DEVELOPMENT, HEALTH SERVICES AND SOCIAL DETERMINANTS OF PERCEIVED HEALTH IN HONDURAS: A NON LINEAR ECONOMETRIC MODEL APPLIED TO THREE DEPARTMENT CAPITALS

SÁNCHEZ, Esdras Josiel. [1*]
LICONA, Tania Soledad. [2]
LICONA, Kenssy Jackeline. [3]
GONZALEZ, Stephanie Julissa. [4]
MEJÍA, Diana Alejandra. [5]
PAREDES, Felipe Alejandro. [5]
SALINAS, Luis Roberto. [6]

Abstract

This article is pioneering by using econometric models for analyzing the perceived health factors in Honduras. A simple random samples was taken from three regions of Tegucigalpa, San Pedro Sula and Santa Barbara, later, we estimated a probit model. We conclude that there is proof of a relationship between socioeconomic factors and the perceived health, where in a cluster of 14 explanatory variables, nine are determinant and five weren´t. There was a 38% probability for a positive perceived health for an individual, which diminishes by ages older than 35. Women tended to have a better perception than men did.

Keywords: social determinants, probit model, Honduras, health.

Código JEL: I15, I10, C51.

1. Introduction

The development of the countries has aspects that must be explained with debt, the role of the state, tax, structure, political instability, defense expenses, geographical position, Capital, specialization in foreign trade and technological adaptation (Bildirici and Sunal, 2006, p.5). The relationship between human capital, physical capital, population, technological progress and development is real but not sufficient. In the year 2014 the average life expectancy worldwide was 71 years (Guisan and Exposito, 2016) and the low life expectancy values depend on the high mortality rates of some diseases that affect the young population.

For a long time, health was exclusively related to the absence of disease and

---

[*] [1] Ph.D. Candidate in Economics at the Pontifical Catholic University of Argentina and M.Sc. in Econometrics at Torcuato Di Tella University. josielsanchez@uca.edu.ar; [2]Professor of the University School of Health Sciences. Universidad Nacional Autónoma de Honduras, Valle de Sula. EUCS, UNAH-VS. tania.licona@unah.edu.hn; [3]Professor of the Department of Business Administration of Centro Universitario Tecnológico (CEUTEC), San Pedro Sula, Honduras, 21101, kenssy.licona@unitec.edu; [4] Student of Centro Universitario Tecnológico(CEUTEC) Department of Engineering in Logistics Management, San Pedro Sula, Honduras, 21101, stephannyg@unitec.edu; [5]Students of the medical degree. EUCS, UNAH-VS. aianaverdial1@hotmail.com, felipe221995@gmail.com
[6]Medical doctor, graduated at UNAH. luisrobertotti@hotmail.com

limitations, until the World Health Organization (WHO) in its 1946 letter considered that social, economic, cultural and epidemiological factors are related to the Definition of health. In this sense, the concept of causality is crucial to make analyzes and conclusions in a research, particularly in the field of epidemiology, which according to Parascandola (2001), there is interest in using causal models of the disease. In this sense, an integral form of studying the disease and its prevention is integrated within the framework of Social Epidemiology, defined by Berkman and Kawachi (2000), as part of the epidemiology dedicated to the study of social determinants of health and social distribution. The study of social determinants of health has as one of its pioneering approaches the model of Laframboise (1973), applied in Canada, contributing in the advances of Public Health. Later, other models such as Dever (1976), Tarlov, Ware, Greenfield, Nelson, Perrin and Zubkoff (1989), Dahlgren and Whitehead (1991) were developed, but the Laframboise model continues to be used to establish Public health policies, which in turn denotes the relevance of the study of the social determinants of health. In this sense, several studies (Lantz, Lichestein, and Pollack 2007; Phelan, Bruce, Roux, Kawachi, and Levin, 2004; WHO, Wilkinson and Marmot, 2003; Marmot, 2004; Rose, 2001; and Lee, Moss, and Krieger, 1995), indicate that the population with less access to resources has worse health situations.

The general objective of the research was to find the health determinants in the population of 16 years or older of the head departments of Tegucigalpa, San Pedro Sula, and Santa Bárbara, using as an indicator of health perceived by individuals. For this, a survey is applied to obtain a sample survey in order to obtain information on the health status and perceived morbidity of the population. In respect to the analysis, the research has an added value, because it is a pioneer in the application and estimation of an econometric model in the field of health of Honduras, that is, to use the theoretical model of the social determinants of health of the World Health Organization (WHO) launched in 2005, and then apply it to the case of the head departments in analysis to study the health status perceived positively according to potential explanatory variables.

The econometric specifically, logistic models of binary regression are estimated. Once the model is estimated, it is possible to know the social determinants of health perceived positively from the set of potential explanatory variables, this in econometric terms is, that it is statistically significant. Then the marginal effect of each of these social determinants on perceived health is estimated, keeping the rest of the variables constant.

