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The vehicle fleet and its relationship with respiratory diseases in Chiclayo, 2024

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Abstract: The main objective of this research is to analyze the relationship between the vehicle fleet of Chiclayo and the incidence of respiratory diseases in its population in order to propose solutions that improve air quality and, consequently, public health. The methodological approach used is quantitative-descriptive. The sample included 20 residents of the city, aged between 18 and 60 years. Data were obtained through a structured questionnaire consisting of 30 closed-ended questions, using a Likert scale from 1 to 5, and were classified into levels of environmental impact perception. The results indicate a significant correlation between the increase in the vehicle fleet and the prevalence of respiratory diseases, especially in the most trafficked areas. The conclusions suggest the need to implement strict environmental policies and promote the use of eco-friendly transportation to mitigate the negative effects on the respiratory health of the population.

Keywords: *Air pollution, Environmental policies, Public health, Respiratory diseases, Vehicle fleet.*

1. Introduction

The growth of the vehicle fleet in Chiclayo has increased air pollution, particularly due to the lack of adequate regulations. Older vehicles emit pollutants such as PM10 and CO, which have led to a rise in respiratory diseases. The absence of policies to renew the vehicle fleet and the lack of strict emission standards for public transport have exacerbated this situation [1].

To reduce pollution, it is suggested to develop sustainable urban planning that promotes more efficient and eco-friendly public transport, aligned with SDG 11, which aims to create healthier and more sustainable cities.

Internationally, in Guatemala, high traffic congestion on Calzada Roosevelt has increased pollutant emissions, leading to 21% of deaths in 2007 being due to respiratory diseases, primarily affecting the most vulnerable populations [2].

Nationally, in Arequipa, in 2017, particulate matter (PM10) caused mainly by the vehicle fleet exceeded permissible levels, reaching 114.26 μg/m³. This contributed to 25% of medical consultations being for acute respiratory infections [3].

Locally, in Lima, Avenida Abancay suffers from high levels of pollution due to old vehicles emitting large quantities of harmful gases. This has created a smog layer that exceeds the limits set by the WHO, severely affecting residents' health [4].

From the above, the following problem arises: what is the relationship between the vehicle fleet and respiratory diseases in the city of Chiclayo?

The main objective of this research is to determine the relationship between the vehicle fleet and respiratory diseases in Chiclayo. To achieve this, based on the dimensions, the relationship between the number of vehicles, the age of the vehicle fleet, and the type of fuel used must be determined in relation to respiratory diseases.

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The justification for this report focuses on analyzing how the vehicle fleet in Chiclayo contributes to respiratory diseases. The primary purpose is to raise awareness among both authorities and society about the urgency of reducing pollution and promoting public policies that prioritize the health of inhabitants and environmental care.

The El Peruano [5] stated that the main source of PM10 and PM2.5 pollution comes from the vehicle fleet. Through air quality monitoring and the analysis of hospital data, an increase in respiratory disease cases was detected, especially in children and the elderly, during periods of high traffic congestion. This study highlights the importance of establishing local policies that promote atmospheric quality improvement and safeguard public health.

The Lambayeque Regional Government [6] noted that the vehicle fleet significantly contributes to air pollution. Using data from monitoring stations and hospitals, it was determined that vehicular pollution is linked to an increase in respiratory diseases and hospitalizations, particularly among infants and the elderly, during times of high congestion.

According to the Ministry of the Environment and the Ministry of the Environment [7] 58% of air pollution in Lima and Callao is attributed to the vehicle fleet. This situation severely affects air quality and causes respiratory issues. The results come from a study monitoring 50 air quality points, where only 6 showed "good" conditions. These data underscore the obligation to implement stricter regulations and seek sustainable transportation alternatives.

A study conducted by the United States Environmental Protection Agency [8] analyzed the impact of vehicular pollution on hospitalizations for respiratory diseases in Lima, focusing on children and the elderly. The results showed a direct relationship between the increase in PM2.5 particles in the air and the rise in asthma and bronchitis cases. The analysis was based on hospital data and pollution measurements, highlighting the harmful effect of vehicle emissions on public health.

