Mental health and other factors associated with the perception of the improvement of the environment after the first months of the pandemic in Latin America

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Mental health and other factors associated with the perception of the improvement of the environment after the first months of the pandemic in Latin America

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Abstract

Introduction: Due to the restrictions of mobility during the first months of the pandemic, an improvement in the environment was observed, but this has not been estimated from the perspective of mental health. **Aim:** To determine whether mental health and other factors were associated with the perception of the improvement of the environment after the first months of the pandemic in Latin America. **Methodology:** Analytical and multicenter cross-sectional study. Four questions were asked about their perception of change in the environment after a quarter of the pandemic, Alpha of Cronbach: 0,96). **Results:** Descriptive and analytical statistics were obtained. In the multivariate analysis, an association of a greater perception of environmental change was found according to having moderate or severe stress (RPa: 1,16; IC95%: 1,05-1,28; valor p=0,003) and live in Bolivia (RPa: 1,24; IC95%: 1,10-1,40; valor p<0,001); In contrast, there was less perception of change among men. (RPa: 0,84; IC95%: 0,78-0,90; valor p<0,001), among the youngest (RPa: 0,995; IC95%: 0,992-0,998; valor p=0,003), among those living in Mexico (RPa: 0,80; IC95%: 0,69-0,93; valor p=0,003) and other Latin American countries (RPa: 0,64; IC95%: 0,43-0,98; valor p=0,039), adjusted for level of education and having anxiety. **Discussion:** The environment changed due to the lack of human activity, but this perception was also associated with mental health status. **Conclusion:** A

greater perception of environmental change was associated with having moderate/severe stress and living in Bolivia; there was less perception of change among men, in younger men, depending on living in Mexico or in other Latin American countries.

Keywords: Mental Health, Perception, Environmental Pollution, Latin America, Environmental Change.

Introduction

In the last 2 decades according to the 16th edition of the Climate Risk Index, it reports that more than 475,000 people lost their lives as a direct result of more than 11,000 extreme weather events (rainfall, floods and landslides) worldwide and the losses amounted to around $2.56 billion [1], China reported in the last quarter of 2019 cases of atypical pneumonia in some patients from its Hubei province [2]. Then it would be known that it was the beginning of an outbreak that would lead to the greatest pandemic that humanity had seen in the last 100 years [3, 4]. Vulnerability to climate, geophysical, economic or health-related risk is systemic and interconnected, the global COVID-19 pandemic has reiterated this. It is therefore important to strengthen the resilience of countries that are more vulnerable to different types of risks [1].

At the beginning of the pandemic, measures were decreed that were totally unexpected, such as mobility restrictions, social distancing, quarantines, curfews, among others [5, 6]. In many of the countries of Latin America, a strict quarantine began since March 2020, which generated that people almost did not go out on the street for fear of being infected, there was also little mobility, alarming news through the media, the large influx of police and military who guarded the cities [7, 8]. Same situation that was experienced in many parts of the world, where people were practically forced not to go out to the streets, beaches, fields and countless places around the world, which generated a minimum reduction in traffic, vehicular congestion, the agglomeration of people, especially in large cities [9–11].

These measures were taken to curb the transmission of the virus; However, it also brought side effects [12, 13]. Since, unexpected changes began to be reported in some ecosystems, animals were seen roaming urban areas and some cities [14, 15]. The water began to clear in certain seas, lakes and rivers, the fauna of these places began to be seen more frequently: as whales, dolphins and other marine animals; There were measurements showing a decrease in carbon dioxide, as well as, it was reported that nitrogen dioxide (NO2) it was reduced by up to 30% in places like Spain, France and Italy; where greenhouse gas emissions were reduced by 20-30% [12]. In this context the environment began to change, because the main producer of environmental pollution was in "quarantine", which was measured technically by some studies, however, there is little information on how people have perceived it and its association with the mental health of the population. Therefore, the objective of the research was to determine whether mental health and other factors were associated with the perception of the improvement of the environment after the first months of the pandemic in Latin America.

Methodology

Cross-sectional, analytical and retrospective research was conducted. The study was based on a secondary data analysis, as the top four questions were taken exploratory when the respondent was asked. The population was made up of the countries of Bolivia, Colombia, Honduras, Peru, Chile, Ecuador, Paraguay, Costa Rica, El Salvador, Mexico, Panama, Guatemala, and others in Latin America. It was surveyed in a non-random way in the second quarter of the first wave of the pandemic, this after having had several months of quarantine, curfews, restrictions on mobility in the various countries [16]. People of legal age at the time of the survey, who resided in one of the countries already mentioned during the first wave of the pandemic and who voluntarily agreed to participate in the research were included. Fewer than 200 surveys were excluded because they did not have the answer in any of the four items that would show the perception of environmental change during the first wave of the pandemic.

