International Journal of Modern Agriculture
ISSN: 2305-7246
Volume 10 Issue 1, Month 2021

Perception of the Environmental Pollution of the Torocochariver in the Health of the Population Living in Areas Surrounding the City of Juliaca-Peru

Quispe-Mamani, J. C.*[1];Aguilar-Pinto, S. L.[2];Madueño-Portilla, R.[3];Yapuchura-Saico, C. R.[4]

[1]University teacher
National University of Altiplano, Peru
ORCID: http://orcid.org/0000-0002-3938-1459

[3] University teacher
National Amazonian University of Madre of Dios, Peru
https://orcid.org/0000-0002-4242-0041

[2]University teacher
AndeanUniversity Néstor Cáceres Velásquez, Peru
ORCID: http://orcid.org/0000-0002-1796-9278

[4]University teacher
National University of Altiplano, Peru
https://orcid.org/0000-0003-1956-3922

*Corresponding authore-mail: jcquispe@unap.edu.pe

Abstract

The objective of the research was to determine the variables that explain the perception of environmental pollution of the Torococha river on human health, for which the non-experimental methodological design, descriptive-correlal, was used, applying surveys to a household member for data collection, the logit model was used. The variables that explain the perception of environmental pollution of the Torocochariver on people's health are the distance to which it lives from the river and the degree of pollution of the river. It was determined that if people live a greater distance from the river, then the likelihood that the person perceives that the pollution of the river affects their health decreases by 4.28%; wheree's if the degree of river pollution increases at a level, then the likelihood that the river's pollution affects their health increases by 7.20%.

Keywords-*Pollution; Logit model; Perception, Health.*

I. INTRODUCTION

This templateprovides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are

identified in italic type, within parentheses, following the example. PLEASE DO NOT RE-ADJUST THESE MARGINS.Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

The world today faces a number of ecological problems, with pollution being the ones that make the greatest impact on different organisms; defining this as the factor that causes the modification of the physical, chemical and biological characteristics of the environment [1]–[6]

Hence, it is established that the current situation of water resources at the global level and therefore at the local level deserves to take into account its future conservation, as it is a resource that becomes increasingly scarce [7]–[9]. This situation is further complicated by pollution processes, by the lack of policies for comprehensive management of water resources, both superficial and underground [10]–[12]. The users of the resource do not consider a rational use of that element and on the contrary permanently waste it [13], [14].

Pollution of water resources is one of the most important problems that water management has, because of the diversity, knowledge and aggressiveness of sources of pollution: urban, industrial, mining, hydrocarbon, agro-industrial and by the multiplicity, inefficiency and uncoordination of public institutions with functions in this field [6], [15], [16]. It is a case that appears to become a normal situation in humans and in the world, humans are not aware of the impact we have on polluting, nor in preventing and not cooperating with the policies that governments put forward to reduce pollution; in addition to the rational control we should have in the use of this resource [17], [18]. In this sense, with justifiable reason many people, environmentalists, government authorities and people who love nature have set to work on the problem of pollution of river waters and their tributaries, there is the law, what does not exist is the tax content of the legal rule, which is why, the problem of pollution is growing [3]–[5], [19]. We have been repeated to the fullness that water is life, but unfortunately the lack of awareness in many people shows the little importance they attach to the subject. It is worrying the environmental culture that the population possesses, the consequences of pollution is the responsibility of man, however, many times we do not realize and at the moment we give our eyes it is not done much to compensate for the damage caused [20]–[22].

Moreover, it is clear that the disorganized growth of the population and the low presence of regulation of economic activity cause the situation of rivers to be identified as alarming in their pollution. The health of the population is affected by pollution, by the presence of diseases ranging from mild (gastrointestinal) to acute (cancer); causing loss of general well-being of the population and in the long term affects the economy [23]–[26]. Therefore, pollution is now seen as a public health problem. Discharges of foreign matter, infectious agents, waste or wastewater impair water quality and make it unfit for various uses, which also poses a high degree of risk to people's health, which could result in microbiological diseases transmitted by water, such as: typhoid fever, cholera, gastroenteritis, etc. [13], [27], [28]. About 70%–75% of global marine pollution is the product of human activities on the Earth's surface. 90% of pollutants are transported by rivers to the sea.

On the other hand, between 70% and 80% of the world's population (approximately 3.6 trillion people) is located on or near the coasts, especially in urban areas, where a significant part of the waste produced there is deposited directly in the ocean [19], [29]. As a result, many critical ecosystems, some unique in the world, such as mangrove forests, coral reefs, coastal lagoons and other places of interface between land and sea, have been altered beyond their ability to recover.

At the level of the city of Juliaca, it was never projected that there would be a population explosion in the middle of the 21st century, along with this growth we have also seen development in the area of trade and the increase of companies, but along with this growth we have also come up with health problems especially the increase of waste, in rainy weather sewer networks do not bear the burden of river waste [30], [31], This is how the pipes begin to burst, all this problem triggers the sources of environmental contamination where they proliferated in an alarming way, to such an extent that the same municipal authority can do nothing to remedy this health problem, urgently they must act In order to find solutions, the diagnosis of this problem is that strategies must be sought that allow waste to be processed (Laura & Mamani, 2016; Quispe-Mamani et al., 2021).

