



## CYCLING AS A SPORT AND LEISURE PRACTICE DURING THE COVID-19 PANDEMIC

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### Abstract

**Main goal:** to identify the factors of the Covid-19 pandemic influencing the adoption of bicycle in sports and leisure practices in regions of Paraíba-Brazil.

**Methodology:** it uses a qualitative approach by performing a lexical analysis of the data through Iramuteq.

**Originality/relevance:** It discusses contexts of relevance about the pandemic, the impacts on urban mobility and the increase in the practice of cycling as a safe mobility for a sustainable city model, during the contagion of covid-19.

**Main results:** our main findings revealed that the negative effects of the lockdown, the home office, the perception of a sedentary lifestyle and psychological pressures motivated new adepts to use the bicycle for sports and leisure.

**Theoretical/methodological contributions:** the research advances in the discovery of classes that confirm the increase in bicycle use in the pandemic and calls attention to the implementation of public policies that make cycling viable in the cities studied, especially in the face of current health uncertainties.

**Keywords:** Cycling. Sport. Leisure. Covid-19 pandemic. Mobility.

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## O CICLISMO COMO PRÁTICA DE ESPORTE E LAZER DURANTE A PANDEMIA DE COVID-19

### Resumo

**Objetivo do estudo:** identificar os fatores da pandemia da Covid-19 que influenciaram a adoção da bicicleta nas práticas de esporte e lazer nas regiões metropolitanas da Paraíba.

**Metodologia/abordagem:** o estudo usa uma abordagem qualitativa realizando uma análise léxica dos dados por meio do Iramuteq.

**Originalidade/relevância:** discute contextos de atual relevância sobre a pandemia, os impactos na mobilidade urbana e o aumento da prática do ciclismo como mobilidade segura para um modelo de cidade sustentável, diante do contágio da covid-19.

**Principais resultados:** os achados revelaram que os efeitos negativos do lockdown, o home office, a percepção sobre o sedentarismo e as pressões psicológicas motivaram novos adeptos ao uso da bicicleta para as práticas de esporte e lazer.

**Contribuições teóricas/metodológicas:** a pesquisa avança na descoberta de classes que confirmam o aumento do uso da bicicleta na pandemia e chama atenção para implementação de políticas públicas que viabilizem o ciclismo nas cidades estudadas, principalmente diante das incertezas sanitárias vigentes.

**Palavras chave:** Ciclismo. Esporte. Lazer. Pandemia covid-19. Mobilidade.

## EL CICLISMO COMO PRÁCTICA DEPORTIVA Y DE OCIO DURANTE LA PANDEMIA DE COVID-19

### Resumen

**Objetivo del estudio:** identificar los factores Covid-19 que influyeron en la adopción de la bicicleta en las prácticas deportivas y de ocio en las regiones metropolitanas de Paraíba.

**Metodología/enfoque:** el estudio utiliza un enfoque cualitativo realizando un análisis léxico de los datos mediante Iramuteq.

**Originalidad/relevancia:** discute contextos de relevancia actual sobre la pandemia, los impactos en la movilidad urbana y el aumento de la práctica del uso de la bicicleta como movilidad segura para un modelo de ciudad sostenible, frente al contagio del covid-19.

**Principales resultados:** las conclusiones revelaron que los efectos negativos del encierro, la oficina en casa, la percepción sobre el sedentarismo y las presiones psicológicas motivaron a los nuevos aficionados a utilizar la bicicleta para prácticas deportivas y de ocio.

**Contribuciones teóricas/metodológicas:** la investigación avanza en el descubrimiento de clases que confirman el aumento del uso de la bicicleta en la pandemia y llama la atención para la implementación de políticas públicas que posibiliten el uso de la bicicleta en las ciudades estudiadas, especialmente frente a las incertidumbres sanitarias actuales.

**Palabras clave:** Ciclismo. Deporte. Ocio. Pandemia de covid-19.


## 1 Introduction

In individual and collective dimensions, mobility was suddenly impacted with the SARS-CoV2 coronavirus pandemic, responsible for one of the largest health crises in the world and the transmission of Covid-19 (Medeiros & Rajs, 2020; García, Caicedo & Muñoz, 2020). Several factors transformed the daily coming and going in terms of health, education, work, and leisure such as the need for social distancing, the lockdown phases with mandatory blockades, the sanitary process of total isolation of contaminated people preventing the transmission of the virus, and the suspension and/or reduction of transportation services in the several modalities.

In this scenario of impacts, the use of bicycles has gained prominence, incentives, and supporters for having been identified by the World Health Organization (WHO) as a safe transportation in the pandemic reality (WHO, 2020), improving physical and mental health in the period of uncertainty and restrictions on social contacts (Rodrigues & Peña, 2020; Neri & Junior, 2020). Yet, in the focus of environmental issues, it played a key role in discussions on sustainable urban mobility (Rodrigues & Peña, 2020; Batista & Lima, 2020; Neri & Junior, 2020).

However, the predominance of the model focused on automobile traffic in the urban design of most Brazilian cities (Garrefa & Carvalho, 2020; Batista & Lima, 2020), places at the center of discussions the insecurity for those who adhere to the bicycle as an utilitarian means of transport, although the Traffic Code determines the preference of bicycles over vehicles in the order of responsibility for the safe circulation in the city (De Sá, 2013). Such problematic added to the change in urban flows with the increase of home office, remote learning and e-commerce (Alves, 2020), revealed that, in some Brazilian cities, pandemic has accelerated the status of the use of the bicycle for sports and leisure practices (Pancoto, 2020).

This is the case of the cities of João Pessoa and Campina Grande considered metropolises of Paraíba (Silva, Silva & Miranda, 2018), whose cycling infrastructures are incipient and concentrate the best cycling axes in the prime neighborhoods and tourist spots of the cities (Batista & Lima, 2020). It favors the bicycle usage, especially for recreational and sports activities in outdoor spaces. With the encouragement of active transportation during the pandemic, cycling gained prominence, especially because it is possible to practice it individually, visually providing an increase in bicycle usage for sport and recreational purposes.



