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Remoteness and demographic distribution of diabetes, hypertension and common medical conditions among indigenous Panamanian communities

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The primary aim of the study was to describe associations between remoteness and demographic variables and common medical conditions among children, juveniles, adults and elderly in selected indigenous communities in northwestern Panama. The secondary aim was to investigate the prevalence and risk factors of diabetes and hypertension as they relate to community remoteness.

Data was collected from 2011-2015 by the non-profit, non-governmental organization Floating Doctors, a mobile clinic providing healthcare to remote communities of northwestern Panama. A cross-sectional design was used to describe common conditions and determine risk factors associated with diabetes and hypertension.

Helminth infection was the most common diagnosis overall (24.9%) and among children (33.1%) and juveniles (35.8%), with frequencies increasing with remoteness. Lower back pain (15.2-21.6%) and osteoarthritis (13.7-17.3%) were frequent conditions among adult men and the elderly, respectively. Prevalence of overweight and obesity status was high (72.7%-80.9%) and increased with community remoteness (*P*=0.0001). Low prevalence of diabetes (1.0%) and hypertension (1.6%) was detected. Female gender (OR:1.54 (95%CI:1.24-1.91)), age 41-49 years (OR:1.93 (95%CI:1.24-3.03)), age 50+ years (OR:2.54 (95%CI:1.92-3.35)), family history of diabetes (OR:6.53 (95%CI:3.22-13.23)), and hypertension (OR:3.28 (95%CI:1.36-7.93)) were identified risk factors for diabetes. Community remoteness was not associated to diabetes (OR: 1.00 (95%CI: 0.55-1.82)) comparing community type 1 with 2, (OR: 0.81 (95%CI:0.44-1.48)) comparing 1 with 3). Risk factors for hypertension were: age 41-49 years (OR:1.70 (95%CI:1.17-2.47)), age 50+ years (OR:2.52 (95%CI:2.04-3.12)) and obesity(OR:4.04 (95%CI:1:36-12.02)),whereas community remoteness was a protective factor of hypertension(OR:0.23 (95%CI:0.51-1.02)).

The low prevalence of hypertension and diabetes detected despite high BMI indicates that remoteness could be a protective factor for non-communicable diseases in these communities. However, the results signify that remoteness and limited access to basic medical needs increases vulnerability to diseases like helminth infections, lower back pain and osteoarthritis.

Introduction

Panama is a country in Central America bordering the Caribbean Sea to the north and Costa Rica to the west.[1] Although Panama is characterized as a middle-income country, the socio-economic inequality in the population reaffirms the regional health disparities and uneven distribution of social determinants.[2] In Panama, 95% of the indigenous population lives below the poverty line. There was a higher poverty incidence among indigenous ethnic people living within the remote areas (Kuna Yala, Embera´, and Nga¨be-Bugle) than those living outside, indicating that geography seems to be a more influential determinant of poverty than ethnicity.[1,2] The Bocas del Toro province of Panama and Ngabe-Bugle *Comarca* (indigenous reserve) harbors the majority of the indigenous population and many of these communities are utterly remote. For many of these communities, the time of transportation to nearest town, road or hospital is up to ten hours. This geographical remoteness manifests itself in these areas' poor health statuses. The Bocas province carries the country's highest birthrate (31.5 per 1000), a life expectancy of 68.6 years (7,2 years lower than the national life expectancy) and the country's highest age-adjusted diabetes mortality rate (28.1 per 100000) .[1,2]

In a rapidly changing environment, health is shaped by aging populations, urbanization and changing behavioral risk factors, such as altering patterns of diet and physical activity causing increases in obesity. As a consequence, non-communicable diseases (NCDs) such as cardiovascular disease (CVD) and diabetes have become the leading cause of death worldwide, but with a discriminatory distribution. Nearly 80% of the mortalities caused by NCDs occur in low- and middle-income countries.[4, 5,6,7,8] In 2012, a diabetes prevalence of 9.3% was estimated in U.S.A, similar to a prevalence of 9.4% in Panama in 2015.[9,10] Diabetes is the sixth leading cause of death in Panama in 2011; the age-adjusted diabetes mortality rate accounted for 23.3 deaths per 100,000 between 2001–2011, with the second highest rate found in the province of Bocas del Toro.[2] This diabetes prevalence is expected to increase further .[7,14] The morbidity and mortality caused by diabetes is rising fastest among middle and lower-income countries, populations and communities, making these underprivileged societies more vulnerable to the high diabetes prevalence, compared to high-income countries.[7,14] Like diabetes, hypertension is a worldwide public health challenge.[8,12,13] The World Health Organization (WHO) estimated the prevalence of hypertension to be 35% in the Americas in 2008, similar to high-income countries.[12] A retrospective study estimated a 29.6% prevalence of hypertension between 2001-2011 among people over 18 years of age in Panama.[13] To our knowledge, there have not been any studies conducted on hypertension prevalence in Panama since 2011. Although similar prevalence of hypertension and diabetes was observed in middle-low income countries and high-income countries, the much larger populations of developing countries result in a considerably larger absolute number of individuals affected.[12] Moreover, disadvantaged populations have access to weaker healthcare systems, resulting in a great number of undiagnosed and untreated patients with hypertension and diabetes. As a consequence, NCDs impose large costs in human, social and economic terms.[7,15,16]

