

# Driver Perception of Food Delivery Riders

Shabna SayedMohammed<sup>1</sup>, Mohamed Kharbeche<sup>1</sup>, Wael Alhajyaseen<sup>1,2</sup>, and Mohammed AlQaradawi<sup>1,3</sup>

<sup>1</sup>Qatar Transportation and Traffic Safety Center, College of Engineering, Qatar University,  
P.O. Box 2713, Doha, Qatar

<sup>2</sup>Department of Civil and Architectural Engineering, College of Engineering, Qatar University,  
P.O. Box 2713 Doha, Qatar

<sup>3</sup>Department of Mechanical and Industrial Engineering, College of Engineering, Qatar University,  
P.O. Box 2713 Doha, Qatar

Email for correspondence: [sk2000596@qu.edu.qa](mailto:sk2000596@qu.edu.qa)

## Abstract

Motorcycles are the most preferred mode of transport in food delivery services due to their efficiency, compact size, and easy maneuverability. However, motorcycle riders are highly vulnerable to severe crashes. The perception of the drivers regarding the riders might have a significant effect on their behavior towards them. The current research assesses the drivers' perception of food delivery riders and the frequency of dangerous riding behaviors through a questionnaire survey. Even though serious violations were not given higher ratings by the drivers, it was found that risky riding behaviors were very frequent. Further, there is a predominantly negative perception towards the riders while there is a significant difference in the perception of dual-licensed drivers towards the food delivery riders. Moreover, it was ascertained that explicit communication would improve the safety of road users. The results indicate that interventions are required to improve the communications between road users and to reduce negative attitudes toward the riders

## 1. Introduction

In recent years food delivery services have seen unprecedented growth due to the boom in online commerce. Most delivery companies employ motorcycle riders due to their good mobility, high speeds, compact size, and cost-effectiveness. This worldwide upsurge in the number of food delivery riders (FDR) has been followed by an increase in the number of crashes and fatalities involving motorcyclists. A similar rise in traffic violations, crashes, and fatalities have been reported in the UAE and Qatar [1,2]. In metropolitan Australia, the injuries were reported as a major problem with one in four riders reporting being in a crash while working [3]. Most of these FDRs who were injured were not Australian citizens and most of the injuries occurred at night and on weekends. Due to the increase in the number of crashes as well as due to the higher risk-taking attitudes by food delivery riders, they have often been perceived as a risk to traffic safety [4, 5]. Even though studies have shown that traffic offenses are caused to a certain extent by the work pressure exerted on the riders, the public opinion towards them in the context of traffic safety is often negative [6, 7, 8].

The food delivery riders are often over-represented in the crash statistics, however, they might not always be at fault when there is a crash. A vast number of motorcycle crashes or near misses are caused by other drivers. Looked But Failed To See errors by the drivers might result in the right of way violations and are the most common cause of not-at-fault crashes involving motorcyclists [9, 10]. In other instances, the car drivers might not consider the vulnerability

and space utilization required for motorcycles and this might increase the crash rates or near misses [11]. This could be due to the ignorance of car drivers regarding the constraints and riding styles of motorcycles due to the physical and dynamic characteristics of motorcycles as observed by Ragot-Court et al. [12]. Moreover, the introduction of a large number of motorcycle riders into fairly homogeneous traffic as prevalent in Qatar could affect traffic safety. This is also important because of the non-adherence to lane discipline while having a heterogeneous traffic mix as pointed out by Damani et al. [13].

Video recordings of riding trips of 15 courier riders in Malaysia by Ibrahim et al. (2018) to investigate the types of crash risk factors and hazards faced by the riders observed that on average the riders encountered 5 near misses and about 30 hazardous scenarios per hour of delivery trips. Of these, about half of all the near-miss incidents were due to the driving /riding behavior of the other motorists on the roadway. The riders' behavior caused a third of the near-miss incidents and 14 % of the near-miss incidents involved cyclists and pedestrians and about 6 % were due to the obstruction of view. This suggests that the perception of other motorists towards the delivery rider needs to be studied also giving due importance to the lack of visibility of hazards like pedestrians or cyclists [14].

The drivers of other vehicles who have varying demographic characteristics, license status (dual drivers or single vehicle drivers) varying driving experience, and personality traits might have different attitudes towards the motorcyclists, especially food delivery riders. The attitude toward motorcyclists by other drivers plays a substantial role in driving behaviors and this, in turn, affects the safety of motorcyclists [15].

Crundall et al. found that, when compared to an experienced dual-driver group, all other drivers showed divergent results for negative attitude, empathic attitude, awareness of perceptual problems as well as spatial understanding toward motorcyclists [16]. Moreover, drivers owning a motorcycle license tend to be less responsible for crashes and they have less negative attitudes toward motorcyclists as studied by Magazzu et al. [17]. Interventions using driving simulators have proved to improve the safer attitude of drivers towards motorcyclists as well as perceptual knowledge and spatial understanding with regard to driving in mixed traffic conditions. Shahar et al. found that training the car driver by showing them motorcycle hazard perception clips gave better results than training using simulators. These studies help to develop innovative strategies for optimal intervention intended to improve attitudes that may reduce motorcycle fatalities [18].

