



Research article

Public transportation means as seen by citizens: Approaching the case of the Dominican Republic

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ARTICLE INFO

Keywords:

Dominican Republic
Public transportation
Quality
Perception
Safety
Mobility

ABSTRACT

Especially in low- and middle-income countries, key constraints such as dense traffic flows, jams, and pollution constitute frequent issues that potentially explain many negative consequences in terms of (e.g.) efficiency, sustainability, and mobility safety. In this regard, recent evidence supports the idea that fostering public transportation is crucial to offering solutions for this difficult panorama. However, transport mode-related choices and shifts have been proven to depend highly on key perceptions and needs of potential users. The aim of this study was to analyze a set of key users' perceptions, usage, and perceived quality of public transportation in the Dominican Republic, as well as to explore the most relevant features for Dominicans from the "desired quality" paradigm. For this research at a national level, data retrieved from a nationwide sample of 1254 inhabitants of the Dominican Republic was used, proportional to the ONE census in terms of sex, age, habitat, and region. Overall, the results show that the general quality of transportation is 6.70 points out of 10. The use of public transportation in the Dominican Republic has a medium-low rating and is very focused on urban buses (41 %) and public cars (27.1 %). Nonetheless, the metro remains the most highly rated means of transport ($M = 8.75$). Concerning the quality variables analyzed, the highest scores are for accessibility ($M = 7.08$) and frequency of service ($M = 6.99$). Further, Dominicans focus on improving comfort, vehicle conditions, and safety. This study constitutes a first approximation to the desired quality of public transportation for Dominican Citizens, which may help policymakers scope user-based needs in public transportation systems and encourage a more frequent (and friendlier) public transport use in the country.

1. Introduction

After several decades, one of the most traditional concerns explaining mobility issues of many cities remains the extensive number of private vehicles daily crowding urban areas [1]. Apart from the classic problem of traffic jams, this situation also encompasses other negative outcomes, such as deepening social inequities, commuting stress among occasional and frequent road users, high levels of environmental pollution, and (overall) impaired transport dynamics [2,3]. Additionally, this panorama explains that traffic crash rates can worsen, while many users may avoid using public transportation as it is usually considered inefficient and insecure [4].

Notwithstanding, what in the first light seems to be the problem could partake in the solution. We speak, of course, of the

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<https://doi.org/10.1016/j.heliyon.2024.e32363>

Received 20 February 2023; Received in revised form 28 May 2024; Accepted 3 June 2024

Available online 4 June 2024

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strengthening of public transport as an effective strategy to decongest the streets and improve the mobility habits of the population, especially in the case of low and middle-income countries (LMICs), where a large part of the population uses it mainly for convenience [5,6]. On the other hand, private cars have shown to be the preferred alternative in many industrialized or high-income countries, even though they constitute those vehicles with the highest energy need per traveler and kilometer, as they use twice as much energy as metros and up to four times more than what is needed for a bus [7]. Therefore, during the past few years, many efforts have been made to improve the efficiency and quality of public transportation, thus aiming to make it more attractive for citizens and potentially fostering its daily use among them [8].

Similarly, a paradigm change has been shown in transportation research dynamics during the last few years. Traditional research on perceived quality trends provides knowledge on the impact triggered by the decisions taken by transport companies on their users (commonly perceived as “clients”). In contrast, current studies are growingly starting to focus on users themselves as key stakeholders for assessing both the current quality and further needs of public transportation systems [9].

This emphasis has shown to have a certain potential for developing contextual insights, helping transport planners and policy-makers to adjust new actions and strategies to users’ actual needs. In other words, the objective pursued by this paradigm is that perceived quality may be equal to users’ desired quality. Likewise, recent studies highlight how important it is to change the public’s habits of daily public transportation, favoring the choice of more sustainable alternatives for their movements that may encompass improvements in further spheres, such as their economy, security, and mental health [10]. Moreover, most studies dealing with public transport-related actions performed during the last decade also agree on the fact that knowing the movement dynamics of a context before intervening is crucial so that the public transportation offer would be more likely to adjust to the motivations and needs of users [8].

1.1. Study framework

The study of public transport on a global scale reveals the complexity of the criteria that influence the choice between this mode of transport and private alternatives [11]. Generally, the user can always choose between different displacement modes with very heterogeneous characteristics. Therefore, factors such as cost, accessibility, convenience, and environmental concerns are critical determinants in this choice [12]. Cost plays an important role, as affordable public transport systems tend to attract higher ridership, especially in urban contexts where the costs of operating a private vehicle can be significant [13]. In addition, the accessibility of public transport stops and stations, as well as their proximity to origin and destination locations, strongly influence the decision to use public transport [14].

Convenience and service quality are crucial factors [15]. Public transport systems that offer reliable frequency and punctuality tend to be more attractive to users [16]. The ability to make direct trips without transfers is also valued for the efficiency it brings to travel time [17]. Furthermore, in congested urban areas, where finding parking and dealing with traffic are challenges, public transport can present itself as a more convenient alternative [18].

On the other hand, there are reasons to avoid public transportation. Some individuals prefer the convenience, privacy, and flexibility private vehicles offer [19]. Travel time is another decisive factor: if public transport involves indirect routes or long waits, some users may opt for faster means of transportation [20]. The perception of service quality also plays a significant role, including aspects such as cleanliness, safety, and overall travel experience [21]. In relation to safety, several studies have shown that it is a particularly relevant factor in women’s choice of transport, with public transport vehicles and bus stops or stations being perceived as unsafe and more likely to suffer a situation of harassment or sexual aggression, especially at night [22,23].

Moreover, as a result of the several constraints generated by COVID-19 (which also impacted greatly the public transportation sphere), many people choose not to use public transport to avoid crowds and maintain social distancing [24]. The reduction in the use of public transport as a result of the restrictions implemented during the pandemic has been evidenced in research in different countries such as China [25], Spain [26], the United States [27], and Australia [28], among others, being a majority scenario at the international level.

In addition to the previously mentioned attributes or characteristics of the transport service, the choice of transport is influenced by other factors, such as individual characteristics, lifestyle, psychological factors, and situational variables [29]. Along these lines, Klöckner & Friedrichsmeier (2011) [30] propose a multilevel approach model that integrates psychological variables (such as car use habit, social norms, intention or attitudes) and situational conditions (such as trip purpose, vehicle access, weather conditions, or trip duration) to explain travel mode choice, which has been empirically demonstrated.