The research is structured in 5 sections; Section 1 describes the introduction. In section 2 a review of the literature methodology uses maximum plausability techniques to estimate the model, more is developed: status of the issue, section 2 is divided into: 2.1 Concept of health, 2.2 Social epidemiology and determinants of health, 2.3 Determinants of health, 2.4 Self-perceived health. Section 3 includes a comparison of economic development and health indicators of Honduras in comparison with other countries. Section 4 describes the model and methodology developed, 4.1 Structure of the proposed health model, 4.2 Design of the survey, 4.3 Population, sample and its design, 4.4 Econometric methodology for the health model, 4.4.1 Model specifications Regression Probit. Section 5 presents the results of the econometric model of health, 5.1 Descriptive analysis and 5.2 Results of the Probit model. Finally, section 6 shows

the conclusions and future lines of research.

2. Review of the literature: status of the issue

Sigerist (1941), stated that health implies besides the absence of disease, a positive aspect. The ultimate exponent of this broad perspective of the conception of health is the definition of WHO contained in its fundamental letter of April 7, 1946 and conceived in 1945 originally by Stampar "health is a state of complete physical, mental and social well-being and not just the absence of diseases, "Orozco (2006), It should be noted that Terris (1975), establishes a definition of health that seeks to overcome a number of critiques of the WHO definition (for example, equating well-being with health). Denoting that health is "a state of physical, mental and social well-being with capacity to function and not only the absence of illness or disability.

2.1 Social epidemiology and determinants of health

Berkman and Kawachi (2000), establish that social epidemiology has devoted its studies to the social determinants of health and social distribution. In addition, for Krieger and Higgins (2002), social epidemiology focuses on investigating the social determinants of health, disease and well-being distributions in populations, rather than considering these determinants as a simple variable for biomedical phenomena. Recently, the three theories developed by social epidemiologists are: a) psychosocial, b) social production of disease and / or political health economics, and c) ecosocial theory and related multi-level conceptual frameworks.

2.2 Determinants of health

After the conceptualization of health were developed pioneering "models" of health and its determinants, certainly in an era of progress Public Health. A groundbreaking reference is the Laframboise model (1973) applied in Canada and presented by Lalonde (1981), in the document "A new perspective on the health of Canadians", which conceptualizes health beyond disease, as the result of The interaction of a series of variables that can be grouped into four determinants: human biology, environment, lifestyles and health behaviors, and the health care system.

Lalonde's model influenced health policies in most developed countries, as well as the development of WHO's "Health for All by the Year 2000" strategy, but later on it also had its criticisms and modifications because did not stipulate explicitly social, economic and political factors in health production. For this reason, in the Ottawa Charter of 1986, population health focuses on the social and economic determinants of health, leading to models of health determinants including these factors. In this way, Tarlov (1989), structured the determinants of health considering the following determinants: 1) biological, physical and psychic 2) lifestyle 3) environmental and community 4) physical environment, climate and environmental pollution 5) macrosocial structure, politics and population perceptions. In addition, we have the model reference of Dahlgren and Whitehead (1992), in which the basis are the characteristics and genetic factors of individuals that determine health conditions.

Health determinants are lifestyle-based properties affected by broad social, economic, and political forces that influence the quality of personal health (PAHO, 2013). In other cases, socio-economic factors such as political, economic, social, technological, and environmental factors are called "social determinants of health (SDH)" and are considered critical to affect health outcomes around the world(Kamiya and Yusuke ,

2011). Also, social determinants of health can be considered to explain most of the health inequities, that is, the unjust and avoidable differences observed in and between countries in terms of health status (WHO, 2016). Therefore, it can be said that the study of social determinants is born as a response to the restrictions of the vision of health oriented only to the risks of disease, considering from these individual risk factors towards the social and structural models that determine the opportunities to be healthy.

2.3 Self-perceived health and perceived quality of health assistance

Similarly, to what happened with the concept of health and its determinants, indicators are constantly changing according to cultural, economic and social mutations, trying to cover different dimensions of health (Ware, 1987). Health indicators can be distinguished into two types: objective and subjective ones. Among the subjective indicators is self-perceived health, which refers to an individual's self-assessment or consideration of his / her own state of general well-being or clinical state of health.

Self-perceived health is one of the most used health indicators in the investigation of social inequalities in health, since it is considered a faithful reflection of the state of health in which the individual is. The importance of its measurement lies in its strong association with the probability of suffering chronic diseases. (Morcillo, Cáceres, Domínguez, Rodríguez and Torijano, 2014) People with a negative self-perception of their health tend to suffer more often disorders related to depression and anxiety, and likewise, the subjective perception of general health itself is directly related to objective measures of the health status and mortality of the population; the measurement of subjective aspects related to health is being used in many current epidemiological studies, since it allows the discovery of novel information on the physical, social and psychic components of health (Gómez and Moya, 2013).

Self-perceived health is determined by many factors, for example; Age, sex, socioeconomic status, emotional problems and even the type of television advertising. Some studies indicate that lower socioeconomic groups tend to value their health worse. (Morcillo et al., 2014).Individuals who perceive their health as low tend to use medical services more frequently and have a greater absence in their work, compared with those who have the opposite attitude toward their health, coupled with the fact that epidemiological data indicates that a higher level of education, higher income, no smoking, recreational physical activity, being male, psychological well-being and high self-esteem are associated with higher self-rated health (Kaleta, Polańska, Dziankowska, Hanke and Drygas, 2009).

https://pdfs.semanticscholar.org/58d6/7ff6c145c0a4b8902571d00c9baa8835b5d5.pdf
Article 18- Percevied health services Latin America

3. Economic development and Health indicators in Honduras

Table 1 shows the evolution of real value-added of Manufacturing per head (QMH) and real Gross Domestic Product per head (GDPH) and real value-added of Non Manufacturing Activities per head (QNMH), for the period 2000-2010, as well as the Population in both years, of several countries of North and Central America, and the World average.

