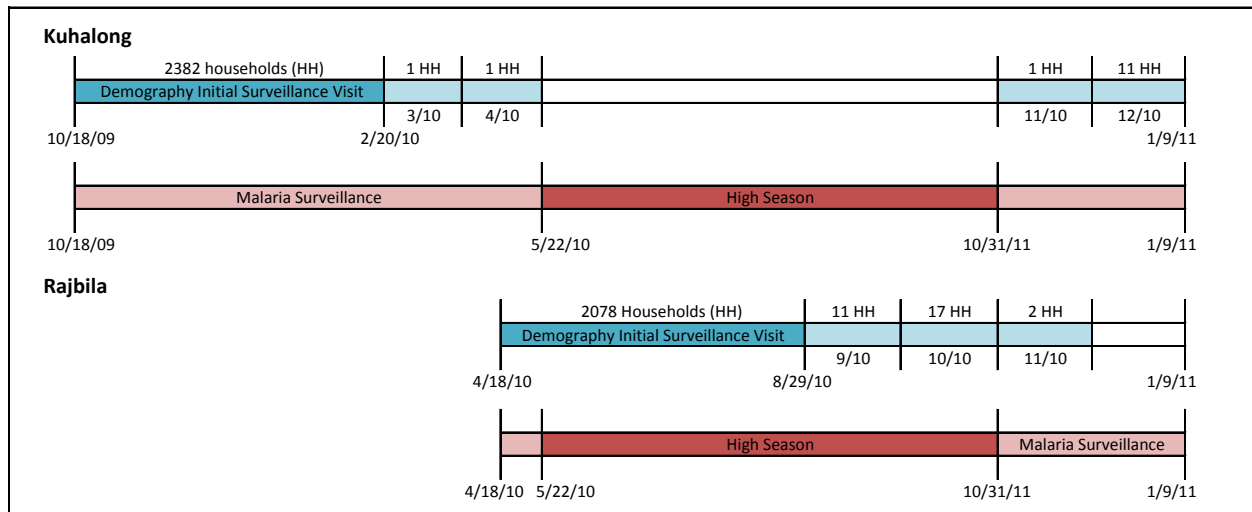


Figure 1. Demographic and malaria surveillance schematic for Kuhlalong and Rajbila unions. Demographic and malaria surveillance were first begun in Kuhlalong followed 6 months later by Rajbila.

Results

There were 20,558 people recorded in the initial demographic surveillance visit. In Rajbila, there were 9,168 people in 2,105 households and one orphanage with 100 tribal children, and in Kuhlalong, there 11,390 people in 2,406 households.

Ethnic Composition				
Ethnic Group	Rajbila		Kuhlalong	
	Count	%	Count	%
Marma	6,198	67.60	6,200	54.43
Tanchangya	1,101	12.01	659	5.79
Khyang	0	0	1,021	8.96
Chakma	301	3.28	411	3.61
Tripura	104	1.13	223	1.96
Bawm	0	0	85	0.75
Rakhaine	1	0.01	4	0.04
Mro	0	0	6	0.05
Bangali	1,463	15.96	2,781	24.42
Total	9,168	100	11,390	100

Race and Ethnicity. Out of the 12 tribes found in the CHTs, 8 were represented in our surveillance population of Kuhlalong and Rajbila residents: Marma, Tanchangya, Chakma, Tripura, Khyang, Bawm, Rakhaine and Mro. Based on what is known about the ethnic composition about Bandarban from a UNDP survey, we might have also expected there to Pangko and Chak, but regional differences are normal (15).

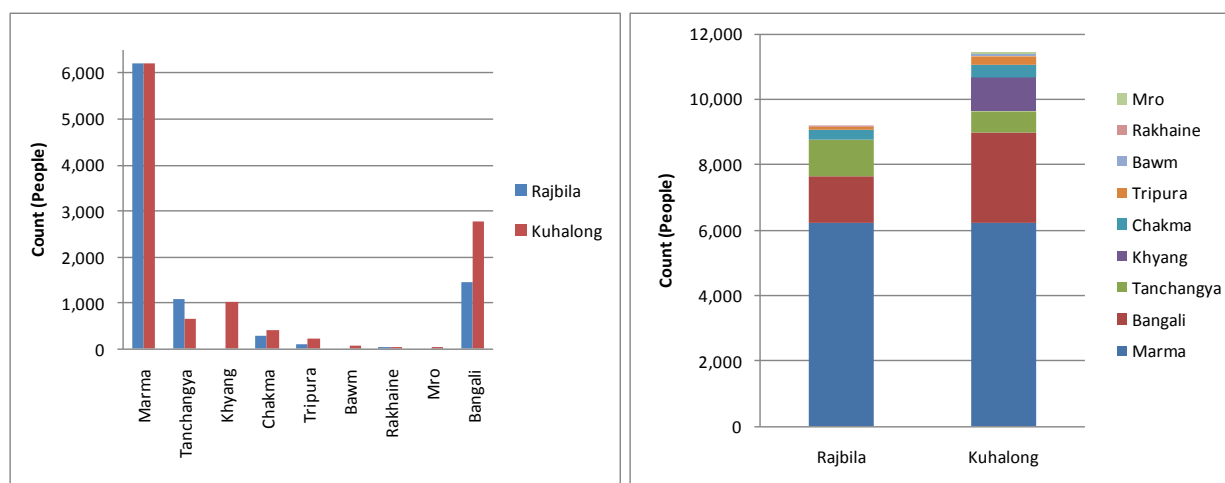


Figure 2. Ethnic composition of Rajbila versus Kuhlalong. There was a Marma majority in both Rajbila and Kuhlalong with equivalent numbers of Marma in each union. While Bengalis comprised the second largest group, twice as many Bengalis lived in Kuhlalong than Rajbila. Also, Kuhlalong had a substantial Khyang group, but Rajbila had none. There were few Mro and Rakhaine in the population.

In our survey region, by far the largest ethnic group was Marma, followed by Bengali. Although Kuhlalong and Rajbila had equivalent Marma populations, the Bengali population in Kuhlalong was almost twice that of Rajbila. Tanchangya were numerous in both unions, but were almost two-times as frequent in Rajbila. Kuhlalong had a large Khyang population, while Rajbila had none. Chakma and Tripura were the next largest groups and were common to both unions. Bawm were less numerous than the other groups and only in Kuhlalong. Very few Mro and Rakhaine (6 and 4 people, respectively) were in the survey region (Figure 2).

In our surveillance region, Bengali and non-tribal were synonymous, as there were no “non-tribal” “non-Bengalis.” Also synonymous were ethnicity and language. While most people in the region speak at least some Marma language and possibly Bengali to engage in local commerce, in our survey there was a 100% overlap between tribal ethnicity and the language spoken.

Religion Frequency (%)				
Religion	Rajbila		Kuhalong	
	Tribal	Non-Tribal	Tribal	Non-Tribal
Muslim	0	1,246 (85.2)	0	2,507 (90.2)
Hindu	0	158 (10.8)	0	159 (5.7)
Christian	75 (1.0)	0	308 (3.6)	0
Buddhist	7,630 (99.0)	59 (4.0)	8,301 (96.4)	115 (4.1)
Total	7,705 (100)	1,463 (100)	8,609 (100)	2,781 (100)

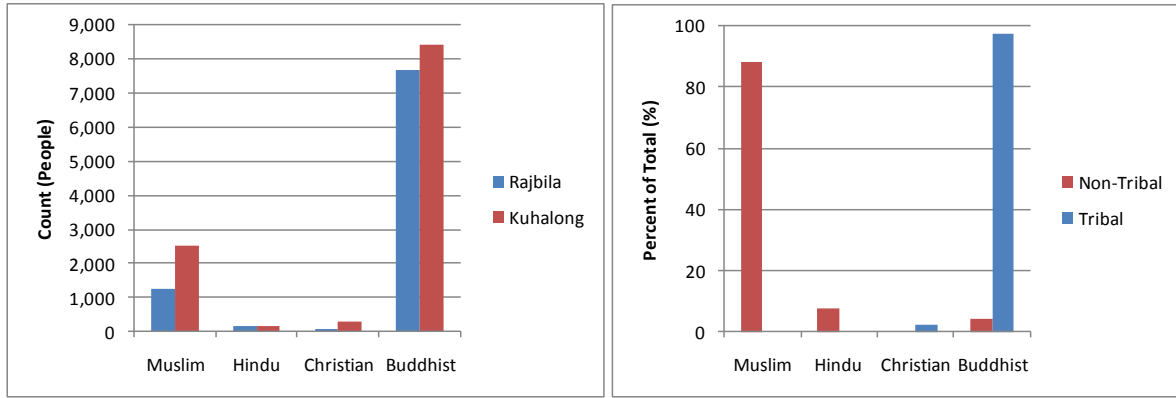


Figure 3. Religion by union of residence and ethnicity. The majority of people in both unions are Buddhist. Muslim, Hindu and Christian faiths make up the minority. Amongst tribal people, the majority are Buddhist with a small fraction of Christians. Amongst Bengalis, most are Muslims with some Hindus and Buddhists.

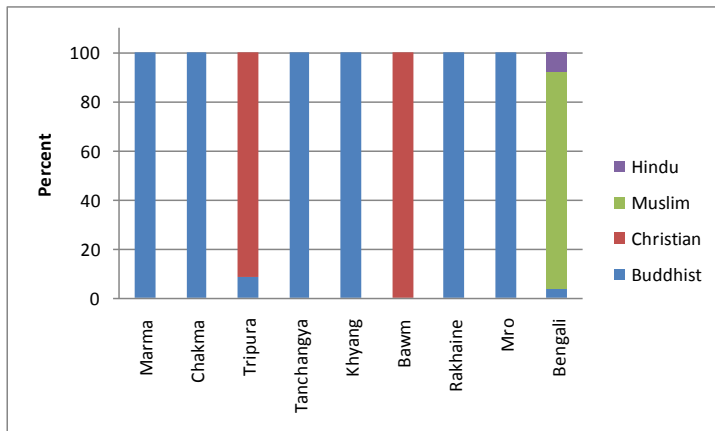


Figure 4. Religion by ethnicity. Most of the people making up the tribal ethnicities in our surveillance region are Buddhist, but all Bawm are Christian and the majority of Tripura are too.

