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Reliability of Self-Reported Road Crash and Violation Data of Professional Drivers: The Case of Qatar

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Abstract

Having accurate road traffic crashes (RTCs) and violations data is essential for establishing more realistic crash and casualty reduction programs. Although crash data commonly suffer from issues of accuracy and comprehensiveness, these factors are often disregarded in crash analyses. This research aims to evaluate the trustworthiness of self-reported RTCs and violations data in relation to actual record data among professional taxi and bus drivers in the state of Qatar. The analysis will account for divergences across socio-demographic features and driver types. A statistical analysis i.e. Wilcoxon signed-rank test was used on the collected data (one year self-reported and two years actual data) of 566 participants, comprising 361 taxi drivers and 206 bus drivers who were employed by Karwa driving school. The results revealed significant differences between self-reported RTCs and traffic violation data and actual records. The accuracy of self-reporting also varies depending on the type of driver and across various socio-demographic categories. The variations observed in the data have significant inferences for the overall reliability of the data and their influence on crash analysis.

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1. Introduction

Road traffic crashes (RTCs) are a major global public health concern, causing numerous fatalities and injuries

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annually [1]. Preventing these crashes relies on insights from road safety analyses, which require substantial data. However, the accuracy of crash records for road safety analyses remains uncertain due to limited research in this area [2]. Nevertheless, there are indications that available crash data may have significant shortcomings, potentially distorting research findings and negatively impacting the development of crash prevention measures [3], [4].

The primary sources for RTCs data typically include official records, hospital registers, insurance companies, and self-reported data. However, the first three sources present challenges due to incomplete crash records [5]. Additionally, self-report has also a limitation of underreporting, a well-recognized issue in global road safety research [6], [7], [8] with various factors contributing to this problem. As per [2], it was noted that the problem of underreported crashes by authorities is not solely the responsibility of reporting authorities. For instance, not all crashes are reported to the police, often due to private settlements for insurance purposes. Additionally, underreporting occurs in cases of single-vehicle crashes or when injuries are not immediately apparent. Furthermore, even reported crash data are imperfect, and affected by misreporting and incompleteness. RTC data from hospital registers and insurance companies also suffer from underreporting, and the latter is often inaccessible to external parties [9]. In light of the challenges in accessing official data and their inherent limitations, as discussed in [10], many researchers have come to the conclusion that self-reports provide a more dependable alternative (e.g., [11]). This has led to a growing reliance on self-reported RTCs data for studying individual differences in traffic safety.

Self-report data, where individuals provide information about their involvement in crashes and violations, is commonly used. In the past, research on individual differences in traffic safety has heavily relied on self-reported data for crashes and violations, assuming that drivers report such information accurately. According to [12], the popularity of self-reports has increased, as evidenced by a SCOPUS literature search (October 15, 2010), which found three times more studies for the 2000-2009 period using questionnaire based data collection approach compared to 1990-1999. They also claimed that the self-report surveys are considered cost-effective and efficient for collecting large datasets. The research conducted by [5] stated that self-reported data, although appearing dependable, are inherently limited by the memory and perception biases of respondents. These can lead to inaccuracies in their reports, ultimately affecting overall data reliability. Furthermore, social desirability bias cause individuals to be reluctant in admitting risky behaviors due to societal judgment or legal consequences, resulting in underreporting and compromising data reliability for crash analysis. Additionally, the absence of objectivity due to personal interpretation, subjective judgment, and the potential for sampling bias are additional drawbacks of using self-reported data.

1.1. Is self-report road traffic crashes and violations data reliable?

A study carried out by [13] revealed that the agreement between self-report and state records for identifying crash-involved of older drivers was moderately consistent. However, significant differences emerged in between different demographics, driving intensity (mileage, number of days), and vision-related factors. They acknowledged the potential for biased association measures, especially when using self-report to identify older drivers involved in crashes. In a study by [14], the convergence of self-report and actual crash and traffic violation data over a 2-year period was assessed. The analysis revealed a lack of agreement between the two data sources. Self-report data appeared to encompass a wider range of incidents (more crashes and tickets), suggesting its advantage when capturing low severity crashes that are not reported in state records.