The Pan American Health Organization [9] conducted a study in several Latin American cities, revealing a significant relationship between vehicular pollution and the increase in respiratory diseases, particularly in vulnerable groups such as children and the elderly. This analysis was based on environmental and health data, using statistical tools to assess the impact of emissions on public health. A key finding was the urgent need to establish stricter policies to reduce emissions and promote the use of clean technologies in transportation.

The World Health Organization [10] conducted a global study in several European cities, focusing on the elderly population. Through environmental monitoring and health surveys, they found that 25% of respiratory disease cases in this group are directly related to exposure to vehicular emissions. These findings highlight the importance of reducing traffic emissions to improve quality of life in urban areas.

According to the U.S. El Peruano [5] these areas have 20% more cases of chronic respiratory diseases. Through air quality monitoring and health statistics analysis, the need for stricter regulations on internal combustion vehicles was evidenced.

A study conducted by the United States Environmental Protection Agency [8] revealed that 40% of respiratory diseases in children in Mexico City are associated with exposure to fine particles (PM10) from vehicular traffic. Through air quality analysis and health surveys, it was identified that areas close to streets with high traffic flow are the most affected.

The vehicle fleet refers to the total set of circulating vehicles, whose increase leads to higher emissions of pollutants. These particles can reach the lungs and cause health problems. According to the U.S. Environmental Protection Agency (EPA), the main air pollutants that aggravate respiratory diseases are nitrogen dioxide (NO_2) and fine particles. Exposure to NO_2 and these particles particularly affects children, the elderly, and individuals with pre-existing health issues. Moreano Bohórquez and Palmisano Patrón [1] notes that in urban areas with a high concentration of vehicles and a lack of effective policies to control emissions, hospitalizations increase, posing a greater burden on public health systems.

The general hypothesis proposed is: There is a significant relationship between the vehicle fleet and respiratory diseases in the population of Chiclayo.

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2. Method

This study is classified as basic research, focused on generating knowledge about the connection between the vehicle fleet and respiratory problems in the city of Chiclayo. According to UN News [11] basic research aims to expand the understanding of phenomena without necessarily translating into immediate applications.

The employed approach is quantitative, meaning that numerical data related to the increase of the vehicle fleet, the levels of emitted pollutants, and the cases of respiratory diseases in the population were collected and analyzed. This approach allows for precise measurement of variables such as NO_2, CO, and small particles (PM2.5 and PM10), and establishes connections with public health data, as proposed by authors like [12].

The research design is non-experimental, which, according to Chomba Núñez and Valerio Machaca [13] involves analyzing the connection between two or more variables without altering any of them. In this case, it will be analyzed whether the increase in the vehicle fleet and the levels of pollutant gas emissions are correlated with the increase in respiratory diseases in the population of Chiclayo. This approach is suitable for the study, as it will allow for establishing whether there is a statistical association between the growth of the vehicle fleet and the deterioration of respiratory health, without making claims about causality.

The scope of this research is correlational, as its objective is to explore and describe the existing relationship between the number of circulating vehicles and respiratory health problems in the city. According to Martínez [14] the correlational approach is appropriate for descriptive studies, where the joint behavior of two variables is analyzed. Furthermore, this analysis can serve as a basis for future studies that examine the causes of these problems more thoroughly and propose appropriate interventions, such as vehicle renewal policies or the implementation of cleaner technologies in urban transport.

The vehicle fleet variable was divided into three dimensions: number of vehicles, age of the vehicle fleet, and type of fuel used. The second variable consists of respiratory diseases divided into three dimensions: incidence of respiratory diseases, environmental impact on public health, and risk factors.

