

Abstract

Many hunter-gatherer groups live on the outskirts of wider society, experiencing poor health outcomes with little access to medical care. From a development perspective, key interventions include the sedentarisation of these mobile peoples into camps nearby larger towns with sanitation infrastructure and medical care, as increased access to services is assumed to improve outcomes. However, recent research in the Agta (Philippine foragers from North-east Luzon) has demonstrated that individuals residing in more 'developed' communities suffer from increased morbidity and mortality. Here, using quantitative and ethnographic data on health collected between 2002 and 2014, we explore why this trend occurs by examining the relationship between key development initiatives with self-reported illness and the uptake of medical interventions with 415 Agta men, women and children. We demonstrate that health outcomes worsen as sedentarisation progresses, despite some increases in medical access. We argue this is because the development paradigm is not evidence-based, but rather stems from an ideological dislike of mobile hunter-gatherer lifestyles. This, in addition to cultural insensitivity and daily discrimination means these interventions are ill-suited to the unique needs of hunter-gatherers, and thus ineffective. Based on our findings we offer future short and long-term policy suggestions which seek to reduce the Agta's vulnerability, rather than increase it.

Keywords: Hunter-gatherers; health; development; sedentarisation; policy; Philippines; Agta; multi-level modelling

Introduction

With increasing research, the alarming state of indigenous peoples' health is being brought to the fore. As a review by Valeggia & Snodgrass (2015, p.117) shows, "[r]egardless of their geographical location or sociopolitical situation, health indicators are always poorer for indigenous populations than for nonindigenous ones." Moreover, indigenous peoples worldwide receive little, if any, medical care compared to their fellow countrymen and women (Walker, 2013). However, while such health disparities stimulates reams of research in larger populations, it is glossed over for hunter-gatherers (Hurtado et al., 2005). Hunter-gatherers are indigenous peoples who rely primarily on hunting, fishing and foraging and are frequently mobile, owning little wealth. Foragers, without wealth, tenurial security and viable mechanisms to legally secure their territory due to their mobility, often fall to the bottom of the social scale (Early and Headland, 1998). Thus, with unique lifestyles, they present unique challenges to health and wellbeing.

By analysing how and why dominant development strategies are compromising Philippine hunter-gatherers' health, we connect with two major lines of medical anthropological enquiry. First, our study documents and explains health inequities in relation to political economy, history and development ideology (Janes and Corbett 2009: 170). Getting to the 'causes of the causes' of socially excluded minorities' ill health requires considering its social determinants (Marmot 2005: 1102), including history and racism (Mitchell 2007; Paradies 2007). Second, we join the anthropological critique of policies that impact the health and wellbeing of the intended beneficiaries (Janes and Corbett 2009: 173). Crucially, the ideology embedded within health policy and practice, is shaped to a large extent by hegemonic ideology (Baer, Singer and Johnsen 1986: 95) and conventional wisdom outside it.

Ethnography can be a powerful way to correct such influential, but often groundless conventional wisdom (Pfeiffer and Nichter 2008: 412).

In the specific context of hunter-gatherers, prevailing developmental policies and practices have focused on sedentarisation and agriculture as a pathway to increased access to services (Cohen, 2005; Marchi, 2010). Sedentarisation is assumed to improved access to health care and education, however, we know little about the health of foragers, and more importantly the consequences of decreasing isolation and transition to sedentary agriculture (Froment, 2001). The need for evidence-based policy is apparent in South America as indigenous peoples are increasingly coming into accidental contact with an ill-prepared wider society (Pringle, 2015). Without a well-informed policy, enacted by trained professionals, the potential for damage to indigenous groups is extreme (Walker and Hill, 2015). Thus, there is an urgent need to not only quantify the health of hunter-gatherers, but critically review the impact of developmental policies undertaken by governments and NGOs.

Here, we approach this question with data from the Agta from North-eastern Luzon, the Philippines. The total Agta population was estimated at 10,000 at the turn of the century (Headland 2003). Our study focuses on a population of 1,000 individuals who reside within the municipality of Palanan, Isabela Province. Living in small settlements (of 30-100 individuals) at the coast and along rivers, the Palanan Agta are mainly fisher-foragers, with variable emphasis on hunting, combined with cultivation and wage labour. The resources on which they subsist are situated in the Northern Sierra Madre Natural Park (NSMNP), the Philippines' largest protected area (Persoon and van Weerd 2006). Having indigenous status, the Agta hold user and settlement rights in the park. However, as a result of weak law

enforcement (Anonymous 2016), in practice they face considerable resource competition from other land users and Agta consistently report dwindling foraging returns (Anonymous 2014). More generally, the Agta's history is characterized by marginalization, discrimination and human rights abuses (Headland 2003). The majority of Agta strongly believe in spiritual forces of several kinds. As will be elaborated in the discussion, most of these are feared for their capacity to cause sickness and even death, and for that reason they need to be constantly appeased (Anonymous 2010: 72-83). Thus, Agta notions of health and sickness are fully intertwined with their belief system, and this has important implications for intercultural communication in relation to medical service provisioning.

The Agta provide a perfect case for studying the impact of sedentarisation on health outcomes as they have experienced pressure to sedentarise and farm since the Spanish colonial era (Anonymous, in press). This campaign against the hunter-gatherer lifestyle is accompanied by the persistent stereotype of the Agta lifestyle being lazy compared to the settled, agricultural lifestyle of non-Agta. These ideologies and perceptions persist to this day and continue to influence developmental policy and practice by government- and non-government agents. This pressure to sedentarise has been, in part, based on the assumption that it would improve the Agta's social position, educational status and health outcomes. However, we have previously shown that Agta individuals who sedentarised experienced a significant health deterioration (Anonymous 2016). We analysed blood and stool samples and found that morbidity was significantly increased in sedentarised camps. For instance, individuals living in large camps with little mobility had a 2.8 times higher chance of presenting with lymphocytosis (marker of viral infection) while people residing in permanent camps suffered from significantly higher intestinal helminths loads. Consequentially, mothers living

in permanent, compared to temporary camps, experienced a 63.2% increase in child mortality rates (Anonymous 2016). Thus, here we explore the cause of these trends by examining the relationship between key developmental initiatives in the Philippines (sedentarisation of camps, installation of water pumps and the placement of camps closer to market towns) and self-reported illness, medical treatment uptake and vaccination rates.

Here, we show that health outcomes worsen as sedentarisation progresses, despite some increases in medical and sanitation access. Camps which are the most 'developed' and with increased access to medical services are those which experience the worst health outcomes. This is arguably due to the problem of sedentism itself increasing the disease burden, *as well as* interventions lacking cultural relevance, proper implementation and long-term maintenance. Finally, the Agta also face ubiquitous discrimination against their lifestyle. The Agta's health is thus not helped by dominant development policy, which encourages, if not requires sedentarisation. Such policy only adds to the Agta's vulnerability as it is ill-suited to the unique needs of mobile hunter-gatherers.

Materials and Methods

The quantitative data on health outcomes and use of medical services was collected by X and X over two field seasons from April to June 2013 and February to October 2014. X has conducted long-term ethnographic research among Agta in nine municipalities of Isabela Province, including Palanan, in different periods between 2002 and 2014. This included 159 semi-structured interviews with individual households heads (mostly females) on birth histories, child mortality, and perceived causes of sickness and mortality which were. This research has informed the discussion of the biomedical results, alongside the insights from

the other authors. Given the small population size inherent with hunter-gatherers an opportunistic sampling protocol was followed. Households were interviewed when camps could be reached (dependent on weather conditions or camp movements), and when households were present in these camps and willing to under-go the medical survey. Of the total population of roughly 1,000 Agta from Palanan 415 were interviewed.

