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Bike lanes and public health in San Juan de Lurigancho:

analysis of usage, safety and lifestyle perceptions

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Dedicatory

I dedicate this work to my family, who have supported me unconditionally throughout this semester. I would especially like to thank my mother, who has been the pillar of my emotional stability. She has accompanied me in every difficult moment, helping me to face them and teaching me to always see the positive side of things.

Abstract

The urban population faces increasing health problems, many of which can be mitigated by more active lifestyles. Cycling is a prime example of such an activity. This study examines the relationship between cycling infrastructure and health in San Juan de Lurigancho, Lima, Peru, focusing on a section of the bike lanes on Las Flores de Primavera Avenue. Observations and surveys were conducted to analyze the frequency and purpose of bike lane use, residents' perceptions of safety, and their levels of physical activity. The results reveal that while the existence of cycling infrastructure can facilitate mobility, its health benefits are limited by the cultural perception of cycling as a leisure activity rather than as an exercise activity. Additionally, disparities in the quality of bike lane conditions were found to significantly influence perceptions of safety, with well-maintained sections offering a more positive experience than those with infrastructure deficiencies. The study also concluded that lack of time is the main barrier to cycling regularly, with most residents exercised predominantly on weekends. These results highlight the need for improved infrastructure, public safety measures, and campaigns to promote cycling as a health-oriented activity, ensuring its integration into daily life and its potential to address urban health challenges. Overall, this study contributes to expanding the literature on the role of cycling infrastructure in addressing health problems in urban areas.

Key words: bike infrastructure, public health, safety perceptions, time, leisure, Lima.

1. Introduction

In recent years, the increasing prevalence of obesity has become a significant public health issue worldwide. In urban areas, the promotion of active transportation, such as cycling, has been identified as a potential solution to encourage physical activity and combat obesity (Guzman et al., 2020). In Lima, Peru, the district of San Juan de Lurigancho stands out not only for its large population but also for its high obesity rates. As cities like Lima strive to improve urban infrastructure, the question arises: can cycling infrastructure, such as bike lanes, play a crucial role in fostering healthier lifestyles? This study aims to evaluate the relationship between the presence and quality of bike lanes and the physical activity levels of residents in San Juan de Lurigancho, with a particular focus on how these factors may contribute to addressing obesity within the district.

There are various factors that influence obesity. When people do not include physical activity in their lifestyles, they tend to consume more calories than they burn during normal daily activities or exercise (Barragan & Anaya, 2010). Another factor is diet. Having a calorie-dense diet, characterized by frequent consumption of fast food, high-calorie beverages, etc., contributes to weight gain. Furthermore, social and economic conditions also influence obesity, because when there is not enough access to safe areas to carry out some physical activity, or when there is not enough money to buy fruits, fresh vegetables, equipment to exercise or do sports, the probability of experiencing obesity increases (García & Creus, 2016).

Promoting physical activity, such as cycling, can be an effective way to counteract these risks. Biking has been found to be associated with reduced risk of mortality from cardiovascular issues, cancer, and diabetes (Jordi, 2017).

Riding a bicycle for at least 20 minutes a day, most days of the week, reduces the risk of death by at least 10% (Kelly et al., 2014). To reinforce this idea, active commuting (walking or cycling) is associated with a 10% decrease in the risk of cardiovascular diseases (CVD) (Dinu et al., 2019; Hamer & Chida, 2008). The risk of developing type 2 diabetes, reduces by 30% (Dinu et al., 2019). Cancer mortality is 30% lower among individuals who use a bicycle for transportation (Dinu et al., 2019).

In addition to physical health benefits, biking is also an important tool to for mental health because when doing physical exercise, neurotransmitters such as serotonin, endorphins, oxytocins or dopamines are activated. This relaxes the brain and increases self-esteem, self-confidence, and emotional stability (Crespo, 2022).

In addition to this, cycling also has economic and environmental benefits. When people opt for this active mode of transport on a daily or frequent basis, instead of public transport, they reduce on cost of transportation and can even save money. Also, as a non-motorized vehicle, its use contributes to the reduction of the carbon footprint (Aguilar, 2021).

Furthermore, a study involving 80,306 adults in England, found that those who incorporated cycling into their lives had a 15% lower probability of dying from any cause. In contrast, runners also had a percentage reduction, but it was not as significant as that of swimmers and cyclists (Oja et al., 2017).

Another study with a population of 45,000 adults in Denmark discovered that mandatory cycling (for commuting) or cycling for leisure reduced the risk of heart attacks by 11% to 18% (Blond et al., 2016). A study from the United Kingdom with 260,000 adult participants found that cycling was associated with a lower risk of CVD, cancer, and all-cause mortality (Celis et al., 2017).