Ethics were always respected, the study was conducted under the Declaration of Helsinki. This research's preparation and execution fully complied with the fundamental ethical principles of autonomy, justice, beneficence, and non-maleficence. the study had the approval of the ethics committee of the Antenor Orrego Private University (resolution N°0043-2022-UPAO). Either an anonymous survey was used, the participants were informed of the objective of the study and that they were free not to answer the questions with which they did not feel comfortable. The answers to the four main questions, as well as the other variables, were recorded in a Microsoft Excel version 2019 program sheet, then the data was transferred to a sheet in the Stata version 16 program, where the selection criteria were considered and a data quality control was carried out.

The main variable was the perception of environmental change during the first wave of the COVID-19 pandemic in Latin America, this was obtained through four individual questions (where it was asked if they perceived that the air, rivers, oceans or the environment were cleaner or purer compared to before), it is important to mention that each of these questions had answers from very disagree (equal to one point) to very Agree (equal to 5 points), so people could have a total response ranging from four points to 20. Those who were in the upper third of the grades were considered as those who perceived a positive change in the environment (this being the interest category) and being compared versus those who were in the middle and lower third (those who did not perceive a positive change in the environment). Cronbach's Alpha for all four questions was equal to 0,96.

In addition, the variables of sex (male and female), age (years completed), level of education (secondary or lower, baccalaureate, high school, technical, university and postgraduate studies), country of residence (within those already mentioned) and the DASS-21 scale was used to measure depression, anxiety and stress; which measured These three aspects of the mental sphere through 21 questions already validated and used in multiple studies in Latin America and the world [17, 18]. For statistical analysis, depression, anxiety and stress were considered; each with 2 categories: moderate or severe (which had the sum of the categories moderate plus severe and very severe) versus mild or no (which had normal values or low intensity of symptoms).

The percentages of each perception were described, this according to each of the 4 questions that served to create the dependent variable. The percentage of perception in some of the Latin American countries surveyed was then described. Next, a cross was made between the perception of improvement of the environment according to each of the secondary variables already described; It is here where frequencies and percentages were obtained for the crossing of categorical variables, as well as the medians and interquartile ranges for the crossing of the main variable versus age (due to having a non-normal behavior); p-values were also obtained with the chi-square test (for all categorical crosses) and the Wilcoxon test (for the crossing with age). Being a secondary data analysis, this is where the statistical power of the main crossings had to be calculated, where it was determined that the power was not sufficient for the crossing of the main perception versus depression (power: 9%), nor for the comparison against Chile (power: 4%), Paraguay (power: 73%), Colombia (power: 76%), Ecuador (power: 4%), Costa Rica (power: 78%) and Honduras (power: 25%); In all other cases the potencies were excellent (97% or more).

Finally, we obtained the bivariate and multivariate models of the associated factors, this with the generalized linear models, with the use of the Poisson family, log link function and models for robust variances. With all this, the crude, adjusted prevalence ratios, 95% confidence intervals and p-values were obtained. For a variable to pass from the bivariate model to the final model it had to have a p-value less than 0.05 and for a variable it had to be considered statistically significant in the final multivariate model it had to have p-values less than 0.05 or the confidence intervals should not touch unity.

Results

Of the 7756 respondents in Latin America, most agreed that they perceived that the environment had changed (32% strongly agree and 42% agree), that the air was cleaner/purer (30% strongly agree and 39% agree) and that the rivers were cleaner (30% strongly agree and 40% agree) Cronbach's overall Alpha was 0.96. (Table 1)

Table 1. Percentages of the perception of environmental change during the first wave of the COVID-19 pandemic in Latin America, n=7756.