A research undertaken in Australia by [3], examined outcome measures in driving study for drivers aged 69 – 95, including self-reported crashes, state crash records, and on-road driving tests. Their findings from five years of retrospective and one year of prospective data indicated limited agreement between self-reports and state-recorded crashes, which in line with a prior study carried out using a population-based sample by [15]. A similar study in Canada by [16] that used a prospective data of older drivers (> 70 years), found older drivers were diligent in self-reported collisions, with substantial discrepancies reported to researchers but not authorities. A review study by [5], acknowledged the likelihood of underreporting of crashes/violations in self-reports and they recommended additional research, particularly focusing on adolescents, young adults (aged 15–30 years), and vulnerable road users (VRUs).

In summary, most of the previous studies [3], [12], [15], [16] found that there is limited agreement between self-report and the official RTCs data. The magnitude of association varies between the studies. Although these studies

provide an insight on the convergence level of the self-reported data and actual records, certain limitation of these studies such as the use of limited number of samples, most of the study focus only on the older drivers, few studies considered variations between different socio-demographics and the use of longer recall time warrants additional research. This is crucial for the reliability and the generalization of the achieved outcomes from studies that are based on self-reported crash/violation data.

1.2. Objectives

This study aims to provide an explanatory analysis to assess the reliability of self-reported RTCs and violations data for professional drivers, which are vital inputs for road safety analysis and the development of accident prevention measures in the case of Qatar. To accomplish this objective, the following sub-objectives have been identified:

- Assess the trustworthiness of self-reported data in contrast to actual records obtained from General Directorate of Traffic (Ministry of Interior) and examine how this reliability may vary among different socio-demographic factors, such as nationality, age, education level, and driving experience.
- Investigate whether there is a difference between taxi and public bus professional drivers in the reliability of self-reported crashes and violations data.

2. Methods

2.1. Participants

The data were collected from taxi and bus drivers at Karwa driving school, Qatar's primary public transportation provider, offering various services like public buses and taxis. A total of 361 professional taxi drivers and 206 bus drivers willingly participated in the survey, with random selection ensuring an equal and unbiased chance of inclusion across different individual and socio-demographic categories within the population.

2.2. The questionnaire

In this study, self-report data were gathered through a questionnaire survey in July 2021, while the actual records for the same drivers were obtained from the General Directorate of Traffic (Ministry of Interior). The questionnaire had two sections. The first section covered general information about the drivers, including age, gender, marital status, type of license, driving convictions, and the number of crashes and violations involved in the previous one year (July 2020 to June 2021). The later section inquired about their profession or education level and the number of years they had been driving since passing their test.

2.3. Data collection procedure

Taxi drivers in Qatar predominantly come from South Asian and African countries. To accommodate this diversity, the English version of the questionnaire was translated into three languages: Arabic, Hindi, and Sinhala, following the recommendation of Karwa driving school staff. Ethical approval for the questionnaire was granted by the Institutional Review Board of Qatar University. The selected respondents were divided into groups of 10 to 15 person and briefed to respond to questions anonymously. The actual data on RTCs and violations for each participant over the previous two years (2020–2021) were provided by Mowasalat Karwa Driving School through the General Directorate of Traffic (MOI).

2.4. Data analysis

A Statistical Package for the Social Sciences (SPSS 27.0) was used for statistical analyses, including descriptive statistics and a nonparametric test (Wilcoxon Signed-Rank Test) to assess the reliability of self-report data compared to actual records. The test determines if there is a statistically significant difference in the median of a dependent

variable between two related groups. The comparison was performed based on age categories, nationality, level of education and driving experience. The reliability comparison was conducted separately for road traffic crashes and traffic violations. Two years of actual RTCs and violations data were transformed into one-year data by averaging. The statistical analysis was carried out using SPSS with a significance level of $\alpha = 0.05$.