On the Torococha river mainly flow the wastewater generated by the population of the city of Juliaca, there is agglomeration of garbage on the banks of the river and the population of the surrounding neighborhoods uses the banks of the river as public latrines, which generates many health problems and environmental pollution (Gutierrez, 2018). Contamination by metals, chemical residues and antibiotics remains the main factors of water pollution, which has a serious impact on people's health (Machaca, 2014; Quispe et al., 2021).

In this sense, the work seeks to answer the following questions: What are the variables that explain the perception of environmental pollution of the Torocochariver on people's health? and what are the variables that explain the perception of environmental pollution of the Torococha river?. The objective of the research was to determine the variables that explain the perception of environmental pollution of the Torocochariver on human health and to determine the variables that explain the perception of environmental pollution of the Torococha river. The work of Laura & Mamani (2016) refers to the fact that indicators of environmental sanitation that influence nutritional status in children from 1 to 5 years old living on the banks of the Torococha river in the city of Juliaca are: disposal of waste, water consumption, sewerage network; so the research hypothesis was that the population living in surrounding areas perceives that environmental pollution of the Torococha river has negative effects on their health.

II. THEORETICAL FRAMEWORK

The wáter

Water is the only abundant mineral that is liquid at the temperature that reigns most of the Earth's surface; while the solid and gaseous states of matter are explained to an advanced degree, the liquid state is more difficult to understand. Water helps eliminate substances resulting from biochemical processes that develop in our organisms, through excretory organs, especially urine and sweat. However, because of this same property, it can transport a number of toxins to the body that can affect different organs reversiblely or irreversibly [13].

Water properties

Water is a molecule that is made up of two hydrogen atoms and one oxygen atom, so its chemical formula is H2O. When these three atoms are joined, electrons form around the 3 nuclei, which are located in the form of a triangle. This results in a bipolar molecule, i.e. it has two poles: Negative on the oxygen side and positive on the side of hydrogen atoms [35]. Electrons take on a strange form

(hydrogen bond) that causes it to attract hydrogen atoms from other water molecules, bonding strongly and causing some of the curious and necessary properties that water has; out of every 107 water molecules, only one is ionized. Gases in water carry nitrogen (N2), oxygen (O2), carbon dioxide (CO2), hydrogen sulphide (H2S), ammonia (NH3) and methane (CH4). The first three are common gases in the atmosphere and are found in all waters in contact with the atmospheric environment; the last three are associated with bacterial breathing and metabolism [13]

Water quality

Water quality refers to the conditions in which water is located with respect to physical, chemical and biological characteristics, in their natural state or after being altered by human action. Water quality has been associated with water use for human consumption, because water is of quality when it can be used without causing harm to health. However, depending on the uses required for water, water quality can be determined for such uses [28].

Water is considered to be of good quality when it is free of substances and microorganisms that are dangerous to consumers and are free of substances that transmit unpleasant sensory sensations for consumption, such as color, smell, taste or turbidity. The importance of water quality is because water is also one of the main means of transporting many diseases affecting humans. The term water quality is relative and only of universal importance if it is related to the use of the resource. This means that a sufficiently clean water source that allows fish to live may not be suitable for swimming and good water for human consumption may be unsuitable for industry [36], [37].

Water and health

Contaminated water and poor sanitation are linked to the transmission of diseases such as cholera, other diarrhoea, dysentery, hepatitis A, typhoid and polio. Non-existent, insufficient or improperly managed water and sanitation services expose the population to preventable health risks [25], [38]. Water contamination brings with it serious diseases caused by pathogenic organisms present in water, not only through intake or consumption, but also by the skin. Contaminated water then compromises the well-being of the population and consequently the country's economy [39].

Water Pollution

Water has 2 sources of pollution [40]:

Natural sources: Depending on the land that passes through the water may contain components of natural origin from contact with the atmosphere and soil (e.g. mineral salts, calcium, magnesium, iron etc. Although they can be harmful to health, they are generally substances that can be easily identified and eliminated.

Artificial sources: Produced as a result of human activities. Industrial development has led to the presence of certain components that are hazardous to the environment and to organisms and difficult to eliminate.

So the main water pollutants are pathogenic microorganisms, organic wastes, inorganic chemicals, inorganic plant nutrients, organic compounds and suspended sediments and materials [41].

Perception

One of the main disciplines that has been responsible for the study of perception has been psychology and, in general terms, traditionally this field has defined perception as the cognitive process of consciousness consisting of recognition, interpretation and significance for the elaboration of judgments around the sensations obtained from the physical and social environment, involving other psychic processes including learning, memory and symbolization [42].

There are several approaches to social perception from a selective, dynamic and functional process, in which perceiving is basically about formulating hypotheses and making decisions, this process is determined by needs, social values, learnings and in general by the permanent and temporal characteristics of individuals. Perception depends on the management, classification and development of category systems with which the stimuli that the subject receives are compared. Therefore, perception is the action of receiving, interpreting and understanding the signals that come from the senses of the human being, this perception can be good or bad according to the criteria of the person (Fernandez et al., 2016).