It is important to analyze the drivers' attitudes to other more vulnerable road users as this might be an important factor contributing to road rage in a mixed traffic culture [19,20]. Road rage also depends upon the amount of irritation or anger induced by the riders in the drivers and this in turn also depends upon the personality and license characteristics of the drivers. Studies have shown that the trait of driver anger influenced driver aggression [21]. Moreover, road rage incidents depend upon the perception of the power imbalance between perpetrators and victims [22]. Poulos et al. found that aggressive behavior towards cyclists was the result of ignorance of cyclists' rights or road rules [23]. Similar to cyclists, who are considered a minority group and are viewed as potential risk takers and lawbreakers, food delivery riders may be also viewed negatively by drivers [24]. However, similar studies related to food delivery riders have not been undertaken. More experience with motorcyclists as in the case of dual drivers has been found to improve the attitude as well as reduce crash risk with motorcyclists in general. The attitude toward motorcyclists by single-vehicle drivers was found to be more negative and less empathetic when compared to dual-vehicle drivers [16]. Similar research conducted on the attitudes of drivers toward bicyclists revealed that people who use the car as their major mode of transport have a more negative attitude towards cyclists [25].

The cognitive compatibility of different types of road users is also different and might generate unfavorable behaviors by car drivers that might not be anticipated by motorcyclists [26]. This incompatibility is more evident at intersections [27]. Therefore, the same road situation might be interpreted by motorcyclists and car drivers differently. This could be very significant in countries like the State of Qatar where the primary modes of transport are private cars or SUVs. Until recently motorcycles were used mainly for leisure and were very few in the State of Qatar [28, 29]. The increase in the number of food delivery companies and limited movement imposed by restrictions due to the COVID-19 pandemic has resulted in more people choosing online food delivery services to order food and thus introducing a new classification of occupational powered two-wheelers on the roads of the State of Qatar. Moreover, the State of Qatar has a unique driving population consisting of a wide diversity of nationalities and cultural backgrounds and has been found to drive aggressively from previous research in the region [30, 31].

It is worth mentioning that few studies have been conducted to understand the attitudes of car drivers towards motorcyclists. However, the attitudes of drivers towards food delivery riders have not yet been studied. Most of the studies regarding food delivery riders are concentrated on understanding the behavior of the riders only focussing more on the violations performed by the food delivery riders due to time pressure and calls for stricter enforcement of traffic rules [4, 5, 7, 8, 32, 33, 34]. As implied by these studies, improving the riding behavior of the food delivery riders and forcing them to adhere to the traffic rules would help to improve the traffic safety of this highly vulnerable group of road users. However, it is also important to understand the issues related to the introduction of motorcycle food delivery riders in the traffic stream that is mainly dominated by car/SUV drivers who have little experience with motorcycle riders. This research focuses on understanding the driver perception towards the food delivery riders and estimating the most frequent riding behavior noticed by the drivers that could affect their perception toward food delivery riders. Also, it evaluates whether the perception towards food delivery riders differs based on demographic as well as emotional states and personality traits anger of drivers. It is equally important to improve the traffic safety of all road users particularly by improving the attitude and communication between the drivers and riders.

## **2. Methods**

### **2.1. Questionnaire development**

To study the perception of the drivers regarding the riding behavior of food delivery riders who used motorcycles as their mode of transport for delivery, a questionnaire with seven sections was developed. The first section consisted of screening questions to ensure that the respondent was a resident of Qatar with a valid driving license. The second section consisted of eleven questions regarding the demographic characteristics of the participants. This section was comprised of questions related to gender, age, nationality, year of receiving the Qatari driving license, total driving experience, distance traveled per day, type of vehicles used by the participant, employment type, level of education, and income level. This also included information regarding whether the participant had a license to drive both car and a motorcycle (mentioned as a dual license driver in the following sections) or had a license to drive only a car (mentioned as a single license driver in the following sections). The third section consisted of questions required to assess the frequency of unsafe riding behaviors performed by food delivery riders as perceived by drivers of other vehicles. The participants were required to rate the behavior on a five-point scale from never to always or not sure. This section included questions regarding violations like running a red light at signals, over speeding, overtaking from the right, not indicating while exiting/ turning/ changing lanes, and parking

