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The Driver Behaviour Questionnaire as an Accident Predictor in Cross-cultural Countries in Qatar and Turkey: Global Public Health Problem

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Authors' contributions

This work was carried out in collaboration between all authors. Author AB organized study, collected data, performed statistical analysis and wrote the first draft of the article. Authors EY and EB collected data and contributed to the interpretation of the data and writing the manuscript. Authors TO and TL contributed to the interpretation of the data and writing the manuscript.

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ABSTRACT

Background: The Manchester Driver Behaviour Questionnaire (DBQ) has been extensively used as predictor of self-reported road traffic accidents. The associations between crashes and the violation and error factors of the DBQ however, might be reporting a little bias.
Aim: The current study aiming to explore the driving behaviours of Qatari's and Turkish ethnic groups and to investigate the relationship between error, violations, and lapses of DBQ and accident involvement.

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Materials and Methods: The DBQ instruments has been used to measure the aggressive driving behaviours leading to road accidents. The study included a representative sample of 2050 drivers and of whom 1,511 drivers agreed to participate (73.7%). A sample of 1,511 drivers from two ethnic groups; Qatar (620), and Turkish (891) completed the driver behaviour questionnaire and background information.

Results: There was a significant difference found between both the countries, Qatar and Turkish, in age group, education, occupation, marital status, car type, and seat belt use ($p<0.001$). The Qatari drivers scored higher on almost all items of violations, errors and lapses compared to other ethnic groups, while Turkish drivers were lower on all the items. Turkish drivers (38.9%) have been involved in more accidents compared to Qatari drivers (32.9%). In terms of cause of accidents, careless driving (31.6%) and excessive speeding (28.5%) were significantly higher among Qatari drivers ($p<0.001$). More than one third of the studied drivers of two ethnic groups were involved in traffic violations; Qatari (26.6%), and Turkish (33.3%). The use of DBQ permitted the differentiation between deliberate deviations from safe driving practices and errors and violation due to misjudgments or lapses in focus.

Conclusion: The present study revealed driver behaviour is different in two ethnic and cultural groups and scores rated differently. Qatari drivers scored higher on most of the items of violations, errors and lapses of DBQ compared to Turkish drivers in all DBQ items. The results emphasise the importance of social, socio-economic, life-style, cultural factors, general driving style and skills, differ between both countries with the respect of traffic safety.

Keywords: Driver Behaviour Questionnaire (DBQ); traffic accidents; public health; cross culture; Qatar and Turkey.

1. INTRODUCTION

It was supposed that different traffic cultures require different components of driver performance for safe driving [1-7]. Although there are some variations across cultures and within countries in driving behaviour and skills [3,4]. It is likely, on the other hand, that intrinsic variables, driver performance and the asymmetric link between perceptual-motor and safety skills and accident involvement might be shaped differently by the interaction between intrinsic and extrinsic factors in different traffic cultures.

Traffic collisions were reported as one of the 10 leading causes of death and are projected to become the third leading cause of disability adjusted life years (DALYs) lost by 2020 [8-9]. The state of Qatar, for example, had to go through a rapid transition in its socio-economic status during the last two decades. Studies conducted in Qatar [3,4,10,11] showed an increasing trend in road traffic accidents and different types of driver behaviour causing accidents among Qatari drivers. It should also be noted that the significant relationship between self-reported driver behaviours (e.g., violations) and objective measures of highway driving has been recently reported [12].

It is very well documented in literature that the Manchester DBQ [13,14] is one of the commonly used instruments in Traffic Psychology for measuring self-reported driving style and investigating the relationship between driving behaviour and accident involvement [15]. The DBQ questionnaire has three components; violations, errors and lapses [16,17,18]. Errors and violations can lead to death because they are potentially dangerous. In particular, violations have been reported to be associated with active loss-of-control as well as with speeding and parking offences [19]. Errors seemed to be the main predictor of accident involvement among elderly drivers [20].