Although cycling has been shown to be associated with numerous health benefits, access to cycling is unequal across countries and socioeconomic parameters. For example, in Denmark, where cycling infrastructure is considered among the best in the world, citizens enjoy easy access to bicycles and safe bike lanes (Utopia, 2022). In contrast, in countries like Peru where infrastructure is poor, cycling may be limited, affecting public health and the well-being of residents.

According to Rojas et al., In Lima, Peru, the cycling culture is not well developed and people tend to limit the function of the bicycle to a means of transportation or a tool for entertainment. In addition, the authors established that bicycles present significantly low levels of use compared to buses and combis (small public transportation vehicles). Furthermore, there is a notable lack of advertising and marketing campaigns that promote the use of bicycles as an ideal mean to improve health. (Ninaquispe, 2021).

This could be happening because the development of bike lanes in each district is unequal. On one hand, there is the Miraflores district, which stands out for having a more developed infrastructure (Cannock et al., 2020). On the other hand, there is the Comas district, which lacks quality bike lanes and infrastructure. While the bike lanes in Miraflores have sufficient standards to ensure a pleasant journey for cyclists, other districts do not. Zambrano (2022) analyzes a section of Avenida Universitaria in Comas and determines that the circulation of cars generates vehicular congestion, and they begin to take over the surrounding streets, promoting disorder. This is detrimental to the trafficability of cyclists, especially when there is no bike lane established along the avenue where they can travel safely. In addition, Alva (2021) relies in her research on the commentary of an architect named Sasha Chumpitaz to highlight that along the bike lane of Avenida Universitaria (from Comas to Lima Cercado) there are not enough traffic lights for cyclists. Likewise, the presence of vehicular ramps in the middle of bike lanes is frequent and risky for cyclists.

Cyclists in Lima face numerous daily risks, primarily due to inadequate infrastructure. Many bike lanes show signs of wear, potholes, debris, faded markings, and disconnections that complicate safe travel (Guevara, 2022). Additionally, poor road safety education among drivers places cyclists in danger, and bicycle theft remains a significant concern due to insufficient secure parking. All of these problems affect people's decisions to use bike lanes (Guevara, 2022).

Due to the presence of this type of obstacles in bike lanes, cyclists usually end up opting for other spaces, such as tracks or sidewalks, to move around (Roman, 2021). Therefore, when riding on the roads, cyclists are exposed to the risk of being run over due to the lack of road safety education. On the other hand, the presence of bicycles on the sidewalk limits the space for pedestrians to walk comfortably and safely (Andia, 2023). This type of deficiencies assumes a significant obstacle for cyclists, which could cause people to abstain from riding bicycles (Barrios et al., 2022).

According to a study by Aymara & Bustinza it was established that in San Juan de Lurigancho, the bike lane situation varies on different avenues. It states that, on Avenida Los Postes Este, the bike lane is continuous, and there is no sign of potholes or puddles. In other words, the bike lanes on this avenue are properly maintained, since even the signage is not faded. Their study also highlighted that the vehicular lanes surrounding the bike lane are in good condition and there is vegetation separating the bike lane from the traffic. However, they point out that, this is something that is not repeated on the bike lane on Avenida Canto Grande, where potholes and puddles are present. Their study concludes by indicating that the discontinuity of the bike lane represents a greater risk when the tracks surrounding this infrastructure are in poor condition, as well as the sardinels and signage.

In addition to physical barriers to riding bikes, there are also economic challenges. Basic review of Facebook forums on second-hand bicycle sales revealed, that the average bicycle cost ranges from S/. 250 to 3000. On the other hand, a review of catalogs from

sales companies showed that the cost of new bicycles ranges from S/.500 to 4000. This cost might be unaffordable to many people in San Juan de Lurigancho because the average monthly salary is only S/.1,599.8 (INEI, 2023).

The economic challenges to owning a bicycle contrast the physical opportunities to engage in biking in San Juan de Lurigancho as in this district bike lanes extend over 14 kilometers, covering seven main avenues in the district (Sáenz, 2023). The construction of these lanes began in 2021, and they are currently fully operational. This includes the installation of signage, bollards, traffic lights, parking areas, exercise equipment at each stop, green spaces, and waste collection points. Additionally, it states that Avenida Las Flores de Primavera has the longest bike lane, measuring 4.3 km, while Avenida San Hilarión has the shortest, at 1.16 km. This indicates that residents living near Avenida Las Flores de Primavera have significant access to these bike lanes, potentially encouraging increased cycling activity.

The district of San Juan de Lurigancho can benefit from more people engaging in biking as it has high levels of obesity (El Comercio, 2017). Studies found that obesity is experienced by various demographic groups. For example, a study that was conducted in a private school in San Juan de Lurigancho, found that 36% of adolescents were overweight and 24% were obese. The study also indicated that after school hours, adolescents spent their time using their phones, playing on the computer, watching TV, and/or playing video games. Furthermore, the study noted that the proportion of adolescents exhibiting low physical activity levels and high sedentary behaviors increases as adolescents grow older (Quiñones, 2018). This is important to take into account because during adolescence, behavior patterns are developed and they tend to be maintained throughout life. The accumulation of these patterns can even have a negative impact on health (Piñeros & Pardo, 2010).