Health

According to WHO, it is a perfect state of both physical, mental and social well-being; but on the other hand, a person is healthy when in addition to feeling good physically, mentally and socially, his body structures and behavior are within the limits accepted as normal for all people who compare characteristics and the same environment. Health is the general condition of a person's mind and body. It usually means being free of illness, injury or pain. Being healthy is a desirable state because a person's health directly affects their ability to function in the world. For example, if a person suffering from chronic knee pain may not be able to perform simple day-to-day tasks due to their health status. Similarly, a person with cardiovascular disease may also not be able to function at the same level of productivity as healthy people [43].

III. METHODS

Description of the study area

The study area was a stretch of the Torocochariver, which is part of the Juliaca district located in the northern part of the province of San Román and on the northeast side of Lake Titicaca and 35 km from it. The geographical area of Juliaca district occupies the central part of the department of Puno and the Collao Plateau (Figure 1).

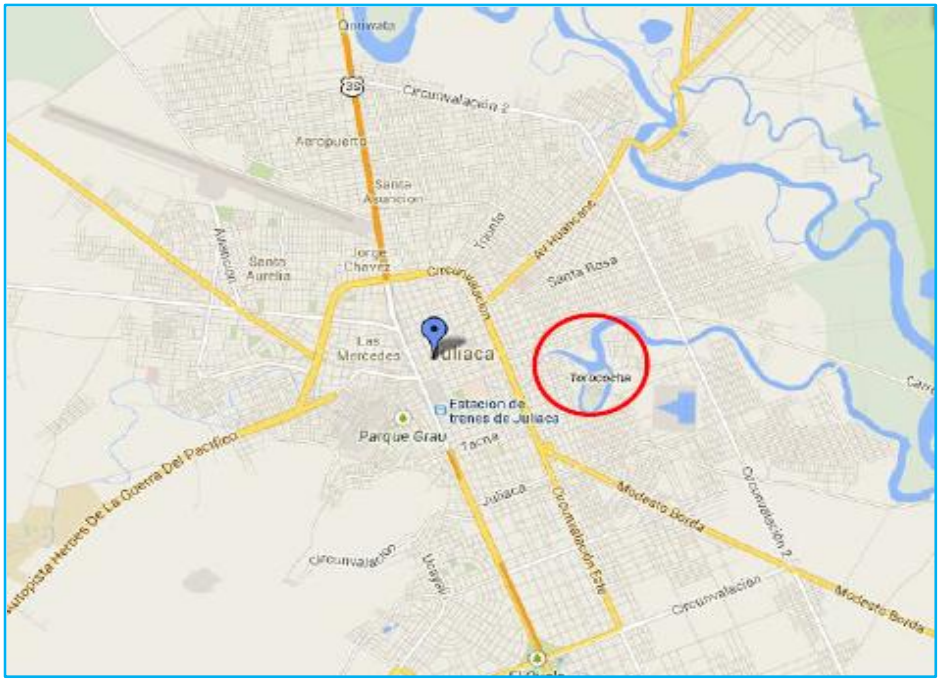

Fig. 1. Location of the scope of study

Research design

The design of the research is of the non-experimental and correlal type (Hernández et al., 2010), because you use an econometric model that visualizes how variables relate or link to each other. This type of model was used, Logit, because the endogenous variable of our regression is a dichotomous variable, in this sense, we must use techniques that allow us to estimate models in which the dependent variable is a discrete variable (Mendoza, 2014).

Research instruments

The instrument applied was the questionnaire to determine the variables that explain the perception of environmental pollution of the Torococharivеr on the health of people living in surrounding areas. The questionnaire applied was 12 questions. In addition, an analysis of the behavior of variables was performed with the use of software such as SPSS and STATA [46].

Population and sample

In order to gather information that relates to the object of study, the population that resides in surrounding areas of the Torococha river of the city of Juliaca, residing or for any reason or remaining in the area of direct influence of the Torococha river and able to issue criteria related to the variables of the research, was considered as a universe. The population considered for this research are the inhabitants of the Squeaky Town Center, which according to INEI 2017 has 3,874 inhabitants, in this case the sample that was considered to be 351 inhabitants. To calculate the sample, a 95% confidence level was considered and performed as follows:

$$n = \frac{N * Z^2 * p * q}{d^2 * (N-1) + Z^2 * p * q}$$

Where, N=population size, Z=confidence level, p=probability of success or expected proportion, q=probability of failure and d=accuracy.

IV. RESULTS

Sociodemographic characteristics of respondents

The average age of respondents was 30 years, with a minimum age of 17 years and a maximum of 60 years; 54.4% were female and 45.6% male, with average study years of 11.20, with a minimum of 4 and a maximum of 19 years; In addition, respondents have on average 4 people living in their households, with a minimum of 1 person and a maximum of 9 people, with an average household income of S/. 534.05 soles, with a minimum of S/. 100.00 soles and a maximum of S/. 1450.00 soles.

Perception between local residents and the Torocochariver

According to the total number of respondents it was determined that 80.9% of the people surveyed have a poor perception of the Torococha river, which is evident because at first glance it shows that the Torococha river does not reflect good conditions and 19.1% of respondents indicate that they have a regular perception of the river. It should be mentioned that citizens living near the Torocochariver perceive that they are in a worrying state. The population living in the surrounding areas of the Torocochariver perceives that this river is effectively contaminated, the results indicate that 99.7% of the sample receives contamination and only 0.3% do not perceive pollution. In addition, according to the total number of respondents 77.8% consider that there are mainly odors coming from river and 22.2% that do not perceive odors.

