Analysis of social indicators in the context of COVID-19 in Ecuador

By

Rosa Gómez
Universidad Técnica Estatal de Quevedo, Campus "Ingeniero Manuel Agustín Haz Álvarez", Av. Quito km. 1 1/2 vía a Santo Domingo de los Tsáchilas, Quevedo – Ecuador
Email: rgomezp@uteq.edu.ec

Emma Mendoza Vargas
Universidad Técnica Estatal de Quevedo, Campus "Ingeniero Manuel Agustín Haz Álvarez", Av. Quito km. 1 1/2 vía a Santo Domingo de los Tsáchilas, Quevedo – Ecuador
Email:emendoza@uteq.edu.ec

Laura Tachong Alencastro
Universidad Técnica Estatal de Quevedo, Campus "Ingeniero Manuel Agustín Haz Álvarez", Av. Quito km. 1 1/2 vía a Santo Domingo de los Tsáchilas, Quevedo – Ecuador
Email:ltachong@uteq.edu.ec

Javier Pérez Juez
Universidad Técnica Estatal de Quevedo, Campus "Ingeniero Manuel Agustín Haz Álvarez", Av. Quito km. 1 1/2 vía a Santo Domingo de los Tsáchilas, Quevedo – Ecuador
Email:eperez@uteq.edu.ec

Abstract

This research analyzes social indicators in Ecuador before and during the pandemic - comparing the periods 2019 and 2020. It begins with a methodological review of the calculation of poverty, employment, education, and health metrics and develops the methodological section like a quantitative study based on secondary information from official sources. These data were obtained from sample surveys and administrative records. Among the main results is that the pandemic caused increased deaths and income poverty. It was also found that adequate employment, primary and secondary education attendance rates, the number of teachers and the number of students in regular education were reduced.

Keywords: Hypothesis testing, indicators, quality of life, COVID.

Resumen

La presente investigación analiza los indicadores sociales en el Ecuador, antes y durante la pandemia -comparando los periodos 2019 y 2020-. Inicia con una revisión metodológica del cálculo de las métricas de pobreza, empleo, educación, y salud. Luego desarrolla la sección metodológica, siendo un estudio cuantitativo que se fundamenta en información secundaria de fuentes oficiales. Estos datos han sido obtenidos a partir levantamientos por muestras y mediante registros administrativos. Entre los principales resultados se encuentra que la pandemia ocasionó el incremento de los fallecidos y de pobreza por ingresos. También se evidenció que se ha reducido el empleo adecuado, la tasa de asistencia a la educación primaria y secundaria de igual manera el número de profesores y el número de estudiantes en educación regular.

Palabras clave: Pruebas de hipótesis, indicadores, calidad de vida, COVID.

Introduction

"*Everyone has the right to a standard of living adequate for the health and well-being of himself and his family*" (United Nations, 1948). In the country, the Constitution of the Republic (EC, 2008), in Article 3, the first paragraph indicates that the State must guarantee to all inhabitants of the country, without any discrimination: "*access to education, health, food, social security and water.*" Since 2020, the main public health problem worldwide has been the arrival of HIV/AIDS-19. In the pandemic, state authorities took measures to prevent the number of infections. However, these actions impacted the country's economic and social indicators, adversely affecting Ecuadorians' living conditions. The evaluation of these indicators will allow determining the effects of the pandemic in the country, especially in the social sphere.

The main objective of this study is to analyze the social indicators before and during the pandemic -comparing the periods 2019 and 2020. For this analysis, a review of poverty, employment, education, and health metrics will be carried out. The issues mentioned above are the minimum that populations must have to guarantee the quality of life of the inhabitants and the viability of developing the countries.

The review or calculation of these indicators has been carried out through secondary sources. These official sources will be the reports or databases held by public entities. The methodology is of a transversal descriptive type since the situation has been investigated at a point in time by a specific group of people using the deductive method. In order to compare whether there is a difference in the social indicators, hypothesis tests were employed. This methodology will allow concluding whether the metrics are statistically maintained or changed from one period to another.

Once the hypothesis tests were carried out for the indicators calculated from samples, it was concluded that they all have statistical differences from one year to another (p-value <0.05). The main results of this analysis are that there has been a negative impact in the different social contexts, which implies an increase of 1.4 million people who fell into poverty or extreme poverty. Also, approximately 600 thousand people ceased to have adequate employment, reducing the number of teachers by 5 thousand. The same occurred with the number of students enrolled in schools and colleges in regular education, with a total of 69 thousand fewer students. Regarding the general mortality rate, there was an increase of 2.3 deaths per 1.000 inhabitants, which was expected due to the pandemic.