Ethics

The research and fieldwork carried out by X and X was approved by X Ethics Committee (X ethics code 3086/003) and carried out with permission from local government and tribal leaders in Palanan. The ethnographic field work by X took place under the Cagayan Valley Programme on Environment and Development. It was carried out with permits from the Protected Area Management Board of the Northern Sierra Madre Natural Park and the Municipal Mayors. Informed consent was obtained from all participants, after group and individual consultation in the local language.

Medical survey

We conducted medical surveys and household questionnaires to quantify medical histories and household wealth in 12 camps with 415 individuals (age: mean = 20.27 ± 18.9, range = 1 month to 80 years; sex: 43.9% female). Interviews were conducted in the homes of each of the families included in the study. Each adult or older child (roughly aged 10 and over) answered for themselves, while parents answered for younger children. The medical questionnaire quantified what symptoms household members had experienced over the last two weeks. This included questions on key symptoms used to medical diagnose gastrointestinal infections, respiratory tract infections as well as non-diagnosed symptoms of

general ill health (fever, tiredness, dizziness and lack of appetite). The questionnaire was designed in collaboration with doctors at the Palanan Hospital, following the most frequent symptoms presented by patients in the region and was conducted with a non-Agta qualified health care assistant (no Agta in Palanan have received medical training) and the completed questionnaire was then handed back to the local doctor for diagnosis. As part of this questionnaire, we also collected data on treatment rates of reported symptoms as well as vaccination rates.

Household wealth survey

Our interview included a quantification of the numbers of belongings owned or '*household wealth*' (italics indicate variable names used in analysis, fully detailed in Table 1). To create an 'emic' based list, we first sought to establish the most important items from a sub-sample ($n = 16$) of households. We asked each household to name 10 of the most important belongings an Agta could own. Based on this we created a list of 14 household items that were mentioned the most frequently. This list was then shown to each household, asking whether they had these items and if they did, how many they had. As some items were more important than others we weighted each item according to the number of times it appeared in the list. Further details can be found in the SI.

Daily activities survey

We conducted daily camp scans to record activity patterns based on spot observation techniques (Borgerhoff Mulder and Caro, 1985; Gibson and Mace, 2005). We categorized everyone's activity at the allocated time, and if they were out of camp their reported location and activity was recorded. To produce an unbiased time sample, the first scan time was

rotated daily and then three more scans were conducted every four hours from this starting point. From this data, we extracted how long individuals spent foraging (i.e. hunting, fishing and gathering) compared to cash labour and agricultural food production. Households who spent more than 75% of their time in hunter-gathering activities (the mean of the sample) were coded as '*high foragers*' (1 = more than 75% foraging, 0 = less than 75% of activities foraging). A binary variable was also created for households which had ever (during our fieldwork) participated in *cash labour*.

Individual mobility and camp characteristics

To capture individual mobility, we created a *settled* variable. Individuals were either allocated as 'mobile' or 'settled' depending on whether they were ever witnessed to move camp (for more than one night) at least once during our fieldwork. The degree of camp sedentarisation was captured by coding *camp type* and was on a three-point scale, 0 being the most temporary and includes camps with lean-to shelters, which frequently change in either location or position. Camps allocated to 2 on the scale were fully settled camps in which the houses were permanent (wooden huts with metal roofs) and unable to move. Camps with a mixture of these features were coded as 1. We also coded whether a camp's main *water supply* was from a stream (a source direct from the mountains with no settlements upstream), water pump or river, and whether a camp had a *church* present. For the medical treatment analysis, these last two (church and water pump presence) measures were combined to produce a measure of camp *infrastructure*. Finally, we also captured *distance to market town*, measured in kilometres using GPS data. Each of these variables captures a different measure of 'development'.

Statistical analysis

In order to test the effects of different measures of development on health outcomes and use of medical services we ran generalised logistic and linear mixed-effect models in R version 3.1.2 (R Core Team 2012). All models were ran with level 1 as the individual, level 2 as the household and level 3 as the camp. Theoretically informed variables based on the anthropological and epidemiological literature were entered into the models, shown in Table 1. From an epidemiological perspective, increased sedentarisation is associated with the spread of virulent bacterial and viral pathogens as well as soil-born helminths due to increased population sizes, presence of rodents and poor sanitation (Froment 2001; Barrett et al. 1998; Cockburn 1977). As many of the camp variables co-vary, the maximal model suffered from multicollinearity. Therefore, four models were produced, separating the four different camp measures: 1) water supply; 2) camp type; 3) church and; 4) distance from market town. Otherwise all models contained household level variables of high forager, settled, cash labour and household wealth, as well as appropriate individual (*age* and *sex*) and household level controls (*number of household dependents*). All models are reported in the SI; in the main text we present the 'best fit' model following AICc procedures (Table 2).

Results

Reflecting the results from blood and stool samples reported in Anonymous (2016), settled Agta living in permanent camps reported more occurrences of sickness. The reported frequencies of respiratory tract infections, gastro-intestinal infections and all non-specific causes of ill health were higher in settled camps than mobile ones. These same Agta, however, also experienced increased vaccination and medical treatment rates.

Reported Sickness

Of 415 men, women and children interviewed, 79.9% reported some form of sickness in the last few weeks. Most common was gastro-intestinal infections (including intestinal worm symptoms, diarrhoea, vomiting and bloating) as only 15% of individuals never reported an incidence in the last two weeks. Less common was respiratory tract infections, as 35% of individuals reported symptoms of cough, shortness of breath, wheezing and mucus and chest/back pain. The major predictors of sickness are demonstrated in Figure 1.

The best model for gastro-intestinal infections was the water supply model (Tables 2 and 3), revealing that compared to living by a mountain stream, individuals in a river camp are associated with an factor increase of 5.742 (OR = 5.742, $p < 0.001$) of reporting gastro-intestinal infections, while individuals in camps with a water pump experience a factor increase of 4.962 ($p = 0.003$). This model also revealed that settled individuals experienced an increase in gastro-intestinal infections (OR = 3.269, $p = 0.001$). The second-best model included distance to town, revealing that increased distance decreased the probability of gastro-intestinal infections (OR = 0.53, $p = 0.003$). The presence of a church in camp (OR = 0.505, $p = 0.237$), or the permanence of buildings (OR = 1.356, $p = 0.701$) was not significantly correlated with gastro-intestinal infections.

The results for respiratory tract infections represent a similar picture as the best fit model was the water supply model. Compared to camps with streams, the odds of reporting respiratory tract infections were increased by a factor of 3.002 ($p = 0.01$) in river camps and by a factor of 2.693 ($p = 0.03$) in camps with water pumps. However, increases in household wealth were significantly associated with odd reductions of respiratory tract infections (OR = 0.759, $p =$

0.034). Finally, for a one km increase in distance from market town, the odds of reporting a respiratory tract infection decreased by a factor of 0.71, ($p = 0.05$), however this is of marginal significance. No other variable significantly predicted respiratory tract infections (permanent camps: OR = 1.196, $p = 0.615$; church: OR = 0.553, $p = 0.071$).

When examining all other instances of sickness reported over the last two weeks the water supply model and individual mobility best explained the variance in sickness, accounting for 26.3% of the variance. Here, individuals in camps on the river (OR = 12.6, $p = 0.002$) and camps with water pumps (OR = 5.59, $p = 0.02$) experienced large increases in likelihood of reporting sickness, compared to camps with streams. Individuals never witnessed to move camp, also suffered from increased odds of sickness (OR = 4.071, $p = 0.01$). Church presence (OR = 0.0481, $p = 0.459$) or camp type (OR = 0.704, $p = 0.380$) had no significant relationship with reported sickness, demonstrating that overall camps with infrastructure did not experience any better outcomes than camps without infrastructure, while water pumps were *negatively* associated with health outcomes.

