Article

An Integrated Approach to the Spanish Driving Behavior Questionnaire (SDBQ) in the City of Cuenca, Ecuador

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Abstract: Traffic collisions are the seventh leading cause of death in Ecuador, with reckless driving being one of the main causes. Although there are statistical data on traffic crashes, there has not yet been a comprehensive investigation of the causes. Therefore, the main objective of this study is to investigate unsafe driving behavior using a modified version of the Spanish Driving Behavior Questionnaire (SDBQ) adapted for Ecuador. The 34-item SDBQ we used has four main dimensions: lapses, errors, violations, and aggressive driving. To apply the SDBQ, a stratified random probability sample of 470 drivers with valid driver's licenses aged 18–69 was used. Of the drivers, 68.8% were male, while 33.2% were female. We used a chi-square test and descriptive statistics to analyze the data for the SDBQ application items. Finally, four generalized linear Poisson models were used. The results show that taxi drivers have the highest scores on three of the four main dimensions of the SDBQ and male drivers are more likely than female drivers to cause traffic accidents. Drivers are also more likely to cause traffic accidents if they drive more hours per day. This research is the first of its kind to analyze driver behavior-based solutions in Ecuador to reduce traffic accidents. The error factor is the most critical outcome of dangerous behavior in the city of Cuenca. The SDBQ aims to foster a culture of safety and sustainability by promoting road safety measures through legislation and traffic regulations.

Keywords: driver behavior questionnaire; traffic collisions; drivers; aggressive driving; traffic law violations

1. Introduction

Road traffic collisions (RTCs) are the ninth leading cause of death in the world [1]. Prior investigation of each region and country is necessary to reduce this preventable rate, as generalizing driving conditions and causes of road crashes is not possible. Factors contributing to RTCs vary between countries. Cyclists, pedestrians, and motorcyclists comprise approximately half of all road traffic fatalities in European countries [2]. In the 15–29 age group, road traffic crashes are the leading cause of death. However, in regions such as South America and especially Ecuador, the factors causing road accidents and the groups causing them differ. Therefore, the same statistics cannot be used as in Europe.

According to a report by the Pan American Health Organization, the Americas region is responsible for about 11% of global traffic crash fatalities, which equates to about 155,000 lives lost each year [3–5]. Drivers who have been involved in RTCs account for 34%.

This is an alarming number, and unlike in regions such as Europe, where the rate of drivers engaged in RTCs is decreasing, in every Latin American region, especially Ecuador, it is increasing. The National Institute of Statistics and Census (INEC) registered 73,341 deaths in Ecuador, with 3142 directly associated with RTCs. Therefore, among the leading causes of death in Ecuador, RTCs rank seventh [6,7].

Consequently, Ecuador and other countries in the region face significant challenges in reducing RTCs. The challenges start with a fundamental analysis of the causes, their components, and possible solutions. The lack of comprehensive research and diagnostics backed by empirical data and objective analysis makes it difficult to work under uncertainty and probably with statistical data that are not specific to the country. The lack of data makes it difficult to accurately determine the causes of road crashes, especially among drivers, who are primarily responsible. As a result, it is clear that further research and analysis are needed to understand these problems better and find more effective solutions.

The Driving Behavior Questionnaire (DBQ) is a tool used to investigate the causes of RTCs. This type of questionnaire is used worldwide and allows for extensive research into the causes, factors, and possible solutions to RTCs. Various regions of the world have used this DBQ and adapted it to address the problems of RTCs in each region. Therefore, the SDBQ is a variation of the DBQ that applies to Spanish-speaking countries. As mentioned above, these adaptations include driver licensing types, driving-related cultural issues, and local characteristics. These studies emphasize that human behavior, especially driver behavior, is crucial for analyzing the complex sequence of events that can theoretically explain RTCs. However, it is necessary to adapt this modification to the Ecuadorian setting due to country-specific characteristics such as driver licensing, human aspects such as the authorization to drive for people with disabilities in Ecuador, and vehicle types that vary by region. By encouraging practices such as efficient driving and road safety enforcement, the SDBQ seeks to promote a culture of safety and sustainability. This not only improves road safety but also contributes to the city's sustainability goals that focus on the Mobility Plan, creating a safer and greener urban environment.

To carry out research on RTCs in Ecuador, it is essential to achieve the objectives outlined in this article:

- Carry out a comprehensive analysis of the DBQ in order to gain an understanding of its influence on reducing road traffic accidents, distinguish the advantages and disadvantages that are mentioned in the existing literature, and ascertain whether or not it is suitable for addressing this matter.
- In order to create a Driver Behavior Questionnaire (DBQ) specifically for Ecuador, it is crucial to scientifically modify the current DBQ structure to accurately represent the distinct driving habits and circumstances in Ecuador. This research can be an innovative scientific contribution to Ecuador and greatly improve traffic safety programs by offering data-driven insights to reduce road accidents.
- To ascertain the outcomes of the SDBQ for Ecuador, it is imperative to employ sophisticated statistical techniques for identifying the primary causes of road accidents within the nation. By employing this scientific methodology, which entails meticulous data analysis, the SDBQ is able to precisely mirror the unique driving conditions and behaviors in Ecuador. Through the implementation of scientific modifications to the questionnaire in accordance with the findings, the revised SDBQ will enhance its efficacy as a diagnostic and intervention instrument for identifying and mitigating the primary causes of road safety issues. Consequently, this will facilitate the development of road safety interventions that are more focused and successful.