Another study examined the relationship between obesity and sedentary behavior among merchants at the Mercado 19 de Enero in San Juan de Lurigancho found that more than half of the 40 participants exhibited moderate levels of sedentary behavior, accompanied by obesity due to excessive work (Morales, 2021). This prevented them from dedicating time to more developed physical activities or participating in sports. These results confirm the existence of a significant relationship between sedentary behavior and obesity in this group.

Staff in health centers are no exception. A study conducted at the San Juan de Lurigancho Hospital found that 78% of all nurses have an unhealthy lifestyle. Twenty percent are categorized as unhealthy, and only 2% are considered healthy (Ñacari & Ochante, 2019). The authors of the study rely on four factors to determine an unhealthy lifestyle: inadequate diet, lack of physical activity, frequent cigarette use, and alcohol consumption. The study highlights that 40.4% are overweight and 35.3% have some degree of obesity. It also establishes a relationship between an increased body mass index and poor diet and lack of physical activity. In fact, among the sample of 90 nurses, it was found that 64.4% exhibited an unhealthy lifestyle by not engaging in physical activity. Following this,

27.8% had an unhealthy lifestyle by not exercising frequently. Meanwhile, 7.8% demonstrated a healthy lifestyle by incorporating physical activity into their daily lives (Ñacari & Ochante, 2019).

While there have been many studies done examining the relationships between biking and human health, there is a lack of research on the link between cycling infrastructure and physical activity. To fill this gap, this study will evaluate the presence and quality of bike lanes on Avenida Las Flores de Primavera in San Juan de Lurigancho to answer the following research questions:

- **How does the presence and quality of cycling infrastructure on Avenida Las Flores de Primavera affect the physical activity levels of residents in San Juan de Lurigancho?**
- **How do these factors contribute to the reduction of obesity in the district?**

This is crucial for understanding how cycling infrastructure can influence the mobility behavior of the population and contribute to reducing obesity in the district. Finally, the study will enrich the existing literature by providing a wide analysis in the context of San Juan de Lurigancho, opening new possible lines of research in public health and urban planning.

2. Methodology

Study Site

The study takes place in San Juan de Lurigancho, one of the districts in Lima, Peru. This district has the highest level of obesity in Lima, with 11.8% of its population affected (El Comercio, 2017). Additionally, San Juan de Lurigancho is a home to 12.28% of Lima's population (INEI, 2024).

Since the district is so large, it would be impossible to study it in its entirety. Therefore, this study focuses on one specific location: Las Flores de Primavera Avenue. This location was chosen because it has the longest bike lane in the district and is very populous. Since the avenue extends far, the investigation will be carried out on one section of it, which starts at the intersection of Miosotiles and Las Flores de Primavera Avenue, and ends at the intersection of Las Flores de Primavera and Tusilagos Oeste Avenue. (Figure 1). All of these factors make San Juan de Lurigancho a good site to study the intersection of bike infrastructure and health.



Figure 1: The study site.

Study Design

This study aims to assess the relationship between cycling infrastructure and obesity levels in San Juan de Lurigancho using a mixed-methods approach that includes observational research and surveys. The observational component will evaluate the quality and usage of existing bike lanes, documenting their condition and the frequency of use. To corroborate observations, a survey will be conducted to collect data from local residents regarding their cycling habits, perceptions of safety, and physical activity levels. This combined approach will improve the understanding of how biking infrastructure influences health outcomes in the community.

Data collection and analysis

Data was collected through observations and surveys. Observations focus on the quality and use of the bike lane along the selected section. Specifically, this includes documenting the physical condition of the bike lane (surface quality, signage, etc.) and recording the time and number of people using it. Observations are conducted on Sunday mornings and Wednesday mornings. The first observation week started on Sunday 20th of October, and ended on Wednesday 23th of the same month. The second observation week started on Sunday 27th and ended on Wednesday 30th of October. All observations were made between 6:00 am and 8:00 am. This time frame was selected based on preliminary observations and local information, which indicates that morning hours tend to have higher bicycle traffic in the area. Sundays were chosen to assess weekend usage patterns,

when residents may have more free time for cycling, while Wednesday was selected to allow for a comparison of weekday usage.