Complementarily, considering different factors, Beirão & Cabral (2007) [31] point out that users mostly identify cost, the ability to rest during the trip, and the lower stress compared to driving a motor vehicle as advantages of public transport. On the contrary, the main disadvantages are related to the lack of comfort, the large number of people occupying the vehicle, the lack of flexibility, and the travel and waiting time, especially when more than one mode of transport is to be used.

In the context of emerging Latin American countries, the situation is particularly complex. Population density in many cities in the region can favor the viability of public transport but can also generate challenges in terms of congestion and urban planning [32]. Moreover, the growth of the middle class in these countries may lead to increased demand for customized transportation options, which could have implications for public transport utilization [33]. Socioeconomic inequalities also influence transport mode choice, as economic and social factors can disproportionately impact vulnerable segments of the population [34].

Insufficient investment and funding in public transport infrastructure and services can result in unreliable and low-quality systems, negatively affecting adoption [35]. Consequently, citizens’ opinions about this service are often negative [36]. In this regard, to date, several studies address the “perceived quality” of public transport as seen by users [9]. However, none of them has been conducted in

the Dominican Republic. Following this approach, the quality of public transport systems comprises many factors, including users' evaluations of their accessibility [37], service frequency and transit transfer [38], cost and affordability [39], safety [21], safety [40] time required for the trip [41], condition, cleanliness, and comfort of the vehicles [32]. Therefore, this seems a relevant topic to explore in the case of an emerging country whose population could benefit from user-based improvements in the configuration of available public transport modes [42].

Accordingly, several studies point out that to increase the use of public transport, the characteristics of the service must be designed and planned to adapt to the requirements and needs of users, in order to attract potential customers [43]. Strategies aimed at encouraging the use of public transport should focus on improving its public perception. Nevertheless, at the same time, public transport systems must become more efficient and competitive in the market [44]. This implies improving the quality of service, which can only be achieved by understanding in detail the travel patterns and the needs and expectations of users [45].

1.2. The Dominican Republic in figures: road traffic and mobility context

The Dominican Republic is a country located in Central America with more than 11 million inhabitants. In recent years, the National Institute of Traffic and Land Transportation (INTRANT) has undertaken multiple actions to reduce the country's road accident rates, which are among the highest in the world [45]. In fact, the Pan American Health Organization places the Dominican Republic among the top five countries with the highest rate of road traffic fatalities from 2000 to 2019 [46].

These high figures are the consequence of a set of factors such as poor infrastructure, lack of road education and training for drivers, or the poor condition of vehicles [47,48]. In this sense, the choice of mode of transport for regular commuting is also an influencing variable. According to the 2022 statistical bulletin of the General Directorate of Internal Taxes [49], the vehicle fleet increased to 5,463,996 units, representing an increase of 6 % over the previous year. Thus, motorcycles, which have presented the highest number of accidents according to available statistics, had a growth of 6.6 % with respect to 2021, with 189,114 new registrations. This type of vehicle represents more than half of the entire vehicle fleet and represents the main form of travel for Dominican citizens.

In addition to travel by private means of transportation, some citizens opt for the use of public transportation. The National Mobility Survey [50] reflects that approximately half of the population has made some of its trips in one of the available public transportation modes. In this sense, the most used are urban buses (called "guagua") and motorcycle cabs (called "motoconchos"). Although this may seem a positive aspect, the characteristics of these means of transport can lead to traffic jams in urban areas and mobility problems. Urban buses and, especially, motorcycle cabs involve a large number of vehicles with small passenger capacity and high age, which do not have specific programmed routes but adjust to the needs of their customers to design their routes and stops, which are changeable [51]. Therefore, this circumstance causes difficulties in directing vehicular traffic and for an adequate traffic flow [52].

There are also other means of public transportation, although they are not available in all regions of the country. This is the case of the metro and the metropolitan buses (called "Autobuses OMSA", for its acronym Oficina Metropolitana de Servicios Públicos de Autobuses del país). In both cases, they only exist in some cities, such as Santo Domingo or Santiago, so they can only transport a small percentage of the population that uses public transportation [53]. Furthermore, in recent years, national and local authorities have tried to promote sustainable transport through communication and awareness campaigns [54,55]. However, the lack of safety perceived by users and deficits in infrastructure do not favor this type of travel. Thus, 2018 data indicate that only 21 % regularly travel on foot, and less than 1 % make regular trips by bicycle [50].

Therefore, the Dominican Republic presents different challenges related to reducing road accidents in the region and improving the fluidity and mobility of vehicles, especially in the urban centers of its cities [56]. Some of the factors that explain the current problems are related to the overpopulation of motorized vehicles and the age and conditions of these vehicles. Further, the majority presence of motorcycles and motorcycle cabs, although they provide a convenient and economical form of travel for many Dominicans, also present important challenges in terms of road safety because they generally operate without regulation and with deficient safety standards [51]. This traffic context is similar to other emerging countries, especially in Latin and Central America, because the accelerated growth of cities and the mobility needs of citizens have not been sufficiently accompanied by specific actions and efficient transport networks in many of these countries.

Complementarily, one of the objectives of the authorities responsible for transport in the country has been to majorly improve the characteristics of public transport and invest in infrastructure to favor soft and sustainable modes of travel [57]. However, and especially in relation to collective transport, it is important to address the needs and requests of citizens in terms of accessibility, cost, safety, cleanliness, and comfort, as well as other formal aspects related to the established routes and stops of the country's public transport networks [58–60]. In the same way, the results obtained can be extrapolated to other regions with similar characteristics in terms of socioeconomic conditions and urban mobility context, especially in Latin America and Central America.

1.3. Objectives of the study

Bearing in mind the aforementioned considerations, this study aimed to analyze a set of key users' perceptions, usage and perceived quality of public transportation in the Dominican Republic, as well as to explore the most relevant features for Dominicans under the desired quality paradigm.

2. Methods

2.1. Participants

For this cross-sectional study, the data gathered from a nationwide sample was used, involving a total of $n = 1254$ Dominican citizens. A detailed summary of the partakers' demographic features is shown in both Table 1, and the regional coverage in Fig. 1.

Regarding the representativeness of the sample, it is worth acknowledging that the sample size was larger than necessary to ensure that the sample was representative. The minimum required assuming a level of confidence of 95 %, a maximum margin of error of 5 % ($\alpha = 0.05$), and a beta (β) of 0.20, was $n = 680$ participants, but we obtained almost twice as many $n = 1254$ participants. In addition, the sample was representative of the national census of the Dominican Republic (ONE Census) for the variables gender, age (older than 18), province, and habitat. Subsequently, samples were randomly selected from each stratum proportional to their size in the population.