One of the problems that can also be identified in contamination by garbage accumulation, are the odors emanating from these wastes, in the Torococha river, the accumulation of garbage becomes present and so do odors; of the total surveyed, 68.4% of respondents indicate that odors perceive it every day, especially in the mornings and evenings when the winds start to occur. In this understanding, it can be determined that the population living near the Torocoha river perceives that the degree of pollution is high. Of the total number of respondents, 88% felt that the degree of pollution they perceived from the river was high; while 12% consider the degree of pollution they perceive to be medium.

Perception of the effects of Torococha river pollution

In this case, of the total respondents, 90% receive Torococha river pollution, while only 10% responded that they do not receive such contamination. Therefore, respondents can be established to consider the type of disease affecting their families to be of different types; 27.9% stress that such pollution causes respiratory diseases, 27.7% consider affecting them with infectious diseases and 44.4% indicate that they are caused by stomach diseases (Table 1).

Table 1. Types of diseases generated by pollution of the Torocochariver

Description	Frequency	Percentage
Respiratory	153	27,9%
Infectious	152	27,7%
Stomach	244	44,4%

Total	549	100,0%

In addition, of the neighbors surveyed who live on the banks of the Torococha river, 33% perceive that the main source of river pollution is from drains, 29.1% consider solid waste pollution, 20.4% indicate that the source is from inorganic waste and 17.4% of respondents perceive that the source of contamination is from inorganic waste (Table 2).

Table 2. Sources of Pollution of the Torocochariver

Description	Frequency	Percentage
Solid waste	231	29,1%
Drain	262	33,0%
Organic waste	162	20,4%
Inorganic waste	138	17,4%
Total	793	100,0%

Therefore, when consulting on the perceived measures of the population to reduce pollution of the Torocochariver, they suggest that these should be given priority considering the proportionality of the importance of the measures that the municipality should implement to improve the critical state of environmental pollution of the Torococha river. 35.7% consider it important that the garbage truck pass through their homes, 33.2% believe that a cleaning project should be implemented and 31.1% that larger garbage containers should be placed (Table 3).

Table 3. Measures perceived by the local population that the municipality should implement to improve the state of the Torococha River

Description	Frequency	Percentage
Larger containers	188	31,1%
Cleaning project	201	33,2%
Trash truck	216	35,7%
Total	605	100,0%

In this sense, in order to determine the variables that explain the perception of environmental pollution of the Torococha river, the Logit econometric model was applied, considering that two values are evaluated for the perception of environmental pollution of the Torococha river: 0= the person perceives that the river is not contaminated and 1= the person perceives that the river is contaminated (Table 4).

Table 4. Stata output of logit model for pollution perception

Logisticregression					Number of obs =351	
					LR chi2(4) = 13.62	
					Prob> chi2 = 0.0031	
Log likelihood = -13.243592					Pseudo R2 = 0.3140	
Perception of environmental pollution of the Torococha river	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Years of study	0.0609	0.3682	9.180	0.0000	0.0609	0.0680
Number of people living in the household	0.9213	1.0005	2.100	0.0030	0.0437	1.3022
Family economic income	0.0041	0.0073	1.200	0.0140	-0.0428	0.1789
Distance you live from the river	-1.1627	1.2205	-2.370	0.0000	-4.9599	-0.2594
Constant	0.6564	5.7146	-1.280	0.0490	0.5529	2.8168

Assessing the signs in Table 4, it can be shown that the perception of environmental pollution of the Torococha river has a direct relationship with the number of years studied; that is, the more years studied, the greater the likelihood of perceiving that the river is contaminated; the same goes for the number of people living in the household, as well as people's income. But the opposite happens with distance, because if people live further away there will be a higher chance that they will perceive that the river is not contaminated. In this regard, the marginal effects of the model are presented below for analysis.

Table 5. Marginal analysis for pollution perception

Expression: Pr (Perception of environmental pollution of the Torococha river), prediction ()						
Variable	dy/dx	Std. Err.	z	P>|z|	[95% Interv. conf.]	
Years of study	0.0004228	0.0025682	0.16	0.869	-0.004611	0.005456
Number of people living in the household	0.0063976	0.0083821	0.76	0.445	-0.010031	0.022826
Family economic income	0.0000282	0.0000547	0.52	0.606	-0.000079	0.000135
Distance you live from the river	-0.008074	0.0100096	-0.81	0.42	-0.027692	0.011545

Therefore, the variables that explain the perception of environmental pollution of the Torocochariver are the years of study, the number of people living in the home, the family economic income and the distance to which you live from the river. In the case of study years it has a coefficient of 0.04%, indicating that if people have one more year of study received, then the probability that the person perceives that the river is contaminated will increase by 0.04%; if the number of people living in the household increases by 1 person, then the probability that the person perceives that the river is

contaminated will increase by 0.63%; if household economic income increases by S/. 1.00 sun, then the probability that the person perceives that the river is contaminated will increase by 0.002%% and if the distance at which the person lives from the river increases, then the probability that the person perceives that the river is contaminated will decrease by 0.80%.

The pollution of the Torococha river has negative effects on the population that lies in the areas surrounding it; therefore, in order to determine the variables that explain the perception of environmental pollution of the Torococha river on human health, the Logit model was also applied, considering the perception of pollution assessed in two values: 0= the person perceives that the pollution of the river does not affect their health and 1= the person perceives that the pollution of the river affects their health (Table 6).