This article is divided into several sections to achieve the intended objective: Section 2 reviews the existing literature on the DBQ and SDBQ. Section 3 clearly explains the methodology used in this study. Section 4 presents the results. Section 5 examines the results for interpretation by comparing and contrasting them with the available literature. Finally, the Conclusion section summarizes the main findings and proposes future research.

2. Literature Review

Two important parts structure the literature: The first part focuses on analyzing the DBQ, which refers to the investigation of traffic psychology, ranging from errors and violations to aggressive driving behavior. Countries adapting to cultural differences have applied the DBQ. The second part of the literature is on the Spanish Driver Behavior Questionnaire (SDBQ), an adaptation of the original DBQ for the Spanish-speaking population, adjusting for traffic regulations, driving culture, and other factors specific to Spanish-speaking countries.

The DBQ is used to identify unsafe driving behaviors [8]. These behaviors include poor driving behavior, lack of concentration, aggressive attitudes, and infractions or violations of traffic regulations [9,10]. In line with the search for risk factors in road traffic crashes, the use of the DBQ provides data to identify the main characteristics that separate cautious drivers from high-risk drivers [11–13]. In this way, road safety prevention strategies can be developed, and the different elements involved in road crashes can be understood.

The DBQ is a tool for assessing human factors in driving, particularly those related to unsafe behavior [14]. This instrument has been applied worldwide, including countries such as Qatar [15], the United Arab Emirates [16], United States [17], China [18], Australia [19], Greece [20], Netherlands [21], Spain [22], France [23], New Zealand [24], Turkey [25], and the United Kingdom [26]. However, the items of the DBQ vary according to the country to which they are applied, but all address specific relevant cultural variables. Differences in age, gender, driving experience, vehicle type, educational programs, and mental health problems may be part of these. In addition, the sociodemographic characteristics of drivers and their crash experiences are recorded with the DBQ [27]. An abbreviated version of the DBQ, known as the SDBQ, has proven useful in predicting individual differences in traffic crashes. In its original version, the DBQ has a total of 126 items. However, the short version, adapted to the SDBQ, consists of 34 items.

The SDBQ is an instrument for assessing and analyzing driver behavior. It was developed by translating and adapting the items with specific adjustments to reflect the unique characteristics of the Spanish population [28]. Modifications and adaptations focused not only on linguistic translation but also on cultural contextualization [29]. This allowed for greater accuracy in the interpretation of responses and a more accurate assessment of driver behavior [30–32]

In recent years, the SDBQ has been applied in research in Spanish-speaking populations, for example, Colombia [33], Mexico [34], Spain [35], Brazil [36], and Argentina [37]. For this purpose, the four dimensions of assessment shown in Figure 1 have been used.

Figure 1. Reduced-scale dimensions of SDBQ.

The versatility and applicability of the SDBQ in different Spanish-speaking environments demonstrate that the questionnaire is a valuable tool in the fields of traffic psychology and road safety. The collaboration and effort of experts who have come from different countries to adjust and apply the SDBQ testify to the continued commitment of the scientific community to improving the understanding of human behavior on the road, which is fundamental to the development of policies and practices that improve transportation safety and efficiency throughout the Spanish-speaking world [38].

Research in driver behavior has revealed multiple factors that contribute to RTC situations. According to this survey, male drivers are more likely to break traffic laws, which increases their risk of being involved in crashes; however, the validity of this claim may vary depending on the country [39].

In addition, studies have underlined the importance of human factors in traffic accidents. They emphasize that human aspects play a key role in these events while concluding that human error is involved in most road traffic accidents [40]. These results underline the importance of a detailed analysis of the various risk forms, including psychological factors and driving skills.

The SDBQ is a valuable tool that allows a more detailed approach to studying human error and RTCs since it allows a more thorough approach to everyday driving. Age-related studies have established that young, middle-aged drivers have a lower risk of being involved in road crashes [41]. This points to the need to assess the importance of age in evaluating and avoiding RTCs.

This literature review has demonstrated that the SDBQ is a proficient instrument for evaluating the dangerous conduct of drivers. Since the inception of research on RTCs, it has been utilized and modified in numerous Spanish-speaking nations. Countries such as Ecuador, characterized by a high rate of RTCs, exhibit a notably low prevalence of comprehensive research in this domain. The absence of such research highlights the significance of conducting an initial investigation within the country, utilizing the SDBQ tailored to the specific context of Ecuador. This endeavor aims to enhance comprehension of local issues and facilitate the advancement of road safety.

3. Method

The developed method consists of an explanation of the instrument, participants, and process. The objective is to measure the impact of unsafe driving behaviors, taking the daily driving hours, which are present in almost all items of the SDBQ, as an independent variable.

3.1. Instrument

The SDBQ was applied, consisting of four items: infractions, aggressive driving, lapses, and errors [42], composed as follows: 7 items of infractions or violations, 7 items of errors, 7 items of aggressive driving, and 7 items of lapses focused on answering ("how often had been related to the situations or behaviors mentioned in the SDBQ").