Although disadvantaged populations, compared to high-income countries, appear to be at higher risk of poor outcomes from hypertension and diabetes despite similar disease prevalence, some studies have revealed a low NCD burden in native societies due to a variety of factors such as conservation of traditional culture or remoteness. However, the lack of other basic needs, such as access to healthcare, makes these native communities vulnerable to other conditions, such as parasitic and infectious diseases.[1,2,16]

These health inequities of risk and vulnerability to poor health illustrates that the association between health and geographic variables, such as remoteness and health care accessibility, are important components of the epidemiological profile of diseases.[2,4,17] The initial assumption is that lack of health care access due to poverty and remoteness necessarily translates into poorer health outcomes, but closer examination shows a more complicated picture where inaccessibility to health service increases vulnerability to some conditions but may be protective against others. Thus, this study had a two-part goal:

The first aim of the study was to describe the association between remoteness and demographic variables and common medical conditions among children, juveniles, adults and elderly in selected indigenous communities in northwestern Panama.

The secondary aim was to investigate the prevalence and risk factors of diabetes and hypertension and their association to community remoteness.

Investigating how remoteness affects the profile of most common medical conditions and the prevalence of hypertension and diabetes could help create tailored health care solutions, discriminating on regional demand.

Methods

Data were collected by Floating Doctors –a non-governmental, non-profit medical organization whose main aim is to provide free health care services to isolated communities, mainly of the Bocas del Toro Province of Panama. The organization consists of permanent employees, as well as volunteering Spanish translators, doctors and other healthcare professionals from all over the world.

Occasionally, the Floating Doctors provided home visits; however, the most common patient contact was setting up a clinic in the village upon arrival. When arriving to the clinic patients were registered by name, date of birth or age, and social security number, if available. If existing, old medical records were obtained from previous clinics. Data on height, weight (measured with a "Thinner scale, model: TH100NIB), blood pressure (measured with a sphygmomanometer), heart rate (measured manually) and temperature (measured with an auricular thermometer) were collected. Additionally, blood sugar levels were measured on all pregnant women and patients >35 years, using a glucometer. A detailed medical form was filled out, including family history of chronic illnesses, information regarding number of people in household, substance abuse, medication intake among other medical information. Subsequently, patients were seen by a doctor and were given medicine, soap, condoms and vitamins, which were provided by the Floating Doctors. After every clinical visit, the medical records were scanned by volunteers and typed into an excel spread sheet by a data entry specialist in India.[18]

The study data collected from 2011-2015 consist of 10 786 first clinical visits, from individual patients of the 34 villages (or smaller villages nearby) assisted by the Floating Doctors.

Information regarding age was missing in 234 cases, gender in 62 cases and for patients >15 years. If data was unavailable, they were grouped as “unknown age” or “unknown gender” in the statistical analysis. Data regarding height and/or weight were missing in 1365 cases. Additionally, data were missing on number of people in household in 4899 cases. Missing data on weight/ height, as well as number of people in household was only excluded from the statistical analysis regarding household crowding and body mass index (BMI).

To describe the association between remoteness and demographic variables and common diseases, a cross-sectional design was used.

A case-control design was used to identify risk factors for diabetes and hypertension including patients ≥20 years. For precise case definitions, only patients with a diagnosis, regardless of measured blood pressure/blood sugar levels, were included. If the diagnosis was unclear, patients were excluded (n=2). Cases were matched on gender, and categorically matched on age with controls. If an exact match (on gender within age category) could not be obtained, cases were excluded (n=1).