In addition to the observations, a survey was conducted to find out if the population is physically active using the bike lanes of San Juan de Lurigancho. The survey consists of both closed and open-ended questions. The survey is conducted in person and randomly approaches anyone within the section to be studied, regardless whether they live nearby or in a different area. This is because many people in this section may not actually reside there but may be there for shopping, working, or just passing through. For this reason, the questions cover the use of any bike lane in San Juan de Lurigancho, not just the one on Avenida Las Flores. In this way, the answers will provide a broader perspective on the use of cycling infrastructure throughout the district. Two surveys are developed (one for those who use the bike lanes and one for those who do not). Depending on their initial answer (if they use the cycling infrastructure or not), they will be asked to scan a QR code that will redirect them to their specific survey. The target number of participants in each survey will be about 20. Those who do not use bike lanes, will answer questions on the reasons why and some general lifestyle/health questions. Those who use the infrastructure, will be asked questions about their biking patterns and lifestyle/health questions.

Data from the observations is analyzed quantitatively and qualitatively. The quantitative analysis focuses on the frequency of cyclists observed during each session, calculating the average number of users per time interval. These data will help identify patterns in the usage of the bike lane throughout the observation days. Qualitative analysis involves evaluating the physical condition of the bike lane based on notes taken during the observations, assessing factors such as surface quality and signage effectiveness.

For the survey answers, the data is analyzed quantitatively by calculating the percentage of residents who report being physically active and utilizing the bike lanes of San Juan de Lurigancho. This analysis will provide insights into the relationship between the presence of bike lanes in the district and the physical activity levels of residents.

3. Results

Along the selected section of Avenida Las Flores de Primavera, which begins at the intersection of Las Flores de Primavera and Tusilagos Oeste Avenue and ends at the intersection of Miosotiles and Las Flores de Primavera Avenue, it was observed that the cycling infrastructure integrates bike lanes that, before the first intersection, were separate. Starting from this section, a bike lane extends along the avenue with segmented yellow lines (indicating that it is a two-lane bike path). It should be noted that this bike lane is 2.1 meters wide. However, it was observed that the **signage** (including arrows indicating the direction of traffic, the bicycle symbol indicating the reserved space for this mode of transport, and the bike crossing marking on the road) was faded (**Table 1**).

Potholes and puddles were also observed. However, there was no physical obstructions interfering with cyclists. Still, litter was visible around the infrastructure, specifically to the side and along the path, and many people used the bike lane for running, walking, or walking their dogs. Only seven motorcycles were observed invading the bike lane during the observation period. They invaded the bike lanes to avoid heavy vehicular traffic. It was observed how cyclists had to move aside to allow the motorized vehicle to pass. When there is traffic, cars block cyclists from passing through the bike crossing markings, which are painted (although faded) on the road.

Table 1: Observations of the bike lane.

Themes	Observation 1	Observation 2
Maintenance	Litter, potholes, puddles	Litter, potholes, puddles
Number of users	52 (Sundays); 37 (Wednesday)	32 (Sundays); 17 (Wednesday)
Signage	Faded	Faded
Conflict of use	3 Motorcyclist, pedestrians, pets, cars	4 Motorcyclist, pedestrians, pets, cars

Observations determined that on weekends, residents of San Juan de Lurigancho tend to make greater use of the bike lanes than on weekdays.

The survey results indicate that, most people who ride bicycles use the bike lanes between two to five times per week (**Figure 1**).

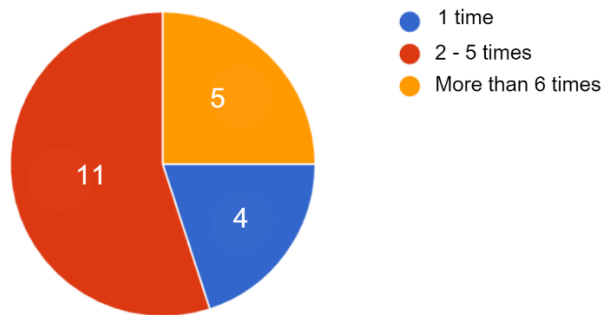


Figure 1: Bike lanes usage by those who reported to bike.

Most participants stated that they use the bike lanes for entertainment or exercise (**Figure 2**). Very few reported using the infrastructure for health reasons.

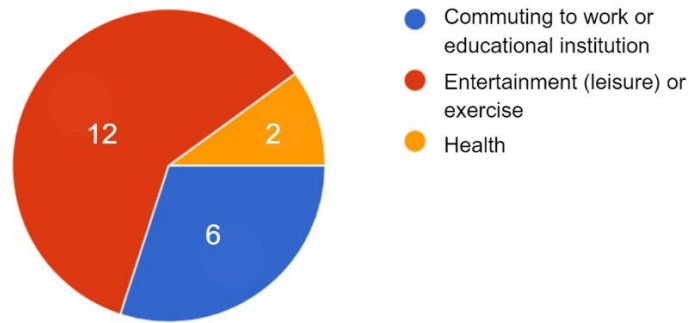


Figure 2: Reasons for the usage of bike lanes.

Additionally, very few participants reported being completely satisfied with the quality of the bike lanes (**Figure 3**). Most of the people who use bike lanes state that they are just satisfied or have a neutral opinion regarding the quality of these infrastructures.

