
This is the **published version** of the master thesis:

Sax, Julius; Honey-Rosés, Jordi , dir. Bike Theft in Barcelona : Reporting Behaviour and Impacts on Cycling. Bellaterra: Universitat Autònoma de Barcelona, 2023. 37 pag. (Màster Universitari en Estudis Territorials i Planejament)

This version is available at <https://ddd.uab.cat/record/286669>

under the terms of the  license

City Lab Barcelona
&
Geography Department
Universitat Autònoma de Barcelona
Màster en Estudis Territorials i Planejament 2022-2023

Master's Thesis

Bike Theft in Barcelona: Reporting Behaviour and Impacts on Cycling

Author: Julius Sax

Supervisor: Jordi Honey-Rosés

Why did I choose the International Journal of Sustainable Transportation?

The decision to submit the paper to the International Journal of Sustainable Transportation was based on the content overlap with the journal's thematic area. The thesis explores the impact of bicycle theft on cycling and its implications for sustainable transport, which fits well with the focus of the journal. The journal actively promotes interdisciplinary research, which is reflected in the multidisciplinary approach of my study, incorporating criminology, urban planning and policy analysis.

In addition, the journal welcomes case studies and surveys conducted in different contexts. As my work explores the specific context of Barcelona and the impact of bicycle theft using a survey, it fits well with the journal's focus on global perspectives and diverse research methods.

The journal's rigorous peer-review process ensures the quality and validity of published research. Furthermore, it is a journal with prestige and impact as can be seen in the **citation metrics**:

- **3.963 (2021)** Impact Factor
- **Q2** Impact Factor Best Quartile
- **4.260 (2021)** 5 year IF
- **7.6 (2021)** CiteScore (Scopus)
- **Q1 (2021)** CiteScore Best Quartile
- **1.519 (2021)** SNIP
- **1.336 (2021)** SJR

I have followed the specific layout and formatting requirements of the journal. The journal does not specify a word count limit. However, a word count excluding the references is required. My paper consists of 7641 words.

Contents

Introduction	5
Aims of the study	6
Literature Review	7
Impacts of bicycle theft	8
Reporting of bike theft	9
Methodology	11
Survey design	12
Statistical Methods.....	13
Description of the sample	13
Results	15
Impacts of bike theft	16
Reporting of bike theft	17
Binary Logistic Regression Analysis	18
Interpretation.....	19
Reasons for not reporting	20
Reporting in case of another theft	21
Discussion.....	22
Impacts of bike theft	23
Reporting of bike theft	25
Analysis binary logistic regression on reporting.....	26
Limitations.....	29
Conclusion.....	30
Acknowledgments.....	33
References.....	34

Bike Theft in Barcelona: Reporting Behaviour and Impacts on Cycling

Bicycles are a key element for sustainable transportation in urban areas. The prevalence of bicycle theft is a major challenge to endorsing cycling as a means of transport. However, its impact on the local cycling community and high under-reporting rate remains understudied. The aim of this research is to examine the impacts of bike theft on cycling, assess the reporting rate of bike theft incidents, and identify factors that influence victims' reporting behaviour in Barcelona. By applying the results of an online survey to the official data on bicycle thefts in Barcelona, the study reveals significant negative impacts of bicycle theft, resulting in around 1.5 cyclists giving up cycling every day. Moreover, it shows that in Barcelona at least 67% of bicycle thefts are not reported to the police. This paper demonstrates that victims with a master's degree or higher have a 71% higher probability to report, and the value of the stolen bike significantly influences the likelihood of reporting, with an impact of up to 98%. These results can be used by the city and local authorities to take tailored measures to combat bicycle theft and the issues related to it and thus promote cycling as a means of transport to support the transition to sustainable mobility.

Keywords: bike theft; under-reporting; impacts, stop cycling, Barcelona

Introduction

In the last decades, cities worldwide have increasingly adopted sustainable modes of transportation. One of the most sustainable means of transport that can cover short and medium distances is the bicycle. Cycling is on the rise especially in Western Europe, North America and South America (Pucher & Buehler, 2017). Particularly during the Covid pandemic, when public transport use declined significantly, the bicycle emerged as a viable alternative to private motorized mobility (Buehler & Pucher, 2022). Overall, the urban planning landscape is witnessing a growing emphasis on bicycle integration and the development of cities that encourage cycling.

In this paper, I will focus on Barcelona as one of the European cities that in recent years has most incentivized cycling as a mean of transport. The city implemented new bicycle lanes, which extended the network to 240 km (Ajuntament Barcelona, 2023), constructed numerous parking facilities for bicycles and promotes cycling as a sustainable and healthy mode of transportation in events such as the “Bicicletada” (Ajuntament Barcelona, 2022). Although not every neighbourhood in Barcelona is equally ensuring good conditions to cycle, overall, the city’s traffic is relatively safe for cyclists (Codina et al., 2022). Especially the centric districts, where the bulk of the population lives, are relatively flat, dispose parking spaces and are well equipped with connected infrastructure (Codina et al., 2022).

However, bicycle theft is a major challenge in creating bikeable cities. In the survey “Baròmetre de la bicicleta” conducted by the Government of Catalonia bike theft emerged as a significant reason for individuals' reluctance to use bicycles for transportation, second only to concerns about interacting with motor vehicles (Generalitat de Catalunya, 2019). Moreover, bike theft is the key challenge cyclists face in Barcelona (Melo, 2023). The mobility share of the bicycles is 2,9% of all daily trips

in the city (ATM & iermB, 2022). Tackling bicycle theft could lower the barrier to cycle and therefore would make Barcelona more attractive for cycling (Angeles Small, 2020).

To effectively address the problem of bike theft, a comprehensive understanding of the real magnitude is crucial. In comparison to other cities, the official number of thefts in Barcelona is low (Vetter & Honey-Rosés, 2022). Nevertheless, the low number does not reflect the general high perception of the risk of bike theft that prevents citizens from cycling. The notable discrepancy between official data and public perception can be attributed to a considerable under-reporting of bike theft incidents (Vetter & Honey-Rosés, 2022). To date, the unreported rate of bicycle theft has received limited attention in academia thus far (Van Lierop et al., 2015). However, this is problematic because the real magnitude of the problem of bike theft is not represented and the impact on the cyclist and society cannot be estimated. As a result, public authorities and policy makers have a low capacity to develop effective strategies to prevent bicycle theft and protect cyclists.

Aims of the study

This paper aims to explore the impact of bike theft on cyclists in Barcelona. Moreover, it assesses the reporting behaviour of victims of bicycle theft and estimates the proportion of under-reporting. In addition, it examines the factors that contribute to reporting in order to better understand the phenomenon.