In the BMI analysis 27 patients were excluded due to outliers in measurements if the corroborated weight and/or height were: <25kg; >200kg, <130cm), since this was interpreted as resulting from typing errors.

The final analysis sample consisted of 87 diabetes cases, 135 hypertension cases, 261 diabetes controls and 405 hypertension controls.

To group the communities for further analysis, average time of travel to road, town and hospital were estimated from each community. Measurement of transportation time is relative and depending on terrain, daily and seasonal variations of rain and waves, as well as means of transportation accessible. In this manner, the subdivision was based on the mean transportation time with motor-driven cayuco (a sort of canoe), with all these factors taken into account. Assessing the preferred choice of hospital was challenging, seeing that the preference depends on many variables, such as: poor local confidence, travel time, cost and purpose of visit (some hospitals are poorly equipped with very limited resources). The estimation was made by first author in collaboration with people from the local communities, an experienced coworker, and was based on the most likely choice, with these variables considered. In that manner, the 34 communities were divided into 3 community types based on their remoteness degree: Type 1 ≤1 hour, Type 2: >1;<2 hours and type 3:>2 hours of average transportation time to road, town and/or hospital.

BMI was calculated as weight [kg]/height^2 [m]. People with a BMI of 25-29.9 kg/m^2 were defined as overweight, and people with a BMI≥ 30 kg/m^2 were defined as obese. For patients 15-19 years of age, WHO’s BMI for sex and age Z-scores defining overweight as > +1SD, and obesity as > +2SD was used.[19]

Age was categorized as follows: children: [0-4 years], juvenile, [5-14 years], adult, [15-49 years], elderly, [50+ years], and unknown age.

Regarding measurement of outcome, the helminth infection diagnosis was based on self-reported worms in stool.

Diabetes diagnoses were based on current WHO diagnostic criteria defined by: fasting blood sugar level level>7mmol/L or postprandial blood sugar levels>11.1 mmol/L.[20] Hypertension diagnoses were based on WHO diagnostic criteria 140/90 mmHg.[12] If blood pressure was elevated, it was ideally measured twice more and the average of the two last measurements calculated. However, data is sparse on second and third blood pressure measurements.

STATA (version14) and Excel 2016 were used for data cleaning and logistic regressions and Epi Info (version 7.1.5) for all other statistical analysis. Chi square tests (X^2) and paired t-test were applied to investigate statistical differences between groups and 2×2-tables as well as multiple logistic regression models to evaluate the association between outcome and various risk factors. P<0.05 was considered statistically significant.

Power calculations indicated a required sample size of 125 to detect a 33.3% difference of hypertension prevalence between community type 1 and 3.

The study received ethical approval from the Ministry of Health of Panama.

Results

Demographic characteristics

It is estimated that the study population of 10,786 patients represent 33.6% of the total populations of all 34 communities. As seen in Figure 1, the patients of community type 3 had the smallest proportion of children (P<0.001 compared to community type 1) and type 2 the largest proportion of adults (P**<**0.001).With a mean of 7.30 people/household, community type 3 (most distant/rural) had a statistically significant greater number of people in the household compared to community type 1(P**<**0.001) (Table 1).

Most frequent diagnosis

Helminth infection was overall the most common diagnosis among all communities (24.9 % (n=2681)), particularly among children (33.1% (n=967)) and juveniles(35.8% (n=983)). The prevalence of helminth infection increased with community remoteness ranging from 30.0% (n=222)-41.3% (n=373) among juveniles in community type 1 and 3 respectively.

Among the adult female population, dehydration (14.6% (n=125)), headache (14.1% (n=133)) and helminth infection (17.5% (n=147)) were the most frequent diagnosis in community type 1,2 and 3 respectively.

Lower back pain was the most frequent diagnosis among adult men, ranging from 15.2% (n=44)–21.6% (n=88) in community type 1 and 2, respectively. Lower back pain was overall the most frequent diagnosis among the adult population in community type 2 (15.0%

(*n*=203)) and 3 (17.7% (*n*=220)).

Among the elderly population, osteoarthritis was the most frequent diagnosis in community type 2(13.7% (*n*=62)) and 3(17.3% (n=78)), and helminth infection among elderly in community type 1 (13.3% (*n*=44)) (Figure 2).