The participants were evaluated on a 1–6-point scale (1 = never, 2 = almost never, 3 = rarely, 4 = sometimes, 5 = frequently, and 6 = always) [43]. In addition, drivers were asked to include information on their gender, age, marital status, educational level, license type, driving hours, seat belt use, alcohol consumption, and, finally, RTCs in the last three years [44,45].

3.2. Participants

This research was based on a stratified random sample [46] which was divided into different strata according to the age variant of the drivers [47].

The sample included 470 drivers between 18 and 69 years of age with a valid driver's license. The drivers were randomly selected in Cuenca, including 314 male and 156 female drivers. Among this population, 55.5% had a professional license, which is for driving public transport vehicles, and 44.5% had a non-professional license, which is for driving

private cars; in addition, 26.4% of the drivers reported driving less than three hours, 22.1% between 3 and 5 h, 21.7% between 5 and 8 h, and finally 29.8% more than eight hours a day. Finally, this study also considered 31 motorcycle drivers, 33 truck drivers, 26 city bus drivers, 6 van drivers, 176 car drivers, 86 van drivers, and 112 cab drivers.

3.3. Process

The SDBQ questionnaire was applied to and completed by the drivers. Before starting the survey, respondents were provided with brief and precise information about its purpose. All surveys considered were those carried out by a driver holding a valid license. The average time spent filling out each survey was approximately 14 min per driver. On the other hand, incomplete surveys were excluded.

Finally, the statistical analysis for this research was carried out using SPSS-25 software, resulting in descriptive statistics to evaluate the means and standard deviations of the SDBQ items. Generalized linear Poisson models were also developed to establish unsafe driving behaviors. Finally, the chi-square test was applied. The level of statistical significance was set at $p < 0.05$.

4. Results

Table 1 illustrates the results of the first part of the survey, in particular, the distribution of the sociodemographic characteristics of the 470 drivers. The responses were divided into male and female responses.

Table 1. Sociodemographic distribution of drivers by gender.

Variable	Male	Female	*p*-Value
	n = 314 (%)	*n* = 156 (%)	
Age			
50–69	94 (29.9%)	19 (12.2%)	
35–49	97 (30.9%)	47 (30.1%)	<0.001
26–34	92 (29.3%)	46 (29.5%)	
18–25	31 (9.9%)	44 (28.2%)	
Marital Status			
Living with partner	19 (6.1%)	15 (9.6%)	
Widowed	22 (7.0%)	15 (9.6%)	0.719
Married	168 (53.5%)	63 (40.4%)	
Single	105 (33.4%)	63 (40.4%)	
Education level			
Postgraduate	10 (3.2%)	8 (5.1%)	
University	91 (29%)	80 (51.3%)	<0.001
Secondary	141 (44.9%)	50 (32.1%)	
Primary	72 (22.9%)	18 (11.5%)	
License Type			
Non-professional	112 (35.7%)	98 (62.8%)	<0.001
Professional	202 (64.3%)	58 (37.2%)	
Vehicle type			
Minibus	5 (1.6%)	1 (0.6%)	
Taxi	88 (28.0%)	24 (15.4%)	
Lorry/truck	30 (9.6%)	3 (1.9%)	
Motorcycle	15 (4.8%)	16 (10.3%)	<0.001
Automobile	88 (28.0%)	88 (56.4%)	
Bus	23 (7.3%)	3 (1.9%)	
Pickup truck	65 (20.7%)	21 (13.5%)	

Table 1. *Cont.*

Variable	Male	Female	*p*-Value
	n = 314 (%)	*n* = 156 (%)	
Hours of driving per day			
Less than 3	72 (22.9%)	52 (33.3%)	
3–5	66 (21.1%)	38 (24.4%)	<0.001
5–8	57 (18.2%)	45 (28.8%)	
More than 8	119 (37.9%)	21 (13.5%)	
Do you wear your seat belt?			
Never	11 (3.5%)	13 (8.3%)	
Always	207 (65.9%)	100 (64.1%)	0.471
Occasionally	96 (30.5%)	43 (27.6%)	
Have you consumed alcohol?			
Never	68 (21.7%)	39 (25%)	
High quantity	7 (2.2%)	8 (5.1%)	0.655
Low quantity	174 (55.4%)	82 (52.6%)	
Regular quantity	65 (20.7%)	27 (17.3%)	
Have you had any traffic collisions in the last three years?			
No	206 (65.6%)	95 (60.9%)	0.3171
Yes	108 (34.4%)	61 (39.1%)	

Among the participants in this research, 65.3% of the drivers claim to always use seat belts, 29.6% use them occasionally, and 5.1% do not use them at all. The latter two groups are the most likely to suffer severe RTC injuries, such as being hit by hard items inside the vehicle or being thrown out of the vehicle. Research conducted in [48] supports this claim, establishing that seat belts reduce the risk of death in a traffic accident by 45% to 50%. Another risk factor, such as phone use while driving, has become a significant safety issue worldwide, according to [49]. Finally, 36% of male and female drivers reported experiencing RTCs in the past three years, while 64% of participants claimed not to have experienced any RTCs. These figures highlight the need for preventive and educational measures focused on promoting seat belt use and raising awareness of the dangers of using a phone while driving, thus reducing accidents and injuries on the road.

