

# Cycling Assessment: A tool to inform policymakers and enhance the cyclist's travel experience, with a gender perspective

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## Abstract

Since 1998, Bogotá has consistently made substantial efforts to foster the bicycle's role as a primary mode of transportation. Recent years have witnessed a compelling aspiration for the city to ascend as the "bicycle capital of the world," evident in its accomplishment of 6.6% of daily trips completed by bicycle in 2019. This achievement translates to 880.367 daily cycling journeys (District Secretariat of Mobility of Bogotá, 2019). These statistics surpass regional benchmarks; for instance, other capital cities such as Santiago de Chile account for 510.569 bicycle trips, Mexico City for 433.981, and Rio de Janeiro for 217.000 (Ríos et al., 2015). Despite this progress, Bogotá lacks a comprehensive evaluation of both infrastructure quality and the user experience while cycling.

This translational research article aimed to explore this gap by delving into the integration of user perceptions and experiences within the policy formulation process. This strategic approach is poised to enhance cycling's allure as a mode of transportation for prospective cyclists while simultaneously maximizing the efficiency of investments in cycling infrastructure.

## Policy Significance Statement

This translational article seeks to highlight the importance of incorporating the perceptions and experiences of road users into the planning and execution of infrastructure, ensuring a safe and comfortable cycling environment for all. Promoting cycling as a mode of transportation stands as a potent strategy for policymakers to tackle challenges such as climate change and unsafe road conditions. However, this endeavor needs active engagement with those who already navigate the urban landscape on bicycles. Moreover, this article introduces a decision-making tool that enables policymakers to integrate cyclist's experiences, employing a gender-sensitive approach. Furthermore, it sheds light on similar experiences from diverse cities around the world, facilitating cross-context learning and knowledge sharing.

  This research article was awarded Open Data and Open Materials badges for transparent practices. See the Data Availability Statement for details.

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## 1. Introduction

The success of advocating bicycles as a mode of urban transport in Bogotá stands as a noteworthy accomplishment. Initiated by the city government in 1998, the endeavor bore fruit in the form of an expanding network of cycling lanes. From a mere 8 km in 1998, this network burgeoned rapidly to 240 km within two years. This trajectory of work has persisted consistently, culminating in a substantial 550 km by 2020 (Pardo, 2013).

Bogotá, the capital city of Colombia, aspires to be the “world capital of the bicycle.” This aspiration materialized in 6.6% of the daily trips undertaken on bicycles in 2019, amounting to a staggering 880,367 daily trips (District Secretariat of Mobility of Bogotá, 2019). A pertinent consideration is that only 25% of these bicycle trips are undertaken by women, highlighting an avenue for enhancement (Universidad de los Andes, 2022). Nevertheless, it is notable that women tend to proportionally double the number of care trips made by bicycle within the city (Pipicano et al., 2021).

While these figures suggest triumphant bicycle use in the city, the question arises: What if the yardstick of success was extended to encompass the quality of the cycling experience and the perception of existing cycling infrastructure? This translational research article seeks to delve into the integration of user experience and perception within the policymaking process, aiming to render cycling a more appealing mode for potential cyclists while optimizing the efficacy of cycling investments.

Bogotá’s cycling landscape transcends recreation, embracing daily commuting. However, interconnected facets such as infrastructure upkeep, road safety, and personal security cast their shadows on cycling experiences by failing to guarantee cyclists’ comfort and safety. The underrepresentation of women in cycling, largely due to perceptions of road and personal insecurity, underlines the gendered impacts of mobility service design and operation (GIZ, 2018).

One of the aspects that shows that the cycling experience could be improved is the figures on road safety, with 82 cyclists’ fatalities in 2021, amid a total of 469 fatalities, according to the Bogotá Road Accident Yearbook (District Secretariat of Mobility of Bogotá, 2021). In 2022, the number increased to 94 cyclist fatalities (National Road Safety Agency, 2022). Despite concerted efforts such as expanding cycling infrastructure and reducing urban road speed limit to 50 km/h, cyclist fatalities escalate annually. Moreover, the majority of cyclist fatalities are among youth aged 20 to 30 (National Road Safety Agency, 2022).

Personal security remains another facet that tempers the cycling experience. A total of 4071 bicycle thefts were recorded in Bogotá from January to June 2023, underscoring an ongoing issue (District Secretariat for Security, Coexistence and Justice, 2023). Sexual harassment presents an important barrier to cycling, particularly for women (Moscoso et al., 2021). Seven of 10 women in Bogotá say that they feel unsafe on public transport and public spaces, and 8 of 10 women have experienced a situation of harassment at some moment in their lives (District Oversight Office, 2023). Unfortunately, official data on sexual harassment endured by female cyclists remain absent (Moscoso et al., 2020).

Despite its extensive 600 km expanse, Bogotá’s cycling infrastructure does not uniformly offer a favorable user experience. Personal observations of the authors, who are both urban cyclists and Bogotá researchers, unveil shortcomings such as road deterioration, obstructions such as light posts within cycling paths, deficient drainage, narrow lanes, and inadequate public lighting, all hampering the cycling journey.

To foster urban cycling, it is imperative for the design, operation, and regulation of mobility services to adopt a gender-sensitive approach, thereby rectifying current equity gaps (ECLAC, 2019). Building upon these insights, informed by the authors’ personal experiences as urban cyclists and researchers in Bogotá, a policy challenge emerges in the implementation of new cycling infrastructure. It is evident that such implementations often transpire with limited or no consideration of prior iterations and without addressing the genuine cycling experiences and perceptions of infrastructure users.