Engagement with medical services

Vaccination rates

Of the 311 individuals who knew whether they had ever received a vaccination, only 36.8% had received at least one vaccination in their life time. Of these 115 individuals, the majority received only one (SD = 1.42) vaccination, while the maximum number of reported vaccinations received was four. The strongest predictors of having vaccinations included household wealth, distance to town and age. Older individuals had significantly lower odds of having a vaccination (OR = 0.98, $p = 0.01$), indicating that vaccinations are more common among children and adolescents. Increasing household wealth was also associated with

increased vaccination odds (OR = 2.09, $p = 0.01$). However, increasing distance from the market town decreased the odds of receiving a vaccination by a factor of 0.865 per km. No other variable was significantly correlated with vaccinations (permanent camps: OR = 1.682, $p = 0.641$; infrastructure: OR = 3.556, $p = 0.559$).

Treatment uptake rates

From the 415 Agta we interviewed, 719 occurrences of sickness were reported over the last two weeks. Of these 719 incidences, only 45% were ever-sought treatment for, be it traditional or medical. Of these, 34% were treated at the Palanan station hospital. The remaining conditions were treated using traditional methods.

As revealed in Figure 2, each of the camp level variables positively predicted the proportion of cases of sickness individuals received treatment for. The overriding trend is that individuals living closer to market towns, participating in cash labour and residing in camps with infrastructure and permanent buildings demonstrated increased levels of participation in the medical system (Table 4). Cash labour is a major predictor of medical treatment across all models, and in the best fit model having ever engaged in cash labour resulted in a 0.26 increased ($p < 0.001$) in proportion of sickness treated. Household wealth was only significantly correlated with treatment in the distances model ($B = 0.12$, $p = 0.01$), suggesting that camp infrastructure ($B = 0.23$, $p = 0.03$) and/or camp permanence (permanent camps compared to temporary camps experience an 0.25 point increased in treatment, $p = 0.03$) are stronger predictors of treatment rate when considered simultaneously. Finally, camps furthest away from market towns had a significant lower uptake of medical treatment ($B = -0.03$, $p < 0.001$). Therefore, the most developed camps do treat a higher proportion of

instances of sickness, as frequently assumed by public health policy. However, crucially, these same individuals do not benefit from these increases as they suffer poorer health outcomes and ultimately, higher mortality rates (Anonymous 2016).

Discussion

Sedentarisation was associated with poorer health outcomes among the Agta, despite increased access to medical services and sanitation infrastructure. In fact, while individuals furthest away from town received less vaccinations and lower treatment rates, they still demonstrated lower levels of sickness. This is extremely concerning given that development interventions directed at the Agta from the colonial era up till the present have focused on the abandonment of a mobile lifestyle. A suite of different organisations have consistently thrown one message at the Agta: 'settle down and become (Christian) farmers' (Anonymous in press). To an important extent, this paradigm stems from the urge to control remote and mobile peoples and eradicate supposedly primitive and uncivilized lifeways (Figure 3). But it also, often simultaneously, strives to uplift the lives of deprived communities by providing basic services. Indeed, sedentarisation is widely assumed to benefit hunter-gatherers' health because permanent settlements allow for the construction of sanitary facilities such as toilets and water-pumps, and they are expected to be better connected to medical services (Cohen, 2005; Marchi, 2010). However, here we have demonstrated that this technocratic assumption is flawed. Furthermore, while the costs of sedentism appear somewhat offset by increased access to medical services, we argue that this offset has minimal positive outcomes, as settled individuals continue to experience worse outcomes.

A key question that underlies these observations thus is: why do settled Agta continue to experience worse health outcomes when settlement is associated with increased access to infrastructure and medical services? To answer this question, we will discuss the negative consequences of sedentism, and show how they are exacerbated by the lack of culturally relevant sanitation infrastructure, as well as strained intercultural relations between Agta and other ethnic groups. Using insights from long-term fieldwork with the Agta and their interactions with the wider socio-political systems, we will argue sedentarisation without culturally relevant services only further damages the most vulnerable in society.

Sedentarisation

We have previously shown that multiple markers of sedentarisation are associated with increased morbidity and mortality rates for the Agta in Palanan (Anonymous 2016). These findings are re-affirmed above, as markers of sedentism are positively correlated with different measures of sickness. Such trends are well predicted by epidemiological theory. Mobile groups, living at low population densities, are protected from acute, epidemic disease organisms which are impossible to maintain in small isolates (Cockburn, 1977; Froment, 2008). However, sedentism leads to increased population density, presence of rodents attracted to waste, contamination of water sources and faecal pollution (Barrett et al., 1998; Cockburn, 1977; Froment, 2014). Each of these trends are associated with the spread of virulent bacterial and viral pathogens as well as soil-borne helminths (Bethony et al., 2006; Hurtado et al., 2008). Similar associations between sedentarisation and deterioration of health has been observed also amongst the Punan hunter-gatherers in Borneo (Dounias, et al. 2007). Ultimately, the combination of these acute and chronic pathogenic burdens significantly decreases quality of life and life expectancy.

Certainly, mobile foragers demonstrate many behaviours which can be considered disease transmission risks. For instance, defecation commonly occurs in and around the camp, rubbish and waste are left to accumulate and animal carcasses are left hanging in shelters. However, crucially *mobile* foragers can simply pack up their few belongings and leave when an area becomes too filthy or infested. Individuals often reported bad smells as a reason to move; however, with sedentarisation this is no longer an option. As households remain all year round and camps increase in size as new families arrive, the issue of poor sanitation, food storage and waste accumulation becomes critical.

Consequently, from an epidemiological perspective, sedentism is not necessarily the pathway to increased health and wellbeing. Of course, many would argue that sedentarised camps must be provided with sanitation infrastructure and clean water sources to eliminate this increased disease burden. However, these findings reveal, contra prevailing development policy and practice, that markers of infrastructure are associated with worse rather than better health outcomes. This is due to a lack of cultural relevance of the health infrastructure, as well as its poor installation and maintenance as policy interventions force hunter-gatherers into a wholly different lifestyle without consideration to their goals and beliefs.

Cultural relevance of health infrastructure

Most Agta obtain their drinking water from rivers, streams or springs. Under circumstances of low population densities and little upstream human activity, this is not necessarily problematic. However, due to increased logging and mining operations immigration into the NSMNP has ballooned since the 1950s and these water sources have, in many places, become

undrinkable. Our results demonstrate this relationship well. Individuals' drinking from rivers, which are heavily used by others, suffer from increased instances of sickness, compared to individuals drinking from mountain streams, where there are few others living further upstream.

This problem has been noted by both government and non-government organisations. Probably the most extensive water and sanitation programme directed at the Agta was implemented by Plan International-Philippines in the 1990s and early 2000s, when water pumps and toilets were brought to Agta settlements, especially in the coastal areas of Palanan and Divilacan (Anonymous 2010). Despite the best intentions underlying such costly and logistically complicated interventions, our results show that camps with water pumps do not experience a reduction in reported sickness levels. One explanation for this finding lies in the lack of both a practical and cultural basis of the intervention. Some of the infrastructure was incompletely installed and the recipients were neither trained nor motivated to maintain it. As a result, by the early 2000s, most pumps and toilets had become dysfunctional and many settlements in which they were present had been abandoned (Anonymous, 2010). Furthermore, in some settlements that continue to have a functional water pump, not everyone wishes to use it. Some informants have explained this deliberate choice as a result of stomach problems that they encountered after drinking water from the pump, which may again point to inferior quality and/or poor maintenance of the infrastructure. Others give more culturally laden explanations, saying that they prefer to drink water from creeks and streams as it tastes 'alive', as opposed to the 'boring' water from a pump well. This last type of reflection is crucial in understanding why water pumps may not offer a culturally acceptable alternative to existing water use practices. Our research group for instance, has

fixed pumps, left replacement parts, as well as trained individuals to fix the pump. Returning to the same camp months later, we found the pump broken. When asked why they have not fixed the pump, Agta reply that 'each family would prefer to go and collect their own water from rivers'. This explanation highlights that Agta culture is based on the freedom of movement and independence of families. Consequently, public buildings are not perceived as a common public good, to be maintained by the community.