Sixty percent of the drivers were between 26 and 49 years of age. It was observed that 29.3% of the male drivers in this sample were aged between 26 and 34, while 30.1% of the participants were women aged 35–49. Male drivers had driven an average of 2.71 h, compared to 2.22 h for female drivers. A sample of 169 drivers (108 men and 61 women) was analyzed, representing 35.95% of the total surveys in this study. Drivers reported whether they had been involved in a traffic crash within the last three years.

Significantly, the men had more excellent driving experience and more daily driving hours because of their vehicle type and license type ($p < 0.001$). According to the data presented between men and women, there were no significant differences in their marital status ($p < 0.719$), alcohol consumption ($p < 0.655$), use of seat belts ($p < 0.471$), and RTCs in the last three years ($p < 0.317$).

4.1. SDBQ Evaluation and Scales

Table 2 shows the scores obtained from the averages and standard deviations based on the responses to each SDBQ item for the four factors: lapses, errors, aggressive driving, and infractions. Overall, significantly high means were obtained for all SDBQ items. When considering cab drivers, the following risky driving behaviors were most frequently observed: "Nearly colliding with traffic that had the right of way due to failing to stop before a 'Give way' sign while turning left", "Missing an exit on a highway or freeway and having to make a lengthy detour", and "Missing 'Give way' signs and narrowly avoiding an accident with traffic that had the right of way". Additional common risky driving

behaviors included the following: "Expressing anger through aggressive gestures towards another driver" (aggressive driving), "Disregarding speed limits while traveling on a highway" (infraction), "Failure to use an exit on a highway or freeway", and "Decrepitly stopping the vehicle at an intersection until oncoming traffic is compelled to yield and allow you to pass" (lapses). The mean scores for the six noted risky driving behaviors were all greater than 2.8, according to Table 2. Additionally, 27 risky driving behaviors received ratings between 2.00 and 2.80, and "Attempting to drive away from the traffic light in third gear" (lapse) received a rating between 1.00 and 1.99. When considering bus drivers, the following four risky driving behaviors were identified: "Aggressive driving" (speeding up and competing with other vehicles); "Crossing an intersection despite the traffic light having already turned red" (crossing an intersection in violation); "Error in overtaking due to underestimating the speed of an oncoming vehicle" (error); and "When approaching a specific location, momentarily reverting to the thought that you are approaching a more familiar location" (lapse). Each of these behaviors received a score ranging from 2.5 to 3.0. Simultaneously, truck drivers exhibited the same four most prevalent behaviors as bus drivers; however, their performance was assessed with marginally diminished scores, as illustrated in Table 2. The three most commonly observed risky driving behaviors among truck and bus operators were as follows: "Expressing anger towards another driver through aggressive gestures or other means" (aggressive driving); "Crossing an intersection while aware that the traffic light has already changed to red" (infraction); and "Nearly colliding with a cyclist approaching you from the inside while making a left turn" (lapsing). Their average scores ranged from 2.51 to 2.73 for all three.

Table 2. The means and standard deviations of the SDBQ based on the type of driven vehicle.

Variable	Motorcycle	Minibus	Bus	Automobile	Pickup	Truck	Taxi
	N = 31	N = 6	N = 26	N = 176	N = 86	N = 33	N = 112
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Aggressive driving							
Sound your horn to indicate your annoyance to another road user	2.12 (0.22)	2.83 (0.65)	2.69 (0.29)	2.29 (0.10)	2.34 (0.14)	2.87 (0.24)	2.75 (0.11)
Get angry with a driver and show his anger by whatever means, for example, with aggressive gestures	2.23 (0.24)	2.67 (0.80)	2.85 (0.28)	2.19 (0.08)	2.10 (0.12)	2.94 (0.27)	2.81 (0.11)
Become angered by a certain type of driver and indicate your hostility by whatever means you can	1.83 (0.19)	2.00 (0.51)	2.19 (0.22)	1.88 (0.08)	2.05 (0.12)	2.30 (0.23)	2.50 (0.11)
Stick too close to the vehicle in front to tell you to go faster or pull away	2.06 (0.20)	2.66 (0.42)	2.73 (0.33)	2.00 (0.09)	2.03 (0.11)	2.69 (0.29)	2.54 (0.11)
Race away from traffic lights to beat the driver next	2.32 (0.25)	1.33 (0.33)	2.11 (0.25)	1.89 (0.09)	1.81 (0.13)	2.42 (0.26)	2.13 (0.09)
Become angered by another driver and give chase with the intention of giving them a piece of your mind	2.00 (0.23)	2.00 (0.44)	2.76 (0.36)	1.89 (0.08)	2.04 (0.13)	2.06 (0.19)	2.69 (0.11)
"Speed up" and racing with other drivers	1.97 (0.22)	2.17 (0.60)	2.88 (0.38)	1.89 (0.09)	1.96 (0.13)	2.27 (0.27)	2.64 (0.11)
Violations							
Make a U-turn by stepping on a solid line or somewhere else where it is not allowed	2.45 (0.25)	1.66 (0.42)	2.46 (0.24)	2.22 (0.08)	2.29 (0.11)	2.72 (0.23)	2.56 (0.08)
Drive so close to the car in front that it would be difficult to stop in an emergency	2.03 (0.24)	2.33 (0.72)	2.23 (0.25)	2.14 (0.09)	2.04 (0.13)	2.36 (0.25)	2.46 (0.08)
Ignores speed limits on a motorway	2.32 (0.27)	2.00 (0.68)	3.11 (0.38)	2.07 (0.09)	2.25 (0.15)	2.78 (0.27)	2.96 (0.13)
Go faster than allowed, late at night or early in the morning	2.42 (0.25)	1.66 (0.49)	2.42 (0.24)	2.31 (0.92)	2.42 (0.15)	3.03 (0.27)	2.57 (0.09)
Bypass speed limits to follow traffic flow	2.45 (0.24)	2.16 (0.54)	2.42 (0.25)	2.04 (0.08)	2.13 (0.10)	2.57 (0.18)	2.50 (0.09)
Disregard the speed limit on a residential road	2.22 (0.23)	2.00 (0.51)	2.19 (0.22)	2.07 (0.38)	2.02 (0.10)	2.30 (0.21)	2.50 (0.09)
Cross a junction knowing that the traffic lights have already turned red	1.93 (0.20)	1.83 (0.47)	2.73 (0.35)	2.25 (0.10)	2.33 (0.14)	2.72 (0.23)	2.78 (0.13)
Driving even when you are aware of being above the legal alcohol limit	2.00 (0.25)	1.50 (0.50)	1.96 (0.25)	2.02 (0.09)	1.90 (0.12)	2.51 (0.29)	2.20 (0.10)
Errors							

