# Behavior of Riders of Micromobility Vehicles in New York City

Conducted by Students at Hunter College,

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## Introduction

The number of users of micromobility vehicles in urban America has grown phenomenally in the last five years. These vehicles include devices such as electric bikes (e-bikes), electric scooters (e-scooters), mopeds, and hoverboards. The surge in popularity of these vehicles results from several factors. They are eco-friendly, a convenient and relatively inexpensive form of transportation, occupy little space for parking, and are fun to ride. The coronavirus pandemic starting in 2020, during which people shunned public transit, further spurred the growth of these devices.

The proliferation of micromobility vehicles has changed the streetscape in urban areas in the United States. An array of vehicles now compete for scarce street space which was once the exclusive domain of cars and trucks. The presence of these newly-emergent forms of transportation has created an environment in which there is intense jostling for space among the different road users. At the same time, there is a rising concern about the hazards which these new forms of transportation pose to their operators and to other street users.

Underscoring this concern is anecdotal evidence about riders of micromobility devices who flout traffic rules and thus imperil themselves and others. Stories abound in the media about riders who speed, run red lights, go against the flow of traffic, and ride on the sidewalks. Typifying these stories is a newspaper article in which a woman from Queens commented, “The e-bikes, they don’t mind which way they have to go, how they go, where they go, even if they go on the sidewalk or the opposite way on the street.” The woman continued by saying, “Now when you’re crossing the street, it’s not just looking for a car, you have to look to see if any bike is coming.”[1] Another media story reported observing a number of riders on e-scooters and e-bikes across Manhattan flagrantly disobeying traffic rules. The article noted "dozens running red lights at high speeds, driving … the wrong way down streets, swerving into incoming traffic and narrowly missing pedestrians crossing at traffic lights."[2]

Aside from this anecdotal evidence, there has been little systematic study undertaken about the behavior of riders of micromobility devices. An important question which arises is to what extent does their behavior actually mirror the accounts portrayed in the media? Also, are the patterns of usage of e-bikes, e-scooters, and other devices the same or do they differ depending upon the particular type of device? These are important questions to consider at a time when the safety of these devices is being called into question and when traffic rules are being debated and formulated to keep pace with the rapid growth of these devices on city streets. The rules being considered cover a broad range of issues such as minimum age requirements, which, if any, of these devices can be ridden on sidewalks or in bike lanes, whether the wearing of helmets should be made mandatory, and whether operators should be licensed.

The present study examines the behavior of over 5,000 riders of micromobility vehicles in Manhattan. The vehicles include the following: electric bikes, electric scooters, mopeds, non-motorized Citi Bikes, and motorized Citi Bikes. The study measures the frequency with which riders of these different devices: (1) run red lights, (2) ride against traffic, (3) ride on the sidewalk, and (4) do not wear helmets. In addition to measuring the overall frequency with which riders engage in these patterns of behavior, the study examines the effects of gender, type of rider (messenger/delivery vs. other), type of street infrastructure (no bike lane, unprotected bike lane, protected bike lane), day of the week (weekday vs. weekend), and time of day on their riding behavior.

## Methodology

The results of this study are based upon observations of 5,180 riders of micromobility vehicles at 84 intersections in Manhattan. The intersections were selected from 34 different zip codes located throughout Manhattan.

All observations were carried out by Hunter College students enrolled in one of four different courses offered in the Department of Sociology. The courses consisted of two separate sections of Introduction to Research Methods, Social Statistics, and Population Dynamics. (An enumeration of the students who participated in the research is provided in the Appendix.)

Students were provided with a list of the 3 streets or avenues which had the largest number of street segments in each of the 5-digit zip codes comprising the sample frame. The students then selected an intersection with a traffic light situated at one of the 3 streets or avenues. On approximately one third of the streets or avenues on which students carried out their observations (32.1%), there was no bike lane, on more than two-fifths (42.9%) there was an unprotected bike lane, and on the rest (25%) there was a protected bike lane. Students were instructed to visit their designated site on two separate occasions. Each site was visited for a period of one hour in duration. The hours were staggered across the seven days of the week and ranged from 7:30 am to 6:30 pm.