Table 6. Stata output of the logit model for the perception of the health effects of pollution

Logisticregression					Number of obs =351	
					LR chi2(2) = 33.37	
					Prob> chi2 = 0.0000	
Log likelihood = -97.201426					Pseudo R2 = 1465	
Perception of environmental pollution of the Torococha river on people's health	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Distance you live from the river	-0.5517118	0.1896436	0.0012	0.004	-0.92340	-0.18001
River pollution degree	0.9287444	0.2058014	0.0023	0.000	0.52538	1.33210
Constant	0.5462812	0.6207556	0.088	0.079	-0.67037	1.76294

It is clear from the table above that the perception of the effects of pollution on health has a direct relationship with the degree of pollution perceived by the inhabitants, where to an increase in the degree of pollution of the river, then the greater the likelihood of perceived that the pollution of the river has health effects; the opposite happens with the distance you live from the river. In addition, a Pseudo R2 of 14.65% of the variations in the dependent variable are due to variations in the distance variables to which it lives from the river and the degree of pollution of the river.

Table 7. Marginal analysis for perception of the health effects of pollution

Expression: Pr (Perception of environmental pollution of the Torococha river on people's health), predict ()						
Variable	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Distance you live from the river	-0.042828	0.014721	-2.91	0.004	-0.016824	-0.013975
River pollution degree	0.072097	0.015478	4.66	0.000	0.0417604	0.102434

It can therefore be concluded that the variables that explain the perception of environmental pollution of the Torocochariver on human health are the distance to which it lives from the river and the degree of pollution of the river. In the first case, it is determined that if people live a greater

distance from the river, then the probability that the person perceives that the pollution of the river affects their health decreases by 4.28%; wherea while increasing the degree of river pollution by one level, then the likelihood that the person perceives that the pollution of the river affects their health increases by 7.20% (Table 7).

V. DISCUSSIONS

The population is aware of the damage to the ecosystem and the need to implement a comprehensive environmental management system. In affinity with this article, which seeks to measure the degree of pollution of miracle river of the Canton San Francisco de Milagro, where it can be seen that the riverine population perceives this problem and believe that it is necessary to implement actions for the reduction of pollution (Fernandez et al., 2016). The results are similar to this research, since the methodology used is oriented to the perception of the river population, surveying field information and reviewing existing information and obtaining the information through surveys carried out on the population living on rivers of the Torocochariver, as they are able to issue criteria related to the variables of the research. The perception of odors and the degree of pollution perceived by respondents are important aspects that was considered to establish the perception of Torococha river pollution, as mentioned in the concept of perception, is through our senses that we can perceive our environment.

Another important aspect was that in the work of Bustamante-González et al. (2016), who mentions that the main source of pollution of the Tlapaneco river is the discharge of wastewater, which is a result that coincides with the results in this article, since the vast majority of respondents responded as the main source of pollution the drainage that reaches the Torococha river. These results are because both the Tlapanecoriver and the Torococha River pass through a city and the drains of the population living on its river usually flow into the river, in addition to other domestic substances that are toxic. As a result, rivers have been unable by themselves to absorb and neutralize this polluting burden, so these bodies of water have lost their natural physical-looking conditions and their ability to sustain adequate aquatic life. These must respond to the ecological balance that is expected of them to preserve bodies of water. As a result, they lose those minimum conditions that are required for their rational and adequate use as sources of water supply.

In addition, the results obtained in our research coincide with what is reported by Laura & Mamani (2016), who mentions that children are the main ones affected by these problems mainly the article mentions that gastro-intestinal diseases, through a wide range of pathogens can infect the gastrointestinal tract. They are acquired faecally - orally from contaminated liquids, food or hands. For the infection to occur pathogens must be ingested in adequate numbers and possess special attributes to evade the defenses of the upper digestive tract and reach the intestine. This contrasts with the above results, the main perception of river pollution turned out to be from the informal drains that flow into the river, this results in stomach diseases and according to the results on perception, the most affected age group are children and the elderly because they have a weak immune system.

It is complemented by the results obtained by Bustamante-González et al. (2016), where 5.3% said there is a generation of odors and they harm the environment and crops, which consequently brings with it health problems. 61% believe that pollution in this river has a solution, but there is some mistrust in the authorities, so in this case it is important to consider designing a river sanitation program, where it is important to consider the availability to be paid for future benefits. It is true that

there are problems with regard to the issue of river pollution and its forms of remediation, as it also implies that there are problems in the development of environmental impact policies of the authorities that favour its remediation; since people's health involves several aspects, but this in turn is influenced by environmental factors that affect them, such as non-drinking or contaminated drinking water; transmit numerous diseases that affect the short, medium and long term, which causes a negative impact on the development of the person whether economic, social, etc., affecting their well-being and that of the country.

VI. Conclusions

The results show that the variables that explain the perception of environmental pollution of the Torocochariver on people's health are the distance to which it lives from the river and the degree of pollution of the river. It was determined that if people live a greater distance from the river, then the likelihood that the person perceives that the pollution of the river affects their health decreases by 4.28%; wheree's if the degree of river pollution increases at a level, then the likelihood that the river's pollution affects their health increases by 7.20%. Therefore, there are effects of Torococha river pollution on health, depending on the perception of the population living in surrounding areas.