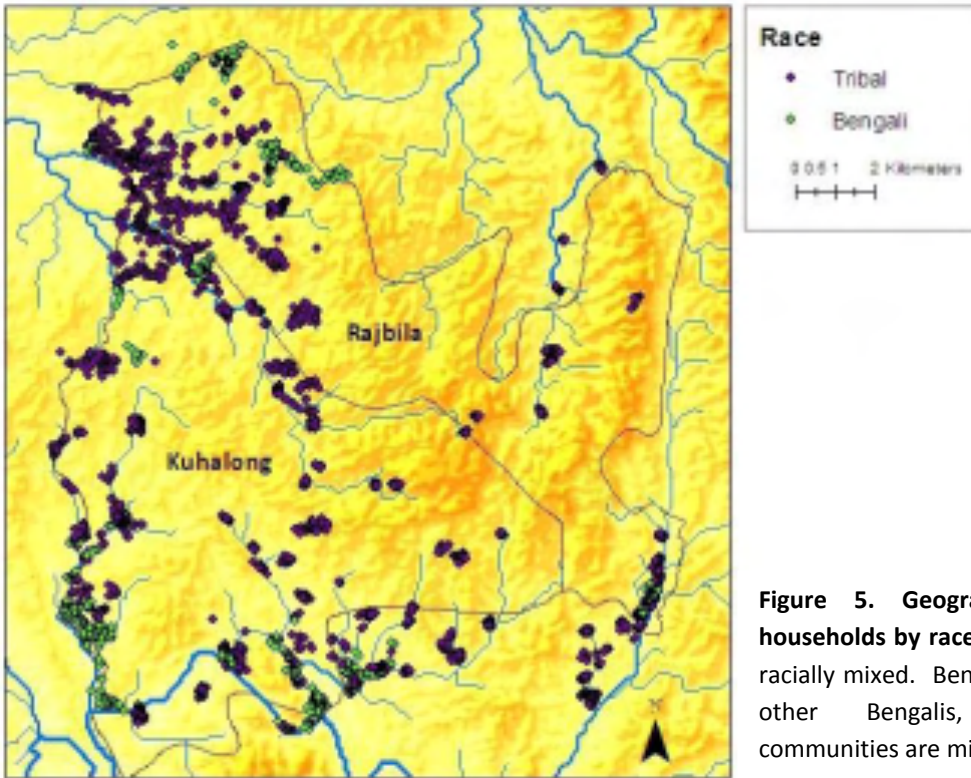


Figure 5. Geographical location of households by race. Households are not racially mixed. Bengalis tend to live near other Bengalis, although some communities are mixed.

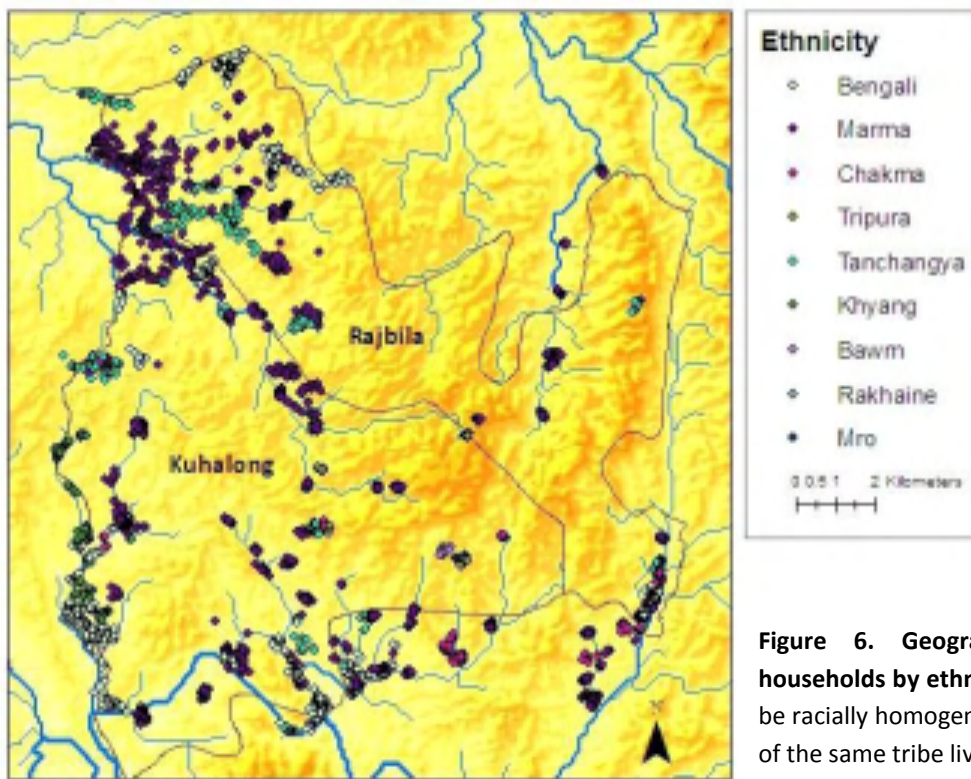
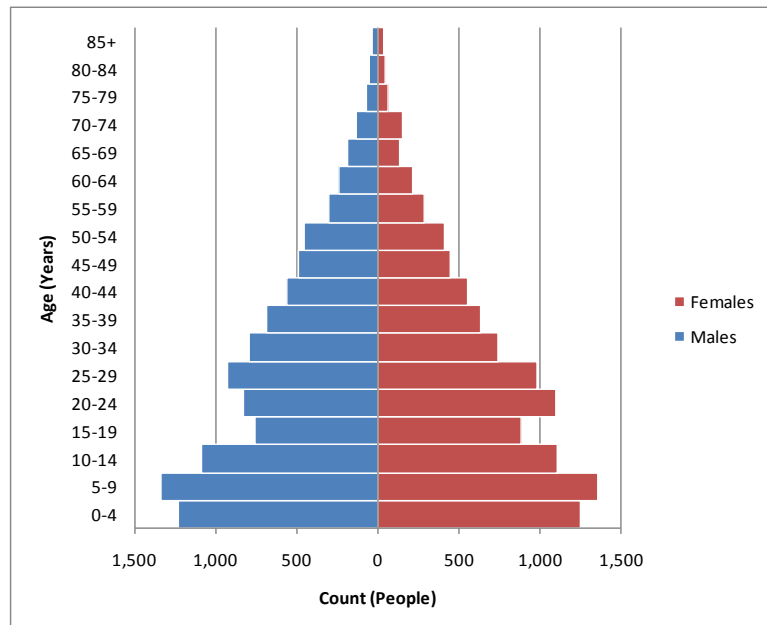


Figure 6. Geographical location of households by ethnicity. Villages tend to be racially homogeneous with households of the same tribe living near each other.

The tribal groups were historically Buddhist, but some have converted to Christianity. This is in contrast to the Muslim majority faith practiced by the Bengalis in the rest of the country. In Kuhalong and Rajbila, the vast majority of people are Buddhist, followed by Muslim with minor Christian and Hindu segments. If we examine who makes up these faiths, we see that tribal people are 96-99% Buddhist and 1-4% Christian, while Bengalis are 85-90% Muslim, 6-11% Hindu and 4% Buddhist, depending on the union (Figure 3). If we look closer at the individual tribes, most tribes are 100% Buddhist. However, Bawm are 100% Christian, and Tripura are 91% Christian and 9% Buddhist (Figure 4).

It should be noted that households of like ethnicities tend to cluster together in racially homogeneous villages. Bengalis live near other Bengalis (Figure 5). Individual tribal households also cluster near one another (Figure 6). This has important implications in terms of malaria risk as environmental risk factors like proximity to mosquito breeding sites and other malaria cases may be similar within tribal groups, in addition to possible biological variation in hemoglobinopathies that are known to exist in the region.

Age and Sex. The age of our study population is relatively young with an overall mean age of 25.8 years. A population pyramid reveals an immature age structure with more children than adults. This is characteristic of a population in a developing country like Bangladesh. There appear to be people missing in the 15-19 and 20-24 year categories for men and 15-19 year category for women. This may be due to out-migration for employment. It should be noted that men in Bangladesh tend to



marry younger women, so when looking at the pyramid, male categories would be matched with female categories at least one age group lower, respectively (Figure 7).

Figure 7. Age pyramid of the total population in Rajbila and Kuhalong by sex. The age structure of the population has more children than adults. Out-migration for employment likely accounts for people missing in the male 15-24 year and female 15-19 year age categories.

When the population is stratified by union of residence, we observe that Kuhalong residents (mean age= 25.0) are younger on average than Rajbila residents (mean age= 27.0). This is a statistically significant difference ($p < 0.001$). When the population pyramids for the two unions are compared side-by-side, we observe that they have slightly different shapes. Rajbila appears to have slightly more relative out-migration of 15-24 year olds compared to Kuhalong. Rajbila has fewer children in the 0-4 than the 5-10 year age category, which may reflect a recent decrease in the birth rate, while Kuhalong has equal numbers of 0-4 and 5-10 year olds and appears more stable (Figure 8).

When the population is stratified by race, we observe that Bengali people (mean age= 21.6) were younger on average than tribal people (mean age= 27.0) ($p < 0.001$). When the population pyramids for tribal and non-tribal ethnic groups are compared side-by-side, we observe a dramatic difference in the shapes of the pyramids. The non-tribal group has a pyramid characteristic of an expanding population with many more children (0-14 years old) relative to adults (15+ years old), while the tribal pyramid indicates a population that is stabilizing. We also see that the tribal group has fewer children in the 0-4 than the 5-10 year age category (Figure 9). A younger age structure for the Bengali group means that a higher proportion of people are of reproductive age, resulting in a higher proportion of children in their population.