Individuals in camps with water pumps experienced an increased likelihood of reported sickness, but it must be emphasised that this is not a causal analysis. The causal factor may well be a correlate of water pumps, such as increased camp size and permanence resulting in increased disease transmission. However, what these findings do reveal is that due to the lack of maintenance and use of the water pumps they do not have enough of a protective effect to override the negative consequences of sedentarisation. Therefore, settlement without a functional and culturally applicable health infrastructure is extremely problematic, exposing residents to an increased risk of ill-health without any protective measures. Given these findings, a solution which brings the supposed benefits of sedentarisation (primarily access to health care) without the negative health outcomes associated with permanent camps is far more preferable. As has been pointed out by Coffey et al. (2017) the social and cultural context is crucial when trying to understand and bring about change in sanitation behaviour. Solutions which *work with* the Agta's mobile lifestyle, rather than destroy it should be sought.

Intercultural relations

Our results have demonstrated that the use of medical care is positively predicted by living in more settled camps closer to market towns, and having increased wealth and market integration. These results are not surprising, as households with more money are more likely

to purchase medicines, needles and other medical equipment required for treatment. Furthermore, more settled camps, closer to the market town are better integrated with other ethnic groups. Therefore, Agta living in settled camps may be more aware of what help is available to them and be willing to use these services. Nonetheless, those Agta living in more settled camps closer to market towns continued to demonstrate higher morbidity. Thus, this increased access was not producing a protective effect. We argue that this is due to two interwoven factors: firstly, the Agta face continual discrimination from wider society; and secondly, there are significant cultural differences between the Agta and other, more dominant ethnic groups. Both factors obstruct the Agta from seeking medical attention, and when they do, the quality and efficacy of the service is significantly reduced.

While amiable economic and social relationships certainly do exist between Agta and others (Anonymous 2009), their position in society is best characterized as outcasts, whom the majority regards with disdain and prejudice. The Agta's mobile, foraging lifestyle and the fact that many have not converted to Christianity are far removed from mainstream Filipino values. This lack of intercultural understanding and respect is also apparent in the context of health care provisioning. As is the case for indigenous peoples worldwide (Valeggia and Snodgrass, 2015), the common perception of Agta as backward, dirty, lazy and incapable resonates in how medical personnel treat them and leaves little room for constructive and genuine communication. The impact of such prejudice and hostility is clear from the expression by some Agta informants that they 'cannot breathe in the *barrio* [village of non-Agta]'. Many Agta are fearful to seek medical assistance and rarely understand others' obligations to them in terms of providing treatment and advice. In Palanan Town, it is common to see Agta lingering outside of the station hospital, seemingly unsure about how to

proceed. This hesitation stems to a large extent from negative experiences with medical personnel: Agta commonly report having been 'treated like a child', ignored or given poor medical assistance and information. Particularly telling, is how nursing personnel repeatedly urged an anthropologist, within earshot of the family, to adopt a critically sick Agta infant whom she accompanied to the hospital, 'as it would otherwise have no future'. In the same case, the infant's mother was publicly and loudly summoned to go wash herself (Pers. Comm. Hagen October 2016). In another case, a nurse explained to the authors how they had to treat the Agta well, even though "[...] they [are] not people". Thus, pervasive prejudice and paternalism results in yet another barrier to seek medical help, on top of the already large hurdles of distance and cost.

During two workshops we organized in 2005 and 2014, representatives from Agta communities and government offices, including the Department of Health, were brought together in order to facilitate a conversation on an equal footing (Anonymous 2005). While the workshops were positively experienced by both Agta and government participants, they also lay bare the ideological stance of officials, resulting in a standoff where government officials' message echoed the mantra of sedentarisation as the only way forward. In the 2014 workshop, health workers' and officials' negative views about the Agta and the causes of their ill health were far from reality. Not only were the Agta understood to be ill because they were lazy and unclean, their health was said to be bad because they had no permanent address. In fact, as we have demonstrated here, the reverse is true.

Cultural Competency

Biomedicine stems from a western, and scientifically driven framework which venerates rationality, objectivity and empirical testing. This, however is just one conceptual model by which individuals understand and impose meaning on sickness (Eisenberg, 1976). Patients' and doctors' conceptual models of illness frequently differ, leading to conflict and a need for negotiation to produce positive clinical outcomes (Stimson and Webb, 1975). This is true within western societies, but even more so in culturally diverse contexts such as the Philippines. Failure to bridge these gaps, increasing cultural competency of medical staff and reaching a point of mutually understanding is highly problematic, resulting in increasing health inequality (Betancourt, 2006), as we see with the Agta.

Agta explain many of their health problems in spiritual rather than biophysical terms, resulting in an issue of motivation to access medical services and communication issues once these services have been accessed. Many common diseases, including gastro-intestinal infections, are thought to be caused either by a curse inflicted by a malevolent person, or by one of several classes of spirit. For instance, spirits of deceased relatives are believed to cause sickness and even death because they feel lonely and long to be reunited with close relatives. Avoiding this requires the abandonment or even the burning down of a settlement after the death of a relative, thus accounting for a lot of mobility. Depending on the situation, the move may be as far as across the mountain range, or as close as just across the river. Also, breaking certain taboos related to natural resource use, notably refraining from providing an offering to guardian spirits of prey animals, is believed to cause sickness in hunters. Likewise, many sicknesses in young children are considered the work of malevolent forest and seaside spirits, which results in various protective measures being taken during pregnancy, childbirth and throughout the nursing period. For instance, malevolent spirits are believed to be felt in the

form of a cold wind, thus the cold must be constantly avoided by a fire under the floor on which the mother delivers her child.

These perceived causes of illness have direct consequences for what Agta consider appropriate medical care. The need to keep a fire burning while giving birth, is among the most important reasons for many women to strongly prefer a home delivery over giving birth in a clinic. Likewise, in the many cases where sickness is suspected to be spirit-induced, biomedical treatment is considered useless. Thus, when Agta feel sick, they will usually resort to the use medicinal plants and services performed by traditional healers (Anonymous 2010: 153). Healers include spirit mediums (*bunogen*) (Headland 1987) have the capacity to neutralize strained relationships with spirits (usually through a ritual performance), and may drive out harmful spirits from the body of the sick by getting into a state of trance (Anonymous 2010: 80-82).

The inefficacy of regular medical care within Agta society, is partially attributable to these differing explanations for health and sickness. Matters are however further complicated by the fact that the Agta's beliefs and rituals remain mostly hidden. While the belief in ancestor spirits and other supernatural creatures is strong, centuries of systematic and often violent disapproval of the Agta's belief system by colonizing forces has instilled a wariness in the Agta to openly discuss it with outsiders. Yet, without an understanding or consideration of the Agta's conceptual models of sickness, they will remain disadvantaged by the current medical system. Of course, convincing the Agta to seek out medical assistance is important, but pressuring the Agta to conform to the biomedical paradigm, is not sufficient. Awareness of and respect for their worldview and using this to create an explanatory model of illness that

they can understand and associate with will go a long way to establish trust and understanding between the Agta and medical professionals (Kleinman, 1981), increasing their use of medical services and the efficacy of these services once accessed.

Policy suggestions

Health services driven by uninformed and prejudiced standpoints will not benefit the Agta, now or in the future. At both empowerment workshops, the Agta participants requested to be respected for who they are, revealing that development measures should be negotiated within the Agta's existing lifestyle, rather than overthrowing it completely. Thus, essentially they asked for the replacement of a centralized, top-down, one fits all model of development, by a bottom-up, inclusive model that allows for cultural diversity and endogenous definitions of 'progress'. Here, we make five policy suggestions that could help facilitate this paradigm shift. The first two interventions are directed at the local level and could generate results in the short to medium term; the last three interventions are directed at the supra-local level and their impact can be expected in the medium to long term.