The students were given strict methodological guidelines in carrying out their observations. Importantly, students had to choose riders of the vehicles they observed at their intersections on a random basis without employing subjective criteria and they had to remain as inconspicuous as possible.

Students were told to record observations for *every* rider of one of the 5 designated micromobility vehicles who passed them by within each hour interval with one caveat. If more than one rider passed them by in quick succession, they were to observe only those riders about whom they could accurately record data.

With respect to riding behavior, students gathered data on the following variables: (1) type of micromobility vehicle (electric bike, electric scooter, moped, non-motorized Citi Bike, motorized Citi Bike), (2) stopping at, pausing at, or running a red light, (3) going in the same direction as traffic, (4) riding on a sidewalk, (5) using an unprotected or protected bike lane, if either were applicable, and (6) use of a helmet.

In addition to these variables, students collected information of the gender of the rider and whether the rider was a messenger or delivery worker or not. Also, information about the site of the intersection was appended to each record. Site attributes included the precise street address, the 5-digit zip code, and whether the street/avenue had a designated unprotected or protected bike lane. Finally, the calendar date and time and day of the week were recoded.

All observations were carried out between April 4-26, 2022.

## Findings

### 1. Overall Frequency of Micromobility Vehicles and Profile of Riders

As shown in Table 1 below, the most common type of micromobility vehicle observed was electric bikes (49.3%), followed in descending order by non-motorized Citi Bikes (19.7%), mopeds (11.4%), electric scooters (11.3%), and motorized Citi Bikes (6.2%). In a small fraction of the cases (2.1%), the classification of the vehicle was uncertain.  A majority of riders were classified as non-commercial (52.2%), with about two-fifths of riders being labelled as commercial (40.7%) and the remainder being of indeterminate status. Among just the non-commercial riders, the most frequently observed type of wheeled device was the non-motorized Citi Bikes.

**Table 1. Type of Wheeled Device by Type of Rider**

| | | Type of rider | | | |
|---|---|---|---|---|---|
| | | Non-commercial | Commercial | Not sure | Total |
| Type of device | Electric bike | 27.2% | 76.7% | 54.6% | 49.3% |
| | Electric scooter | 17.9% | 3.0% | 10.3% | 11.3% |
| | Moped | 9.4% | 12.4% | 20.4% | 11.4% |
| | Regular Citi Bike | 32.8% | 4.9% | 7.9% | 19.7% |
| | Motorized Citi Bike | 10.1% | 1.8% | 3.0% | 6.2% |
| | Not sure | 2.6% | 1.1% | 3.8% | 2.1% |
| Total | | 2703 | 2109 | 368 | 5180 |
| | | 100.0% | 100.0% | 100.0% | 100.0% |

Overall, males predominated among the riders (86.4%). Almost all of the commercial riders were males (97.6%). Excluding commercial riders from the analysis, disparities still exist in the type of wheeled device being driven by gender (see Table 2). Close to half (45.6%) of the females were riding non-motorized Citi Bikes compared to less than a third (29.9%) of the males. Significantly, both males and females were equally represented among the electric scooter riders.

**Table 2. Type of Wheeled Device by Gender of Rider**

| | | Gender of rider | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| Type of device | Electric bike | 28.9% | 21.3% | 27.4% |
| | Electric scooter | 17.9% | 17.1% | 17.7% |
| | Moped | 10.8% | 2.2% | 9.1% |
| | Regular Citi Bike | 29.9% | 45.6% | 33.1% |
| | Motorized Citi Bike | 9.7% | 11.9% | 10.2% |
| | Not sure | 2.7% | 1.9% | 2.5% |
| Total | | 2105 | 539 | 2644 |
| | | 100.0% | 100.0% | 100.0% |

## 2. Behavior at the Traffic Light

When the traffic light was red, one-third of the riders (33%) stopped and waited for the light to turn green, a quarter (25.9%) paused and then rode thru the red light, and slightly more than a third (35%) went thru the light without stopping or pausing. Riders who did not stop or pause at the red light were disproportionately male (37.6%), commercial riders (38.9%), and electric-bike riders (41.2%).