Literature Review

The literature on cycling as a mean of transport has long focused on the active use of the bicycle and neglected the condition when it is not in use. However, bikes that are parked shape the urban space and have an important impact on the users who often go to great lengths to keep their bicycles safe (Aldred & Jungnickel, 2013). The research on bike theft identified location-based risk factors, such as access, length of stay, lighting, surveillance (either natural or CCTV surveillance), (informal) guardianship, signage regarding, appropriate use of the facility, locking practices and locking bikes in a location that is not designated for bike parking – known as flyparking - as important factors influencing the risk of bike theft (Gamman et al., 2004; Johnson et al., 2008; Levy et al., 2018) Additionally, it has been studied that the environment in which the bike is parked has an impact on the risk of a bike being stolen. Parking a bike in areas that are more frequented, close to train or metro stations or with demographic characteristics that favour theft does increase the likelihood of bike theft (Chen et al., 2018; Levy et al., 2018; Mburu & Helbich, 2016).

The Routine Activity Theory was postulated as a criminological concept by Lawrence E. Cohen and Marcus Felson (1979) to explain how crime occurs. They identify three elements that are necessary for most crimes: likely offenders, suitable targets, and the absence of a capable guardian. If one of these elements is missing, crime will not occur. In the context of the present study the theory is used to explain why bicycle thefts occur and the implications for victims to protect themselves against new thefts.

Impacts of bicycle theft

The theft of bicycles has multiple “harmful economic and societal effects” for cycling communities (Johnson et al., 2008, p. 2). Most significantly, thefts may discourage cyclists from replacing their stolen bicycle and stop cycling altogether. There are indirect impacts for the society that must be considered if victims stop cycling and choose a less sustainable mode of transportation, which will negatively impact public health, greenhouse gas emissions, and quality of life (Chen et al., 2018). Depending on the specific survey, the geographic area, and year, the proportion of cyclists who discontinue cycling is changing, but remains consistently of significant importance. For instance, Bryan-Brown and Savill (1997) found that approximately 24% of cyclists discontinue cycling following theft incidents, while Lehner-Lierz (2006) reported a similar figure of 25% for Germany. These alarming numbers have long been acknowledged within the field, with earlier research by Replogle (1984), already citing a study conducted in Maryland (USA) highlighting that 20% of cyclists stop cycling after experiencing a theft.

Also among those who do not give up cycling, the fear about another incidence leads 66% of the cyclist to cycle less often in the UK (Department of the Environment, Transport and the Regions, 1997; as cited in Gamman et al., 2004). The theft itself might not be the only determining factor for this behaviour as in Montreal (Canada) only 15.5% cycled less compared to 24% that reported an increase in cycling (Van Lierop et al., 2015). Yet, the majority of the victims changed their locking behaviour and adopted additional security measures. However, it is noteworthy that only 40.2% of victims who had registered their stolen bikes reported subsequently registering their new bikes (Van Lierop et al., 2015).

Rather than repurchasing new bikes, victims of theft are increasingly transitioning to bike-sharing systems as an alternative. For instance, Bachand-Marleau

et al. (2012) discovered that 39% of users in Montreal's shared bicycle system had encountered theft incidents, and preventing theft was one of their primary motivations for utilizing the system. Another strategy employed by individuals to mitigate theft risks is to exclusively use old or poorly maintained bicycles (Lehner-Lierz, 2006).

Reporting of bike theft

Estimating the extent of the impacts of bike theft poses a significant challenge due to substantial under-reporting to local authorities (Johnson et al., 2008). The issue of under-reporting of bike thefts is well-recognized but varies considerably depending on the social, political and geographical context. Bryan-Brown and Savill (1997) estimate that in the United Kingdom more than three quarters of all bicycle thefts are reported to the police. Whilst data from the *British crime survey* suggest that the reporting rate was 69% in 1991 and dropped to 40.6% in 2007/2008 (Tarling & Morris, 2010).

Studies in the United States indicate that only about 20% (Johnson et al., 2008) to one-third of all bike thefts are reported to the authorities (Levy et al., 2018). In the case of the Netherlands, it appears that the reporting rate has declined over time. In 1995, Weijers (1995, as cited in Bryan-Brown & Savill, 1997) reported a reporting rate of 57% for thefts to the police), while in 2012, it dropped to 17.1%, further decreasing to 14.2% in 2019 (Kuppens et al., 2020). However, it is important to note that estimated reporting rates vary significantly due to different methodologies employed to measure the willingness to report. For instance, in Amsterdam, the municipal estimates indicate a reporting rate of approximately 40% (De Ridder et al., 2020), while bike advocacy groups suggest a lower reporting rate, falling below 14% (Venverloo et al., 2023). These discrepancies highlight the lack of a standardized methodology in accurately measuring the reporting rate of bike theft incidents. This leads to the problem that bike

theft is not assessed correctly and cannot reliably be analysed over time (Office for National Statistics, 2017). The knowledge gap is exacerbated as in most countries there are no published data of surveys that can be used to estimate the under-reporting rate. Nevertheless, consistent patterns emerge across various studies regarding the reasons provided for not reporting bicycle theft incidents. The first reason is the consistently low clearance rate for bike theft, so victims perceive that the police can do little or nothing (Johnson et al. 2008) and that there is only a very low chance to get the bike back. This perception is confirmed by the studies of Van Lierop et al. (2015), in which 2,4% of the bicycles were recovered and Bryan-Brown and Savill (1997) who found a recovery rate of 6%. Whilst the likelihood of recovery of a bike when reported improved slightly but significantly in the study of Van Lierop et al. (2015), it did not vary whether the victim reported the theft in the study of Bryan-Brown and Savill (1997). Second, many victims feel that bike theft is a crime that is too trivial/no loss to report to the police and consumes resources that could be deployed to combat other crime (Tarling & Morris, 2010). Third, victims confront high opportunity costs for reporting, which implies a visit to the police station, waiting in line, compromised privacy, embarrassing admission of one's own vulnerability or the risk of reprisals among others (Tarling & Morris, 2010). Especially considering the low probability of the bike being recovered, many victims decide that may not be worth the effort (Van Lierop et al., 2015). Lastly, there are victims of bike theft that do not report the incidence due to bad experiences with the police (Tarling & Morris, 2010).