1. Training programme for Agta Rural Health Workers

Currently there is no link between Agta communities and the regular medical system. We suggest that by training some Agta individuals with basic medicine and health practices they can become mediators and cultural interlocutors. This could reduce the feeling of apprehension towards medical treatment and it could play a major role in monitoring recovery and proper use of medication at home. Respect for indigenous health practices must be at the heart of this programme as should modules on indigenous rights. Similar policies have been suggested by Chino & DeBruyn, (2006), demonstrating that the participation of

indigenous peoples in their community health care has successfully increased access in North American populations.

2. Sensitivity training and awareness of alternative lifestyles for health workers

We suggest that medical doctors and nursing staff working in relative proximity to Agta settlements undergo an intercultural awareness and sensitivity training. This training should result in participants' a) constructive reflection on how existing negative perceptions affect medical care; b) improved understanding of the Agta's economic and cultural organization, including their belief system, and how this relates to their settlement patterns; c) practical understanding of the impacts of sedentarisation on Agta health outcomes; and d) the identification of local solutions. Similar concerns and policy suggestions were raised by Ohenjo and colleagues (2006), who found that an absence of sensitivity among health workers, and a lack of land demarcation for hunter-gatherers (see below), were the main causes of disease among African Pygmies and the Kung! San.

3. Curriculum development medical schools

To ensure more broad and long-term integration of the principles of intercultural understanding and respect in the medical system, they will need to become an integral part of the curriculum at medical schools. Cultural prejudice, which affects indigenous peoples throughout and beyond the Philippines, is partly produced and reproduced in the educational system. We therefore suggest the design of an inclusive medical curriculum that fosters respect for cultural diversity and provides training in intercultural communication.

4. Evidence-based development policy which does not necessitate the settlement of mobile peoples

Effecting a paradigm shift will require moving beyond the medical domain and into the wider realm of development policy and practice. We suggest training, lobby and dialogue at all government departments with a development mandate is needed to design an evidence-based policy for development, instead of following a linear Western development model. Our work highlights the need for solutions which fit within the Agta's mobile lifestyle, rather than replace it. For instance, the organisation of trained medical professionals to regularly visit Agta camps to provide health assessments and assistance would go a long way to avoid unnecessarily suffering.

5. Awarding of collective title deed to the Agta's ancestral land

Mobility is an important characteristic of the hunter-gatherer lifestyle, allowing to access dispersed resources over a large territory regardless of local shortfalls or overexploitation (Kelly, 2013). However, we have demonstrated that not only is mobility an integral part of the hunter-gatherer lifeway, but it is associated with positive health outcomes. The Agta consider vast areas of the NSMNP and beyond as 'Agta land'. For our informants, mobility and freedom of access throughout this land based on collective rather than individual land ownership is a crucial part of 'being Agta'. While this runs contra to western legal notions which are based on settlement and individual property (Bryan, 2000; Layton, 1983), collective land rights are recognized under Philippine law. Since 1997 indigenous communities may apply for collective title deeds (Certificate of Ancestral Domain Titles) to vast land areas under the Indigenous Peoples' Rights Act (Anonymous 2016). While numerous such title deeds have been awarded to other groups, the application process for the Agta of the NSMNP has been pending for 20 years, mainly for political reasons (Anonymous, in press). It is, however, essential that the Agta obtain the title deed as soon as possible. Not only will it give them far more legal security

and, it will support their right to self-determination by giving them complete freedom to reside in their ancestral lands without being forced to settle within constrained localities.

Concluding remarks

Development practitioners' emphasis on sedentarisation poses a threat to Agta health. Our results show that health outcomes in settled Agta camps were worse than those in more mobile camps. This is even though these settled camps had increased access to health infrastructure and were situated in closer proximity to medical services. The poor quality of sanitation infrastructure, the lack of proper training, maintenance and cultural acceptance explain the overwhelming failure of efforts to make Agta use toilets and water pumps. Settled Agta's limited use of medical services is partly explained by lack of cultural acceptance too. More than anything else, however, prevailing prejudice held against the Agta by mainstream Filipino society, and by extension by medical personnel, accounts for poorer health outcomes. Thus, even if the Agta are better able to negotiate the medical system, its effectiveness is equally reliant on health workers' social acceptance of the Agta and their lifestyle.

Given the deeply-rooted perception that a settled life is a prerequisite for a healthy life, as anthropologists we have an important role in carefully communicating the counter-evidence to all who are involved in the design and provisioning of health care (Valeggia and Snodgrass 2015). Only when intercultural understanding and communication improves can creative and culturally sensitive health solutions be designed. Here, we have suggested that such solutions must include both short-term and long-term interventions. Ultimately, we need a shift away from the current development paradigm which dictates that progress demands

sedentarisation, to evidence-based health policy that builds on existing lifeways to pave the way for healthy hunter-gatherers.

References

- Baer, H. A., Singer, M., & Johnsen, J. H. (1986). Toward a critical medical anthropology. *Social Science & Medicine*, 23(2), 95-98.
- Barrett, R., Kuzawa, C.W., McDade, T., Armelagos, G.J., 1998. Emerging and re-emerging infectious diseases: The Third Epidemiologic Transition. *Annu. Rev. Anthropol.*
- Betancourt, J., 2006. Improving quality and achieving equity: the role of cultural competence in reducing racial and ethnic disparities in health care. The Commonwealth Fund, October 2006
- Bethony, J., Brooker, S., Albonico, M., Geiger, S.M., Loukas, A., Diemert, D., Hotez, P.J., 2006. Soil-transmitted helminth infections. *Lancet* 367, 1521–1532.
- Borgerhoff Mulder, M., Caro, T.M., 1985. The use of quantitative observational techniques in anthropology. *Curr. Anthropol.* 26, 323–335.
- Bryan, B., 2000. Property as Ontology: On Aboriginal and English Understandings of Ownership. *Can. J. Law Jurisprud.* 13, 3–33.
- Chino, M., & DeBruyn, L., 2006. Building true capacity: Indigenous models for indigenous communities. *American Journal of Public Health*, 96, 596-599.
- Cockburn, T.A., 1977. Infectious Diseases in Ancient Populations, in: Landy, D. (Ed.), *Culture, Disease and Healing. Studies in Medical Anthropology.* Macmillan Publishing, New York, pp. 83–96.
- Coffey, D., Spears, D., & Vyas, S. (2017). Switching to sanitation: Understanding latrine adoption in a representative panel of rural Indian households. *Social Science & Medicine*, 188, 41-50.
- Cohen, D., 2005. Providing nomadic people with health care. *BMJ Br. Med. J.* 331, 720.
- Dounias, E., Selzner, A., Koizumi, M., & Levang, P., 2007 From sago to rice, from forest to town. The consequences of sedentarization on the nutritional ecology of Punan former hunter-gatherers of Borneo. *Food and Nutrition Bulletin*, 28, S294-S302