In the pandemic I perceive...	Strongly disagree	Disagree	Indifferent	I agree	Strongly agree	Alpha
That the air is cleaner/purer compared to before	9%	7%	15%	39%	30%	0,96
That the rivers are cleaner / purer compared to before	9%	8%	13%	40%	30%	0,93
That the oceans are cleaner/purer compared to before	9%	9%	14%	39%	29%	0,94
That the environment has improved compared to before	8%	6%	12%	42%	32%	0,94

The countries that perceived a greater change in the environment were Bolivia (44%), Colombia (37%), Honduras (36%) and Peru (35%), those that perceived a smaller change were Panama (29%), Guatemala (25%) and other countries (23%). When the socio-geographical and mental health factors associated with the perception of environmental change were evaluated, it was found that there was an association according to sex ($p<0.001$), age ($p<0.001$), having moderate/severe degrees of anxiety ($p=0.006$), or stress

(p<0.001) and country of residence (p<0.001); All these values were statistically significant. (Table 2)

Table 2. Socio-geographical factors associated with the perception of environmental change during the first wave of the COVID-19 pandemic in Latin America, n=7756.

Variable	Perception of environmental change		Valor p
	No n (%)	Yes n (%)	
Sex			
Female	2914 (63,6)	1670 (36,4)	<0,001
Male	2214 (69,8)	958 (30,2)	
Age (years)*	22 (20-30)	22 (19-27)	<0,001
Instruction			
Secondary or less	711 (63,0)	417 (37,0)	0,060
High School	438 (66,1)	225 (33,9)	
Technical studies	452 (68,8)	205 (31,2)	
University	3162 (66,2)	1618 (33,8)	
Posgrado	365 (69,1)	163 (30,9)	
Depression			
Mild or no	4056 (66,0)	2089 (34,0)	0,685
Moderate or severe	1072 (66,5)	539 (33,5)	
Anxiety			
Mild or no	3862 (67,0)	1904 (33,0)	0,006
Moderate or severe	1266 (63,6)	724 (36,4)	
Stress			
Mild or no	4331 (67,2)	2113 (32,8)	<0,001
Moderate or severe	797 (60,8)	515 (39,2)	
Country			
Perú	2714 (65,5)	1431 (34,5)	<0,001
Chile	489 (65,7)	255 (34,3)	
Paraguay	384 (67,5)	185 (32,5)	
México	348 (71,5)	139 (28,5)	
Colombia	71 (63,4)	41 (36,6)	
Bolivia	221 (56,1)	173 (43,9)	
Panamá	245 (71,0)	100 (29,0)	
Ecuador	180 (65,7)	94 (34,3)	
Costa Rica	127 (67,6)	61 (32,4)	
El Salvador	126 (69,6)	55 (30,4)	
Honduras	98 (64,5)	54 (35,5)	
Guatemala	69 (75,0)	23 (25,0)	
Other	56 (76,7)	17 (23,3)	

When performing the multivariate analysis, it was found that moderate or severe stress was associated with a greater perception of environmental change (RPa: 1,16; IC95%: 1,05-1,28; value p=0,003) and live in Bolivia (RPa: 1,24; IC95%: 1,10-1,40; valor p<0,001); In contrast, there was less perception of change among men. (RPa: 0,84; IC95%: 0,78-0,90; value p<0,001), among those who were younger (RPa: 0,995; IC95%: 0,992-0,998; value p=0,003), among those living in Mexico (RPa: 0,80; IC95%: 0,69-

0,93; valor p=0,003) among those living in Mexico (RPa: 0,64; IC95%: 0,43-0,98; valor p=0,039), adjusted for the level of education and having anxiety. (Table 3)

Table 3. Bivariate and multivariate analysis of the factors associated with the perception of environmental change during the first wave of the COVID-19 pandemic in Latin America, n=7756.

