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Beyond the income inequality hypothesis and human health: a worldwide exploration

Além da hipótese de desigualdade de renda e influência na saúde humana: uma exploração global

ABSTRACT

OBJECTIVE: To analyze whether the relationship between income inequality and human health is mediated through social capital, and whether political regime determines differences in income inequality and social capital among countries.

METHODS: Path analysis of cross sectional ecological data from 110 countries. Life expectancy at birth was the outcome variable, and income inequality (measured by the Gini coefficient), social capital (measured by the Corruption Perceptions Index or generalized trust), and political regime (measured by the Index of Freedom) were the predictor variables. Corruption Perceptions Index (an indirect indicator of social capital) was used to include more developing countries in the analysis. The correlation between Gini coefficient and predictor variables was calculated using Spearman's coefficients. The path analysis was designed to assess the effect of income inequality, social capital proxies and political regime on life expectancy.

RESULTS: The path coefficients suggest that income inequality has a greater direct effect on life expectancy at birth than through social capital. Political regime acts on life expectancy at birth through income inequality.

CONCLUSIONS: Income inequality and social capital have direct effects on life expectancy at birth. The "class/welfare regime model" can be useful for understanding social and health inequalities between countries, whereas the "income inequality hypothesis" which is only a partial approach is especially useful for analyzing differences within countries.

DESCRIPTORS: Income. Social Inequity. Health Inequalities. Economic Development. Public Policy. Sociology.

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RESUMO

OBJETIVO: Analisar se a relação entre a desigualdade de renda e a saúde humana é mediada pelo capital social, assim como a influência do regime político na distribuição de renda nos países.

MÉTODOS: Estudo ecológico de trajetórias utilizando dados transversais de 110 países. A variável de desfecho foi a esperança de vida ao nascer; as variáveis independentes foram: desigualdade de renda (medida pelo índice de Gini), capital social (medido pelo índice de percepção de corrupção ou confiança generalizada) e regime político (medido pelo Índice de Liberdade). O Índice de Percepção de Corrupção (um indicador indireto do capital social) foi usado para incluir mais países em desenvolvimento na análise. Foram calculados os coeficientes de correlação de Spearman entre o índice de Gini com as demais variáveis independentes. A análise de trajetória foi realizada para avaliar o efeito da desigualdade de renda, dos *proxys* de social capital e do regime político na expectativa de vida.

RESULTADOS: Os coeficientes de trajetória sugerem que a desigualdade de renda tem maior impacto direto sobre a esperança de vida ao nascer do que por meio do capital social. O regime político atua sobre a esperança de vida ao nascer por meio da desigualdade de renda.

CONCLUSÕES: A desigualdade de renda e o capital social têm efeitos diretos sobre a esperança de vida ao nascer. O modelo de regime de "classe/bem-estar" pode ser útil para entender as desigualdades sociais e de saúde entre países, enquanto a hipótese de desigualdade de renda se limita a uma aproximação parcial útil para analisar diferenças dentro dos países.

DESCRITORES: Renda. Iniquidade Social. Desigualdades em Saúde. Desenvolvimento Econômico. Política Social. Sociologia.

INTRODUCTION

The "income inequality hypothesis" suggests that the greater the inequality the more resulting adverse effects on health,[21] and this effect is deemed to occur through social capital.[2,14] Putnam's definition of social capital is the most commonly used in epidemiology. Social capital is conceived as a community level resource defined by features of social organization such as networks, norms and social trust, facilitating coordination and cooperation for mutual benefit.[17] However other definitions are equally important (e.g. Bourdieu & Coleman, cited by Baum & Ziersch[4]), but they are rarely used in social epidemiology due to a lack of awareness or the non-availability of quantitative indicators.

The majority of studies based on the "income inequality hypothesis" have been exploratory and do not explicitly consider the possible causal pathways. Previous studies, which provided evidence that social capital acts as an intermediate variable, were carried out in the United States.[11,14,] However a general theory to explain the relationship between human health, social capital and income inequality requires testing in different contexts and levels of aggregation. This is very important to

developing countries, such as those in Latin America, because they tend to be excluded in studies carried out in developed countries, constituting a selection bias against more vulnerable populations.