In addition, the variables that explain the perception of environmental pollution of the Torocochariver are the years of study, the number of people living in the household, the family economic income and the distance to which you live from the river. In the case of years of study, if people have one more year of study received, then the probability that the person perceives that the river is contaminated will increase by 0.04%; if the number of people living in the household increases by 1 person, then the probability that the person perceives that the river is contaminated will increase by 0.63%; if household economic income increases by S/. 1.00 sun, then the probability that the person perceives that the river is contaminated will increase by 0.002%% and if the distance at which the person of the river lives increases, then the probability that the person perceives that the river is contaminated will decrease by 0.80%. In addition, the results of this research show that 35.7% of respondents consider it important that the garbage truck pass through their homes, 33.2% believe that a cleaning project should be implemented and 31.1% that larger dumpsters should be placed. Policies should be implemented considering the results of different researches, such as the one in mind.

References

[1] C. Acey, “The Political Ecology of Watershed Depletion and Contamination in Rural Ghana.” 2013, Accessed: Mar. 07, 2021. [Online]. Available: https://papers.ssrn.com/abstract=2236761.

[2] D. L. Hey and P. G. Heltne, “Thinking like a river: A Riverine National Park for the Upper Mississippi River,” *Ecological Engineering*, vol. 68. pp. 8–13, Jul. 2014, doi: 10.1016/j.ecoleng.2013.12.058.

[3] J. P. Hoehn, “Methods to address selection effects in the meta regression and transfer of ecosystem values,” *Ecol. Econ.*, vol. 60, no. 2, pp. 389–398, Dec. 2006, doi: 10.1016/j.ecolecon.2006.05.021.

[4] J. R. Linehan and M. Gross, “Back to the future, back to basics: The social ecology of landscapes and the future of landscape planning,” *Landsc. Urban Plan.*, vol. 42, no. 2–4, pp. 207–223, Dec. 1998, doi: 10.1016/S0169-2046(98)00088-7.

[5] L. C. Madera, L. C. Angulo, L. C. Díaz, and R. Rojano, "Evaluación de la Calidad del Agua en Algunos Puntos Afluentes del río Cesar (Colombia) utilizando Macroinvertebrados Acuáticos como Bioindicadores de Contaminación," *Inf. Tecnol.*, vol. 27, no. 4, pp. 103–110, 2016, doi: 10.4067/S0718-07642016000400011.

[6] J. Aragonés, C. Tapia-Fonllem, L. Poggio, and B. Fraijo-Sing, "Perception on the Risk of the Sonora River Pollution," *Sustainability*, vol. 9, no. 2, p. 263, Feb. 2017, doi: 10.3390/su9020263.

[7] N. Confortí, "Principios en la gestión de los recursos naturales compartidos por los estados del primigenio Mercosur," *Latinoamérica. Rev. Estud. Latinoam.*, vol. 59, no. 59, pp. 129–163, Jan. 2014, doi: 10.1016/s1665-8574(14)71728-4.

[8] D. P. Dupont, "Tapping into Consumers' Perceptions of Drinking Water Quality in Canada: Capturing Customer Demand to Assist in Better Management of Water Resources," *Can. Water Resour. J.*, vol. 30, no. 1, pp. 11–20, 2005, doi: 10.4296/cwrj300111.

[9] K. E. McConnell and M. A. Rosado, "Valuing discrete improvements in drinking water quality through revealed preferences," *Water Resour. Res.*, vol. 36, no. 6, pp. 1575–1582, 2000, doi: 10.1029/2000WR900043.

[10] G. L. Poe and R. C. Bishop, "Valuing the incremental benefits of groundwater protection when exposure levels are known," *Environ. Resour. Econ.*, vol. 13, no. 3, pp. 341–367, Apr. 1999, doi: 10.1023/A:1008251418007.

[11] J. C. Quispe-Mamani, S. L. Aguilar-Pinto, C. N. Quispe-Lino, Y. A. Tuesta-Ramirez, and O. Tintaya-Choquehuanca, "Incidence of Contamination of Water Resources in the Development of Livestock Activities in the Lower Area of the Coata River Watershed, Peru," *IT Ind.*, vol. 9, no. 1, p. 2021, Mar. 2021, Accessed: Mar. 16, 2021. [Online]. Available: http://it-in-industry.org/index.php/itii/article/view/176.

[12] M. J. Um, S. J. Kwak, and T. Y. Kim, "Estimating willingness to pay for improved drinking water quality using averting behavior method with perception measure," *Environ. Resour. Econ.*, vol. 21, no. 3, pp. 287–302, 2002, doi: 10.1023/A:1014537330423.

[13] C. P. Acosta, J. A. Benavides, and C. H. Sierra, "Análisis cualitativo del deterioro de la calidad del agua y la infección por Helicobacter pylori en una comunidad de alto riesgo de cáncer de estómago (Cauca, Colombia)," *Salud Colect.*, vol. 11, no. 4, pp. 575–590, 2015, doi: 10.18294/sc.2015.796.

[14] E. T. Alonso, "Fernando Pérez Correa (coord.), Gestión pública y social del agua en México, México, UNAM, 2014, 154 pp.," *Estud. Políticos*, vol. 35, pp. 173–176, May 2015, doi: 10.1016/j.espol.2015.03.001.