Variable	Bivariate analysis	Multivariate analysis
Male	0,83 (0,78-0,88) <0,001	0,84 (0,78-0,90) <0,001
Age (years)*	0,994 (0,991-0,997) <0,001	0,995 (0,992-0,998) 0,003
Instruction		
Secondary or less	Comparison group	Comparison group
Bachelor	0,92 (0,81-1,05) 0,200	0,94 (0,82-1,08) 0,369
Technical studies	0,84 (0,74-0,97) 0,015	0,90 (0,78-1,03) 0,138
University	0,92 (0,84-0,99) 0,044	0,93 (0,85-1,01) 0,102
Posgrado	0,84 (0,72-0,97) 0,017	0,92 (0,78-1,07) 0,276
Moderate depression or more	0,98 (0,91-1,06) 0,686	No entró al modelo final
Moderate anxiety or more	1,10 (1,03-1,18) 0,006	0,97 (0,89-1,06) 0,499
Moderate stress or more	1,20 (1,11-1,29) <0,001	1,16 (1,05-1,28) 0,003
Country		
Perú	Comparison group	Comparison group
Chile	0,99 (0,89-1,11) 0,895	0,98 (0,88-1,09) 0,686
Paraguay	0,94 (0,83-1,07) 0,349	0,92 (0,81-1,05) 0,230
México	0,83 (0,71-0,96) 0,011	0,80 (0,69-0,93) 0,003
Colombia	1,06 (0,83-1,36) 0,642	1,02 (0,80-1,31) 0,853
Bolivia	1,27 (1,13-1,43) <0,001	1,24 (1,10-1,40) <0,001
Panamá	0,84 (0,71-,99) 0,044	0,85 (0,71-1,00) 0,056
Ecuador	0,99 (0,84-1,18) 0,942	0,97 (0,82-1,16) 0,766
Costa Rica	0,94 (0,76-1,16) 0,563	0,95 (0,77-1,17) 0,602
El Salvador	0,88 (0,70-1,10) 0,265	0,90 (0,71-1,13) 0,362
Honduras	1,03 (0,83-1,28) 0,797	1,01 (0,81-1,26) 0,920
Guatemala	0,72 (0,51-1,03) 0,076	0,74 (0,52-1,05) 0,095
Other	0,67 (0,44-1,03) 0,065	0,64 (0,43-0,98) 0,039

The statistical values were obtained with the generalized linear models: Poisson family, log link function and models for robust variances. Shown: prevalence ratios (left), intervalos de confianza al 95% (centro) y valores p (derecha).

Discussion

The objective of this study was to determine whether mental health and other factors were associated with the perception of the improvement of the environment after the first months of the pandemic in Latin America, knowing that this context contributed positively to changes in the environment, but has also caused negative alterations in the mental health of the population, Especially those who had access to overcrowded homes, those who were alone, those who lacked access to outdoor facilities, etc ; which together were important factors in contributing to poor mental health during lockdown [19].

Therefore, this study shows that people who had stress in a moderate or severe range, had more perception about the change in the environment that occurred in the first months of the pandemic, which could be explained by the symptoms of stress, being an important alteration of the sense of reality, that can produce a feeling of lightheadedness, which also generates perceiving that time slows down, where there is a state of hypervigilance and intolerance to uncertainty; It is for all this that it could generate that respondents overestimate the threats or their perceptions to changes in the environment [20]. In addition, people with more stress and anxiety are those who were generally immersed in the infodemic of this global crisis, where an overload of information of all kinds was generated [21, 22]. Other pathologies could also influence this association, such as what Schuch et al. reported in their meta-analysis that low levels of physical activity were more likely to suffer from problems in the mental sphere, generating a protective effect against the onset of depression in young people, adults and the elderly [23]; Other pathologies could also influence this association, such as what Schuch et al. reported in their meta-analysis that low levels of physical activity were more likely to suffer from problems in the mental sphere, generating a protective effect against the onset of depression in young people, adults and the elderly. Within the sociodemographic factors, the youngest perceived a greater change in the environment, which could be caused by multiple situations, such as the information they received from the media, since many of them stated at the beginning of the pandemic that the earth would have a reduction of 4-8% of carbon dioxide emissions, as well as, a decrease in seismic noise due to social immobilization, the fall in air traffic and means of transport in general, all caused by the confinement experienced in the first months of the pandemic [24, 25]. But what we find is also a bit contradictory with certain studies, which mention the impact that the physical environment has on human behavior in a beneficial way, being this driver of better environmental actions [26, 27]. This is based on the fact that a quality environment generates well-being mainly in adults, who prefer less polluted, more ecological and natural climates, on the other hand, the youngest prefer more urban, commercial and residential spaces [28]. This is based on the fact that a quality environment generates well-being mainly in adults, who prefer less polluted, more ecological and natural climates, on the other hand, the youngest prefer more urban, commercial and residential spaces [29]. This is based on the fact that a quality environment generates well-being mainly in adults, who prefer less polluted, more ecological and natural climates, on the other hand, the youngest prefer more urban, commercial and residential spaces [30]. However, the countries of Central America, especially Honduras and Nicaragua, were affected by two category 5 hurricanes in just

under a month, and despite the improvements in the environment that occurred worldwide, these countries were strongly affected by natural events that were not seen in two decades. This may have influenced the perception of climate change in these countries [31]. This confirms the fact that each population could have diverse influencers in these perceptions, so it is expected that there will be more multicenter studies with good samples to continue studying this perception.