Remarkably, Bogotá lacks a quantification of infrastructure quality perceptions and cycling experience. To address this gap, a cycling assessment materialized as a tool, efficiently capturing relevant cyclist-centric aspects and transmitting findings to decision-makers. Developed to assess key components

of the cycling experience, this assessment informs potential infrastructure enhancements that respond to urban cyclists' needs, political priorities, and equity gaps when cycling within the city. Developed and deployed in Bogotá during 2022, this assessment formed a core component of a youth-led project executed by *Despacio* -a Colombian nonprofit organization that promotes quality of life in cities through applied research.

Subsequent sections will further expand upon similar experiences and present the assessment's results within Bogotá's context.

### **1.1. What is a cycling assessment and what are the best practices from around the world?**

A cycling assessment aims to understand the strengths, weaknesses, opportunities, and challenges of the cycling ecosystem. It typically involves collecting data on factors such as the quality of cycling paths, safety measures, user experiences, accessibility, and overall bike-friendliness of the city.

On the other hand, a "cycling index" is a tool used to measure and rank the bike-friendliness of different cities or regions. It combines multiple indicators and criteria related to cycling, such as the percentage of bike usage, infrastructure quality, safety measures, gender inclusivity, and cycling fatalities (Copenhagenize Index, 2019). By assigning scores to these indicators and aggregating them, a cycling index provides a numerical representation of how well a city supports cycling as a mode of transportation.

In our exploration of the urban cycling experience, we delve into an assessment driven by the perception of diverse facets. We anchor our assessment on the concept of a cycling index—a comprehensive framework to gauge cycling's status in the city. "Cycling assessment" and "cycling index" are two terms used to analyze different aspects of cycling in urban environments. While they are related concepts, they focus on slightly different perspectives.

Manifesting the potential of cycling indices is the "Copenhagenize Index" conceived as a benchmark for cycling-friendliness, this index harmonizes diverse parameters to quantify and rank cities accordingly (Copenhagenize Index, 2019). However, its impact transcends classification—it serves as a global beacon, illuminating pathways for cities to enhance their cycling ecosystems. By nurturing an environment conducive to cycling, the Copenhagenize Index reshapes urban landscapes and fosters sustainable, health-conscious, and eco-friendly transportation alternatives.

This article spotlights four international best practices, each representing a distinct stride toward measuring and enhancing the urban cycling experience.

#### *1.1.1. Promoting cyclist-friendly cities: Germany's Fahrradklima-test*

Since 2012, Germany has been actively fostering cyclist-friendly cities through the *Fahradklima-Test*, also known as the classification of bicycle-friendly cities. This biennial assessment is conducted by the General Association of German Cyclists (ADFC), an influential group boasting over 220,000 members. The ADFC is resolute in its pursuit of transforming transportation patterns, centering on the bicycle as a catalyst for climate protection, safety, health, and an enriched quality of life (ADFC, 2023).

This test, performed in German cities, is partitioned into six categories based on population size, an approach underscored by the ADFC (2023). Administered from September to November, this evaluation casts a spotlight on pivotal cycling elements, encompassing factors such as urban biking convenience, preservation of cycling infrastructure from motor vehicle intrusion, access to vital urban activity hubs, mitigation of obstacles within infrastructure, adequacy of bike lane width, and assessment of segregation appropriateness, among other criteria.

Financed in collaboration with the German Ministry of Transport and Digital Infrastructure as part of the National Cycling Plan, the *Fahradklima-Test* garners significant participation, with around 230,000 individuals joining in 2018. Results from that year's examination unveiled compelling insights: 82% recognized the significance of cyclists as road users, 80% expressed a strong sense of safety, 79% voiced satisfaction with obstructions being removed from bike lanes, 79% appreciated the absence of cyclist-vehicle conflicts, and 67% endorsed the adequacy of bike lane width (GIZ, 2021).

The Fahrradklima-Test is a panoramic survey, encompassing the urban landscape holistically rather than focusing on specific corridors. This wide-ranging approach is funded by the national government. The outcomes accentuate the challenges in ensuring cyclist enjoyment, safety, conflict-free coexistence with motor vehicles, and the quality of cycle paths. These results equip city planners with valuable data, enabling them to make infrastructure decisions based on the first-hand experiences of cyclists.

Beyond this, the test's objectives extend to spotlighting cycling's advancement in cities and galvanizing decision-makers to allocate greater resources for cycling initiatives. The insights garnered through the test, identifying strengths and areas for improvement, serve as a compass for government initiatives and policies, steering local authorities in the right direction (ADFC, 2023). Notably, at the national level, a similar tool known as the Fahrrad-Monitor is also applied.

Germany's Fahrradklima-Test transcends mere assessment; it stands as a proactive endeavor to elevate cycling conditions, encouraging cities to evolve into havens for cyclists and ensuring a harmonious coexistence between bicycles and urban landscapes.

### *1.1.2. Copenhagen, Denmark*

A Bicycle Account serves as a valuable tool for regularly monitoring the progress of bicycling activities within a community, allowing for an assessment of whether the community is meeting its cycling goals (Urban Systems and The League of American Bicyclists, 2013). Copenhagen, Denmark, initiated its first Bicycle Account in 1996 and has consistently produced updates every two years. The primary audience for this report is the citizens of Copenhagen, with the additional aim of inspiring other cities to promote cycling. For the city of Copenhagen, this publication plays an indispensable role in further enhancing the city's bicycle-friendliness (City of Copenhagen, 2022).