inappropriately. It also included riding behaviors like riding recklessly, riding without a sufficient gap, cutting in front, speeding while the driver tries to pass them, filtering through slow-moving or stopped traffic and performing inappropriate maneuvers. The rest of the questions were related to lapses (not dimming the light at night, not starting up at a green signal, and riding too fast for given road conditions), safety measures (precautions taken in wet weather conditions and using reflective clothing) and drivers being unable to view the FDR either due to blind spots or due to clutter and background in the streets. The fourth section comprised of questions regarding the perception of drivers regarding motorcycle food delivery riders for specific characteristics related to having motorcycles in the traffic, like making sudden swerves, filtering through traffic, visibility, fault at crash, rule following, distraction, speeding, and the inability of car drivers to estimate the speed of approaching food delivery riders. The participants were asked to rate these questions using five-point scale from strongly disagree to strongly agree. The fifth section consists of questions that assessed the anger personality trait of the driver as well as their emotional states like stress, hurry, and driving enjoyment. The fifth section incorporated questions regarding the self-reported crash statistics of the drivers with the food delivery riders, including the injury level and who is at fault. The last section focused on questions that can improve the communication between the motorists and riders as well as the riding positions that pose potential crash risks. This section also included questions that enabled the drivers to provide solutions required to improve the shared use of roadways.

Since the topic is of interest to Qatar citizens, the data was collected by distributing the online questionnaire through social media. Moreover, it was sent via the Qatar University email system to the students, staff, and faculty members.

## 2.2. Sample Description

695 responses were collected out of which 265 either were not residents of Qatar or did not have a valid driving license in Qatar. These 265 responses were excluded and the remaining 430 responses were used for analysis. The demographic characteristics of the participants as well as their driving experience are shown in Table 1.

**Table 1: Demographic characteristics of participants**

<b>Demographic Characteristics</b>	<b>Category</b>	<b>Percentage</b>
<b>Participants</b>	Total	695
	Completed Responses	430
	Incomplete Responses	265
<b>Gender</b>	Male	68.1
	Female	31.9
<b>Nationality</b>	Middle East	51.6
	Asia	36.0
	Europe/America/Australia	4.7
	Africa	7.7
<b>Age</b>	18-25	24.9
	26-35	29.3
	36-45	21.4
	Above 45	13.3
<b>Education</b>	High school or less	10.5
	Diploma/Bachelors	59.8
	Master's/Ph.D.	29.3

<b>Employment</b>	Employed full time	64.9
	Others	34.0
<b>Total Driving Experience</b>	<2	14.7
	2-5	17.9
	6-10	25.8
	>10	41.6
<b>Distance per day</b>	Less than 10km	16.3
	10km – 30 km	40.9
	More than 30 km	42.8
<b>License status</b>	Single license driver	68.1
	Dual license driver	31.9

### 2.3. Statistical analysis

The cleaned data were analyzed using statistical methods using IBM SPSS Statistics software (version 26) software. The mean rating for the frequency of rider behavior was obtained for the cleaned data and has been included in contingency tables. The non-parametric tests conducted include Mann-Whitney’s and Kruskal Wallis tests for perception questions with demographic as well as personality factors. Further to this, post hoc tests were conducted using Dunn’s pairwise test with Bonferroni adjustment to identify the significant differences between the groups in the Kruskal Wallis test. For all analyses, a significant value of 0.05 was chosen. Spearman's correlation coefficient was estimated for the personality trait score to understand the influence of the anger trait and the perception towards the food delivery riders.

## 3. Results

### 3.1. Riding behaviors of food delivery riders

The frequency of different riding behaviors as rated by the drivers is listed in Figure 1 and Table 2. Among the most common riding behaviors that could lead to safety risks while riding the drivers found that riding very close behind without leaving a sufficient gap and weaving recklessly in and out of traffic were the most prominent ones, which are a violation of traffic rules and an error or lapse of the rider respectively. In the behaviors listed as violations, they have given a lower rating for running a red light at signals (1.325). For behaviors listed as errors or lapses, the drivers gave a higher mean rating for riding too fast for the given road conditions (3.53). Not dimming the light at night when a vehicle comes in opposite direction was given a low rating by the drivers. Food delivery riders were given a higher rating for using protective clothing while riding. However, the precautions taken while riding in wet weather conditions were given a lower rating of 2.072.