## 3. Riding on the Street, Bike Lane, or Sidewalk

As Table 3 indicates, half of the riders (49.9%) were observed riding on the street or avenue, about 45 percent were riding on either an unprotected or protected bike lane, and just over 5 percent were found riding on the sidewalk. Noteworthy is that when an unprotected bike lane is installed on a street or avenue, less than a third (32.3%) of operators of micromobility devices ride on the street or avenue. This figure plummets even further when a protected bike lane is installed on a street or avenue (25.6%). Furthermore, the presence of a bike lane reduces the number of operators riding on the sidewalk. The figure falls from 7.7 percent where there is no bike lane to just 3.5 percent where there is a protected bike lane.

**Table 3. Location of Rider by Type of Street or Avenue**

| | | Type of street or avenue | | | |
|---|---|---|---|---|---|
| | | No bike lane | Unprotected bike lane | Protected bike lane | Total |
| Location of rider | Street or avenue | 92.3% | 32.2% | 25.6% | 49.9% |
| | Unprotected bike lane | 0.0% | 63.5% | 0.0% | 27.2% |
| | Protected bike lane | 0.0% | 0.0% | 70.9% | 17.7% |
| | Sidewalk | 7.7% | 4.3% | 3.5% | 5.2% |
| Total | | 1660 | 2220 | 1292 | 5172 |
| | | 100.0% | 100.0% | 100.0% | 100.0% |

The street location of the rider also varies noticeably by the type of wheeled device (Table 4). Not unexpectedly, the percentage of moped riders driving on the street or avenue was markedly higher than the overall percentage (77.5% vs. 49.9%). Electric scooters are disproportionately found riding on sidewalks (13.7% vs. 5.1%).

**Table 4. Location of Rider by Type of Wheeled Device**

| | | Type of Wheeled Device | | | | | |
|---|---|---|---|---|---|---|---|
| | | Eelectric bike | Electric scooter | Moped | Regular Citi Bike | Motorized Citi Bike | Total |
| Location of rider | Street or avenue | 46.9% | 52.9% | 77.5% | 40.8% | 46.4% | 49.9% |
| | Unprotected bike lane | 30.5% | 20.4% | 13.2% | 32.8% | 25.9% | 27.5% |
| | Protected bike lane | 18.6% | 13.7% | 6.9% | 21.0% | 24.0% | 17.5% |
| | Sidewalk | 4.0% | 13.0% | 2.4% | 5.4% | 3.7% | 5.1% |
| Total | | 2552 | 584 | 591 | 1015 | 321 | 5063 |
| | | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

In addition there is a difference in the location of the rider by gender (Table 5). Females are more likely to utilize bike lanes (either unprotected or protected) than their male counterparts.

**Table 5. Location of Rider by Gender of Rider**

| | | Gender of rider | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| Location of rider | Street or avenue | 51.5% | 36.1% | 49.7% |
| | Unprotected bike lane | 26.2% | 35.2% | 27.3% |
| | Protected bike lane | 17.3% | 22.5% | 17.9% |
| | Sidewalk | 5.0% | 6.2% | 5.1% |
| Total | | 4474 | 599 | 5073 |
| | | 100.0% | 100.0% | 100.0% |

There is also a relationship between the location of the rider and behavior of the rider at the traffic light (Table 6). Riders of wheeled devices who use protected bike lanes or unprotected bike lanes are far more likely than riders driving on streets or avenues to stop at a red light and wait until it turns green before continuing. The table shows that 43.7 percent of those riding in a protected bike lane and 39.3 percent of those riding in an unprotected bike lane wait until the light turns green as opposed to just 29.3 percent of those who drive on a street or avenue.