The present study sought to empirically evaluate the causal pathways that allow income inequality to affect human health and to explore the effect of political regime on health, through income distribution and level of social capital. This approach partially follows the "class/welfare regime model",[7] since an explicit exploration of this model would require data not actually available. Testing alternative models is important due to recent evidence suggesting that the "income inequality hypothesis" is not fully supported.[13]

METHODS

An ecological study was carried out using comparable data from 110 countries. Life expectancy at birth (LEB) is the average number of additional years that a person could live if current mortality trends continue for the

rest of their life.[2] Given that life expectancy is strongly dependent on the criteria used for selecting groups, in areas of high infant mortality LEB reflects a high risk of death in the first years of life. We selected LEB in order to consider a latency period between exposure and event. LEB also reflects infant mortality, a good indication of contemporary conditions.[7] Data on LEB were obtained from the United Nations Development Programme.[a]

Countries included in the study, by continent, were: Africa: Algeria*, Botswana, Cameroon, Cote d'Ivoire, Egypt*, Ethiopia, Gambia, Ghana*, Kenya, Madagascar, Malawi, Mali, Morocco*, Mozambique, Namibia, Niger, Nigeria*, Senegal, Sierra Leone, South Africa*, Tanzania*, Tunisia, Uganda*, Zambia, and Zimbabwe*; America: Argentina*, Bolivia, Brazil*, Canada*, Chile*, Colombia*, Costa Rica*, Dominican Republic*, Ecuador*, El Salvador*, Guatemala, Honduras, Jamaica, Mexico*, Nicaragua, Panama, Paraguay, Peru*, Trinidad and Tobago, United States of America*, and Venezuela*; Asia: Bangladesh*, China, India*, Indonesia*, Iran*, Israel*, Japan*, Jordan*, Kazakhstan, Korea, Republic (south), Kyrgyzstan, Malaysia, Mongolia, Nepal, Pakistan*, Philippines*, Singapore*, Sri Lanka, Tajikistan, Thailand, Turkey*, Turkmenistan, Uzbekistan, and Viet Nam*; Europe: Albania*, Armenia*, Austria*, Azerbaijan*, Belgium*, Bosnia and Herzegovina*, Bulgaria*, Croatia*, Czech Republic*, Denmark*, Estonia*, Finland*, France*, Georgia*, Germany*, Greece*, Hungary*, Ireland*, Italy*, Latvia*, Lithuania*, Luxembourg*, Macedonia*, Moldova*, Netherlands*, Norway*, Poland*, Portugal*, Romania*, Russian Federation*, Slovakia*, Slovenia*, Spain*, Sweden*, Switzerland*, Ukraine*, and United Kingdom*; and Oceania: Australia*, New Zealand*, and Papua New Guinea. The countries with "*" were analyzed using generalized trust as a proxy for social capital (n=73). Social capital was measured in terms of generalized trust (direct indicator) and perceived corruption (indirect indicator).[5,6] The former measure, one of the most frequently used unidimensional indicators of social capital, was taken from a previous study using the World Value Surveys.[5] The generalized trust is given by the percentage of the population that answered yes to the question: "In general, do you think that most people can be trusted, or is it the case that you can't be too careful?".[5]

The bases for using perceived corruption as an indirect indicator of social capital are available in sociological or economic publications.[5,8,16] For instance, Narayan & Cassidy indicated and empirically validated that corruption is an outcome of low social capital.[16] Bjørnskov[5] considered social capital as a multidimensional construct, in which perceived corruption had higher factor loading than generalized trust and civic participation.[5] Moreover, according to this author social trust and social norms are different; the former is robustly associated with lower corruption while the latter is not related to corruption.[5] Note that Putnam's definition of social capital includes social trust and social norms; thus they are two different dimensions of the same construct. Despite its limitations, there is no other indicator available to increase the sample size.