Considering this context, this paper aimed to identify the factors of the Covid-19 pandemic influencing the adoption of the bicycle in the sport and leisure practices. We performed this research in both cities, João Pessoa and Campina Grande. Specifically, this study conducted an investigation about the factors that facilitated bicycling based on three key arguments: 1) the pandemic as a motivating factor for bicycling for sport and leisure; 2) bicycling as a safe transportation in the face of the covid-19 contagion; and 3) bicycling as a contributor to a more sustainable city.

Methodologically, this current study uses a qualitative approach, performing a lexical analysis of the concepts surrounding these three key questions. The data were analyzed using the software *Interface of R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (Iramuteq). The results of the research showed that the pandemic had an influence on the decision to practice cycling in the cities studied, especially with the impacts of the lockdown. The use of the bicycle, for sport and leisure practices, was done safely, following the sanitary standards in force to avoid risks of contagion, therefore, reconnected the population with the urban space, calling attention to the discussions about sustainable mobility and the connections between health and environment.

## 2 Theoretical background

### 2.1 Urban mobility: the pandemic scenario

Discussions on urban mobility in the Brazilian context involve issues concerning to some research topics such as public policies on the right to the city (Coelho, 2020; De Sá, 2013), challenges in improving infrastructure, transportation systems, and territorial planning in the face of accelerated urban growth (Carvalho, 2016), as well as the perspective of sustainability, in response to the conventional urban model negatively impacts the social, political, ecological, and economic spheres of the city (Dotto & Silva, 2019; Neto & Ramos, 2017). These discussions also stimulate the debate on how the urban mobility system influences on human health (Macêdo, Wany & Paiva, 2020), expanding the bias of analysis of contemporary urban problems.

For instance, Neto and Ramos (2017) explain that the lack of planning in the development process of Brazilian cities has contributed negatively to society, in economic and environmental terms, and enhanced traffic accidents, traffic jams, violence, air pollution, noise pollution, among other problems that, in addition to impacting quality of life, make inefficient


and stressful the movement of people (Neto & Ramos, 2017). Globally, urban sprawl, especially to accommodate automobiles, has also contributed to climate change and high consumption of natural resources due to the concentration of activities and people (Louro, Marques da Costa & Marques Costa, 2019).

In the perception of mobility as an environmental health issue, Macêdo *et al.* (2020) recognize the impacts of urban mobility on physical, psychological and social integrity, as well as, the political, economic and ecological factors grounded in the operation, management and organization of cities. Expanding the discussion, Louro *et al.* (2019) explain that the city must be a process for the view of health not only as the absence of disease, but as a complete status of well-being, thus requiring strategies for the inclusion of the theme in various policies, which interconnects the precepts of sustainable development.

Particularly, in the field of urban mobility, sustainability means meeting the present needs of society to move freely, ensuring safe and timely access for future generations (Louro *et al.*, 2019), and allowing people to have universal access to the city, without social hegemony, by transit, pedestrian, individual or collective transport, or motorized or non-motorized modal (Macedo *et al.*, 2020). It also means breaking the current dependence on the automobile for citizen transportation (Dotto & Silva, 2019); being affordable and functioning efficiently (Silva, Costa & Macedo, 2008); and ensuring communication, commerce, and relationship building without compromising human health, ecosystems, and the planet's environmental resources as well (Louro *et al.*, 2019).

Searching for healthy and sustainable urban reconfigurations, the pandemic brought new impacts to mobility, the right to the city, and the enjoyment of public spaces. The periods of confinement caused significant changes in work relations, living spaces, and displacements (Barata-Salgueiro, 2020). The city related to the movement and bustle has become an empty space, traffic noise has turned into silence (Barata-Salgueiro, 2020), and social distance has become a norm for the foreseeable future (Barbarossa, 2020). In Brazil, for some social segments, the phases of restrictions provoked claims about the freedom to come and go, punctuating mobility as a basic right and demanding initiatives from public authorities (Meirelles & Inchauste, 2021). On the other hand, the flexibilization reflected the panorama of social inequalities in the country and the absence of investments to improve transportation in cities.

Leiva, Reis and Ourico Filho (2020) analyzed this scenario by studying how urban structure, city organization, and social mobility have implications for the spread of Covid-19.



The researchers drew a comparison between compact and sprawling cities. The compact cities were characterized as dense, favoring the use of public transportation and the proximity between housing, work, education, and leisure (Leiva *et al.*, 2020). While sprawling cities are defined by the distance between center and periphery with the predominance of car usage (Leiva *et al.*, 2020). In the context of the pandemic, compact cities recorded a faster rate of contagion due to the predominance of public transportation, compared to sprawling cities, whose structure favors social distancing by car usage (Leiva *et al.*, 2020).

However, in Brazil, the dissemination trajectory of the virus followed the dynamics of social inequalities even in the sprawling model (Leiva *et al.*, 2020). In a first moment, the contamination kept the distance between the center and periphery but the predominance of the use of public transportation by the peripheral population brought the spread of the virus to concerning contexts, considering the social vulnerability of the segment, the high number of people per household and the lack of basic infrastructure in communities (Leiva *et al.*, 2020). In terms of mobility and social equality, these factors that showed the importance of a more democratic city for the control of the pandemic (Leiva *et al.*, 2020).

Such problematic changed the traditional way of conceiving the city (Alves, 2020; Centro, 2020, Torres & Córdova, 2020), as well as evidenced an obsolete, insufficient and unsustainable city model, with an need for public spaces and a better functionality for alternative mobility (Torres & Córdova, 2020). Moreno *et al.* (2021) add that, in the short term, the pandemic has also shown the need to ensure that cities remain resilient and livable, but in the long term, it comes from the perspective of social well-being and ecological sustainability. Barbarossa (2020) states that this is a historic moment when cities can change course, in the sense of meeting public health guidelines, struggling inequalities, decreasing climate change, and making life more pleasant and safe for all.