Table 2. *Cont.*

Variable	Motorcycle	Minibus	Bus	Automobile	Pickup	Truck	Taxi
	N = 31	N = 6	N = 26	N = 176	N = 86	N = 33	N = 112
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Underestimate the speed of an oncoming vehicle when overtaking	2.13 (0.24)	1.67 (0.42)	2.65 (0.42)	2.20 (0.10)	2.23 (0.13)	2.39 (0.25)	2.36 (0.08)
Fail to notice that pedestrians are crossing when turning into a side street from a main road	2.22 (0.23)	1.33 (0.33)	2.34 (0.27)	2.00 (0.09)	2.10 (0.13)	2.03 (0.20)	2.54 (0.08)
Fail to check your rear-view mirror before pulling out, changing lanes, etc.	2.19 (0.20)	2.00 (0.68)	1.80 (0.23)	1.95 (0.09)	2.12 (0.15)	2.15 (0.20)	2.32 (0.10)
Lapses							
Forget where you left your car in a car park	1.93 (0.22)	1.66 (0.49)	2.23 (0.27)	2.19 (0.10)	2.15 (0.15)	2.33 (0.26)	2.76 (0.13)
Misread the signs and exit from a roundabout on the wrong road	2.45 (0.21)	2.16 (0.86)	2.07 (0.22)	2.10 (0.09)	2.17 (0.12)	2.48 (0.21)	2.42 (0.09)
Not noticing the presence of new traffic signs on a road that is routinely driven	2.25 (0.22)	2.17 (0.65)	2.50 (0.19)	2.27 (0.08)	2.38 (0.14)	2.48 (0.21)	2.70 (0.09)
Intending to drive to destination A, you "wake up" to find yourself on the road to destination B.	2.32 (0.22)	2.66 (0.80)	2.73 (0.23)	2.32 (0.10)	2.23 (0.14)	2.51 (0.23)	2.60 (0.11)
Passing an exit on a motorway or highway and being forced to make a long detour	2.13 (0.22)	2.66 (0.80)	2.23 (0.27)	2.23 (0.09)	2.39 (0.14)	2.45 (0.27)	2.86 (0.13)
Stay in a motorway lane that you know will be closed ahead until the last minute before forcing your way into the other lane	2.22 (0.22)	3.00 (0.93)	2.34 (0.25)	2.14 (0.09)	2.22 (0.12)	2.12 (0.21)	2.72 (0.20)
Switch on one thing, such as the headlights, when you meant to switch on something else, such as the wipers	2.22 (0.23)	2.66 (0.92)	2.07 (0.25)	2.07 (0.09)	2.08 (0.14)	1.45 (0.51)	2.07 (0.09)
Hit something when reversing that you had not previously seen	2.06 (0.22)	2.00 (0.51)	2.57 (0.28)	2.05 (0.09)	2.15 (0.13)	2.21 (0.23)	2.80 (0.39)
Attempt to drive away from the traffic lights in third gear	1.93 (0.19)	1.50 (0.50)	2.03 (0.21)	1.91 (0.08)	1.76 (0.11)	1.93 (0.20)	1.93 (0.07)
Queuing to turn left onto a main road, you pay such close attention to the mainstream traffic that you nearly hit the car in front	2.09 (0.24)	2.33 (0.61)	2.65 (0.27)	2.13 (0.09)	2.11 (0.11)	2.30 (0.21)	2.46 (0.09)
Get into the wrong lane approaching a roundabout or a junction	2.12 (0.24)	2.50 (0.50)	2.65 (0.22)	2.12 (0.09)	2.10 (0.12)	2.45 (0.23)	2.47 (0.08)
Pull out of a junction so far that the driver with right of way has to stop and let you out	1.93 (0.23)	2.50 (0.95)	2.30 (0.22)	1.92 (0.09)	2.08 (0.12)	2.33 (0.25)	2.84 (0.12)
Realize you have no clear recollection of the road along which you have been traveling	2.16 (0.22)	2.50 (0.95)	2.50 (0.27)	2.10 (0.09)	2.22 (0.13)	1.96 (0.21)	2.47 (0.09)
On turning left nearly hit a cyclist who had come up on your inside	1.90 (0.20)	2.16 (0.54)	3.11 (0.40)	2.33 (0.15)	2.72 (0.27)	2.51 (0.24)	3.25 (0.17)
Attempt to overtake someone that you had not noticed to be signaling a right turn	2.19 (0.25)	1.66 (0.33)	2.50 (0.24)	1.94 (0.08)	2.02 (0.11)	1.90 (0.19)	2.51 (0.09)
Miss "Give Way" signs and narrowly avoid colliding with traffic having the right of way	1.90 (0.20)	2.00 (0.36)	2.69 (0.34)	2.22 (0.10)	2.19 (0.16)	2.45 (0.24)	3.13 (0.15)