Prevalent corruption in each country was determined using the Corruption Perceptions Index (CPI) 2004, obtained from the Transparency International webpage. This index ranges between 0 and 10, respectively representing the highest and the lowest perceived corruption. It should include information from 2002 and 2004 from three different sources and include 18 surveys and interviews, undertaken by different institutions. These interviews of the country's experts (analysts and businessmen), resident and non-resident, were used to create an average score on a points system. A detailed explanation of the construction of the CPI 2004, as well as some data on its reliability, is available at the Transparency International webpage.[b]

Based on evidence indicating that corruption depends on the cultural context,[20] we used the measurement of ethnic fractionalization (MET), proposed by Alesina et al.[1] This variable was used in a recent study exploring the association between income inequality and population health indicators, because ethnic heterogeneity in health models may bias the associations.[18] The MET consists of a number between 0 and 1 which indicates the degree of ethnic fractionalization; values nearer zero indicate greater homogeneity and those nearer one, greater heterogeneity. MET is calculated as one minus the Herfindahl index of ethnic groups' population shares. An important characteristic of this indicator is that it includes a greater cross-country sample than any other.[18]

Income inequality was measured using the Gini coefficient, which values ranges between 0 and 1; higher values indicate greater concentration of wealth and lower values, a more even distribution of income. For the purpose of this analysis, the original data from UNDP were converted to percentages, and interpreted in the same way. The political regimes of each country were evaluated using the Index of Freedom from Freedom House International, proposed by Franco et al[9] which allows for the classification of nations according to type of political regime. The Index of Freedom has two sub-indices: one concerning political

Table 1. Spearman correlations between life expectancy at birth, income inequality, perception of corruption, ethnic fractionalization, the Index of Freedom and generalized trust, from 110 countries.

Index	n	Life expectancy at birth	Gini coefficient	Corruption perceptions index	Ethnic fractionalization	Index of Freedom
Gini coefficient	110	-0.46*	1			
Corruption Perceptions	110	0.73*	-0.28*	1		
Ethnic fractionalization	110	-0.62*	0.35*	-0.43*	1	
Index of Freedom	110	-0.67*	0.29*	-0.74*	0.39*	1
Generalized trust	73	0.39*	-0.44*	0.42*	-0.27**	-0.28**

* $p<0.01$; ** $p<0.05$.

rights and the other civil liberties. Each may display values between 1 and 7 with the value being lower where there is greater liberty.

Spearman's correlation coefficients were calculated using the Gini coefficient, the CPI 2004, the MET, the Index of Freedom, generalized trust, and LEB. Then, path analyses were used to assess the effect of income inequality, the *proxies* for social capital, and political regime upon life expectancy at birth. The models were fitted with EQS 6.1 (Multivariate Software, Encino, California), using maximum likelihood estimators. When we used the CPI 2004 in the analysis, the entire sample was included (n=110); when we used generalized trust, 73 countries were included.

RESULTS

The correlations between the variables studied were statistically significant ($p<0.05$) and displayed the desired tendency (Table 1). Where LEB was lower, income inequality, political rights and civil liberties or ethnic fractionalization were greater. In addition, LEB was higher when less corruption was perceived and where there are more generalized trust. The Gini coefficient was greater where ethnic fractionalization was greater and lower where there was less perceived corruption. The Gini coefficient was negatively correlated with generalized trust and the CPI 2004, and it was positively correlated with ethnic fractionalization and the Index of Freedom. The correlations between the CPI

Table 2. Goodness of fit of analyzed models for the causal pathways of political regime, income inequality and social capital upon life expectancy at birth.