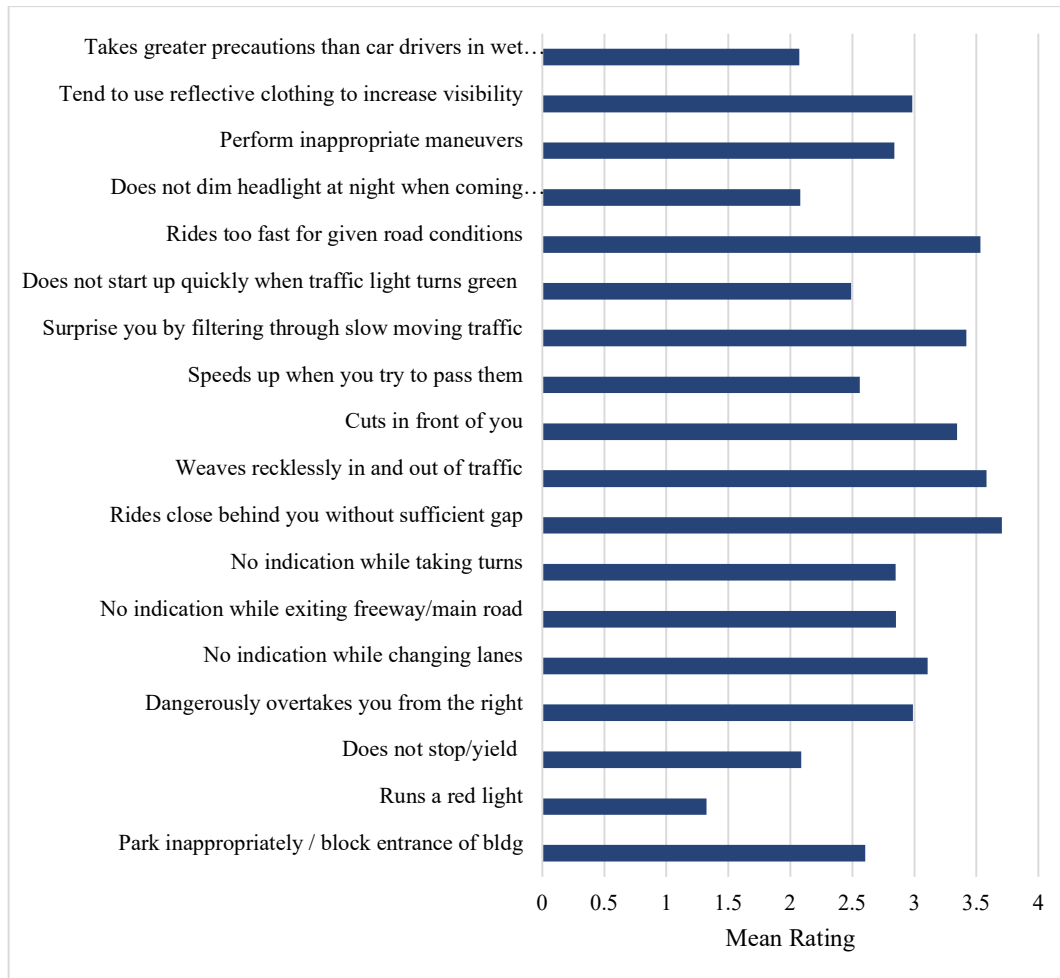
**Table 2: Frequency of riding behaviors of food delivery riders as reported by drivers of other vehicles.**

Frequency of riding behaviors	Category (%)						Rating
	Never	Rarely	Sometimes	Often	Always	Not sure	Mean Rating
<b>Violations</b>							
<b>Park inappropriately / block the entrance of the building</b>	16.74	21.63	18.60	15.35	10.00	4.88	2.61
<b>Runs a red light</b>	47.21	14.88	6.28	2.33	2.09	14.42	1.33
<b>Does not stop/yield</b>	16.74	20.93	15.58	11.63	6.05	16.28	2.09
<b>Dangerously overtakes you from the right</b>	12.33	12.79	20.47	22.33	14.42	4.88	2.99

<b>No indication while changing lanes</b>	6.74	14.19	21.63	25.58	13.72	5.35	3.11
<b>No indication while exiting freeway/main road</b>	8.14	16.05	21.86	23.26	10.00	7.91	2.85
<b>No indication while taking turns</b>	8.84	14.65	23.95	21.86	10.23	7.67	2.85
<b>Errors/Lapses</b>							
<b>Rides close behind you without a sufficient gap</b>	3.26	10.47	17.44	26.51	28.14	1.40	3.71
<b>Weaves recklessly in and out of traffic</b>	3.49	10.47	19.07	26.05	25.35	2.79	3.58
<b>Cuts in front of you</b>	7.21	14.65	21.63	21.40	20.93	1.40	3.34
<b>Speeds up when you try to pass them</b>	17.44	20.23	21.40	12.56	10.23	5.35	2.56
<b>Surprise you by filtering through slow-moving traffic</b>	4.88	7.91	19.53	23.95	24.65	6.28	3.42
<b>Does not start up quickly when the traffic light turns green</b>	13.95	25.12	23.49	12.79	6.28	5.58	2.49
<b>Rides too fast for given road conditions</b>	3.95	10.93	21.16	28.84	20.70	1.63	3.53
<b>Does not dim your headlight at night when coming toward you</b>	20.93	18.14	13.02	10.23	8.84	16.05	2.08
<b>Perform inappropriate maneuvers</b>	10.23	14.65	24.19	18.14	12.56	7.44	2.84
<b>Protective</b>							
<b>Tend to use reflective clothing to increase visibility</b>	8.14	14.65	15.58	22.79	16.98	9.07	2.98
<b>Takes greater precautions than car drivers in wet weather conditions</b>	7.21	14.19	20.23	13.26	6.28	26.05	2.07