In this scenario of unexpected impacts of historical vulnerabilities and perspectives of change, this is an issue of theoretical and practical relevance because the use of the bicycle came as an alternative that, besides responding to the urgency of the pandemic, represents a solution to the broader environmental problems and may contribute to the sustainable and efficient city model (Centeno, 2020; Moreno *et al.* 2021).



## 2.2 *The use of the bicycle, changes in habits, and routines*

The forms of appropriation attributed to the bicycle usage emphasize the transition from a fun alternative to a useful and advantageous means of transport for different leisure practices, sports, work, studies, and other utilitarian displacements (Rechia., Tschoke & Joukoski, 2016). Silent and non-polluting, the bicycle increases accessibility, allows faster travel, does not require fuel, demands a simple and cheap infrastructure, and has low impact on the environment and the consumption of public space (Chapadeiro & Antunes, 2012). In European cities and developed countries, the insertion of the bicycle as well as being appropriate to the sociocultural context, climate, and infrastructure, address emerging environmental issues (Chapadeiro & Antunes, 2012; Silva, 2019).

In Brazil, despite several positive attributes, the risks for coexistence with motor vehicles and the absence of an adequate cycling infrastructure are pointed out as the main reasons for the population not to use the bicycle in daily commuting (Chapadeiro & Antunes, 2012). However, the modal gained interest from the population in several Brazilian cities and metropolises for meeting the current demand of social distancing, for being an option for not facing the collective transportation (Lohmann & Silva, 2021) and for changing in commuting habits arising from health restrictions (Alves, 2020).

Campisi, Basbas, Skoufas, Akgün, Ticali and Tesoriere (2020) explain that before the pandemic there was a positive trend around cycling worldwide, especially with the implementation of public policies aimed at improving infrastructure and expanding micromobility services. However, the health crisis led people to move cautiously, notoriously pointing to modal transition and the preference for walking and/or cycling (Campisi *et al.*, 2020). The WHO was one of the influential entities of this transition, as it published a document on the essential displacements of the population during the Covid-19 outbreak, in which it was highlighted the preference for the use of the bicycle and/or the displacements on foot individually to provide the distance and meet the minimum requirements of daily physical activity, especially with the increase of home office and limitations to sports and recreational practices in enclosed spaces and collective use (WHO, 2020).

Researchers (Centero, 2020; García, Caicedo & Muñoz, 2020; Moreno *et al.*, 2021) argue the bicycle has positioned itself as a safe transportation in the face of the Covid-19 contagion, for being an individual-use vehicle and providing positive effects on physical health and mental health affected by the pandemic. The bicycle also drew attention to the reconnection

of the population with mobility, which is a fundamental right guaranteed by the Federal Constitution, but which cannot go against the right to life (García *et al.*, 2020). It has shown the economic benefits due to the low cost of the modal compared to motor vehicles, especially in the face of the financial crisis intensified with the health crisis (García *et al.*, 2020). It also has contributed to the construction of a sense of sustainable city, through the appreciation of public spaces, green areas, and co-responsibility for this model (Centero, 2020).

It seems notable that the bicycle is a symbol of sustainable transportation. Moreno *et al.* (2021) point out that bicycles have proven the influence in the health emergency by controlling the spread of Covid-19. The authors explain that, in addition to utilitarian commuting, other activities linked to public spaces, squares, cultural and leisure services, gained popularity with the increased use of bicycles in the pandemic, forcing public managers to facilitate this process. The adoption of temporary lanes for the active modal was a strategy used in many cities in Brazil and worldwide, with the possibility of becoming a permanent infrastructure in the post-pandemic (Campisi *et al.*, 2020; Neri & Junior, 2020). At the same time, a boom in bicycle sales was reported, especially for people who did not use the bicycle in the previous scenario (Barbiero, 2020), because the implementation of an appropriate infrastructure tends to attract cyclists, in addition to interconnecting areas and reducing urban distances in the daily routes (Neri & Junior, 2020).

Specifically in the cities of João Pessoa/PB and Campina Grande/PB there was a visible increase in the use of bicycles for sports and leisure practices during the pandemic period. Such evidence is perceived by observing the profile of cyclists, since they use bicycles with specialized patterns, individual protection equipment, signaling devices, specific clothing for cycling, and other technological equipment that differentiate them from bicycle workers, whose socioeconomic conditions are not favorable for the acquisition of these products (De Sá, 2013; Aquino & Macedo, 2014).

The cycling network in João Pessoa is described as a priority for leisure bike lanes, especially in the neighborhoods along the city's waterfront that have connecting stretches and favor recreational and sport practices (Silva, 2019). The conditions for the use of the bicycle as an utilitarian means of transport are not as favorable due to the lack of connection between the stretches of the cycling network, lack of paving, absence of bicycle racks, and low safety due to intense car traffic (Silva, 2019). However, in the pandemic period, the government of the expanded temporary bike lanes and revitalized existing sections to ensure the safe practice of cycling (Sorrentino, 2021), as well as promoted the implementation of new bike lanes




contemplating neighborhoods outside the city's tourist circuit as an incentive to active transportation (Brandão, 2020).

Campina Grande presents a similar context, a diagnosis conducted on bicycle usage in the city (Aquino & Macedo, 2014) pointed out that the highest number of cyclists is registered in Açude Velho, whose space is used for sport and leisure practices, in addition to having a bike lane for a safe path for those seeking other neighborhoods. However, the absence of a bicycle network and the volume of vehicles competing for space on the roads were highlighted as major problems faced by cyclists, despite the fact that the city can be easily traveled by bicycle (Aquino & Macedo, 2014). The interdiction of roads encouraging the practice of cycling and awareness of drivers represents one of the actions of the public authorities in the pandemic period, especially given the increase in the practice of sports.