The most recent Bicycle Account, released in 2022, encompasses various key metrics, including:

- **Reasons for cycling:** Examining why people choose to cycle, considering both the benefits it provides and whether it serves as a mode of transportation or a leisure activity.
- **Satisfaction with Copenhagen as a cycling-friendly city:** Gauging the level of satisfaction among residents with regard to Copenhagen's cycling infrastructure and policies.
- **Access to bicycles:** Evaluating the accessibility of bicycles to the public.
- **Peak hour space availability:** Analyzing the availability of space for cycling during peak hours.
- **Average cycling speed:** Measuring the typical cycling speed within the city.
- **Utilization of specific streets and bridges:** Studying the usage patterns of selected streets and bridges by cyclists.
- **Investment in cycling-related initiatives:** Assessing the level of financial investment in initiatives aimed at promoting cycling.
- **Safety perception:** Gathering insights into how residents perceive road safety for cyclists.
- **Children's school route safety:** Capturing the perceptions of both adults and children regarding the safety of routes to schools. Notably, this variable stands out in comparison with other best practices mentioned in this document.

It is important to note that this specific measurement regarding school route safety was conducted in 2020 as part of a study involving public and private primary schools. Overall, satisfaction with the city's cycling infrastructure stands at an impressive 97% (City of Copenhagen, 2022).

### *1.1.3. Calgary's cycling project: A multi-perspective evaluation*

The city of Calgary in Canada presents a notable example of progressive cycling infrastructure development. A pivotal pilot project, initiated by the city of Calgary Transportation Department (2016), aimed to establish a safeguarded 4-mile network of bike lanes, elevating transportation options for both residents and visitors seeking to access downtown destinations.

PERFORMANCE MEASURE	MEASUREMENT METHOD
Satisfaction	Ipsos (third party) telephone survey of Calgaryians
Safety	Collision data collected by Calgary Police Service
Bicycle Volumes	Automated counters embedded into pavement at 10 count locations along the cycle tracks
Peak period travel time for automobiles	GPS and stop watch trials for a vehicle travelling the entire length of the corridor
Unlawful sidewalk riding and wrong way riding	Manual count by Transportation
Economic Vitality - merchants along route	In-person surveys conducted by Transportation
Economic Vitality - pedestrians along route	In-person surveys conducted by Transportation
Demographics - age	Manual count by Transportation
Demographics - gender	Manual count by Transportation

**Figure 1.** Calgary pilot assessment plan performance measures.

This project encompassed an exhaustive evaluation, scrutinizing diverse performance indicators to ensure its effectiveness. The assessment encompassed aspects such as cyclist contentment, experiential insights, perceived safety levels, volume of bicycle trips, and common infringements such as riding in the opposite direction. The demographic profile of the cyclists, depicted in Figure 1, was also a focal point of analysis.

The assessment focused exclusively on the designated bicycle lanes within the pilot project's scope. It engaged not only cyclists but also pedestrians and motorists. Throughout the pilot program, over 100 adaptations were implemented, as highlighted by the Department of Transportation (2016). These adjustments aimed at enhancing parking and traffic dynamics while mitigating conflicts among pedestrians, cyclists and drivers.

The study's outcomes illuminated key achievements. Particularly noteworthy was the 8% surge in female cyclist participation—a secondary performance metric—compared with previous bike lanes. Equally striking was the high satisfaction rate registered among cyclists, soaring at 79.75%. Notably, pedestrians expressed a contentment rate of 65%, while drivers of motor vehicles followed closely with 52.25%.

Calgary's case showcases an exhaustive evaluation approach, not confined to mere statistics, but encompassing experiential facets and multiple perspectives. This multifaceted assessment encapsulates the city's commitment to fostering a harmonious coexistence between diverse road users, spotlighting the project's triumphs and catalyzing ongoing enhancements.

#### 1.1.4. Mexico: Evaluating cyclist-friendly streets

Within the Mexican context, an initiative has taken root. The local nongovernmental organization (NGO), Estrategia Misión Cero, orchestrated the creation of a comprehensive manual designed to assess safe streets for cyclists in 2022. This manual presents an open-source methodology that extends an invitation to all interested parties to evaluate cycling infrastructure, spanning street, route, and neighborhood levels (Estrategia Misión Cero, 2022). The assessment framework encompasses an array of categories and indicators:

- Safety: Encompassing an evaluation of area speeds and the nature of cycling infrastructure.
- Usability: Encompassing habitability<sup>1</sup>, vehicle type<sup>2</sup>, and nocturnal vitality<sup>3</sup>.
- Comfort: Analyzing potential obstacles, heat management, and street surface.

The methodology supports the idea that infrastructure should embody three core attributes: tolerance, self-explanatory design, and inclusivity. Furthermore, it emphasizes the necessity of infrastructure catering to

<sup>1</sup> This concept refers to an urban setting that plants a sense of security among its inhabitants. It includes a variety of elements, including vibrant street frontage, the presence of essential amenities such as hospitals, parks, stores, and schools, as well as the provision of convenient cycling parking facilities (Estrategia Misión Cero, 2022).

<sup>2</sup> Related to the presence of light or heavy motorized vehicles (Ibidem).

<sup>3</sup> Referring to the presence of nocturnal activity and public lighting (Ibidem).

the diverse mobility needs of all individuals. The culmination of this evaluation process yields a score ranging between 0 and 105 points<sup>4</sup>, guided by a weighing of all contributing elements.