BMI

Mean BMI among patients age≥20 was 29.4 kg/m^2 (SD=5.7). In this group, BMI among women (30.4kg/m^2 (SD=6.03)) was significantly greater compared to men (27.4kg/m^2 (SD=4.48)) (P<0.0001).The prevalence of overweight and obesity was: 67.3% (*n*=191) and 34.9% (*n*=30) among 15-19 year old female and males, respectively. No statistically significant differences in overweight prevalence was detected for combined sex between community types (P=0.37).

The prevalence of overweightness and obesity increased significantly with community remoteness (72.7 % (*n*=520)), 80.0% (*n*=755) and 80.9% (*n*=832) for community type 1,2 and 3 respectively) (P=0.0001).

Distribution, Risk factors and Prevalence of Diabetes

As shown in Table 2 the prevalence of diabetes among community members≥20 years was estimated to be 1.0% and associated with family history of diabetes(OR:6.53 (95%Cl:3.22-13.23)), as well as hypertension co-morbidity (OR:3.28 (95%Cl:1.36-7.93)). Other independent risk factors of diabetes were female gender(OR:1.54 (95%Cl:1.24-1.91))age: 41-50 years(OR:1.93 (95%Cl:1.24-3.03)) and age 51+ years(OR:2.54 (95%Cl:1.92-3.35)), but not obesity(OR:0.84 (95%Cl:0.42-1.70)) or community type(OR:1.00 (95%Cl:0.55-1.82)) comparing community type 1 with 2, (OR:0.81(95% Cl:0.44-1.48)) comparing 1 with 3).

Distribution, Risk factors and Prevalence of Hypertension

As shown in Table 3, the prevalence of hypertension among community members ≥20 years of age was 1.6%. Hypertension was associated with age 41-50 (OR:1.70 (95%Cl:1.17-2.47)) and age 51+ years (OR:2.52(95% Cl:2.04-3.12)).In the crude hypertension analysis, high BMI tended to increase the risk of hypertension(OR:1.76 (95%Cl:0.96-3.21))and after adjusting for family history, diabetes co-morbidity, BMI and community type, BMI was a strong predictor for hypertension(OR:4.04 (95%Cl:1.36-12.02)).

Furthermore, being a member of community type3 (the most remote community) revealed to be a protective factor for hypertension compared to community type 1, in both the crude (OR: 0.45 (95%Cl: 0.27-0.75)) and adjusted analysis (OR: 0.23 (95%Cl: 0.51-1.02)).

Discussion

In this study, a high burden of helminth infection and a low prevalence of hypertension and diabetes among indigenous communities of northwestern Panama was detected.

The demographic distribution of patients seen by Floating Doctors indicates a large proportion of children and juveniles (52.6%) and a small proportion of elderly (10.6%), with overall 42.1% men. Data regarding demographic distribution of the Panamanian indigenous population is sparse; however, the National Institute of Statistics and Census in Panama reports that the population of Bocas del Toro are young (27% of the population was 0-14 years in 2016) and with short life expectancy, consistent with this study's findings.[21] However, using non-random sampling, only including patients of the Floating Doctors may enhance this demographic distortion, because of age and gender dependent health seeking behavior. Nevertheless, these results indicate that women seek medical attention with their children, whereas men demonstrate less care-seeking behavior. This underrepresentation of the male gender, might underestimate conditions more prevalent among men.

Helminth infection is known to be the most common infectious agent in developing countries, mostly affecting children, being particularly prevalent in endemic communities, consistent with this study's findings.[22] In a cross-sectional study conducted 2008-2010 in Panama, a countrywide prevalence of soil-transmitted helminth infection was estimated to 33.3%, consistent with, wide-ranging, but high prevalence in other Central American countries.[22, 23] However, the overrepresentation of children (52,6% compared to regional estimates of 27%) as well as potential over-reporting (since the diagnosis is based on self-reported presence of worms in stool) to receive free medication could lead to overestimations of the frequencies of helminth infections.[21]

Dense household crowding, which also is a proxy variable for poverty, is a known risk factor for helminth infection, consistent with the dense household crowding found in all community types, with significantly denser crowding in community type 3, where highest frequencies of helminth infection are found. Because this was a cross-sectional study, it is impossible to draw any associations; nevertheless these results are consistent with other literature.[22]

That frequency of helminth infections increasing with remoteness could be a gauge of how proximity to infrastructure improves health through addition of sanitation, cleaner water supply, access to health care facilities, making communities more affluent, and decreasing frequencies of infectious diseases.[1,2,24] However, one study from an indigenous area of Panama shows that more densely populated homes in areas with better access to health-related infrastructure did not always correspond with better health outcomes. This stresses how great of a risk factor household crowding is for infectious diseases whether a home is in a remote rural area or urban center close to health services.[24] These results illustrate a syndemic perspective of how adverse social conditions play a critical role in facilitating clustering of infectious diseases.[25]