However, only isolated factors have been identified in the literature that explain why people are more likely to report. Bryan-Brown and Savill (1997) found a significant association between the value of the bicycle and reporting behaviour. That bike with higher value are more likely to be reported attributed to an increase in the

perceived seriousness of the crime and therefore the readiness to report it (Tarling & Morris, 2010) or that a bigger share of them is insured. Additionally, the belief system of the may increase the likelihood of reporting if reporting is perceived as a public duty (Tarling & Morris, 2010). Moreover, the probability of reporting crime is increasing with the educational level (Tarling & Morris, 2010). While the crime reporting rates differ according to the neighbourhood, suggesting a correlation of reporting and immigration rates (Gutierrez & Kirk, 2017), and there are discriminatory patterns in reporting and the recording (Warner, 2006; Wu et al., 2020), the neighbourhood where the bike is stolen is not a decisive factor for reporting (Bryan-Brown & Savill, 1997). However, the significance of most of these factors remains understudied, as has not yet been tested in a model that quantifies their importance on the probability of reporting.

Within the existing literature, there is a notable knowledge gap concerning the generalizable impacts of theft. The presented findings only apply to specific contexts and the reasons for differences have not yet been explored. Furthermore, the present study will, to the author's best knowledge, be the first study in Spain analysing the impact and the reporting behaviour of bicycle theft.

Methodology

To gather pertinent data on bike theft in Barcelona, I requested through a formal letter to the police department in Barcelona the bike theft data of 2022. The official data provided to me includes thefts reported to the local and regional police (Guardia Urbana and Mossos d'esquadra). However, as revealed through informal discussions with local law enforcement, the official data include only entirely stolen bicycles (not stolen bike

parts) that are identifiable e.g. have unique characteristics or were reported with the serial number of the bike.

To examine the extent and impact of bicycle theft, I deployed an online survey to bicycle theft victims. Moreover, I used the survey results to estimate the number of unreported cases. Similar data collection methods were applied in other studies of the field (Bachand-Marleau et al., 2012; Li et al., 2019; Van Lierop et al., 2015)

By combining the estimated under-reporting rate and the official data, I could estimate the total number of bike thefts in Barcelona. This comprehensive figure facilitated the calculation of the estimated impacts found in through the survey, providing an overview of the extent of the effects.

Survey design

The conducted survey was a trilingual (Catalan, Spanish, and English) online survey that was promoted in Barcelona. For broader exposure and in order to mitigate the potential bias resulting from overrepresented groups, a diverse range of online and offline channels for survey distribution were employed (Dillman et al., 2014). These included social media platforms (Twitter and Facebook), messengers, posters displayed in local bike shops, flyers, and dissemination during cycling events such as the critical mass and the kidical mass in Barcelona.

The survey was conducted between 31 April 2023 and 4 June 2023 to ensure a comprehensive data collection period. In order to prevent respondents from reporting multiple incidents of theft, they were asked to report only their experience of the most recent bicycle theft. Of the 298 valid responses 149 cases were included in the study. The high exclusion rate is mainly due to the fact that the respondents experienced theft of parts of the bicycle, an intended theft or a theft outside Barcelona. The survey

provides, on the one hand, socio-demographic information on the victims of bicycle theft that can be used for extrapolation based on estimates to the total cycling population and, on the other hand, data that can be used to create a statistical model.

Statistical Methods

I used a binary logistic regression to analyse the factors that contribute to reporting of bike theft. This method shows the relationships between a dichotomous outcome variable, in the present case is if the theft was reported to the police (yes/no), and one or more categorical or continuous predictor variables (Peng et al., 2002). The model tested a variety of variables based on results of previous studies and theoretical considerations that were expected to influence the reporting behaviour.

Description of the sample

Out of the 148 participants who reported that their bike was stolen in Barcelona, 48.65% identified as male, 47.30% as female, 2.70% as non-binary and 1.35% preferred not to answer. Their mean age was 38.59, with the youngest respondent aged 18 years and the oldest 71 years. Regarding the education level, a significant proportion held a Master's degree or higher (51.70%) or a Bachelor's degree (34.01%). Additionally, 8.16% had completed Vocational Training (VET), 4.08% had a high school diploma, and 2.04% had not finished high school. For improved statistical analysis, all that did not hold a Master's degree or higher were combined into the category "Bachelor's degree or lower". The majority of participants (72.30%) were from Spain, followed by the rest of Europe (14.86%), and Latin America (6.76%). A smaller proportion of participants were from North America (4.73%), and a small share came from other regions of the world (1.35%).

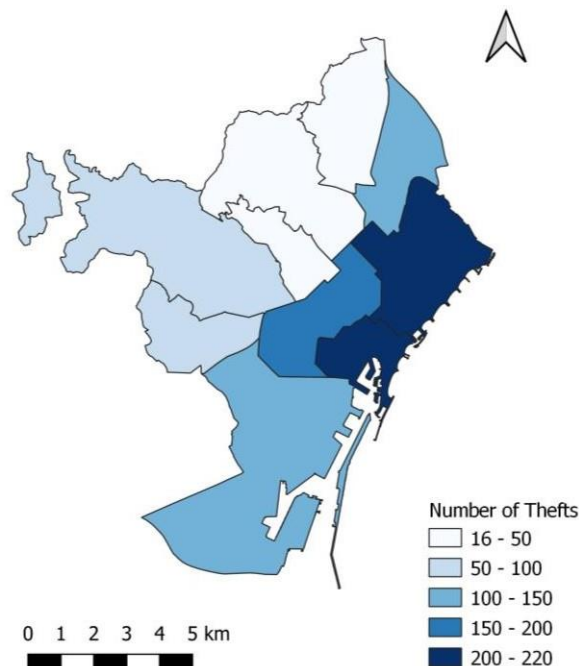
Most respondents (88%) indicated that they use a bicycle because it is healthy and provides good exercise or because it is environmentally friendly (83%). Additionally, 76% stated that they use a bicycle because it is faster than other transportation modes (e.g., car, bus). Moreover, 60% of participants reported using a bicycle due to its economic benefits. A small proportion of participants (9%) mentioned "Other" reasons for using a bicycle (reference was mostly made to the fun aspect), while an even smaller percentage (3%) stated that they use a bicycle because there is no alternative mode of transportation available to them. The results indicate that most of the participants choose the bicycle as a means of transportation not out of necessity, but because of the personal benefits it gives to the cyclists.

Results

The official data from the police show that in total 1042 bikes were reported stolen in Barcelona in 2022. This is an increase of 20% compared to the 870 reported stolen bicycles in 2021 (Vetter & Honey-Rosés, 2022).

The following map indicates in which districts the bicycles were reported stolen in 2022.

Reported Bike Thefts in Barcelona 2022



Own work. CRS - EPSG: 2581; *Source of the data:* Barcelona's City Hall Open Data

Service

Most of the reported thefts took place in the in the old town (Ciutat Vella) followed by the districts bordering the centre (L'Eixample, Sant-Martí and Sants-Montjuïc). This finding is consistent with the data from the survey and also similar to the pattern of 2021 (Vetter & Honey-Rosés, 2022).