Currently it refers that the impact on health has accelerated in recent years, suffering more frequent heat stroke, dehydration, alterations in mental health, neurological, cardiovascular and renal health, as well as having a greater frequency and severity of respiratory and systemic viral diseases [32]. Similar situations for most countries in the world, although in this study there was a difference in perception according to the country, for example, according to the global risk index of climate change shows that among the 10 most affected countries the tenth position belonged to Bolivia in 2019 being the only country in Latin America [1], Similar situations for most countries in the world, although in this study there was a difference in perception according to the country, for example, Bolivia perceived more change in the environment, on the contrary, Mexico and other countries perceived less change. Pollution is a problem that has affected, affects and will continue to affect the daily lives of the countries of South America and other parts of the world [33]. That is why the perception of pollution has an important cultural value [34]. Each country also has its particularities, which affects each one to perceive differently, in the case of Bolivia, there is currently an economic model based on agriculture, consumption, exploitation of raw materials, with water, soil and the environment being the most affected [35], in April 2019, where the World Resources Institute (WRI) revealed that Bolivia ranked fifth among the countries that lost the highest forest cover in the world during 2018 [36]. Likewise, the internal and external commercial market demands the continuous production of food, after the presence of climate change, the productivity of soils is gradually decreasing [37]. These facts possibly influenced the perception of the Bolivian population, who are currently reassessing the importance of water, soil, environment and others as a base of raw material and economic income of the country [33, 37], a fact that is also evident when mentioning that the achievement of the Sustainable Development Goals (SDG)) By 2030 it will be affected by the alteration in the management of natural resources such as water, electricity, minerals, fuels, agriculture and biodiversity, which will need major post-pandemic improvement efforts [38].

In addition, government policies during the COVID-19 pandemic have drastically altered energy demand patterns around the world. Many international borders were closed and populations were confined to their homes, reducing transportation and changing consumption patterns. Daily global CO2 emissions decreased by 17% (change range: –11 to –25%). This in early April 2020 compared to 2019 average levels, just under half of that change was due to changes in surface transport. So government actions and post-crisis economic incentives are likely to influence the global trajectory of CO2 emissions for decades [39]. In addition to this, it has also been found in other realities that the change produced by the environment is perceived differently, such as in Europe, in which a study of 37 countries saw difficulties in the pandemic, such as the increase in the consumption of personal protective equipment (masks, COVID-19 test kits, disposable gloves, among others), and impact on tourism in cities that depend economically, however, this side of the world at the same time took the opportunity to use more technology for remote work, supplying the need to mobilize or physically mobilize without means of transport, and

even 90% of participants in this study believed that it was a good opportunity for governments to create more sustainable policies with the environment [40, 41].

It was found that men had a lower perception of environmental change, it may be due to the fact that in Latin America women make more than 80% of decisions regarding the home and the environment that surrounds them [42]. Yuan found associations of all three mental health symptoms (depression, anxiety and insomnia) with being a woman [43]. In addition, men, when fulfilling their social role, gradually distance themselves from the environment and biodiversity, since women are generally responsible for ensuring the survival of families by providing them with resources such as water and food on a day-to-day basis. The prevalence of mental health symptoms was also reported to be higher in South America than in Central America (36% vs. 28%), on average, 32% of adults in Latin America had symptoms of distress during COVID-19, which could be attributed to variations between these countries in the evolution of the pandemic (e.g., some countries such as Peru and Brazil started well but deteriorated quickly [44]. In addition, men were less affected in relation to stress and mental health; this is related to studies where it was found that the negative impacts of COVID-19 on stress levels and mental health were much more pronounced among female students, which would directly affect the perception between both genders [45].

Limitations

The main limitation of the study was that it is exploratory research, which relied on few questions that measured the primary endpoint. But there were also many strengths, such as the fact that thousands of people were surveyed in one of the regions most affected by the pandemic, due to effects on climate change (such as the ozone layer, social and political conflicts, poverty, among many others) and that it was carried out just after a period in which all its respondents were locked up and could perceive the repercussions of these measures. We know that many questions were missing, as well as to investigate in a deeper way the perception of this change, to know your opinion about global/current climate change, and others that could be important, but it is expected that these other questions will be asked in future research, which will deal more in depth with various issues in the population of Latin America.

Conclusion

With the results that have been obtained, it can be concluded that the respondents agreed that they perceived that the environment had changed. In addition, a greater perception of environmental change was associated with having moderate or severe stress and living in Bolivia; on the contrary, there was less perception of change among men, among those of younger age, among those living in Mexico and other Latin American countries.

