

# The Income-Inequality Hypothesis among Tsimane' adults in lowland Bolivia

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## **Abstract**

A significant body of literature reports an adverse relationship between income inequalities and health in industrialized populations. To explain this negative association, researchers have proposed different mechanisms. The first mechanism is that income inequalities create a negative emotional environment for both the rich and the poor which subsequently translates into biological stress and adverse health outcomes. Secondly, inequalities erode social cohesion and social capital leaving societies without social safety nets to buffer against adverse health outcomes. Little is known about the health consequences of income inequality in smaller, pre-industrial societies. The present study tests the association with data from the Tsimane', a foraging and farming society who live in the Bolivian Amazon. Participants included 2598 adults (15 years or above) from 13 villages at variable distances from the market center San Borja. Dependent variables included a social capital index and various stress indices. The independent variable is a Gini Coefficient, an economic measure of income inequality within a society. While income inequalities did not correlate with measures of stress, there was a strong negative relationship between income inequality and social capital. This suggests that social cohesion may be an important link between social inequalities and adverse health outcomes in a traditional society transitioning toward a market economy.

## **Introduction**

The relationship between a person's socioeconomic status and their health is well documented, but how can health differences among societies be explained? There is an increasing body of literature supporting the association between income inequalities, or relative measure of societal poverty, and population-level health (Kawachi 2000;

Wilkinson 2006). Rather than looking at socioeconomic status, an indicator of absolute poverty levels, income inequalities have been used to address the issue of population-level health. It is especially important to look at these trends in the developing world in countries such as Bolivia because the development of income inequalities threatens to worsen the health of the population as their economy expands (Kawachi 1997).

This paper comes from a research project conducted in lowland Bolivia. The Tsimane' are an indigenous group who live in the Bolivian Amazon, and serve as model population for the transition from foraging and farming to a market economy. Living along a main river that connects the various villages to the market center San Borja, the population is experiencing a slow infusion of cash into their wealth creating inequity that has become highly visible. The Tsimane', living deep in the jungles are fairly isolated and are not very educated. A few of the Tsimane' men know Spanish and even less make the long trip to San Borja. For this reason, they are an ideal study population for this project.

### *Problem Statement*

It has been methodologically difficult to separate the effects of poverty from that of inequality. If there are definite patterns of worsening health in an unequal society, how can researchers be sure that these processes are in fact due to inequality and not poverty? Anthropological perspectives on the relation between the two can help us gain valuable insight understanding cultural, political, and historical forces (Diamond 1997). Anthropologists have devised many different cross-sectional and cohort studies which aim to understand the mechanisms through which social inequalities translate into poor

health outcomes (Marmot 1986; Wilkinson 1999; Lynch 2001; Nguyen 2003; Wilkinson 2006).

### *Gaps in the Literature*

While there is extensive literature about these mechanisms in developed countries, such as the United States and other OECD-member (Organization for Economic Co-Operation Development) countries, there is little known about the effects in other populations (Marmot 1986; Kawachi 2000; Lynch 2001; Subramanian 2002; Wilkinson 2006). Richard Wilkinson and other prominent proponents of the hypothesis claim that studies regarding the topic cannot be accurately conducted in small, rural areas for a number of different reasons. The low level of income, high levels of poverty, the homogenous nature of these societies, and the lack of a scale of social classes all make it hard to find powerful data to support this hypothesis. However, such conclusions neglect to consider the confounding variables that exist within industrial society which are not applicable to the Tsimane' including racial and ethnic heterogeneity, immigration, and government transfers. The literature largely omits subgroups analysis, which this study shows to be important. Since the Tsimane' can be considered ethnically homogenous, subgroup analysis, rather than population analysis, is more appropriate.

Previous researchers have obtained imprecise measures of income based on monetary earnings or wealth. These measures are problematic because the Tsimane' economy is not based on cash earnings, but are self-reliant with some trading of goods. In order to avoid this problem, I propose to use height in place of height for a number of reasons. First, height, which acts as a proxy for work efficiency in the fields, is the best approximation of incoming goods or assets for that years' harvest. Secondly, height

ignores any seasonal variation that may skew the data for any given year due to natural disasters. Third, height has been shown to be highly correlated with income and various measures of wealth (Godoy 2005). Table 2 lists the Gini Coefficients using income data for each individual for the second quarter of 2005. While these values may be influenced by seasonal variation, there is strong correlation ( $r^2 = 0.435$ ) between the Gini Coefficient using stature and the Gini Coefficient using income. The approaching significance ( $p = 0.135$ ) validates stature as a good proxy for income.

### *Hypotheses*

To better understand these issues, I propose the following hypotheses. First, as income inequalities increase, there will be a decrease in social capital. Income inequality is measured by Gini Coefficients. Social capital has been proposed to be a mechanism for which inequalities to affect health. Second, as income inequalities increase, negative emotions will increase and positive emotions will decrease. Emotions have been implicated as possible mechanisms for inequality to affect health.