The research is structured as follows: the first part presents the sources of information on which the research is based. Next, the methodology follows this for calculating indicators and hypothesis testing; then, the results and their respective interpretation are developed; finally, the last section presents the study's conclusions.

Data and information sources

For employment, income, poverty and education indicators, secondary sources were analyzed, such as reports and databases obtained from the National Survey of Employment, Unemployment and Underemployment (ENEMDU) conducted in December 2019 and the same month for 2020. The National Institute of Statistics and Census (INEC) provides this information. Additionally, it is important to indicate that some of the education indicators have been obtained from the administrative records kept by the Ministry of Education (MINEDUC) in the Master File of Educational Institutions (AMIE) for the final period of the school year 2019 - 2020 and 2020 - 2021. Likewise, in the case of indicators related to health,

the Statistical Registry of General Deaths was consulted. These data are consolidated in the INEC. The indicators on which the research has been carried out are the following:

Poverty[1]

- **Income poverty:**

A person is in poverty when his or her per capita family income is below the poverty line (set of food and non-food needs considered essential, expressed in a monetary value).

- **Extreme poverty by income**

A person is in extreme poverty when his or her per capita income is below the extreme poverty line (set of basic food needs, expressed in a monetary value).

Employment[2]

- **Employment:**

It is for persons 15 years or older who worked at least one hour during the reference week. Also considered are those who work but are absent due to vacations, illness, or study leave, among others. In addition, those who perform activities within the household for an income are included.

- **Adequate/full employment:**

Employed persons who, during the previous month of the survey, received an income equal to or higher than the basic wage and who worked during the reference week:

- 40 hours or more, regardless of whether they are willing or available to work longer.
- Less than 40 hours, but do not wish to work additional hours.

Education [3,4]

- **Net attendance rate**

The number of persons in the age group theoretically corresponding to a given level of education and attending that level, divided by the total population of that age group, in period (t), multiplied by 100.

- **Average number of students per teacher**

The total number of students enrolled at given educational levels over the number of teachers at the same level. In this case, all students enrolled in regular education are considered. Therefore, it is considered from the first year of primary education to the third year of high school.

Health [5]

- **Overall mortality rate**

The number of deaths occurring in a given time over the total population at mid-year, expressed per 1,000 persons.

It should be noted that other health indicators were sought, such as morbidity. However, the official sources did not provide an update for 2020, so they were not included in this research.

---

[1] (National Institute of Statistics and Census, 2008).

[2] (Castillo Añazco & Rosero Moncayo, 2015)

[3] (Ministry of Education, 2021)

[4] (National Institute of Statistics and Census, 2017).

[5] (National Institute of Statistics and Census, 2021).

Methodology

This research uses a quantitative methodology based on information from official sources. For the calculation and analysis of indicators, secondary sources have been used, such as databases and methodological reports of state organizations; additionally, a literature review of official documents and scientific journals was carried out, where mechanisms are established to collect information, make a diagnosis, and comparisons of social indicators in the context of poverty, employment, education and health.

In this study, a statistical methodology has been used to determine whether there are significant variations between 2019 and 2020 in the group of indicators collected from samples, such as the information obtained through the National Survey of Employment, Unemployment and Underemployment. For metrics obtained from sources such as administrative records, it is not necessary to perform these tests to conclude because, theoretically, the entire target group has been covered. In the latter case, an analysis of the behavior of the indicators will be made.

Hypothesis testing

This test is a statistical inference technique that allows a decision based on information obtained from a random sample whose hypotheses cannot be satisfied simultaneously. Hypothesis testing determines whether a hypothetical value for a parameter should be accepted as plausible based on the sample evidence. It is important to note that sample results were considered for this analysis. This implies that the data were not calculated using the expansion factors presented in the Employment survey to approximate populations.

Hypothesis test for two proportions (left lateral contrast):

$$H_0: p_1 = p_2$$
$$Vs$$
$$H_1: p_1 < p_2$$

With (1-α)100% confidence rejects H_0 in favor of H_1 if:

$$\frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}} < -Z_\alpha$$

Hypothesis test for two proportions (left lateral contrast):

$$H_0: p_1 = p_2$$
$$Vs$$
$$H_1: p_1 > p_2$$

With (1-α)100% confidence rejects H_0 in favor of H_1 if:

$$\frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}} Z_\alpha$$

In order to conclude whether there are statistical differences, either by increase or decrease, one-sided contrast hypothesis tests have been performed. This method is applied for indicators collected through sampling, whose source is the ENEMDU. In the case of this research, the comparison will be made for the results of the December 2019 survey (before the pandemic) and for December 2020 (during the pandemic). The rates with which this test has been worked are the following:

- Income poverty rate
- Extreme poverty rate by income
- Employment Rate

- Adequate/Full Employment Rate
- Net attendance rate

For the rest of the indicators, hypothesis testing is not required because the nature of the data collection is different. In this case, the data are obtained through administrative records; therefore, only an analysis of the results will be made since they are part of the social context. These measures are the following:

- Number of teachers in regular education
- Number of students in regular education
- Average student/teacher ratio in regular education
- Overall mortality rate

Results

This section presents the results of the hypothesis tests for two proportions. Also, an analysis is made from the social context based on the poverty, employment, education and health approach.

Table 1. Results of the statistical test performed on the samples.

Indicador	Contraste de Hipótesis	Valor Z	Valor p	Conclusión
Tasa de pobreza por ingreso	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} < p_{2020}$	-21,44	0,000	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, la pobreza del 2019 es menor que en el 2020
Tasa de Pobreza extrema por ingresos	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} < p_{2020}$	-20,48	0,000	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, la pobreza extrema del 2019 es menor que en el 2020
Tasa de Empleo	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} > p_{2020}$	10,54	0,000	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, el empleo del 2019 es mayor que en el 2020
Tasa de Empleo adecuado/pleno	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} > p_{2020}$	13,79	0,000	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, la tasa de empleo adecuado del 2019 es mayor que en el 2020
Tasa neta de asistencia en primaria	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} > p_{2020}$	2,26	0,012	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, la TNA en primaria del 2019 es mayor que en el 2020
Tasa neta de asistencia en secundaria	H_O: $p_{2019} = p_{2020}$ vs H_1: $p_{2019} > p_{2020}$	2,52	0,006	Se rechaza la hipótesis nula a favor de la alterna. Estadísticamente, la TNA en secundaria del 2019 es mayor que en el 2020

The previous table lists the indicators whose results were obtained from samples. In order to conclude, the authors applied the hypothesis tests for two proportions. Each of these measures was compared for the years 2019 and 2020. In all cases, it was determined that, statistically, there are significant differences between the two years (p-value <0.05). In other words, the null hypothesis is rejected in favor of the alternative hypothesis; therefore, there is an increase or decrease in the results of the indicators evaluated.

Table 2. Comparison of social indicators between 2019 and 2020.

FACTOR DE EXPANSIÓN				
Indicador	**dic-19**	**dic-20**	**Diferencia (2020 - 2019)**	**Tipo de variación**
Tasa de pobreza por ingreso	25,0%	33,0%	8,0%	Incremento
Tasa de Pobreza extrema por ingresos	8,9%	15,4%	6,5%	Incremento
Tasa de Empleo	96,2%	95,1%	-1,1%	Reducción
Tasa de Empleo adecuado/pleno	38,8%	30,4%	-8,4%	Reducción
Tasa neta de asistencia en primaria	96,9%	96,6%	-0,3%	Reducción
Tasa neta de asistencia en secundaria	85,9%	85,1%	-0,8%	Reducción
Número de docentes en educación regular	55.750	50.811	- 4.939	Reducción
Número de estudiantes en educación regular	1.125.735	1.056.832	- 68.903	Reducción
Número de estudiantes por cada docente en educación regular	20,2	20,8	0,6	Incremento
Tasa de mortalidad general	4,3	6,6	2,3	Incremento

In the case of poverty and extreme poverty during the pandemic, there was an increase of 8% and 6.5%, respectively. In other words, the country had more people whose income was insufficient to cover the basic food basket and the minimum subsistence basket. This reduction may result from the pandemic's consequences and impact on the different production sectors, causing family members to lose income. When scaling the result in absolute terms, it has been determined that, in the country, more than 1.4 million people became poor. These data are alarming since, during COVID-19, it has not been possible to guarantee Ecuadorians the minimum conditions for an adequate quality of life.

Another group of indicators that has been analyzed is employment and suitable employment. Both have had a reduction between the years of study. The data that has had the most significant impact is adequate employment. During the pandemic, full employment conditions were reduced, implying that employed people earned less than the basic wage and worked 40 hours or more. The group also wants to work more hours since their schedules do not reach the entire working day. Quantifying an approximation of the number of workers who ceased to have adequate employment, more than 600 thousand were employed but not in adequate conditions, and this drop occurred during the pandemic. This can be attributed to the fact that several employers had to reduce the workday to part-time, which reduced wages by half. These conditions trigger the affectation of other social structures. Such is the case of people who became poor.