Declarations:

Ethics approval and consent to participate

The study was conducted under the Declaration of Helsinki. This research's preparation and execution fully complied with the fundamental ethical principles of autonomy, justice, beneficence, and non-maleficence, informed consent was obtained from all participants

involved in the study, consent to publish was obtained from the study participant, This research was generated after conducting a project, which was approved by the ethics committee of the Universidad Privada Antenor Orrego (resolution N°0043-2022-UPAO).

Consent for publication

Kindly include Consent for Publication as Not Applicable.

Availability of data and materials

The data presented in this study are available on request from the corresponding author.

Competing interests

The authors declare no conflict of interest.

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Author Contributions:

Conceptualization: C.R.M., H.C.L., W.V.O., D.A.C., M.A.V.E., V.S.A., L.I.Z., E.E.T., T.R.P.; methodology, C.R.M., H.C.L., W.V.O.; validation: C.R.M.; formal analysis, C.R.M.; investigation, C.R.M., H.C.L., W.V.O., D.A.C., M.A.V.E., V.S.A., L.I.Z., E.E.T., T.R.P.; data curation, C.R.M., H.C.L., W.V.O.; writing original draft preparation, C.R.M., H.C.L., W.V.O., D.A.C., M.A.V.E., V.S.A., L.I.Z., E.E.T., T.R.P.; writing-review and editing, C.R.M., H.C.L., W.V.O., D.A.C., M.A.V.E., V.S.A., L.I.Z., E.E.T., T.R.P.; visualization, C.R.M., H.C.L., W.V.O., D.A.C., M.A.V.E., V.S.A., L.I.Z., E.E.T., T.R.P.

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Conflicts of Interest:

The authors declare no conflict of interest.

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References

1. David Eckstein, Vera Künzel, Laura Schäfer. Global Climate Risk Index 2021. 21 Enero 2021. https://reliefweb.int/report/world/global-climate-risk-index-2021.
2. Zheng Y, Xiong C, Liu Y, Qian X, Tang Y, Liu L, et al. Epidemiological and clinical characteristics analysis of COVID-19 in the surrounding areas of Wuhan, Hubei Province in 2020. Pharmacol Res. 2020;157:104821. doi:10.1016/j.phrs.2020.104821.
3. Adiga A, Dubhashi D, Lewis B, Marathe M, Venkatramanan S, Vullikanti A. Mathematical Models for COVID-19 Pandemic: A Comparative Analysis. J Indian Inst Sci. 2020;100:793–807. doi:10.1007/s41745-020-00200-6.
4. Abufhele M, Jeanneret V. Puertas Adentro: La otra cara de la pandemia. [Home confinement: The other side of the epidemic]. Rev Chil Pediatr. 2020;91:319–21. doi:10.32641/rchped.v91i3.2487.
5. Zhao G. Tomar medidas preventivas inmediatamente: evidencia de China sobre el COVID-19. [Taking preventive measures immediately: evidence from China on COVID-19]. Gac Sanit. 2020;34:217–9. doi:10.1016/j.gaceta.2020.03.002.
6. Güner R, Hasanoğlu I, Aktaş F. COVID-19: Prevention and control measures in community. Turk J Med Sci. 2020;50:571–7. doi:10.3906/sag-2004-146.
7. Chacma-Lara E, Capcha-Condor A. La pandemia del COVID-19 en Lima: Estimaciones con y sin medidas preventivas. [The COVID-19 pandemic in Lima: Estimates with and without preventive measures]. Rev Med Chil. 2021;149:310–1. doi:10.4067/s0034-98872021000200310.
8. Macassi Lavander S. Comunicación para el cambio de comportamientos y estrategias sanitaria del gobierno peruano frente al COVID-19. Chasqui: Revista Latin de Com. 2020:235–58.
9. Baoquan Chen, Mingyi Shi, Xingyu Ni, Liangwang Ruan, Hongda Jiang, Heyuan Yao, et al. Análisis visual de datos y predicción de la simulación para COVID-19. Fronteras de la Ciencia. 2020:35–7.
10. Parra Pedraza MJ. COVID-19 ¿Un alivio temporal para el ambiente? CA. 2020;9:299–311. doi:10.33210/ca.v9i2.318.
11. Gibney E. Coronavirus lockdowns have changed the way Earth moves. Nature. 2020;580:176–7. doi:10.1038/d41586-020-00965-x.
12. Muhammad S, Long X, Salman M. COVID-19 pandemic and environmental pollution: A blessing in disguise? Sci Total Environ. 2020;728:138820. doi:10.1016/j.scitotenv.2020.138820.
13. Soba D, Gámez AL, Becerril JM, Esteban R, Aranjuelo I. Traffic restrictions during COVID-19 lockdown improve air quality and reduce metal biodeposition in tree leaves. Urban For Urban Green. 2022;70:127542. doi:10.1016/j.ufug.2022.127542.
14. A recreation ecology perspective on the COVID-19 (SARS-CoV-2) pandemic: Potential parks and protected area impacts relating to visitor spatial use, terrestrial flora …; 2021.