### *Significance*

Using anthropologic data collected by the Tsimane' Amazonian Panel Study, this study will provide significant insights into: 1) Long-term effects of social inequalities on a populations' health; 2) Understanding the mechanisms behind inequality at the individual level; and 3) Possible levels of intervention for policymakers and development workers. This study will help broaden the application of the theories and better help us understand the mechanism by looking at a highly autarkic population free from the many known and unknown confounders.

### *Background Information: Literature Review & Mechanisms*

Until the mid 1980s, it was firmly believed that poverty was the single most robust predictor of health and that a discrete decrease in poverty is followed by an accompanying increase in health (Subramanian 2002). The landmark Whitehall study in England was the first that supported the idea that there is in fact something more complex than just material deprivation, such as inequality, that can explain the effects of poverty (Marmot 1986). The study found a positive relationship between the ranks of British civil servants and lifespan, even after accounting for lifestyle risk factors such as smoking, lack of exercise and even the neighborhood they live in. The study even compared civil servants that have the same rank, accounting for cultural factors. This pointed to social inequality, or the relative measure of material deprivation, as an explanatory factor independent of income levels. Social inequality can be measured with social classes but this categorical variable, although is a robust measure of social inequality, does not get at the small differences within groups that would otherwise be missed if they were grouped together. Additionally, statistically, it does not appropriately capture the spread between and within different social classes (Forbes 2001).

### Structural Violence

It is necessary to preface the discussion on mechanisms with the idea that the relationship between inequality and disease is a form of violence that has been ingrained into modern notions of everyday life. The violence does not refer to popular conceptions of violence such as physical violence (Nguyen 2003). Rather, this violence is structural and a fact of inequality. The violence is translated into biological differences and are

more commonly known as “risk factors.” For example, high blood pressure, a risk factor for heart disease, can be considered the outcome of violent political processes. Material inequalities are exacerbated by inequality of access to new biomedical technologies which is highly skewed toward the rich. The poor trade in their long-term health for survival while the rich are able to access better health (Nguyen 2003). These health inequalities are a form of structural violence that has become a recent interest to anthropologists since it leads to socioeconomic exclusion and deteriorating health.

#### Mechanism 1: Psychosocial Stress

Psychosocial stress is a mechanism that has been proposed to explain how social hierarchies can be internalized into biological consequences. Researchers have tried to provide a causal pathway between the social environment to the biological by way of stress behaviors and reactions. Inequalities among people produce negative emotion and stress-related behaviors which in turn negatively impact physiological and mental development (Brunner 1997).

According to one model, behavioral choices such as using tobacco, alcohol, or diet and physical activity are dictated by being in low-income, stress environments. These choices are situated within economic, historic, cultural, and political context (Lynch 1997). These health behaviors are differentially distributed by socioeconomic status and are a response to the conditions imposed by the social structure of that particular society. Furthermore, Lynch posited that when looking at the relationships between inequalities and health behaviors, it is important to consider three distinct parts of the life course: childhood, adolescence, and adulthood. It is necessary to split these groups up as such since they experience different stressors and thus have differing health behaviors. The

process of psychosocial stresses translating into long-term, adverse behaviors is best understood when addressing these age groups differently. A child who is exposed to social inequalities will internalize the negative emotions early in life and exhibit these behaviors in adulthood.

Lynch found that graded associations with socioeconomic status at the different stages of the life course. The association adult socioeconomic status and health behavior is dependent on the socioeconomic status of those individuals as children. People born into low, middle, or high-income families have different probabilities of receiving a good education, which then effects status, income, and a number of different behaviors. However, the deterministic idea that a person behaviors are predetermined, given he or she does not choose his or her own socioeconomic status as a child, is hard to believe and rather simplistic.

The other model of psychosocial stress focuses on endocrinology as the entry point for stress into the biological body. Cortisol is a hormone that functions to mobilize energy stores within the body when it faces a stressor. Chronic stress elevates the baseline cortisol level, which results in immunosuppression and other stress-related outcomes (Evans 1994). Similarly to the previously mentioned model, these pathways allow for biological effects to occur much later in life, reinforcing the idea of differential health behaviors and outcomes at various life course stages.

## Mechanism 2: Social Cohesion

Social cohesion has been implicated in a number of clinical epidemiological studies (Kawachi 1997; Wilkinson 1999). Although social cohesion has lacked a coherent and consistent definition within the literature, there is an agreement that social

inequalities are correlated with less social network density and ultimately with lower health and increased mortality (Nguyen 2003). This phenomenon can be understood in low-income settings where those in poor health can ask for social and economic help from those within their social network. However, in affluent societies, this reliance on other as safe-nets is not needed since each individual has the monetary resources to be self-reliant. This observation has triggered a search for a quantifiable measure of social cohesion which has resulted in Jacobs coining the term social capital, which is defined as the density of social ties (Jacobs 1961).