Regarding the indicators corresponding to education, the attendance rate for primary and secondary school is considered. Although the reduction is minimal, several students stopped attending these learning levels. Therefore, the reduction in both cases does not reach 1% compared to 2019. In this case, the most affected level was primary, with approximately 60 thousand children who stopped attending school. These results can be attributed to the lack of technological resources for access to virtual classes, computer availability and internet connection. It is important to mention that the latter does not reach part of the rural sectors of the country.

Concerning Regular Education, in 2019, teachers taught 20 students, while in the following year, there was an increase of one more student for each teacher. Additionally, the rest of the educational indicators are not encouraging because there was a reduction of 69 thousand people who dropped out of school, considering the first year of primary education up to the third year of high school. Thus, by 2020 there were almost 5 thousand fewer teachers for the previously mentioned level of education.

The general mortality rate is one of the indicators with the most significant impact, with an increase of two deaths per 1,000 inhabitants. By 2020, this increase reached 41,000 more deaths than the previous year. This last result is the main effect of the pandemic, which impacts the rest of the social indicators as well as the families that lost a member of the household and probably the livelihood of the family group.

Conclusions

This research determined that the pandemic has negatively affected all the social contexts analyzed, such as poverty, employment, education and health. Furthermore, this behavior was evidenced when comparing indicators between two years. That is, in 2019, more people were in better living conditions.

According to the results, the most significant negative impact indicators are income poverty and adequate employment. Both metrics have a direct relationship; the less income a household member generates affects the living conditions of the rest of the household members because they do not even cover the minimum needs to subsist.

In the education approach, there has been a reduction in the number of teachers; therefore, the number of students enrolled in regular education has decreased. Although school attendance rates have decreased minimally, attributed to the change in the number of students, it cannot be ignored that this problem, whose social impact will be evident in several years because children and adolescents have stopped studying.

Education, employment and health are the rights of the people that are recognized within the international conventions and the regulations of Ecuador. The improvement of these indicators is the new challenge that the current representatives must assume since the pandemic has caused the decompensation of living conditions and the generation of development for the country.

References

Blake, P., & Wadhwa, D. (14 de Diciembre de 2020). *Banco Mundial Blogs.* Obtenido de https://blogs.worldbank.org/es/voices/resumen-anual-2020-el-impacto-de-la-covid-19-coronavirus-en-12-graficos

Castillo Añazco, R., & Rosero Moncayo, J. (2015). Empleo y Condición de Actividad en Ecuador. *Revista de Estadística y Metodologías*, 25.

Comisión Económica para América Latina y el Caribe. (2005). *Indicadores sociales en América.* Santiago de Chile: Comisión Económica para América Latina y el Caribe.

EC. (20 de Octubre de 2008). Constitución de la República del Ecuador. Ecuador: Registro Oficial 449.

Gorgas García, J., Cardiel López, N., & Zamora Calvo, J. (2011). *Estadística básica para estudiantes de ciencias.* Madrid: Departamento de Astrofísica y Ciencias de la Atmósfera.

Instituto Nacional de Estadística y Censos. (2008). *Medidas de pobreza y pobreaz extrema por ingresos.* Quito: Comunicación Social y Relaciones Públicas.

Instituto Nacional de Estadística y Censos. (2017). *Ecuador en cifras*. Obtenido de https://www.ecuadorencifras.gob.ec/educacion/

Instituto Nacional de Estadística y Censos. (2021). *Boletín Técnico Registro Estadístico de Defunciones Generales.* Quito: Dirección de Estadísticas Sociodemográficas.

Inter-American Development Lives. (1996). *Hacia un Sistema de Indicadores Sociales.* Washington.

Ministerio de Educación. (2021). *Manual de Fichas Metodológicas Vol. 1.* Quito: Ministerio de Educación.

Organización de las Naciones Unidas. (10 de Diciembre de 1948). Declaración Universal de los Derechos Humanos. New York.

Reyes Pacheco, M., & Valencia Narváez, P. (2021). La pandemia covid -19 y su impacto sobre el riesgo país del Ecuador. Un análisis coyuntural en el periodo 2020. *Ciencia Latina*, 28.

United Nations Educational, Scientific and Cultural Organization. (2009). *Indicadores de la educación: Especificacionestécnicas.* United Nations Educational, Scientific and Cultural Organization.

Zurita Herrera, G. (2008). *Probabilidad y Estadística: Fundamentos y Aplicaciones.* Guayaquil: Escuela Superior Politécnica del Litoral.