### 3 Methodology

This study adopts a qualitative approach to identify the factors of the Covid-19 pandemic that influenced the adoption of cycling in sport and leisure practices, in the cities of João Pessoa and Campina Grande located in Paraíba-Brazil. Data collection was conducted from November 29, 2021 to March 3, 2022. An in-depth questionnaire was applied to individuals who had used bicycling as a sport and leisure practice during the pandemic, addressing three questions: 1) Comment how the Covid-19 pandemic influenced your decision to use bicycling as a sport and leisure practice; 2) In your experience of bicycling during the pandemic, how do you evaluate bicycling as a safe practice in the face of Covid-19 contagion? and 3) In your perception, how can bicycling contribute to a more sustainable city? Initially, the data collection instrument was submitted to a pre-test with 1 respondent to validate the questions. After adjustments and improvements, we performed an online interview with 15 participants, using Google Meet and Whatsapp (video call), in which only one interview was dropped.

The data were treated quantitatively with the support of the software Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires (Iramuteq). Iramuteq was chosen because it is useful in categorizing qualitative data, effectively identifying significant text segments and words to better organize and classify the information. Thus, we performed a lexical analysis of concepts involving the three questions of the study. We defined inclusion criteria for word classes, including in the analysis: adjectives, adverbs, nouns, and verbs.



Further, we applied the following analysis techniques: 1) Descending Hierarchical Classification (DHA) to perform a textual analysis on the corpus extracted from the interview transcripts and group words with highest statistical significance and 2) Factor Representation Analysis (FPA) to identify the interrelationship between the classes and understand the context from the words classified with highest statistical significance. In the FPA, we consider classes of analysis such as adjectives, adverbs, auxiliaries, supplementary nouns, and verbs.

The ethical issues have been managed in three steps: planning, data collection, and data analysis. Firstly, the planning step was guided by two principles: 1) to avoid any kind of damage to participants and 2) to produce positive benefits (Gibbs, 2009). Secondly, the data collection step used the principle of informed consent. It has intended to keep participants informed about research progress and findings as well. Participants were informed about the focus of the study, how the data would be used after the conclusion of the study (Gibbs, 2009). Finally, in the analysis step, this current study intends to maintain the privacy, confidentiality, and anonymity of the individuals (Gibbs, 2009).

## 4 Analysis and discussions

### 4.1 Summary of the lexical analysis

Summarizing the lexical analysis, from 6.199 words contained in the corpus, we found 863 active words in the lexical analysis. The Hapáx index shows that 46% of the total of the active words contain 399 words that appear only once in the corpus. It means that Hapáx represents only 6.4% of occurrence of words that did not repeat in the textual corpus.

#### 4.1.1 Descending hierarchical analysis (DHA)

In the DHA (Table 1), we found out that the textual corpus (set of 14 transcriptions of the interviews) comprises 175 text segments (TS), representing words in which 1.255 present different radicals per TS. DHA formed a model of five clusters with a set of words statistically significant each one. The analysis of the significance of the words was based on the chi-square measure ( $\chi^2$ ), which, in lexical analysis, represents the measure of relationship between words. High values of  $\chi^2$  means the high relevance of the words in each cluster as well as the certainty that the words can be accepted in the cluster model.

Table 1.

Summary of the descending hierarchical analysis outcomes

N° occurrences	N° of forms	Average of forms by text segment	N° forms with frequency	Lemmas	N° text segments (TS)	N° classified segments	N° of clusters
6199	1255	35.4	232	863	175	175 (73.7%)	5

Note. Extrated from research data.

The model cluster was adjusted following the inclusion criteria. Thereby, DHA classified 73.7% of TS, ensuring the good reliability of the cluster model, since the value of the cluster adjustment complies with the acceptable limit (>70%) indicated in the literature (Camargo & Justo, 2013). Figure 1 shows the cluster model generated in the DHA. It is formed for five classes with the most important words with highest chi-squares in each class.

Figure 1.

Descending Hierarchical Analysis (DHA)