Income inequality erodes community and individual social capital. Social capital encompasses trust, safety nets, generosity, and reciprocity all which allows people to protect their health (Egolf 1992; Wilkinson 1999). The increase in inequalities within a society causes those at the lower end of the hierarchy to compare themselves and resent those at the top (Watson 1995; McDade 2002; Dressler 2004). This comparison produces a sense of relative deprivation and causes negative emotions, such as envy, shame, guilt, anger, depression, hostility, cynicism, insecurity, social isolation, anxiety, and inadequacy (Marmot 1986; Wilkinson 1999; Kawachi 2000; Wilkinson 2006). While these negative emotions are also implicated in the psychosocial stress mechanism, those who support the social cohesion mechanism claim that these emotions translate into depressed health via other pathways. These differences will be discussed further in the discussion section.

The erosion of social cohesion by social inequalities can manifest in the body, as explained by psychosocial stress and disease, but can also be viewed across societies and time. Fassin shows how in premodern society the embodiment of inequality was limited to

modification of the body through ritual, a form of violence that did not significantly translate into differences in morbidity or mortality between groups at different positions on the social ladder (Fassin 1996). In modern societies, however, inequality becomes embodied biologically, as those lower on the ladder suffer higher morbidity and mortality rates supporting Foucaultian theory that modern violence is sublimated. Fassin show how this modern affection of inequalities, a form of violence, is biologized (inscribed into the body) rather than ritualized (inscribed onto the body).

### Mechanism 3: Materialism

Neo-materialists propose a third, broader mechanism for which income inequalities to impact health. This mechanism focuses on the neo-liberal movement in which there was a push for the private sector to provide the goods and services that were originally provided by the public sector. However, because of this, there are no public assurances that every member of that society will have equal access to the services that are privately offered. In fact, this new ideological shift has created many inequalities. The neo-materialists have countered that material factors can explain the gradient effect on ill health (Nguyen 2003).

In unequal societies, there will always be a conflict of interest for those different subgroups which make up the society. For example, the poor are more deprived than in comparatively egalitarian societies because fewer investments are made in infrastructure and social services that are aimed to benefit them (Navarro 2001). These material investments help to shield those lower on the social ladder from broad range of environmental, behavioral, and social risks; these material investments act as a political buffer. The risks that would otherwise compromise their health outcomes include a range

of issues from environmental toxins to endemic violence (Nguyen 2003). Another side of the neo-materialist theory is that material deprivation in childhood, which is more prevalent in unequal societies, has been shown to perpetuate unhealthy behavior later in life, leading to worse health outcomes that persist even as individuals climb the social ladder and become part of a healthier environment.

The proponents of this mechanism argue that income inequalities act as proxy for social stratification and socioeconomic heterogeneity, which makes it harder for people to agree on the provision of public goods that protect or enhance health (Deaton 2001). Material factors can explain the observed gradient effect on ill health. Their reasoning is such that in unequal societies the poor are more deprived than in comparatively egalitarian societies because fewer investments are made in infrastructure and social services that work to buffer negative health effects (Navarro 2001). These material investments are not captured by aggregate data on income as they are investments made by a political authority, and not individuals. The investments help to shield those lower on the social ladder from a broad range of environmental, behavioral, and social risks (Wilkinson 1999). Moreover, material deprivation during childhood has a particularly detrimental effect because it socializes young children to unhealthy behaviors which are perpetuated into adult life, leading to worse health outcomes that persist even if individuals are able to climb up the social ladder (Lynch 1997).

## **Methods**

### *Sample*

There are approximately 8000 Tsimane' that live in villages all along the Maniqui River in the Bolivian Amazon. There is a market center in the middle area called San

Borja (population ~ 19,000) where the Tsimane' can trade and purchase goods. The data comes from 13 select villages that all are in the Department of Beni in Bolivia. The population of the 13 villages account for approximately 20 percent of all Tsimane' (Godoy 2006).

The data from the 13 villages come from a larger panel study called the Tsimane' Amazonian Panel Study (TAPS). The data used in this study comes from the 2005 wave of data collection. Data is collected quarterly and only the second quarter data is used in this study for simplicity. The study collects data for every individual within the 13 villages annually and aims to study the Tsimane' as they integrate with the market economy. The bio-cultural approach aims to estimate the effect of the market on this autarkic indigenous group as cash is slowly being infused into their economy (Godoy 2006). While there are 8 main researchers dedicated to the project, only a couple speak Tsimane'. Translators were used in order to carry out the interviews and questionnaires.