Participants took part in the study voluntarily and anonymously, filling out an informed consent explaining the core ethical considerations of this research. Any personal information was treated in compliance with the existing laws on data protection and following the current ethical guidelines applied to research involving human subjects.

2.2. Design, procedure and instruments

The data used in this study were collected through the *National Survey on Mobility of the Dominican Republic*, whose collection phase was carried out during the second half of 2019 [61,62]. The questionnaire involved questions related to public transportation, knowledge of institutions and traffic laws, private transportation, mobility by bike, mobility on foot, and ITS systems and measures, which included the variables analyzed in this research.

The survey was carried out through in-person interviews. The sample was gathered from November 24th to December 7th. A CAPI system (computer-assisted interviews) was used to conduct the data collection, with the aid of recorded and geo-referenced tablets, so that the time of the interview would be reduced and record mistakes would be minimized.

To achieve the proposed objectives, we considered the following variables.

- *Public transportation use*: frequency of general use, requiring a single response on the subjective demand of public transportation means (i.e., daily, few times a week, few times per month or less, and never); most frequently used public transportation, with an

Table 1
Sociodemographic data of the study participants.

Variable	Category	n	%
Sex	Male	628	50 %
	Female	628	50 %
	Total	1254	100 %
Age range	18–24	260	20.6 %
	25–34	311	24.7 %
	35–49	360	29.0 %
	50–64	221	17.5 %
	>65	102	8.1 %
	Total	1254	100 %
Marital Status	Single	431	34.2 %
	Unmarried with partner	50	4.0 %
	Married	644	51.6 %
	Divorced/separated	83	6.6 %
	Widow/widower	46	3.7 %
	Total	1254	100 %
Do you have children?	Yes	965	77.1 %
	No	289	22.9 %
	Total	1254	100 %
Educational level	Primary studies or lower	379	30.2 %
	Secondary-high school	609	48.6 %
	Technical studies	6	0.5 %
	Undergraduate studies	252	20.1 %
	Post-graduate studies	8	0.6 %
	Total	1254	100 %
Working situation	Unemployed	458	41.6 %
	Retired	41	3.7 %
	Employed full time	213	19.3 %
	Employed part-time	390	35.4 %
	Total	1102	100 %
	Do you usually drive?	Yes	437
No		787	62.7 %
Total		1254	100 %

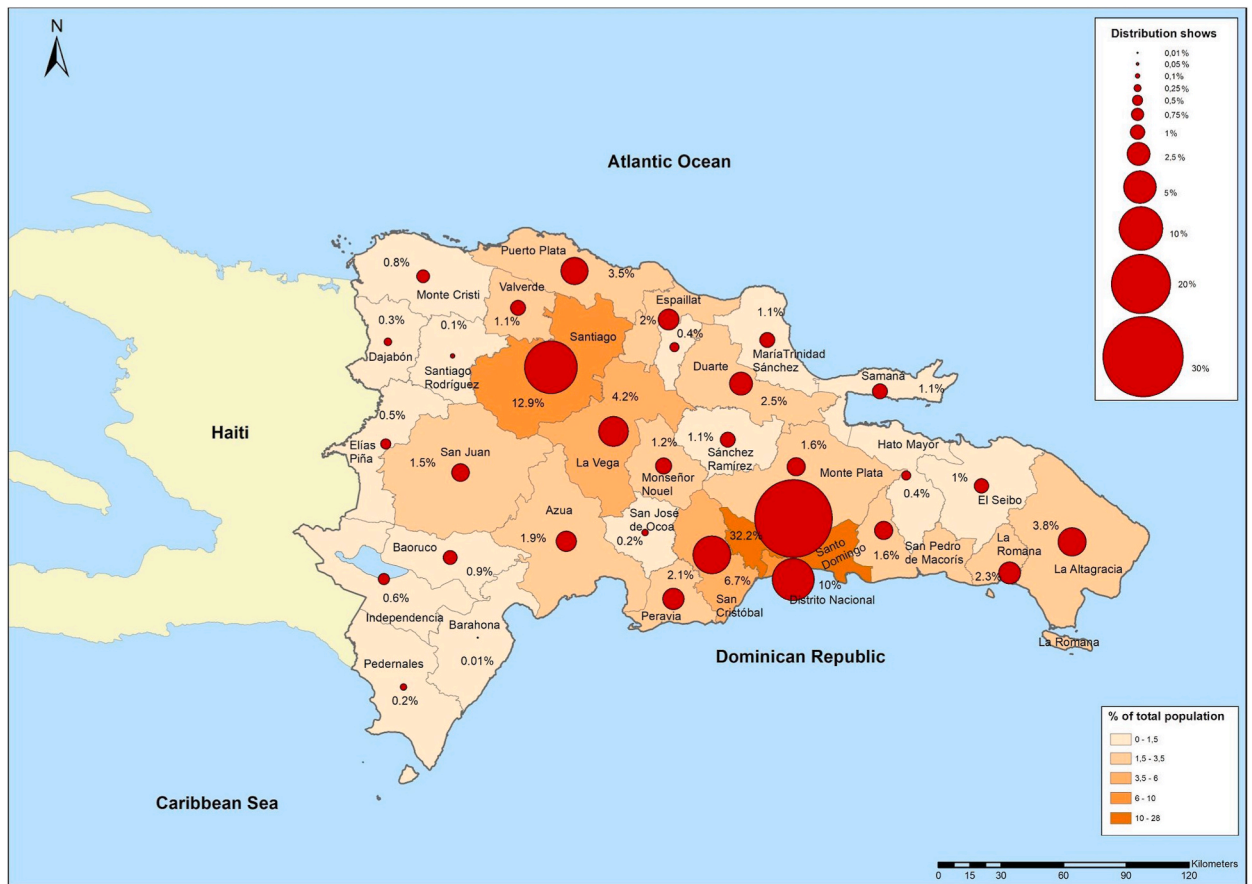


Fig. 1. Sample distribution according to participants' region of provenance, in correspondence with national census (ONE census) data.

open answer; and public transportation means available in the city/town of residence, same as those means that subjects might consider are needed in their city, with an open answer format.