- Early, J.D., Headland, T.N., 1998. Population Dynamics of a Philippine Rain Forest People: The San Ildefonso Agta. University Press of Florida, Gainesville.
- Eisenberg, L., 1976. Delineation of clinical conditions: conceptual models of “physical” and “mental” disorders, in: Black, D. (Ed.), *Research and Medical Practice: Their Interaction*. Elsevier, Oxford, pp. 3–24.
- Froment, A., 2014. Human Biology and Health of African Rainforest Inhabitants., in: Hewlett, B.S. (Ed.), *Hunter-Gatherers of the Congo Basin: Cultures, Histories and Biology of African Pygmies*. Transaction Publishers, London, pp. 117–164.
- Froment, A., 2008. Biodiversity, environment and health among rainforest-dwellers: an evolutionary perspective., in: Colfer, C.J.. P. (Ed.), *Human Health and Forests: A Global Overview of Issues, Practice and Policy*. Earthscan, London, pp. 259–274.
- Froment, A., 2001. Evolutionary biology and health of hunter-gatherer populations, in: Panter-Brick, C., Layton, R.H., Rowley-Conwy, P. (Eds.), *Hunter-Gatherers: An Interdisciplinary Perspective*. Cambridge University Press, Cambridge, pp. 239–267.
- Gibson, M.A., Mace, R., 2005. Helpful grandmothers in rural Ethiopia: A study of the effect of kin on child survival and growth. *Evol. Hum. Behav.* 26, 469–482.
- Headland, T.N. 1987 ‘Kinship and social behavior among Agta Negrito hunter-gatherers’, *Ethnology* 26:261-280.
- Headland, T.N., 2003. Thirty endangered languages in the Philippines, *Work Papers of the Summer Institute of Linguistics, University of North Dakota Session*, 47, 1-12 SIL International.
- Hurtado, a. M., Frey, M.A., Hurtado, I., Hill, K.R., Baker, J., 2008. The role of helminthes in human evolution, in: Elton, S., O’Higgins, P. (Eds.), *Medicine and Evolution: Current Applications, Future Prospects*. CRC Press, London, pp. 153–180.
- Hurtado, A. M., Lambourne, C. a., James, P., Hill, K., Cheman, K., Baca, K., 2005. Human Rights, Biomedical Science, and Infectious Diseases Among South American Indigenous Groups. *Annu. Rev. Anthropol.* 34, 639–665.
- Kelly, R.L., 2013. *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*, second. ed. Cambridge University Press, Cambridge.
- Kleinman, A., 1981. *Patients and healers in the context of culture: a exploration of the borderland between Anthropology, Medicine and Psychiatry*. University of California Press, London.

- Layton, R., 1983. Pitjantjatjara Processes and the Structure of the Land Rights Act, in: Peterson, N., Langton, M. (Eds.), *Aborigines, Land and Land Rights*. Humanities Press, Canberra, pp. 226–337.
- Marmot, M. (2005). Social determinants of health inequalities. *The Lancet*, 365(9464), 1099-1104.
- Marchi, P., 2010. The Right to Health of Nomadic Groups. *Nomad. People*. 14, 31–50.
- Anonymous (2010) Details omitted for double-blind review
- Anonymous (2014) Details omitted for double-blind review
- Anonymous (in press) Details omitted for double-blind review
- Mitchell, J. (2007) 'History' in Bronwyn et al. (eds.) *Social determinants of indigenous health* pp.41-64 Crows Nest: Allen & Unwin.
- Ohenjo, Nyang'ori, et al. (2006)"Health of Indigenous people in Africa." *The Lancet* 367.9526: 1937-1946.
- Anonymous (2016) Details omitted for double-blind review
- Paradies, Y. (2007) 'Racism' in Bronwyn et al. (eds.) *Social determinants of indigenous health* pp.65-86 Crows Nest: Allen & Unwin.
- Persoon, G.A., Weerd, M., 2006. Biodiversity and natural resource management in insular Southeast Asia. *Isl. Stud. J.* 1, 82–108.
- Pfeiffer, J., & Nichter, M. (2008). What can critical medical anthropology contribute to global health?. *Medical Anthropology Quarterly*, 22(4), 410-415.
- Anonymous (2016) Details omitted for double-blind review
- Pringle, H., 2015. In Peril. *Science*. 345, 392–395.
- Stimson, G. V, Webb, B., 1975. *Going to see the doctor: consultation process in general practice*. Routledge and Kegan Paul, London.
- Team, R.C., 2012. *R: A language and environment for statistical computing*.
- Valeggia, C.R., Snodgrass, J.J., 2015. Health of Indigenous Peoples. *Annu. Rev. Anthropol.* 44, 117–135
- Walker, B., 2013. *State of the World's Minorities and Indigenous Peoples 2013*. Minority Rights Group International, London.
- Walker, R.S., Hill, K.R., 2015. Protecting isolated tribes. *Science*, 348, 50.

1 **Figure captions**

2
3 **Figure 1:** Odds ratios for different measures of sedentism and acculturalisation separated by
4 A) gastro-intestinal infections; B) respiratory tract infections and; C) all other forms of sickness
5 including fever, tiredness and dizziness. Lines represent 95% confidence intervals and points
6 the odds ratios. Odds above 1 (the grey line) represent an increase risk associated with the
7 measure of transition. Lines spanning 1 are not statistically significant. Six models were run:
8 a control model (1: age, sex and number of household dependents); a family model (2: high
9 forager, settlement and household wealth); a camp type model (3: the reference category of
10 temporary camp); water source model (4: reference category of stream); church model (5);
11 and distance to town model (6), $n = 354$ (gastrointestinal infections), $n = 354$ (respiratory tract
12 infections) and $n = 352$ (general sickness). Colour figure.

13
14 **Figure 2:** Average proportion of cases of sickness reported to have received biomedical
15 treatment separated by measures of acculturation and sedentism. For all panels bar 'camp
16 type' green bars represent the negative condition (i.e. no cash labour, far from town, mobile
17 households) while the grey bars represent the positive condition (i.e. high wealth,
18 infrastructure present in camp, never witnessed to move camp). Camp type has three
19 conditions and the green bar represents temporary camps, the grey bar semi-permanent
20 camps and the orange bar permanent camps. Measures of household wealth and distance to
21 town were transformed into binary variables for plotting by separating the data at the mean.
22 Households with wealth above the mean (2) were coded as 'high wealth' while camps below
23 the mean (18.5km) were coded as 'close to town'. Error bars represent standard error of the
24 mean, $n = 182$. Colour figure.

25
26 **Figure 3:** The evolution of the Filipino home. Courtesy of Dionece Printing and Marketing. A
27 demonstration of common Filipino approach to 'primitive' lifestyles as being the first stages
28 of evolution. Colour figure.

29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47 **Tables**

48
49
50

Table 1: Description of sedentarisation variables

Variable name	Measurement	Scale
High foragers	Proportion of activities a household spent in foraging versus cash labour and cultivation	1 = more than 75% activities spent foraging 0 = less than 75% of activities spent foraging
Cash labour	Whether a household had ever participated in cash labour	1 = participate in cash labour at least one 0 = no cash labour
Settled	Whether individuals were either witnessed to move camp at least once during fieldwork	1 = witnessed to move camp at least once 0 = never witness to move camp
Camp type	Captures different degrees of camp sedentarisation	2 = permanent camps 1 = semi-permanent camps 0 = temporary camps
Water supply	Captures the different main water supplies in camps	2 = river 1 = water pump 0 = stream
Church	Captures whether a church was present or not in camp	1 = church present 0 = church not present
Infrastructure	Combination of water supply and church to create a variable which captures general infrastructure in a camp	1 = camps with either water pumps or churches 0 = camps with neither water pumps or churches
Distance to market town	Measured in kilometres using GPS data	Range 2.7 – 28.9km (higher value representing further from the market town)
Household wealth	An emic based index which transforms household objects into a continuous scale	Range 0.52 – 2.95 (higher value representing more wealth)

51
52
53
54
55
56
57
58
59

60 **Table 2: AICc scores for each of the models.** The lower the AICc, the better the model fit to
 61 the data. Full model outputs are reported in the SI. Medical treatment rates are reported in
 62 Table 4.