In order to get an accurate representation of the villages, it was necessary to only include those individuals who were above the age of 15 (Godoy 2006). This was done for two different reasons. The panel study asked about various emotions to only the adults who are above the age of 15. For appropriate statistical analysis, it would not have been appropriate to include two different age distributions within two different variables. More importantly, however, Tsimane' are considered adults at the age 15 when they usually get married. As this time, it is usual practice for the male to leave his childhood home and start a new home with their own separate plots elsewhere, creating a new household. These 15 year olds add to the income-income inequality and are an integral part of the economy.

### *Independent Variables*

There are a number of different ways to measure income inequality. The Gini Coefficient is the most used measure of income inequality. The Gini Coefficient is measured on a scale between 0 and 1 representing perfectly equal to perfectly unequal. A value of 0 indicates perfect equality while 1 indicates perfect inequality, independent of any absolute measures such as averages.

The Tsimane', being a society that has just started to trade and develop market integration, do not have measurable cash incomes. It is important to make a distinction between income and wealth because they have different implications in the analysis. I use physical stature as a proxy for income. It has been shown and discussed in various literature that this is not only a decent approximation but that there is a logical explanation behind using stature (Strauss 1996; Godoy 2005; Godoy 2006).

In a foraging and farming such as the one in which the Tsimane' live, the ability to work in the fields is their livelihood. In order to receive a higher income, one must be more efficient in working the fields. There is much evidence that shows taller individuals tend to have increased efficiency in the field, and thus higher levels of income. Height has been shown to correlate with a number of income and wealth measures in the Tsimane'. One strong limitation to this methodology is the lack of information regarding the appropriate height correction for age-related shrinking among the Tsimane'.

The stature (in centimeters) for each adult was measure and a Gini Coefficient was calculated (Wessa 2007) for each village. The following equation was used (Dorfman 1979):

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2 n^2 \mu}$$

Gini coefficients were also calculated for each village using a monetary form of income. Each individual was asked about the total monetary value of their barter in the two weeks prior. Additionally, each individual was asked about total income from wage labor in the two weeks prior. The two variables were added to determine that person's total income. This was done using data from only the second quarter of 2005.

### *Dependent Variables*

There are two categories of dependent variables that were analyzed. The psychosocial stress indicators included four different emotions that the informant felt in the past week. These included happiness, fear, anger, and sadness. Each emotion was categorized from never, sometimes, and always for the having that emotion in the past 7 days. Although the Tsimane' do not have a word for stress, they have unique terms for each of the mentioned emotions (Ellis 2002). Each emotion was analyzed separately because they each address various aspects of stress and could not logically be combined to create an emotion index. One of the limitations to this methodology of addressing statements of emotion among the Tsimane' is the incomparability across cultures. While more accurate emotions may exist, the measured emotions have been used in past studies among the Tsimane' (Godoy 2006).

Social cohesion was measured by social capital. A social capital index was created and a score was calculated for each individual. The score for each adult was averaged by village to determine the average amount of social capital per village. The

index was created using six variables which addressed the two most pertinent and applicable aspects of social capital in Tsimane'. These two aspects included various forms of help and various forms of gifting. The first three variables estimated the number of times the individual helped other Tsimane' and non-Tsimane' people with anything in the 7 days prior while the second three variables estimated the number of times the individual gave a gift to other Tsimane' and non-Tsimane' people within the 7 days prior. Because both gifting and helping are indicators of an individual having increased social capital, an index was created by a summation of the six variables.

### *Ethnography*

Ethnographic interviews were conducted during the summer of 2006. The interviews were aimed at understanding the experience of inequality among the Tsimane and recording stories.

### **Results**

Various descriptive variables have been examined in order to assess the comparability of the various villages. Table 1 shows the number of adults in each village, average age, the male to female ratio, stature, education, and walking distance to San Borja, the market center. There are enough adults in each village to have powerful results. There are two main statistics that are important to notice. First, there are an approximately equal number of males and females in each village. This would be important using stature as a proxy for income since men and women have different roles in Tsimane' culture and therefore having an equal ratio controls for this. Secondly, the education levels are all within one year of each other. Education is strongly correlated

with health and economic success, but since they are relatively equal, any unmeasured related variables would be controlled for.

I have found mixed results in support of the income inequality hypothesis. Table 2 lists the explanatory and dependent variables by village. While there are two different models tested, one was found to be statistically significant. The first model looked at the relationship between Gini Coefficients and the individual emotions (Table 3). At a significance level of .05, there were no significant relationships found. When the Gini was regressed against the sadness index, an  $r^2$  of .002 ( $p = .893$ ) was found. Subsequent analysis of the angriness index, afraid index, and the happiness index resulted in an  $r^2$  value of .053 ( $p = .448$ ), .055 ( $p = .442$ ), and .100 ( $p = .293$ ) respectively. There seems to be almost no relationship between the inequality measure and these emotions, contrary to significant findings in other studies done in the Tsimane'.

