



ANALYSIS OF CARDIOVASCULAR EFFECTS IN RIOBAMBA MERCHANTS THROUGH NEUROECONOMICS AND NEUROHEALTH

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Summary:

The sudden appearance of the COVID 19 pandemic had serious physical, psychological and economic effects on the entire population, our country Ecuador was no exception. The consequences of the aforementioned pandemic still remain today, for example, there are diseases associated with cardiovascular malfunction, stress, lack of sleep, and among others. The present study focuses its research on clearly describing the post-covid affectations suffered by merchants of the markets of the city of Riobamba, for this a collection of data of medical assessments is carried out to 46 merchants, later through descriptive statistics the most frequent diseases and the most common ages in which these characteristics have been presented are established. The objective of the research is to identify how to reduce cardiovascular diseases, neuroeconomic behavior and the contribution of neurohealth in the traders of the Ecuadorian markets.

Keywords: Economic recovery, neurohealth, neuroeconomics, cardiovascular diseases

INTRODUCTION

What is intended with this research is through neuroeconomics and neurohealth which merge from the project of linkage Neuromarketing and Coaching for the economic reactivation of the merchants of the Riobambeños markets where teachers of Medicine and Administration and Economics intervene, in this sense it is intended to determine disease behaviors and be able to measure it through biometric equipment which will yield quantitative results that demonstrate what happens in the heart diseases of these subjects when making decisions and reducing their health, and these results will later be analyzed and interpreted by expert criteria, and with these results will proceed to formulate and propose strategies that allow from the Neuroeconomy. It is responsible for the study of the decisions that an individual must go through at all times, within the behavior of people, "accepts dark behaviors (...) understanding each aspect of it for the differentiation of markets" (Cisneros, 2012. p.21).

Marc Dante & Kliegman (2019) explains that we diet and a few months later we see with satisfaction that the button of the pants closes without forcing it. We started a new weight routine and a few weeks later, in front of the mirror, we appreciate a muscle that begins to mark. These and all the other decisions we make about our bodies and about any other matter are managed by the brain, but we do little to improve the health of the organ that determines how we live our lives.

People live confused because one day they read in the media that a certain thing is good for health and the next day they read the opposite. So, the important thing is to access information based on scientific studies to begin with, it is convenient to know that, contrary to what we believe, human beings have in our hands much of our health. Manes, F., & Niro, M. (2015)

It is true that genetic inheritance influences, but in 60 or 70% the health of our body and brain, depends to a large extent on lifestyle, the decisions we make and, of course, environmental conditions. That's why I say that the zip code is more important than the genetic code. In our intestine live microorganisms that weigh about two kilos. E., Horta, ., Marí, R., & Pérez, A. (2015). It invites us to compare this weight with that of the brain, which is usually 1.5 kilos, we can realize the important portion that these beings represent in our body. Dr. Marín explains that recent neurofeeding research sheds many lights on the important connection between brain health or disease and the presence of bacteria, fungi, viruses and yeasts that inhabit our intestinal tract.

This is just a sample of the importance of these microorganisms for brain health. There are about a thousand species of bacteria that would be directly related to moods, longevity, weight, physical capacity, and that are being investigated. Viosca, J. (2019).

Prolonged use of antibiotics, which severely affect the intestinal flora," says Marín. In short, we must ensure the health of the intestinal microbiota with probiotics, which are basically all fermented preparations (drinks, yogurts, *kombucha*, cheeses) that help repopulate our body with beneficial bacteria, and prebiotics, foods from which these microorganisms are nourished, such as fiber that comes from various legumes and vegetables.

For the present research, the qualitative approach was considered as a method to analyze the social environment through these data to collect information data that served as support for the research. This approach was used to understand the phenomena of neuhealth and neuroeconomics.

METHODS

The city of Riobamba, capital of the province of Chimborazo, is located in the central area of Ecuador, characterized by a cold climate and low humidity. One of the main economic activities of the city develops the commercialization of food products from the agriculture of the area. The merchants dedicated to this productive activity were widely affected by the unexpected arrival of the COVID 19 pandemic, which affected the general population producing health complications, decrease of customers in the markets and consequently devaluation of economic income to the merchants. While it is true that the health situation has improved, there were still physical, psychological and emotional sequelae that continue to affect the city's vendors. The city of Riobamba has approximately 4000 merchants in different markets, however, of these people there is a smaller number who have suffered some type of health impact; The study focused on the investigation of the main sequelae produced.