- *Reasons for using/not using public transportation:* (i) Motives discouraging their demand for public transport services use, and features that the respondent considers must be improved to use this means of transport on a more frequent basis, following an open answer format; and (ii) Motives easing their use of public transportation, such as license withdrawal, fear of driving, environmental sustainability, health reasons, economic reasons, and no specific reason, measured on a symmetric scale ranging from 0 (total disagreement) to 10 (total agreement).
- *Assessment of public transportation:* general and specific assessment of the following elements: comfort, cleanness, safety, punctuality, frequency, and accessibility, using a standard 0 (very poor) to 10 (excellent) scale. Assessment of different transport modes of the Dominican Republic, such as metro, public cars (informal taxis also called "pirate taxis"), motorcycle taxis, urban buses, and metropolitan buses (belonging to the OMSA metropolitan system), also measured on a scale ranging from 0 (very bad overall balance) to 10 (excellent balance).
- *Sociodemographic variables and driving data:* basic questions about the individual, to favor their categorization and the differentiation of their perceptions from those with different possible socio-demographic profiles, namely: sex, age, habitat, working situation, do you usually drive? ("usually" as in 3 or more days per week).

2.3. Data processing

In order to describe and characterize Dominicans' movements on public transportation, as well as their opinions on the various factors involved and the motivations and needs that should be satisfied by this transportation mode in order for them to use it more, descriptive (frequency) analyses were carried out after careful data curation and coding.

For comparative purposes, robust Welch's tests were used to conduct comparative analyses based on categorical sociodemographic traits of Dominican people, such as sex (male/female) and age groups. Welch's tests are t-based and non-parametric calculations that have a number of benefits over parametric tests commonly employed in social science research, such as ANOVA, especially when variances are unequal (*i.e.*, homoscedasticity is not achieved) and compared groups are disproportional in terms of one or more features.

Subsequently, a multiple linear regression analysis was also performed to identify the explanatory variables of the level of quality of public transport perceived by the participants. IBM SPSS (Statistical Package for Social Sciences), version 26.0 (Armonk, NY, USA), was used for all descriptive statistical analyses, and SigmaPlot software, version 12.0, was used to plot all of the figures used in the research (Berkshire, UK).

2.4. Ethics

Prior to conducting the research, the study protocol was assessed and approved by the Ethics Committee of the INTRAS - University of Valencia, granting its accordance with the Declaration of Helsinki (IRB approval number: HE0001251019). All participants gave their informed consent before participating in the study, after the research staff provided them with an explanation of the research objectives and all the previously mentioned considerations.

3. Results

The first descriptive outcome of this study corresponded to the overall quality assessment of public transportation as a suitable alternative for mobility, which was $M = 6.70$ ($SD = 3.32$) on a scale ranging between 0 (lower quality perceived) and 10 (higher quality perceived).

Regarding the frequency of use of public transportation among Dominicans, 21.8 % of them reported using at least one of the available means on a daily basis, 36.7 % a few times per week, and 30.3 % use it a few times per month or less; 11.1 % never use it.

On the other hand, it is noticeable how least-regulated transportation means group most public transport users: the most used public transportation modes among Dominicans were (in descending order) urban bus (41 %), illegal/collective fixed-route taxis (public cars; 27.1 %), and motorcycle taxis (23.6 %), as it is shown in Fig. 2.

Given that the evidence provided by the existing data (which, as aforementioned, is really scarce) does not address potential motives or constraints discouraging Dominicans from using public transportation, this was one of the key questions of this research. As a result, an important number of them do not really attribute any specific reason for it (22.6 %), which makes it hypothesizable that many motives (a “systemic failure”) could be simultaneously explaining this phenomenon. However, there are some key public transport-related features highlighted by Dominicans as “in need of improvement”, that could potentially enhance the attractiveness of public transport systems in the Dominican Republic: this is the case of comfort (22.3 %), vehicle status and maintenance (17.7 %), and trip safety (8.4 %). It is surprising how 8.7 % state they would prefer avoiding public transportation in no case, even if all these substantial improvements had already occurred.

In order to make mode-based comparisons easier to interpret, the overall scores given to the different public transport means are graphically displayed in Fig. 3. The metro particularly stands out ($M = 8.75$; $SD = 2.03$), followed by OMSA buses ($M = 7.21$; $SD = 2.65$). The worst assessment goes to public cars ($M = 5.43$; $SD = 3.54$). The assessment of public cars ($r^2 = -0.068$; $p = 0.016$) and motorcycle taxis ($r^2 = -0.078$; $p = 0.007$) present a small and negative correlation to age. Nevertheless, there are no significant differences in the assessment of any transport mode based on users’ sex, habitat, working situation, and driving habits.

On the other hand, the public transport features with the highest assessments in public transportation are accessibility ($M = 7.08$; $SD = 3.18$), route frequency ($M = 6.99$; $SD = 3.08$), and punctuality ($M = 6.42$; $SD = 3.39$), as graphically shown in Fig. 4. Cleanliness and comfort present significant differences depending on habitat, while accessibility and cleanliness present differences depending on sex (Table 2). Likewise, a slight but positive correlation was found between perceived comfort and users’ age ($r = 0.072$; $p < 0.010$).

The linear regression analysis showed the existence of a relationship between the variables studied and the perception of the general quality of public transportation (dependent variable), which is explained by equation $Y = +11.874 + 3.946X_1 + 1.854X_2 +$

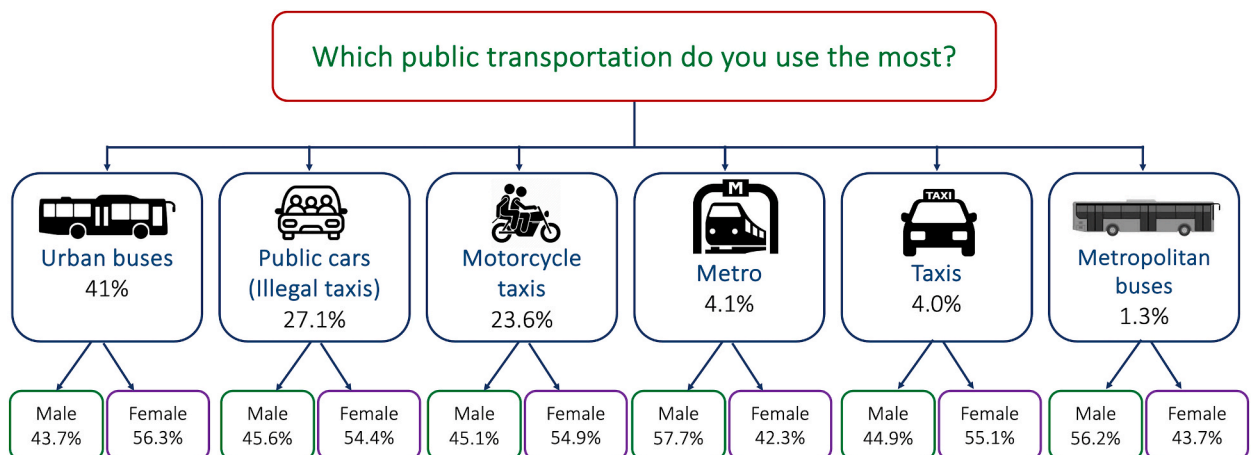


Fig. 2. Use of different public transport means in the Dominican Republic.