The second model tested looked at the relationship between the social capital index and the Gini coefficient of each village. The assumption is that as inequalities increased, or as Gini values increased, average social capital would decrease. This negative relationship was found in the Tsimane'. When a linear regression was conducted, I obtained an  $r^2$  value of .34 ( $p = .036$ ,  $F = 5.726$ ). Table 4 displays these results along with a predictive value of .136.

A regression was run correlating the social capital index with Body Mass Index. An r-squared of .600 was found with a significance level of .007. Body Mass Index is an anthropomorphic calculation estimating the amount of body fat in the body.

In sum, while a positive association was expected between Gini values and Sadness, Anger, and Fear and a negative association was expected between Gini values

and Happiness, there was very little evidence to support this. The negative association between Gini values and the social capital index was found to be significant supporting the Social Capital model of the Income-Inequality Hypothesis.

Table 1. Summary Statistics.

Village Name	Number of Adults (>= 15)	Age (years)	Men/Female	Height (cm)	Education (Years)	Distance (Hrs)
	N	Mean	Ratio	Mean	Mean	Mean
Alta Gracia	58	31.7	0.51	158.49	2.1	1.95
Arenales	35	36.3	0.52	155.89	2.1	0.40
Campo Bello	51	33.7	0.53	157.54	1.4	4.00
Caracara	40	34.3	0.50	155.43	2.5	1.00
La Pampita	26	37.3	0.57	156.93	1.5	1.48
Maraca	29	33.6	0.53	157.96	1.5	3.80
Puerto Mendez	3	35.4	0.41	158.68	2.2	1.97
Puerto Yucumo	53	30.7	0.51	156.35	2.2	5.00
San Antonio	56	33.9	0.50	157.88	2.0	3.00
San Ramon	17	28.7	0.59	158.52	2.8	1.70
Santa Maria	59	31.4	0.56	154.94	2.1	6.85
Uvasichi	50	35.3	0.47	155.48	1.5	1.31
Yaranda	55	35.6	0.53	154.23	2.1	8.00

Table 2. Independent and Dependent Variables.

Village Name	Gini Coefficient	Gini Coefficient	Social Capital Index	Body Mass Index	Angriness Score	Afraid Score	Happiness Score	Sadness Score
	(Stature)	(Income)	Mean	Mean	Mean	Mean	Mean	Mean
Alta Gracia	0.1441	0.0257	2.5138	19.7791	1.4700	1.5800	2.1600	1.9500
Arenales	0.1318	0.0282	3.3200	20.6442	1.6900	1.9300	2.3500	2.0800
Campo Bello	0.1396	0.0258	1.8832	19.5749	1.6100	2.0300	2.3200	2.1600
Caracara	0.1379	0.0245	3.1053	20.1901	1.1700	1.1700	2.8200	1.4100
La Pampita	0.1461	0.0330	1.9109	19.5239	1.4100	1.4700	1.9300	2.0500
Maraca	0.1351	0.0326	2.5315	19.5699	1.2200	1.3300	2.6400	1.5900
Puerto Mendez	0.1416	0.0247	2.4130	19.6563	1.1200	1.5700	1.8600	1.6400
Puerto Yucumo	0.1353	0.0240	2.2264	19.0657	1.2300	1.3500	1.9000	1.6300
San Antonio	0.1409	0.0280	1.5588	19.4719	1.6100	1.6200	2.1300	1.9700
San Ramon	0.1482	0.0260	0.9194	18.9298	1.0600	1.2400	2.2900	1.5800
Santa Maria	0.1379	0.0262	2.9364	19.2967	1.5100	1.7000	2.2700	1.9600
Uvasichi	0.1403	0.0265	2.6277	19.8050	1.8100	1.7900	2.3600	2.2200
Yaranda	0.1411	0.0317	3.6336	20.2422	1.5000	1.7500	2.4500	2.1500

Table 3. Emotion Variables.

	Angriness	Fear	Happiness	Sadness
Gini Coeff.	.053 (p = .448)	.055 (p = .442)	.100 (p = .293)	.002 (p = .893)

Figure 1.