The population of the present research corresponds to 46 merchants who required primary medical attention for cardiovascular problems.

Patient	Sex	Age	Medical Diagnosis
Patient 1	Female	60	HTA*
Patient 2	Female	74	HTA
Patient 3	Male	90	HTA / CIC*
Patient 4	Female	78	HTN / Mitral regurgitation / Tricupidea / Aortic stenosis

Patient 5	Female	73	HTA
Patient 6	Male	68	HTA / CIC
Patient 7	Female	39	HTA
Patient 8	Male	65	CIC / Heart failure / Multivascular insufficiency
Patient 9	Male	76	CIC
Patient 10	Male	52	HTA
Patient 11	Female	42	HTA
Patient 12	Male	79	HTA
Patient 13	Female	61	HTA
Patient 14	Female	35	HTA
Patient 15	Female	85	Multivascular insufficiency
Patient 16	Female	84	HTA
Patient 17	Male	78	HTA
Patient 18	Female	72	HTA / Neuritis
Patient 19	Female	30	HTA
Patient 20	Female	73	HTA
Patient 21	Male	80	Congestive heart failure HTA / CIC
Patient 22	Female	72	HTA
Patient 23	Male	43	HTA
Patient 24	Male	73	HTA
Patient 25	Female	53	HTA
Patient 26	Male	43	Atrial Fibrillation / Congestive Heart Failure
Patient 27	Female	47	CIC / Heart failure /Multivascular insufficiency
Patient 28	Female	90	CIC / Insufficient. cardiac HTA HTA
Patient 29	Male	50	HTA
Patient 30	Male	53	HTA
Patient 31	Male	90	Insuficiencia mitral / HTA
Patient 32	Female	75	HTA
Patient 33	Female	73	Hippulmonary tension /
Patient 34	Female	44	Multivalvular insufficiency
Patient 35	Female	71	HTA
Patient 36	Female	90	HTA HTA HTA
Patient 37	Female	56	HTA
Patient 38	Female	66	HTA
Patient 39	Female	42	HTA / CIC
Patient 40	Female	73	HTA
Patient 41	Female	49	HTA / CIC
Patient 42	Male	67	HTA
Patient 43	Male	71	
Patient 44	Female	87	
Patient 45	Male	66	
Patient 46	Female	42	

DEFINING VARIABLES

The information used for the study corresponds to the different categories of cardiovascular diseases present in the 46 traders, this variable is of nominal qualitative type. On the other hand,



we sought to establish whether there is any relationship (dependence or independence) between the age of the merchants and cardiovascular affectations.

PROCEDURE AND TECHNIQUES

For the research, as a first step, an informative theoretical review was carried out in previous studies related to the consequences of the COVID 19 pandemic on the physical and psychological part of people, the symptoms that occur, the complications and the possible alternatives to improve these aspects.

Subsequently, as a second step, statistical medical information was collected from merchants in the city of Riobamba who have required assessment and medical procedures due to effects on their cardiovascular health related to the COVID 19 pandemic. For this, the information of 46 merchants who work in the different markets of the city of Riobamba and who presented some type of cardiovascular complication was tabulated, this information was collected in the medical files of the health department of the markets of Riobamba so far in 2022.

As a third step, tabulated information was used to determine through descriptive statistics the characteristics of the analyzed data, then by means of the non-parametric Chi-square statistical test if there is a relationship between the variable "cardiovascular disease" and the variable "age of the traders". Observational, descriptive and correlational statistical techniques were used for research development, with a mixed qualitative and quantitative approach.

Finally, after the proper identification of the information studied, alternatives are proposed in Neuroeconomics and Neurohealth, with the aim of ensuring the economic reactivation of merchants and through motivational procedures improve the neurological and physical part.

SAMPLE AND MEDITIONS

As it is a small population (46 merchants with cardiovascular diseases), the use of a representative sample was not required, the calculations on the population.

In the medical department of the markets, we proceeded to the assessment of vital signs and physical affectations present such as: decrease in hours of sleep, heartbeat, blood pressure, breaths per minute, migraines, etc. Medical assessments are detailed in Table 1.