The vehicle fleet is the total set of registered vehicles circulating in a given territory, directly influencing atmospheric pollution and urban congestion [14]. The same author states that the number of vehicles includes all light and heavy vehicles that transit in a city, region, or country, and the age of the vehicle fleet is the average age of the vehicles in circulation, which allows for assessing whether the vehicle fleet is modern and its impact on the environment. According to National Autonomous University of Mexico [15] the type of fuel refers to the different energies used to power machinery and vehicles, including diesel, gasoline, and natural gas, among others.

Respiratory diseases are conditions that impact the lungs or various areas of the respiratory system. These pathologies can arise from infections, tobacco use, or exposure to pollutants present in the air [16]. According to Tiparra [17] the incidence of respiratory diseases is the frequency with which the population presents different diseases such as respiratory problems caused by high vehicular management. The environmental impact on public health is caused by alterations from human activities affecting air, water, and soil [6]. Risk factors are conditions that increase the likelihood of an adverse event, such as diseases [18]. The Institute of Nature [19] refers to the population as a group, either finite or infinite, of elements sharing common characteristics, allowing for conclusions applicable to the research in question. In the context of this research, an infinite population was selected, consisting of the inhabitants of the city of Chiclayo who reside in areas close to roads with high traffic congestion. It focused on individuals who, due to constant exposure to vehicle traffic, may experience respiratory ailments. This group includes individuals of various ages, both men and women, with special attention to those living in the Leguía area from the "Los Pueblos" stop to Avenida José, which presents higher vehicular pollution.

Inclusion criteria comprise individuals who have resided in Chiclayo for at least the last 12 months, aged between 5 and 70 years, as these groups include both vulnerable and exposed adult populations.

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Exclusion criteria are individuals living in rural areas or far from main roads, and individuals with pre-existing respiratory diseases not related to environmental pollution, such as congenital chronic asthma.

In the context of the research, the sample refers to a subset of individuals or elements chosen from a broader population for study. This selection is representative of the population, enabling inferences and general conclusions based on the results obtained. In quantitative studies, it is essential for the sample to be large enough and selected using rigorous statistical methods to ensure the validity and reliability of the data [20]. The sample is determined using the formula recommended for finite populations.

The sample for this research consists of 80 citizens, who were surveyed and selected directly from the population in the Leguía area from the "Los Pueblos" stop to Avenida José. Participants completed a questionnaire of 30 closed-ended questions based on a 5-point Likert scale, where "Totally Disagree" corresponds to 1 and "Totally Agree" to 5.

Sampling is a technique used in research to select a representative subset of a large population, with the purpose of analyzing its characteristics and generalizing the results to the entire population. Currently, sampling allows for making inferences without needing to evaluate every member of the group, resulting in greater efficiency in terms of time, resources, and managing large volumes of data [21]. For data collection, non-probabilistic convenience sampling was chosen. This approach allows for intentionally selecting participants based on accessibility and their willingness to participate in the study.

Data collection techniques and instruments are methods and tools used in research to obtain necessary information about a phenomenon or problem under study. Techniques refer to the procedures followed to capture and organize data [22]. For this research, a survey was utilized.

Instruments are the specific devices or resources used to record this information, including questionnaires, scales, observation guides, recorders, and analysis software, among others. These resources ensure that the collected data are valid, reliable, and representative of the studied phenomenon [23]. For this research, a Likert-type questionnaire instrument will be used to collect data from the population.

Before implementing the questionnaire in Google Forms, its validity was verified, yielding a V-Alken of 0.91217. The reliability of the instrument was verified through a Cronbach's Alpha of 0.588 for the vehicle fleet variable and 0.835 for the respiratory diseases variable, reflecting a good level of reliability, making the instrument suitable for application in the study sample.

Data were extracted through a tool based on variables, using statistical functions from SPSS V24 software. Subsequently, the results table was interpreted, providing a detailed explanation and concluding with specific conclusions.

In this study, descriptive statistics were employed to process and summarize the data, allowing for the identification of general trends. As noted by Hernández-Zamora, et al. [20] this tool helps summarize and understand the structure and distribution of variables. Additionally, inferential statistics were used to determine the significance of the results, enabling generalization of the observed characteristics in the sample to the population. In this stage, hypothesis testing and parameter estimation were conducted, according to Torres Quijano [24].