#### 1.1.5. *BiciRed Colombia ranking: Amplifying citizen voices in Colombian policy assessment*

The final case study underscores the BiciRed Colombia Ranking, an impartial civic endeavor assessing the efficacy of Colombian public policies supporting cycling. This evaluative framework examines a spectrum of factors, including:

- Road safety: Incident rates of cyclist fatalities and injuries.
- Bicycle theft: Occurrences and recoveries of stolen bicycles.
- Planning tools: Existence of strategic land management plans that actively encourage bicycle utilization. It also entails local government plans that articulate well-defined objectives centered on fostering and advancing cycling initiatives.
- Coordination mechanism: Establishment of operational committees or boards within the public sector. It encompasses both their regulation and the composition of their members.
- Human talent: Presence of professionals specifically engaged in advancing the cause of bicycle utilization.
- Cycling infrastructure: Extent and quality of cycling facilities.
- Bike parking: Availability and adequacy of bicycle parking facilities.
- Parking stations and validated trips: Provision of parking amenities at public transport stations, as well as the volume of journeys facilitated by public transport integrated systems.
- Bicycle fleet: Whether the city has a bicycle share system, and if it is operating.
- Loans: Counts on trips of the bicycle share system (BiciRed Colombia, 2021)

Developed by *BiciRed Colombia*, a local network of cycling enthusiasts in urban and rural contexts, this ranking strives to enhance the quality of life through inclusive cycling promotion (BiciRed Colombia, n.d.). Deployed across 17 Colombian cities, this assessment showcases a more extensive purview, encompassing dimensions of public governance that intersect with the cycling landscape of each municipality. Unlike the German Bicycle-Friendly Cities Ranking, this initiative is independent of governmental support.

Gathering data primarily involves research and formal petitions submitted to public entities, soliciting pertinent information. According to BiciRed Colombia, outcomes reveal that cycling is not accorded a high priority within local government agendas. Furthermore, discrepancies persist around cycling infrastructure reporting—instances of underreporting have even emerged compared with earlier data. Additionally, challenges arise in sourcing accurate information about bicycle theft and recovery incidents. Notably, the pandemic presented an opportunity to foster bicycle travel, and citizen involvement in policy-making remains vital and impactful.

The following table summarizes the elements within each case study (Table 1).

## 2. Proposed Cycling Assessment for Bogotá

Currently, Bogotá lacks mechanisms to gauge the satisfaction levels of cyclists regarding its cycling infrastructure. Such information would prove invaluable for shaping policy decisions, as it would serve as concrete evidence of cyclists' needs and the priority areas requiring infrastructure enhancements. It is important to note that while there are plans and even a public policy in place with defined goals for expanding cycling infrastructure in Bogotá, there is a conspicuous absence of periodic evaluation mechanisms to track their execution.

Within the context of an advocacy project led by *Despacio*, with support from the Global Youth Coalition for Road Safety, a team of young professionals undertook a project named “Local Actions:

<sup>4</sup> The scoring system unfolds as follows: Scores between 0 and 44,9 indicate suitability for seasoned cyclists. Scores between 50 and 61,9 call for cautious usage. Scores between 61 and 74,9 signal a commendable choice. Scores between 75 and 105 underscore a truly cyclist-friendly environment.

**Table 1.** Elements evaluated in the cycling indices by country

Country	Personal safety	Road safety	Quality of the cycle infrastructure	Sense of well-being	Other
Germany		Segregation. Invasion of vehicles in the cycling infrastructure.	Ease of reaching the city's activity centers. Presence of obstacles in the infrastructure. Width of the bike lanes.	Ease of biking in the city.	
Copenhagen, Denmark		Perceived safety while cycling (%). Serious cyclist casualties (number per year). Cycled kilometers between serious casualties (mil. km).	Satisfaction with cycle track maintenance (%). General satisfaction with bicycle parking (%). Cycle lanes (km). Cycle tracks (km).	General satisfaction with Copenhagen as a bicycle-friendly city (%). Satisfaction with cycling culture's impact on urban life (%). General satisfaction with bicycle parking (%).	Share of all trips by bicycle (%). Share of trips to work/education by bicycle (%). Cycle superhighways (km). Estimated average cycling speed (km/h).
Calgary, Canada		Safety (collision data). Unlawful sidewalk riding and wrong-way riding.		Satisfaction (telephone survey).	Bicycle volumes (automated counters). Peak period travel time. Economic vitality (merchants and pedestrians along route). Demographics (age and gender).
Mexico		Assessment of the speeds of the area and the type of cycling infrastructure.		Comfort: obstacles, heat management, and street surface.	Usability: habitability, vehicle type, and nocturnal vitality.

(Continued)

*Table 1. Continued*

Country	Personal safety	Road safety	Quality of the cycle infrastructure	Sense of well-being	Other
Colombia (BiciRed)		Stolen and recovered bicycles. Bicycle fleet.	Road safety (dead and injured cyclists).	Cycling infrastructure. Bike parking. Parking stations and validated trips.	Planning tools. Coordination mechanism. Human talent. Loans.
Bogotá (Despacio)	Perception of unsafety. Occurrence of harassment. Consequences of the sexual harassment (in terms of mode choice).	Perfection of road safety. Segregation. Presence of traffic lights. Perceived speed of vehicles passing by. Invasion of the cycling infrastructure.	Preferred cycling infrastructure. Personal scoring on the condition of the pavement, cycle infrastructure connectivity, availability of bicycle parking, availability of workshops for bike maintenance.	Personal perception about the existence of trees and green areas, city noises, air quality, diversity of cyclists, smells of the city, presence of street vendors in the cycle infrastructure, presence of garbage and waste in the cycle infrastructure.	Safety and comfort of care trips.