We may notice that Honduras has experienced an increase of real Gross Domestic

Product, thanks to the development of several non manufacturing activities, but the country needs to increase the low values of real value of manufacturing per head, because it has an important positive impact on non manufacturing activities and economic development. The values of QMH in Honduras are below the World average and much lower than in Mexico.

Table 1. Economic development of 11 American countries and Population, 2000-2010

Country name	QMH 2000	QMH 2010	GDPH 2000	GDPH 2010	QNMH 2000	QNMH 2010	POP 2000	POP 2010
Costa Rica	2029	1764	8117	10377	6088	8613	3929	4659
Dominican R.	1289	1929	4957	8387	3668	6458	8265	9927
El Salvador	1244	1196	4974	5981	3731	4785	6280	6193
Guatemala	832	858	3963	4292	3131	3434	11166	14389
Haiti	163	137	1190	996	1027	860	7939	9993
Honduras	667	669	2898	3519	2231	2850	6424	7600
Jamaica	633	619	5758	6883	5125	6264	2589	2702
Mexico	2414	2239	12071	12441	9657	10202	97966	113423
Nicaragua	296	418	2115	2613	1819	2195	4959	5789
Panama	815	732	8149	12206	7334	11474	2950	3517
USA	6257	5499	39108	42297	32851	36798	282224	309349
America	3312	3052	19865	21908	16553	18856	813445	912549
World (132)	1494	1728	7905	9852	6411	8124	5863730	6647073

Source: Guisan and Aguayo(2015) from World Bank indicators. Notes: American average is the mean of 22 American countries included in that study. QMH=real value-added of Manufacturing per inhabitant, QNMH=real value-added of non Manufacturing per inhabitant (QNMH=GDPH-QMH), GDPH=real Gross Domestic Product per inhabitant. Values of these variables in Dollars at 2005 prices and Purchasing Power Parities (PPPs). Population in thousands.

Table 2. **Health indicators of Honduras in comparison with Mexico and Costa Rica**

Indidcator	Honduras	Mexico	Costa Rica
Life expectancy at birth m/f (years, 2016) (M/F)	73/78	74/79	77/82
Probability of dying under five (per 1 000 live births, 0)	not available	not available	not available
Probability of dying between 15 and 60 years m/f (per 1 000 population, 2016)	172/119	164/89	126/66
Total expenditure on health per capita (Intl $, 2014)	400	1,122	1,389
Total expenditure on health as % of GDP (2014)	8.7	6.3	9.3

Source: WHO(2017). Note: Data correspond to years around 2014 and 2016.

We may notice important differences between Honduras and Costa Rica, due to the higher level of development of Costa Rica what has positive impact on the increase of life expectancy (Males 73 years in Honduras and 77 in Costa Rica, Females 78 years in Honduras and 82 in Costa Rica. The probability of dying between 15 and 60 years is lower in Costa Rica than in Honduras. Total expenditure per capita is much higher in Costa Rica due to its higher level of economic development.

4. Model and methodology

4.1 Structure of the proposed health model

This article uses as a theoretical model to base the econometric model, the conceptual framework of the potential determinants of health established by the WHO Health Commission (see figure 1):

Figure 1. Conceptual framework of the social determinants of health.
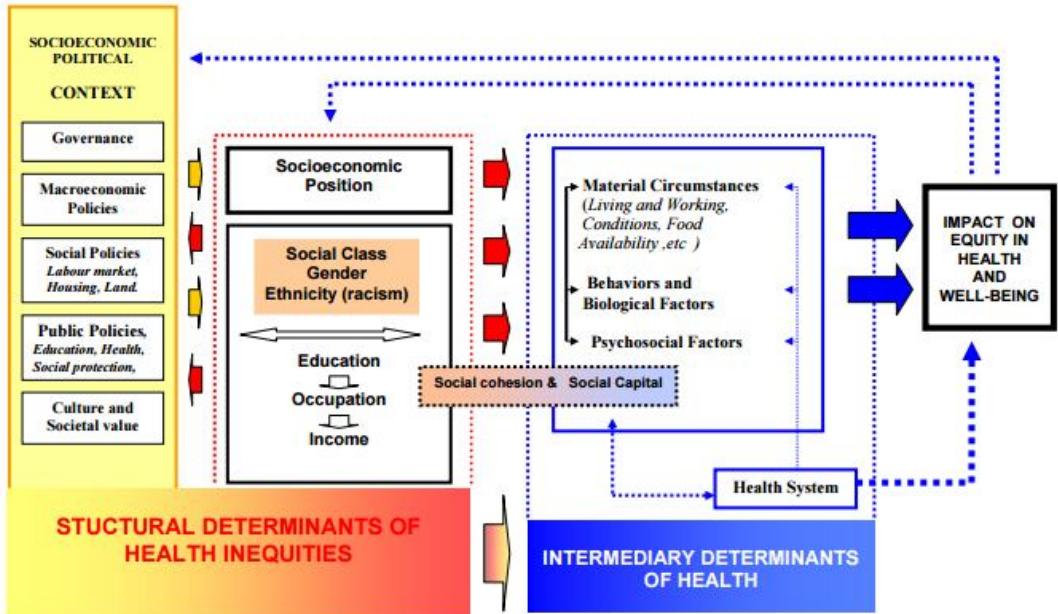
It should be noted that the social determinants of health explain most of the health inequities, that is, of the unfair and avoidable differences observed in and between countries in relation to the health situation. Thus, in response to the growing concern about these persistent and growing inequalites, the World Health Organization established in 2005 the Commission on Social Determinants of Health to provide advice on how to mitigate them. The conceptual framework of WHO potential determinants of health allows us to establish perceived health according to a series of explanatory variables, more specifically:

Perceived health = f (age, gender, social class, labor activity, number of dependents, housing tenure, tobacco consumption, alcohol consumption, physical activity in leisure time, body mass index, frequency with which one becomes ill, number of drugs consumed, use of the emergency department, hospitalization).

4.2 Design of the survey

The instrument consisted of 14 sociodemographic and health variables: gender, age, social status, work activity, number of dependents, housing tenure, smoking, alcohol consumption, physical activity in leisure time, body mass index, frequency of illness, use of medications in the last two weeks, use of emergency services and hospitalizations in the last six months.

4.3 Population, sample and design

The target population of the localities in analysis was made up of the inhabitants of the three departmental heads: Cortes department, San Pedro Sula: 700,852, department of Francisco Morazán, Tegucigalpa: 1,083,984 and Santa Bárbara, Santa Barbara: 25,495 inhabitants. The type of sample design applied was structured to avoid the problem of "selection bias" and that the sample did not represent the study population. It should be noted that health sector (or other general) research that does not avoid selection bias, because it generates distorted statistical analyzes (eg, biased averages), and therefore its conclusions are usually incorrect. In this regard, the practice of applying surveys in hospitals or health centers was avoided. In addition, stratified multistage sampling was applied, complying with the randomness characteristic to avoid selection bias.

In summary the stages of the type of sample design were:
1. The first stage units were the identified areas of the localities under analysis.
2. The second stage units were randomly selected conglomerates.
3. Then, in each cluster randomly selected adults (16 years old or older) were selected to apply the questionnaire, making a proportional affixation to adequately represent the proportions of the strati.

The sample size has been determined so that estimates can be obtained with a certain degree of reliability at the level of the population of the localities and to have a representation of the sex stratum, with a confidence interval of 99%, summarizing the results in Table 3.

Table 3. Sample according to stratum

Department Capital	Stratum	Population /Stratum	Proportion	Sample/ Stratum
San Pedro Sula	Women	368.753	52,60%	167
	Men	332.099	47,40%	151
	TOTAL	700,852	100,00%	318
Tegucigalpa	Women	576.987	53,20%	262
	Men	506.997	46,80%	230
	TOTAL	1,083,984	100,00%	492
Santa Bárbara	Women	13.345	52,30%	6
	Men	12.150	47,70%	6
	TOTAL	25,495	100,00%	12

Source: self made, proportional shrinkage with 99% confidence sample.

4.4   Econometric methodology for health models

In this section, we intend to detail how it is estimated the structure of the proposed health model (see section 3.1), using an econometric model, where the positively perceived health atory or independent variables measured in n individuals.

The results variable (dependent variable) is the positive perception of health in function of a set of explan of the econometric model allow us to know which variables are social determinants of the positively perceived health of the whole set of potential explanatory variables that were initially considered, this in econometric terms is; Which is statistically significant, and then estimate the marginal effect of each of these social determinants on perceived health, keeping the rest of the variables constant to make the interpretation of results. In general, the stages of the econometric methodology are:

1) Specification of the model
2) Estimation of the model
3) Evaluation of the estimates

Table 4: Classification of the explanatory variables.

Variable	Definition	
	Description	**Representation in the model**
Variables of social environment: Includes sociodemographic characteristics and of the interviewee´s home.		
Age	Gives a value of 1 when the individual of age is higher or equal to 36, and 0 otherwise	x_{1i}
Sex	Gives a value of 1 when the individual of sex is women and 0 when it´s men.	x_{2i}
Social class	Gives a value of 1 when the individual of social class is high and 0 otherwise.	x_{3i}
Employment situation	Gives a value of 1 when the individual is employed and 0 otherwise.	x_{4i}
Number of dependents	Gives a value of 1 when the individual has less than 3 dependents or none and 0 otherwise.	x_{5i}
Living place	Gives a value of 1 when the individual has his own living place and 0 otherwise.	x_{6i}
Life style variables: Includes costumes and living habits that could influence health.		
Smoking	Gives a value of 1 when the individual does not smoke and 0 otherwise.	x_{7i}
Alcohol intake	Gives a value of 1 when the individual consumes alcohol and 0 otherwise.	x_{8i}
Physical activity during free time	Gives a value of 1 when the individual does physical activity during free time and 0 otherwise.	x_{9i}
Body mass index (BMI)	Gives a value of 1 when the individual has a normal BMI and 0 otherwise.	x_{10i}
Use of sanitary services variables: Includes the use of sanitary services by the population, including private services, not only public.		
Frequency of sickness	Gives a value of 1 when the individual does not, annually or occasionally gets sick and 0 otherwise.	x_{11i}
Number of medicines consumed in the last two weeks	Gives a value of 1 when the individual who has not consumed medicines in the last two weeks and 0 otherwise.	x_{12i}
Use of emergency services in the last twelve months	Gives a value of 1 when the individual who has not use emergency services and 0 otherwise.	x_{13i}
Hospitalizations in the last six months	Gives a value of 1 when the individual who has not been hospitalized in the last six months and 0 otherwise.	x_{14i}