Index	Models using the Corruption Perceptions Index			Models using generalized trust	
	Initial[a]	Intermediate[b]	Final[c]	Initial[d]	Final[e]
P-value (x^2)	Undefined	<0.001	<0.001	Undefined	<0.001
Bentler-Bonett normed fit index	1	0.796	0.791	1	0.741
Bentler-Bonett non-normed fit index	-	-0.236	0.320	-	-0.599
Comparative fit index	-	0.794	0.796	-	0.733
Bollen fit index	-	0.802	0.804	-	0.750
McDonald fit index	-	0.891	0.845	-	0.914
Lisrel GFI fit index	-	0.903	0.890	-	0.920
Lisrel AGFI index	-	0.033	0.452	-	0.204
Standardized Root Mean-Square Residual	-	0.096	0.133	-	0.103
Function (minimum)	0	0.24108	0.36650	0	0.19000
r^2	0.441	0.441	0.429	0.321	0.321

[a] The level of perceived corruption acts as an intermediate variable in the relationship between income inequality and life expectancy at birth (see Figure 1 – initial model). Saturated model; not possible to calculate the indices.
[b] Same as the previous model but the variable for fractionalization as a predictor of the level of perceived corruption (see Figure 1 – intermediate model).
[c] Same as the previous model plus the proxy variable for the political regime as the predictor for income inequality, ethnic fractionalization and perceived corruption (see Figure 1 – final model).
[d] The level of generalized trust acts as an intermediate variable in the relationship between income inequality and life expectancy (see Figure 2 – initial model).
[e] Same as the previous model plus the proxy variable for political regime as a predictor of income inequality and generalized trust (see Figure 2 – final model).
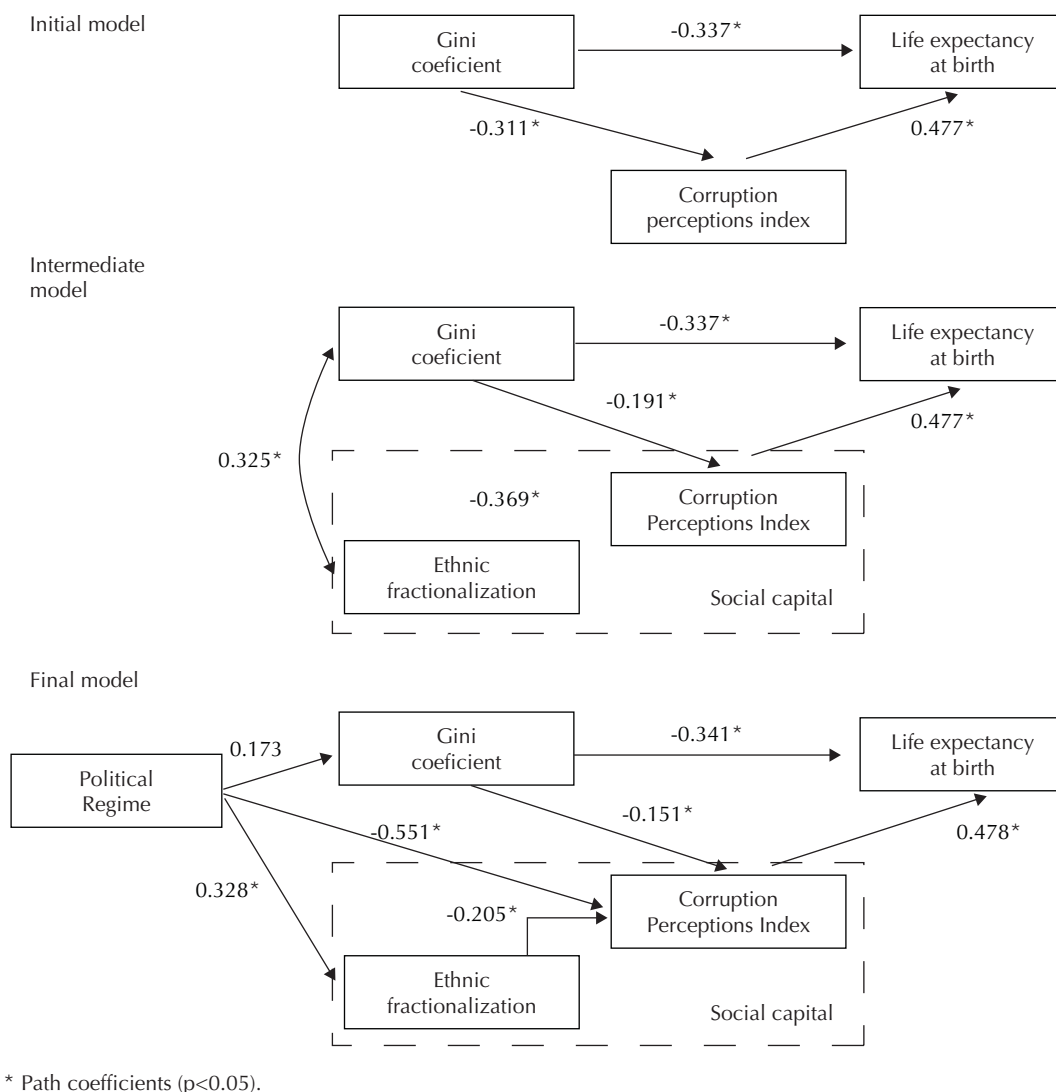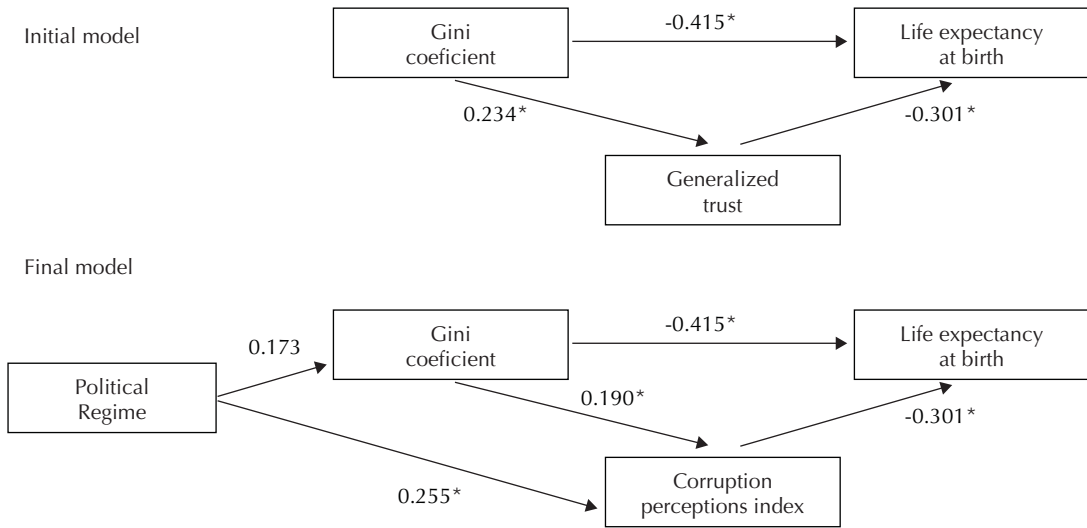
Figure 1. Construction of path analysis of relationship between income inequality, corruption perception, ethnic fractionalization, political regime, and life expectancy at birth.