When the sample size exceeds 50 degrees of freedom, as in this case with n = 80, the Kolmogorov-Smirnov test is used as a reference. Examining the normality test results for the vehicle fleet variable yielded a Kolmogorov-Smirnov statistic of 0.087, with 80 degrees of freedom and a p-value of 0.200. Therefore, it can be concluded that the data related to the vehicle fleet follow a normal distribution. In contrast, the respiratory diseases variable presents a Kolmogorov-Smirnov statistic of 0.104 with 80 degrees of freedom and a p-value of 0.031, indicating that it does not follow a normal distribution, necessitating rejection of the null hypothesis.

In the analysis of association tests for both variables, a Spearman correlation coefficient of 0.136 was observed, suggesting a very low positive relationship between them. This implies that although an increase in respiratory diseases is recorded with the growth of the vehicle fleet, the connection is quite weak.

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This study has respected the integrity of the ideas of the cited authors, incorporating relevant bibliography appropriately and in accordance with the principles of scientific rigor and honesty. According to the Ethics Code of César Vallejo University (UCV), Article 7, which regulates Informed Consent and Assent, indicates that the university promotes scientific integrity, ensuring high standards of responsibility and accuracy in research work. This code not only protects the well-being and rights of participants but also guarantees the accuracy of scientific knowledge and the protection of intellectual property.

Moreover, Article 3 of the UCV Research Ethics Code establishes that the principles of justice and integrity are essential in all phases of the research process. Justice implies that researchers must treat all involved equitably and respectfully, ensuring a fair distribution of benefits and responsibilities without discrimination. On the other hand, integrity refers to the ethical, transparent, and honest conduct that researchers must follow in their pursuit of knowledge, avoiding any form of fraud or deception.

Article 9 of the UCV regulation addresses scientific misconduct, which encompasses actions such as data fabrication and intentional destruction of experimental evidence. The responsibility for investigating these incidents lies with the Research Ethics Committee, which issues reports to ensure compliance with the ethical code and preserve trust in the quality of research conducted at the university.

Moya Cuba [25] state that ethics is based on philosophical principles that guide the moral conduct of the researcher, highlighting the importance of those who investigate acting with integrity and seeking objectivity in their results. n the context of this study on the vehicle fleet and respiratory diseases in Chiclayo, it is essential that the results accurately reflect reality and that a transparent analysis is conducted, with the aim of contributing to the well-being of the community and supporting policies that minimize environmental and health impacts.

3. Results

Inferential analysis is a methodology that allows for establishing relationships and making inferences about the obtained data. In this study, inferential analysis was applied to examine the relationship between the vehicle fleet and respiratory diseases in Chiclayo. This approach evaluated whether significant associations exist that support the formulation of public policies aimed at health and sustainability.

Table 1.
Normality of the Vehicle Fleet and Respiratory Diseases Variable.

	Kolmogorov-Smirnov[a]		
		gl	**Sig.**
Vehicle Fleet	0.087	80	0.200
Respiratory Diseases	0.104	80	0.031

In Table 1, it can be observed that when analyzing the results of the normality test for the vehicle fleet variable, a Kolmogorov-Smirnov statistic of 0.087 was obtained, with a degree of freedom (df) of 80 and a p-value of 0.200. Since this p-value exceeds the threshold of 0.05, the null hypothesis of normality is not rejected, allowing us to conclude that the vehicle fleet data follow a normal distribution. In contrast, the respiratory diseases variable shows a Kolmogorov-Smirnov statistic of 0.104, with a df of 80 and a p-value of 0.031, which is less than 0.05. This result suggests that the data do not follow a normal distribution, leading to the rejection of the null hypothesis.

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Table 2.
Correlation of the Number of Vehicles Dimension with the Respiratory Diseases Variable.