Source: Own elaboration, march 2017

The survey design shows that most of the variables have ordered categories. In the case of the perceived health variable, it has five categories that will be used to define a positively perceived health variable, more specifically to define it as a binary variable that takes the value 1 and 0.

The given value is 1, when the value is:
- Very good
- Good

The given value is 0, when the value is:
- Normal
- Bad
- Very bad

Similarly, in the case of explanatory or independent variables there were five categories and they were transformed into binary variables. For this, a broad group has been classified into four groups: social environment variables, morbidity and disability variables, life style variables and health service use variables. As in the case of the perceived health variable, the following definitions are made for explanatory variables (see Table 4).

3.4.1 Specifications of the probit regression model

To specify the model, we have to consider that the perceived state of health is the variable of perceived health. Let's assume that the perception can be expressed as an utility (satisfaction) of the positive perceived health as "Very good" or "Good" in a lineal index expressed in function of the explanatory variables ($x_{1i}, \dots \dots x_{14i}$) and a stochastic error term (ε_{1i}): $V_{1i} = \pi_0 + \pi_1 x_{1i} + \cdots \dots \dots + \pi_{14} x_{14i} + \varepsilon_{1i}$, where i=1,……..824 individuals. In the same way. The utility of the individual perceived health as "normal, "Bad", "Very bad"), depends of the explanatory variables and a stochastic error term: $V_{0i} = \delta_0 + \delta_1 x_{1i} + \cdots \dots \dots + \delta_{14} x_{14i} + \varepsilon_{0i}$. The individual will manifest his state of perceived health positively if: $V_{i1} > V_{i0}$ equals to $V_{1i} - V_{0i} > 0$.

Now we define the latent variables Y_i^* as the difference of utilities (not directly observed variables): $Y_i^* = V_{1i} - V_{0i}$. Then we can see the value of an individual by result of comparing both utilities:

$$Y_i = \begin{cases} 1 & \text{it has positive perceived healt: } V_{1i} - V_{0i} < 0 \\ 0 & \text{otherwise:: } V_{1i} - V_{0i} \leq 0 \end{cases}$$

The latent variable Y_i^*, is a lineal index of comparison of non-directly observed utilities: $Y_i^* = \beta_0 + \beta_1 x_{1i} + \cdots \dots \dots + \beta_{14} x_{14i} + u_{1i}$, where u_{1i} is a stochastic error term.

The idea is to estimating the "average" relation between a positive perceived health variable in binary form presented in function of all explanatory variables:

$E(x_{1i}, \dots \dots x_{14i})$, where E is the mathematical expectation, and represents the average relationship. Then, we can expose the average relationship using a probabilistic relationship, since the perceived health by an individual, Y_i, is a binary variable:

The next step is selecting a distribution function of the stochastic error term, to complete the specification of the econometric model and calculate the probability. In our case, we used a normal distribution function considering its symmetric characteristic:

$$\beta_0 + \beta_1\, x_{1i} + \cdots \ldots \ldots . + x_{14}$$

Where F represents the normal distribution function. With this, we obtain the probit regression model:

$$prob(x_{1i}, \ldots \ldots \ldots, x_{14i}) = F(x_{1i}, \ldots \ldots \ldots, x_{14i}) = F(x\beta),$$ where

$x\beta = \beta_0 + \beta_1\, x_{1i} + \cdots \ldots \ldots + \beta_{14} x_{14i}$ and $prob(x_{1i}, \ldots \ldots \ldots, x_{14i})$ is   the probability of a positive perceived health. This implies that the normal density function is:

$$\frac{dF(x\beta)}{dx} = f(x\beta) = \frac{e^{-\frac{1}{2}(x\beta)^2}}{\sqrt{2\pi}}$$

In other words we applied a probit regression econometric model for binary values, one of the non-lineal models most used, where the observed perceived health variable, yi, takes values of 0 and 1 only, going from the utility (satisfaction) represented in the perception of the original variable with five categories ("Very good", "Good", "Normal", "Bad" and "Very bad").