**Table 6. Behavior of Rider at Traffic Light by Location of Rider**

| | | Location of rider | | | | |
|---|---|---|---|---|---|---|
| | | Street or avenue | Unprotected bike lane | Protected bike lane | Sidewalk | Total |
| Behavior of rider | Waits until light is green | 29.3% | 39.3% | 43.7% | 35.7% | 35.2% |
| | Pauses and then goes thru light | 29.5% | 29.3% | 19.1% | 34.5% | 27.6% |
| | Runs red light | 41.1% | 31.4% | 37.2% | 29.8% | 37.2% |
| Total | | 1084 | 652 | 430 | 84 | 2250 |
| | | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

## 4. Riding in the Direction of Traffic

Approximately 8 percent of riders were observed going against the flow of traffic. There is little variability in the characteristics among those who ride in the opposite direction of traffic. As might be expected, moped riders (which can attain the fastest speeds among the micromobility vehicles studied) are the least likely to ride against traffic (5.2%).

## 5. Use of Helmets

Excluding the few instances in which a determination of helmet wearing could not be reliably made (1.4%), only a minority of riders were observed wearing helmets (43.6%). In New York city, delivery or messenger cyclists are required to wear helmets. But even among this subgroup of riders, only a slim majority (53.9%) were observed wearing a helmet.

As the data in Table 7 reveals moped riders were the most likely to don a helmet (62.1%), while both non-motorized Citi Bike riders and motorized Citi Bike riders were least likely to do so (24.9% and 22.9%, respectively).

**Table 7. Wearing a Helmet by Type of Wheeled Device**

| | | Type of wheeled device | | | | | |
|---|---|---|---|---|---|---|---|
| | | Electic bike | Electric scooter | Moped | Regular Citi Bike | Motorized Citi Bike | Total |
| Wearing a helmet | Yes | 46.4% | 42.3% | 68.7% | 27.1% | 28.3% | 43.5% |
| | No | 53.6% | 57.7% | 31.3% | 72.9% | 71.7% | 56.5% |
| Total | | 2512 | 574 | 585 | 1013 | 318 | 5002 |
| | | 100.0% | 100.0% | 100% | 100.0% | 100.0% | 100.0% |

Interestingly, there is a relationship between wearing a helmet and compliance with traffic laws. Those who wear a helmet are more likely to stop fully at a red light than their counterparts who are without helmets (41.6% vs. 26.9%). They are also slightly less likely to ride on the sidewalk (4.2% vs. 6.0%).

## Discussion

This study has uncovered a number of significant findings. A sizable percent of riders of micromobility vehicles disobey existing traffic laws. Almost two-fifths run red lights without even pausing and nearly one out of ten ride the wrong way on streets. Also a majority do not wear helmets. These findings are concerning because reckless behavior endangers the riders themselves, riders of other micromobility devices, and other road users such as pedestrians. Furthermore, not wearing protective gear can seriously imperil the physical safety of riders.

Buttressing these concerns is the surge in the incidence of injuries associated with the use of micromobility vehicles. According to figures released by the U.S. Consumer Product Safety Commission (CPSC), the number of emergency room (ED) visits resulting from the use of all micromobility devices (e.g., electric scooters, electric bicycles, hoverboards, etc.) totaled more than 190,000 between the years 2017 to 2020. During that span of time, there was a 70 percent increase.[3] Undoubtedly, this steep rise in the number of injuries is due to the growing popularity of micromobility vehicles.

Importantly, patients who ride electric bicycles and electric scooters incur far more serious injuries (as measured by hospitalization rates) than users of conventional bicycles.[4] This is not surprising since riders of e-bikes and e-scooters typically ride these vehicles at a faster pace than human-powered bicycles.