Among adult men, lower back pain was the most frequent diagnosis and the most common condition among the total adult population in the more remote community types 2 and 3. Lower back pain is an extremely common condition and knowing that the primary source of revenue in the most remote communities is agricultural, working in plantations and other types of physically demanding jobs, makes these findings expected.[26,27]

Among the elderly population, osteoarthritis was the most frequent diagnosis overall, which is to be expected, since 9.6% of men and 18% of women aged >60 years suffer from this condition world wide –it is a prevalent disabling condition causing health seeking behavior.[28]

Of note, overweightness did not occur as a prevalent diagnosis, although a high overweight prevalence was detected among men and especially women with age ≥15. Overweightness has simply not been coded as a diagnosis in the database, possibly because some doctors do not categorize it as a disease in itself.

Mean BMI among all community members≥20 years was indicative of overweight, bordering on obesity status, and increasing significantly with community remoteness.

This is consistent with other literature revealing an obesity prevalence of 61.2% (95%Cl:53.5-73.8) in the total Panamanian population age 20+ .[7] High prevalence has also been observed among native groups in South America.[4] Due to high rates of obesity ostensibly present among the study population, high prevalence of diabetes could be expected among the indigenous communities. This, however, is not the case.

The estimated prevalence of diabetes and hypertension found in this study is considerably lower than national estimates. However, studies demonstrate that rural to urban migration of the same ethnic group increases diabetes and hypertension prevalence, insulin resistance and mean diastolic blood pressure, indicating that indigenous and rural locations are a protective factor of NCDs.[4,29,30] This tendency might be due to a healthier diet with less sugar content, a more active lifestyle, as well as tobacco and alcohol being unaffordable and inaccessible in rural areas.

The prevalence of diabetes in other native communities ranges from: 0.5% in rural Peru to 4.1% in rural Chile, and 3.4% in indigenous areas of Panama; however, most of these studies have small sample sizes, which might underestimate or overestimate prevalence of diabetes.[4, 16,29] On the contrary, other studies found higher prevalence; one example is a cross-sectional study estimating a 68.1% among adults>40 years in native Ecuadorians.[32]

Regarding hypertension, a study from 2014 estimated a prevalence of 10.8% among the indigenous Panamanian population, with a higher prevalence among people living in urban areas (31.7%).[13] Even higher prevalence of hypertension has been detected among indigenous populations of Brazil (29.5%).[32] One of the key factors causing variation of prevalence estimates of NCDs may be due to differences in diagnostic definitions, methods and age of study participants.

Consistent with these findings, a significant difference in the prevalence of hypertension was detected comparing community type 1 to 3, indicating that only utterly remote communities are unexposed enough to westernized lifestyle to detect a protecting effect. However, it is striking that patients among the most remote communities had the highest BMI, but the lowest incidence of hypertension. This observation raises the question if the indigenous genetic disposition could play a protective role against CVD, however this is merely speculation.[4]

Nevertheless, the diabetes prevalence was slightly lower, and hypertension prevalence profoundly lower than studies from other native areas, possibly indicating an underestimation.

The underrepresentation of men (possibly due to differences in health seeking behaviors and employment) could affect the validity of diabetes and hypertension prevalence estimates, since male patients with diabetes and hypertension may remain undiagnosed. Not seeking medical attention may be associated with other risk factors and exposures, creating a selection bias, devilling the statistical results, potentially generating underestimations of diabetes and hypertension prevalence among men. This explanation could also clarify another finding not corresponding with previous research; diabetes are more prevalent among women in this study.[33] On the other hand, there was no gender-related difference detected among hypertensive subjects, which is consistent with other literature.[8]

This underrepresentation could also arise from mistrust to, and unfamiliarity with, modern medicine.[1] This may be more prevalent among the elderly population, decreasing the diabetes and hypertension prevalence estimates further, because prevalence increases with age in both diseases.[11]

Another factor that conceivably could lower prevalence estimates, are cultural differences in illness behavior, as defined by D. Mechanic: *"the ways in which given symptoms may be differentially perceived, evaluated and acted (or not acted) upon by different kinds of persons.".*[35] Illness being shaped by sociocultural factors broadens the boundaries of illness perception. The hardship of the indigenous life may create more marginalized definitions of being sick, thus the less severe (or non-excising) symptoms dominating earlier stages of NCDs may decrease the likelihood of care seeking behavior, resulting in larger numbers of people with silent hypertension or diabetes remaining undiagnosed.[35]