4.2. Effects of Risky Driving Behaviors in Traffic Collisions

Risky driving behaviors are related to high violations of the law and driving attitudes at the time of driving [48–50].

Table 3 shows how the Poisson generalized linear regression models [51] were built to measure the effect of self-reported risky driving behaviors in RTCs, using driving hours and gender as independent variables. In addition, the sociodemographic characteristics of drivers are divided into four groups: (1) age, marital status, and education; (2) type of driver's license and vehicle; (3) belt use; (4) alcohol consumption and RTCs in the last three years [52].

Table 3. Poisson linear regression model results.

	Model A		Model B		Model C		Model D	
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
Male drivers								
Less than 3 h (72)	1		1		1		1	
More than 8 h	0.81	(0.932–1.209)	0.01	(0.898–1.10)	0.04	(0.903–1.11)	0.05	(0.904–1.119)
5 to 8 h (57)	1.17	(0.937–1.253)	0.14	(0.912–1.14)	0.1	(0.909–1.14)	0.15	(0.913–1.14)
3–5 h (66)	5.39	(0.616–0.960)	6.76	(0.806–1.09)	0.87	(0.798–1.08)	1.72	(0.779–1.05)
Observations used	314		314		314		314	
LR chi2	2759		2174.84		2186.93		2201.54	
Log probability	−1346		−1633.99		−1029.35		−1173.06	
Pseudo R2	0.31		0.382		0.434		0.437	
Prob > chi2	<0.001		<0.001		0.003		<0.001	
Female drivers								
Less than 3 h (52)	1		1		1		1	
More than 8 h (21)	2.14	(0.934–1.605)	6.97	(1.094–1.83)	7.16	(1.101–1.86)	5.1	(1.042–1.79)
5 to 8 h (45)	2.62	(0.954–1.645)	2.57	(0.954–1.61)	2.74	(0.960–1.68)	1.13	(0.880–1.53)
3–5 h (38)	2.58	(0.946–1.746)	2.63	(0.953–1.66)	2.7	(0.955–1.68)	1.75	(0.910–1.62)
Observations used	156		156		156		156	
LR chi2	1283		997.01		1008.83		1027.39	
Log probability	−498.40		−634.39		−626.72		−645.81	
Pseudo R2	0.38		0.446		0.457		0.406	
Prob > chi2	0.062		<0.001		<0.001		<0.001	

Table 3 shows RR (Relative Risk) and CI (confidence interval).

Therefore, four generalized linear regression models based on the Poisson distribution were used [53]. This study utilized four models, labeled A–D, to analyze the impact of driving frequency on risky driving behavior. Model A adjusted for age, marital status, and education, while model B adjusted for age, marital status, education, type of driver's license, and type of vehicle. Model C further adjusted for the use of seat belts, and model D included additional factors such as alcohol consumption and involvement in road traffic collisions in the past three years.

According to the data presented in Table 3, it is evident that the effects varied. The results indicate that model A accounted for 5.39 (95% CI 0.616–0.960) men who drove between 3 and 5 h and were more prone to being involved in a road traffic collision (RTC). Analogously, an analysis was conducted for model B, considering the covariates of sex and driving hours. The findings indicated that 6.76 individuals (95% confidence interval: 0.806–1.09) exhibited aggressive driving behavior. In contrast, models C and D had a smaller effect, leading to a decreased likelihood of being involved in a road traffic collision [54,55]. Later, comparable analyses were utilized to evaluate the risk for women while driving. The data results indicate that the associations for models A, B, and C remained relatively stable. The results for each model were 2.58, 2.63, and 2.70, respectively, with corresponding 95% confidence intervals of (0.946–1.746), (0.953–1.66), and (0.955–1.68). In contrast, model D exhibited a lower score than the other models, with a value of 1.75 (95% CI: 0.910–1.62).

4.3. Chi-2 DBQ Items Statistical Test

Table 4 presents the chi-square results to estimate the association of two variables: the risky driving behaviors highly described in the DBQ items versus driving hours. The driving hours variable was considered an independent factor. It was discovered that drivers with more hours of daily driving were more likely to be involved in RTCs [56].

Table 4. Chi-2 square DBQ test.