It is well known that there are considerable differences between countries in driving behaviour and driving style [3,4,7,10,11,21-23]. Therefore, driver behaviour might vary from country to country due to potential interpersonal conflicts and traffic environment [7,21]. The current study aiming to explore the driving behaviours of Qatari's and Turkish ethnic groups and to investigate the relationship between error, violations, and lapses of DBQ and accident involvement.

2. SUBJECT AND METHODS

2.1 Participants

2.1.1 Qatari driver sample

A multi-stage stratified cluster sampling was applied by using the administrative division of the

Qatar into twenty-one Primary Health Care (PHC) Clinics of the State of Qatar. The study based on structurally interview of DBQ for randomly selected 850 Qatari both males and females aged 22 years and above during the period from January 2012 to September 2013 and 620 participated in this survey giving a response rate of 72.9% and were included in the statistical analysis.

2.1.2 Turkish' driver sample

A cross-sectional survey was conducted during the period from July, 2015 to December 2015 in the Istanbul City, Turkey. A multi-stage stratified cluster sampling design was performed. In order to ensure a representative sample of the study population, the sampling plan was stratified with proportional allocation according to stratum size. Stratification was based upon geographical districts and with 2.5% error bound, 99% confidence limits the required sample size computed to be 1,200. These were considered the target sample from the population. A representative sample of 1200 Turkish drivers was selected from both males and females aged 22 years and above. A total number of 891 Turkish drivers with 236 females and 655 males (74.3%) took part in the study and were included in the statistical analysis. All participants had driving licenses and were assured of anonymity and confidentiality. The participants filled out the Driver Behaviour Questionnaire (DBQ) and items related to drivers' driving records and demographic variables.

Although the sampling strategy was different in the two studied countries, the Driver Behaviour Questionnaire was the tool used to investigate the relationship between self-reported driving questionnaire and crash involvement in both the countries. Qatar will most likely be similar to Turkey as the two countries share the same cultural, lifestyle, socioeconomic and driving characteristics.

2.2 Measures

2.2.1 Aberrant driver behaviours

Driver Behaviour Questionnaire (DBQ) with extended violations was used to measure aberrant driver behaviours [24-26]. The DBQ questionnaire includes 10 items of ordinary violations ; 8 items of lapses, and 8 items of errors [1,3,4,10,11,22]. The DBQ questionnaire has 26 behaviours on a six-point scale (0 = never, 1= hardly ever, 2 = occasionally, 3 = quite often, 4 = frequently, and 5 = nearly all the time) and the research assistants asked the participants to indicate how often they have committed every behaviour in the previous year.

2.2.2 Demographic variables

Participants were asked to indicate their age, gender, marital status, educational level, occupation, place of living, housing conditions, driving experience, type of car, frequency of seatbelt use, reasons for not wearing seat belt, speed choice on different roads, annual mileage, traffic offences, history of accident and injury involvement.

2.3 Statistical Analyses

Student-t test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by non-parametric Mann-Whitney test. Chi-square and Fisher exact test (two-tailed) were performed to test for differences in proportions of categorical variables between two or more groups. Principal component analysis (PCA) with Varimax rotation and Kaiser Normalization was performed to examine the factor structure of the DBQ among Qataris and Turkish. Internal consistencies of each factor with percentage variance were calculated using Cronbach's alpha coefficients. The level $p<0.05$ was considered as the cut-off value for significance.

The ethical clearance was approved by the IRB of the Hamad Medical Corporation (HMC RP # 12060/12) for Qatar and IRB ethical approval by Medipol University, Faculty of Medicine (Research Protocol # 108400987-401) was obtained for Turkey.

3. RESULTS

In Qatar, the age distribution of the participants ranged from 22 to 70 years with the mean age 33.72±10.21 and the mean annual mileage (km) was 37,168±21751. Meanwhile, in Turkish, the age distribution of the participants ranged from 24 to 70 years with the mean age 33.51±10.02 and the mean annual mileage (km) was 31,842±20409 ($p<0.001$). Table 1 shows the socio-demographic characteristics of the surveyed drivers in Qatar and Turkish. There was a significant difference found between both the countries, Qatar and Turkish, in age group, education, occupation, marital status, car type, and seat belt use ($p<0.001$).