The following table indicates the reported type of place from which the bicycle was stolen.

Table 1 - *Theft location*

Location	Absolute number	Percentage
Public space (streets, squares, parks, beaches)	617	59%
Homes	173	17%
Private parking facilities	122	12%
Shops and enterprises*	120	11%
Public transport	10	1%

Note. *One incident involved the theft from 64 bicycles from a bike store in the district Sant Andreu; $N = 1042$.

Impacts of bike theft

One of the most substantial impacts of theft is when victims stop cycling. The study was able to reproduce the relation suggested in the literature and found for Barcelona that 17% of the theft victims that got their entire bike stolen stopped cycling after the incident. Most of the cyclists that did not stop adopted new security mechanisms after the theft such as better locks or geolocation trackers (63%). Also, more than half of the cyclists decided to not park on the street anymore (53%) while another 37.10% would only leave the bike outside when they could keep an eye on it. 40% opted to substitute the stolen bicycle with a cheaper one. Another effect is that one fourth shifted to bicycle sharing or obtained a foldable bike (23%). 11% cycled less and only 9% opted for a bike insurance. In total, the overwhelming majority (99%) did take new precautions as a result of the theft.

Reporting of bike theft

The results of the survey show that 33% of thefts of bikes were reported to the police and 67% were not reported to the police. Table 2 displays the distribution of reporting rates according to the of sociodemographic and theft related variables.

Table 2 -*Reporting rates from the survey respondents*

		Not reported		Reported	
		Number	Percentage	Number	Percentage
Gender	Female	50	71.43%	20	28.57%
	Male	44	61.11%	28	38.89%
	Non-binary	3	75.00%	1	25.00%
	Prefer not to answer	2	100.00%	0	0.00%
Birth country	Spain	72	67.29%	35	32.71%
	Rest of Europe	14	63.64%	8	36.36%
	Latin America	6	60.00%	4	40.00%
	North America	5	71.43%	2	28.57%
	Other	2	100.00%	0	0.00%
Educational level**	Master's Degree or higher	64	65.31%	34	34.69%
	Bachelor's Degree or lower	84	82%	19	18%
Value of the bike**	<50€	15	93.75%	1	6.25%
	51-99€	25	89.29%	3	10.71%
	100-199€	25	68.57%	11	31.43%
	200-299€	15	68.18%	7	31.82%
	300-399€	12	57.14%	9	42.86%
	400-499€	5	50.00%	5	50.00%
	500€ +	4	18.75%	13	81.25%
Times of theft*	One time	55	72.37%	21	27.63%
	Two times	19	57.58%	14	42.42%
	Three times	11	50.00%	11	50.00%
	More than three times	14	82.35%	3	17.65%

* significant on a confidence level of 90%; ** significant on a confidence level of 95%

Binary Logistic Regression Analysis

A binary logistic model to predict if a bike theft was reported (Yes/No) was fitted to the data. The predictor variables (independent variables) that were included are number of thefts, the highest educational level of the victim and the value of the bike. The logistic regression analysis was carried out using the program SPSS (version 29.0.1.0). The result showed that:

Equation:

$$\text{Predicted logit of (Reported)} = -3.2548 + (.874)*\text{Master_or_higher} + (.637)*\text{Value}(51-99\text{€}) + (1.837)*\text{Value}(100-199\text{€}) + (2.017)*\text{Value}(200-299\text{€}) + (2.377)*\text{Value}(300-399\text{€}) + 2.611)*\text{Value}(400-499\text{€}) + (4.073)*\text{Value}(500\text{€}+) + (.558)*2_times + (.481)*3_times + (-.951)*\text{more_than_3_times}.$$

Table 3 - *Results of the binary logistic regression analysis using SPSS (version 29.0.1.0)*

Predictor	β	$SE \beta$	Wald	df	p	Odds ratio
Constant	-3.255	1.101	8.746	1	.003	NA
Education (0 = Bachelor's or lower; 1 = Master's or higher)	0.874	0.427	4.19	1	.041	2.396
Value of the bike (reference category <50€)	NA	NA	19.855	6	.003	NA
51-99€	0.637	1.218	0.273	1	.601	1.89
100-199€	1.837	1.12	2.689	1	.101	6.279
200-299€	2.017	1.156	3.046	1	.081	7.514
300-399€	2.377	1.147	4.297	1	.038	10.768
400-499€	2.611	1.257	4.317	1	.038	13.616
500€ +	4.073	1.236	10.853	1	<.001	58.727

Times of theft (reference category one time)	NA	NA	4.226	3	.238	NA
Two times	0.558	0.502	1.236	1	.266	1.746
Three times	0.481	0.583	0.682	1	.409	1.618
More than three times	-0.951	0.781	1.482	1	.223	0.386
Test			χ^2	df	p	
<i>Goodness-of-fit-test</i>						
Hosmer-Lemeshow-Test			13.212	8	.105	
R^2						
Cox & Snell			.241			
Nagelkerkes			.334			

The Goodness-of-fit of the present model is ensured by the Hosmer-Lemeshow test that was not significant.

Interpretation

According to the model, the log of the odds of a theft being reported was positively related to the victim having a master's degree or higher ($p=0.041$; Table 3). This means that the odds of a victims with a Master's degree or higher are 2.396 times greater than for victim with a lower degree.

Additionally, the log of the odds of a theft being reported was positively related to a higher value of the bike than the reference category of less than 50€ ($p=0.003$; see Table 3). In other words, the higher the value of the bike, the more probable was reporting of theft. In fact, the odds of reporting a theft for a bike that was worth more than 500€ were 58.727 times greater than a theft of a bike of less than 50€. This means

that an expensive bike of a value greater than 500€ is 98% more likely to be reported than a cheap bike of a values of less than 50€.

The model shows no significant relation of the variable “times of theft” on “reporting”. This means that the differences between the reporting rate of the reference category (one-time experienced bike theft) and the other category could not be proved statistically. However, the model gains more explanatory power when the variable “times of theft” is included.

There was no multicollinearity detected between the variables used in the model. All the other variables that were collected in the survey do not significantly improve the model, as tested using WEKA (Waikato Environment for Knowledge Analysis).

Reasons for not reporting

Respondents that stated that they did not report the bike theft were asked for the reasons.