Reality of confinement Class 1 ( $\chi^2 = 17,8$ )		Safe cycling assesement Class 2 ( $\chi^2 = 20,16$ )		Habit change Class 3 ( $\chi^2 = 17,05$ )		Perception of urban space Class 4 ( $\chi^2 = 21,71$ )		Health and environment relation Class 5 ( $\chi^2 = 23,26$ )	
pass	$\chi^2 = 34,46$	safe	$\chi^2 = 51,48$	walk	$\chi^2 = 28,7$	bikeway	$\chi^2 = 33,89$	decrease	$\chi^2 = 31,93$
home	$\chi^2 = 26,07$	practice	$\chi^2 = 32,82$	never	$\chi^2 = 25,3$	driver	$\chi^2 = 22,7$	use	$\chi^2 = 14,49$
pandemic	$\chi^2 = 20,32$	mask	$\chi^2 = 24,12$	bicycle	$\chi^2 = 16,57$	city	$\chi^2 = 21,3$	bring	$\chi^2 = 16,18$
pedal	$\chi^2 = 14,82$	contact	$\chi^2 = 20,51$	buy	$\chi^2 = 15,97$	sustainable	$\chi^2 = 18,76$	health	$\chi^2 = 16,11$
gym	$\chi^2 = 14,16$	crowding	$\chi^2 = 16,35$	desire	$\chi^2 = 14,94$	place	$\chi^2 = 17,84$	car	$\chi^2 = 14,98$
nothing	$\chi^2 = 14,16$	pedal	$\chi^2 = 15,61$	like	$\chi^2 = 14,57$	cyclist	$\chi^2 = 15,74$	help	$\chi^2 = 13,62$
inside	$\chi^2 = 13,62$	avoid	$\chi^2 = 15,61$	enjoy	$\chi^2 = 10,14$	space	$\chi^2 = 14,89$	pollutants	$\chi^2 = 12,73$
thinking	$\chi^2 = 9,21$	contaminate	$\chi^2 = 12,17$	right	$\chi^2 = 9,8$	public	$\chi^2 = 14,06$	emission	$\chi^2 = 12,73$
isolation	$\chi^2 = 5,0$	sport	$\chi^2 = 11,98$	give	$\chi^2 = 6,54$	reduce	$\chi^2 = 11,8$	fuel	$\chi^2 = 12,73$
looking	$\chi^2 = 2,92$	group	$\chi^2 = 11,58$	leisure	$\chi^2 = 5,34$	respect	$\chi^2 = 11,8$	utilize	$\chi^2 = 10,14$
staying	$\chi^2 = 2,25$	close	$\chi^2 = 11,58$	means	$\chi^2 = 3,17$	safety	$\chi^2 = 5,11$	gas	$\chi^2 = 10,14$
time	$\chi^2 = 12,8$	contagion	$\chi^2 = 11,58$	physical	$\chi^2 = 3,17$	transit	$\chi^2 = 5,11$	benefit	$\chi^2 = 9,38$
		alone	$\chi^2 = 7,72$	go	$\chi^2 = 2,65$	bus	$\chi^2 = 3,65$	quite	$\chi^2 = 9,38$
		care	$\chi^2 = 6,29$			lane	$\chi^2 = 3,65$	bicycle	$\chi^2 = 7,43$
		environment	$\chi^2 = 4,13$			education	$\chi^2 = 3,65$	pollution	$\chi^2 = 6,64$
		colleague	$\chi^2 = 4,13$			share	$\chi^2 = 3,65$	contribute	$\chi^2 = 3,42$
						breakdown	$\chi^2 = 3,65$	exercise	$\chi^2 = 3,24$
						lane		problem	$\chi^2 = 3,24$
								infrastructure	$\chi^2 = 3,24$
								carbon	$\chi^2 = 3,24$

Source: Extrated from Iramuteq.

**4.1.1.1 The reality of confinement.** The first class was named *reality of confinement*. This class represents 17.83% of the text corpus and is composed of 12 statistically significant words: pass ( $\chi^2 = 34.46$ ), home ( $\chi^2 = 26.07$ ), pandemic ( $\chi^2 = 20.32$ ), pedal ( $\chi^2 = 14.82$ ), gym ( $\chi^2 = 14.16$ ), nothing ( $\chi^2 = 14.16$ ), inside ( $\chi^2 = 13.62$ ), thinking ( $\chi^2 = 9.21$ ), isolation ( $\chi^2 = 5.0$ ), looking ( $\chi^2 = 2.92$ ), staying ( $\chi^2 = 2.25$ ), time ( $\chi^2 = 12.8$ ). The analysis of this class shows



that the influence of the pandemic on the decision to use the bicycle as a sport and leisure practice was reflected in the lockdown period, representing the adoption of the strict forms of isolation for sanitary control.

The need for lockdown led to the search for alternatives to escape the reality of the pandemic. Thus, two factors may have influenced the decision to cycle. Firstly, the closing of gyms during the lockdown makes it difficult to practice physical exercises. Secondly, cycling presented itself as an alternative sport for those who did not practice physical activities and felt the need to exercise as a consequence of the isolation. Yet, this class shows the influence of the search for cycling, such as the mental fatigue of the home office, the sedentary lifestyle, the feeling of loneliness, TV as the only form of entertainment, and family tensions, according to the following examples of statements:

The pressure was intense, there were four adults inside an apartment, a pregnant woman and three dogs, I thought I was going to lose it at that time (E. N. Personal communication, March 3, 2022).

I believe that the brain didn't understand that my resting place was also my work place, so it generated that confusion and I ended up being a little more tired than I normally was (C.A. Personal communication, February 21, 2022).

Man, when the pandemic came, we stayed at home and I found myself more sedentary than I already was (J. A. Personal communication, December 15, 2021).

Before the pandemic my girlfriend and I used to go to the gym [...] but then we stayed indoors for six months without doing anything, then we thought: let's find a way to exercise and the bicycle was one way (S.S. Personal communication, January 05, 2022).

Studies (Lima, 2020; Gonçalves, Nardi & King, 2020; Cossio-Bolaños, 2021) indicate that several negative impacts on physical and mental health in the population were accentuated in the period of isolation, such as anxiety, insomnia, obesity, irritability, emotional exhaustion and various fears, leading to the hypothesis of the emergence of a health crisis by stress-related diseases, panic syndrome and depression. The home office, which presented itself as an option to maintain professional, business and academic activities in the pandemic, was considered one of the causes of impacts on the routine and well-being of the population (Gonçalves et al. 2020). This was due to the lack of ideal ergonomic conditions for work and studies at home, the excessive use of digital technologies, the loss in the notion of work and rest times, eating disorders, among other problems (Gonçalves *et al.*, 2020).

The negative effects of isolation and home office have driven recommendations by health agencies (OMS, 2020; Fiocruz, 2020) in order to minimize the psychological pressures



and uncertainties of the pandemic. Among the behaviors, those related to movement stand out: avoiding idleness, respecting periods of rest from work, seeking leisure alternatives and performing physical activities at home or in open spaces, and protecting from crowds (Lima, 2020).