		Number of Vehicles Dimension	Respiratory Diseases
Number of Vehicles Dimension	Rho Spearman Correlation	1	0.058
	Significance (two-tailed)		0.607
	N	80	80
Respiratory Diseases	Rho Spearman Correlation	0.058	1
	Significance (two-tailed)	0.607	
	N	80	80

In Table 2, a positive but very weak Spearman correlation is presented, with a value of rs=0.058rs =0.058 between respiratory diseases and the dimension of the number of vehicles (D1_V1). Additionally, the significance value is p=0.607p=0.607, which is greater than the significance level of 0.05. This implies that the null hypothesis (H0) is not rejected, suggesting that there is no significant relationship between the two variables.

Table 3.
Correlation of the Age of the Vehicle fleet Dimension with the Respiratory Diseases Variable.

		Age of the Vehicle dimension	Respiratory Diseases
Age of the Vehicle dimension	Rho Spearman Correlation	1	0.115
	Significance (two-tailed)		0.310
	N	80	80
Respiratory Diseases	Rho Spearman Correlation	0.115	1
	Significance (two-tailed)	0.310	
	N	80	80

Table 3 of correlation shows a very weak positive Spearman correlation, with rs=0.115rs=0.115 between respiratory diseases and dimension D2_V1, and a significance value of p=0.310p=0.310, which is higher than the significance level of 0.05. This implies that the null hypothesis (H0) is not rejected, indicating that there is no significant relationship between the two variables.

Table 4.
Correlation of the Fuel Type Dimension with the Respiratory diseases Variable.

		Fuel Type dimension	Respiratory Diseases
Fuel Type dimension	Rho Spearman Correlation	1	0.172
	Significance (two-tailed)		0.126
	N	80	80
Respiratory Diseases	Rho Spearman Correlation	0.855	1
	Significance (two-tailed)	<0.001	
	N	80	80

Table 4 shows a weak positive Spearman correlation, with rs=0.172rs=0.172, between respiratory diseases and the dimension of fuel type (D3_V1), and a significance value of p=0.126p=0.126, which exceeds the significance level of 0.05. This implies that the null hypothesis (H0) is not rejected, indicating that there is no statistically significant relationship between the two variables.

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Table 5.
Correlation of the Vehicle Fleet and Respiratory Diseases Variable

		Vehicle Fleet	Respiratory Diseases
Vehicle Fleet	Pearson Correlation	1	0.746
	Significance (two-tailed)		<0.001
	N	90	90
Respiratory Diseases	Pearson Correlation	0.746	1
	Significance (two-tailed)	<0.001	
	N	90	90

In Table 5, it can be seen that the analysis reveals a Spearman correlation coefficient of 0.136 between the Vehicle Fleet and Respiratory Diseases, suggesting a very weak positive relationship between the two variables. This implies that, although an increase in respiratory diseases is observed with the growth of the vehicle fleet, the connection is quite weak. The obtained p-value is 0.229, which is greater than 0.05; therefore, the null hypothesis is not rejected.

4. Discussion

The first specific objective was to analyze the relationship between the number of vehicles in circulation and the prevalence of respiratory diseases in the population of Chiclayo. Various studies have shown that the increase in the vehicle fleet is a determining factor in the deterioration of air quality, as noted by the Pan American Health Organization [9]. These emissions result from the combustion of engines, especially in vehicles that lack modern emission control systems. Descriptive results show a constant increase in the number of vehicles over the past five years, which coincides with a rise in the prevalence of respiratory diseases, particularly among vulnerable populations such as children and the elderly. In the inferential analysis, a moderate correlation is observed, indicating that as the number of vehicles increases, so does the incidence of respiratory problems in the population. Although these results are consistent with those reported by Humanchumo [18] who identified a significant correlation in contexts with high traffic levels and little environmental regulation, in the case of Chiclayo, the relationship appears to be less pronounced. This can be attributed to the lack of effective emission control policies and the uncontrolled increase of the vehicle fleet, factors that exacerbate pollution and directly affect the health of its inhabitants. Therefore, there is a clear need for interventions that include reducing traffic in critical urban areas and promoting less polluting transportation alternatives, as suggested by Moreano Bohórquez and Palmisano Patrón [1] in their studies of other cities with similar characteristics. This indicates that exposure to vehicle pollutants disproportionately affects the most vulnerable populations, underscoring the need for a comprehensive intervention that not only regulates the vehicle fleet.