In contrast of a lineal regression model, the coefficients of the probit non-lineal model ($\beta_0, \beta_1, \ldots \ldots, \beta_{14}$) shouldn´t be interpreted directly, but in the start they are used to know if a explanatory variable is a social determinant of the perceived health variable, it´s statistically significant in econometric terms. To do an interpretation, we calculate "the marginal effects" of the explanatory variables over the positive perceived health. Finally, for estimating the probit model we use the verisimilitude maximum method, that consists of calculating the probability of the parameters ($\beta_0, \beta_1, \ldots \ldots, \beta_{14}$) in function of the observed sample.

5.   Results of the econometric model of health
5.1 Descriptive analysis

The data that is available for the estimation are of cross section obtained by a survey applied in three department capitals of Honduras. All the variables included in the database are binary. The descriptive statistic of these variables are shown in table 5. In average, the positive perceived health was of a 40.5% of the Population in analysis and the explanatory variables denote the following results:

1) With regard to social environment variables, 53.2% belong to the female gender, 19.2% are older than 35, 3.9% are from a high social stratum, 6.6% are employed, 97.1% have fewer than three people Depend on them, and 30.7% have their own home.

2) In life habits, 85.4% have never consumed tobacco, 60.2% have never consumed

alcohol, 39.1% do physical activity during leisure time, and 46.5% have normal body mass index.

3) The use of health services shows that 86.7% have never been ill or become sick annually, 53.1% have not consumed medications in the last two weeks 88.4% have not used emergency services and 93.3% have not been hospitalized in the Last six months.

Table 5: Descriptive statistics of the variables

Variable	Average	Standard deviation
Positive perceived health	40.5%	0.49
Sex	53.2%	0.50
Age	19.2%	0.39
Social class	3.9%	0.19
Labor activity	6.6%	0.25
Number of dependents	97.1%	0.17
Living place	30.7%	0.46
Smoking	85.4%	0.35
Alcohol intake	60.2%	0.49
Physical activity in free time	39.1%	0.49
Body mass index (BMI)	46.5%	0.50
Frequency of sickness	86.7%	0.34
Medicine consumption	53.1%	0.50
Use of emergency services	88.4%	0.32
Hospitalizations	93.3%	0.25

Source: Own elaboration

5.2 Results of the probit model

As mentioned before, the estimated coefficients, at first, didn´t have a direct interpretation but they are helpful to find all the explanatory variables included in the model, which are social determinants. Table 6 shows the estimated parameters in the probit model ($\hat{\beta}_0, \ldots, \hat{\beta}_{14}$) with their standard deviation, their statistic value of z and p value, respectively. The criteria used to determine if an explanatory variable is a positive perceived health determinant is: p value<0.05, this implies it has a 5% statistical significance.

With the criteria established (p value less than 0.05), the fourteen explanatory variables initially considered, nine were social determinants: sex, age, social class, labor activity, living place, smoking, physical activity in free time, frequency of sickness and medicines consumption.

It implies that the variables: number of dependents, alcohol intake, body mass index, use of emergency services and hospitalizations, are not significant statistically for

explaining the "average" of the positive perceived health, in other words, they are not social determinants for the population of the analyzed communities. For example, in average, the population doesn´t considers the BMI as a determinant of positive perceived health, probably because when people doesn´t considers their weight as a determinant of health, but they do consider the physical activity in free time.

Likewise, on average, alcohol consumption is not considered a social determinant of perceived health, but smoking is considered a determinant. In addition, not using an emergency service in the last 6 months is not considered on average as a social determinant of perceived health, and the frequency with which they become ill it´s considered a determinant. It was found that hospitalization was not considered a social determinant of perceived health, however, the consumption of medication was considered determinant. The number of people who depended on them wasn´t considered a determinant of the health perceived in the study population, probably because the work activity was a determinant.

Table 6: Parameters estimated in the probit model

Variable	Estimated parameter	Standard deviation	Statistic Z	p value
Sex	0.40	0.11	3.63	0.00
Age	-0.55	0.16	-3.31	0.00
Social class	0.66	0.28	2.38	0.02
Labor activity	0.45	0.20	2.23	0.03
Number of dependents	0.31	0.34	0.93	0.35
Living place	0.29	0.12	2.41	0.02
Smoking	0.49	0.16	3.03	0.00
Alcohol intake	0.02	0.11	0.15	0.88
Physical activity in free time	0.52	0.11	4.93	0.00
Body mass index (BMI)	0.11	0.10	1.02	0.31
Frequency of sickness	0.38	0.17	2.20	0.03
Medicines consumption	0.24	0.11	2.29	0.02
Use of emergency services	0.28	0.20	1.40	0.16
Hospitalization	0.46	0.27	1.70	0.09
Constant	-2.7	0.48	-5.62	0.00
Pseudo R2	0.14			
Log likelihood	-438.0			

Source: Own elaboration

However, using the estimated parameters we proceed to estimate the "marginal effects" of the probit model presented in Table 7, with the objective of interpreting the effect of each identified social determinant on positively perceived health.