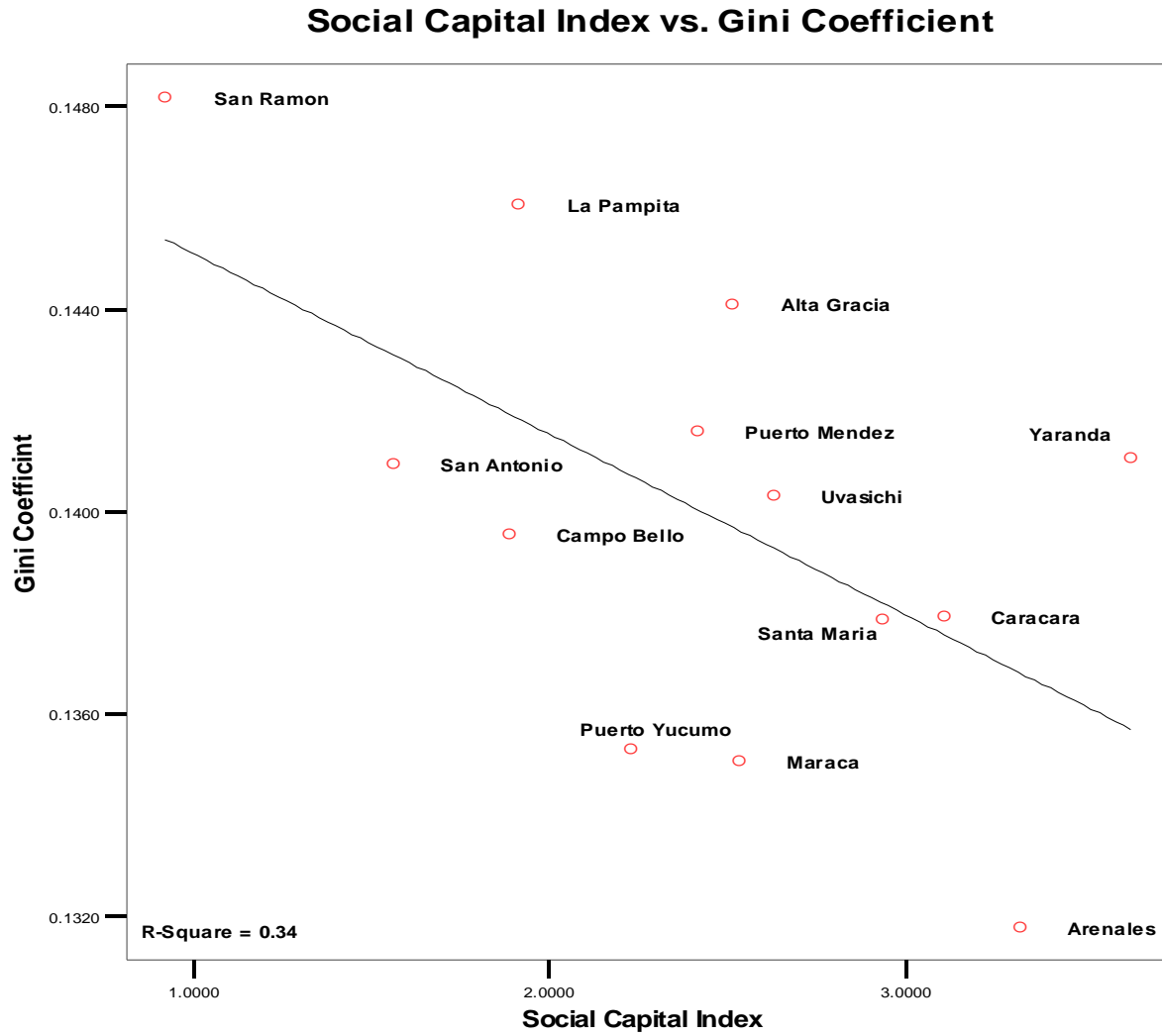


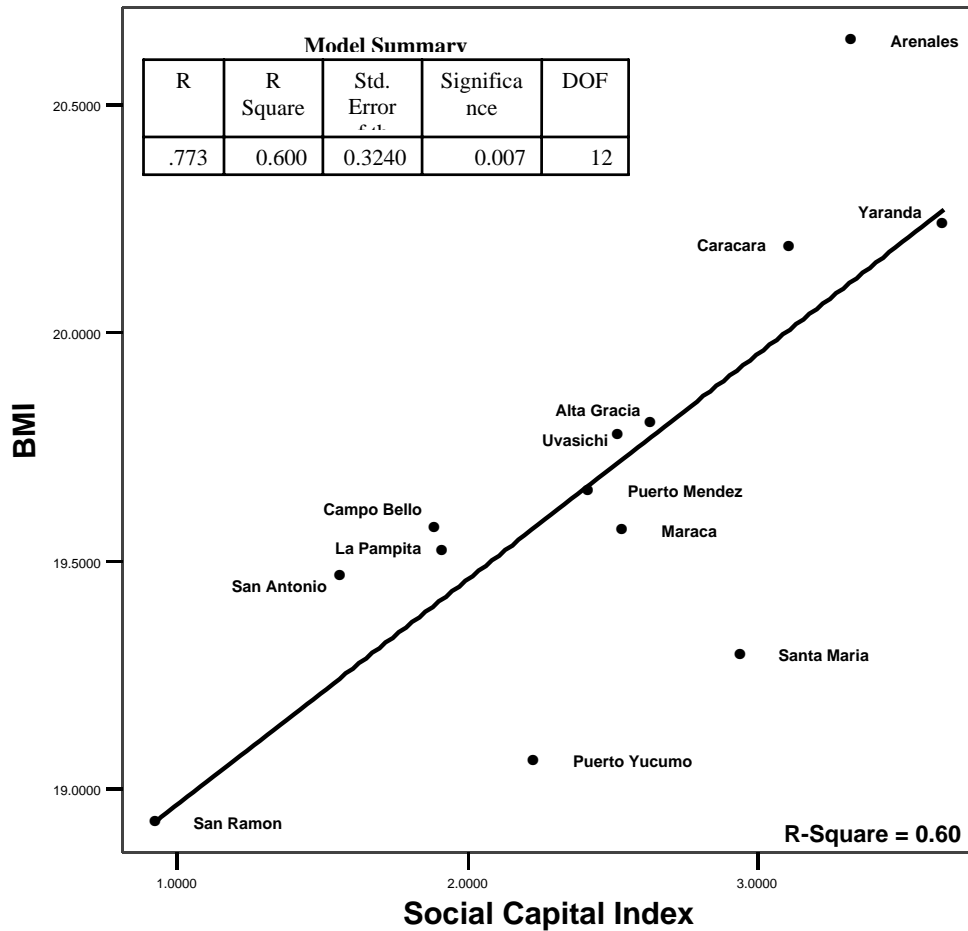
Table 4. Social Capital Model Statistics Summary

R	0.585	P-Value	.036 <sup>a</sup>
R <sup>2</sup>	0.342	Coefficient B	0.149
Adj. R <sup>2</sup>	0.283	Confidence Interval <sup>o</sup> on B	(.140-.157)
F	5.726	Predictive Value	0.136

<sup>a</sup>Significant at .05 level

<sup>o</sup>95% Confidence Interval

**Figure 2. Body Mass Index vs Social Capital Index**



### Discussion and Conclusions

This study has helped our understanding of how income inequalities negatively affect health by testing two different models of action. The data comes from a panel study called TAPS that aims to study the Tsimane' who are a population in transition. They are a highly autarkic, small-scale, pre-industrial society just beginning to integrate with outside market economies (Godoy 2006). The vast majority of the literature regarding the Income-Inequality Hypothesis has been conducted in highly developed countries, specifically in the member countries of the Organization of Economic Co-operation and

Development (OECD), which include the 25 richest countries in the world. This study helps to understand the forces underlying the Income Inequality Hypothesis, however, it contradict parts of the prominent literature in terms of the study population.

The Income-Inequality Hypothesis states that as income inequalities increase within a society, we would expect lower levels of population-level health such as life spans, independent of absolute levels of poverty and gross national product (GDP) (Wilkinson 1999). However, the path in which the income inequalities take in order to have an effect on morbidity and mortality is not known. This cross-sectional study has suggested that there is a significant relationship between the levels of inequality and the social capital available within each village. I have suggested reasons why this relationship exists.