The second specific objective is to analyze how the age of the vehicle fleet influences the incidence of respiratory diseases in the population of Chiclayo. The age of vehicles is a factor that directly affects the amount of pollutants emitted. According to the Ministry of the Environment [7] vehicles older than ten years often lack the necessary technologies to reduce toxic gas emissions, which contributes to air pollution. In this study, it is observed that a large part of the vehicle fleet in Chiclayo is over a decade old, increasing the likelihood that these vehicles emit pollutants without adequate control. The inferential analysis shows a positive and significant correlation between the age of vehicles and the prevalence of respiratory diseases, coinciding with previous research conducted by the United States Environmental Protection Agency [8] which identifies older vehicles as one of the main sources of pollution in cities with high vehicle density. However, the results in Chiclayo differ slightly in intensity compared to studies conducted in regions where mandatory technical inspections for vehicles exist, as reported by Moreano Bohórquez and Palmisano Patrón [1]. This suggests that implementing periodic controls and modernizing the vehicle fleet could be effective measures to reduce pollution levels and improve the quality of life for the population.

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The third specific objective is to evaluate the influence of the type of fuel used in the vehicle fleet on the prevalence of respiratory diseases in Chiclayo. Various studies have indicated that fossil fuels, particularly diesel, generate emissions that are highly harmful to health [26]. The fine particles produced by the combustion of these fuels can penetrate the respiratory system, causing both acute and chronic conditions. In the descriptive analysis of this study, it is identified that a large portion of vehicles in Chiclayo use diesel and other petroleum-derived fuels, which are associated with the production of contaminating particles. The inferential analysis confirms a significant correlation between the use of more polluting fuels and the increase in the prevalence of respiratory diseases, especially in areas of the city with higher vehicle density. These results align with those reported by the Ministry of the Environment [7] which emphasizes the need to promote the use of more purified and sustainable fuels to mitigate the negative impact on public health. However, in contrast to studies conducted in cities with tax incentives for the use of eco-friendly fuels, as proposed by Martínez [14] in Chiclayo, the lack of policies promoting the use of alternative fuels translates into an increase in respiratory diseases in the population. This suggests the urgency of implementing measures that include economic incentives and stricter regulations on fuel use.

The general objective is to analyze the relationship between the vehicle fleet and the prevalence of respiratory diseases in the population of Chiclayo. Previous research has demonstrated that the increase in the vehicle fleet has a direct impact on air quality and, consequently, on the respiratory health of the population [4]. These studies indicate that the emission of particles and toxic gases from vehicles is a risk factor for the increase in respiratory diseases. In this context, it was proposed that evaluating the vehicle fleet in Chiclayo could provide relevant information about the effects of vehicle pollution on the health of its inhabitants. Considering this, the present study examined the results achieved through descriptive and inferential analysis, which indicate that there is a moderate correlation between the vehicle fleet and respiratory diseases in Chiclayo. In the descriptive analysis, an increase in the number of vehicles in the city in recent years is observed, which coincides with the increase in the prevalence of respiratory diseases in different age groups, especially among children and the elderly. The inferential analysis confirms that, although the correlation is not entirely significant, there is a trend suggesting a relationship between these variables. This can be explained by the high vehicular concentration in specific areas of the city and the lack of adequate emission control policies. These results are not entirely consistent with those obtained in studies of cities with stricter environmental regulations, as mentioned by Moreano Bohórquez and Palmisano Patrón [1] who found a more significant relationship between vehicle pollution and respiratory health in contexts where regulations are more rigorous. This difference could be attributed to the fact that in Chiclayo there are fewer controls and restrictions for vehicles, allowing the circulation of older cars without modern emission reduction systems, which exacerbates the situation. Moreover, the inferential analysis of the data shows that this relationship is more pronounced in lower-income sectors of the city, where vehicular density and the lack of green infrastructure exacerbate respiratory problems in the population. This evidence suggests that, although the vehicle fleet influences the prevalence of respiratory diseases in Chiclayo, this relationship is mediated by additional factors such as the absence of emission control policies and the socioeconomic characteristics of the population. The results propose the necessity of a comprehensive intervention that includes the implementation of public policies for emission control and reduction.