63

Dependent variable	Model	AICc
Gastro-intestinal disease	Controls only (sex and age)	338.100
	Camp type	289.121
	Water supply	281.018
	Church	286.436
	Distance to market town	281.387
Respiratory tract infections	Controls only (sex and age)	555.600
	Camp type	494.751
	Water supply	491.834
	Church	493.687
	Distance to market town	493.214
General sickness	Controls only (sex and age)	370.000
	Camp type	305.274
	Water supply	299.474
	Church	303.551
	Distance to market town	302.691
Vaccination rates	Controls only (sex and age)	390.200
	Camp type	384.900
	Infrastructure model	374.632
	Distance to market town	385.548

64
 65
 66
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80
 81
 82
 83
 84
 85

86 **Table 3: Best fit models for gastrointestinal infections and respiratory tract infections.** OR
 87 represent odds ratios: above 1 represents an increased probability of an event, below 1 a
 88 decrease in probability. OR with 95% confidence intervals (CI) spanning 1 are not statistically
 89 significant, $n = 354$.
 90

	Gastrointestinal infections Water Supply Model				Respiratory tract infections Water Supply Model			
	OR	Lower CI	Upper CI	<i>p</i>	OR	Lower CI	Upper CI	<i>p</i>
Intercept	0.691	0.156	3.056	0.626	0.335	0.098	1.143	0.081
Sex (ref male)	1.402	0.733	2.680	0.307	0.992	0.630	1.564	0.974
Age	0.978	0.963	0.993	0.004	1.010	0.997	1.023	0.121
Dependents	1.013	0.866	1.185	0.868	1.074	0.940	1.227	0.293
House wealth	1.079	0.800	1.455	0.620	0.744	0.576	0.962	0.024
High forager (ref No)	2.163	0.946	4.948	0.068	1.574	0.831	2.983	0.164
Settled (ref No)	3.269	1.582	6.753	0.001	1.302	0.714	2.374	0.389
Water supply			-				-	
Stream	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>
Pump	4.962	1.738	14.166	0.003	2.693	1.129	6.425	0.026
River	5.742	2.213	14.899	0.000	3.002	1.312	6.869	0.009
% explained	0.185				0.091			

91
 92
 93
 94
 95
 96
 97
 98
 99
 100
 101
 102
 103
 104
 105
 106
 107
 108
 109
 110
 111
 112
 113

114
 115
 116
 117
 118

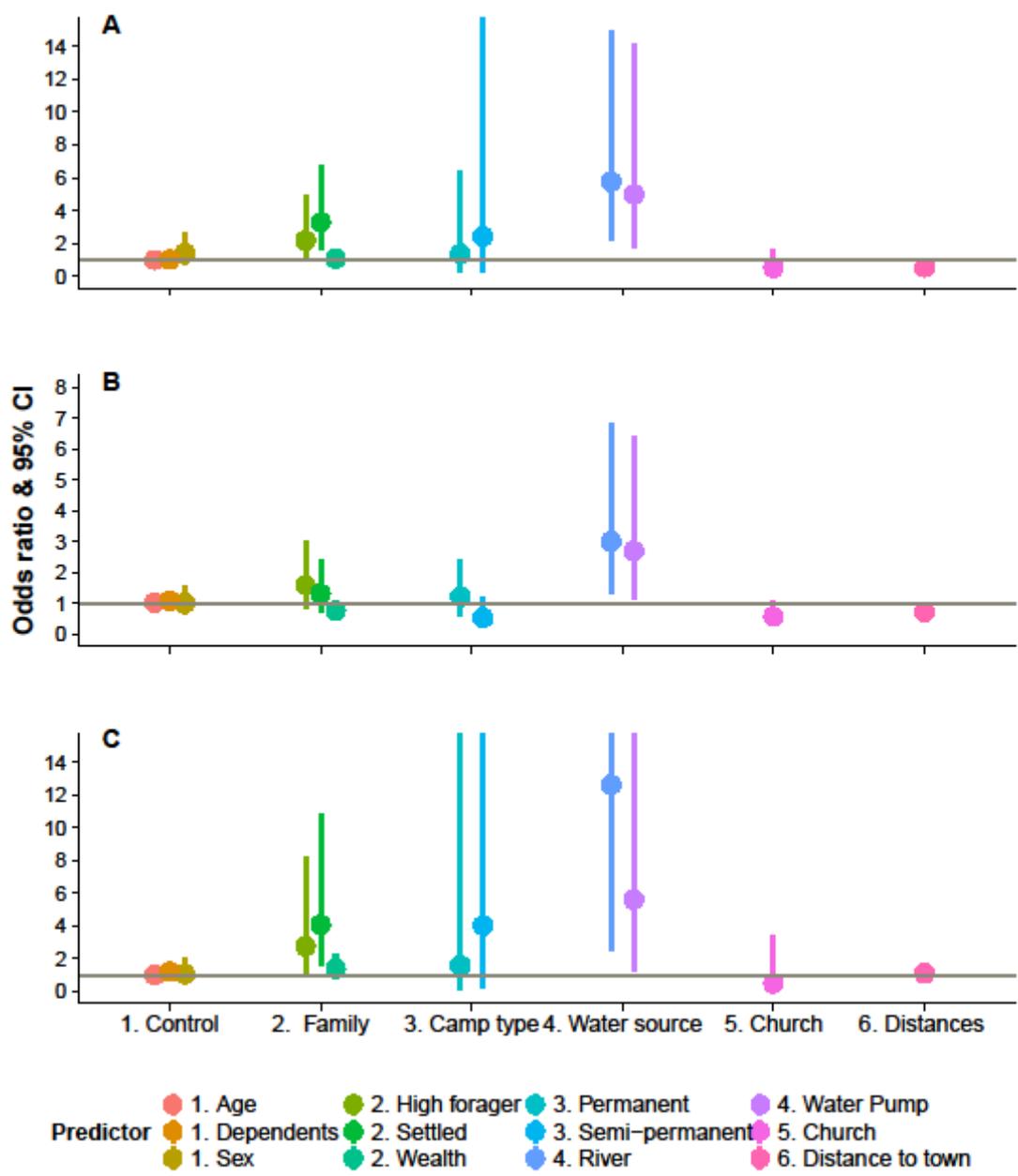
Table 4: All linear models for predicting proportion of instances of sickness treated medically. Percent of variance reduced reveals the reduction in unexplained variance in the model compared to a model with no fixed effect predictors, $n = 182$.

	Infrastructure model				Distance to town				Camp type model			
	B	CI	CI	p	B	CI	CI	p	B	CI	CI	p
		-							-	-		
Intercept	0.6	0.3	0.1	0.4	0.5	0.0	1.0	0.0	0.1	0.5	0.1	0.2
	9	9	7	5	7	9	5	2	9	3	6	8
Sex (ref male)	1.4	0.0	0.0	0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.7
	0	0	0	4	0	0	0	2	0	0	0	2
		-				-				-		
Age	0.9	0.1	0.0	0.5	0.0	0.1	0.0	0.7	0.0	0.1	0.0	0.5
	8	4	8	8	2	2	8	1	3	4	7	4
		-				-				-		
Dependents	1.0	0.0	0.0	0.8	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.8
	1	4	4	3	1	5	3	7	0	4	5	2
		-				-				-		
House wealth	0.0	0.0	0.1	0.2	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.2
	5	4	4	4	2	2	1	1	5	5	4	9
Cash labour (ref No)	0.2	0.0	0.4	0.0	0.2	0.0	0.4	0.0	0.2	0.1	0.4	0.0
	6	9	4	0	3	7	0	0	7	0	5	0
		-				-				-		
Settled (ref No)	0.0	0.1	0.2	0.6	0.0	0.1	0.2	0.7	0.1	0.0	0.3	0.2
	5	5	6	2	3	7	3	7	3	7	2	1
Infrastructure (ref No)	0.2	0.0	0.4	0.0	-	-	-	-	-	-	-	-
	3	2	3	3								
		-				-				-		
Distance to town	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-
					3	5	1	0				
Temporary camp	-	-	-	-	-	-	-	-	<i>ref</i>	<i>ref</i>	<i>ref</i>	<i>ref</i>
										-		
Semi-permanent	-	-	-	-	-	-	-	-	0.1	0.0	0.4	0.1
									8	7	3	5
Permanent	-	-	-	-	-	-	-	-	0.2	0.0	0.4	0.0
									5	2	8	3
% variance reduced												
			0.08				0.10				0.08	
AICc			203.861				205.167				213.761	