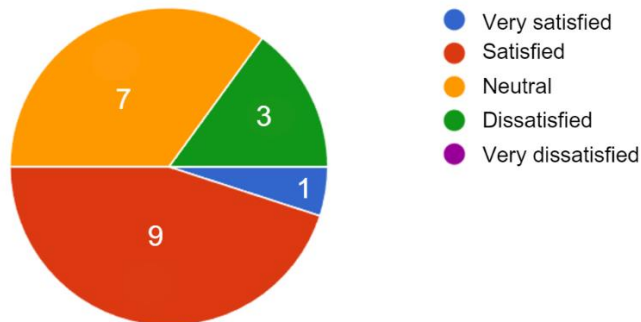


Figure 3: Satisfaction with the quality of bike lanes.

Furthermore, a conflict of opinion has been found regarding the safety of bike lanes for cyclists (**Figure 4**). A certain group considers bike lanes to be safe, while another group, with an equal number of people, does not consider them safe.

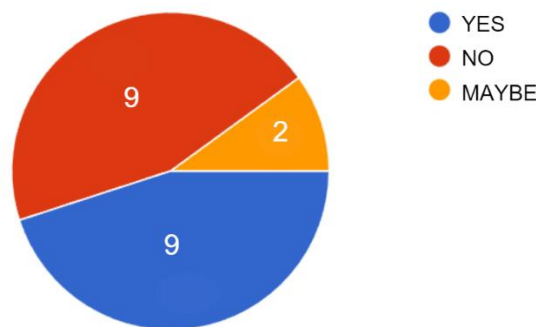


Figure 4: Safety perception of bike lanes.

Most of the respondents perceive the invasion of pedestrians and motorcycles as the main obstacles they face while cycling (**Table 2**). Almost half reported excessive vehicular traffic around bike lanes and maintenance problems as the main issues. Only a small number pointed out that the infrastructure is incomplete and disconnected.

Table 2: Perceived issues with bike lanes as reported by the participants who bike.

Category	Count
Incomplete and disconnected infrastructure	1
Pedestrian invasion	9
Motorcycle invasion	7
Excessive vehicular traffic around	5
Maintenance problems	4

Moreover, most people believed that cycling infrastructure helps promote an active lifestyle, while a small number reported that it does not. They indicated that the infrastructure does not necessarily encourage the activity because there are people who own bicycles and have access to the bike lanes, but still do not use them. Additionally, most participants who bike reported having an understanding of the connection between biking infrastructure and health benefits.

Lastly, it has been found that the majority of those who bike consider their health status as “Very healthy” and “Somewhat healthy” (**Figure 5**) Very few participants describe their general health status as “Unhealthy.”

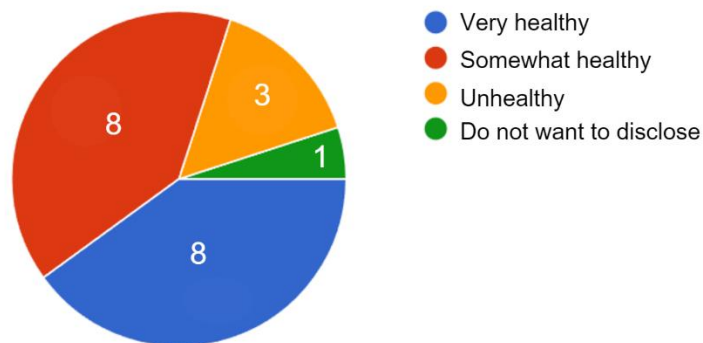


Figure 5: Description of overall health status in the population that bikes.

Now, among the population that does not use bike lanes, the main reasons for not using them were found to be safety issues (which may be due to fear of theft or vehicular accident), and lack of time (**Table 3**). Very few people stated that it was due to poor bike lane conditions.

Table 3: Reasons for not using the bike lanes as reported by the participants who do not bike.

Reasons	Count
Safety issues (fear of theft or vehicular accident)	12
Poor condition of the bike lanes	4
I prefer other means of transportation	1
Lack of time	9
I do not know how to ride a bicycle	4

I do not have a bicycle	6
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However, a significant portion of the population that does not use bike lanes did not discount the idea of using bike lanes in the future (**Figure 6**).

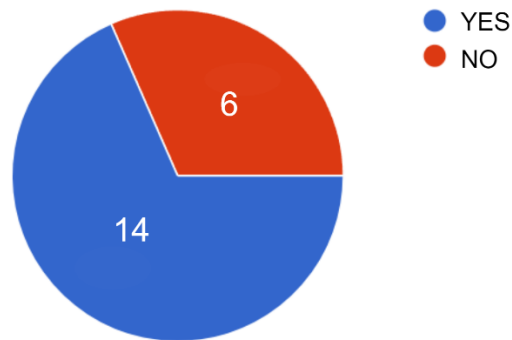


Figure 6: Possible future use of bike lanes.