Table 4 indicates the reasons to not report the theft that the bike theft victims ($N = 99$) stated

Table 4 - *Stated reasons for not reporting*

Reason	Absolute number	Percentage
The police could do nothing	57	58
It was not worth the effort/Too much trouble	52	53
Too trivial/ I don't think it matters	11	11
Bad experiences with the police in the past/Fear of reprisals	8	8
Other reason	7	7

Note. Multiple answers were possible.

Under other reasons participants give explanations such as “will not get the bike back because I have no proof of the ownership”, “got bike back before reporting” or

“bad image of police”. The police are a highly polarizing institution and at least one participant expressed deep mistrust: “*La policía es el enemigo, denunciar solo sirve para colaborar con sus estadísticas sobre inseguridad en las calles y justificar el aumento de maderos.*” – statement of a participant when asked for reasons of not reporting.

Reporting in case of another theft

Most survey participants (68%) who reported the theft to the police said that they would certainly or probably report another theft again. Those who did not report, were inquired as to provide reasons for their decision not to report again. The most frequently mentioned reasons were “It was not worth the effort/Too much trouble” and “The police could do nothing” both accounting for 71% of the responses. Considerably less frequent reasons were “Too trivial/ I don't think it matters” (12 %) and 6% stated that they would refrain from reporting due to “Bad experiences with the police in the past/Fear of reprisals”. Participants could state multiple reasons.

Discussion

The official data from the police provides into the prevalence of bike theft in Barcelona. However, the accuracy of measuring bike theft incidents is compromised by inherent limitations within the official police data. Primarily, the data exclusively relies on reported thefts to the police, thus excluding unreported cases from the dataset. Furthermore, even when incidents are reported, there may be inconsistencies in their recording by the police and not all recorded cases are necessarily included in the official data (Bryan-Brown & Savill, 1997, p. 10). Moreover, as mentioned above, it should be noted that the official data on bike thefts of Barcelona is additionally biased because only the bikes with a unique identifier are included in the database.

The sharp increase in the number of reported stolen bicycles indicates that more bicycle thefts are taking place in the city. Accordingly, it is not surprising that many cyclists would like to see a better response from local authorities to tackle the thefts (Melo, 2023).

There most reported thefts happened in the public space. However, it is noteworthy that a considerable percentage were stolen from private homes (17%) and private parking facilities (12%). This could be an indicator that many bikes are stored at home. Furthermore, it is likely that the thefts from homes are considered more serious, since they involved trespass and are therefore more likely to be reported (Tarling & Morris, 2010). The number of bikes that were stolen Stores and companies is driven up by one incident where 64 bicycles were stolen from a storage hall. Also noteworthy is that there are only a small number of reported thefts in public transport (1%).

Impacts of bike theft

Bike theft is having significant impacts on the cycling community in Barcelona. The survey demonstrates that most cyclists changed their behaviour or precaution mechanisms after experiencing a theft. The victims' behaviour changes after a theft can be explained by applying the Routine Activity Theory, that says that for most thefts' likely offenders, suitable targets, and the absence of a capable guardian are required. As cyclists cannot influence the presence of cycle thieves, they focus their efforts on either preventing their bike from becoming a suitable target or finding a capable guardian. To prevent their bike from being a suitable target, cyclists in Barcelona invest in new security mechanisms that increase the difficulty of theft, no longer park their bike on the street, or keep it in a safe place or indoors, evidenced by the considerable adoption of foldable bikes. However, the latter are only viable options for those cyclists that can afford to rent a safe place for storing their bikes or have enough space in their home to store a bike. And even those that can store their bike inside experience challenges such as conflicts about the use of the space and additional barriers to make use of the stored bike (Aldred & Jungnickel, 2013).

Moreover, over a third of the respondents acknowledged that they only leave their bikes exposed on the streets (and therefore as suitable targets) when they can personally act as a capable guardian. This highlights the limitations of local authorities in providing consistent guardianship, leaving cyclists to take on this responsibility themselves. This situation appears to be inequitable when compared to other road users who can rely on local authorities as capable guardians to protect their vehicles and act in case of theft.

Another approach is not to try preventing theft but rather accept the risk of a bike being stolen and pursue a mitigation strategy. The survey shows that a considerable number of cyclists in Barcelona shift to utilizing bicycle-sharing services after

experiencing theft. Research indicates that even the risk of theft is a strong motivation to use bicycle-sharing systems (Li et al., 2019). It can therefore be assumed that the theft risk has a major influence on the fact that in Barcelona only 60% of all bicycle trips are made with private bicycles, while 36% are made with the local public bike sharing system "bicing" (ATM & iermB, 2022). Moreover, few respondents opt for bike insurance, potentially due to the perceived cost-benefit imbalance associated with insuring bicycles of lower value. This aligns with the finding that many cyclists bought a cheaper bike and thus limits the possible loss. However, it seems to be specific to Barcelona, as it contrasts with results from the UK, where victims of theft tend to buy more expensive bicycles than the stolen ones. This difference is attributable to longer rides and a higher rate of insurance adoption in the UK (Bryan-Brown and Savill, 1997).

The strategy to use cheaper bicycles comes with inherent risks. These bicycles are more prone to technical or mechanical defects, leading to an increased likelihood of accidents with potentially severe consequences for the cyclists involved (Juhra et al., 2012). Given the growing number of road traffic accidents involving cyclists in Barcelona and throughout Spain (Gomes-Bastos et al., 2022; Martí-Belda Bertolín et al., 2016), it would be valuable for future research to investigate the potential relationship between bike theft and road accidents.

Moreover, the survey indicates that a substantial number of cyclists (17%) chose to give up cycling after experiencing bike theft. According to the official but unpublished data on bike theft in Barcelona, there were 1042 reported and recorded cases of stolen entire bikes in 2022. Applying the survey results to these data and considering the reporting rate from the survey (33%), it can be estimated that approximately 547 cyclists stopped cycling in Barcelona in 2022. This equates to an

average of roughly 1.5 cyclists per day. This is a conservative estimate, as the police only registers bikes that are uniquely identifiable in the statistics. Thus, there are more reported thefts, but since their number is not known, they cannot be considered in the. Nevertheless, it cannot be ruled out that the survey sample produced biased results. However, when compared to the literature, the number of 17% of cyclists who chose to give up cycling after experiencing bike theft are at the lower end of the spectrum (Bryan-Brown & Savill, 1997; Lehner-Lierz, 2006; Replogle, 1984).

Reporting of bike theft

The results of the survey demonstrate a high under-reporting rate in Barcelona, consistent with findings in other geographic contexts. However, it must be assumed that the data was subjected to self-selection bias, since those more motivated to report the bike theft are also more likely to respond to the survey. As a result, I suspect that the real reporting rate of bicycle theft is likely to be lower than 33%. Thus, the survey confirms the hypothesis of Vetter & Honey-Rosés of a high prevalence of under-reporting in Barcelona (2021).