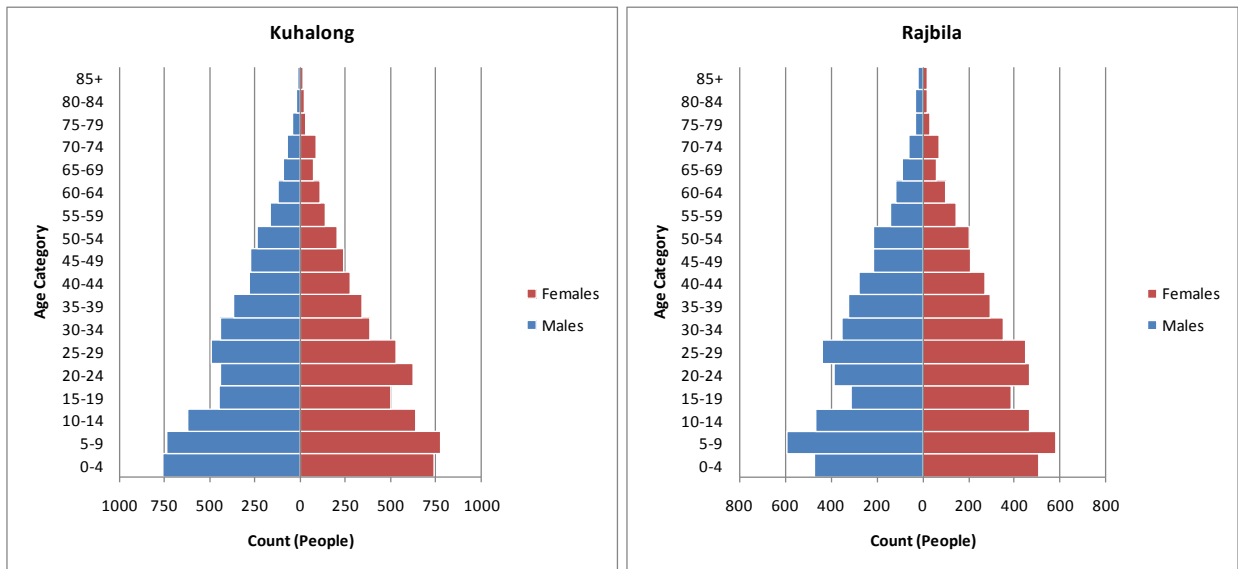


Figure 8. Age pyramids of the total population by union of residence and sex. Rajbila has relatively fewer children in the 0-4 than 5-9 year age category compared to Kuhalong.

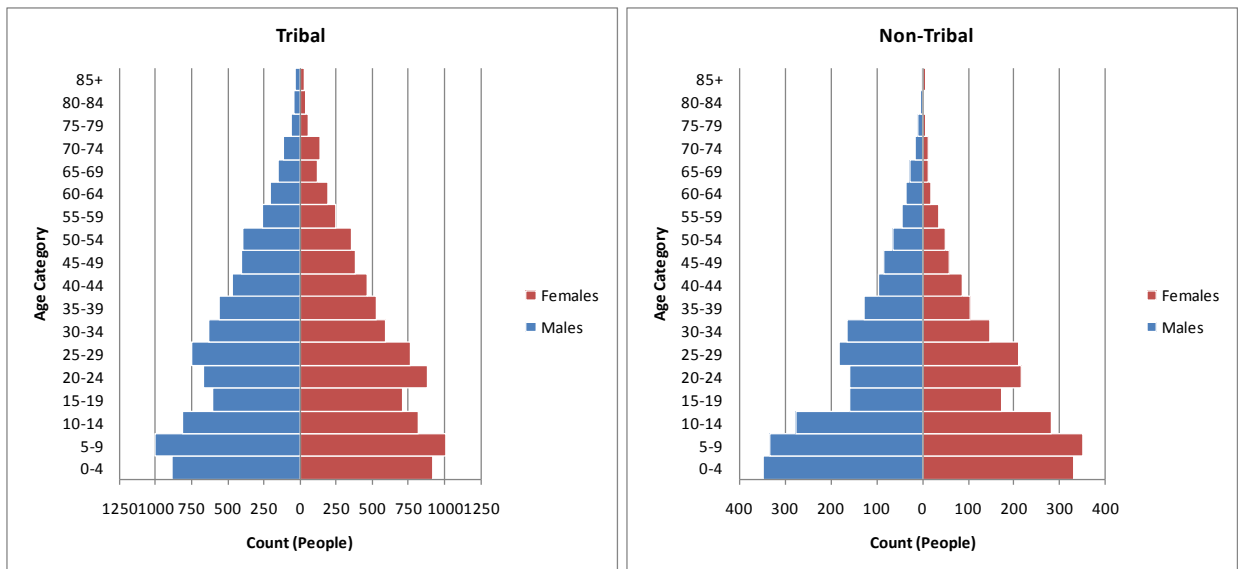
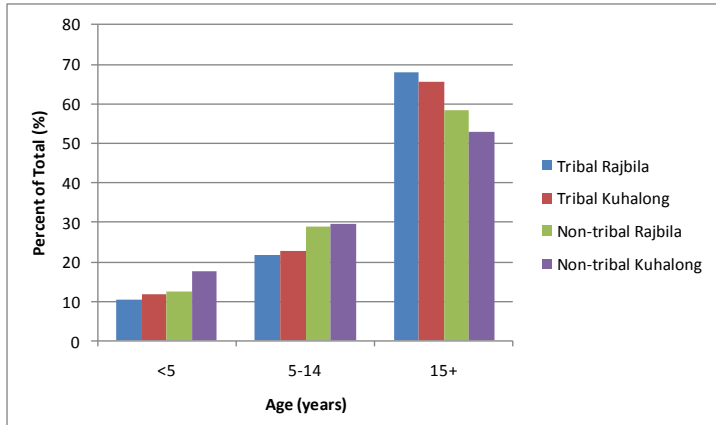


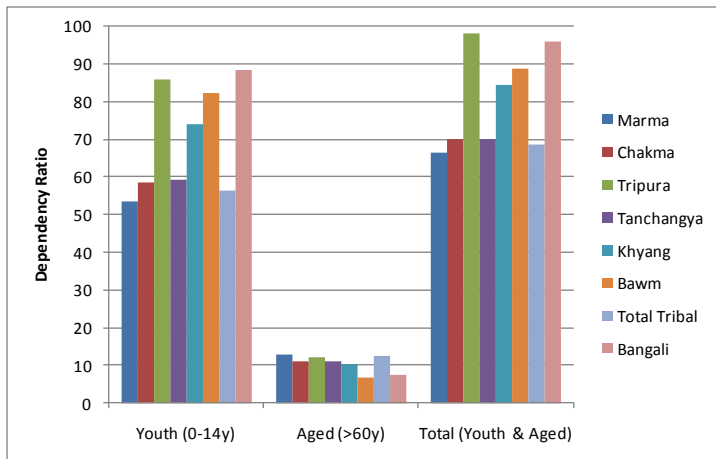
Figure 9. Age pyramids of the total population by race and sex. There are many more children (0-14 years old) relative to adults (15+ years old) in the non-tribal groups versus the tribal group.

Differences in numbers of children may affect malaria risk, as children <15 years old are considered more susceptible to disease than adults. Analysis of the proportions of the population in the 0-4, 5-14 and 15+ year age categories revealed there was the highest proportion of <5 year old children in amongst Kuhlalong non-tribal people at 17.6%, while the other groups were 10.3-12.7%. In the 5-14 year age groups, the proportion was higher for non-tribal people (29.0-29.5%) than tribal people (21.8-22.8%), but roughly equivalent across unions (as indicated by the percentage ranges) (Figure 10). This would suggest that there is a larger proportion of Bengalis at high malaria disease risk than in tribal people, especially in Kuhlalong (Figure 10).



Age Group	Tribal		Non-tribal	
	Rajbila	Kuhlalong	Rajbila	Kuhlalong
<5	10.28	11.71	12.65	17.58
5-14	21.77	22.77	28.98	29.45
15+	67.95	65.5	58.38	52.97
Total	100	100	100	100

Figure 10. Proportions of adults and children in the population stratified by union and race. There are a larger proportion of children in the non-tribal (Bengali) population than in the tribal population, especially in Kuhlalong. Greater malaria disease risk typically occurs in ages 0-4, followed by ages 5-14.



Ethnicity	Age Dependency Ratio			n
	Youth (0-14 y)	Aged (>60 y)	Total (Youth/Aged)	
Marma	53.56	12.86	66.42	12,398
Chakma	58.71	11.22	69.93	712
Tripura	86.06	12.12	98.18	327
Tanchangya	59.19	11.03	70.21	1,760
Khyang	74.14	10.49	84.63	1,021
Bawm	82.22	6.67	88.89	85
Rakhaine	NA	NA	NA	5
Mro	NA	NA	NA	6
Total Tribal	56.28	12.41	68.69	16,314
Bangali	88.51	7.34	95.85	4,244

Figure 11. Age dependency ratio by ethnic group. Bengalis have a much higher youth dependency ratio than the tribal population which influences their total dependency ratio. Tripura, Khyang, and Bawm have higher youth dependency ratios than the tribal average, which makes them more comparable to Bengalis in their dependency ratios.

The age dependency ratio is the proportion of population that is economically dependent on the working population, which was calculated by dividing numbers of children (<15 years) and/or aged people (>59 years) by people of working age (15-59 years). The total age dependency ratio was 95.9% for Bengalis and 68.7% for tribal people. This was largely due, again, to differences in the youth dependency ratio (Figure 11). This suggests a greater economic burden on the Bengali working population for taking care of dependents versus that of tribal people. The national dependency ratio is 77% (19).

When the tribal population was stratified into individual tribes, we observed differences in the respective mean ages of the groups. Tripura (mean age= 23.3), Khyang (mean age= 23.1) and Bawm (mean age= 22.7) were younger in age on average than Marma (mean age= 27.7) and Chakma (mean age=26.4). The mean ages for Rakhaine and Mro were also low, but there are very few people in these groups (Figure 12). The higher age dependency rates in these groups reflect their younger age structure. The age dependency ratios for Tripura, Khyang and Bawm are 98.2%, 84.6% and 88.9%, respectively (Figure 11.) In fact, these groups are more similar in mean age and age dependency ratios to Bengalis. By contrast, Marma, Chakma and Tanchangya had age dependency ratios of 66.4%, 69.9% and 70.2%, respectively (Figure 11 and 12).

The sex ratio, or number of males per 100 females, was not significantly different between Bangalis and tribal people at 101.9 and 97.8, respectively. The sex ratio was roughly the same across ethnic groups with a few exceptions. The Chakma sex ratio of 115.6 was significantly different than that of Marma ($p=0.023$), while the Tripura sex ratio of 86.85 was not significantly different ($p=0.318$) (Figure 13). It is unclear why the Chakma sex ratio is high. The commonly cited assumption is that 105 males are born for every 100 females, but over time the sex ratio decreases because women live longer than men. The existence of fewer Chakma women could possibly be explained by a socio-economic reason that the women are leaving or men are migrating into the community. The national sex ratio is 95 (19).