3. Results

3.1. Reliability test of road traffic crashes and violations for taxi drivers

The results of Wilcoxon signed-rank test presented in table 1 showed that the difference between self-report and actual RTCs data was statistically significant for drivers of both ethnic groups ($p < 0.001$). However, in the case of traffic violations data for drivers from Africa, the test revealed a statistically insignificant difference. For both RTCs and violations, drivers from Africa were found to have a higher likelihood of having crash records compared to Asian drivers. The data was also analyzed on a nationwide scale, and it was observed that only drivers from Ethiopia reported reliable data for both road traffic crashes ($z = -1.33, p = 0.183$) and violations ($z = -1.94, p = 0.052$). However, drivers from all other countries, even though they reported significantly different data for RTCs compared to actual data, the analysis indicated they reported reliable data for traffic violations except for drivers from Bangladesh, $z = -2.60, p = 0.009$, and Sri Lanka, $z = -2.05, p = 0.041$.

Table 2 reveals the test conducted across different age categories unveiled a statistically significant difference ($p < 0.001$) in RTCs data from the two data sources, indicating an age bias in crash records. Conversely, the results indicated no statistically significant difference in data related to traffic violations among various age groups. Similarly, when examining drivers with different education levels, the analysis uncovered a statistically significant difference ($p < 0.001$) in RTCs data, while no significant difference was observed in traffic violation data. Across all categories of general and professional driving experience, an overall variation ($p < 0.001$) in RTCs data from the two sources was noted. The results of the Wilcoxon signed-rank test within these categories suggest that most groups do not significantly contribute to the reporting bias for traffic violation data, with exceptions found in the professional driving experience categories of “5 – 10” ($p < 0.001$) and “>15” ($p < 0.05$).

Table 1. Wilcoxon signed-rank test for convergence of self-report and actual data by ethnicity and nationality (Taxi drivers)

Socio-demographic attributes	Road traffic crashes								Traffic violations					
	N	Self-report (SR)		Actual (A)		Wilcoxon statistics test		Self-report (SR)	Actual (A)		Wilcoxon statistics test			
		Mean	STD	Mean	STD	Z	p-value		Mean	STD	Mean	STD	Z	p-value
Ethnicity	African	251	0.98	1.74	2.38	1.79	-9.62	<.001	1.20	1.55	1.02	1.21	-1.33	0.185
	Asian	110	0.38	0.90	1.46	1.39	-6.90	<.001	0.41	0.88	0.70	0.93	-3.50	<.001
Nationality	Bangladesh	27	0.04	0.19	1.17	1.10	-4.00	<.001	0.30	0.72	0.74	0.91	-2.60	0.009
	Ethiopia	15	1.40	2.59	1.60	1.21	-1.33	0.183	1.60	1.99	0.63	0.44	-1.94	0.052
	Ghana	67	1.03	1.53	2.49	1.57	-5.19	<.001	1.40	1.70	1.22	1.09	-0.09	0.932
	Indian	46	0.59	1.20	1.25	1.05	-3.59	<.001	0.39	0.93	0.46	0.64	-1.09	0.278
	Kenyan	56	0.91	1.52	2.74	2.20	-5.37	<.001	1.05	1.42	1.04	1.12	-0.24	0.814
	Nepal	16	0.31	0.70	1.69	2.09	-2.79	0.005	0.31	0.60	0.59	0.61	-1.55	0.121
	Sri Lanka	21	0.43	0.68	2.12	1.58	-3.51	<.001	0.67	1.11	1.24	1.40	-2.05	0.041
	Uganda	104	0.96	1.92	2.34	1.75	-5.84	<.001	1.13	1.48	0.99	1.40	-1.55	0.122
	Other African	9	0.56	0.73	1.22	0.75	-1.76	0.079	0.56	1.01	0.39	0.55	-0.18	0.854

Table 2. Wilcoxon signed rank test for convergence of self-report and actual data by age, driving experience and education level (Taxi drivers)