From this, it is determined that the main reasons are based on the improvement of security measures and more time for leisure (**Table 4**). The improvement of the conditions of the bike lanes does not stand out as one of the reasons, as did the other two above.

Table 4: Reasons that can motivate participants to use the bike lanes as reported by those who do not bike.

Reasons	Count
Improved security measures	12
Improved bike lane conditions	6
Owning a bicycle	3
More time for leisure	8
It is not in my plans to use them	3

The majority of the participants that does not use the bike lanes states that they exercise even though they do not use the cycling infrastructure (**Figure 7**).

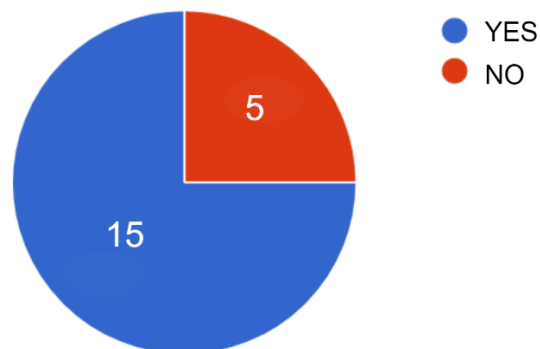


Figure 7: Development of other physical activities as reported by those who do not bike.

It has been found that the level of physical activity among the population that does not use bike lanes is, for the most part, moderately active (**Figure 8**). That is, they engage in activities that work every muscle in their body and demand higher levels of energy from time to time. Very few described their overall physical activity level as “very active.” In fact, more described it as “sedentary” than “very active.”

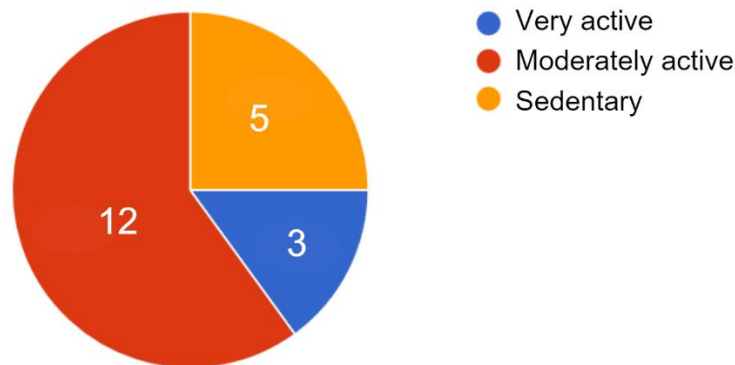


Figure 8: Level of overall physical activity among the participants that do not use bike lanes.

Additionally, the majority of those who do not bike reported their general health status as “Somewhat healthy” (**Figure 9**). Unlike the participants who use the bike lanes, this population presents a much lower number of people who consider their general health status as “very healthy.”

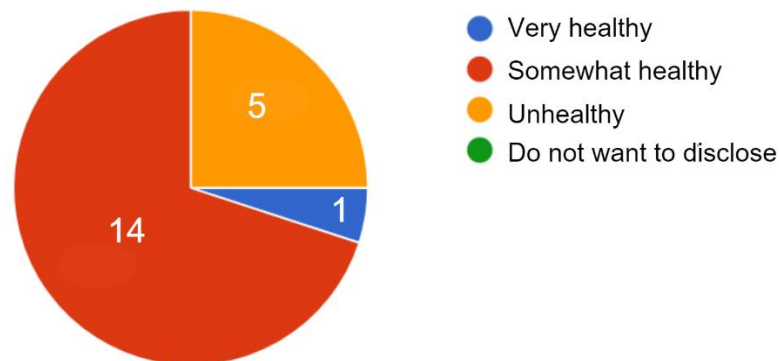


Figure 9: Description of overall health status in the population that does not bike.

4. Discussion

This study examines the presence of cycling infrastructure in relation to human health in San Juan de Lurigancho. The study yielded three main results: more people exercise on weekends than on weekdays, there is an unequal perception of bike lane safety, and most people perceive their lifestyle as healthy.

It was observed that most people exercised on weekends as compared to weekdays, which is corroborated by the participants’ answers that they would exercise more if they had more free time. Likewise, according to the answers of those who make use of the bike

lanes, the majority stated that they use these infrastructures for entertainment (leisure) and exercise. This helps explain why far fewer people were observed using the bike lanes during the week. In fact, other studies found a similar trend. For example, Morales (2021) found among a certain group of merchant's moderate levels of sedentary behavior and obesity due to overwork, a factor that prevented that population from taking time to engage in appropriate physical activity or participate in sports. Therefore, it is possible to classify time as a determining factor in developing a physical activity routine. It is possible that the lack of this element was one of the reasons why a large part of the population studied by Ñacari & Ochante (2019) presented an unhealthy lifestyle by not exercising frequently. In addition, based on the survey results, having more time for leisure is one of the main factors that was indicated to motivate people who do not use bike lanes to start using them. So, in contrast to what was believed at the beginning, not much has to do with the quality and presence of the infrastructure, since it was discovered that a small number of the population that uses the bike lanes said they know people who, despite having equipment to ride a bicycle and living near this type of infrastructure, do not use it.