Regarding other risk factors, this study found that diabetes and hypertension prevalence increased with age, and diabetes was significantly associated with family history; consistent with other literature.[8,10,12] Another significant association was co-morbidity of hypertension among diabetics. Hypertension coexists with diabetes in over 2/3 of cases, by virtue of shared behavioral risk factors such as unhealthy diet, smoking, physical inactivity and harmful alcohol use.[35] As a consequence of these risk factors being overweight is highly associated with both diseases.[8,11,13] In this study obesity was a strong predictor for hypertension.

The study limitations include distortion of the demographic profile through use of non-random sampling, health seeking behavioral patterns and cultural circumstances. However, the external validity of the study is offset by including over 1/3 of the total population of the 34 indigenous communities in the study.

These findings taken together indicate that women seek medical attention with their children, whereas men demonstrate less care seeking behavior. Despite high prevalence of overweight and obesity, low hypertension and diabetes prevalence were seen illustrating that geographic remoteness could be a protective factor of NCDs such as diabetes and hypertension in these communities. The hardship of the indigenous life, limited access to healthcare, hygienic conditions as well as lack of infrastructure, could make them vulnerable to other diseases, such as helminth infections, lower back pain and osteoarthritis. Interventions to target these diseases could include: access to clean water, soap, deworming medicine, ergonomic education, as well as weight loss programs.

Figures & Tables

Figure 1:

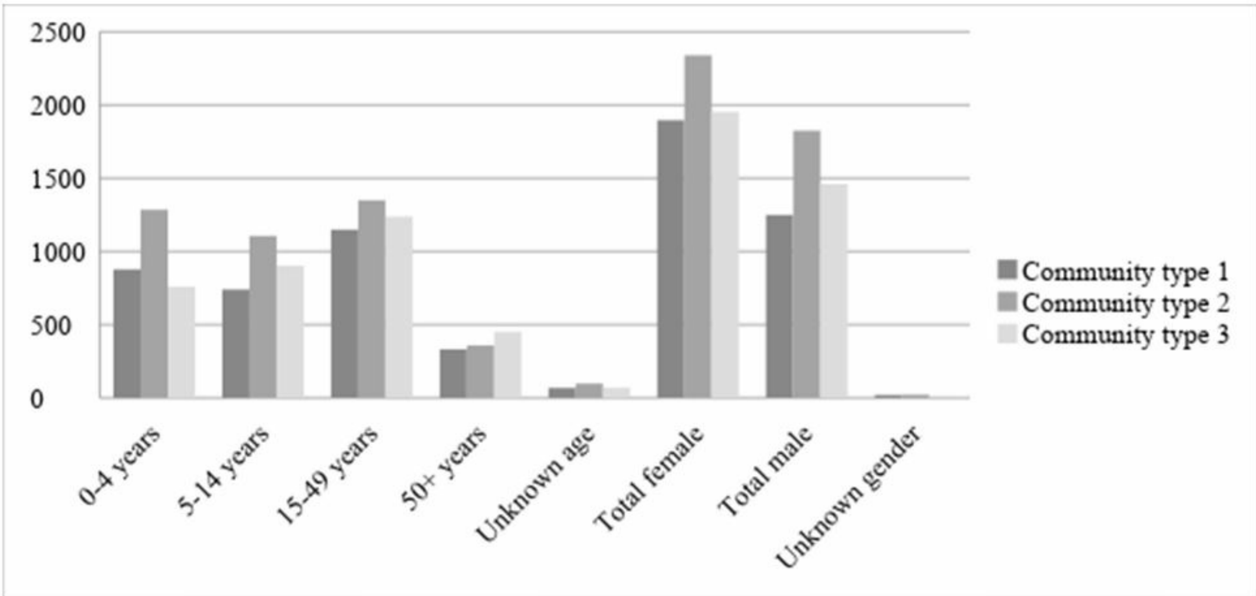

Figure 1: Number of individuals distributed on age groups and gender in each community type at first clinical visit of the floating Doctors between 2011-2015.