Items	Chi^2 *sig*
Aggressive driving	
Get angry with a driver and shows anger by whatever means, for example, with aggressive gestures	0.001
Become angered by a certain type of driver and indicate your hostility by whatever means you can	0.001
Sound your horn to indicate your annoyance to another road user	0.001
Become angered by another driver and give chase with the intention of giving them a piece of your mind	0.001
Stick too close to the vehicle in front to tell you to go faster or pull away	0.044
Race away from traffic lights to beat the driver next	0.087
"Speed up" and racing with other drivers	0.001
Violations	
Ignores speed limits on a motorway	0.001
Bypass speed limits to follow traffic flow	0.653
Makes U-turns by crossing solid lines or elsewhere where it is not allowed	0.009
Cross a junction knowing that the traffic lights have already turned red	0.001
Drive so close to the car in front that it would be difficult to stop in an emergency	0.014
Driving even when you are aware of being above the legal alcohol limit	0.955
Disregard the speed limit on a residential road	0.040
Go faster than allowed, late at night or early in the morning	0.015
Errors	
Underestimate the speed of an oncoming vehicle when overtaking	0.011
Fail to check your rear-view mirror before pulling out, changing lanes, etc.	0.044
Fail to notice that pedestrians are crossing when turning into a side street from a main road	0.006
Lapses	
Miss "Give Way" signs and narrowly avoid colliding with traffic having the right of way	0.000
Forget where you left your car in a car park	0.035
Not noticing the presence of new traffic signs on a road that is routinely driven	0.000
Misread the signs and exit from a roundabout on the wrong road	0.152
Intending to drive to destination A, you "wake up" to find yourself on the road to destination B	0.000
Attempt to drive away from the traffic lights in third gear	0.059
Stay in a motorway lane that you know will be closed ahead until the last minute before forcing your way into the other lane	0.007
Get into the wrong lane approaching a roundabout or a junction	0.011
Realize you have no clear recollection of the road along which you have been traveling	0.029
Hit something when reversing that you had not previously seen	0.089
Switch on one thing, such as the headlights, when you meant to switch on something else, such as the wipers.	0.320
Queuing to turn left onto a main road, you pay such close attention to the mainstream of traffic that you nearly hit the car in front	0.001
Pull out of a junction so far that the driver with right of way has to stop and let you out	0.000
On turning left nearly hit a cyclist who had come up on your inside	0.000
Passing an exit on a highway or freeway and being forced to make a long detour	0.018
Attempt to overtake someone that you had not noticed to be signaling a right turn	0.028

5. Discussion

The SDBQ is the most widely used instrument for measuring dangerous driving attitudes. This study assessed the age of drivers, marital status, level of education, license, vehicle type, and alcohol consumption among other sociodemographic characteristics [57].

In addition, the SDBQ results clearly showed that male drivers report a high number of incidents, errors, aggressive driving, and lapses and are more exposed than females to RTCs in consideration of the research conducted by Weller et al. [58], where it is stated that the presence of male drivers is associated with risky or unsafe driving behaviors and that they are more exposed than females to RTCs. Furthermore, research by Hung [59] revealed a distinction between errors, lapses, and violations, thus clearly showing the difference between intentional and unintentional hazardous driving behavior of male drivers compared to females. Likewise, research by Behnood et al. [60] showed that male and younger drivers in a group under 30 years of age were also more prone to RTCs. Likewise, according to the mean scores in all items of the four factors of the SDBQ, it could

be detected, as the main finding, that cab drivers in the city of Cuenca are more prone to develop unsafe driving behaviors, having significantly high scores in infractions, lapses, and aggressive behaviors in similarity to the other types of drivers (bus, minibus, truck, car, and motorcycle drivers) and therefore being involved in a greater number of RTCs. This is also confirmed by research conducted in China by Zhou et al. [61], whose study determined that cab drivers present high scores in law violations, errors, and lapses, concluding that cab drivers are more likely to be involved in RTCs compared to another study conducted by Shi et al. [62], which detailed more studies on unsafe driving behaviors in Beijing cab drivers. The same study determined that Beijing cab drivers present more infractions, lapses, and aggressive behaviors in the main items of the DBQ, causing more RTCs than in other countries. However, very few studies have been conducted on the unsafe driving behaviors of cab drivers. On the other hand, it is necessary to highlight the research of McMurry et al. [63], whose study states that Bogota cab drivers represented higher scores in aggressive driving, lapses, and errors, being the group of drivers more prone and daily to be involved in RTCs in Bogotá, Colombia, unlike the other groups analyzed: private drivers and transmilenio (SITP) operators. It was also found that bus and truck drivers were also found to have higher SDBQ scores than the other driver groups studied: motorcycle drivers, bus drivers, minibus drivers, car drivers, truck drivers, and cab drivers, who are prone to unsafe driving and to be involved in RTCs, relative to the other driver groups. Considering all the results, it is recommended to design strategies to reduce hazardous driving among drivers, with special attention to cab and bus drivers, in order to achieve a reduction in hazardous driving behaviors such as "Disregarding speed at night or in the early morning", "speeding on the highway and urbanizations", and "crossing at an intersection despite having seen that the traffic light turned red". Unlike cab drivers, car drivers provided the least information in the scores for each SDBQ item. These results bear some similarity to the study by Olandoski, et al. [64].