The ratings for the frequencies of the rider behavior were further analyzed based on demographic factors (gender, age, and ethnicity) and driving characteristics (distance driven, driving experience, and license status) as shown in Table 3. However, different categories gave different ratings for the various behaviors of the riders. Females rated not indicating while turning as the most important violation while males said that running a red light is the most important violation. The lower age groups (18-25 and 26-35) found lack of indication while exiting the freeway and turning as the most important violation while the age group 36-45 gave a higher score for parking inappropriately. Those above 45 years said that running a red light was a more frequent violation. Those who drive less gave more rating scores for red light running, while those who drive more distance per day gave less frequency for red light running. Those who had less driving experience said that there is more frequent red light running. While those who had more than 10 years of experience gave fewer frequency ratings for red light, running violations and more frequently observed that the FDR was parking inappropriately. Those who had no experience in riding a motorcycle said that the most frequent violation was overtaking from the right, while the dual-licensed drivers said that running a red light had more frequency. While the single licensed drivers said that the frequency of overtaking from the right is more frequent, the dual licensed drivers said that this violation has a low frequency.

**Figure 1: Mean rating for frequency of riding behaviors**



Similarly, those who drive less distance per day observed that riders were too fast for the given road conditions while those who drive more and have more experience (>10 years) gave more prominence to weaving recklessly in and out of traffic. Those who had a dual driving license gave more scores for riding too fast for given road conditions while those who did not have a motorcycle riding license said that FDR filters through slow-moving traffic to surprise them more frequently.

### 3.2. Perception of riding behaviors of food delivery riders by drivers

The perception of drivers towards the food delivery riders was assessed using non-parametric tests to evaluate the influence of demographic factors and personality traits as shown in Tables 4 and Table 5. For gender, none of the items were perceived differently by male and female participants. Regarding the single or dual license driver categories, the difference was significant for the perception regarding the crashes being the fault of the rider, difficulty in seeing the FDRs due to parked vehicles, and the use of mobile phones being a distraction to the FDR while riding. Single drivers gave more ratings for all three items while dual riders gave less mean rank for these items. For the groups categorized by the distance driven per day, there was no significant difference for any of the questionnaire items.

Table 3: Ratings for frequency of riding behaviors of food delivery riders as reported by drivers of other vehicles based on demographics of participants.

Riding behaviors	Category																		
	Gender		Age (years)				Ethnicity				Distance Driven (km/day)			Driving Experience (years)				License status	
	F	M	18-25	26-35	36-45	> 45	ME	Asia	Er/US	Afr	<10	10-30	> 30	< 2	2-5	6-10	>10	Single	Dual
<b>Violations</b>																			
<b>Park inappropriately / block the entrance of building</b>	3.00	3.00	3.07	2.99	2.94	2.91	3.12	2.75	3.25	3.14	2.98	3.04	2.97	3.10	2.85	2.81	3.13	3.02	2.95
<b>Runs a red light</b>	2.87	3.05	2.79	3.13	2.57	3.37	2.73	3.18	3.16	3.66	3.59	3.17	2.39	3.43	2.25	3.16	2.97	2.84	3.27
<b>Does not stop/yield</b>	3.00	3.00	2.97	3.02	3.06	3.04	3.06	2.72	3.38	3.44	3.57	2.88	2.90	3.11	2.80	3.00	3.03	3.11	2.78
<b>Dangerously overtakes you from the right</b>	3.09	2.96	3.02	3.18	2.82	2.94	2.99	2.93	3.20	3.24	3.13	3.09	2.88	3.15	2.91	2.98	3.00	3.12	2.77
<b>No indication while changing lanes</b>	3.05	2.98	2.90	3.19	2.91	3.12	2.95	3.08	2.92	3.05	2.98	3.02	2.98	3.01	2.77	3.21	2.97	3.06	2.87
<b>No indication while exiting freeway/main road</b>	3.20	2.92	2.93	3.21	2.91	3.03	3.13	2.70	2.98	3.40	3.32	2.89	3.01	3.33	2.55	3.18	2.99	3.07	2.86
<b>No indication while taking turns</b>	3.28	2.89	3.08	3.15	2.90	2.96	3.00	2.99	2.99	3.03	3.37	2.90	2.99	3.36	2.81	2.96	3.00	3.06	2.86
<b>Errors/Lapses</b>																			
<b>Rides close behind you without a sufficient gap</b>	2.96	3.02	2.65	3.50	2.86	3.05	2.75	3.38	2.87	3.59	2.80	3.11	2.97	2.59	2.84	3.44	3.00	3.02	2.97
<b>Weaves recklessly in and out of traffic</b>	2.79	3.11	2.70	3.15	3.13	3.12	2.84	3.35	3.09	2.72	2.73	2.97	3.12	3.21	2.36	3.05	3.28	2.99	3.03
<b>Cuts in front of you</b>	3.12	2.95	2.86	3.31	2.76	3.12	2.98	3.06	3.00	2.90	2.71	3.14	2.97	2.91	2.96	3.12	2.98	3.03	2.94
<b>Speeds up when you try to pass them</b>	3.19	2.91	3.17	3.11	2.78	2.79	3.02	2.89	3.23	3.15	2.93	3.09	2.93	3.31	2.91	2.96	2.97	3.06	2.87
<b>Surprise you by filtering through slow-moving traffic</b>	3.07	2.97	2.94	3.13	3.12	2.82	3.02	3.02	2.76	2.99	2.75	3.06	3.02	3.06	2.78	3.05	3.05	3.13	2.77