[15] C. W. Abdalla, B. A. Roach, and D. J. Epp, "Valuing environmental quality changes using averting expenditures: an application to groundwater contamination," *Land Econ.*, vol. 68, no. 2, pp. 163–169, 1992, doi: 10.2307/3146771.

[16] A. Bustamante-González, G. D. Jesús, J. L. Jaramillo-Villanueva, and S. Vargas-López, "Percepción de la contaminación del Río Tlapaneco por la población ribereña," *Agric. Soc. y Desarro.*, vol. 13, no. 1, pp. 47–62, 2016, Accessed: Mar. 07, 2021. [Online]. Available: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-54722016000100047.

[17] E. Maack, S. Mills, C. P. Borick, C. Gore, and B. G. Rabe, "Environmental Policy in the Great Lakes

Region: Current Issues and Public Opinion." 2014, Accessed: Mar. 16, 2021. [Online]. Available: https://papers.ssrn.com/abstract=2652857.

[18] C. Acey, "The Political Ecology of Watershed Depletion and Contamination in Rural Ghana." 2013, Accessed: Mar. 16, 2021. [Online]. Available: https://papers.ssrn.com/abstract=2236761.

[19] K. C. Tran, J. Euan, and M. L. Isla, "Public perception of development issues: Impact of water pollution on a small coastal community," *Ocean Coast. Manag.*, vol. 45, no. 6–7, pp. 405–420, Jan. 2002, doi: 10.1016/S0964-5691(02)00077-7.

[20] F. Li and T. Zhou, "Effects of objective and subjective environmental pollution on well-being in urban China: A structural equation model approach," *Soc. Sci. Med.*, vol. 249, p. 112859, Mar. 2020, doi: 10.1016/j.socscimed.2020.112859.

[21] D. R. Laura Cari and R. M. Mamani Mayta, "La Contaminación Ambiental y su Influencia en el Crecimiento de niños de 1 a 5 años que viven en las riveras del río Torococha de Juliaca, diciembre 2015-marzo 2016," 2016. Accessed: Mar. 16, 2021. [Online]. Available: https://scholar.google.es/scholar?hl=es&as_sdt=0%2C5&q=Laura+%2C+D.+%282016%29.+La+contaminacion+Ambiental+Y+su+Influencia+en+el+Crecimeinto+de+Niños+de+1+a+5+años+que+viven+en+las+riveras+del+Rio+Torococha+de+Juliaca&btnG=.

[22] M. Fernandez Ronquillo, T. Fernández Solís, and G. Solís Beltrán, "Percepción de la población sobre los niveles de contaminación ambiental del Río Milagro y grado de conocimiento preventivo social sobre el efecto de su carga contaminante," *Rev. Cienc. Unemi*, vol. 9, no. 21, pp. 125–134, May 2016, doi: 10.29076/issn.2528-7737vol9iss21.2016pp125-134p.

[23] J. Flynn, P. Slovic, and C. K. Mertz, "Decidedly Different: Expert and Public Views of Risks from a Radioactive Waste Repository," *Risk Anal.*, vol. 13, no. 6, pp. 643–648, 1993, doi: 10.1111/j.1539-6924.1993.tb01326.x.

[24] D. Goodwin, M. Raffin, P. Jeffrey, and H. M. Smith, "Stakeholder evaluations of risk interventions for non-potable recycled water schemes: A case study," *Sci. Total Environ.*, vol. 674, pp. 439–450, Jul. 2019, doi: 10.1016/j.scitotenv.2019.04.044.

[25] B. A. Larson and E. D. Gnedenko, "Avoiding health risks from drinking water in Moscow: An empirical analysis," *Environ. Dev. Econ.*, vol. 4, no. 4, pp. 565–581, 1999, doi: 10.1017/S1355770X99000339.

[26] J. Doménech, "Medio ambiente y sus efectos sobre la salud. La oficina de farmacia y la información sanitario-ambiental," *Offarm Farm. y Soc.*, vol. 22, no. 3, pp. 115–120, 2003, Accessed: Mar. 16, 2021. [Online]. Available: https://www.elsevier.es/es-revista-offarm-4-articulo-medio-ambiente-sus-efectos-sobre-13044458?referer=buscador.

[27] N. T. Rubio-Cisneros, J. Herrera-Silveira, S. Morales-Ojeda, M. Moreno-Báez, J. Montero, and M. Pech-Cárdenas, "Water quality of inlets' water bodies in a growing touristic barrier reef Island 'Isla Holbox' at the Yucatan Peninsula," *Reg. Stud. Mar. Sci.*, vol. 22, pp. 112–124, Jul. 2018, doi: 10.1016/j.rsma.2018.06.006.

[28] M. C. Benez, E. F. Kauffer Michel, and G. D. C. Álvarez Gordillo, "Percepciones ambientales de la calidad del agua superficial en la microcuenca del río Fogótico, Chiapas," *Front. norte*, vol. 22, no. 43, pp. 129–158, 2010, Accessed: Mar. 16, 2021. [Online]. Available: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0187-73722010000100006.