**4.1.1.2 Safe Cycling Assessment.** The second class, called *safe cycling assessment*, corresponds to 20.16% of the text corpus, formed by 16 words of higher significance: safe ( $\chi^2 = 51.48$ ), practice ( $\chi^2 = 32.82$ ), mask ( $\chi^2 = 24.12$ ), contact ( $\chi^2 = 20.51$ ), crowding ( $\chi^2 = 16.35$ ), pedal ( $\chi^2 = 15.61$ ), avoid ( $\chi^2 = 15.61$ ), contaminate ( $\chi^2 = 12.17$ ), sport ( $\chi^2 = 11.98$ ), group ( $\chi^2 = 11.58$ ), close ( $\chi^2 = 11.58$ ), contagion ( $\chi^2 = 11.58$ ), alone ( $\chi^2 = 7.72$ ), care ( $\chi^2 = 6.29$ ), environment ( $\chi^2 = 4.13$ ), colleague ( $\chi^2 = 4.13$ ).

The participants reported several factors related to the experience of bicycling during the pandemic, stating that cycling is a safe practice for sport and leisure, as well as highlighting the use of mask, care to avoid contacts and crowds, attention to distance, not sharing personal objects, the fact that the cycling groups are formed by people close to the cycle of friendships, among other hygiene measures to avoid contamination. Such finding corroborates other research (Rodríguez & Peña 2020; García *et al.*, 2020; Moreno *et al.*, 2021) when the authors argue that these factors led the bicycle to play an important role in urban mobility during the pandemic. In addition, the factors indicate highest environmental awareness through the socioeconomic and ecological influence of the modal (Centero, 2020).

It is important to highlight that the safe evaluation of cycling, in the view of the participants, was also related to the fact that the practice is performed outdoors and individually. The following two reports provide evidence for some of the arguments highlighted.

The fact that cycling was a sport that I could do on an individual basis had a big influence of this safety issue in relation to Covid contagion (A.A Personal communication, February 25, 2022).

Because you can bike alone, even if you go with a group you can have a certain distance from one to the other. And because it is in an open place, outdoors, I believe it becomes safe (P. M. Personal communication, November 29, 2021).

Considering the cycling groups, most said they started cycling alone. However, after the more severe health restrictions, they became part of these collectives. Such groups reflect positive aspects because, according to Martins (2019), they are formed for several reasons that relate to sport training, leisure and/or environmental activism, incorporate new dynamics in the



urban space, act as a reference for initiation of new cyclists, and undertake influences with public administrators to build a bicycle-friendly city.

**4.1.1.3 Habit change.** The third class was named *habit change* and covers 17.05% of the text corpus, composed of 13 statistically significant words. The interpretation of this class indicates that the pandemic, in addition to boosting the search for sports and leisure practices, awakened to a change in lifestyle, since all the research participants bought a bicycle during the pandemic. The words such as walk ( $\chi^2 = 28.7$ ), never ( $\chi^2 = 25.3$ ), bicycle ( $\chi^2 = 16.57$ ), buy ( $\chi^2 = 15.97$ ), desire ( $\chi^2 = 14.94$ ), like ( $\chi^2 = 14.57$ ), enjoy ( $\chi^2 = 10.14$ ), right ( $\chi^2 = 9.8$ ), give ( $\chi^2 = 6.54$ ), leisure ( $\chi^2 = 5.34$ ), means ( $\chi^2 = 3.17$ ), physical ( $\chi^2 = 3.17$ ), go ( $\chi^2 = 2.65$ ) indicate that many participants had never cycled in a previous setting; others had always liked cycling and had the desire to cycle, but only in the pandemic did they take the initiative. Still, some of them started cycling as a leisure practice, renting bicycles for rides, and after realizing the physical benefits, they decided to use the bicycle as a sport practice.

The triggers for the health issue indeed were driven in the pandemic and the change in lifestyle was inevitable (Medeiros & Rajs, 2020). Cossio-Bolaños (2021) points out that Covid-19 brought new health concerns, new dynamics for usual commuting, physical activity at home for some, inactivity for others, changes in eating habits and other health risk behaviors, which consequently influenced the search for healthier lifestyle habits. The two statements below are examples of segments showing evidences these findings.

I thought if we get out of this pandemic I will change my lifestyle a little bit, because I worked a lot, lived stressed and said I had no time for anything" (J.V Personal Communication, February 25, 2022).

During the pandemic I started seeing the need to look for a better quality of life, I was totally sedentary, I didn't practice any kind of physical activity (A.A Personal Communication, February 25, 2022).

In this specific context, the use of the bicycle represented a change in habits, since all participants in the survey said they had started practicing sport and leisure through the bicycle due to the changes that came with the pandemic. It is worth mentioning that the expansion of the use of the bicycle for utilitarian trips, such as going to work or performing daily tasks, also presents itself as a relevant aspect of this class and was mentioned by some interviewees, as shown in the segments of the following reports:

The bicycle opened my horizon [...] I went to a sport practice and it turned out that today I solved everything by bike (P. M. Personal Communication, November 29, 2021).





Using my example, I spent some days in the week going to work by bike instead of going by car (A.A Personal Communication, February 25, 2022).

I think I looked for something to do that would get me out of that situation that was not good for anyone [...] Every day now I am going to work by bike (E. N. Personal Communication, March 03, 2022).

**4.1.1.4 Perception of urban space.** The fourth class was named *perception of urban space*. This class represents 21.71% of the text corpus and is formed by 16 statistically significant words: bikeway ( $\chi^2 = 33.89$ ), driver ( $\chi^2 = 22.7$ ), city ( $\chi^2 = 21.3$ ), sustainable ( $\chi^2 = 18.76$ ), place ( $\chi^2 = 17.84$ ), cyclist ( $\chi^2 = 15.74$ ), space ( $\chi^2 = 14.89$ ), public ( $\chi^2 = 14.06$ ), reduce ( $\chi^2 = 11.8$ ), respect ( $\chi^2 = 11.08$ ), safety ( $\chi^2 = 5.11$ ), transit ( $\chi^2 = 5.11$ ), bus ( $\chi^2 = 3.65$ ), lane ( $\chi^2 = 3.65$ ), education ( $\chi^2 = 3.65$ ), share ( $\chi^2 = 3.65$ ), breakdown lane ( $\chi^2 = 3.65$ ).