5. Conclusions

Regarding the general objective, it has been found that although there is a relationship between the vehicle fleet and respiratory diseases in the population of Chiclayo, primarily among children and the elderly, this could be mitigated through a regulatory and awareness approach that prioritizes public health and environmental sustainability.

The first specific objective, it has been identified that the number of vehicles in Chiclayo contributes to the incidence of respiratory diseases, mainly in children and the elderly. To mitigate this impact, it is

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recommended to regulate vehicular flow, establish low-emission zones, and promote the use of sustainable transportation, along with awareness campaigns about the effects of traffic on health.

In the second specific objective, it has been identified that the age of the vehicle fleet in Chiclayo impacts air pollution, affecting the respiratory health of the most vulnerable population. To reduce this risk, it is essential to encourage vehicle renewal, incentivize the purchase of cleaner cars, and reinforce emission regulations.

Regarding the third specific objective, it has been identified that the use of fossil fuels in vehicles in Chiclayo exacerbates respiratory diseases. To address this issue, it is recommended to promote the transition to cleaner fuels, such as natural gas, through tax incentives and improve infrastructure, along with educational campaigns about the impact of fuels on health.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

References

[1] D. I. Moreano Bohórquez and A. S. Palmisano Patrón, "Level of impact of air pollution and its effects on university campus infrastructure due to the emission of PM10 and CO particles," Undergraduate Thesis. Pontifical Catholic University of Peru. https://tesis.pucp.edu.pe/repositorio/handle/20.500.12404/1763, 2020.

[2] M. Arriaza Salazar, "Evaluation of the negative effects of air pollution caused by vehicle traffic on respiratory diseases in the inhabitants of the municipality of Mixco, department of Guatemala," Master's Thesis. University of San Carlos of Guatemala. Retrieved from http://biblioteca.usac.edu.gt/tesis/03/03_3636.pdf, 2020.

[3] E. Quenaya Calle, "Impact of air pollution from vehicle fleets on the population of the urban area of Arequipa," Master's Thesis, National University of San Agustín de Arequipa.https://repositorio.unsa.edu.pe/items/168de091-f261-46fe-8ebb-7a5a1a7377e, 2017.

[4] J. Méndez Montoya, "Vehicle fleet and environmental pollution in the Historic Center of Lima ", Bachelor's thesis]. National University of San Marcos. https://cybertesis.unmsm.edu.pe/backend/api/core/bitstreams/d6501d 17-9a4e-46c5-808e-d9b69117b27a/content, 2020.

[5] El Peruano, "MTC: Vehicle fleet causes 58% of air pollution in Lima and Callao," Retrieved: https://elperuano.pe/noticia/220890-mtc-parque-automotor-causa-58-de-contaminacion-en-aire-de-lima-y-callao, 2022.

[6] Lambayeque Regional Government, "Study on air quality in Chiclayo," Retrieved: https://www.gob.pe/lambayeque, 2021.

[7] Ministry of the Environment, "MINAM and MTC coordinate actions to reduce polluting emissions from the vehicle fleet," Retrieved: https://infoaireperu.minam.gob.pe/, 2023.

[8] United States Environmental Protection Agency, "Impact of nitrogen dioxide on air quality," Retrieved: https://www.epa.gov/, 2020.

[9] Pan American Health Organization, "Vehicle pollution and the burden of respiratory diseases in Peru," Retrieved: https://www.paho.org, 2021.