Table 1. Comparison of socio-demographic characteristics of the studied drivers in Qatar and Turkey (N=1,511)

Variables	Total N=1,511	Qatar n=620	Turkey n=891	P value
Age group				
<30	366(24.2)	174(28.1)	192(21.5)	0.006
30-39	553(36.6)	230(37.1)	323(36.3)	
40-49	377(25.0)	143(23.1)	234(26.3)	
≥50	215(14.2)	73(11.8)	142(15.9)	
Gender				
Male	1132(74.9)	477(76.9)	655(73.5)	0.131
Female	379(25.1)	143(23.1)	236(26.5)	
Education				
Illiterate	293(19.4)	147(23.7)	146(16,4)	<0.001
Primary	297(19.7)	123(19,8)	174(19.5)	
Intermediate	443(29.3)	225(36,3)	218(24,5)	
Secondary	478(31.6)	125(20,2)	353(39,6)	
Occupation				
Student	90(6.0)	26(4.2)	64(7.2)	<0.001
Housewife	242(16.0)	118(19.0)	124(13.9)	
Professional	337(22.3)	89(14.4)	248(27.8)	
Army/police	82(5.4)	37(6.0)	45(5.1)	
Business	240(15.9)	114(18.4)	126(14.1)	
Marital status				
Single	291(19.3)	148(23.9)	143(16.0)	<0.001
Married	1196(77.4)	449(72.4)	720(75.5)	
Widow	51(3.4)	23(3.7)	28(3.1)	
Driving experience				
<2 years	194(12.8)	70(11.3)	124(13.9)	0.193
2-5 years	385(25.5)	160(25.8)	225(25.3)	
5-10 years	355(23.5)	160(25.8)	195(21.9)	
>10 years	577(38.2)	230(37.1)	347(38.9)	
Car type				
4 WD / Jeep	255(16.9)	138(22.3)	117(13.1)	<0.001
Small car	862(57.0)	327(52.7)	535(60.0)	
Heavy truck	127(8.4)	45(7.3)	82(9.2)	
Small Van	216(14.3)	97(15.6)	119(13.4)	
Motorcycles	51(3.4)	13(2.1)	38(4.3)	
Annual mileage km	34,027±21126	37,168±21751	31,842±20409	<0.001
Seat belt use				
Never	407(26.9)	191(30.8)	216(24.2)	
Seldom	254(16.8)	131(21.1)	123(13.8)	<0.001
Frequently	422(27.9)	160(25.8)	262(29.4)	
Always	428(28.3)	138(22.3)	290(32.5)	

Table 2 compares the road traffic accident characteristics and nature of collision among studied drivers of two ethnic groups. Turkish drivers (38.9%) have been involved in more accidents compared to Qatari drivers (32.9%). In terms of cause of accidents, careless driving (31.6%) and excessive speeding (28.5%) were significantly higher among Qatari drivers (p<0.001). More than one third of the studied drivers of two ethnic groups were involved in traffic violations; Qatari (26.6%), and Turkish (33.3%).

Table 3 shows the DBQ mean scores for each of the individual items relating to violations, errors and lapses among Turkish and Qatari's driver. Qatari drivers scored higher on all violation items with a significant difference in comparison to the Turkish drivers group. The two most common violations were similar in Qatari (2.25 & 2.24), and Turkish (1.63 & 1.62) drivers which were "become impatient with a slow driver in the outer lane and overtake on the inside lane" and "sound your horn to indicate your annoyance". Turkish drivers had the lowest mean score for all error

items and they were significantly different from Qatari's ethnic group. The most common item of lapses was different in both ethnic groups that "switch on one thing, when you meant to switch on something else". Qatari drivers had the significantly highest mean score (1.59) of lapses items compared to the Turkish drivers in all items.