Socio-demographic attributes	Road traffic crashes								Traffic violations						
	N	Self-report		Actual		Wilcoxon statistics test		Z	p-value	Self-report		Actual		Wilcoxon statistics test	
		Mean	STD	Mean	STD	Z	p-value			Mean	STD	Mean	STD	Z	p-value
Age category	25 - 35	133	0.90	1.83	1.97	1.57	6.36	<.001	1.08	1.50	0.89	1.14	-1.42	0.156	
	36 - 45	173	0.77	1.42	2.30	1.91	8.83	<.001	0.90	1.37	0.93	1.15	-1.02	0.306	
	> 45	55	0.64	1.27	1.79	1.41	4.43	<.001	0.84	1.42	0.95	1.13	-1.58	0.112	
General experience	<= 10	172	0.80	1.39	2.28	1.93	8.63	<.001	1.07	1.52	0.93	1.21	-0.90	0.37	
	11 - 20	160	0.87	1.79	2.00	1.55	7.17	<.001	0.85	1.29	0.89	1.06	-0.94	0.347	
	> 20	29	0.38	1.01	1.62	1.23	3.51	<.001	0.86	1.55	1.00	1.16	-1.44	0.151	
Professional experience	< = 5	108	0.90	1.73	2.44	2.04	6.11	<.001	1.12	1.56	0.95	1.19	-0.94	0.348	
	5 - 10	141	0.70	1.26	2.13	1.64	8.41	<.001	0.96	1.40	0.88	1.11	-8.41	<.001	
	11 - 15	74	0.92	1.92	1.66	1.36	4.00	<.001	0.91	1.48	0.95	1.22	-0.81	0.415	
	> 15	38	0.63	1.26	1.89	1.54	4.24	<.001	0.58	0.83	0.91	0.96	-2.26	0.024	
Education level	Elementary	128	0.80	1.26	2.04	1.61	6.76	<.001	1.12	1.41	0.94	1.01	-0.63	0.528	
	High school	156	0.87	1.78	2.18	1.73	7.40	<.001	0.90	1.48	0.99	1.33	-1.08	0.277	
	Higher education	77	0.64	1.56	2.04	1.91	6.17	<.001	0.79	1.33	0.74	0.90	-0.30	0.762	

3.1. Reliability test of road traffic crashes and violations for bus drivers

Table 3 demonstrates that unlike taxi drivers, bus drivers generally provide self-reported RTCs data that aligns with actual records. The exception was observed among drivers from Sri Lanka, reported no crash contributions ($p < 0.001$), raising concerns about the reliability of their self-report data and its impact on the overall significance of the Asian ethnicity ($z=-2.36, p=0.018$). The analysis of traffic violations also showed significant differences in data reported by drivers from Sri Lanka, Ethiopia, Kenya, and Nepal. Conversely, drivers from other countries did not report significant differences in violations from the actual records. Additionally, our analysis indicated that bus drivers reported lower RTCs and violations compared to actual records, except for Ghana and other Asian countries.

Table 3: Wilcoxon signed rank test for convergence of self-report and actual data by ethnicity and nationality (Bus drivers)