As discussed by Fang, two distinct approaches have been adopted towards reducing the incidence of injuries related to the use of micromobility devices.[4] One approach, which is accentuated in the medical literature, emphasizes the wearing of helmets, wrist guards, knee pads, etc. or what is referred to as personal protective equipment (PPE). This approach underscores the importance of personal responsibility when using these devices – avoiding risky behavior while riding and wearing protective gear. A second approach, which figures prominently in the transportation and urban planning literature, focusses on "understanding the factors that precipitate injury events." Here the emphasis is placed on creating a safe physical environment such as protected bike lanes or the re-timing of traffic lights to accommodate the needs of users of micromobility vehicles.

Lending support to the first approach are the large number of studies which demonstrate the effectiveness of helmets in reducing head injuries among cyclists riding standard bikes.[5] The low rate of use of helmets also has been associated with the high frequency of head injuries among electric scooter riders.[6]

The present study has revealed that over half of the riders observed (56.4%) were not wearing helmets. When messenger or delivery , who are required to wear helmets, are omitted from the analysis, this figure jumps to (65.4%).

The authors of this study recommend that operators of *motorized* micromobility vehicles should be required to wear a helmet. We are aware of the arguments advanced against this recommendation. Those who oppose this recommendation maintain that requiring the use of helmets will depress ridership of these vehicles which, in turn, would adversely affect the safety of all riders (the "safety in numbers" argument). Critics of this recommendation also cite data from the

Netherlands, Germany, and Denmark which have much higher levels of cycling and considerably lower levels of cycling fatality and injury rates than either the US or the UK but do not require the use of helmets.[7]

Notwithstanding these arguments, we believe that the benefits of requiring the use of helmets by motorized micromobility vehicles outweigh the gains of not making helmet use mandatory. First, while both Germany and Denmark do not have laws which require the use of helmets, both countries strongly encourage their use. Second, the cycling infrastructure and culture in the Netherlands, Germany, and Denmark are vastly different than in either the US or the UK. Since the mid-1970s, the Netherlands, Germany, and Denmark have implemented policies and programs which have made cycling a widespread, attractive, and safe mode of transportation. By contrast, the US and UK are in the embryonic stages of promoting cycling as an attractive and convenient mode of transportation. Until cycling becomes a more viable means of transportation in the US (e.g., by growing the number of dedicated bike lanes, providing ample and safe parking facilities for cyclists, introducing traffic calming measures, etc.), we believe it is prudent for riders of *all* micromobility vehicles to wear helmets. In the case of *motorized* micromobility vehicles, which can attain much higher speeds than conventional bikes and which result in more serious injuries, helmet use should be made mandatory.

The findings from the present study also highlight the critical role played by bike lanes (particularly protected bike lanes) in promoting the safety of riders of micromobility vehicles as well as other road users. First, the data reported here have shown that the installation of a bike lane dramatically reduces the number of riders of e-bikes, e-scooters, Citi Bikes, etc. who drive on the traffic lanes used by cars and trucks. The presence of a bike lane also reduces the number of riders of wheeled devices who drive on the sidewalk. By creating an exclusive space for riders of wheeled devices, bike lanes minimize contact between these riders and motorists and pedestrians, thus decreasing the likelihood of injury-producing collisions. Second, the data show that a substantially higher proportion of females than males utilize bike lanes. These data coincide with previous research demonstrating that improving the biking infrastructure helps to reduce the gender imbalance in rates of cycling.[8] Lastly, the data reported here found that operators of wheeled devices who ride in the bike lanes are more likely than others to stop at a red light and wait until it turned green before proceeding. This finding persists for both males and females. Thus, it appears that another benefit of bike lanes is that they increase compliance with existing traffic laws.

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**Appendix**

Names of Students Who Participated in the Field Research

Introduction to Social Research -- SOCIOLOGY 240, Section 1

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Camille Villapaz

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