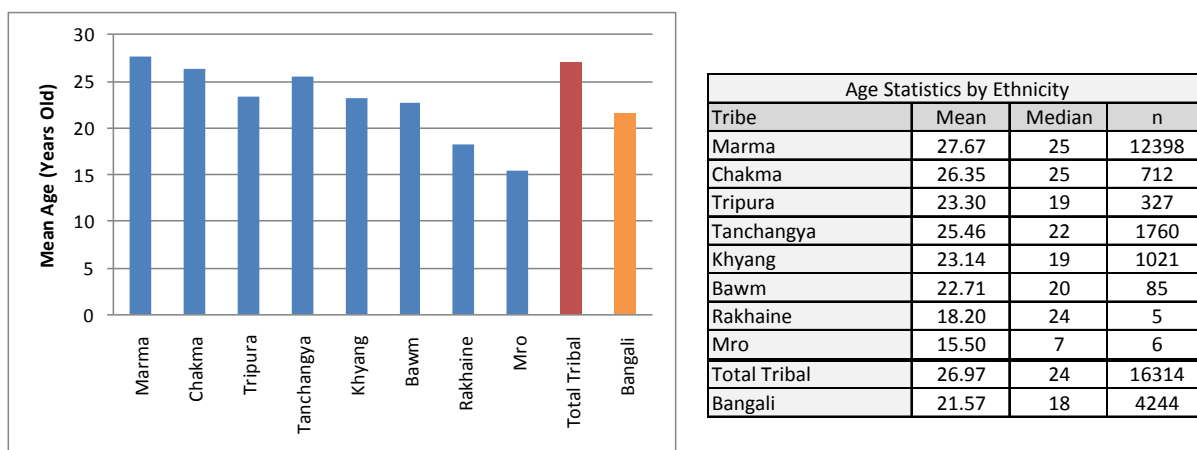
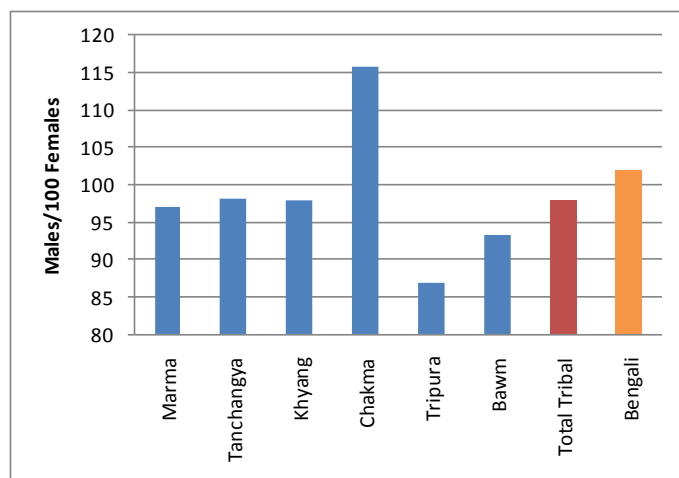


Figure 12. Mean age by tribal ethnic group. Tripura, Khyang, and Bawm had lower mean averages than the tribal average and were more comparable to that of Bengalis. Rakhaine and Mro were also young on average, but there were very few people in these groups.



Ethnicity	Males/ 100 Females	n
Marma	97.12	12,398
Tanchangya	98.22	1,760
Khyang	97.86	1,021
Chakma	115.75	712
Tripura	86.85	327
Bawm	93.20	85
Rakhaine	NA	5
Mro	NA	6
Total Tribal	97.82	16,314
Bengali	101.90	4,244

Figure 13. Sex ratio by ethnic group. The sex ratio, or number of men/100 females, was roughly equivalent across ethnicities, with the exception of a statistically significantly higher ratio for Chakma relative to Marma. The ratio for Tripura was not significantly different than Marma.

Age group	Single	Married	Widowed	Separated	Divorced	Total	Count
15-19	90.16	9.71	0.13	0.00	0.00	100	762
20-24	49.88	49.03	0.48	0.24	0.36	100	826
25-29	16.43	82.17	0.64	0.64	0.11	100	931
30-34	4.27	93.85	1.00	0.38	0.50	100	797
35-39	2.75	95.51	0.87	0.14	0.72	100	690
40-44	2.12	94.69	2.12	0.53	0.53	100	565
45-49	2.05	92.42	4.10	0.61	0.82	100	488
50-54	0.22	92.34	5.69	0.66	1.09	100	457
55-59	0.33	92.81	5.88	0.33	0.65	100	306
60-64	0.41	85.77	13.01	0.81	0.00	100	246
65-69	0.54	83.24	15.14	1.08	0.00	100	185
70-74	0.73	78.83	19.71	0.73	0.00	100	137
75-79	0.00	52.11	43.66	2.82	1.41	100	71
80-84	0.00	46.15	48.08	5.77	0.00	100	52
85+	0.00	57.14	42.86	0.00	0.00	100	35
Total	20.34	74.79	3.96	0.49	0.43	100	6548

Marriage. Marriage is almost universal in Bangladesh. In the surveillance region, >90% of males were married by age 30, and by age 50, married men were >99%. For women, >90% were married by age 25, and by age 35, married women were >99%. While males began getting married between 17-18 years old, 1% of 10-15 year old female were married.

Age group	Single	Married	Widowed	Separated	Divorced	Total	Count
15-19	72.51	26.47	0.57	0.34	0.11	100	884
20-24	22.51	75.85	0.46	0.55	0.64	100	1093
25-29	6.64	90.19	0.92	1.12	1.12	100	979
30-34	2.16	90.28	4.05	2.56	0.94	100	741
35-39	0.63	94.02	3.62	0.94	0.79	100	635
40-44	0.55	86.18	9.82	1.64	1.82	100	550
45-49	0.45	84.27	13.03	1.35	0.90	100	445
50-54	0.98	75.74	21.08	0.98	1.23	100	408
55-59	1.06	68.09	27.30	1.42	2.13	100	282
60-64	0.48	58.57	39.05	0.95	0.95	100	210
65-69	1.49	52.99	42.54	1.49	1.49	100	134
70-74	1.30	25.97	72.08	0.65	0.00	100	154
75-79	1.69	33.90	61.02	3.39	0.00	100	59
80-84	4.55	9.09	86.36	0.00	0.00	100	44
85+	0.00	9.38	90.63	0.00	0.00	100	32
Total	14.92	72.53	10.53	1.13	0.90	100	6,650

If we stratified the marital status of males and females, union of residence and race, we saw that a greater proportion of males were single. Notable also was the larger proportion of females that were widows. Both of these phenomena might be explained by a younger marriage age for females. Less than 2% of females and <1% of males were separated or divorced (Figure 14).

Age group	Single	Married	Widowed	Separated	Divorced	Total	Count
Males	100.00	0.00	0.00	0.00	0.00	100	1,088
Females	99.00	0.82	0.09	0.09	0.00	100	1,102

The major marital status difference we observe between races was a

higher proportion of married non-tribal females. If we examined more closely, we saw that this was due to non-tribal women marrying at a younger age. Also, Kuhlalong women tended to get married earlier than Rajbila women. In Rajbila, the age at which 50% of women were married was 19.5 for tribal and 18 years old for non-tribal. In Kuhlalong, the age at which 50% of the women were married was 18.5 for tribal and 16.5 for non-tribal (Figure 15). In contrast, the age at which 50% of men were married was 21.5 for Rajbila and 20.5 for Kuhlalong, regardless of race (data not shown). A younger age of marriage is linked to pregnancy at a younger age. This leads to a greater proportion of the population being pregnant (see below) and at risk for malaria disease and complications.

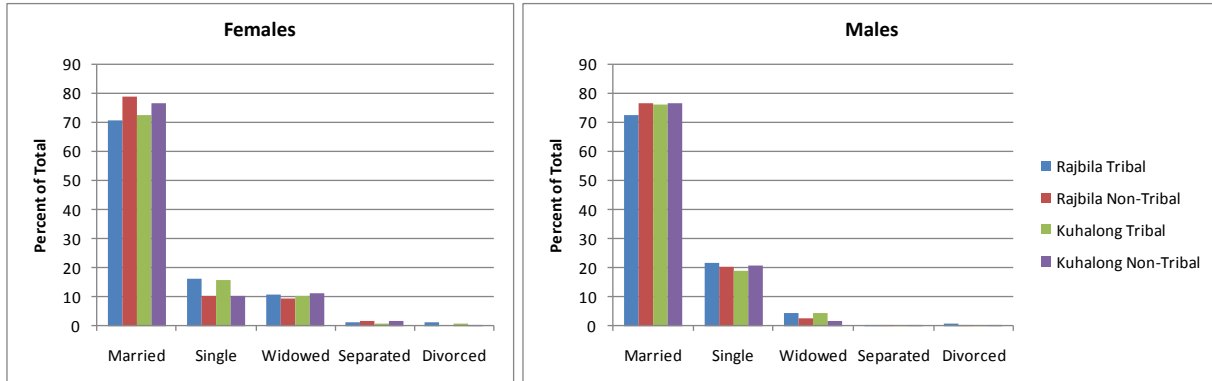


Figure 14. Marital status of the population by union of residence and race. While the proportion of married females and males was about the same, more males were married than females, and more females were widowed than males. The proportions separated or divorced was small. The proportion of single tribal females was greater than for non-tribal females due to a later age of marriage for tribal females.

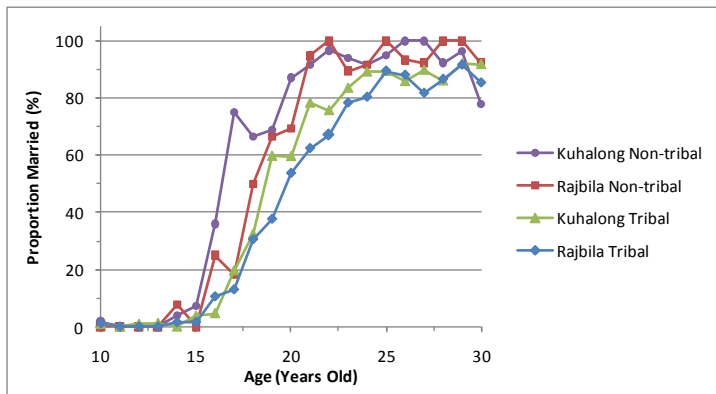


Figure 15. Proportion of women married by age. Non-tribal women appear to get married at an earlier age than tribal women. Also in Kuhlalong, the age at which 50% of the women were married (16.5 for non-tribal and 18.5 for tribal) is younger than that in Rajbila (18 for non-tribal and 19.5 for tribal).