Meaningful Cycling Actions with a Gender Perspective” between April and August 2022. One of its primary objectives was to gain insight into the needs, experiences, and perceptions of cyclists in the city through a variety of activities and the creation of a cyclist assessment. The concept of this assessment was initially discussed with members of the city’s Bicycle Board the previous year, within the framework of a similar project also supported by the Coalition. Through workshops with the Bicycle Board members, the key themes of the assessment were validated.

Given the absence of relevant data in Bogotá, the data collection process became a central component of the assessment’s development. This assessment was calculated using responses gathered through a virtual survey promoted on social networks, conducted from July 19 to August 3. The survey yielded 345 responses, with 43.1% of participants identifying as women, 54.8% as men, 0.9% as nonbinary, and 1.2% not providing a response. Additionally, 73% of survey participants fell within the age range of 18 to 35, 25% were over 35, and 2% were under 18. The survey was tailored to focus on these age groups, aligning with the project’s target demographic of young people aged 18 to 35.

To calculate this cycling assessment, the survey questions were categorized into the following aspects: perception of cycling infrastructure quality, sense of well-being, personal security perception, road safety perception, and perception of safety and comfort during care-related trips. The following tables illustrate the questions included in the survey, [Table 2](#) to [Table 7](#), according to the aspect evaluated and indicating the type of question for each one.

**Table 2.** *Basic questions*

Question	Type
Age	Single-choice multiple-answer question
Gender identity	Single-choice multiple-answer question
Occupation	Single-choice multiple-answer question
Frequency of bicycle use as a mode of transport	Single-choice multiple-answer question
Road corridors of the city in which the person usually mobilizes by bicycle	Multiple answer
Reason for the trip	Single-choice multiple-answer question

**Table 3.** *Questions to estimate the perception of personal safety*

Question	Type
How safe do you feel traveling by bicycle?	Semantic differential
Have you experienced any situation of sexual harassment while riding a bicycle?	Single-choice multiple-answer question
Have you changed your bicycle transport habits because you feel insecure?	Single-choice multiple-answer question
Have you stopped taking bicycle trips because you feel insecure?	Single-choice multiple-answer question
If you identify as a woman, do you think you put yourself at greater risk as a female cyclist?	Single-choice multiple-answer question
Qualification of some aspects that can make you feel insecure when mobilizing by bicycle: urban lighting, presence of cyclists, presence of the authorities, fear of suffering some type of harassment, fear of robbery, fear of discrimination, respect between road actors	Scoring scale

**Table 4.** Questions to estimate the perception of road safety

Question	Type
Qualification of some aspects that can make you feel insecure when mobilizing by bicycle: fear of being the victim of a traffic accident, existence/state of horizontal signage, existence/state of vertical signage, existence/state of traffic lights	Scoring scale
What kind of separation of motorized vehicles does the cycle infrastructure through which you move most frequently have?	Single-choice multiple-answer question
What type of pedestrian separation does the cycle infrastructure through which you use most frequently have?	Single-choice multiple-answer question
What type of traffic lights are the most frequent during your bike trip?	Single-choice multiple-answer question
Speed of vehicles passing by you	Semantic differential
How often do you find the presence of pedestrians, electric vehicles, and human-powered vehicles on the cycling infrastructure?	Scoring scale

**Table 5.** Questions to estimate the perception of the quality of the cycle infrastructure

Question	Type
In what type of cycle infrastructure do you prefer to make your trips by bicycle?	Single-choice multiple-answer question
Qualification of some aspects of the cycle infrastructure: condition of the pavement, cycle infrastructure connectivity, availability of bicycle parking, availability of workshops for bike maintenance	Scoring scale

**Table 6.** Questions to estimate the sense of well-being

Question	Type
Qualification of some aspects of the city that impact your well-being: existence of trees and green areas, city noises, air quality, diversity of cyclists, smells of the city, presence of street vendors in the cycle infrastructure, presence of garbage and waste in the cycle infrastructure	Scoring scale
If you could, would you change the bicycle for another mode of transport? Why?	Single-choice multiple-answer question

**Table 7.** Questions to estimate the perception of safety and comfort in care trips

Question	Type
Do you ever travel by bike accompanied by children, older adults, or people in your care?	Single-choice multiple-answer question
Do you feel comfortable and safe when traveling accompanied by children, older adults, or people in your care, by bicycle?	Semantic differential

### 3. Results

The above aspects and questions were identified based on the case review and the unique characteristics and requirements of Bogotá.

For example, the inclusion of queries probing the specific corridors predominantly utilized by cyclists in the city offers an insightful lens into the distinct requirements of each cycling track. Moreover, addressing the prevalence of vendors, a common sight in Bogotá's public spaces, or by addressing the theme of personal security, based on the city's elevated crime rates, further enriches the assessment. Furthermore, a designated section dedicated to assessing the quality of care trips caters to the prevalent sight of individuals commuting with children on bicycles across the urban panorama. This strategic augmentation aligns the assessment intricately with Bogotá's distinctive attributes, creating an evaluation that's not only comprehensive but contextually attuned to the city's intricate dynamics. The result is an assessment that resonates deeply with Bogotá's needs while encompassing the broader perspectives gleaned from the case studies.