The reporting process for bike thefts in Barcelona is cumbersome. It requires the victims to physically present themselves at a police station. As the survey indicates it is therefore not worth the effort for many victims. The results also show that many respondents do not believe that the police could help them, although they do not consider bicycle theft to be a trivial matter. This belief of the victims raises concerns as it indicates a lack of priority given to bicycle theft by the police. In general, the findings underscore the shortcomings of the reporting practices. However, they also show that there is an opportunity to increase reporting rates if alternative reporting methods with lower opportunity costs for victims, such as online reporting, were made available.

It is worth noting that a considerable number of the victims that stated that they had reported the thefts would not report again in the case of another theft. This subgroup provides interesting insights because it shows that the people that reported despite the opportunity costs, do reconsider their behaviour. A reason for the change is possibly that their expectations were not met, as supported by the finding that compared to the other victims, they stated more often that the “police could do nothing”. However, only few stated that they had made bad experiences. Therefore, a main undertaking to improve the situation would be to increase the returns, such as a successful recovery of their stolen bike or receiving insurance reimbursement, for victims when they report. Albeit, given that low recovery rates of bike thefts are not unique to Barcelona but prevalent in other contexts as well, it might be difficult to gain fast improvements. Hence, policymakers, local authorities and urban planners could explore other strategies to strengthen the belief that reporting theft is essential, such as reassurance call-backs after reporting (Clark et al., 2022). This aligns with the finding that reporting rates could also be improved when victims consider reporting a theft as a public duty (Tarling & Morris, 2010). Conversely, however a strong commitment to public duty could also result in not reporting bike theft as “social conscience will restrain them from wishing to waste police and other people’s time in dealing with a trivial matter (especially if there is little prospect of successfully solving the crime) when that time could be spent more profitably on more urgent or important tasks.” (Tarling & Morris, 2010, p.475).

Analysis binary logistic regression on reporting

The results of the model investigating reporting behaviour show that most of the sociodemographic factors included do not exert a significant influence on reporting behaviour. In other words, the victims’ age, gender and nationality do not appear to be

robust predictors of whether the victim chooses to report bicycle thefts to the authorities. However, the educational level of the respondents is an exception, as it is found to be a significant factor in reporting behaviour. The model suggests that victims with a master's degree or higher are 71% more likely to report bicycle theft. This finding aligns with prior research, which has demonstrated that the likelihood of reporting crime is increasing with the educational level (Tarling & Morris, 2010).

Moreover, the location of theft on district level was not found to be a significant predictor of reporting. That is in congruent with other research that found that it is not decisive where the bike is stolen from for reporting (Bryan-Brown und Savill, 1997). Similarly, the number of thefts experienced by a victim also showed no statistical significance in predicting his/her reporting behaviour. This outcome may be attributed to the model's limitation in adequately capturing the effects of repeat victimization. The experience of victims with the police, can lead to lower reporting rates, and can only be accurately captured by a covariate that indicates repeat victimization (Conaway & Lohr, 1994; MacDonald, 2001; Tarling & Morris, 2010). This tendency is reflected in the survey results, as the more theft events a victim experienced the higher is the probability that s/he states that “The police could do nothing”. However, the difference is not significant.

As expected from the results in the literature, the value of the bike emerged as the most influential predictor of reporting behaviour in the model (Table 3). Bryan-Brown and Savill (1997) also found a significant association between the value of the bicycle and reporting behaviour. However, they found this association at a level with bicycles with much higher values.

A noteworthy observation is the prevalence of relatively inexpensive bikes in Barcelona, where more than two-thirds of the stolen bikes had a value below 300 Euro.

This might be due to the fact that more expensive bikes are better protected and therefore less likely to be targeted for theft (Van Lierop et al., 2015). However, as the results of the present study show, opting for cheaper bicycles is a common strategy among cyclists to mitigate potential losses. Therefore, it is highly probable that the average value of a bicycle in Barcelona is comparatively lower than in other cities.

The model shows that relatively small changes in the value of the bike significantly impacted reporting rates (Table 3). The high sensitivity supports the hypothesis that the perceived severity of the loss is highly related to the monetary value of the bike. This might especially be true for those cyclists who cannot afford to substitute the loss. As a result, the decision to report the theft is influenced by the possibly higher returns, such as recovering a the more valuable bike or making an insurance claim, thereby shifting the balance for the victim's willingness to incur additional costs (Tarling & Morris, 2010).

The implication of the program *Weka* provides the information that with the data recollected from the study it was not possible to significantly improve the model, even when considering variables that were not based on a theoretic foundation. The low model fit ($R^2=.241$ (Cox & Snell) / $.334$ Nagelkerke) indicates that there are important factors influencing the decision to report that were not assessed.

Among these potential factors are disposing of a unique identifier for the bike, such as the frame number, having an insurance, past experiences with reporting and the perceived efficacy of the reporting. In addition, measuring the perceived seriousness of the offence and the sense of duty to report could potentially be explicative (Tarling & Morris, 2010). Furthermore, including an indicator on attitudes towards the police could provide valuable insights, as a negative attitude towards law enforcement has been found to significantly reduce the likelihood of reporting a crime (MacDonald, 2001).

Limitations

The recruitment of the respondents of the survey was based on the direct approach to cyclist on events and a web-based survey. This led to a self-selection bias especially when answering the web survey (Bethlehem, 2010). As no detailed socio-demographic data on the cycling community or victims of bicycle theft in Barcelona has been published, it is not possible to determine the extent of this bias. Another factor to take into consideration is that the survey was promoted in spaces that are mostly frequented by still practicing cyclists (such as bike stores or groups on bike theft). Additionally, these group of the population had a bigger motivation in taking the survey, as they might be more interested in the results. Both factors could have implications on the estimate of cyclist that stopped cycling, because it might not have reached many of the ex-cyclists.

As the survey only asked for the district where the theft occurred and not the location where the victims cycle, it is not possible to identify neighbourhood effects on reporting and recording crime (Warner, 2006; Wu et al., 2020). Still, understanding the social environment of the victims could provide valuable insights into cycling habits and their implications (Handy et al., 2014). Therefore, further research should take into account the neighbourhood context to contribute to a more comprehensive understanding of bike theft.

The high rate of exclusion for valid entries of stolen bike parts highlights the significance of this issue, which has received limited attention in the existing literature. Another notable occurrence that contributes to the general problem of bicycle theft is intended but not executed thefts. In the present study, these entries were not included due to the non-applicability of certain variables. However, both issues should be further investigated in future research to gain a more comprehensive understanding of the complexities of bicycle theft.