Pregnancy. There were 198 pregnancies reported at the time of the initial demographic surveillance visit. 98.5% of the pregnant women were married, and 1% and 0.5% were separated and divorced, respectively. The pregnancies occurred in women ranging in age from 15-46. Pregnancies peak in the 20-24 year age category with 82 pregnancies, while only 1 pregnancy occurred in each of the 40-44 and 45-49 year age categories (Figure 16). The overall mean and median age of pregnancy was 24.4 and 24 years old, respectively. There was some variability in the mean and median ages of pregnancy when examined by union of residence and race. Non-tribal women in Kuhlalong had the lowest median age at

Pregnancy by Union & Race						
Union	Race	Mean Age	Median Age	Count	# Women Aged 15-44	% Pregnant
Rajbila	Tribal	23.88	24	57	1,872	3.04
	Non-Tribal	25.00	25	11	346	3.18
Kuhalong	Tribal	25.38	24.5	84	2,072	4.05
	Non-Tribal	23.07	22	46	593	7.76
	Total	24.39	24	198	4,883	4.05

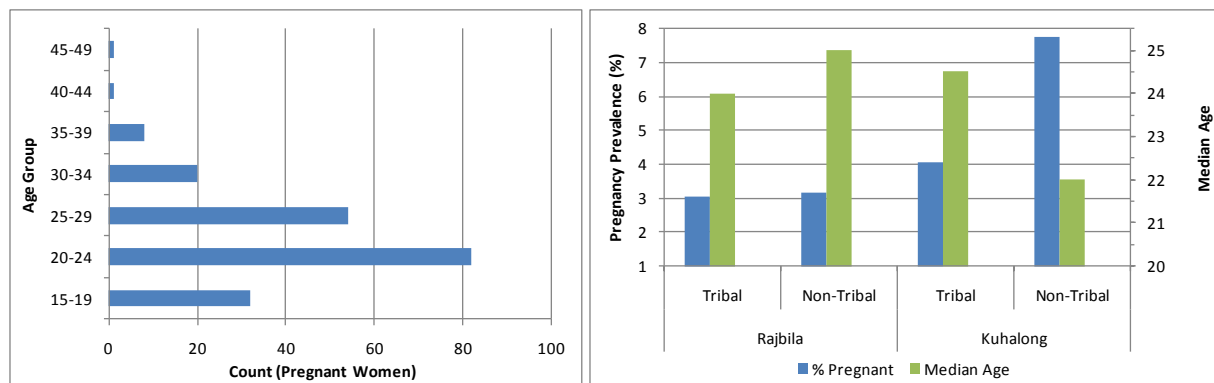


Figure 16. Pregnancies by age (left). Pregnancy prevalence and median age by union of residence and race (right). There were 198 pregnancies at the initial DSS visit. Pregnancies occur in women aged 15-49, but peak in the 20-24 age category. The prevalence for pregnant Kuhalong non-tribal women was about 2-fold higher than in other groups, and their median age was also 2-3 years younger. This may be due to a younger average age of marriage (Fig. 5). Prevalence was calculated using the number of women aged 15-44.

Prenatal Care by Trimester			
Prenatal Care Type	1st	2nd	3rd
Trained Traditional Birth Attendant	29	17	6
Traditional Birth Attendant	13	12	4
Nurse/Other Field Level Health Worker	12	7	2
CC/FWC/Satellite Clinic	10	8	2
Maternal & Child Welfare Center	6	6	1
Bandarban Sadar Hospital	4	6	2
BRAC Health Center	3	-	-
Private Clinic/Health Center	2	1	-
Graus Health Center	1	-	-
Kabiraj/Village Doctor	1	-	-
Did not seek care	98	41	18
In trimester but has not sought care yet	19	80	53
Total women reporting for the trimester	198	178	88
Not at 2nd /3rd Trimester	-	20	110
Pregnant Women by Trimester	20	90	88

Prenatal Care Status	1st	2nd	3rd
Sought Care	41%	32%	19%
May Still Seek Care	10%	45%	60%
Did not Seek Care	49%	23%	20%

Prenatal Care by Skill Level	1st	2nd	3rd
Traditional Birth Attendant	7%	7%	5%
Kabiraj/ Village doctor	1%	-	-
Trained TBA/ Nurse/ Field worker	21%	13%	9%
Smaller Clinic/ Hospitals	10%	8%	3%
Bigger hospitals	3%	3%	2%
May still seek care	10%	45%	60%
Did not seek care	49%	23%	20%

22, while other groups' median ages ranged between 24-25 years old (Figure 16). This age difference correlated with the 2-3 year age gap observed between Kuhalong non-tribal women and the other groups for the age at which 50% of the group was married (Figure 15). This younger age of marriage and pregnancy is also correlated with a twice as high pregnancy prevalence for Kuhalong non-tribal women (7.8%) compared to other groups (3.0-4.0%). However, it is also interesting to note that tribal women in Kuhalong had a 1% higher pregnancy prevalence than Rajbila tribal women ($p=0.004$) and non-tribal women. This may indicate differences in the socio-economic or health conditions between the two unions that make Kuhalong more conducive to more pregnancy.

There were 20, 90 and 88 women in the first, second and third trimester of pregnancy,

respectively. The low number of women in their first trimester is likely explained by women not having known about their pregnancy, or social stigma around talking about it too early. Women at all stages of pregnancy were questioned about the prenatal care they received. 41% of pregnant women sought care in the first trimester, while 49% did not, and 10% were in the first trimester but had not received care yet. In the second trimester, 32% received care, 23% did not, and 45% were in the second trimester but had not received care yet in the second trimester. For the third trimester, 19% received care, 20% did not, and 60% were in the third trimester but had not received care yet in the third trimester. The most popular providers of prenatal care were *trained* traditional birth attendants (TBAs), TBAs, nurse/other field level health workers, and CC/FWC/satellite clinic.

For prenatal care, women often used *trained* TBAs/nurses/field level workers in both Rajbila and Kuhlalong. However, a large percentage of women in Rajbila also used TBAs, while in Kuhlalong they tended to use small clinics/hospitals. When prenatal care was stratified by union, we saw that in general more women in Rajbila sought care than in Kuhlalong. More tribal women than non-tribal women sought prenatal care. The largest proportion of tribal women used *trained* TBAs/nurses/field workers, while non-tribal women used small clinics/hospitals (Figure 17). So while Rajbila women and

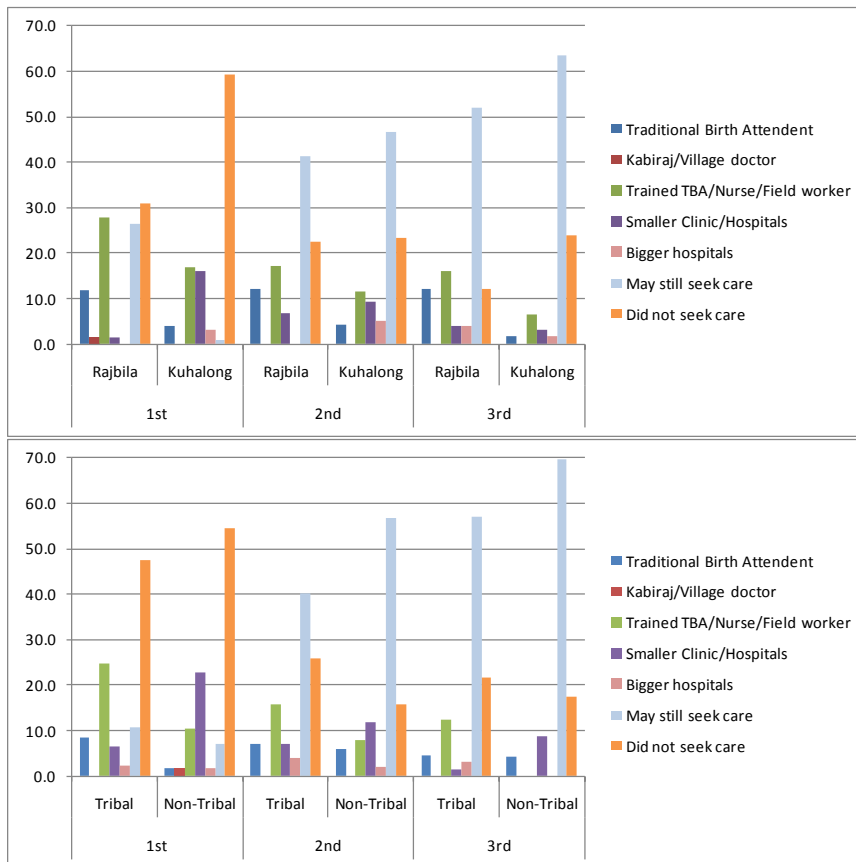


Figure 17. Prenatal care by level of skill, trimester, union of residence and race. More women sought prenatal care in Rajbila than Kuhlalong. In Rajbila and Kuhlalong, women used *trained* TBAs/nurses/field level workers while Rajbila women also used TBAs, and Kuhlalong women also used small clinics/hospitals. More tribal than non-tribal women sought prenatal care. Tribal women used trained TBAs/nurses/field workers, while non-tribal women used small clinics/hospitals.

tribal women sought prenatal care more than Kuhlalong women and non-tribal women, respectively, the skill of the prenatal providers used by Kuhlalong women and non-tribal women is higher. Kuhlalong is reportedly more developed with better services, so it may be that even within Kuhlalong and Rajbila, tribal people are living in more remote places where less skilled prenatal care is all that is available. It should also be noted that the higher pregnancy prevalence in Kuhlalong, especially amongst non-tribal women (Figure 16) correlates with less prenatal care (Figure 17). This suggests a plausible hypothesis that these women are also not receiving family

planning guidance, and that this, rather than relative economic abundance explains the higher pregnancy prevalence. Prenatal care can be used as a general indicator of a populations' healthcare seeking tendencies and access, which could be considered when evaluating potential risk for complications resulting from malaria infection.

Household size and structure. The average household size in the surveillance region was 4.5 people. For the purpose of calculating household size, the 102-person tribal orphanage in Rajbila was excluded. When household size is stratified by union of residence and race, we see that the distribution of household sizes is shifted to the right for non-tribal people or people living in Kuhlalong relative to Rajbila tribal people. The distribution peaks at 4 members for the Rajbila tribal group, while the Kuhlalong non-tribal group distribution peaks at 5 members. The other groups, Kuhlalong tribal and Rajbila non-tribal peak at 4 members, but have intermediate distribution curves (Figure 18). The mean household size for Rajbila tribal, Kuhlalong tribal, Rajbila non-tribal and Kuhlalong non-tribal people was 4.2, 4.6, 4.8 and 5.3, respectively (Figure 19). When household size was examined by individual tribal ethnicities, Marma and Chakma both had a mean household size of 4.2, while Tanchangya, Tripura, Bawm, and Khyang had higher means of 4.9-5.6 which were more similar to the Bengali mean of 5.1 (Figure 19). Decreasing household size has been linked to decreasing malaria rates (20).