In order to evaluate the responses obtained, since not all of them corresponded to the same type of question, the weighted average was performed. Values from 1 to 5 were assigned to the possible answers for each question (where 1 is the score for the worst scenario and 5 for the best scenario). Three different types of evaluations were established, which were assigned according to the response options. The examples are shown below:

Then, with the value obtained from each answer, on a scale from 1 to 5, the results of each group of general aspects evaluated (indicated from Tables 3 to 7) were averaged (Tables 8–10). These results are presented in Table 11 and can be seen more clearly in Figure 2. Three different types of evaluations were established, which were assigned according to the response options. The examples are shown below in Table 8:

Then, with the value obtained from each answer, on a scale from 1 to 5, the results of each group of general aspects evaluated (indicated from Table 3 to Table 7) were averaged. These results are presented in Table 11 and can be seen more clearly in Figure 2.

**Table 8.** Example answer type A (more than one answer allowed)

Have you experienced any situation of sexual harassment while riding a bicycle?	No. of responses	Assigned value
Yes: visually (stare, leer, and photographs)	76	1
Yes: verbally (hissing, compliments, and obscene insults)	98	1
Yes: physical (touch, grab, and grope)	20	1
Yes: acts of exhibitionism and/or masturbation	6	1
Yes: persecution or intimidation	36	1
No, none	178	5
Weighted average		2.72

**Table 9.** Example answer type B (only one answer allowed)

What type of separation of motorized vehicles does the cycle infrastructure through which you move most frequently have?	No. of responses	Assigned value
There is no separation of motor vehicles	126	1
Separation of less than two meters	80	2
Separation of two to three meters	16	3
Separation of more than three meters	15	4
Physical separation (green areas, physical barriers such as concrete)	57	5
Weighted average		2.31

**Table 10.** Example answer type C (only one answer allowed)

The speed of the vehicles passing by you is	No. of responses	Assigned value
Adequate	40	5
Fast	174	2
Excessively fast	75	1
Weighted average		2.64

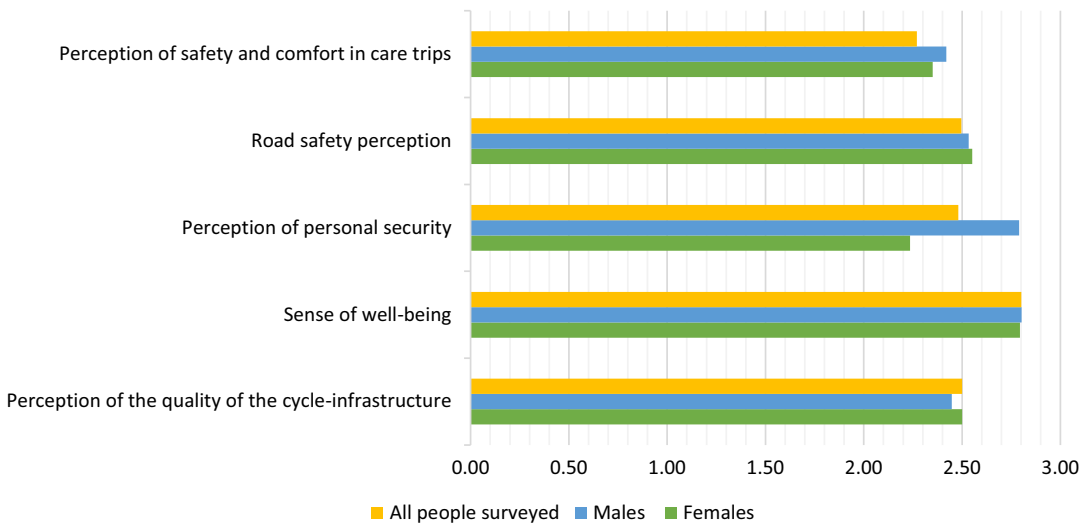
**Table 11.** Results

Indicator	Female	Male	All people surveyed
Perception of the quality of the cycle infrastructure	2.50	2.45	2.50
Sense of well-being	2.79	2.80	2.80
Perception of personal security	2.23	2.79	2.48
Road safety perception	2.49	2.48	2.50
Perception of safety and comfort in care trips	2.35	2.42	2.27
General perception of the cycle infrastructure and the bicycle experience in Bogotá	2.47	2.66	2.62

Among the assessed categories, the lowest-rated category pertains to the comfort and safety of care-related trips, followed by personal safety, cycling infrastructure quality, and road safety, in that order. Conversely, the aspect with the highest satisfaction rating is the feeling of well-being while cycling, with this aspect demonstrating remarkable consistency in perceptions among all survey participants.

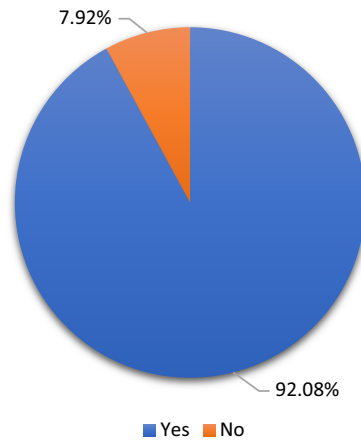
Notably, the area in which the perceptions of men and women exhibit the greatest disparity is related to personal safety. As illustrated in [Figure 3](#), a striking 92.1% of female respondents believe they face a greater risk than male cyclists. Men, on the other hand, hold a significantly more positive perception of personal safety, with an 11% difference compared with women. It is crucial to note that this divergence is influenced by the issue of sexual harassment, as indicated by the fact that 87% of women have experienced some form of sexual harassment while cycling, while 76% of men have never encountered such situations when riding in the city, as depicted in [Figure 4](#).