Table 7: Probit model marginal effects

Variable	Marginal effect	Standard deviation	Statistic Z	p value
Sex	0.15	0.04	3.63	0.00
Age	-0.19	0.05	-3.31	0.00
Social class	0.26	0.10	2.38	0.02
Labor activity	0.18	0.08	2.23	0.03
Number of dependents	0.11	0.11	0.93	0.35
Living place	0.11	0.05	2.41	0.02
NOT Smoking	0.17	0.05	3.03	0.00
Alcohol intake	0.01	0.04	0.15	0.88
Physical activity in free time	0.20	0.04	4.93	0.00
Body mass index (BMI)	0.04	0.04	1.02	0.31
Frequency of sickness	0.14	0.06	2.20	0.03
Medicines consumption	0.09	0.04	2.29	0.02
Use of emergency services	0.10	0.07	1.40	0.16
Hospitalizations	0.16	0.08	1.70	0.09
Average probability	0.38			
Pseudo R2	0.14			
Log likelihood	-438.0			

Source: Own elaboration

In general, the expected probability of positive perceived health of an average individual is 38%. If we determine the social determinants previously identified (statistically significant) according to the greater magnitude of their marginal effect on perceived health, we obtain that according to their relevance are: social stratum, physical activity in free time, age, employment status, smoking sex, frequency of sickness, living place, medicines consumption.

The interpretation of the marginal effect of each marginal variable is as follows: women have 15% more positive perceived health than men; The probability of positive perceived health decreases by 19% if a person is over 35 years old; as the social stratum increases, the positively perceived health probability increases by 26%; if a person is employed, the positively perceived health probability increases by 18%; when an individual doesn´t smoke the positively perceived health probability increases by 17%.

When a person exercises in their free time, the probability of health perceived positively increases by 20% and if he becomes ill with little or no frequency, it increases by 14%. If in the last two weeks, the individual has not consumed any medication, the positively perceived health probability increases by 9%. Likewise, if an individual has never used an emergency service, positively perceived health increases

by 10% and if the person has not been hospitalized in the last six months, positively perceived health increases by 16%.

5. Conclusions and future lines of research

The analysis of information on the health of the population is a fundamental element for the design and evaluation of policies and programs of the health system. At the regional level and in particular in Honduras, the health conditions of the population are still measured through indicators of morbidity or mortality, without taking into account the social conditions of the population that largely determine their health.

The study emphasizes that health research should avoid selection bias as it produces distorted statistical analysis (eg, biased averages), and therefore usually incorrect conclusions. In this regard, the practice of applying surveys at hospitals or health centers was avoided. In addition, stratified multistage sampling was applied, complying with the randomness characteristic to avoid selection bias.

In this study, it was found that according to the estimated parameters of the probit model, of the 14 explanatory variables for positive perceived health, 9 were social determinants ($p < 0.05$): Gender, Age, Social status, Work activity, Tenure of housing, tobacco consumption, physical activity in leisure time, frequency of illness, and number of drugs consumed. And 5 are not: number of dependents, alcohol consumption, body mass index, use of emergency services, and the use of hospitalization services.

However, special attention should be given to the 5 variables that were excluded, because overweight measured by body mass is a cardiovascular risk factor predisposing to serious diseases such as acute myocardial infarction, heart failure, high blood pressure, valvular disease, stroke and cardiac arrhythmias. These diseases are currently the leading cause of death in the United States and are becoming more frequent in Honduras. This is where the importance of the results of this research, which must be taken into account in order to carry out a strategic health plan of Honduras, where public intervention policies are aimed at educating the population about the importance of healthy eating and avoiding overweight and obesity, because although it is a risk factor, it can be modified with a healthy lifestyle. Alcohol consumption, although not described as a cardiovascular risk factor when performed in a moderate way, can be cause digestive bleeding, economic problems, family impact, social effects and traffic accidents that often cause severe cranioencephalic traumas in patients whose costs are onerous for family members and public hospitals. For all of the above, it is extremely urgent to improve public health policies to prevent morbidity and mortality of the population.

In general, the expected probability of health perceived positively for an average individual is 38%. Women have 15% more health perceived positively than men, this can be explained due to the lifestyle of men that induces them to suffer diseases with higher risk of early death, while women are more prone to non-fatal diseases. Also, we can mention the men chauvinism of Honduran society, where men are taught that they can not cry, they can not get sick, so it is not common to see a man in a care center, which makes them seek health care in extreme cases when diseases are advanced.

Another relevant variable is age, which marks differences in perception, more specifically the probability of perceived health positively decreases if a person is older

than 35 years and as the person rises in social stratum, the probability of perceived health positively increases.

It is proposed to carry out more research on the social determinants of the perceived health of the Honduran population, relating it to the quality of life. In addition, it aims to expand the study of perceived health at the national level.

References

Berkman, L. F. and Kawachi, I. (2000), *Social epidemiology*. New York. Oxford University

Bildirici, M., and Sunal, S. (2006), Economic determinants of development in world economy, 1820-2005. an analysis of 165 countries. *Applied Econometrics and International Development.* Vol 6(3), 5-30

Dahlgren, G. and Whitehead, M. (1991), *Policies and Strategies to Promote Social Equity in Health*. Stockholm, Sweden: Institute for Futures Studies.

Dahlgren, G. and Whitehead, M. (1992), *Policies and strategies to promote equity in health*. Copenhagen, WHO Regional Office for Europe (document number: EUR/ICP/RPD 414 (2); http://whqlibdoc.who.int/euro/-1993/EUR_ICP_RPD414(2). pdf, accessed 15 May 2006)

Dever, A. (1976) An epidemiological model for health policy analysis. *Soc Ind Res*, (2): p. 453-466.