Table 1. Information collected on cardiovascular effects in merchants in the city of Riobamba

SOURCE: Medical Department of Markets in Riobamba City

HTA : Hipertensión Arterial

CIC : Chronic ischemic heart disease

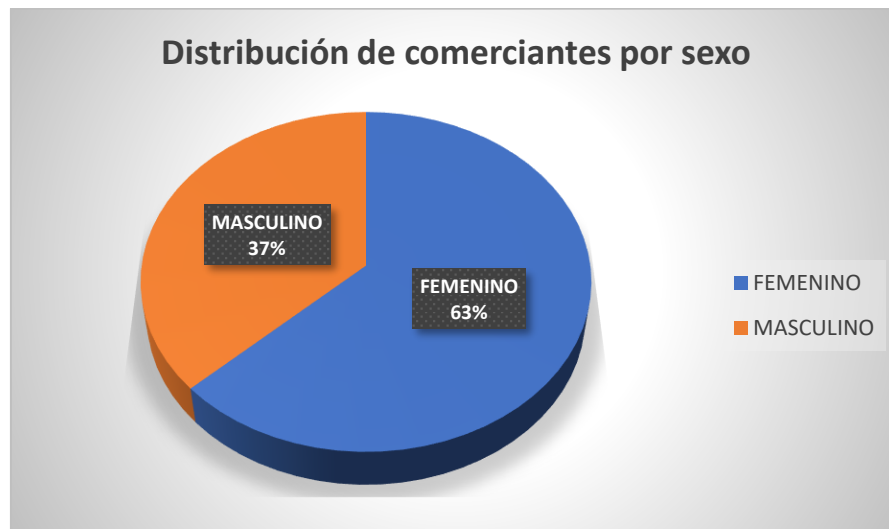
RESULTS

Based on Table 1, in which the frequencies of patients for each cardiovascular disease are measured, we sought to determine the characteristics of the analyzed data through descriptive statistics and hypothesis validation using non-parametric Chi-square test.