**General aspects of the cycling assessment evaluated by gender**



**Figure 2.** Results of the general aspects of the cycling assessment evaluated by gender.

**If you identify as a woman, do you think you expose yourself to a greater risk as a female cyclist?**



**Figure 3.** Results of perception of risk by female cyclists.

In summary, the assessment of the overall perception of cycling infrastructure and the cycling experience in Bogotá yields a moderate score of 2.62, indicating a fairly average performance.

In terms of care trips, it is noteworthy that the majority of such trips are undertaken by women, accounting for 37%, as opposed to the 26% reported by men. Significantly, women express a higher level of comfort and a sense of safety when making care trips by bicycle, with 19% compared with the 13% reported by men, as illustrated in Figure 5.

Regarding the safety aspect, 69% of the surveyed individuals indicated that they have modified their cycling habits, including altering their routes, travel times, and frequency, due to feelings of insecurity

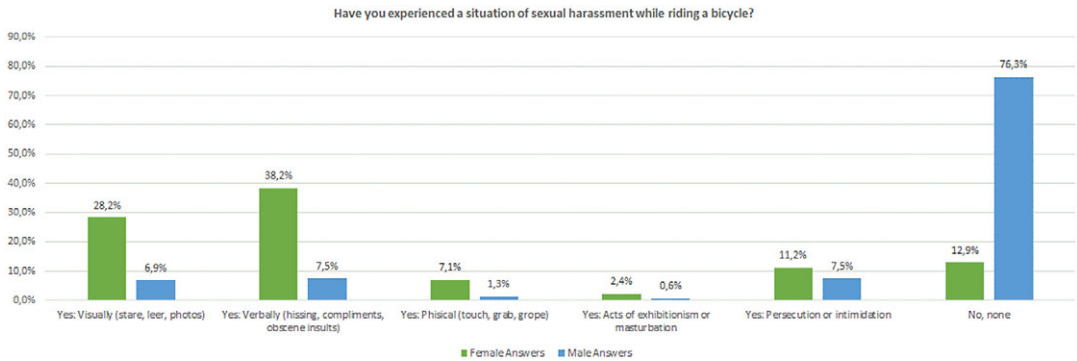


Figure 4. Results of experiences of sexual harassment while riding a bicycle by gender.

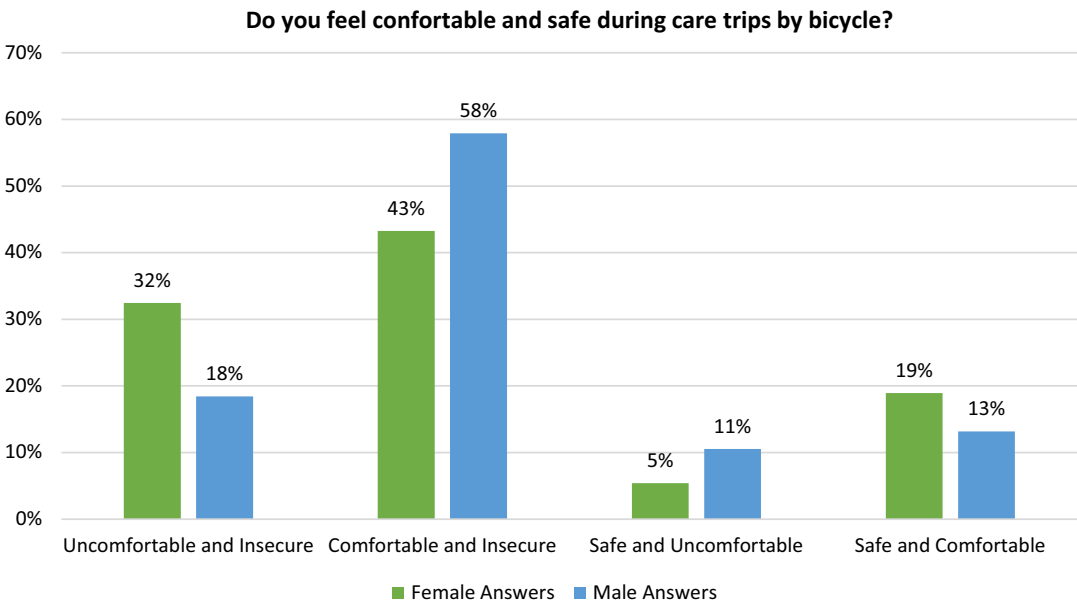
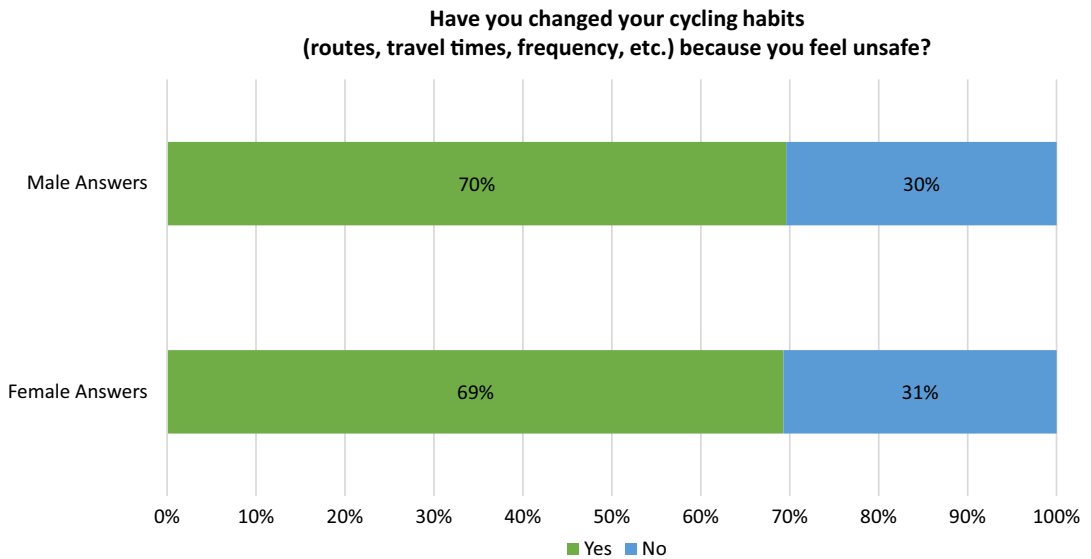