Socio-demographic attributes	Road traffic crashes								Traffic violations						
	N	Self-report		Actual		Wilcoxon statistics test		Z	p-value	Self-report		Actual		Wilcoxon statistics test	
		Mean	STD	Mean	STD	Z	p-value			Mean	STD	Mean	STD	Z	p-value
Ethnicity	African	74	0.43	0.95	0.35	0.51	-0.07	0.945	0.30	0.74	0.56	0.57	-3.32	0.001	
	Asian	132	0.11	0.38	0.19	0.34	-2.36	0.018	0.16	0.77	0.29	0.46	-3.76	0.000	
Nationality	Bangladeshi	18	0.06	0.24	0.14	0.29	-0.83	0.408	0.22	0.55	0.38	0.68	-0.71	0.475	
	Ethiopia	19	0.32	0.82	0.32	0.42	-0.73	0.464	0.21	0.54	0.64	0.65	-2.08	0.038	
	Ghana	10	0.50	0.97	0.40	0.46	-0.18	0.861	0.50	0.85	0.43	0.29	-0.21	0.833	
	Indian	31	0.03	0.18	0.15	0.32	-1.61	0.107	0.03	0.18	0.11	0.29	-1.56	0.118	
	Kenyan	24	0.38	0.71	0.46	0.66	-0.39	0.697	0.17	0.48	0.66	0.69	-3.27	0.001	
	Nepal	51	0.18	0.48	0.20	0.38	-0.48	0.634	0.14	0.40	0.30	0.37	-2.80	0.005	
	Sri Lanka	22	0.00	0.00	0.32	0.33	-3.28	0.001	0.00	0.00	0.49	0.59	-3.31	0.001	
	Uganda	8	0.25	0.71	0.31	0.53	-0.37	0.713	0.25	0.71	0.25	0.27	-0.69	0.492	
	Other African	13	0.77	1.54	0.19	0.33	-1.36	0.176	0.54	1.20	0.56	0.49	-0.67	0.503	
	Other Asian	10	0.30	0.67	0.10	0.21	-0.74	0.461	0.90	2.51	0.13	0.32	-0.82	0.414	

Table 4. Wilcoxon signed rank test for convergence of self-report and actual data by age, driving experience and education level (Bus drivers)

Socio-demographic attributes		Road traffic crashes							Traffic violations					
		Self-report			Actual		Wilcoxon statistics test		Self-report		Actual		Wilcoxon statistics test	
		N	Mean	STD	Mean	STD	Z	p-value	Mean	STD	Mean	STD	Z	p-value
Age category	25 - 35	37	0.30	0.66	0.28	0.42	-0.02	0.982	0.14	0.35	0.37	0.50	-2.79	0.005
	36 - 45	97	0.18	0.56	0.25	0.36	-1.71	0.088	0.13	0.39	0.42	0.49	-3.84	0.000
	> 45	72	0.25	0.78	0.23	0.47	-0.91	0.364	0.35	1.15	0.39	0.58	-2.11	0.035
General driving experience (years)	<= 10	62	0.37	0.73	0.30	0.41	-0.53	0.593	0.11	0.32	0.36	0.49	-3.60	0.000
	11 - 20	105	0.11	0.45	0.22	0.36	-2.85	0.004	0.19	0.87	0.40	0.51	-4.14	0.000
	> 20	39	0.28	0.94	0.24	0.54	-0.71	0.480	0.41	0.91	0.38	0.59	-0.26	0.794
Professional driving experience (years)	<= 5	52	0.37	0.74	0.32	0.42	-0.27	0.786	0.12	0.38	0.47	0.54	-3.66	0.000
	5 - 10	66	0.21	0.60	0.23	0.39	-0.82	0.410	0.27	1.07	0.40	0.55	-3.08	0.002
	11 - 15	41	0.02	0.16	0.22	0.32	-2.91	0.004	0.15	0.36	0.40	0.47	-2.28	0.023
	> 15		0.26	0.87	0.22	0.50	-0.63	0.528	0.28	0.80	0.26	0.49	-0.86	0.392
Education level	Elementary	108	0.16	0.25	0.46	0.38	-2.09	0.036	0.14	0.44	0.40	0.50	-4.38	0.000
	High school	75	0.29	0.82	0.27	0.47	-0.38	0.706	0.29	1.08	0.35	0.51	-2.45	0.014
	Higher education	23	0.30	0.88	0.17	0.36	-0.06	0.952	0.26	0.69	0.45	0.62	-1.23	0.220

In Table 4, the outcomes of the Wilcoxon signed-rank test, categorized by age groups, indicated no statistically significant difference in RTCs data between the two sources. However, for traffic violations data, a noticeable and statistically significant difference ($p < 0.05$) between these sources was observed. The analysis based on education levels revealed that drivers with elementary educational level tended to provide less reliable data ($p < 0.05$) for both RTCs and violations. In contrast, drivers with higher education credentials reported a number of RTC and violation incidents that closely aligned with the actual data. Drivers with less than 10 years of driving experience reported inconsistent traffic violation data with actual records ($p < 0.001$), while providing data matching actual records for RTCs. Conversely, drivers with general and professional driving experience of 11 - 20 years, reported significantly different ($p < 0.05$) RTC and violation data (refer to Table 4).