[29] X. Shi and F. He, "The environmental pollution perception of residents in coal mining areas: A Case study in the hancheng mine area, Shaanxi Province, China," *Environ. Manage.*, vol. 50, no. 4, pp. 505–513, Oct. 2012, doi: 10.1007/s00267-012-9920-8.

[30] J. R. Lissarrague, "Aguas residuales cus consecuencias en el desarrollo y la produccion," *Rev. la Fac. Ing. USIL*, vol. 2, no. 1991, pp. 9–25, 2015.

[31] Y. Huacani and J. Mamani, "Valoración ambiental del reciclado de residuos sólidos: El caso de Juliaca, Perú," p. 32, 2017.

[32] V. R. Gutierrez Cabana, "Evaluación de la calidad de agua del río Coata en la desembocadura del río Torococha utilizando el Índice de Calidad de Agua del Consejo Canadiense CCME–WQI y el ICA–PE, Puno–2018.," 2018. Accessed: Dec. 02, 2020. [Online]. Available: https://repositorio.upeu.edu.pe/handle/UPEU/1771.

[33] V. H. Machaca, "Contaminación del rio Torococha en Juliaca (Perú) y su impacto en la salud pública," 2014. .

[34] J. C. Quispe Mamani, N. J. Ulloa Gallardo, M. Guevara Mamani, A. Catachura Vilca, C. E. Roque Guizada, and F. A. Rivera Mamani, "Willingness to pay for the recovery and conservation of urban green areas for public use in the city of Juliaca , Peru," *J. Contemp. Issues Bus. Gov.*, vol. 27, no. 1, 2021, [Online]. Available: https://cibg.org.au/index.php/cibg/article/download/7/journal/article_8335_28b3e1e934ad24015d67f54b2a77766e.pdf.

[35] C. Audouit, V. Pasqualini, R. De Wit, H. Flanquart, P. Deboudt, and C. Rufin-Soler, "Comparing social representation of water quality in coastal lagoons with normative use of ecological indicators," *Mar. Policy*, vol. 101, pp. 137–146, Mar. 2019, doi: 10.1016/j.marpol.2017.08.023.

[36] A. A. Ibarra, A. S. Vargas, and R. M. Nayga, "Water quality concerns and acceptance of irradiated food: A pilot study on Mexican consumers," *J. Sci. Food Agric.*, vol. 90, no. 13, pp. 2342–2344, Oct. 2010, doi: 10.1002/jsfa.4087.

[37] J. Janmaat, "A little knowledge···: Household water quality investment in the Annapolis Valley," *Can. J. Agric. Econ.*, vol. 55, no. 2, pp. 233–253, Jun. 2007, doi: 10.1111/j.1744-7976.2007.00090.x.

[38] L. M. McKenzie, R. Z. Witter, L. S. Newman, and J. L. Adgate, "Human health risk assessment of air emissions from development of unconventional natural gas resources," *Sci. Total Environ.*, vol. 424, pp. 79–87, May 2012, doi: 10.1016/j.scitotenv.2012.02.018.

[39] K. M. Dobransky, "Reassessing mental illness stigma in mental health care: Competing stigmas and risk containment," *Soc. Sci. Med.*, vol. 249, Mar. 2020, doi: 10.1016/j.socscimed.2020.112861.

[40] M. Préndez and V. Calderón, "Análisis de contaminantes en la cuenca del río aconcagua en Chile. Evaluación de riesgo humano y ambiental," *Inf. Tecnol.*, vol. 24, no. 1, pp. 3–14, 2013, doi: 10.4067/S0718-07642013000100002.

[41] S. Baggett, P. Jeffrey, and B. Jefferson, "Risk perception in participatory planning for water reuse," *Desalination*, vol. 187, no. 1–3, pp. 149–158, Feb. 2006, doi: 10.1016/j.desal.2005.04.075.

[42] M. Ortega Márquez and O. Márquez Fernández, "Percepción social del servicio de agua potable

en el municipio de Xalapa, Veracruz," *Rev. Mex. Opinión Pública*, vol. 23, no. 23, p. 41, Jun. 2017, doi: 10.22201/fcpys.24484911e.2017.23.58515.

[43] L. Chen, Y. Fan, and W. Guo, "Relationship of economic development, family income and health status in China: The moderating role of environmental pollution perception," *J. Health Psychol.*, vol. 25, no. 13–14, pp. 2499–2510, Nov. 2020, doi: 10.1177/1359105320913953.

[44] R. Hernández Sampieri, C. Fernández Collado, and P. Baptista Lucio, *Metodología de la investigación*, no. 1. 2010.

[45] W. Mendoza Bellido, "Cómo investigan los economístas? Guía para elaborar y desarrollar un proyecto de investigación," 2014. Accessed: Oct. 12, 2020. [Online]. Available: https://files.pucp.education/departamento/economia/lde-2014-05.pdf.

[46] L. StataCorp, *STATA POWER AND SAMPLE-SIZE REFERENCE MANUAL RELEASE 15*. 2013.

[47] A. Bustamante-González, G. D. Jesús, J. L. Jaramillo-Villanueva, and S. Vargas-López, "Percepción de la contaminación del Río Tlapaneco por la población ribereña," *Agric. Soc. y Desarro.*, vol. 13, no. 1, pp. 47–62, 2016, Accessed: Mar. 16, 2021. [Online]. Available: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-54722016000100047.