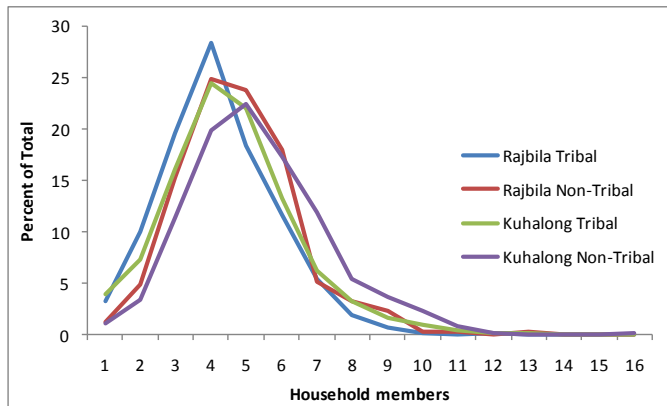


Figure 18. Household size distribution by union of residence and race. The distribution peaked at 4 members for the Rajbila tribal group. Other curves were shifted to the right relative to this curve. The Kuhlalong non-tribal group peaked at 5 members.

The mean number of children of the household head (HHH) still living in the household was found to be higher for people living in Kuhlalong and amongst non-tribal people. Kuhlalong non-tribal, Rajbila non-

Mean Household Size by Union and Race		
Race	Rajbila	Kuhlalong
Tribal	4.23	4.57
Non-Tribal	4.78	5.34

Mean Household Size by Ethnicity		
Ethnicity	Mean	n
Marma	4.24	2898
Chakma	4.24	168
Tripura	5.45	60
Tanchangya	4.92	358
Khyang	5.64	181
Bawm	5.31	16
Rakhaine	2.50	2
Mro	6	1
Total Tribal	4.43	3685
Bengali	5.13	827

tribal, Kuhlalong tribal, and Rajbila tribal HHH had an average of 2.8, 2.4, 2.1 and 1.8 children living at home, respectively (Figure 20). This suggested that increased household size was a function of having more children. While these numbers of children provide estimates for the spatio-ethnic groups, we did not collect the data in a way that allowed linkage of every child back to their parent. For example, we know there are children and grandchildren of the HHH (house hold head) living in the household, but we do not know to which HHH's child the grandchildren belong.

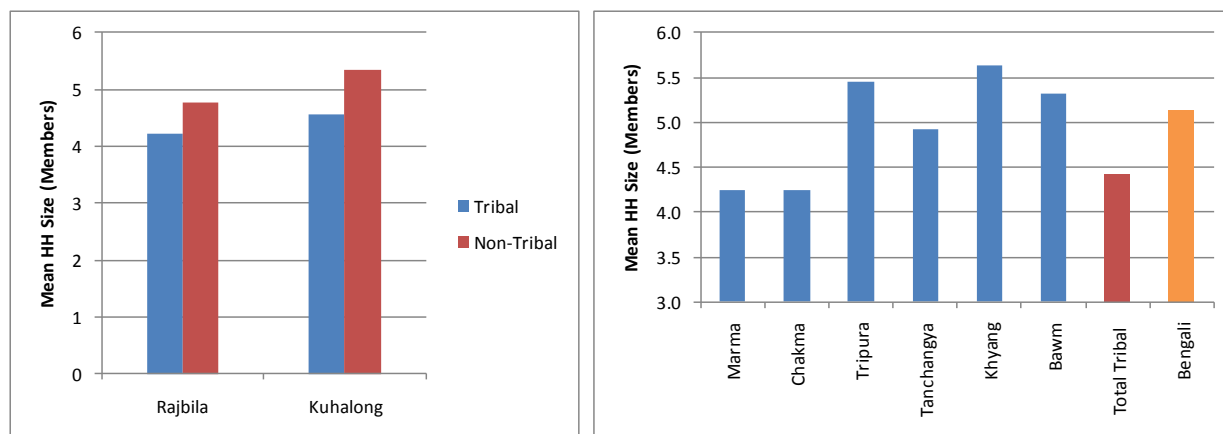
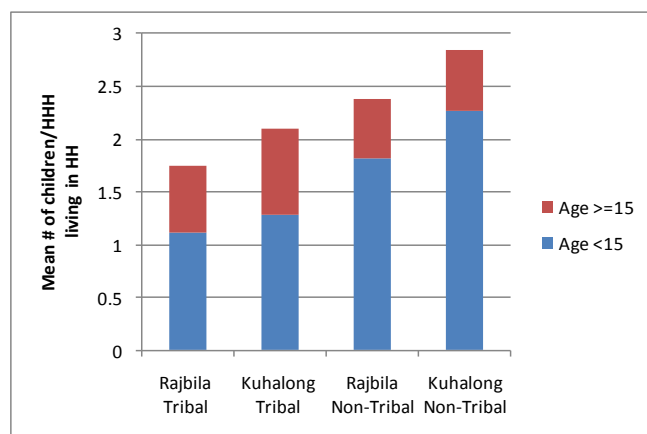


Figure 19. Mean household size by union of residence and race (left). Mean household size by ethnicity (right). The mean household size for non-tribal people and people living in Kuhalong are higher than tribal people or people living in Rajbila. Marma and Chakma both had a lower mean household size compared to Tanchangya, Tripura, Bawm, Khyang and Bengali.



Children/HHH Living in HH		
Group	Age <15	Total
Rajbila Tribal	1.11	1.75
Kuhalong Tribal	1.29	2.10
Rajbila Non-Tribal	1.82	2.37
Kuhalong Non-Tribal	2.26	2.84

Figure 20. Mean number of children of the household head still living in the household. Kuhalong household heads (HHHs) had greater number of children living in the household than Rajbila HHHs. Non-tribal HHHs had a greater number of children living in the household than tribal HHHs. The number of children <15 was also greater for Kuhalong vs Rajbila and non-tribal vs tribal HHHs.

Also missing are children that have moved out of the household. Because of this problem, fertility rates could not be calculated and the numbers of children/couple may be underestimated. Nonetheless, these numbers are helpful in considering household composition.

Interestingly, non-tribal HHHs also had more spouses present in the household. The percent of HHHs with missing spouses was 8.8% and 9.8% for non-tribal people in Rajbila and Kuhalong, and 14.2% and 17.6% for tribal people in Rajbila and Kuhalong, respectively. This may be explained by the greater proportion of male widows in the tribal population (Figure 14) and the greater proportion of tribal female HHHs (discussed below).

Relationship to HHH by Union and Race								
Relationship to HHH	Rajbila Tribal		Rajbila Non-Tribal		Kuhalong Tribal		Kuhalong Non-Tribal	
	Count	#/100 HH	Count	#/100 HH	Count	#/100 HH	Count	#/100 HH
Self	1,799	100.00	306	100.00	1,885	100.00	520	100.00
Spouse	1,543	85.77	279	91.18	1,553	82.39	469	90.19
Child	3,154	175.32	726	237.25	3,959	210.03	1,476	283.85
Grandchild	366	20.34	49	16.01	563	29.87	89	17.12
Daughter-in-Law	189	10.51	42	13.73	244	12.94	44	8.46
Son-in-Law	69	3.84	3	0.98	99	5.25	11	2.12
Mother	169	9.39	26	8.50	96	5.09	54	10.38
Father	77	4.28	9	2.94	37	1.96	10	1.92
Brother/Sister	87	4.84	10	3.27	64	3.40	62	11.92
Mother-in-Law	38	2.11	3	0.98	17	0.90	1	0.19
Father-in-Law	12	0.67	-	-	5	0.27	-	-
Brother/Sister-in-Law	22	1.22	4	1.31	11	0.58	8	1.54
Adopted child	13	0.72	1	0.33	-	-	1	0.19
Niece	15	0.83	1	0.33	20	1.06	11	2.12
Nephew	11	0.61	4	1.31	12	0.64	18	3.46
Aunt/Uncle	6	0.33	-	-	11	0.58	2	0.38
Grandparent	8	0.44	-	-	5	0.27	-	-
Stepchild	5	0.28	-	-	7	0.37	1	0.19
Other Relation	4	0.22	-	-	15	0.80	-	-
No Relation	16	0.89	-	-	6	0.32	4	0.77

In analyzing relationships of the HH members to the HHH, we observe that non-tribal HHHs have greater average numbers of spouses, children, and nephews. Tribal HHHs have greater average numbers of grandchildren, son-in-laws, mother-in-laws, father-in laws, aunts/uncles, grandparents and stepchildren.

We also see that there are a greater fraction of households with female HHHs in the tribal population (10.5%) compared to the non-tribal population (7.4%). The mean age for tribal female HHHs is 53.0, while the mean age for non-tribal female HHHs is 45.1. Most female HHHs are widowed. A larger

Female Head of Household		
Ethnicity	HHs	Female HHHs %
Marma	2,898	330 11.39
Tanchangya	358	27 7.54
Khyang	182	20 10.99
Chakma	168	2 2.98
Tripura	60	2 3.33
Bawm	16	3 18.75
Rakhaine	2	0 0
Mro	1	0 0
Total Tribal	3,685	387 10.50
Bangali	826	61 7.38

HHH with Missing Spouse		
Race	Rajbila	Kuhalong
Tribal	14.2%	17.6%
Non-Tribal	8.8%	9.8%

Age of Female HHHs		
Race	Mean	Median
Tribal	53.01	52
Non-Tribal	45.11	44

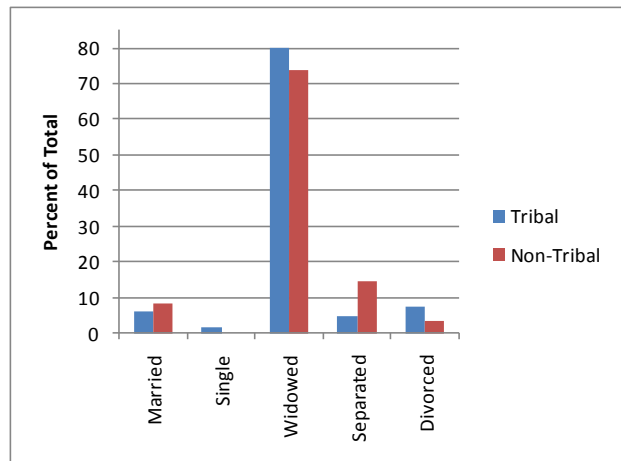
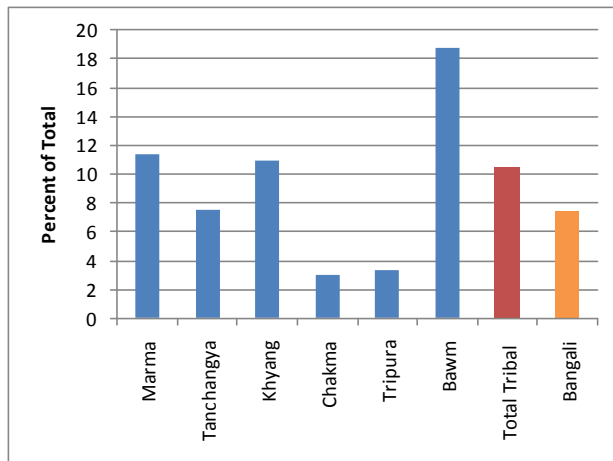


Figure 21. Mean number of children of the household head still living in the household. Kuhalong household heads (HHHs) had greater number of children living in the household than Rajbila HHHs. Non-tribal HHHs had a greater number of children living in the household than tribal HHHs. The number of children <15 was also greater for Kuhalong vs Rajbila and non-tribal vs tribal HHHs.

proportion of tribal female HHHs are divorced or single, while a larger proportion of non-tribal female HHHs are married or separated (Figure 21). The higher proportion of female HHH amongst the tribal populations may reflect the fact that status for women is generally considered higher amongst tribal groups than Bengalis. On the other hand, female HHH may have greater economic vulnerability, which in turn is associated with negative health outcomes.