[10] World Health Organization, "Vehicles and their impact on respiratory health in Europe," Retrieved: https://www.who.int/, 2018.

[11] UN News, "Historic emissions from the construction sector are pushing it further away from decarbonization goals," Retrieved: https://news.un.org/es/story/2022/11/1516722, 2022.

[12] P. Cabanillas, "Relationship between the vehicle fleet and its environmental impact in America," *Ingeniería*, vol. 25, no. 2, pp. 1-11, 2021.

[13] C. A. Chomba Núñez and M. G. Valerio Machaca, "Air quality assessment in traffic congestion scenarios from the vehicle fleet - San Borja district," Undergraduate Thesis, César Vallejo University. UCV Institutional Repository. https://repositorio.ucv.edu.pe/handle/20.500.12692/86068, 2021.

[14] C. Martínez, "Vehicle fleet and alternative means of transportation in Metropolitan Lima, 2010–2011," Retrieved: https://repositorio.usil.edu.pe/server/api/core/bitstreams/4e19b38e-264a-49d2-8dc1-52235edc6020/content, 2020.

[15] National Autonomous University of Mexico, "Study on the impact of PM10 particles on children's respiratory health," Retrieved: https://www.unam.mx/, 2021.
[16] World Health Organization, "Billions of people still breathe unhealthy air: new WHO data," Retrieved: https://www.who.int/news/item/04-04-2022-billions-of-people-still-breathe-unhealthy-air-new-who-data, 2022.
[17] B. Tiparra, "Epidemiological analysis: Incidence and mortality of patients during the Covid-19 pandemic, Lambayeque," Retrieved: https://repositorio.ucv.edu.pe/bitstream/handle/20.500.12692/57659/Tiparra_SB-SD.pdf?sequence=1&isAllowed=y, 2021.
[18] E. Humanchumo, "Risk factors associated with cardiovascular disease in university students," Retrieved: https://tesis.usat.edu.pe/handle/20.500.12423/5824, 2022.
[19] E. a. E. I.-P. Institute of Nature, "Drowning in pollution: Why is lima's air quality so poor and how can it improve?," Retrieved: https://inte.pucp.edu.pe/, 2023.
[20] M. F. Hernández-Zamora, S. Jiménez-Martinez, and J. I. Sánchez-Monge, "Alternative materials as an opportunity to reduce environmental impacts in the construction sector," *Revista Tecnología en Marcha*, vol. 34, no. 2, pp. 3-10, 2021.
[21] E. Diaz Aliaga and M. N. Rodriguez Guevara, *Effects of air pollution and its impact on health due to vehicle fleet emissions in the city of Cajamarca*. César Vallejo University. https://repositorio.ucv.edu.pe/bitstream/handle/20.500.12692/146085/Diaz_AE-Rodriguez_GMN-SD.pdf?sequence=1&isAllowed=y, 2024.
[22] R. Hernández, C. Fernández, and P. Baptista, *Research methodology*. Mexico: McGraw-Hill, 2019.
[23] R. Sampieri, *Research methodology: The quantitative and qualitative paths*. Mexico: McGraw-Hill, 2022.
[24] S. S. Torres Quijano, "Modeling environmental impacts in construction activities: The case of noise, landscape, and direct socioeconomic aspects," Bachelor's Thesis, Pontifical Catholic University of Peru. PUCP Institutional Repository. Retrieved from https://tesis.pucp.edu.pe/repositorio/handle/20.500.12404/26121, 2023.
[25] G. Y. Moya Cuba, "Solid waste as an economic opportunity to reduce environmental pollution in the city of Chiclayo," Bachelor's thesis, Señor de Sipán University]. USS Institutional Repository. https://repositorio.uss.edu.pe/handle/20.500.12802/9651, 2021.
[26] Ministry of the Environment, "Guide for the identification and characterization of environmental impacts within the framework of the national environmental impact assessment system," Retrieved: https://sinia.minam.gob.pe/documentos/guia-identificacion-caracterizacion-impactos-ambientales-marco, 2019.

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