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<b>Does not start up quickly when the traffic light turns green</b>	2.92	3.03	3.09	3.11	2.81	3.01	2.96	3.13	2.59	2.86	3.22	2.88	3.04	3.12	3.13	2.86	2.99	3.03	2.94
<b>Rides too fast for given road conditions</b>	2.98	3.01	2.58	3.32	2.92	3.52	2.89	3.31	2.69	2.70	3.24	3.22	2.76	3.22	2.53	2.90	3.24	2.96	3.09
<b>Does not dim the headlight at night when coming toward you</b>	3.07	2.97	3.24	3.08	2.85	2.81	3.10	2.64	3.20	3.66	3.19	2.94	3.00	3.12	3.05	3.02	2.94	3.13	2.72
<b>Perform inappropriate maneuvers</b>	2.96	3.02	2.87	3.22	3.04	2.85	3.06	2.78	3.27	3.33	2.82	3.03	3.03	2.74	2.89	3.10	3.06	3.11	2.77
<b>Protective</b>																			
<b>Tend to use reflective clothing to increase visibility</b>	3.08	2.96	2.87	2.90	3.20	3.15	2.93	3.08	2.68	3.36	2.93	3.08	2.94	3.19	3.05	2.77	3.06	2.92	3.18
<b>Takes greater precautions than car drivers in wet weather conditions</b>	3.30	2.85	3.17	3.03	2.94	2.67	2.87	3.05	2.92	3.49	3.24	3.02	2.91	3.57	3.37	2.96	2.71	2.81	3.24

M-Male, F-Female, ME – Middle-East, Asia – Parts of Asia other than Middle East countries, Afr – Africa, ER/US – countries in Europe, North America, Australia

Table 4: Ratings for perception of FDR as reported by drivers based on the participants' demographics.

Perception of riding behaviors	Category (%)					
	Gender		License status (Single/Dual)		Distance Driven per day	
	MW	Sig.	MW	Sig.	KW	Sig.
It is easier for FDR to make sudden swerve to avoid the crash	10852.00	0.117	12166.00	0.818	1.864	0.394
FDR is allowed to move past stationary or slow-moving traffic	12934.00	0.283	12784.50	0.585	0.046	0.977
FDR is as easy to see at night as cars	12594.50	0.520	12266.00	0.917	1.201	0.549
Other motorists should take extra care to look for FDR	11573.50	0.503	11462.50	0.253	0.727	0.695
When a car and an FDR collide, it is typically the fault of the FDR	11578.50	0.516	<b>10650.00</b>	<b>0.032</b>	0.897	0.638
FDRs are hard to see due to parked vehicles, buildings, or overgrown vegetation	11007.50	0.172	<b>10405.00</b>	<b>0.015</b>	0.625	0.731
FDR is usually difficult to spot against a 'cluttered' background (containing road signs, adverts, etc.)	11938.00	0.850	11575.50	0.332	0.269	0.874
Car drivers are typically more law-abiding than FDR	11429.50	0.413	10788.00	0.054	0.815	0.665
FDRs are usually distracted while riding due to the use of mobile phones	12712.50	0.431	<b>9312.50</b>	<b>0.000</b>	0.418	0.811
It is often difficult to estimate the speed of approaching FDR	11022.50	0.173	11011.50	0.090	1.045	0.593
FDR often rides at speeds higher than the speed limit	12447.00	0.653	13090.00	0.361	1.176	0.555

MW-Mann Whitney's Test, KW – Kruskal Wallis Test

The perception of the drivers towards the food delivery riders was also analyzed based on the emotional state of the drivers (nervousness, being in a hurry while driving, and driving enjoyment) as shown in Table 5. Being at fault during a crash, difficulty in seeing FDR due to roadside objects as well as having a cluttered background had a significant difference when compared with the nervousness /stress of the participants. The nervousness/stress rating of the participants also had a significant effect on the ratings given for the difficulty in estimating the speed of approaching FDR and perception regarding the FDR riding above the speed limit. Using post hoc test, it was assessed that those who were always stressed had a significantly higher rating than those who were never or rarely stressed for being at fault during a crash. Moreover, those who were always nervous or stressed had a higher significant mean rating when compared to those who were never nervous or stressed for difficulty in spotting the FDR as shown in the post hoc test. For difficulty in spotting the FDR in a cluttered background, those who mentioned that they were always nervous had a higher significant mean rating than the participants who were never or only sometimes nervous/stressed. Drivers who rated that they were always nervous or stressed gave significantly higher mean rank than those who were sometimes stressed for estimation of speed and riding above the speed limit.