Education. For analysis of education, participants reported how many years of school was attended, not how many years of school they passed, which could be an important distinction in Bangladesh. For calculations, participants over 5 years old were included. There is a large disparity in the number of women versus men and tribal versus non-tribal people entering school. Around 40% of non-tribal women and 54-57% of tribal women receive no formal education, compared with 26-28% of non-tribal males and 39-40% of tribal males, depending on the union. For the people that enter school, tribal people actually attend school for slightly longer on average than non-tribal people. Men attend school for slightly longer on average than women. Tribal men and women entering school attend for 5.1-5.4 years and 4.8-4.9 years, depending on the union, compared with 4.8 years and 4.4 years for non-tribal men and women, respectively.

When the education of individual tribal groups was analyzed, we found that Khyang had lower mean years of education, while Bawm had higher mean education years. However, this was due to a difference in the respective proportions receiving no education. Marma, Chakma, Tripura and Tanchangya tribal groups ranged between 31-29% uneducated, while Khyang and Bawm were 50% and 21% uneducated, respectively (Figure 23).

Education for People 5+ Years Old							
Group	Sex	Tribe	Union	Years of Education			% Uneducated (0 years)
				Mean	Median	n	
Total Population	Males	Tribal	Rajbila	3.06	2	3435	39.71
			Kuhalong	3.30	2	3744	38.57
		Non-Tribal	Rajbila	3.45	3	646	28.48
			Kuhalong	3.56	3	1149	26.20
	Females	Tribal	Rajbila	2.09	0	3478	56.73
			Kuhalong	2.27	0	3854	53.71
		Non-Tribal	Rajbila	2.63	2	632	39.72
			Kuhalong	2.66	2	1141	39.61
Excluding Uneducated (0 years)	Males	Tribal	Rajbila	5.08	4	2071	-
			Kuhalong	5.37	5	2300	-
		Non-Tribal	Rajbila	4.82	4	462	-
			Kuhalong	4.83	5	848	-
	Females	Tribal	Rajbila	4.84	4	1505	-
			Kuhalong	4.91	5	1784	-
		Non-Tribal	Rajbila	4.36	4	381	-
			Kuhalong	4.41	4	689	-

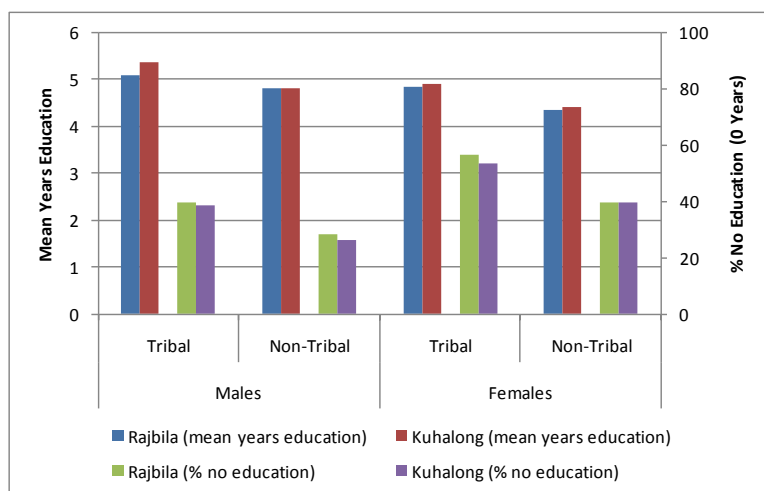


Figure 22. Years of education and proportion with no education by union and race. Tribal people had higher average years of education than non-tribal, when people with no education (0 years) were excluded from the calculation. However, a larger proportion of tribal people and females had no education at all. Calculations include people aged >5.

Education for Tribal People 5+ Years Old				
Sex	Tribe	Mean Years	% Uneducated (0 years)	n
Male	Marma	3.21	39.45	5457
	Chakma	3.57	31.66	338
	Tripura	3.48	30.83	133
	Tanchangya	3.13	36.07	779
	Khyang	2.52	50.23	434
	Bawm	4.32	20.59	34
	Rakhaine	1.00	50.00	2
	Mro	1.00	0	2
Female	Marma	2.29	54.44	5614
	Chakma	1.89	57.77	296
	Tripura	1.91	53.64	151
	Tanchangya	1.97	57.04	796
	Khyang	1.51	61.24	436
	Bawm	2.94	36.11	36
	Rakhaine	0	100.00	1
	Mro	2.00	0	2

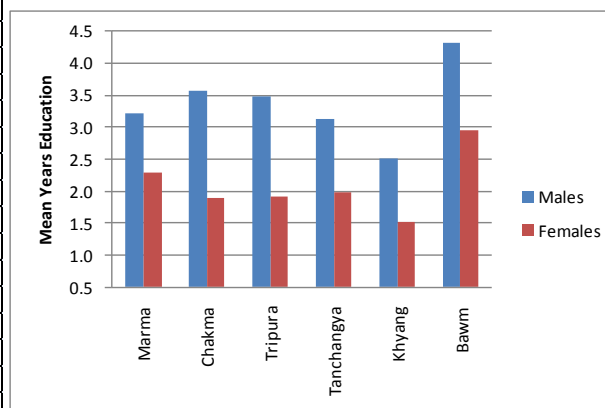


Figure 23. Years of education and proportion with no education by tribal ethnicity. The tribal groups had about equivalent mean years of education and proportions of uneducated people, except for Khyang and Bawm. Less Khyang and more Bawm entered school, producing lower and higher mean years education, respectively, compared to the other tribal groups. Calculations include people aged >5.

For HHHs, the mean years of education was lower than that for the general population, but this was because there were higher proportions of uneducated HHHs. There were 57% and 39% uneducated tribal and non-tribal male HHHs, and 90% and 84% uneducated tribal and non-tribal female HHHs (Figure 24). This indicates that female HHHs may be more economically vulnerable because of their lack of education. The larger educational difference observed between the HHHs and the general population may reflect recent improvements in educational opportunities for the younger generation. Evidence supporting this hypothesis is that people aged 10-24 had a mean of 4.6 years education, while those aged 25-44 had a mean of 2.8 years and those over 45 years had a mean of 0.9 years (data not shown).

Education of Household Heads					
Sex	Race	Mean	% Uneducated (0 years)	Mean (excluding 0 years)	n
Total	Tribal	2.09	60.76	5.33	3685
	Non-Tribal	2.92	42.62	5.09	826
Male	Tribal	2.28	57.31	5.35	3298
	Non-Tribal	3.11	39.35	5.13	765
Female	Tribal	0.46	90.18	4.71	387
	Non-Tribal	0.59	83.61	3.60	61

Education is important in considering malaria risk because it may correlate both with malaria knowledge, as well as economic status.

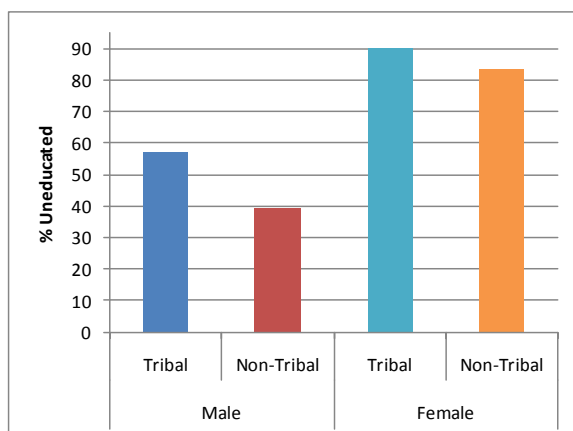


Figure 24. Proportion with no education for household heads by sex and race. The proportion of uneducated HHHs was much higher than the overall average (Fig. 22).

Occupation. Primary occupation data were collected from individual study participants. The top four occupations of those who reported employment were farming own land, daily labor, farming rented land/sharecropping, and an indigenous style of jungle hillside agriculture called “jum” cultivation. 8.4% of 10-14 year olds were employed, primarily in agriculture (4.3%) and menial labor (3.5%). 80.8% of 10-14 year olds attend school, with only a 3% disparity of school attendance between males and females. For people in the working ages of 15-59 years old, 2.5% of men and 5.6% of women reported they were unemployed. Overall, men were primarily employed in agriculture (53.8%) and menial labor (20.9%), while women were employed in agriculture (40.9%) and as housewives (27.8%).