When we asked about the use of the bicycle for a more sustainable city, the participants, besides an analysis of the public space, pointed out the difficulties for the use of the modal as a utilitarian transportation alternative, indicating that the substitution of motor vehicles for the bicycle is considered an important point for sustainability.


Among the difficulties reported, the absence of bike lanes with connections between routes stands out, which in addition to requiring cyclists to share the shoulder with cars and buses, discourages the use of bicycles for daily activities. Traffic education was also mentioned, since the participants reported cases of drivers who do not respect cyclists, nor the road signs, or even those who think that the road is exclusive for vehicles, generating insecurity and fear in cyclists. In addition to the theft of bicycles and the absence of bicycle racks for secure parking, which compromises the use of bicycles in a sustainable way. The following are examples of reports evidencing these findings.

First, I think that to be sustainable we need to have a better structure of bike lanes and better signage, and also education in society [...] (A.L. Personal Communication, December 14, 2021).

Unfortunately there is no bike lane, the place where I live until I get downtown doesn't have one. I go squeezing myself, dodging between the cars (E. N. Personal Communication, March 03, 2022).

The big problem that makes it impossible to change the use of the bicycle to the detriment of the car is because of violence. That way, whoever is on a bicycle is subject to assault and theft (V.M. Personal Communication, January 12, 2022).

Let's say, in terms of sustainability of going to work, going to a bakery, these things, I think the issue of public safety. Of fear (J.V Personal Communication, February 25, 2022).



Considering this class, the participants confirm the predominance of motor vehicles in the metropolises studied, as it happens in most Brazilian cities (Garreafa & Carvalho, 2020; Batista & Lima, 2020). The absence of public policies to democratize mobility in the city, through traffic education (Coelho, 2020; De Sá, 2013) and the lack of public investments, in terms of bicycle infrastructure, to support the use of the bicycle in the various displacements and to contribute to a more sustainable city. Chapadeiro and Antunes (2012) state that bicycle transportation in Brazil involves barriers due to the lack or inadequacy of infrastructure, among which we highlight physical vulnerabilities due to coexistence with motor vehicles; vulnerabilities to theft due to the violence in the cities; and prejudice due to the symbol of prosperity that vehicles have to the detriment of the bicycle.

For the participants, despite the problems, in playful and sportive practices, it is possible to do cycling in the cities studied due to the predominance of leisure bike lanes. This evidence corroborates the Batista and Lima (2020). Besides, it is common to use winches in cars to transport the bicycle to a trail area or urban sidewalk. Particularly in João Pessoa/PB, the climate was highlighted as not convenient for the use of the bicycle in daily activities, even though the city is favorable in terms of easy locomotion compared to other Brazilian metropolises. The following reports show evidences these findings.

I can't go to work by bike and not take a shower [...] in other climates the person goes to work already with their work clothes, they go cycling, here I can't do that, because of the heating (S.S. Personal Communication, January 05, 2022).

Complicated depending on the time you are going to use, because as João Pessoa is a very warm city, so sometimes it generates discomfort and depending on the place where you work, it is not interesting that you arrive sweaty (C.A Personal Communication, February 21, 2022).

**4.1.1.5 Health and environment relation.** The fifth class named *health and environment relation*, corresponding to 23.26% of the text corpus with 20 statistically significant words: decrease ( $\chi^2 = 31.93$ ), use ( $\chi^2 = 14.49$ ), bring ( $\chi^2 = 16.18$ ), health ( $\chi^2 = 16.11$ ), car ( $\chi^2 = 14.98$ ), help ( $\chi^2 = 13.62$ ), pollutants ( $\chi^2 = 12.73$ ), emission ( $\chi^2 = 12.73$ ), fuel ( $\chi^2 = 12.73$ ), utilize ( $\chi^2 = 10.14$ ), gas ( $\chi^2 = 10.14$ ), benefit ( $\chi^2 = 9.38$ ), quite ( $\chi^2 = 9.38$ ) bicycle ( $\chi^2 = 7.43$ ), pollution ( $\chi^2 = 6.64$ ), contribute ( $\chi^2 = 3.42$ ), exercise ( $\chi^2 = 3.24$ ), problem ( $\chi^2 = 3.24$ ), infrastructure ( $\chi^2 = 3.24$ ), carbon ( $\chi^2 = 3.24$ ). Such words indicate a connection between bicycle usage providing health and decrease the emission of polluting gases in the environment.

According to the participants, from the environmental point of view, cycling reduces pollution, saves fuel, reduces automobile traffic and, consequently, reduces traffic jams,



minimizes infrastructure problems, favors the planting of more trees in the city, improves the air and the temperature of the environment. In the context of health, cycling promotes physical benefits, decreases the risks of diseases, improves immunity, and contributes to a stronger mind. The following reports are examples of segments that show these findings.

I think that with bicycle usage, for sure, less pollution in the air, less trash, more green, less sick people (G.L. Personal communication, January 28, 2022).

For carbon emission reduction, health issues even. So that people have a better immunity to any kind of disease (V.M. Personal communication, January 12, 2022).


The bicycle brings health, economy, you will decrease the emission of pollutant, the fuel of the car, you will decrease traffic (J. A. Personal communication, December 15, 2021).

It increases the immunity of the person and that can help psychologically, because a strong mind is the best thing in the world (J.R. Personal communication, February 26, 2022).