Drivers who reported different ratings for being in a hurry did have a significant difference in their perceptions related to FDR being allowed to move past the slow/stopped

traffic, difficulty in spotting FDR at night, and also due to roadside objects and buildings. Those who said they were never in a hurry had a lower mean rating when compared to those who were sometimes or often in a hurry, for the FDR being allowed to filter past stationary or slow-moving traffic. For easiness in seeing the FDR at night, those who said that they were always in a hurry had a higher mean rating than those who said that they were rarely in a hurry. Drivers who said that they were rarely in a hurry had a significantly higher mean rating when compared to those who are sometimes in a hurry. However, those who were categorized based on their enjoyment of driving had a significant difference for being distracted by mobile phones as well as for assessing the speed of oncoming riders. The post hoc test with adjusted significance values using Bonferroni correction gave significance between the groups who said they never enjoyed driving and those who said that they sometimes enjoyed driving. Those who said that they never enjoyed driving gave a higher significant mean rating than those who enjoyed driving sometimes. However, the post hoc test for the estimation of speed did not give any significant values after the Bonferroni correction.

**Table 5: Ratings for the perception of food delivery riders as reported by drivers of other vehicles based on the emotional state of participants.**

Perception of riding behaviors	Category (%)					
	Nervous/ Stress		Hurry		Driving Enjoyment	
	KW	Sig.	KW	Sig.	KW	Sig.
It is easier for FDR to make sudden swerves to avoid a crash	9.168	0.057	8.048	0.090	5.832	0.212
FDR is allowed to move past stationary or slow-moving traffic	1.946	0.746	<b>11.913</b>	<b>0.018</b>	4.054	0.399
FDR is as easy to see at night as cars	7.563	0.109	<b>11.055</b>	<b>0.026</b>	2.796	0.592
Other motorists should take extra care to look for FDR	3.908	0.419	1.819	0.769	5.793	0.215
When a car and an FDR collide, it is typically the fault of the FDR	<b>10.584</b>	<b>0.032</b>	1.666	0.797	4.523	0.340
FDRs are hard to see due to parked vehicles, buildings, or overgrown vegetation	<b>10.628</b>	<b>0.031</b>	<b>13.875</b>	<b>0.008</b>	2.029	0.730
FDR is usually difficult to spot against a ‘cluttered’ background (containing road signs, adverts, etc.)	<b>13.295</b>	<b>0.010</b>	3.540	0.472	2.847	0.584
Car drivers are typically more law-abiding than FDR	7.043	0.134	4.178	0.382	1.263	0.868
FDRs are usually distracted while riding due to the use of mobile phones	7.122	0.130	4.766	0.312	<b>11.972</b>	<b>0.018</b>
It is often difficult to estimate the speed of approaching FDR	<b>10.437</b>	<b>0.034</b>	1.559	0.816	<b>9.517</b>	<b>0.049</b>
FDR often rides at speeds higher than the speed limit	<b>11.290</b>	<b>0.023</b>	4.902	0.298	7.620	0.107

KW-Kruskal Wallis

### 3.2. Correlation analysis on perception of riding behaviors of food delivery riders by drivers and personality trait anger of the drivers.

The spearman’s rho correlation analysis, in Table 6, about the perception and personality traits shows that there is a significant negative correlation between the perceptions

regarding the easiness of FDR motorcyclists to swerve to avoid a crash, fault of FDR during a crash, and having difficulty in spotting FDR due to parked vehicles and buildings. However, there is a positive correlation between the personality trait anger and the care required to look out for FRD when in traffic.

**Table 6: Correlation analysis for the perception of food delivery riders as reported by drivers of other vehicles based on the personality trait anger of participants.**

Perception of riding behaviors	Spearman's Rho	
	Correlation Coefficient	Sig.
Item		
<b>It is easier for FDR to make sudden swerves to avoid a crash</b>	<b>-0.132</b>	<b>0.016</b>
<b>FDR is allowed to move past stationary or slow-moving traffic</b>	0.025	0.650
<b>FDR is as easy to see at night as cars</b>	-0.105	0.057
<b>Other motorists should take extra care to look for FDR</b>	<b>0.115</b>	<b>0.037</b>
<b>When a car and an FDR collide, it is typically the fault of the FDR</b>	<b>-0.134</b>	<b>0.015</b>
<b>FDRs are hard to see due to parked vehicles, buildings, or overgrown vegetation</b>	<b>-0.112</b>	<b>0.042</b>
<b>FDR is usually difficult to spot against a 'cluttered' background (containing road signs, adverts, etc.)</b>	-0.065	0.240
<b>Car drivers are typically more law-abiding than FDR</b>	-0.079	0.153
<b>FDRs are usually distracted while riding due to the use of mobile phones</b>	-0.041	0.458
<b>It is often difficult to estimate the speed of approaching FDR</b>	-0.048	0.383
<b>FDR often rides at speeds higher than the speed limit</b>	-0.099	0.071