Table 4 shows the three factor solution of DBQ items including violations, errors and lapses over the two countries in Qatar and Turkish drivers. "Disregard the speed limits on a motorway", "disregard the speed limit late at night and early in the morning", "cross a junction knowing that the traffic lights have already turned red" and "drive especially close to the car in front as a signal to its driver to go faster" were the items which loaded highest on violation in both countries.

4. DISCUSSION

The results showed that the factorial agreement for agressive driver behaviour was common among Qatari's and Turkish drivers, where the lack of social tolerance and interpersonal aggressive violations seem to be important characteristics of driving skill and style. Also, driver behaviour might be mediated the

Table 2. Comparison of road traffic characteristics and nature of collision among surveyed drivers in Qatar and Turkey (N=1,511)

Variables	Total N=1,511	Qatar n=620	Turkey n=891	P value
Ever had accident				
Yes	551(36.5)	204(32.9)	347(38.9)	0.160
No	960(63.5)	416(67.1)	544(61.1)	
Cause of accident: §				
Careless driving				0.001
Yes	550(36.4)	196(31.6)	354(39.7)	
No	961(63.6)	424(68.4)	537(60.3)	
Excessive speeding				
Yes	386(25.5)	177(28.5)	209(23.5)	0.026
No	1125(74.5)	443(71.5)	682(76.5)	
Alcohol/Drug				
Yes	75(5.0)	15(2.4)	60(6.7)	<0.001
No	1436(95.0)	605(97.6)	831(93.3)	
Traffic violation				
Yes	461(30.6)	165(26.6)	296(33.3)	0.006
No	1048(69.4)	455(73.4)	593(66.7)	
Injury				
Yes	457(30.2)	166(26.8)	291(32.7)	0.014
No	1054(69.8)	454(73.2)	600(67.3)	
Accident location				
Main Road	340(24.7)	66(11.6)	274(33.9)	<0.001
Side road	722(52.4)	304(53.3)	418(51.7)	
At the cross road	68(4.9)	43(7.5)	25(3.1)	
Roundabout	187(13.6)	115(20.2)	72(8.9)	
Traffic Light	35(2.5)	23(4.0)	12(1.5)	
Alley	27(2.0)	19(3.3)	8(1.0)	
Nature of collision				
Pedestrian	256(21.1)	87(15.3)	169(26.3)	<0.001
Head on collision	521(43.0)	243(42.6)	278(43.2)	
Angle collision	115(9.5)	49(8.6)	66(10.3)	
Collision when reversing	73(6.0)	43(7.5)	30(4.7)	
Rear-end collision when following	55(4.5)	34(6.0)	21(3.3)	
Side collision	25(2.1)	14(2.5)	11(1.7)	
Hit parked vehicle	11(0.9)	7(1.2)	4(0.6)	
Hit fixed object	33(2.7)	21(3.7)	12(1.9)	
Overturn skid	72(5.9)	40(7.0)	32(5.0)	
Red light violation	17(1.4)	8(1.4)	9(1.4)	
Crash road sign	35(2.9)	26(4.2)	11(1.7)	

Table 3. Means and standard deviations of items of Driver Behaviour Questionnaire (DBQ) among drivers in Qatar and Turkey (N=1,511)