Conclusion

The present study provides evidence of the adverse effects of bike theft on cyclists in Barcelona. The findings reveal that approximately 3 individuals give up on cycling every 2 days in Barcelona, thereby resorting to potentially less sustainable modes of transportation. Moreover, behavioural changes such as where cyclists leave their bikes and the use of cheaper bikes, that increase the risk of accidents, also have indirect repercussions on the equality of cyclists in relation to other road users. Moreover, the finding that two thirds of the bike thefts are not reported explains in part why the numbers of bike theft in Barcelona are relatively low (Vetter & Honey-Rosés, 2022). Nevertheless, official data suggests that the number of bicycle thefts has increased significantly, underlining the growing scale of the problem for cyclists in Barcelona.

The survey results show that the reporting behaviour is due to a negative cost-benefit balance and most of the victims think that police cannot help after experiencing theft. These results align with findings from other studies and confirm the systematic problem that cyclists' individual efforts to prevent thefts are high, whilst the police is only taking minimal efforts (Van Lierop et al., 2015). This suggests that the study's results can contribute to the broader analysis of bicycle theft beyond the specific case of Barcelona.

In order to resolve the negative impacts of bike theft, policymakers, local authorities and urban planners must find strategies to effectively fight bike theft, reassure victims reporting and foster a safer environment for cyclists. An initial step is to update the recording practices of the local police to ensure that all reported bike thefts are accurately captured in official statistics. Currently, the numbers are artificially low, which prevents widespread recognition of the problem and limits the need for policy

makers to take action. However, without a change in the cumbersome reporting procedures, it is unrealistic to expect more victims to report if they do not see the benefit.

The binary logistic regression model demonstrated that part of the reporting rate can be explained by considering the value of the stolen bike and the educational level of the victim. It revealed that victims with a master's degree or higher were 71% more likely to report the theft than victims with a lower level of education. Furthermore, the analysis showed a strong positive correlation between the value of the stolen bicycle and the reporting rate. Thus, it could be demonstrated that the approach is useful to explain reporting behaviour and the model contributes as a foundation to more elaborate models that take into account a larger number of relevant factors. However, the findings of the presented model can already be used to adopt targeted measures to increase the reporting rate of bike theft.

Developing citizen science approaches to collect information on bicycle theft might be another avenue for gathering information on bicycle theft. The BiciZen platform launched in the late spring 2023 provides bike theft victims with an easy way to report the location, time and an image of a stolen bicycle to the bike community. This may assist victims with recovery of their bike. Furthermore, it also provides researchers with needed data that can be used to further explore the phenomenon of bike theft.

In conclusion, the findings shed light on the significant consequences of bike theft for the local cycling community in Barcelona that lead to negative impacts on cycling participation in the city. Notwithstanding, due to the limited availability of data the estimates can only provide a rough picture of the situation. Nevertheless, the effects revealed in this study underscore the obstacle posed by bike theft to the attainment of sustainable mobility in urban contexts. The urgency to address this problem requires a

paradigm shift in policy approaches, with bicycle theft being given the utmost priority to keep Barcelona at the forefront of sustainable urban planning.

Acknowledgments

The author thanks Jordi Honey-Rosés for the support and the critical feedback at all stages of the research. The author also thanks Anna Sach for her constant advice and expertise on the local cycling community. Additionally, gratitude is extended to the entire team of City Lab Barcelona for their feedback and support during the data collection. Special thanks are given to Sidra Raslan for her keen eye for aesthetics, which was of great value in creating promotional materials for the survey. The author would like to acknowledge Albert Parramon Olive and Marcel Pazos Villegas for their insights into the workings of the police database. Lastly, appreciation is expressed to Alba Estela Esteve for her accompaniment.

References

- Ajuntament Barcelona. (2022). *Vuelve la Fiesta de la Bicicleta con la tradicional Bicicletada*. Movilidad y transportes.
https://www.barcelona.cat/mobilitat/es/ctualidad-y-recursos/noticias/vuelve-la-fiesta-de-la-bicicleta-con-la-tradicional-bicicletada_1177614
- Ajuntament Barcelona. (2023). *Red ciclista/ciclable / Bicicleta*.
<https://ajuntament.barcelona.cat/bicicleta/es/red-ciclista-ciclable>
- Aldred, R., & Jungnickel, K. (2013). Matter in or out of place? Bicycle parking strategies and their effects on people, practices and places. *Social & Cultural Geography*, 14(6), 604–624. <https://doi.org/10.1080/14649365.2013.790993>
- Angeles Small, M. (2020). *Cicleabilidad en Barcelona: Análisis de la eficiencia de los carriles bici a partir de desire lines* [Master's Thesis]. Universitat Politècnica de Catalunya.
- ATM, & iermB. (2022). *Enquesta de Mobilitat en Dia Feiner 2021: La mobilitat a Barcelona*. ATM. <https://iermb.uab.cat/ca/estudi/enquesta-de-mobilitat-en-dia-feiner-2021-emef-informacio/>
- Bachand-Marleau, J., Lee, B. H. Y., & El-Geneidy, A. M. (2012). Better Understanding of Factors Influencing Likelihood of Using Shared Bicycle Systems and Frequency of Use. *Transportation Research Record: Journal of the Transportation Research Board*, 2314(1), 66–71. <https://doi.org/10.3141/2314-09>
- Bethlehem, J. (2010). Selection bias in web surveys. *International Statistical Review*, 78(2), 161–188.
- Bryan-Brown, K., & Savill, T. (1997). *Cycle theft in Great Britain. TRL REPORT 284*, 44.
- Buehler, R., & Pucher, J. (2022). Cycling through the COVID-19 pandemic to a more sustainable transport future: Evidence from case studies of 14 large bicycle-friendly cities in Europe and North America. *Sustainability*, 14(12), 7293.
- Pucher, J., & Buehler, R. (2017). Cycling towards a more sustainable transport future. *Transport Reviews*, 37(6), 689–694.
<https://doi.org/10.1080/01441647.2017.1340234>