Income-inequality is a product of capitalism economics in which the wealth and cash income is distributed disproportionately due to various economics, social and political processes within a population. In the United States, we see that there is a disparity in access to jobs, education, and there are highly segregated divisions in living space based on race and class. People living in these resource-poor areas fall into a vicious, cyclical poverty trap. Because of these and many other forces, the U.S. population experiences a highly disproportionate distribution of income and wealth. Those at the bottom of this ladder feel anxiety and resentful of those at the bottom while those at the top because fearful of those at the bottom. Because those at the bottom fall into the poverty trap and those at the top become protective of their wealth and assets, these inequalities persist unless there is an intervention aimed to relax these disparities. We find the similar forces in play in the Bolivian Amazon.

Although the range between the poor and the rich among the Tsimane' is not nearly the magnitude of those in the United States, there is still a drastic difference if thought of by percentages. At the bottom, we find families whose crops have been destroyed and where the men are unlucky in finding logging work. On the other hand, there are families that are lucky to have wage-earning jobs by either logging or working for the Consejo (the Tsimane' representation council) in which wealth accumulation is very much visible. Based on the ethnographic record, it true that the majority of the Tsimane' at the bottom are ashamed and will not ask for help from those who are wealthier or better off. Godoy proposed that in small societies such as this, income inequalities would allow for the richer to buffer their own as well as the poor villagers health by having the capital to do so (Godoy 2005). I propose two reasons why this may not be true with the Tsimane' based on my experience and interviews. First, there are feelings of resentment and shame that are related to stress that stop people from asking for help when they are in need. Second, the persistent inequalities have broken down the expected social cohesion to the point where asking for help from those who are not family is culturally inappropriate.