Gómez, M. A. y Moya, N. M. (2013), Estudio de las dimensiones de la salud autopercibida en mujeres adultas. [Citado 2016 Jun 26]; *Rev Esp Comun Salud.* Vol. 4 No. 2, p 93-103. Available in: http://www.aecs.es/4_2_3.pdf

Guisan, M.C., Aguayo, E. (2015). "Manufacturing and Development in Countries and Areas of America, 2000-2010", *Regional and Sectoral Economic Studies,* Vol. 15-1.

Guisan, M.C. Exposito, P. (2016), Life expectancy, education and development in african countries 1980-2014: improvements and international comparisons. *Applied Econometrics and International Development.* Vol. 16-2, p 87-108.

Kaleta, D., Polańska, K., Dziankowska, Zaborszcyk E., Hanke W. Drygas W. (2009), Factor influencing self-perception of health status. [Citado 2016 Jun 26]; *Cent Eur J Public Health*. Vol 17 No. 3 P 122-127. Available in: https://www.researchgate.net/publication/40728100_Factors_influencing_self-perception_of_health_status

Kamiya and Yusuke. (2011). **E**ffects of health systems and socioeconomic factors in reducing child mortality in developing countries: empirical results from system generalized method of moments**.** *Applied Econometrics and International Development*. Vol. 11-2, 29-42

Krieger, J. and Higgins, D. L. (2002), Housing and Health. Time Again for Public Health Action. *American Journal of Public Healt*. Vol. 92-5, 758–768. DOI: 10.2105/AJPH.92.5.758

Laframboise, H. L. (1973), Health policy: breaking the problem down into more manageable segments. *Can Med Assoc J*. Feb 3; 108(3): 388–passim.

Lalonde, M. (1981), *New perspective on the health of Canadians a working document*. Ontario; Minister of Supply and Services; p. 77

Lantz, P. M., Lichtenstein. R. L. and Pollack, H. A. (2007), Health policy approaches to population health: the limits of medicalization. *Health Aff (Millwood)*. Sep-Oct;26(5):1253-7.

Lee, P. R.., Moss, N., and Krieger, N. (1995). Measuring social inequalities in health. Report on the Conference of the National Institutes of Health. *Public Health Reports*. 110(3), 302–305.

Marmot, M. (2004), Status síndrome. *Significance*. Vol. 1-4, 150–154. DOI. 10.1111/j.1740-9713.2004.00058.x

Morcillo, C. V., Cáceres, A. A., Domínguez, R. de L. P., Rodríguez, B. R., Torijano, C. M. J. (2014), Desigualdades en la salud autopercibida de la población española mayor de 65 años. Gac Sanit [Internet]. Dic [citado 2016 Jun 26] ; 28(6): 511-521. http://dx.doi.org/10.1016/j.gaceta.2014.05.008.

Orozco, A. J. (2006), *Evaluación de la aplicación de políticas públicas de salud en la ciudad de Cartagena.* S. I. eumed.net. ISBN: 9788469015575

Parascandola, M. (2001), Cigarettes and the US Public Health Service in the 1950s. *Am J Public Health.* February; 91(2): 196–205.

Phelan, Jo. C., Bruce, G. L., Roux, A. D., Kawachi, I., and Levin, B. (2004), "Fundamental Causes" of Social Inequalities in Mortality: A Test of the Theory. *Journal of Health and Social Behavior* . Vol 45, Issue 3, pp. 265 – 285.

PAHO.org [Internet]. Organización Panamericana de la Salud [actualizado 2013 Enero 15; citado 2016 Junio 25]. Available in: http://www.paho.org/hq/index.php?option=com_content&view=article&id=5165%3A2011-determinants-health&catid=3483%3Aabout&Itemid=3745&lang=es

Rose, G. (2001), Sick individuals and sick populations. *International Journal of Epidemiology*. Vol.30-3, 427–432. DOI: 10.1093/ije/30.3.427

Sigerist, H. E. (1941), Laudanum in the works of Paracelsus. *Bull Hist Med*. 9: 530–44.

Tarlov, A. R., Ware, J. E., Greenfield, S., Nelson, E. C., Perrin, E. and Zubkoff, M. (1989), The Medical Outcomes Study. An application of methods for monitoring the results of medical care. *JAMA*. 262:925–30. DOI: 10.1001/jama.1989.03430070073033

Terris, M. (1975), Approaches to an Epidemiology of Health. *The American Journal of Public Health*, Vol. 65, No. 10, 1037-1045.

WHO. Determinantes sociales de la salud. Available in: http://www.who.int/social_determinants/es/

WHO.int [Internet]. Organización Mundial de la Salud [actualizado 2016; citado 2016 Junio 25]. Available in: http://www.who.int/suggestions/faq/es/

WHO(2017). Statistics of Health Indicators, http://www.who.int/countries/hnd/en/

Wilkinson, R. and Marmot, M. (2003), Social Determinants of Health: The Solid Facts. 2ed, Copenhagen.