Figure 2:

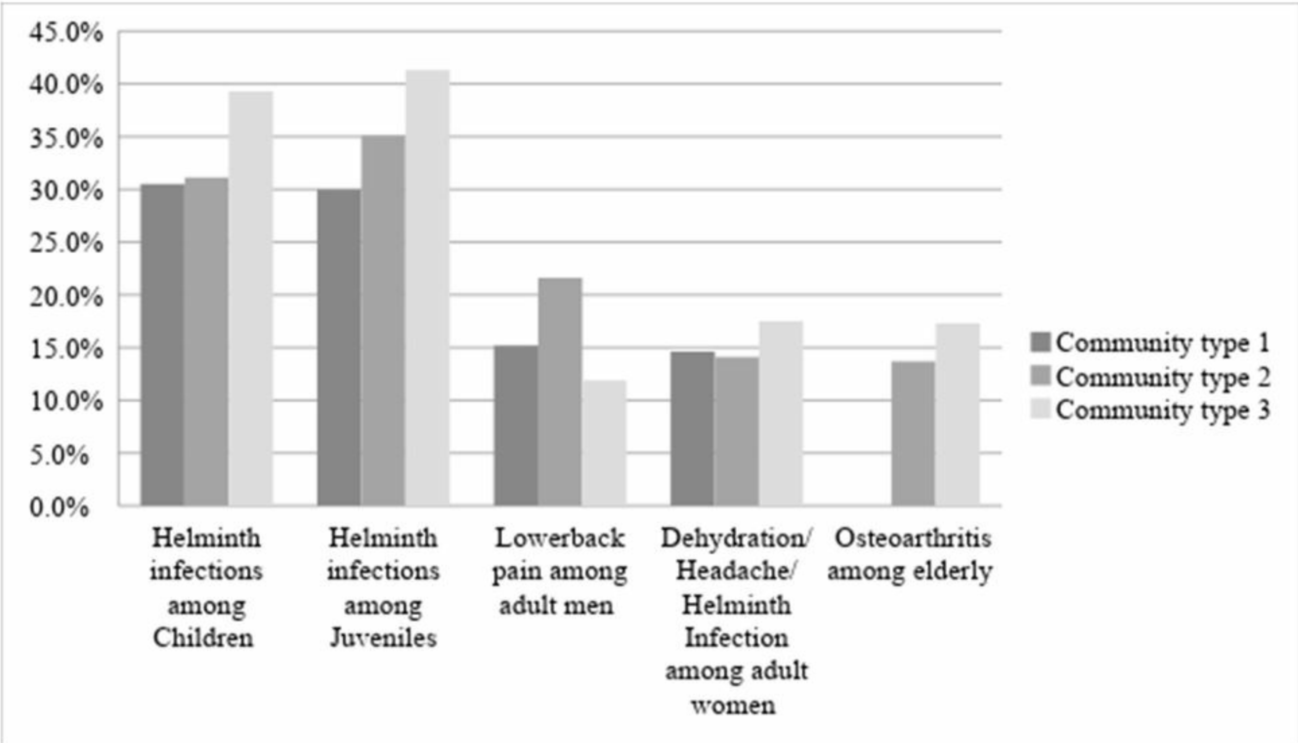

Figure 2: Illustrates common medical conditions among Panamanian indigenous community types at first clinical visit of the floating Doctors between 2011-2015.

Table 1:

Table 1: Demographic characteristics among three Panamanian indigenous community types from 2011-2015.

Community type:	1 *n*(%)	2 *n* (%)	3 *n*(%)	Total *n* (%) (cum. Percent)	*p*[a].	*p*[b].
Age:						
Children:0-4 years:	878(27.7)	1286(30.6)	759 (22.2)	2923 (27.1)(27.1)	<0.01	<0.001
Juvenile: 5-14 years:	740(23.4)	1106(26.3)	903 (26.4)	2749 (25.5)(52.6)	<0.01	0.005
Adults:15-49 years:	1148 (36.3)	1351 (32.2)	1240 (36.3)	3739 (34.7)(87.3)	< 0.001	0.99
Elderly: 50+ years:	332 (10.5)	358 (8.5)	451 (13.2)	1141 (10.6)(97.8)	<0.005	< 0.001
Unknown age:	68 (2.2)	98 (2.3)	68 (2.0)	234 (2.2)(100.0)	0.59	0.65
Total:	3166 (29.4)	4199 (38.9)	3421 (31.7)	10786 (100.0)	NA	NA
Gender:						
Female:	1895 (59.9)	2341 (55.8)	1953 (57.1)	6189 (57.4)	< 0.001	0.01
Male:	1251 (39.5)	1825 (43.5)	1459 (42.1)	4535 (42.1)		
Unknown:	20 (0.6)	22 (0.8)	9 (0.3)	62 (0.6)		
Mean number of people in household[c]**:**	7.0 (3.41)	7.92 (3.06)	7.30 (3.4)	7.06 (3.30)	0.73	< 0.001

a: P-value comparing community type1 and 2.b: P-value comparing community type 1 and 3.c (SD)

Table 2:

Table 2: Characteristics, crude and adjusted odds ratios of diabetic and non-diabetic subjects among Panamanian indigenous community types from 2011-2015.