Description, summary and population analysis

Population analyzed

Figure 1. Merchants distributed by sex

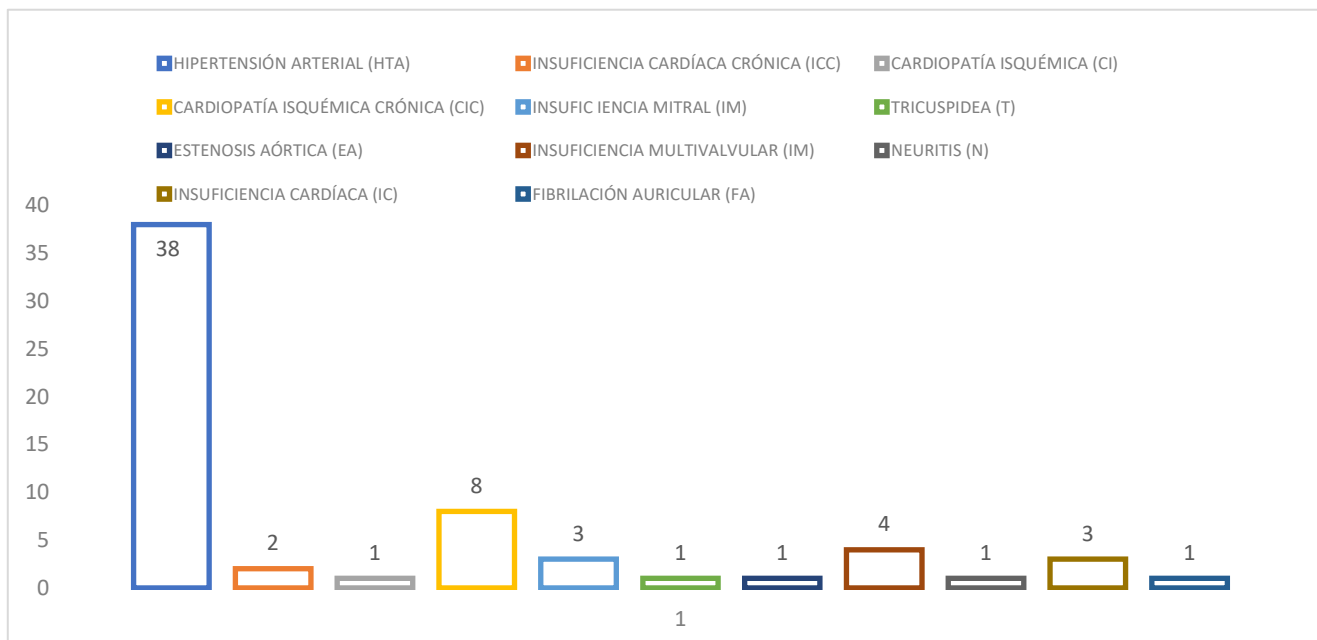


Source: Frequency Distribution Table
Prepared by: Authors.

Figure 1 establishes that most of the population with post-COVID 19 cardiovascular effects corresponds to the female sex. It is also an indicator that the majority of people engaged in commercial activities in the city of Riobamba correspond to women of different ages.

Greater cardiovascular effects

Figure 2. Distribution of cardiac affectations in merchants of Riobamba



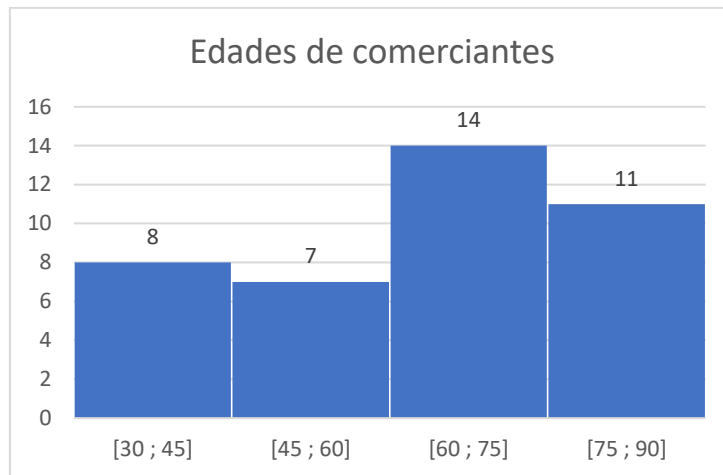
Source: Frequency Distribution Table
Prepared by: Authors.

Figure 2 shows in graphic form the distribution of the affectations detected in the 46 merchants that have been evaluated by the medical department, in this figure it is identified that the greatest

affectation corresponds to HTN (arterial hypertension), secondly, CIC involvement (chronic ischemic heart disease) and in third place HF (heart failure), these being the most frequent in merchants.

Ages of the merchants most affected

Ages of traders with greater cardiovascular effects



Source: Frequency Distribution Table
Prepared by: Authors.

In figure 3, by histogram it is identified that the greatest affectations of the merchants occur in ages between 60 and 75 years, the second highest frequency corresponds to ages between 75 and 90 years, that is, the older the merchants there are more affectations product of COVID 19.

Variable relationship hypothesis.

It is proposed to verify the relationship between analyzed variables, for this it was verified by the chi-square parametric test:

H0> The variables "age of the trader" and "cardiovascular involvement are not related"

H1> The variables "age of the trader" and "cardiovascular involvement are related"

The Chi-square test was used by comparing observed and expected frequencies, obtaining the following tables:

Table 2. Table of observed frequencies (cardiovascular affectations by age)

AGES	CARDIOVASCULAR INVOLVEMENT OBSERVED										TOTAL
	HTA	ICC	CIC	I	SHE	IMU	N	IC	AGO	HP	
[30 ; 45]	10	1	0	0	1	0	0	0	0	0	12
[45 ; 60]	6	0	0	1	0	0	0	1	1	0	9
[60 ; 75]	15	0	0	5	1	0	1	0	0	0	23

[75 ; 90]	7	1	1	2	1	1	0	2	0	1	19
TOTAL	38	2	1	8	3	1	1	3	1	1	63

Table 3. Table of expected *frequencies* (cardiovascular affectations by age)