15. Reyes DC. AVISTAMIENTO DE FAUNA SILVESTRE ANTE INMOVILIZACIÓN SOCIAL POR LA COVID-19. IBS. 2021;1:18–27. doi:10.58720/ibs.v1i1.3.
16. Prieto-Silva R, Sarmiento-Hernández CA, Prieto-Silva F. Morbilidad y mortalidad por COVID-19 en Latinoamérica: estudio en tres países - febrero a julio de 2020. [Morbidity and mortality due to COVID-19 in latin america: study of three countries - february to july 2020]. Rev Salud Publica (Bogota). 2023;22:198–204. doi:10.15446/rsap.V22n2.89682.
17. Tapullima Mori C, Chávez Castañeda BR. Escala de estrés, ansiedad y depresión (DASS-21): propiedades psicométricas en adultos de la provincia de San Martín. Psiquemag. 2021;11:73–88. doi:10.18050/psiquemag.v11i1.2575.
18. Antúnez Z, Vinet EV. Escalas de Depresión, Ansiedad y Estrés (DASS - 21): Validación de la Versión abreviada en Estudiantes Universitarios Chilenos. Ter Psicol. 2012;30:49–55. doi:10.4067/S0718-48082012000300005.
19. Keller A, Groot J, Matta J, Bu F, El Aarbaoui T, Melchior M, et al. Housing environment and mental health of Europeans during the COVID-19 pandemic: a cross-country comparison. Sci Rep. 2022;12:5612. doi:10.1038/s41598-022-09316-4.
20. Orozco A, Cardoner N, Aragón CF, Ruiz-Murugarren S, Vicens M, Álvarez-Mon MÁ, Lahera G. Obsessive-compulsive symptoms in anxiety and depressive disorders: Influence of recent and/or traumatic life events. Rev Psiquiatr Salud Ment (Engl Ed). 2021;14:218–26. doi:10.1016/j.rpsmen.2020.12.002.
21. Dubey S, Biswas P, Ghosh R, Chatterjee S, Dubey MJ, Chatterjee S, et al. Psychosocial impact of COVID-19. Diabetes Metab Syndr. 2020;14:779–88. doi:10.1016/j.dsx.2020.05.035.
22. Rathore FA, Farooq F. Information Overload and Infodemic in the COVID-19 Pandemic. J Pak Med Assoc. 2020;70(Suppl 3):S162-S165. doi:10.5455/JPMA.38.
23. Schuch FB, Vancampfort D, Firth J, Rosenbaum S, Ward PB, Silva ES, et al. Physical Activity and Incident Depression: A Meta-Analysis of Prospective Cohort Studies. Am J Psychiatry. 2018;175:631–48. doi:10.1176/appi.ajp.2018.17111194.
24. BBC News. Coronavirus y cambio climático: por qué la pandemia no es realmente tan buena para el medio ambiente. 2020 (Consultado 26 febrero 2023). https://www.bbc.com/mundo/noticias-52596472.
25. BBC News Mundo. Coronavirus: cómo las medidas contra la pandemia están causando que la Tierra vibre menos. 2020(Consultado 26 febrero 2023). https://www.bbc.com/mundo/noticias-52177361.
26. Sevillano V OP. Social behavior and environment: The influence of social norms on environmental behavior. Papeles del psicólogo. 2019;40:182–9.
27. UNICEF. La juventud en favor de la acción climática Hacer oír las voces de los jóvenes para proteger el futuro de nuestro planeta. 2019 (consultado 26 febrero 2023). https://www.unicef.org/es/medio-ambiente-cambio-climatico/juventud-accion.
28. Laatikainen TE, Broberg A, Kyttä M. The physical environment of positive places: Exploring differences between age groups. Prev Med. 2017;95 Suppl:S85-S91. doi:10.1016/j.ypmed.2016.11.015.
29. Tyrväinen L, Ojala A, Korpela K, Lanki T, Tsunetsugu Y, Kagawa T. The influence of urban green environments on stress relief measures: A field experiment. Journal of Environmental Psychology. 2014;38:1–9. doi:10.1016/j.jenvp.2013.12.005.