The connection between health and environment provides the status of sustainable mobility to the bicycle, since the modal presents as a solution to one of the biggest environmental problems that is the burning of fossil fuel (Louro *et al.*, 2019). Moreover, with the pandemic, the modal started to perform the appropriate safety requirements for the non-contagion of Covid-19 and the guarantee of physical activities, expanding the idea of health, well-being, and quality of life. In this perspective, researchers point to viewing the current health crisis as an opportunity for urban resilience to address mobility problems (Moreno *et al.*, 2021; Barbarossa, 2020), responding to emerging climate change (Kakideri, Oikonomaki & Papadaki, 2021), and favoring bicycling as the dominant modal in the post-pandemic (Campisi *et al.*, 2020; Neri & Junior, 2020). However, according to Spadaro and Pirlone (2021), the absence of government interventions to make sustainable mobility a priority may facilitate a return to previous transport habits, daily commuting, sport and leisure, and allow the increase in active modes during the pandemic to have little effect in realizing sustainable relationships between mobility, health, and environment.

#### 4.2 Factor Representation Analysis

FRA was performed to verify the relationship between the five classes. The findings show that the habit change class is related to the class of the confinement reality, because the reports show that those who already practiced physical activities before the pandemic missed exercising, especially during lockdown, which show evidences to the adoption of the bicycle



as an alternative sports activity. Those who did not practice sports activities had a greater perception about the routine and sedentary lifestyle, indicating changes in lifestyle. Also, those who continued to practice exercises at home during the pandemic, increased the days of training and the modalities right after a decree for sanitary relaxation. The account below shows these findings.

The isolation was one of the things that most led me to seek this issue of sport. I used to go to the gym three times a week, but now with the pandemic I do it every day and on Saturday I go cycling (A.L. Personal communication, December 14, 2021).

The class of the perception of urban space connects with the class of the relationship between health and environment through the perspective of sustainability. Louro *et al.* (2019) state that in the domain of urban mobility, sustainability has a direct influence on building a healthy city that, in addition to public health policies, includes the implementation of infrastructure for active modes, improvements in bicycle networks, attractive environments with shade areas and shelters, safe environments for physical activities, traffic education, among other amenities.

The impacts on the environmental issue were directly associated, especially in the media that conveyed indexes on the improvement of air quality in large cities, the movement of wild animals in urban areas, the images of visually cleaner tourist landscapes and without the intense flow of people, the presence of schools of fish and dolphins in canals whose waters were polluted before the pandemic, among other phenomena (Souza, 2020). Likewise, research has shown a decrease in road accidents with injuries and deaths, as well as a reduction in noise pollution (Spadaro & Pirlone, 2021). These impacts were related to changes in mobility, due to the low circulation of transport, the interruption of tourism, the closing of borders and restrictions on daily activities that mobilize various forms of displacement (Alves, 2020).

However, the return to the old routines raises the question whether such impacts will have lasting strategies and effective policies for a safe and sustainable urban model or will reflect the return of problems and inequalities (Kakideri *et al.*, 2021). This context leads to new reflections on the Brazilian reality, which historically faces challenges to consolidate an urban mobility policy and still predominates the exclusionary model of accessibility to the city (Boareto, 2021). These data were found in the research, as the participants reported the problem of car dependence for utilitarian trips in the cities studied and the importance of the expansion

of cycling infrastructure to democratize the use of the bicycle, which provides benefits in terms of physical and mental health, as well as can improve the environmental quality of the planet.

## 5 Conclusions

This current study aimed to identify the factors of the Covid-19 pandemic that influenced the adoption of the bicycle in sports and leisure practices in the cities of João Pessoa and Campina Grande, located in the state of Paraíba. The findings found out major variables concerning the use of the bicycle as a sport practice during the pandemic context as the reality of confinement, safe cycling assessment, habit change, perception of urban space, and health and environment aspects. The main results revealed that the pandemic was a driver for the use of the bicycle, since the effects of lockdown, social distancing measures, home office, perception about sedentary lifestyle, and psychological pressures led to the search for alternatives to face the health crisis, which may indicate a higher number of cyclists in the both cities under investigation searching for sport and recreational activities.

The practice of cycling was also encouraged from the health point of view, as a safe mobility alternative, reinforcing the relationship between health and environment, since the participants of the modality perceived the physical and psychological benefits, as well as the possibility of protecting themselves from the risks of contagion from Covid-19. Participants reported the advantage of being outdoors, connected with public spaces and nature areas. Such perception also awakened to a change in lifestyle and, consequently, a critical view on the importance of bicycling for a more sustainable city and the need for public policies for better urban mobility.

Once the research sought the participant profile who started cycling during the pandemic period, it was possible to identify the vision of urban sustainability from the reduction of pollution by replacing cars by the use of bicycles. Furthermore, it becomes evident that the problems of infrastructure and urban mobility are similar in Brazilian cities and that the predominance of bicycle usage is for sport and leisure activities, in face of the difficulties to use the modal for utilitarian displacements.

As theoretical contributions, the research advances in the discovery of classes that confirm the increase of bicycle usage in the pandemic, demonstrating changes in habits in terms of urban mobility and expanding the view on the relationship between health and sustainability. From a practical point of view, the research draws attention to the implementation of public

policies that enable adequate infrastructure for cycling in the cities studied, especially in view of the health uncertainties due to the presence of the coronavirus.


It is noteworthy as a limitation of the study that such findings can not be generalized because we collected data from two specific cities. Yet, during the pandemic, a considerable portion of young people aged 18 to 25 years started the practice of cycling for sporting and recreational purposes, but showed discomfort in participating in the interview or provided insufficient answers for the analysis, which led to a decrease in the search for participants in this age group, despite the significant participation of these young people in cycling groups in the cities of Paraiba. This fact reinforces the prominence of the bicycle during the pandemic, the indication of increase of cyclists in the cities, and the importance of public managers to enable this adherence in the post-pandemic, especially in terms of reconciling healthy cities with sustainable development. Searching for generalization, future studies could use a quantitative approach to measure the five variables found out in the analysis, establishing valid and reliable latent constructs to predict its influence in the individual's intention to use cycling as a sport and leisure practice.





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