119
 120
 121
 122
 123
 124
 125

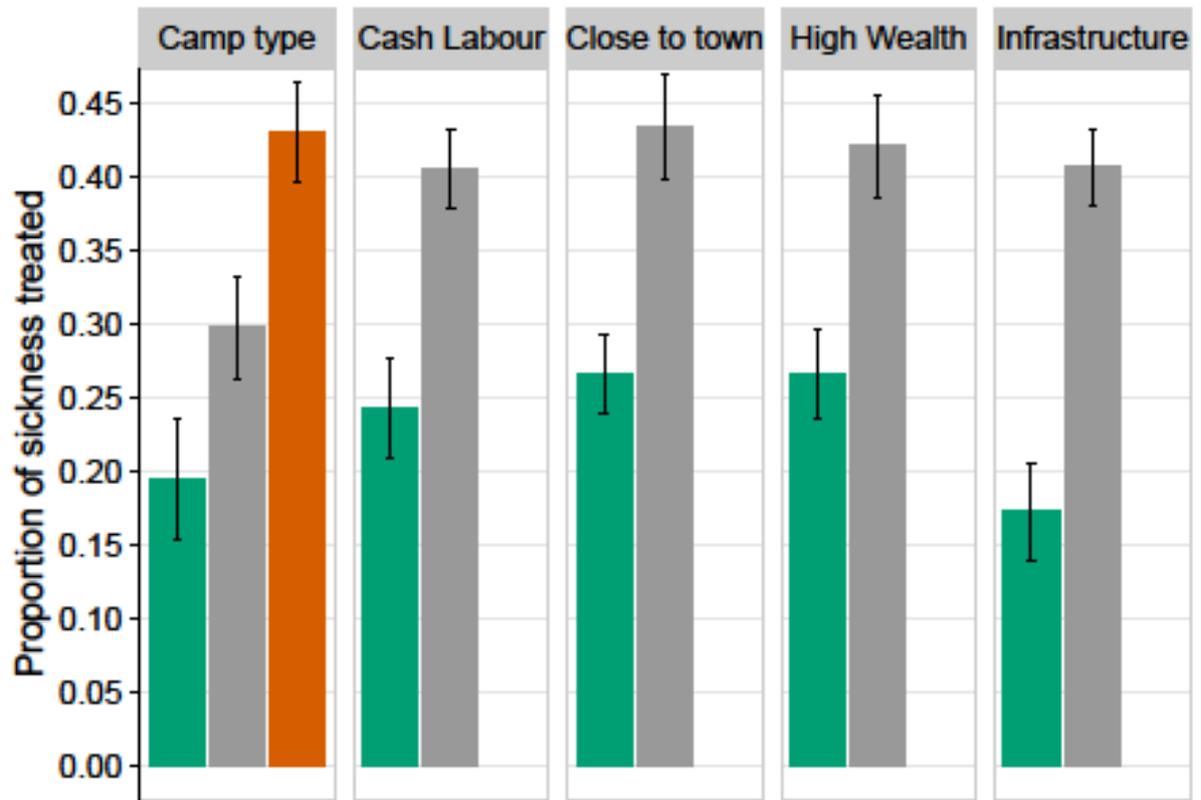
126
127
128
129

Figures



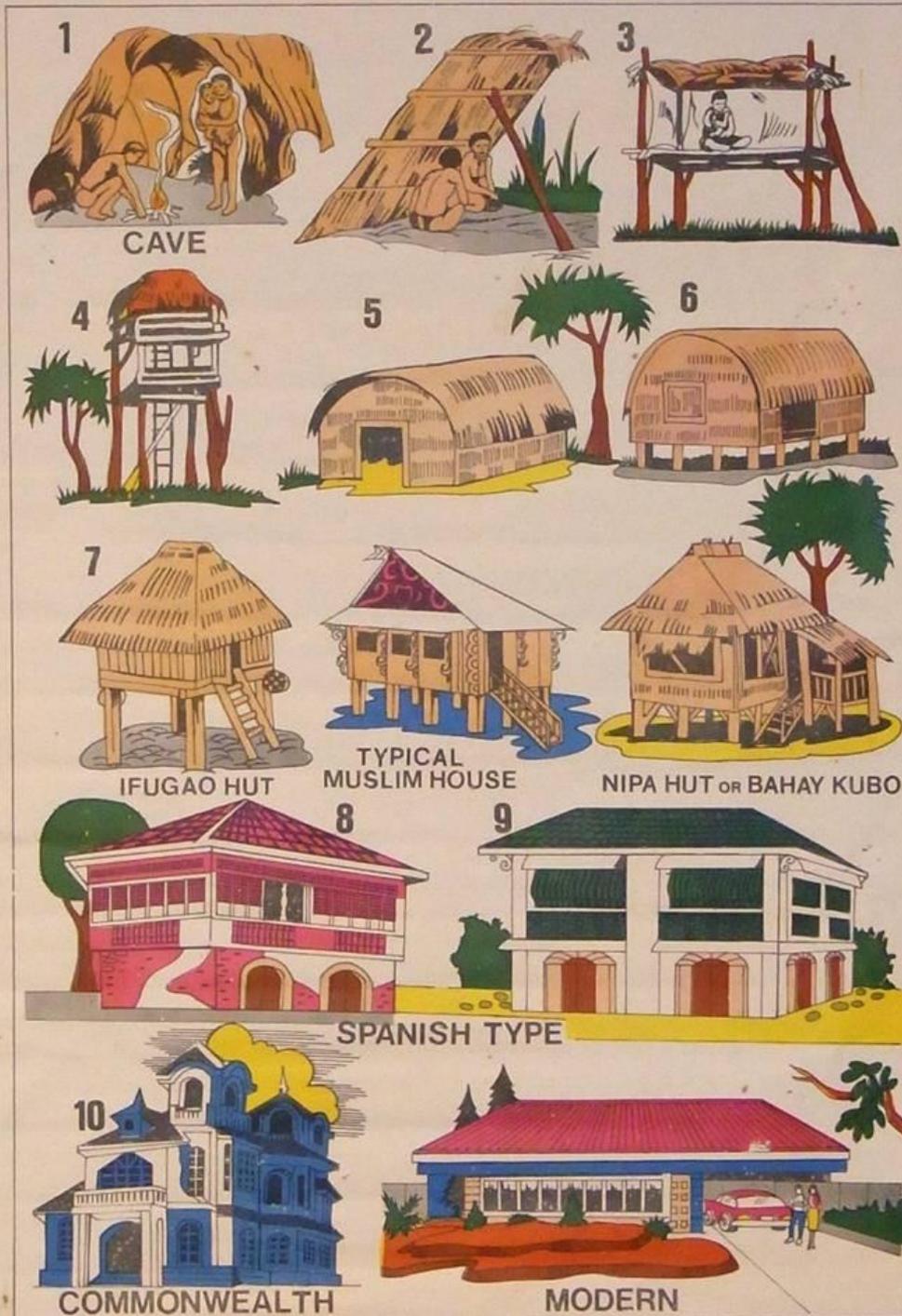
130
131
132
133
134

Figure 1



135
 136 **Figure 2**
 137
 138
 139
 140
 141
 142
 143
 144
 145
 146
 147
 148
 149
 150

EVOLUTION OF THE FILIPINO HOME



Copyright, 1994 by
DIONISCE PRINTING & MARKETING

PREPARED BY Leo Concepcion
ILLUSTRATED BY Boy Madriguera

151
152
153

Figure 3