- Chen, P., Liu, Q., & Sun, F. (2018). Bicycle parking security and built environments. *Transportation Research Part D: Transport and Environment*, 62, 169–178.
<https://doi.org/10.1016/j.trd.2018.02.020>
- Clark, B., Ariel, B., & Harinam, V. (2022). “How Should the Police Let Victims Down?” The Impact of Reassurance Call-Backs by Local Police Officers to Victims of Vehicle and Cycle Crimes: A Block Randomized Controlled Trial. *Police Quarterly*, 109861112211287.
<https://doi.org/10.1177/10986111221128751>
- Codina, O., Maciejewska, M., Nadal, J., & Marquet, O. (2022). Built environment bikeability as a predictor of cycling frequency: Lessons from Barcelona. *Transportation Research Interdisciplinary Perspectives*, 16, 100725.
<https://doi.org/10.1016/j.trip.2022.100725>
- De Ridder, J., Kok, A., van Zon, C., & Helderling, T. (2020). *Fietsdiefstalbestrijding: Deelonderzoek Amsterdam Fietsstad*. Rekenkamer Metropool Amsterdam.
<https://publicaties.rekenkamer.amsterdam.nl/fietsdiefstalbestrijdingonderzoeksrapport/fietsdiefstalbestrijdingonderzoeksrapport.pdf>
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. John Wiley & Sons.
- Gamman, L., Thorpe, A., & Willcocks, M. (2004). Bike off! Tracking the design terrains of cycle parking: Reviewing use, misuse and abuse. *Crime Prevention and Community Safety*, 6, 19–36.
- Generalitat de Catalunya. (2019). *Baròmetre de la bicicleta. 2019. Informe de resultats*.
- Gomes-Bastos, E., Pillajo-Quijia, G., ARENASRAMÍREZ, B., & Aparicio-Izquierdo, F. (2022). LA ACCIDENTALIDAD CICLISTA EN ALGUNAS CIUDADES ESPAÑOLAS. *Revista Iberoamericana de Ingeniería Mecánica*, 26(2).
- Gutierrez, C. M., & Kirk, D. S. (2017). Silence Speaks: The Relationship between Immigration and the Underreporting of Crime. *Crime and Delinquency*, 63(8), 926–950. <https://doi.org/10.1177/0011128715599993>
- Handy, S., van Wee, B., & Kroesen, M. (2014). Promoting Cycling for Transport: Research Needs and Challenges. *Transport Reviews*, 34(1), 4–24.
<https://doi.org/10.1080/01441647.2013.860204>
- Johnson, S. D., Sidebottom, A., & Thorpe, A. (2008). Bicycle Theft. *Problem-Oriented Guides for Police Problem-Specific Guides Series, No. 52*.
<https://popcenter.asu.edu/content/bicycle-theft-0>

- Kuppens, J., Wolsink, J., Van Esseveldt, J., & Ferwerda, H. (2020). *Fietsdiefstal in Nederland*. Bureau Beke.
- Lehner-Lierz, U. (2006). *Fahrraddiebstahlbekämpfung auf der politischen Agenda. Ansätze, Erfahrungen, Empfehlungen aus den Niederlanden.*[Radverkehrskongress" Fahrradparken als Instrument der Radverkehrsförderung im Spannungsfeld zwischen Anspruch und Wirklichkeit". 28. 6.-29. 6. 2006 in Münster.]. <https://orlis.difu.de/handle/difu/131019>
- Levy, J. M., Irvin-Erickson, Y., & Vigne, N. L. (2018). A case study of bicycle theft on the Washington DC Metrorail system using a Routine Activities and Crime Pattern theory framework. *Security Journal*, 31(1), 226–246. <https://doi.org/10.1057/s41284-017-0096-z>
- Li, X., Zhang, Y., Du, M., & Yang, J. (2019). Social Factors Influencing the Choice of Bicycle: Difference Analysis among Private Bike, Public Bike Sharing and Free-Floating Bike Sharing in Kunming, China. *KSCE Journal of Civil Engineering*, 23. <https://doi.org/10.1007/s12205-019-2078-7>
- Martí-Belda Bertolín, A., Bosó Seguí, P., Lijarcio Cárcel, J. I., & López Osma, C. (2016). Análisis de la siniestralidad en ciclistas 2008-2013. *XII Congreso de Ingeniería Del Transporte. 7, 8 y 9 de Junio, Valencia (España)*, 193–200.
- Mburu, L. W., & Helbich, M. (2016). Environmental risk factors influencing bicycle theft: A spatial analysis in London, UK. *PLoS One*, 11(9), 1–19.
- Melo, L. (2023, June 13). Bicycle theft and traffic nuisance: The main concerns faced by cyclists in Barcelona. *City Lab Barcelona*. <https://citylabbcn.org/2023/06/13/bicycle-theft-and-traffic-nuisance-the-main-concerns-faced-by-cyclists-in-barcelona/>
- Office for National Statistics. (2017). *Overview of bicycle theft*. <https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/articles/overviewofbicycletheft/2017-07-20>
- Peng, C.-Y. J., Lee, K. L., & Ingersoll, G. M. (2002). An Introduction to Logistic Regression Analysis and Reporting. *The Journal of Educational Research*, 96(1), 3–14. <https://doi.org/10.1080/00220670209598786>
- Pucher, J., & Buehler, R. (2017). Cycling towards a more sustainable transport future. *Transport Reviews*, 37(6), 689–694. <https://doi.org/10.1080/01441647.2017.1340234>

- Replogle, M. A. (1984). Role of Bicycles in Public Transportation Access. *Transportation Research Record*, 959, 55–62.
- Tarling, R., & Morris, K. (2010). Reporting Crime to the Police. *British Journal of Criminology*, 50(3), 474–490. <https://doi.org/10.1093/bjc/azq011>
- Van Lierop, D., Grimsrud, M., & El-Geneidy, A. (2015). Breaking into Bicycle Theft: Insights from Montreal, Canada. *International Journal of Sustainable Transportation*, 9(7), 490–501. <https://doi.org/10.1080/15568318.2013.811332>
- Venverloo, T., Duarte, F., Benson, T., Leoni, P., Hoogendoorn, S., & Ratti, C. (2023). Tracking stolen bikes in Amsterdam. *PLOS ONE*, 18(2), 1–21. <https://doi.org/10.1371/journal.pone.0279906>
- Vetter, L., & Honey-Rosés, J. (2022). Bike Theft Barcelona 2021. *City Lab Barcelona. Institut de Ciència i Tecnologia Ambientals. Universitat Autònoma de Barcelona*. https://citylabbcn.org/wp-content/uploads/2022/07/Biketheftreport_Barcelona2021_english.pdf
- Warner, B. D. (2006). Community characteristics and the recording of crime: Police recording of citizens' complaints of burglary and assault. *Justice Quarterly*. <https://doi.org/10.1080/07418829700093531>
- Wu, J., Frias-Martinez, E., & Frias-Martinez, V. (2020). Addressing Under-Reporting to Enhance Fairness and Accuracy in Mobility-based Crime Prediction. *Proceedings of the 28th International Conference on Advances in Geographic Information Systems*, 325–336. <https://doi.org/10.1145/3397536.3422205>