2004 and the Index of Freedom or ethnic fractionalization were negative, indicating that fractionalization and political rights and civil liberties were greater, where less corruption was perceived. Ethnic fractionalization was positively correlated with the Index of Freedom and negatively correlated with generalized confidence. Finally, the Index of Freedom was negatively correlated with generalized trust.

The construction of the model for CPI 2004 (Figure 1) was initiated using the perception of corruption as an intermediate variable in the relationship between income inequality and LEB. Here it was observed that income inequality has a greater direct effect than an indirect effect, taking into account perceived corruption. When ethnic fractionalization was included as a predictor of corruption (intermediate model), it was observed that the direct effect of income inequality on

LEB is maintained to a greater extent than the indirect effect, when arrived at by means of the *proxy* of social capital. When political regime was included as a predictive variable of income inequality, corruption and ethnic fractionalization, it was observed that the Index of Freedom has a greater effect when considered to be a causal pathway for inequality than ethnic fractionalization and the CPI 2004.

The model that used generalized trust as a *proxy* for social capital (Figure 2) initially showed that the direct effect of income inequality on LEB was greater when considered as a causal pathway for generalized trust. When the *proxy* of political regime was included, it was observed that the effect is greater through income inequality than through generalized trust. During the construction of the two models, all the coefficients of the trajectory were found to be statistically significant

Initial model

Final model

* Path coefficients (p<0.05).

Figure 2. Construction of path analysis of relationship between income inequality, generalized trust, political regime, and life expectancy at birth.

(*p*<0.05), except for those of political regime to income inequality and political regime to generalized trust, which were only marginally significant. The extent to which each of these models fit are in Table 2. Figure 3 presents some examples of countries according to

income inequality and social capital levels. Studies undertaken in developed countries, which support the "income inequality hypothesis", show relatively minor differences in income (which is also frequently the case within countries).
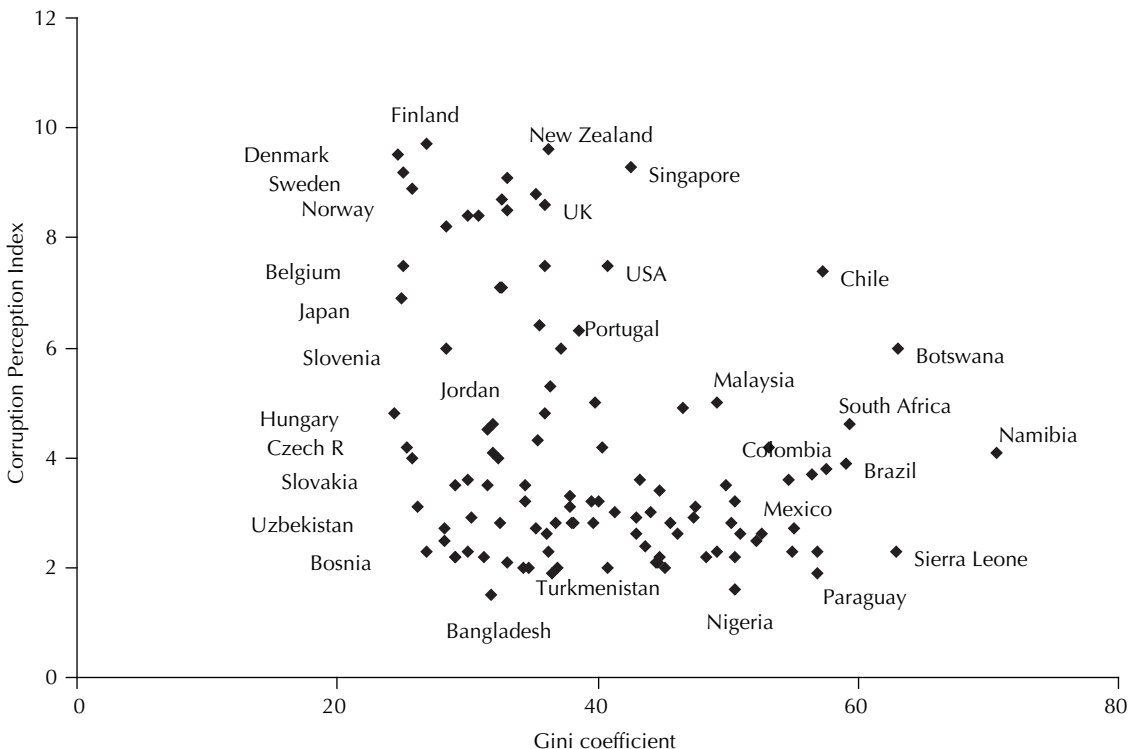

Figure 3. Representative examples of countries according to income inequality and perception of corruption levels.