Variables	Diabetics *n*(%)	Controls *n*(%)	OR(95%CI) a .	P	Matched OR	P
Gender:						
Female:	62 (71.3)	186 (71.3)			1.54 (1.24-1.91)	<0.001
Male:	25 (28.7)	75 (28.7)			1	NA
Age [B]:						
[20-30]	4 (4.6)	12 (4.6)			1	NA
[31-40]	8 (9.2)	24 (9.2)			1.40 (0.79-2.49)	
[41-50]	18 (20.7)	54 (20.7)			1.93 (1.24-3.03)	
[51+[	57 (62.5)	171 (62.5)			2.54 (1.92-3.35)	<0.0001
Community type:						
Community type1:	26 (29.9)	72 (27.6)	1	NA		
Community type2:	32 (36.8)	89 (34.1)	1.00 (0.55-1.82)	0.99		
Community type3:	29 (33.3)	100 (38.3)	0.81 (0.44-1.48)	0.49		
BMI≥30 [C]:	21 (42.9)	72 (43.9)	0.84 (0.42-1.70)	0.63		
Family history of	28 (32.2)	18 (6.9)	6.53 (3.22-13.23)	0		

Diabetes:				
Hypertension Co-Morbidity:	13 (14.9)	16 (6.1)	3.28 (1.36-7.91)	<0.01
Total:	87 (25.0)	261 (75.0)	348 (100.0)	NA
Total:[D].	87/8626 (1.0)			

a: Using community type 1 and household crowding 1-3 as reference group. b: Using age group [20-30] as reference. c: (%) of cases/controls with BMI data. d: *n*= total number of diabetic subjects including unknown gender/whole study population age ≥20.

Table 3:

Table 3: Characteristics, crude and adjusted odds ratios for Hypertensive and non-Hypertensive subjects among Panamanian indigenous community types from 2011-2015.

Variables	Hypertension *n* (%)	Controls *n* (%)	OR(95% CI)	*P*[a].	Adjusted and matched OR	*P*
Gender:						
Female:	68 (50.4)	204 (49.6)			1.00 (0.85-1.19)	0.93
Male:	67 (49.6)	201 (49.6)			1	NA
Age[B].**:**						
[20-30]	7 (5.2)	21 (5.2)			1	NA
[31-40]	10 (7.4)	30 (7.4)			1.19 (0.74-1.92)	
[41-50]	22 (16.3)	66 (16.3)			1.70 (1.17-2.47)	
[51+]	96 (71.1)	288 (71.1)			2.52 (2.04-3.12)	<0.0001
Community type:						
Community type1:	152 (38.5)	119 (29.4)	1	1	NA	NA
Community type 2:	50 (37.0)	126 (31.1)	0.88 (0.55-1.41)	0.59	0.70 (0.17-2.93)	0.63
Community type 3:	33 (24.4)	160 (39.5)	0.45 (0.27-0.75)	0.002	0.23 (0.51-1.02)	0.05
BMI≥30[C].**:**	40 (50.6)	99 (41.3)	1.76 (0.96-3.21)	0.07	4.04 (1.36-12.02)	0.01
Family history of			2.11 (1.16-		1.30 (0.41-	

hypertension	22 (16.3)	36 (8.9)	3.83)	0.02	4.28)	0.65
Diabetes co-Morbidity:	13 (9.6)	12 (3.0)	1.84 (1.01-3.33)	0.05	1.30 (0.36-4.71)	0.69
Total:	135 (25.0)	405 (75.0)			NA	NA
Total:[D]	136/8626 (1.6%)					

a: Using community type 1 and household crowding 1-3 as reference group. B: Using age group [0-30] as reference. c: (%) of cases/controls with BMI data. d: *n*= total number of hypertensive subjects including unknown gender/whole study population age ≥20.

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