AGES	EXPECTED CARDIOVASCULAR INVOLVEMENT									
	HTA	ICC	CIC	I	SHE	IMU	N	IC	AGO	HP
[30 ; 45]	7,24	0,38	0,19	1,52	0,57	0,19	0,76	0,19	0,57	0,19
[45 ; 60]	5,43	0,29	0,14	1,14	0,43	0,14	0,57	0,14	0,43	0,14
[60 ; 75]	13,87	0,73	0,37	2,92	1,10	0,37	1,46	0,37	1,10	0,37
[75 ; 90]	11,46	0,60	0,30	2,41	0,90	0,30	1,21	0,30	0,90	0,30

By using tables 3 and 4 you can get the calculated Chi-square value:

$$X_{calc}^2 = \sum \frac{(f_{obs} - f_{esp})^2}{f_{esp}} (1)$$

The result of the application of (1)

$$X_{calc}^2 = 31.67$$

For the tabulated Chi-squared a significance of $\alpha = 0.05$ and 30 degrees of freedom is used.

$$X_{tab}^2 = 43.77$$

Therefore, under the hypothesis contrast:

$$X_{cal}^2 < X_{tab}^2$$

The null hypothesis is not rejected, establishing as a conclusion that the cardiovascular diseases present in the merchants of the city of Riobamba are not related to their age, that is, regardless of the age of the people, cardiovascular affectations are present in all age ranges.

In addition, as part of the diagnosis and the following matrix to measure which feelings prevail, basic emotions and proposals are considered based on the model of Robert Plutchik and adapted to the strategies to be applied in the Riobambeños Markets, this was done thanks to the results of the eye tracking team.






Eye tracking *metric*

Time of first fixation	Participants	March	Cod. Visual	CODE. Linguistic	Average	Total recording duration
Recording1	Participant1	0,40	1,10	0,00	0,50	42,84
Recording2	Participant1	0,73	0,46	3,09	1,43	92,81
Recording3	Participant1	1,06	0,26	3,43	1,58	52,05
Recording4	Participant1	4,55	2,82	4,99	4,12	53,01
Recording5	Participant1	0,00	0,16	3,68	1,28	54,16
Recording6	Participant1	0,00	0,85		0,42	46,48
Recording7	Participant1	0,00	1,82		0,91	43,97
Recording8	Participant1	0,00	0,74		0,37	49,53
Recording9	Participant1	0,39	0,50	4,84	1,91	131,99
Recording10	Participant1	0,00	0,87	2,09	0,99	42,47
Recording11	Participant1	0,01	0,53	3,46	1,33	59,51
Recording12	Participant1		0,00	3,01	1,50	86,66
Average		0,65	0,84	3,18	1,36	62,96
Account		11	12	9		
Variance		1,81	0,62	2,22	0,99	741,97
Standard deviation (n-1)		1,34	0,79	1,49	1,00	27,24

Source: Metrics eye tracking tobii

Interpretation: For this case, an image of an expected future in the markets was used to publicize the feelings that prevail in the merchants and mostly when seeing the markets with a large influx of clientele and that represents an economic growth for their families, the longest time of first fixation of 2.82, since being an element that stands out in large part of the feelings of joy, tranquility, commitment and confidence.

Matrix to measure satisfaction

Ira	Displeasure	Boredom	Sadness	Tranquillity	Joy	Commitment	Confidence
							

DISCUSSION

Once the diagnosis has been made in the merchants of the markets of the Riobamba Canton, fruit of the Neuromarketing and Coaching linkage project for the economic reactivation of the merchants of the Riobamba Canton, it has been possible to verify that the cardiovascular affectations present in the merchants of the city of Riobamba are present in greater frequency in women, That regardless of the age of the people, cardiovascular affectations are present in all age ranges, this is given by the loss in sales, the fear of uncertainty.

A century ago, scientist Karl Pearson had a peculiar finding while looking at tombstones in cemeteries: spouses usually died one year after another, in this sense, studies show that stress and



hopelessness can significantly affect health, especially heart health. One of the clearest examples is takotsubo cardiomyopathy, dubbed broken heart syndrome, in which the death of a partner, financial worries or some other emotional event weakens the muscle with symptoms similar to those of a heart attack. The emotional weight causes the heart to be in a shape similar to that of a Japanese vessel called takotsubo: a wide base and a narrow neck.

This link between our emotions and our heart health is evident so the following is proposed as suggestions to reduce cardiovascular effects in the merchants of the markets of the Riobamba Canton. Perez, E. (2018).