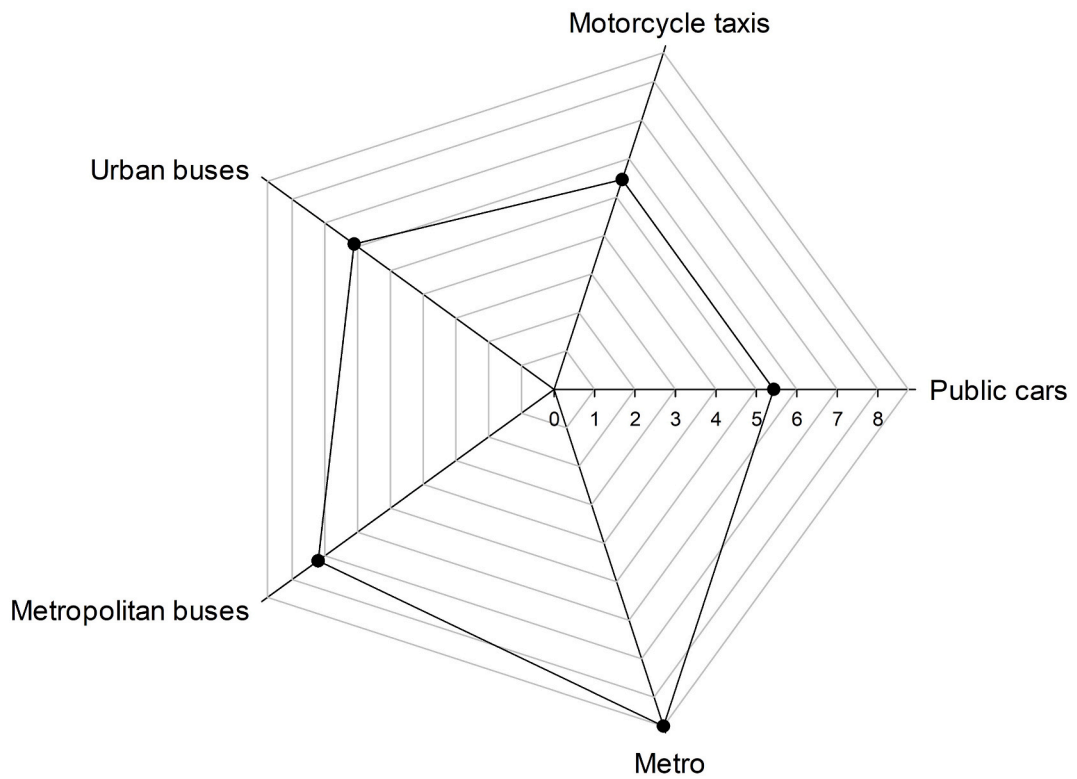


Fig. 3. Overall (average) assessment of public transportation means in the Dominican Republic.

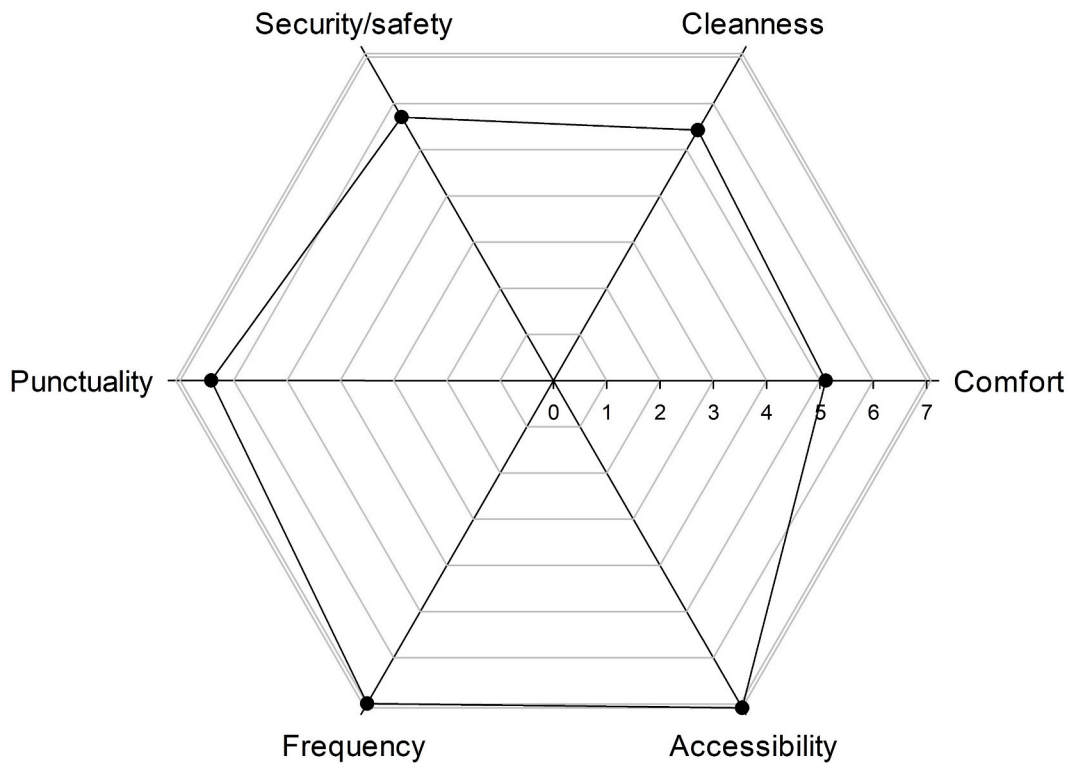


Fig. 4. Study participants' assessment of six key public transport features, from lesser to greater values (0–10 scale).