DISCUSSION

The most important findings in this study are: 1) income inequality seems to have a direct effect on LEB, which is greater than when social capital is considered as a causal pathway; and 2) political regime has a greater effect considering income inequality than does social capital. In interpreting these findings, considerations such as path analysis and ecological design should be taken into account. The extent to which the models fit was considered to be acceptable considering the reduced size of our sample, even though we used all countries providing adequate information. This suggests that the "class/welfare regime model" may be more adequate than the "income inequality hypothesis" for explaining the relationship studied, even though it may be necessary to incorporate new variables in order to construct a general theory.

The main challenge in this study was the measurement of social capital,[4-6,16] a multidimensional concept where outcome depends on the components selected. In this study we use perceived corruption as an indirect proxy of social capital,[5,6] thus increasing sample size, especially for developing countries, although general trust is used to make comparisons. The result when using social capital was possibly due to an error in measurement; this is a problem without solution in path analysis, but its impact on path coefficients can be analyzed if multiple measures of the variables are used. In this study, it was possible to observe consistency in findings using "perception of corruption" and "generalized trust" suggesting that the relationship studied follows the described causal pathways.

The use of ecological variables only allows us to infer results at a national level, and one must avoid drawing conclusions at lower aggregation levels as they may represent a cross-level fallacy. Moreover, it is important to recognize that the measurement of social determinants as used in our study is controversial. The multidimensionality of social constructs, where the choice of a proxy allows for the identification of some results, could conceal other relationships.[22] In this sense our results should be regarded as exploratory of non-hegemonic models.

Two previous studies on the causal pathways between income inequality and human health concluded the contrary of our findings. These studies undertaken in the US[11,14] used states as a unit of analysis and thus only permit comparisons within this country, which suggests that findings depend on the level of aggregation and possibly the level of economic development. This is consistent with a systematic review where social capital tends to have more impact in intra-country levels of aggregation than within countries.[12] However, evidence from foraging-farming Tsimane societies in the Bolivian Amazon indicates that income inequality acts on health through other paths besides social capital.[10] This suggests that populations from non-Western societies could have other causal ways between social determinants and health outcomes. For this reason, generalizations based only on evidence obtained in developed countries could bias results.

Our study includes a great variety of countries with varying levels of economic development, allowing differences between countries to be observed. Thus, the determinants of health conditions vary according to the level of aggregation, a finding which is not discrepant, since the causes of illness in an individual are not always the same as those affecting incidence among the general population.[19] We explored through stratification whether there were different causal pathways among countries with high or low economic development (measured by gross domestic product per capita adjusted for purchasing power parity). However, with the reduced sample size, it was not possible to find statistically significant results.

Our findings suggest that the "class/welfare regime model" is useful for understanding the inequalities which exist when comparing nations. The "hypothesis of income inequality" only partially explains health discrepancies and does not indicate reasons for income inequality or social capital. It is important to remember that recent studies on income inequality and health include some (potentially confounding) variables, because an important discussion about the associations between income inequality, social capital and health could be considered spurious.

According to other authors, these "fundamental causes" are possibly related to the ideas and policies of global capitalism,[15] which tend to reinforce multinational markets in developed countries, where subsidies for agriculture and industry are provided at the cost of developing countries which remain unprotected. This problem was addressed in the G8 summit, 2005, which resulted in the formulation of the Millennium Development Goals. Studies of developing countries or regions with high income inequality may demonstrate varying results. Thus, a general causal theory would be better understood if it were to incorporate all levels of income inequality and the determinants of these social inequalities.

The results presented here justify policies which result in a better distribution of income as a prerequisite for the improvement of social capital among the population. Thus the consequence is that life expectancy will increase by actions on both determinants. Results of studies on the impact of income inequality on health are strong, consistent, statistically significant and non-artifactual,[3] while studies on social capital are controversial. The Millennium Development Goals also uphold the idea that acting only on social capital would tend to wrongly attribute responsibility for poor

health conditions to the population,[15] and upholds the increasingly evident need to remedy poor distribution of income and its causes. Future studies might explore other "fundamental causes" of social inequality and health, and to again test the model proposed here with other ways of measuring determinants. The level of agreement with further studies will strengthen the evidence available to policy makers.

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