Variables	Qatar n=620	Turkey n=891	p value
Violations			
Drive especially close to the car in front as a signal to its driver to go faster or get out of the way	1.64(1.65)	1.20(1.41)	<0.001
Cross a junction knowing that the traffic lights have already turned red	1.37(1.53)	0.83(1.33)	<0.001
Disregard the speed limits late at night or early in the morning	1.99(1.68)	1.23(1.48)	<0.001
Disregard the speed limits on a motorway	1.76(1.62)	1.20(1.49)	<0.001
Have an aversion to a particular class of road user and indicate your hostility by whatever means you can	1.45(1.52)	1.07(1.30)	<0.001
Become impatient with a slow driver in the outer lane and overtake on the inside (right) lane	2.25(1.74)	1.63(1.57)	<0.001
Get involved with unofficial 'races' with other drivers	1.78(1.70)	1.01(1.39)	<0.001
Angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind	1.73(1.58)	1.23(1.42)	<0.001
Sound your horn to indicate your annoyance to another driver	2.24(1.58)	1.62(1.44)	<0.001
Stay in a motorway that you know will be closed ahead until the last minute before forcing you way into the other lane	1.48(1.47)	1.18(1.44)	<0.001
Errors			
Attempt to overtake someone that you hadn't noticed to be signalling a left/right turn	1.18(1.41)	1.11(1.36)	0.280
Miss 'Give Way' signs and narrowly avoid colliding with traffic having right of way	1.31(1.45)	0.99(1.31)	<0.001
Fail to notice that pedestrians are crossing when turning into a side street from a main road	1.25(1.41)	0.98(1.29)	<0.001
Queuing to turn right/left onto a main road, you pay such close attention to the mainstream of traffic that you nearly hit the car in front	1.52(1.56)	1.18(1.74)	<0.001
On turning right/left nearly hit a two wheeler who has come up on your inside	1.43(1.47)	1.11(1.42)	<0.001
Fail to check your rear-view mirror before pulling out or changing lanes, etc	1.36(1.35)	1.14(1.32)	<0.001
Under estimate the speed of an oncoming vehicle when overtaking	1.48(1.42)	1.16(1.36)	<0.001
Apply sudden brakes on a slippery road, or steer wrong way in a skid	1.35(1.24)	1.11(1.28)	<0.001
Lapses			
Get into the wrong lane when approaching a roundabout or a junction	1.06(1.31)	0.85(1.15)	0.002
Misread the signs and exit from the roundabout on the wrong road	1.29(1.60)	1.05(1.46)	0.005
Forget where you left your car in the car park	1.06(1.28)	1.10(1.25)	0.260
Hit something when reversing that you had not previously seen	1.44(1.37)	1.26(1.26)	0.025
Attempt to drive away from the traffic lights	1.59(1.40)	1.20(1.35)	<0.001
Switch on one thing, such as headlights, when you meant to switch on something else, such as wipers	1.55(2.03)	1.33(2.06)	0.007
Intending to drive to destination A and, you 'wake up' to find yourself in destination B, because the latter is your more usual destination	1.28(1.41)	1.09(1.27)	0.011
Realize you have no clear recollection of the road along which you have been travelling	1.41(1.55)	1.06(1.30)	<0.001

relationship between culture and accidents. Although, in both countries Qatari's and Turkish drivers a risky general driving style was mostly related to being young and male, this is consistent with a pervious reported studies [3,4,5,6,21-23].

Consistently with previous studies [19,24,25] the frequencies of the DBQ responses were, in general, between "never" to "hardly ever" and rarely "occasionally" both in Qatar and Turkey. However, the scores of Qatari and Turkish DBQ items were, in general, higher than the scores

Table 4. Three-factor solution of the DBQ items, cronbach's alpha coefficients, and variance of the DBQ subscales across Qatar and Turkey (N=1511)