Table 2
Crossed public transportation features and sociodemographic variables.

Variable	Feature	Category	n	Average	SD	Welch's test		
						Statistic	df	Sig.
Sex	Accessibility	Male	630	6.90	3.17	2.046	1,1258	0.041
		Female	630	7.27	3.18			
	Cleanness	Male	630	5.04	3.56			
		Female	630	5.80	3.72			
Habitat	Comfort	Urban	1029	5.01	3.56	-2.233	1,1258	0.026
		Rural	231	5.58	3.52			
		Cleanness	Urban	1029	5.27			
	Rural		231	6.09	3.56			
						-3.067	1,1258	0.002

$1.811X_3 + 5.109X_4 + 4.210X_5 - 1.499X_6 + 2.744X_7$, Y being overall perceived quality; X_1 is the assessment of accessibility; X_2 is the assessment of the frequency; X_3 is the assessment of punctuality; X_4 is the assessment of security/safety; X_5 is the assessment of comfort; X_6 is the assessment of cleanliness X_7 is the valuation of the economic cost.

The typed regression coefficients and their probability values are presented in Table 3 (see right columns). The fixed coefficient of determination (R square) was $R^2 = 0.224$, being 22.4 %, the percentage in which the dependent variable is predictable using the independent variables included in the model.

In addition to understanding the potential reasons that largely explain the considerably scarce use of public transportation in the Dominican Republic, it is important to know why users do, indeed, use public transportation, or in other words, to address the potential motivators driving people to use it. Economic reasons stand out ($M = 7.18$; $SD = 3.11$), while the fear of driving ($M = 4.54$; $SD = 4.18$) and the withdrawal of the driving license ($M = 3.01$; $SD = 3.86$) are, comparatively, less common reasons, as illustrated graphically in Fig. 5.

Further, it is interesting to point out the significant differences found in the function of the analyzed sociodemographic characteristics, such as sex, habitat, and the fact of owning (or not) a vehicle. In brief, females give significantly higher scores than males due to health reasons and fear of driving. Regarding the habitat, inhabitants of urban zones score higher in economic and health-related issues, as well as for no specific reason, and people who do not usually drive score higher for no specific reason and fear of driving. On the other hand, they score significantly lower in license withdrawal as a reason for using public transportation which could be associated with the outstanding differences in the use of private vehicles, with males being those who drive the most, as shown in Table 4.

Although to the date, there are no studies in this regard, some institutional documents suggest that another reason behind the low use of public transportation in the country could be that specific transport means aimed at this purpose are unequally represented in different territories (INTRANT, 2020). Accordingly, 82.1 % of participants consider that the urban bus availability is considerable, and 74.4 % believe motorcycle taxis are easy to find in their areas of residence. However, other transportation modes, such as metros (31.9 %) or taxis (38.8 %) are available only in very specific urban zones.

Notwithstanding, 37.5 % of Dominicans consider that their city/town of residence does not need more public transportation coverage. On the other hand, 20.2 % of participants consider more metro lines and metropolitan buses (10.2 %) are needed.

4. Discussion

The purpose of this study was to analyze usage and perceived quality of public transportation means in the Dominican Republic, as well as to explore the most relevant features for Dominican citizens, aiming at finding possible solutions to enhance more efficient

Table 3
Regression coefficients of the variables retained in the significant regression model.

Variable	UC ^a	SE ^b	β^c	T ^d	Sig. ^e
(Constant)	2.904	0.245		11.874	<0.001
Accessibility	0.133	0.034	0.127	3.946	<0.001
Route frequency	0.066	0.036	0.061	1.854	0.064
Punctuality	0.060	0.033	0.061	1.811	0.070
Security/Safety	0.174	0.034	0.181	5.109	<0.001
Comfort	0.157	0.037	0.169	4.210	<0.001
Cleanness	-0.050	0.033	-0.055	-1.499	0.134
Economic cost	0.076	0.028	0.078	2.744	0.006

Notes.

^a UC=Unstandardized regression (path) coefficient.

^b SE = Standard Error.

^c β (Beta) = Standardized path coefficients.

^d T = Test statistic.

^e Sig. = Test significance level (*p-value*).

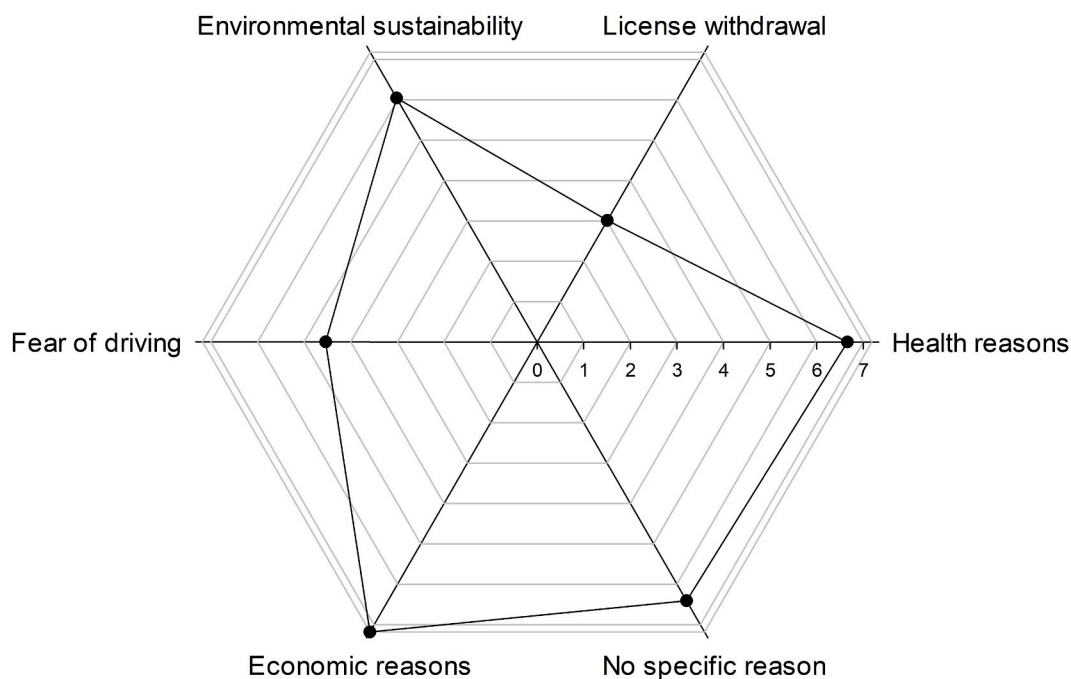


Fig. 5. Self-reported core reasons for using public transportation among Dominican citizens, from lesser to greater valued (0–10 scale).