4. Discussions

The primary objective of this study was to assess the reliability of self-report data compared to the actual records of RTCs and traffic violations among professional taxi and bus drivers in Qatar considering different demographic characteristics. The study revealed that the agreement between self-reported and archived RTCs data significantly differed across various socio-demographic characteristics for taxi drivers, aligning with previous research conducted by [13] on non-professional drivers. The findings were also consistent with studies by [2], [12], and [14], all focusing on non-professional older drivers. In contrast, the analysis of traffic violations showed no significant difference between the two data sources, contradicting the findings reported by [14]. Notably, despite prior studies showing self-reported RTCs exceeding recorded crash data, the mean difference analysis (Self-report - Actual) in this study resulted in negative values, suggesting that taxi drivers tended to underreport their involvement in RTCs. This discrepancy suggests that there might be unique factors or motivations influencing how taxi drivers report their involvement in RTCs and traffic violations compared to the broader population of drivers. Conversely, the analysis on bus drivers data indicated no significant distinction between self-reported and archived RTCs data for drivers of various nationalities, except in the case of Sri Lankan drivers. This phenomenon could be attributed to the fact that, unlike taxi drivers, bus drivers' daily familiarity with the routes they traverse may lead them to easily remember the RTCs they have been involved in. The findings concerning traffic violations revealed variations in reporting based on the nationality of the drivers.

In terms of variations among different socio-demographic categories such as age, driving experience, and educational level, the study found that all categories of taxi drivers had significant difference between self-reported

and actual recorded RTCs, indicating that the bias in self-reporting RTCs did not significantly vary based on socio-demographic characteristics. However, for bus drivers, no variation was observed among different age categories, but significant differences were found in the data reported by drivers with 11 to 20 years of general driving experience and drivers with elementary education levels. Regarding traffic violations, no significant differences between self-reported and actual recorded traffic violations was identified by age, general driving experience, or education level among taxi drivers. However, significant variations were observed among taxi drivers based on their professional driving experience. Similarly, among bus drivers, significant differences were also observed in different categories of general driving experience and education level. These findings indicate that the accuracy of reported traffic violations can be influenced by factors related to education, general and professional driving experiences.

4.1. Conclusions

In summary, the study aimed to assess the trustworthiness of self-reported data revealed, disparities between self-reported data provided by drivers for RTCs and violations compared to actual records. Although no significant differences were observed in reported traffic violations among taxi drivers, a bias in reporting RTCs was evident. Conversely, bus drivers showed no significant disparities in self-reported RTCs data but had significantly different data of traffic violations. This implies that the accuracy of self-reported data may vary depending on the type of driver. Further, variations were also observed across various socio-demographic categories. In general, most professional drivers reported less RTCs and traffic violations than actual records, which can be attributed to the hesitation to acknowledge engaging in risky behaviors due to concerns about societal judgment or potential legal consequences, particularly since all the drivers in the study were foreigners. The observed significant differences in the data have important implications for the overall reliability of the achieved outcomes from the self-reported crash and traffic violation data analysis.

One of the limitations of this study was the use of a one-year self-reported RTCs and violations data. This study also compares professional drivers in the State of Qatar in a sample of only public bus and taxi drivers. The results cannot be generalized to professional drivers using other transportation modes or professional drivers outside Qatar. Accordingly, future research may focus on expanding the scope to generalize the result to professional drivers from different regions and background. Additionally, the paper focused only on assessing the trustworthiness of self-reported data in contrast to actual records. Therefore, the future studies could broaden their focus to investigate the underlying causes of disparities between self-reported and actual data.

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