#### 4. Discussion

From the analysis of the frequency of riding behaviors, riding very close behind without leaving a sufficient gap and weaving recklessly in and out of traffic were perceived as the most predominant dangerous riding behaviors. The drivers have the view that the riders often do not indicate while changing lanes. However, the drivers did not give a higher rating for red-light running and dimming the light at night when a vehicle passes in the opposite direction. Although the rating for the frequency of using reflective clothing for increasing the visibility of the riders was given a higher rating, the precautions taken by riders during wet weather conditions were given a comparatively lower rating. The ratings given to these behaviors vary depending upon the demographic as well as driving experience. The different age groups rated the frequencies differently. Thus, it can be assessed that while the drivers were not able to identify that the riders were performing serious violations of traffic rules, they have identified the risky riding behaviors, which could be a crash risk for the other road users.

The motorcycle riding experience affected the perception regarding fault during a collision, visibility issues due to buildings and parked vehicles, and distracted riding while using a mobile phone. The distance driven per day and gender did not affect the perceptions of food delivery riders. However, personal traits like nervousness or stress, hurry, and driving enjoyment affected some of the perceptions. Personality trait anger also affected the perceptions regarding the easiness to make sudden swerves to avoid a crash, care required by

motorists to avoid a crash, fault of FDR in a crash, and difficulty in seeing FDR due to parked vehicles and buildings.

It is important to mention that some of the perceptions were affected by demographics, driving experience, and personality factors. Therefore, the perceptions regarding the riders are predominantly negative but some of these perceptions do not vary with the demographic or driving characteristics of the participants. In other studies, for instance, the perception of drivers who use bicycles had a less negative attitude toward bicyclists [25]. Similar results have been observed in studies conducted on the attitudes of drivers to motorcyclists [16]. Similarly, in this study, it was found that those with or without motorcycle experience had a significant difference in their perception of the riders. It is interesting to note that drivers who had zero experience in riding motorcycles felt that collision was always the fault of FDR, and they are difficult to spot when there are parked vehicles and buildings as well as being distracted by mobiles. Studies have shown that there is a social identity linked to the mode of transport, and this applies to some extent to the food delivery riders who travel utilizing motorcycles [25]. The group attachment visible for motorcyclists and dual drivers or bicyclists and drivers who ride a bicycle is observed to some extent in this study. The empathy toward the motorcyclists seen in other studies is present towards the food delivery riders in this study [6].

The current study also tries to understand the mitigation measures from the viewpoint of the drivers. The open-ended question regarding the key issues concerning food delivery riders while driving in Qatar gave insight into the main issues identified by the drivers. Most of them mentioned that they are unpredictable and the visibility issues due to other vehicles. However, from our analysis, it is evident that these problems are more prominent for those drivers who do not have motorcycle experience.

Moreover, drivers have identified that effective communication is a potential solution to reduce the crash risk between drivers and riders. Previous research has highlighted that inability of the drivers to predict the behavior of the riders is one of the causes of crashes between them. The research in this direction is focused mainly on the advancements in technologies to improve communications between vehicles by giving alerts to drivers when a crash is probable [35, 36]. Nevertheless, practical applications of these methods of communication to improve safety are still underdeveloped. However, other studies have also shown that explicit hand gestures are rarely used for communication between road users [37]. In the present study, participants agree that this form of explicit communication between the drivers and food delivery riders will help in improving the safety of road users.

## **5. Conclusion**

This paper aims to understand the frequency of dangerous riding behaviors exhibited by food delivery riders as viewed by the other drivers. The perception regarding the various driving behaviors was also assessed through a questionnaire survey and the differences in these perceptions based on the demographics, personality traits, and driving characteristics were assessed. From the results, it was found that riding very close behind without leaving a sufficient gap and weaving recklessly in and out of traffic were perceived as the most predominant dangerous riding behaviors. The drivers have the view that the riders often do not indicate while changing lanes. Personality traits like anger and nervousness or stress affected the way the fault was identified in a crash. The group attachment visible for motorcyclists and dual drivers or bicyclists and drivers who also ride a bicycle is observed to some extent in this paper. Moreover, it was ascertained that explicit communication would improve the safety of road users.

The current study is a subjective evaluation of the data as reported by the drivers. This could cause memory and recall bias. This is a limitation of the present study. Specific strategies to minimize this bias could be undertaken in future studies. The number of motorcycle food delivery riders has seen unprecedented growth in the last decade due to the growth in the online food delivery industry. This has also been coupled with an increase in the number of crashes involving food delivery riders. The overall safety of this vulnerable group of road users depends on the riding behavior improvement of the food delivery riders as well as improving the visibility of the riders and knowledge regarding the behavior of motorcycle riders.

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