Table 4

Reported motives for using public transportation, according to key users' sociodemographic variables.

Variable	Stated reason	Category	n	M ^a	SD ^b	Welch's test		
						T ^c	df ^d	Sig. ^e
Sex	Health issue	Male	619	6.45	3.37	-2.209	1,1232	0.027
		Female	615	6.88	3.39			
	Fear of driving	Male	616	3.88	3.97	-5.689	1,1216	0.001
		Female	602	5.22	4.28			
Habitat	Economic reason	Urban	1018	7.38	3.03	4.685	1,1246	0.001
		Rural	230	6.32	3.28			
	Health issue	Urban	1010	6.77	3.36	2.310	1,1232	0.021
		Rural	224	6.19	3.48			
Owns a vehicle?	No specific reason	Urban	1003	6.53	3.35	2.680	1,1219	0.007
		Rural	218	5.85	3.43			
	Fear of driving	Yes	462	6.12	3.42	-2.348	1,1219	0.019
		No	759	6.58	3.33			
License withdrawal	Yes	439	3.42	3.90	2.864	1,1135	0.041	
	No	698	2.75	3.80				

Notes.

^a M = Arithmetic mean.

^b SD = Standard Deviation.

^c T = Test statistic.

^d df = Degrees of Freedom (group 1, group 2).

^e Sig. = Test significance level (*p-value*).

mobility and sustainability based on strengthening the public transport demand. In this regard, and besides the perceived quality reported by users, the appraisals on their desired improvements or expectations to make it a more attractive option were considered, as several empirical shreds of evidence point that daily transport choices have a direct impact on the quality of life [63,64]. In this sense, it could be hypothesized that efficient measures to improve both the offer and features of public transport supported by adequate information strategies (e.g., communication campaigns) would not only help to attract more potential users but also contribute to strengthening transport sustainability [65].

4.1. Use, disuse and key desired features of public transport in the Dominican Republic

Overall, the findings of this study show a low average use of public transportation in the Dominican Republic. The highest-rated public transportation modes were metro and metropolitan (OMSA) buses. In both cases, the service is carried out in very specific urban areas of the country, mainly in the city of Santo Domingo. Therefore, it is not random that “preferred” transport modes by Dominican citizens correspond to those implemented in higher-income areas, which at the same time correspond to urban locations [66]. This makes us reflect on previous studies problematizing that unequal transport system developments contribute to raising and deepening social gaps and life quality disparities [67]. At this point, the assessment given to the different features of public transport means becomes important. Accessibility and frequency positively stand out, with scores higher than safety, while cleanness and comfort remain the lowest valued features among Dominicans.

Nonetheless, this outcome is mainly related to the most used transport modes. In Santo Domingo, metros and metropolitan (OMSA) buses only move 10 % of the population that actually uses public transportation despite currently being the safest and most financially accessible modes [51]. Why is that? A matter of coverage or accessibility?

One potential explanation is that approximately 75 % of users of this transport mode need to perform an intermodal integration at one of the two ends of their trip. Thus, if passengers choose the metro, they must pay two fares; however, if they use public cars, they only have to pay one [68]. On the other hand, OMSA (metropolitan) buses cover the main routes of the city, but they cannot fulfil the demands of the main passenger concentration points or “dense spots” [69]. Therefore, it would be interesting to widen the network offered by metro and OMSA buses through a preliminary study on the population’s most common movement patterns or establish a combined and intermodal transport system allowing Dominicans to perform their usual trips without paying higher prices.

Another issue worth mentioning is that most intermodal movements (trips) interchanging with metropolitan buses are performed by using public cars (illegally shared taxis), urban buses, and motorcycle taxis, which (being generally part of an informal economy) usually do not have established stops. Nevertheless, they would rather pick up passengers wherever they waited, thus leading to traffic jams [51]. One of the key attributable reasons for such an outcome is that these are, mostly, older vehicles with a lower capacity [52], which negatively influences the perceived cleanness and comfort. These two issues are better assessed in rural areas than in urban ones, which is determined by a higher number of people using these transport modes there. This is a phenomenon that repeats itself in most Latin American countries, where these service-related features are perceived as deficient, being affected by the agglomerations produced inside vehicles [70,71].

In this sense, policymakers and decision-makers in the transport sector could develop measures aimed at digitizing the different modes of public transport. The design of fixed routes and the establishment of mobile applications that allow users to coordinate their routes and intermodality easily could help reduce waiting and travel time, improving the public’s perception of these modes of transport. In this same regard, other previous studies have shown that, technology can help collect real-time data to enable the use of data analysis and predictive models to anticipate problems and improve planning, the implementation of fleet management and electronic ticketing systems to collect accurate data, and the facilitation of real-time communication with users through mobile applications and social networks, helping to plan their trips [35,44].

4.2. Cleanness and bio-security after COVID-19: an emerging feature to strengthen?

One key limitation of this study is that data was collected just a couple of months before the first COVID-19 outbreak, which indeed increased the importance attributed to bio-security and the prevention of contagions in transport means that are usually crowded during weekdays. Therefore, regardless of the low valuation given by Dominicans to this key feature on this occasion, it is worth stating this as an essential issue for future user attraction dynamics during and after the COVID-19 pandemic.

In other recent empirical experiences carried out during the pandemic, improving the cleanness levels of public transportation has emerged as, perhaps, the most relevant issue for many users, even over trip safety and affordability [72,73]. In other words, as a generalized decrease in the use of public transportation has taken place for biosecurity reasons, an inverse logic might partly help rebuild public transport dynamics [74]. This also represents an economic issue since a lower demand implies a decrease in revenue, at the same time as more resources are needed for maintenance and disinfection [75].

4.3. Security in transport: a latent matter in Latin American systems

Similarly to other studies, the outcomes of this research highlight how important security issues become for users’ avoidance of public transport, especially among females, who remain the most vulnerable and affected group in Latin American transit environments [40]. Globally, different studies have shown that security and safety are the elements that influence the choice of a trip or transport mode the most [76].