30. Trevino JE, Monsur M, Lindquist CS, Simpson CR. Student and Nature Interactions and Their Impact on Mental Health during the COVID-19 Pandemic. Int J Environ Res Public Health 2022. doi:10.3390/ijerph19095030.
31. Zambrano LI, Fuentes-Barahona IC, Henriquez-Marquez KI, Vasquez-Bonilla WO, Sierra M, Muñoz-Lara F, et al. COVID-19 and Hurricanes: The Impact of Natural Disasters during a Pandemic in Honduras, Central America. Prehosp Disaster Med. 2021;36:246–8. doi:10.1017/S1049023X21000182.
32. Del Lacy-Niebla MC. Climate change and the COVID-19 pandemic. [El cambio climático y la pandemia de COVID-19]. Arch Cardiol Mex. 2021;91:269–71. doi:10.24875/ACM.M21000076.
33. FORNO E, PAUWELS G. Contaminación ambiental y actores sociales en Bolivia:: Un balance de la situación. Tinkazos. 2009;12:9–31.
34. Casa M, Cusi L, Vilca L. Percepciones sobre contaminación ambiental y actitudes en estudiantes universitarios. Rev. Innova Educ. 2019;1:391–9. doi:10.35622/j.rie.2019.03.011.
35. SIERRA PRAELI Y. Bolivia: polémica por políticas ambientales y más de cinco millones de hectáreas arrasadas. 2020 (Consultado 26 febrero 2023). https://es.mongabay.com/2020/01/bolivia-deudas-ambientales-incendios-2019/.
36. Bosques Andinos y Cambio Climático. World Resources Institute. 2019 (Consultado 26 de febrero 2023). https://www.bosquesandinos.org/tag/world-resources-institute/.
37. Mercado M, García M., Quintanilla J. Evaluación de los niveles de contaminación por plomo y arsénico en muestras de suelos y productos agrícolas procedentes de la región cercana al complejo … Revista Boliviana de Química. 2009;26.
38. CEPAL. El rol de los recursos naturales ante la pandemia por el COVID-19 en América Latina y el Caribe. 2020 (Consultado 26 de febrero 2023). https://www.cepal.org/es/enfoques/rol-recursos-naturales-la-pandemia-covid-19-america-latina-caribe.
39. Le Quéré C, Jackson RB, Jones MW, Smith AJP, Abernethy S, Andrew RM, et al. Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat. Clim. Chang. 2020;10:647–53. doi:10.1038/s41558-020-0797-x.
40. Hidalgo-Triana N, Picornell A, Reyes S, Circella G, Ribeiro H, Bates AE, et al. Perceptions of change in the environment caused by the COVID-19 pandemic: Implications for environmental policy. Environ Impact Assess Rev. 2023;99:107013. doi:10.1016/j.eiar.2022.107013.
41. Diego Portugal Del Pino, Jeff Opperman, Arjette Stevens, Chris Weber, Christo Fabricius, Ninel Escobar. NATURE HIRES:How Nature-based Solutions can power a green jobs recovery. Octubre 2022. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_757823.pdf.
42. Impuestos Verdes:¿ una alternativa viable para el Ecuador?; 2011.
43. Yuan K, Zheng Y-B, Wang Y-J, Sun Y-K, Gong Y-M, Huang Y-T, et al. A systematic review and meta-analysis on prevalence of and risk factors associated with depression, anxiety and insomnia in infectious diseases, including COVID-19: a call to action. Mol Psychiatry. 2022;27:3214–22. doi:10.1038/s41380-022-01638-z.

44. Zhang SX, Batra K, Xu W, Liu T, Dong RK, Yin A, et al. Mental disorder symptoms during the COVID-19 pandemic in Latin America - a systematic review and meta-analysis. Epidemiol Psychiatr Sci. 2022;31:e23. doi:10.1017/S2045796021000767.
45. Prowse R, Sherratt F, Abizaid A, Gabrys RL, Hellemans KGC, Patterson ZR, McQuaid RJ. Coping With the COVID-19 Pandemic: Examining Gender Differences in Stress and Mental Health Among University Students. Front Psychiatry. 2021;12:650759. doi:10.3389/fpsyt.2021.650759.