		Errors		Violations		Lapses	
		Qatar	Turkey	Qatar	Turkey	Qatar	Turkey
V	Drive especially close to the car in front as a signal to its driver to go faster or get out of the way			.65	.60		
V	Cross a junction knowing that the traffic lights have already turned red			.60	.47		
Ov	Disregard the speed limits late at night or early in the morning			.59	.65		
Ov	Disregard the speed limits on a motorway			.73	.71		
Ov	Stay in a motorway that you know will be closed ahead until the last minute before forcing you way into the other lane			.55	.50		
Ov	Become impatient with a slow driver in the outer lane and overtake on the inside (right) lane			.56	.57		
Ov	Get involved with unofficial 'races' with other drivers			.62	.59		
Av	Angered by another driver's behavior, you give chase with the intention of giving him/her a piece of your mind			.60	.61		
Av	Sound your horn to indicate your annoyance to another driver			.48	.45		
Av	Have an aversion to a particular class of road user and indicate your hostility by whatever means you can			.59	.55		
E	Fail to notice that pedestrians are crossing when turning into a side street from a main road	.71	.48				
E	Queuing to turn right/left onto a main road, you pay such close attention to the mainstream of traffic that you nearly hit the car in front	.66	.65				
E	On turning right/left nearly hit a two wheeler who has come up on your inside	.56	.62				
E	Fail to check your rear-view mirror before pulling out or changing lanes, etc	.51	.63				
E	Under estimate the speed of an oncoming vehicle when overtaking	.54	.60				
E	Apply sudden brakes on a slippery road, or steer wrong way in a skid	.49	.65				
L	Get into the wrong lane when approaching at roundabout or a junction	.53				-	-
L	Misread the signs and exit from the roundabout on the wrong road	.56				-	.52
L	Forget where you left your car in the car park					.77	.75
	Hit something when reversing that you had not previously seen					.69	.69
L	Intending to drive to destination A and, you 'wake up' to find yourself in destination B, because the latter is your more usual destination					.61	-
L	Realize you have no clear recollection of the road along which you have been travelling					.53	-
	Eigen values	3.5	3.1	3.9	3.6	2.2	2.6
	Cronbach's alpha	0.73	0.76	0.81	0.80	0.70	0.67
	Variance (%)	13.8	12.2	15.2	14.2	8.7	10.0

Principal component analysis; Varimax rotation with Kaiser Normalization. Factors extracted based on Eigen value>1. (Factor loadings below .40 were omitted for the sake of clarity). Av=aggressive violation, ov=ordinary violations, e=error, L=lapse

of British [14], Australian [25], Finnish and Dutch [18] and Greek and Turkish [21] drivers. Qatari drivers scored higher on all DBQ items than Turkish drivers, except for four DBQ items (see

Table 1). However, the factor structure and reliability scores of the DBQ seem to require some 'culture-specific' items as well, especially in Turkey. In addition, the results of the present study clearly support the idea [21] that external factors (e.g., traffic context with the lack of enforcement and applied rules, and congestion etc.) could sometimes be much more important than internal factors (e.g., cognitive mechanisms, attention etc.) for shaping the factor structure of DBQ. For instance, Istanbul (very congested network in Qatar) might have significantly congested traffic as compared to Istanbul in Turkey. In addition, traffic laws and their application (i.e., traffic fines) in Arab Gulf countries might not be as standardized as in European countries. It was also the first time among Turkish drivers that the DBQ factors were weakly related to accident involvement. It seems that Turkish drivers just drive without being aware of the differences between the types of driver behaviours and their possible consequences in traffic. Thus, the differentiation of errors, lapses, and violations did not emerge among Turkish drivers well and onsite with th previous reported studies [3,4,5,6,714,18,21-26].

In contrast to general findings in literature, reporting that women may commit violations less frequently than men and commit more errors than male [14,24,25], there was no significant difference between male and female Turkish drivers on DBQ items except "Hitting something when reversing". Furthermore, none of the DBQ factors was related to accident involvement in Istanbul, Turkey. However, errors, lapses, and aggression-speeding violations factor were considered could be predictive of accident involvement in Qatar. In particular, errors appeared as the most critical factor in accident involvement.

5. METHODOLOGICAL LIMITATIONS

The data were based mostly on drivers' self-reports of behaviour and no observations were made. Although, several studies have been reported that self-reports of driving may correspond well to actual driving behaviour. It is also possible that some respondents could misslead their answers about positive and aggressive driving. Furthermore, actually, the measurement of accident and injuries involvement were based on a self-report of all past accidents. Therefore, some respondents may have underestimated the number of accidents in which they had been involved.

6. CONCLUSION

The present study revealed that driver behaviour is different in two ethnic and cultural groups and scores rated differently. Qatari drivers scored higher on most of the items of violations, errors and lapses of DBQ compared to Turkish drivers in all DBQ items. The results emphasise the importance of social, socio-economic, life-style, cultural factors, general driving style and skills, differ between both countries with the respect of traffic safety.

CONSENT

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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