The responses reveal a significant disparity in the safety perceptions of cyclists using the bike lanes in San Juan de Lurigancho. This conflict of opinions seems to reflect the variability in the conditions of the cycling infrastructure depending on the avenue, as well as the individual experiences of users when using these routes. While 45% of cyclists consider the bike lanes to be safe, another 45% believe the opposite. This may be related to the uneven quality of bike lanes in the district, something that directly influences the user experience. For example, on Avenida Los Postes Este, the cycling infrastructure is in optimal conditions, with a continuous surface, visible signage, and separation from vehicular traffic by vegetation, which contributes to a safe and reliable experience for those who transit this route (Aymara & Bustinza, 2019). In contrast, the bike lane on Avenida Canto Grande has potholes, puddles, and discontinuous sections, factors that increase the risk for cyclists, especially when adjacent vehicular lanes and sardine lanes are in poor condition and lack adequate signage (Aymara & Bustinza, 2019). These differences in the condition of bike lanes influence perceptions of safety, with users of well-maintained routes feeling safer than those who must deal with poor infrastructure. Additionally, the invasion of pedestrians and motorcycles on the bike lane reinforces the perception of insecurity, especially for frequent users. This is consistent with the observations of Guevara (2022) and Barrios et al. (2022) who note that obstacles such as these significantly influence the perception of safety of cyclists in Lima. Differences in bike lane conditions and shared use of the road appear to be key factors that increase the sense of risk, especially on avenues where these deficiencies are more pronounced.

So, this conflict of perceptions underscores the importance of a uniform and well-maintained infrastructure. Moreover, from the results, it is possible to establish that improving the condition of bike lanes and reducing the invasion of other users (pedestrians and motorcycles) can not only decrease the risks of accidents, but also unify

the perception of safety among cyclists in the district, promoting a more continuous use of this infrastructure.

Finally, most of the residents of San Juan de Lurigancho perceive their lifestyle as healthy, although there are differences in the amount of regular physical activity they engage in. Most of those who do not use the bike lanes indicated participating in other physical activities, which correlates with a perception of “moderately active” in their overall activity levels. However, this suggests a discrepancy: although these individuals report physical activity, their overall health is not perceived as “very healthy.” According to studies such as Morales (2021), the perception of health may be influenced not only by frequency, but also by the intensity and type of exercise performed, as more demanding activities tend to produce greater health benefits.

On the other hand, bike lane users, although they consider themselves moderately active, primarily use bike lanes for entertainment or leisure rather than as a health-oriented exercise. This recreational use reflects a more relaxed approach to cycling, consistent with the notion of incidental exercise, in which physical activity is unintentionally incorporated into daily life. Now, based on the study by Rojas, et al. (2018) it could be determined that this could be due to cultural issues, as they established that in Lima the cycling culture is underdeveloped, with bicycles often seen as no more than a means of transportation or a tool for leisure, rather than a primary source of exercise. Likewise, the low use of bicycles compared to buses and combis, as well as the absence of marketing campaigns promoting cycling as an ideal mode of health improvement, further reinforce this limited view (Ninaquispe, 2021). This lack of cultural promotion could explain why people do not strongly associate cycling with health, despite its potential to contribute to better health outcomes, including reduced obesity levels.

Thus, contrary to what was originally thought, although the existence of cycling infrastructure may facilitate mobility and increase the frequency of cycling, it does not necessarily translate into health benefits if cycling is still predominantly seen as a leisure activity, where physical intensity levels are lower, and not as a health-promoting activity that would require higher levels of intensity and frequency of use.

5. Conclusions

Urban health challenges require solutions that promote an active lifestyle. Biking is a form of exercise that is considered beneficial to overall health. To assess the potential of cycling infrastructure to address health challenges in San Juan de Lurigancho, this study analyzed one section of the bike lane on Las Flores de Primavera Avenue, an avenue that is characterized by having the longest bike lane in the district. Through observations carried out over a two-week period, the study sought to determine the quality and frequency of use of the bike lane, as well as to document the possible problems this infrastructure faces. To corroborate these observations, the study relied on surveys directed to all residents of San Juan de Lurigancho who were passing through the area.