Occupations of All Employed in Rajbila & Kuhlalong			
Occupations by Category	Males	Females	Total
Agriculture	3,568	2,669	6,237
Farming (own land)	2,225	1,691	3,916
Farming (rented land/sharecropping)	797	506	1,303
Jum Cultivation	522	462	984
Rubber Plantation	11	8	19
Tending Livestock (cow boy)	12	1	13
Fishing	1	1	2
Laborer	1,367	885	2,252
Daily Labor	1,171	870	2,041
Driver/Helper	85	2	87
Carpenter/Mason/Electrician/Well Worker	68	0	68
Rickshaw/Van/Boat Operator	25	0	25
Working for Food	5	8	13
Hotel/Restaurant Worker	8	0	8
Tailor	2	5	7
Maid Servant	3	0	3
Business	496	78	574
Small Business	437	64	501
Market Trader	22	7	29
Handicraft	7	6	13
Traditional Medicine (Kabiraj, Homeopath)	11	0	11
Health paraprofessional (Village Doctor)	7	0	7
Merchant	6	0	6
Street Vendor	4	0	4
Astrologer	2	0	2
Wine Maker	0	1	1
Salaried Worker	448	256	704
Employed in Private Sector	352	225	577
Employed in Public Sector	96	31	127
Other	10	5	15
Rent From Land	8	5	13
Yearly Labor	1	0	1
Politician	1	0	1

However, for analysis of occupation by union of residence and race, only people aged 15-59 were included. The majority of tribal males and females in both Kuhlalong and Rajbila were employed in

Occupation of People Aged 10-14 in Rajbila & Kuhlalong (%)			
Occupation	Males	Females	Total
Agriculture	3.49	5.18	4.34
Laborer	4.96	2	3.47
Business	0.28	0.09	0.18
Salaried Worker	0.37	0.18	0.27
Student	82.35	79.29	80.81
Disabled/Retired	0.09	0	0.05
Housewife	0	0.18	0.09
Unemployed	8.46	13.08	10.78
Total	100	100	100

Occupation of People Aged 15-59 in Rajbila & Kuhlalong (%)			
Occupation	Males	Females	Total
Agriculture	53.82	40.92	47.26
Laborer	20.91	13.36	17.07
Business	7.64	1.13	4.33
Salaried Worker	7.40	4.20	5.78
Other	0.07	0.02	0.04
Student	7.67	6.84	14.11
Disabled/Retired	0.02	0.13	7.25
Housewife	0	27.76	0.08
Unemployed	2.47	5.63	4.08
Total	100	100	100

agriculture, mostly farming their own land, but also farming other land, as well as jum cultivation (Figure 25 & 26). The majority of Bengali males in Rajbila and a large percentage in Kuhlalong reporting working as laborers (Figure 25). Most Kuhlalong Bengali males work in agriculture, specifically in farming other people’s land (Figure 25 & 26). Business occupations for Bengali males also comprised a larger proportion than they do for tribal people (Figure 25). While most Bengali females are housewives, most tribal women work in agriculture (Figure 25). Menial labor is a popular occupation for Rajbila non-tribal females, as well as males (Figure 25). It is also evident from this data

that non-tribal people do not do jum cultivation (Figure 26); in our surveillance region, we had one Bengali male out of a total of 984 people doing jum. Many people are known to work in the numerous rubber tree plantations (~11) in the area. Unfortunately, “rubber plantation worker” was not a category on the survey form, and only 19 study participants occupations were written in as such. We think that most likely identified as “day laborers,” making the specific malaria risk of rubber plantation work impossible to analyze. In our surveillance region, the vast majority of people work outside doing farming, jum cultivation or “daily labor,” which in this area is synonymous with outdoor agricultural work. Outdoor occupation may be a malaria risk factor in this region where we have a variety of malaria- carrying mosquito species with different spatiotemporal biting habits.

Occupation of People Aged 15-59 by Sex, Race and Union of Residence (%)								
Occupation	Males				Females			
	Tribal		Non-Tribal		Tribal		Non-Tribal	
	Rajbila	Kuhalong	Rajbila	Kuhalong	Rajbila	Kuhalong	Rajbila	Kuhalong
Agriculture	62.04	57.01	11.40	39.20	46.35	46.98	4.26	20.76
Laborer	15.27	19.54	47.15	29.61	13.15	13.30	19.05	10.96
Business	3.60	6.46	23.58	16.17	0.80	1.60	1.25	0.44
Salaried Worker	9.74	4.96	9.59	7.15	6.57	3.16	1.50	1.46
Other	0.04	0.12	0	0	0.04	0	0	0
Student	6.63	9.39	5.70	6.15	6.36	8.31	2.51	5.56
Disabled/Retired	0.04	0	0	0	0.08	0.23	0	0.00
Housewife	0	0	0	0	21.03	21.65	61.15	54.53
Unemployed	2.63	2.52	2.59	1.72	5.60	4.76	10.28	6.29
Total	100	100	100	100	100	100	100	100

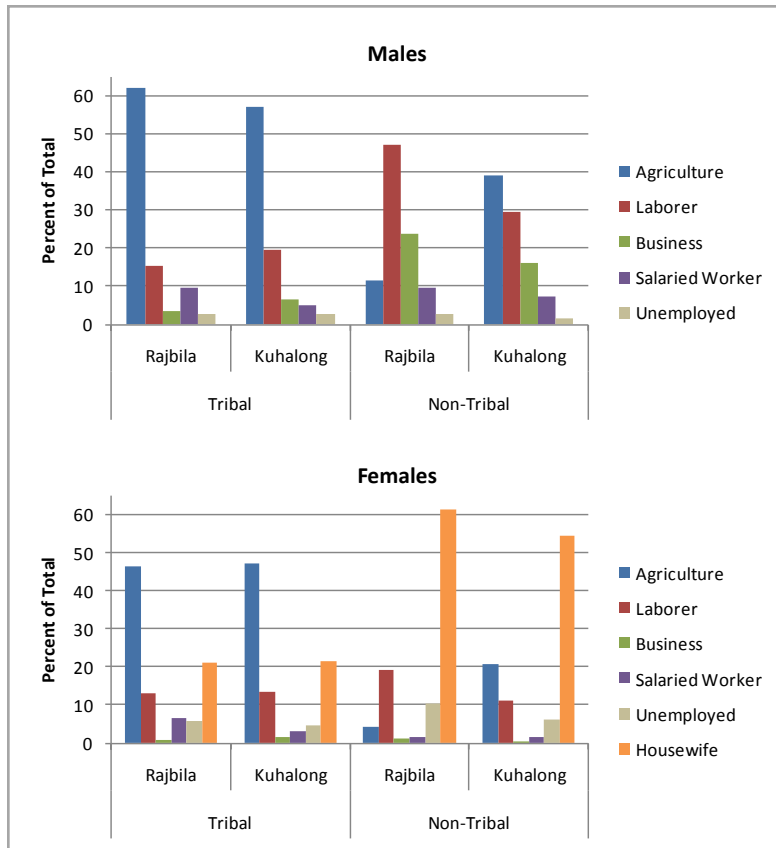
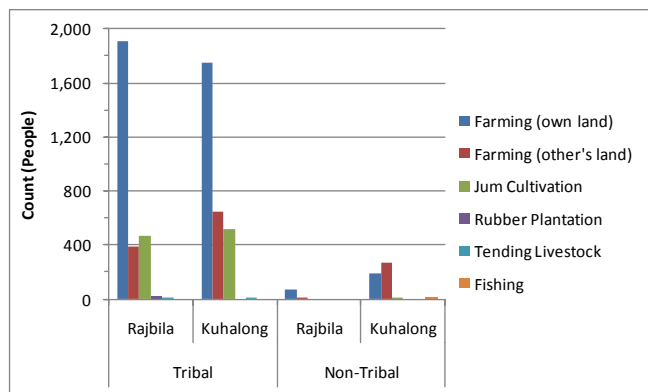


Figure 25. Occupation by union and race. A majority of tribal males had agricultural jobs, while large proportions of non-tribal men do menial labor, business, as well as agriculture. In contrast to the majority of non-tribal housewives, a large proportion of tribal females did agricultural jobs. Calculations include people aged 15-59.

Occupation by Place of Employment				
Occupation	Count		Percentage	
	Union of Residence	Other Union	Union of Residence	Other Union
Agriculture	6,223	14	65.99	4.08
Laborer	2,197	55	23.3	16.03
Business	549	25	5.82	7.29
Salaried Worker	456	248	4.84	72.3
Other	5	1	0.05	0.29
Total	9,430	343	100	100



A striking majority of people traveling to work in places other than the union in which they live have salaried positions (Figure 27). Presumably, this behavior is motivated by the better economic opportunities provided by salaried positions.

Figure 26. Agricultural occupations by union and race. The majority of tribal farmers work their own land, but some work other land or do jum (indigenous hillside) cultivation. More Kuhlalong non-tribal farmers work others' land than work their own. Rubber plantation work is common, but workers may have identified as day laborers in the survey. Few people fish or tend livestock.

Residency status. Only 7 people, or 0.03%, of the population in the initial demographic surveillance visit met the specified criteria of “visitor” versus resident. Four out of 7 of these people were students aged 10-18 years old.

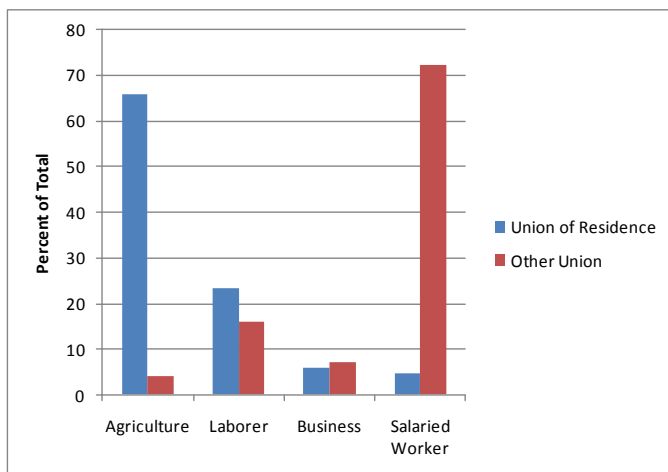


Figure 27. Occupation by whether people work locally or travel to another union. The majority of people who work in the union where they live were employed in agriculture, while the majority of people working somewhere other than the union in which they live have salaried positions.

Possible Malaria Risk Factor	Kuhlalong Non-Tribal	Rajbila Non-Tribal	Kuhlalong Tribal	Rajbila Tribal
More children <15 years old	+++	++		
Larger household size	++	+		
Less equity for women *	+	+		
Higher pregnancy prevalence	++			
Less tendency to seek healthcare **	++	+	++	
Outdoor occupation	++	+	++	++
Indigenous population			++	++
More uneducated people			+	+

Table 1. Summary table of possible malaria risk factors based on demographic surveillance. Based on analysis of the demographic surveillance, we would have predicted Kuhlalong non-tribal people to be most at risk, and Rabila tribal people to be least at risk for malaria, with all other factors being equal. “+” = relative presence of the factor.

* Based on younger marriage age, less work outside the home and less female HHH
 ** Assuming prenatal healthcare seeking tendency can be generally extrapolated

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