In this case, it is remarkable how no differences were found depending on sex since this is a differential factor [77]. A survey carried out by the Thomson Reuters Foundation has established that Latin American cities are those with the most unsafe and dangerous public transportation for women, where 6 out of 10 females have suffered physical harassment [78], something that has been endorsed by some recent studies addressing the perception of users, especially for the case of females [40]. For this reason, it is necessary to keep exploring contextually based security measures that potentially help to face and prevent crime and victimization incidents in transport environments, including harassment in public transportation, which is usually underestimated or underreported in statistical figures [79].

Also, economic reasons stand out as to the reasons behind the choice of public transport [5,63]. As in most LMICs (low and

middle-income countries), wealth distribution remains unequal in the Dominican Republic, and many individuals do not have a high enough income to afford buying and maintaining a private vehicle, which leads them to choose other transport modes for their movements in a forced way [39]. On the other hand, there are significant differences by sex in what concerns the “fear of driving” and the “license withdrawal”, which are determined by the few women who drive in the Dominican Republic [62,80].

Finally, it is convenient to highlight that more than one-third of Dominicans (precisely 37.5 % of them) do not believe that the incorporation of new public transport choices is necessary for their city. This is a very introductory but interesting fact worth further exploring. Yet, it could be initially hypothesized that the actual needs of users exceed the mere coverage and may refer rather to public transport planning, integration and scheduling through a system that can foster adequate mobility for citizens, as well as the environment’s sustainability, leading to a better organization and structure in the country’s transport system.

4.4. Recommendations on possible actions to be applied in the Dominican Republic

The pollution and road safety problems caused, among other factors, by the high number of motorized vehicles that travel daily in the Dominican Republic could be reduced if citizens opted to a greater extent to use collective means of transport [81]. Nonetheless, in view of the present study’s results, several elements make it difficult for users to use public transport for their daily commute.

The responsible entities must be aware of the importance of improving the quality and perception of the service, especially in relation to the attributes that are worst valued by citizens [82]. In this way, user comfort and convenience must be improved through the modernization and improvement of the conditions of the public vehicle fleet, as well as the establishment of sufficient standards of cleanliness to guarantee adequate service. Establishing clear protocols for preventive and corrective maintenance of vehicles and stations is recommended to maintain a reliable and safe service [83].

Efforts should also be made to restructure the available transportation network. As previously mentioned, a significant portion of Dominicans do not consider implementing new public transport options necessary, given that there is already a sufficiently broad set of travel options. Yet, the design of routes and stops should be adapted to the needs of citizens [84]. Many of them opt for private vehicles because no route covers their entire journey. In some cases, it is required to use two or more public vehicles to complete the entire route. This occurs in three-quarters of public transport users, which is a waste of time and money that discourages the use of this mode of transport. Therefore, it is recommended that a study of the routes and routes most frequented by users be carried out, which will allow the optimization of public transportation systems, making them a much more efficient and attractive option for Dominicans. In relation to this point, it is also recommended to review and optimize schedules to ensure greater frequency and punctuality of service, including, to the extent possible, an investment in monitoring technologies and mobile applications to improve coordination and operational efficiency [85,86].

In addition, given the potential influence of social perception in changing travel patterns, awareness campaigns should be promoted to encourage public transport as a viable and sustainable option [87]. The communication strategy should be aimed at two objectives. On the one hand, to raise awareness of the individual and collective benefits of using public transport and other soft modes of travel [88]. Evidence indicates that in the Dominican Republic there is a distortion in the perception of the importance of problems such as road accidents or pollution, with no real perception of their seriousness and underestimation of their negative consequences [65,89]. In this way, the knowledge and acceptability of this transport option will be favored, providing information on how to use the service in an effective and safe manner [65].

4.5. Limitations of the study

The study has some limitations that should be considered when interpreting the results. The data were collected before the COVID-19 pandemic. Thus, there is evidence that recommendations to maintain social distance from other people have affected the commuting routines and transportation choices of citizens worldwide [90,91]. Therefore, it is a factor to be considered as perceptions and use of transport modes today may differ from the results obtained in the study. However, this circumstance also offers the possibility of replicating the research in the present in order to analyze the potential differences that may have occurred and the implications they may have on the development and planning of public transport in the Dominican Republic.

Moreover, this is a cross-sectional study, so it provides information only for the time period the data were collected, without following up on possible changes over time. Also, no specific questions have been addressed on the attributes or characteristics of the different modes of public transport. These are general questions that provide a first approximation to the problem, but which could be supplemented in future research [92,93]. In this sense, and also considering the first limitation mentioned above, we emphasize the importance of carrying out future research to identify and explain the potential evolution in the use and perceptions of the means of transport analyzed.

Finally, a self-reported questionnaire has been used for data collection. As a result, social desirability bias may occur, thus influencing the participants’ responses [94,95] despite reporting no right or wrong answers and guaranteeing the anonymity of the sample.

5. Conclusions

This study, which pioneers the study of public transport user’ perceptions in the Dominican Republic targets different issues, insights, and practical implications useful for the development of massive transport policies and practices, namely:

Although not the only constraints identified, public transportation in the Dominican Republic remains particularly challenging for

users, especially regarding three key issues: comfort, vehicle conditions, and safety.

In areas where public transportation is closer to fulfilling these three features, such as the metro system and metropolitan buses, additional challenges persist, particularly concerning transport accessibility and intermodality. This includes the inability to seamlessly transition between different modes of transportation to complete a single trip.

At a practical level, considering insights from both this study and previous literature, a feasible short-term proposal involves incentivizing public transport usage through incremental enhancements, such as improved route planning and intermodal payment systems.

Moreover, promoting integrated public transport services and enhancing their attractiveness for citizens is expected to increase public transportation usage, thereby fostering safer, more efficient, and more sustainable mobility in the region.

Funding

This study was funded by the National Institute of Transit and Land Transportation (INTRANT) and its Permanent Observatory in Road Safety (OPSEVI; public agency of the Dominican Republic) - Grant number: 20170475. This work was supported by the research grant ACIF/2020/035 (MF) from “Generalitat Valenciana”. Funding entities did not contribute to the study design or data collection, analysis, and interpretation or writing of the manuscript.

Data availability statement

The data used in this study are available upon request to the corresponding author.

CRedit authorship contribution statement

Francisco Alonso: Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Conceptualization. **Cristina Esteban:** Writing – review & editing, Investigation, Formal analysis, Data curation. **Mireia Faus:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Sergio A. Useche:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The corresponding author (Dr. Francisco Alonso) is an Associate Editor of the journal. This does not alter our adherence to the ethical policies of Heliyon. Further, the authors of this study declare the inexistence of competing interests.

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