At least 20 people who use the bike lanes were asked to respond, as well as 20 people who have not used them. These surveys, addressed cycling habits, perceptions of safety, and people's levels of physical activity. Eventually, the data were analyzed quantitatively and qualitatively, so that the study was able to identify patterns in infrastructure use, highlight the physical conditions of the bike lane, and determine the relationship between the presence of bike lanes and the level of physical activity of San Juan de Lurigancho residents.

This study resulted in three important insights on time, safety and health. First, the study found that time is the main factor that influences people's decision whether or not to ride a bicycle. Second, it was also determined that safety issues prevent people from cycling and that safety perceptions may vary according to the area in which cyclists tend to ride a bicycle. It turns out that not all bike lanes in the district of San Juan de Lurigancho have the same quality, the same care, and the same environment. There are bike lanes that are located in places that have more deficiencies and there are others that are able to offer a pleasant, “friendly” and quiet experience to the cyclist.

Finally, there is a disparity in self-perceptions of health between those who use bike lanes and those who do not. Those who make use of the infrastructure report better health compared to those who do not. However, these differences in health perception do not necessarily reflect differences in overall physical activity levels, as many people who do not use the bike lanes reported engaging in other physical activities that contribute to an active lifestyle. This concludes that the presence of bike lanes will not necessarily reduce obesity levels in the district. It can act as a tool to adopt a more active lifestyle. However, there are different factors that influence this “adoption” of a more active lifestyle.

In addressing bike lane safety issues and making the quality of the infrastructure homogeneous across the board, the local government must invest in infrastructure maintenance. This means making repairs or improving the quality of bike lanes in the district, enforcing bicycle use regulations, and developing campaigns or publicity that promote the use of bicycles as an ideal medium for improving health in San Juan de Lurigancho; in other words, fostering a culture of cycling. Through this, the government would be educating people about the health benefits of cycling and would encourage more people to participate in this activity, as well as motivate them to do it for longer and in a more intense way, which will bring greater health benefits.

Future research can focus on studying people's perceptions of cycling as a form of physical activity to better understand the reasons why some people bike and others do not. In addition, more detailed and specialized studies are recommended to analyze the specific characteristics of each bike lane in San Juan de Lurigancho, considering aspects such as infrastructure, road safety and maintenance of each one. In addition, it is essential to implement an accurate and updated registry of incidents of robberies and vehicular accidents involving cyclists in the district, which would provide a better understanding of risk factors and users' perception of safety.

Limitations

The study acknowledges several limitations. First, only one section of the bike lane was analyzed. This fact limits observations on the quality of the whole bike lane. This could have affected the results by overlooking variations in safety, maintenance, or usage patterns on other sections of the bike lanes, which could influence the overall perception of the infrastructure. Second, the study interviewed a small number of people, which might have skewed the results and didn't allow to capture a full range of experiences with biking infrastructure. Third, the lack of detailed and official data on safety incidents such as robberies and vehicular accidents on San Juan de Lurigancho's bike lanes limited the capability to analyze in depth the reasons behind the disparity in safety perceptions among cyclists. Having this information would have allowed for a more comprehensive approach to understanding perceived and actual risk factors and how they influence cycling infrastructure use.

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Supplemental Materials:

Survey Questions:

The main question that will define which survey corresponds to each one is the following:

Do you use the bike lanes of San Juan de Lurigancho?

- Yes
- No

(In case they answer with “YES”)

How many days a week do you use the bike lanes?

- 1 per week
- 2 – 5 per week
- More than 6 per week

What is your primary reason for using the bike lanes?

- Commuting to work or educational institution
- For entertainment (leisure) or exercise
- Health
- Other (Specify)

How satisfied are you with the quality of the bike lanes?

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

Would you consider the bicycle infrastructure in San Juan de Lurigancho to be safe for cyclists?

- Yes
- No
- Maybe

What are the main obstacles you face when cycling along the bike lanes?

- (Write your answer, please)

Do you think that the cycling infrastructure in San Juan de Lurigancho encourages an active lifestyle? (Write “YES” if yes, write “NO” if no and explain why. If you have no idea, write “I DON'T KNOW”).

- (Write your answer, please)

How would you describe your overall health?

- Very healthy
- Somewhat healthy
- Unhealthy
- Do not want to disclose

(In case they answer with “NO”)

Why don't you use the bike lanes?

- Safety issues (fear of theft or vehicular accident)
- Poor condition of the bike lanes
- I prefer other means of transportation
- Lack of time
- I do not know how to ride a bicycle
- I do not have a bicycle
- Other (specify)

Have you ever thought about using the bike lanes in the future?

- Yes
- No

What would encourage you to use the bike lanes?

- Improved security measures
- Improved bike lane conditions
- Owning a bicycle
- More time for leisure
- Other (specify)

Do you practice any other form of physical activity?

- Yes
- No

How would you describe your overall level of physical activity?

- Very active
- Moderately active
- Sedentary

How would you describe your overall health status?

- Very healthy
- Somewhat healthy
- Unhealthy
- Do not want to disclose