Social inequality and friendship, a loose application of social cohesion, vary inversely and have a powerful impact on health. Social status and rank are about power, coercion, and access to resources without regard to the needs of others. In contrast, friendship is about mutuality, reciprocity, sharing, and recognition that the needs of others are the needs of us (Wilkinson 1999). The Tsimane' identity has not united the Tsimane' in helping each other, they exist in a society of competition with their neighbors. That is, friendship plays a bigger role in connecting two families more so than

only the Tsimane'-ness factor. The social hierarchies and friendship can be considered opposite principles of social organization. The social capital index, hence, was a measure of extent to which individual adult had the ability to extend the above forces.

I argue that these forces of coercion and sociality, antagonism or cooperation, reciprocity or competition, order-giving and order-taking are the exact same forces that are played out in both the United States and Bolivian Amazon in different contexts. These social inequalities and the social hierarchies are a function of the culture, economy, and innate human behavior, and independent of population size or absolute per capita income. I therefore suggest that the results found in this study is applicable to the Tsimane' but also helps our understanding of these relationships in the United States or other OECD countries.

However, in order to understand the implications of the inverse relationship between social inequalities and social cohesion, it is necessary to understand how social cohesion impacts health. Reviews of the literature on health in relation to friendship, social support, and social involvement have shown that death rates may also be two to four times as high among those who are poorly socially integrated compared with those with more friends, more social support, or more community involvement (Wilkinson 1999).

Wilkinson provides various pathways for social cohesion to have an effect on health. He notes that there is powerful evidence that social status may affect health based on evidence that comes from work on non-human primates. Studies have shown that low social status results in increases in atherosclerosis, LDL:HDL ratios, central obesity, and signs of depression (Sapolsky 1998). We have seen that the various sources of chronic

anxiety are intimately related to low social status. It is important to consider how disrespect, shame, and humiliation add to the structural violence that is seen in the Bolivian Amazon.

We see a strong positive correlation ( $r^2=.600$ ) between social capital and body mass index in Figure 2. At such low ranges of BMI seen among the Tsimane' (19-21), higher values of BMI represent less under-nutrition and less malnutrition. Body mass index acts as a good measure of health status. The higher BMI acts as a health buffer suggesting that those with more social capital are better protected.

Some argue that there is a long-term time component involved in the presentation of the adverse social cohesion and health effects. That is, exposure during childhood will have profound effects on adult life. Early emotional trauma, poor attachment, and domestic conflict seem to affect stress responses throughout life in much the same way as do low social status and lack of social support (Sapolsky 1998). The health impact of early emotional insecurity and of the insecurities and anxieties resulting from low social status, coupled with the links between income inequality, disrespect, and violence, all point clearly to issues of social comparison, and fear and the main source of chronic anxiety. This anxiety, then, is likely to be related to low social status and greater income inequality (Wilkinson 1999). The health effects of friendship and social affiliations follow this same pattern. These buffers provide positive feedback, boosting one's confidence, sense of adequacy, and self worth, contrasting the health effects of negative social contact.

This idea of social buffers is especially important among the Tsimane.' As the land that the Tsimane' own is considered their main livelihood, not being able to tend to

the fields presents a major issue. Who will work if a family member is sick, injured, or somehow otherwise temporarily incapable of working? The social buffers, which are shaved away in villages with lower social capital, allow for an exchange of laborious help and gifts during times of need.

The social cohesion model does not aim to explain that all health is predetermined using social capital as a risk factor. However, the strength of community life, local associations, and friendship patterns seem most likely to be statistically associated with health because they reflect, on one hand, people's social ease and confidence or, on the other, the extent to which social contacts provokes anxiety, negative social comparisons, feelings of inadequacy, and angst as people feel belittled and undermined by status hierarchies. In other words, social cohesion can be thought of as epiphenomenon for individual processes that create population health. The cause of health and illness must always be attributed to exposures to risk factors, but the exposure can be thought to be determined by societal processes. Social cohesion is likely to work both ways: as an expression of individuals' underlying social confidence, but also as a social environment that feeds back to increase people's self confidence, trust in others, and inclusion (Wilkinson 1999).

As is with any cross-sectional study, it is not possible to prove a causal relationship due to difficulty in separating the temporal relation between the exposure and outcome inherently missing in this study design, although I argue that it is highly apparent that the exposure, income inequality, occurs temporally before the outcome of breaking down social cohesion. This study design proposed and shows and very strong

relationship between social inequalities and social capital. However, in order to assess the causal relationship, an experimental study design is more appropriate.

## Acknowledgments

I would like to thank the Tsimane', the Tsimane' Amazonian Panel Survey (TAPS) Project, and the Laboratory for Human Biology Research at Northwestern University. I would also like to thank the Weinberg College of Arts and Sciences for funding this project.



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