Certain studies prove that thoughts produce chemical substances that intervene in the feeling of each person, these reactions are emotional stimuli, when these substances known as neuropeptides are released, they leave their imprint, which is instant learning in the face of the situation of the moment. (Ruiz H., 2015)

In such a way that, emotional stimuli are thoughts that originate at the time of releasing neuropeptides that exert functions as neurotransmitters, these are able to leave the knowledge or feelings that happen within a given situation

Emotional Economics is responsible for the study of the decisions that an individual must go through at all times, understanding their elements of satisfaction and disappointment, influenced by social pressure within the behavior of people, in addition, "accepts dark behaviors (...) understanding each aspect of it for the differentiation of markets" (Cisneros, 2012. p.21).

Emotional Economy focuses on the behavior of the human being within the social environment that influences when making a decision, and tries to find an explanation for the negative elements present within society that affect the individual in a satisfactory or destructive way, adapting to the environment where he is.

In addition, for the study of the emotions that arise when making a decision, certain hormones intervene that influence the behavior of human beings, being the ones that motivate when selecting the type of product, choosing and finally making the purchase of a product. Viosca, J. (2019). *Brain*

In this sense it is recommended to increase in traders the hormones of happiness through,

Eat healthy. It is estimated that a good dose of daily fiber is 50 grams, but today that intake is at an average of 20 grams. Finally, it should be mentioned that if there is an "enemy" product of the brain and heart, it is refined sugar. "These sugars are neurotoxic and inflammatory. So anything that is ultra-processed, such as soda, should be avoided." It's no secret to anyone that exercise is healthy. But how much does this directly affect brain health and reduce heart disease, a brain has the equivalent of 600 kilometers of blood vessels and as it uses a lot of oxygen that travels through the blood, the brain needs good "pipes". The greater the cardiovascular conditioning, the better the condition of this circulatory framework.

When we exercise, we encourage higher quality breathing and, consequently, the brain will be better oxygenated. Exercise improves bowel function. A recent study showed that you perform a session of between 30 and 60 minutes three times a week. This can lead to an increase in short-chain fatty acids, which are able to improve gut health and encourage the development of No marathons, but just regular exercise, we can reap the benefits of helping the brain eliminate waste from oxidative stress.

Have positive thoughts. As considered by the author Burnett (2018) serotonin is indispensable to feel joy and happiness and to have energy and feel animated throughout the day. Therefore, this author considers that serotonin is a hormone that deals with the transfer of information from one

neuron to another in a particular way, in addition this hormone when released generates well-being, good mood, good memory and also produces energy to continue performing activities, registering a low level of this hormone can produce anxiety, depression or panic attacks.

The hormone oxytocin or better known as love hormone is present in affective feelings, is responsible for the transmission of these to others, creating social bonds, With studies applied in neuroscience appears a new discipline applied to marketing, which allows to measure the levels of attention, recall and emotion of individuals in front of the point of sale in which they are and analyze what happens inside their brain when making a purchase.

In this sense the emotional economy, Neuroeconomics proposes that merchants take into account and also consumption habits are the way in which consumers buy, through custom originated by the constant repetition of acts, which end up being routines to acquire their product, based on instinctive tendencies, individuals are influenced to acquire products due to the mass media that motivates them to take a Purchase Decision . (Herrero, 2013)

In this context, Marcdante & Kliegman (2019) define "hormones as circulating messengers, whose action is carried out at a distance from the organ (gland) origin of the hormone". These are controlled by nerve cells, producing a connection between the endocrine system and the immune system (p.589).

Empathy: we feel and understand people's situations, emotions and life stories.

Respect: humane, dignified and fair treatment.

Integrity: with justice, that is, in accordance with personal and moral principles.

Passion: loving well-being and quality of life.

Responsibility: commit to the obligations acquired.

CONCLUSIONS

This document has allowed us to work as multidisciplinary teams between medicine and Administration, Economics through Neuroeconomics and Nuerosalud analyzing the reality from the Ecuadorian markets of how their health degrades when their emotions are not controlled or when the experiential environment in which they are immersed day by day affect and degrade their health so it is recommended to take care of their health eating healthier, exercising, having positive thoughts reactivating their sales using the Neuroeconomía to retain customers in the Riobambeños mercados.

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