Figure 5. Perception of comfort and safety in care trips by bicycle.

(as shown in Figure 6). In fact, personal safety perception is the lowest-rated indicator by all respondents, scoring 2.48 on a scale of 1 to 5 (with 1 indicating the lowest evaluation and 5 the highest). In stark contrast, the feeling of well-being is the highest-rated indicator, scoring 2.80. This finding is pivotal because, despite most participants associating cycling with positive emotions such as freedom, vitality, and an overall sense of well-being, the urban cycling conditions they encounter in the city elicit feelings of fear and insecurity. Hence, it underscores the importance of assessing and taking into account cyclists’ perceptions in order to create environments that allow them to enjoy the activity while ensuring their safety within the city.

#### 4. Limitations of the Study

Due to constraints in both time and budget, we were unable to conduct a detailed analysis of the specific cycling infrastructure corridors. Such an analysis could have pinpointed particular needs and necessary



*Figure 6. Results of cycling habit changes due to safety concerns.*

improvements for each of these corridors. Additionally, it is worth noting that the data collection method employed—namely, an online survey—may have implications for the representativeness of the results. However, it is important to emphasize that with more substantial resources and the involvement of entities such as the Secretariat of Mobility of Bogotá, a more comprehensive and robust data collection process could be undertaken.

## 5. Conclusions and Recommendations

A cycling assessment serves as a potent tool for evaluating the cycling experience and monitoring investments and decisions related to cycling in urban environments. Its utility has been demonstrated in various contexts, highlighting its potential for enhancing the cycling experience. Cities should refrain from merely implementing infrastructure without assessing the effectiveness of existing structures. This evaluation should not be solely based on the number of cycling trips made but should also encompass the perceptions of cyclists regarding various interconnected facets of their daily cycling experience.

Having government support in the data collection process, as seen in cases such as Germany or Calgary, offers distinct advantages by increasing the availability of resources for data collection and analysis. However, it remains imperative to engage civil society and the broader community to ensure that the analyzed variables are sufficient and attuned to the local reality. In Bogotá's case, the acknowledgment and exchange of specific actions and initiatives undertaken by the city's cycling groups have bolstered ongoing efforts, showcased collective work, and prevented duplication of endeavors. Within the framework of our project, we facilitated "Cyclist Dialogues," creating a platform for citizens, groups, and decision-makers to share insights and disseminate the assessment's results. These Cyclist Dialogues proved essential for exchanging experiences, recognizing initiatives by diverse cycling groups, and fostering collaboration. Expanding and replicating such forums can strengthen these initiatives and minimize redundancy.

Regarding participation, the imperative to involve young cyclists in urban cycling decisions through participatory mechanisms remains critical. While the recently established bicycle discussion tables have provided an opportunity to reinforce participatory processes, they must continue to evolve and serve their intended purpose. These tables can be invaluable allies in implementing a cycling assessment in the city, one that is inclusive and reduces barriers to urban cycling for everyone.

The general perception of cycling infrastructure and the cycling experience in Bogotá, as assessed in our project, received a score of 2.62 on a scale of 1 to 5, where 1 represents the poorest score and 5 signifies the best. A score of 2.62 indicates that the city still requires numerous improvements and advancements to transition from a moderate performance level to an acceptable or excellent one, typically scoring between 4 and 5. Feedback and suggestions for improvement gathered through the survey primarily revolve around three key areas: enhancing cycling infrastructure and network connectivity, implementing and reinforcing measures to combat sexual harassment, and promoting a civic culture among various road users.

The cycling assessment presented for Bogotá can be customized to suit the unique characteristics of each city and its population, with the flexibility to adjust questions or response options. This adaptability renders it an accessible tool capable of shedding light on the bicycle landscape in various cities, providing valuable information for decision-makers seeking to enhance the urban cycling experience and promote sustainable transportation alternatives.

**Supplementary material.** The supplementary material for this article can be found at <https://doi.org/10.1017/dap.2023.35>.

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**Author contribution.** Angie Ángel, Laura Daniela Gómez, and Maryfely Rincón conceptualized the study, designed the methodology, provided resources, visualized the data, wrote the original draft, and wrote, reviewed, and edited the manuscript. Angie Ángel curated the data and involved in formal analysis. Laura Daniela Gómez and Maryfely Rincón acquired funding and investigated the data. Laura Daniela Gómez administered the project and supervised the study. All authors approved the final submitted draft.

**Data availability statement.** Replication data can be found as an attachment to this article in.xlsx format ([Supplementary Material](#)).

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