This work indicates that car drivers committed significantly fewer errors, infractions, lapses, and aggressive behavior compared to other groups of drivers, also considering the work of McMurry et al. [63], where it was established that private drivers indicated the lowest scores on all DBQ items, compared to bus, taxi, and shuttle bus drivers, and each of these behaviors scored less than 2.00 concerning the mean. The four factors contributing to insecure driving behavior for car drivers were identified as "Exiting a traffic light in third gear" (lapse), "Fail to check your rear-view mirror before pulling out, changing lanes, etc." (error), and "'Speed up' and racing with other drivers" (aggressive driving).

As for Poisson's generalized models, they were used in this research to measure the impact of insecure driving behavior by taking as a separate variable driving hours on all models A–D for men (A-0.31; B-0.382; C-0.434; D-0.437) and women (A-0.38; B-0.446; C-0.457; D-0.406), resulting in a *Pseudo R^2* value which is less than 0.5, as detailed above in all models A–D in Table 4. That is, regressions are not strong enough to explain the joint model [64]. In the present study, each variable was analyzed independently, i.e., the items of the SDBQ versus driving hours individually, thanks to the chi-square statistical test, as recommended by the authors Martinussen and de Winter [65,66].

The use of the chi-square method was recommended by the authors [67] in all SDBQ items in its four factors: violations, aggressive driving, lapses, and errors. It is estimated in this research that within aggressive driving, 86% of drivers drive unsafely. The least associated variable is "Race away from traffic lights to beat the driver next". Regarding the factor violations, the results show that 75% of drivers drive insecurely, according to the research carried out in [68]. This finding highlights "unsafe drivers in violation" with high scores in the DBQ. The least associated variables were "Bypass speed limits to follow traffic flow" and "Drive even when you are aware of being able to find yourself above the legal alcohol limit". On the other hand, regarding the error factor, it was detected that 100% of its items influence driving in an insecure and inaccurate way in all types of drivers compared to the study carried out in [69], detailing that the error factor within the DBQ proved to be the most relevant predictor of the TC frequency. Finally, in the SDBQ lapses dimension,

75% of its items were scored mostly high for influencing driving in an unsafe way. The less associated items were "Get into the wrong exit in a roundabout", "Turn the cars light on instead of mopping the windshield, or vice versa", "Exiting a traffic light at third gear", and finally "Driving reversing, hitting against something you haven't seen before".

All of the above-mentioned overall results concluded that drivers with more hours of daily driving, regardless of their gender, are more likely to be involved in unsafe behavior; according to the research conducted by Ortega et al. [70], it was found that driving hours were related to further violations of traffic laws that contribute to most attitudes that cause RTCs [71].

6. Conclusions

The application of the SDBQ in Ecuador has proven to be a significant step in adapting the model to the specific reality of the country, providing valuable insights into RTCs. This adaptation has not only allowed for a better understanding of local behaviors and risk factors but has also opened new avenues for the prevention and improvement of road safety. Incorporating culturally relevant elements and the consideration of the unique traffic conditions in Ecuador make the SDBQ a tool for policy development in the country, contributing to the reduction in crashes and the devastating consequences they can bring.

In the last five years, many concerns have arisen in Ecuador regarding the deficiencies in safety issues of professional drivers and their link with risky behaviors when driving a vehicle, including speeding, disrespect for traffic laws, and fatigue while driving, among others. The results revealed significant differences for most of the SDBQ lapses of aggressiveness, errors, infractions, and driving factors, between male and female drivers, as well as between the different groups of drivers of cabs, buses, motorcycles, minibuses, passenger cars, vans, and trucks. It also showed that male drivers reported a high incidence of unsafe driving—violations, errors, and lapses—and are more likely than female drivers to be involved in traffic accidents. Through this study, policymakers will be able to make specific rules and regulations for focus groups to ensure road safety.

As for the generalized linear Poisson models, they were introduced in this research in order to measure the impact of unsafe driving behavior, taking as an independent variable the daily driving hour, the same that is present in almost all the items of the SDBQ, on risky or unsafe driving behaviors. The models made for both men and women were not strong enough to explain the model jointly, so we proceeded to use the chi-square statistical test in order to study in a concrete and precise way the unsafe driving behavior of the SDBQ items versus driving hours. Investigations revealed that drivers with valid driving licenses were committing offenses that they could have avoided by updating their knowledge of transport regulations and rules.

The SDBQ study in Ecuador represents a vital beginning for future research aimed at reducing traffic accidents in the country. This initial approach provides a solid framework for understanding and addressing risky and unsafe driving behaviors, laying the groundwork for further exploration of causes and solutions. Further research is needed to understand why, when, and how these risky or unsafe driving behaviors occur. The research provided may offer several avenues for further analysis with respect to traffic laws when driving vehicles on public roads. Together, these efforts represent a critical step towards a more complete understanding of road safety in Ecuador, as well as a step forward in creating effective laws and regulations to prevent accidents and save lives. Expanding this research to other regions could also yield valuable comparative insights. Assessing the influence of new policies using SDBQ findings will be essential for enhancing road safety strategies and road safety in other nations. The SDBQ aims to foster a culture of safety and sustainability by promoting practices such as efficient driving and strict enforcement of road safety measures. By enhancing road safety, this initiative not only aligns with the city's sustainability objectives but also supports the Mobility Plan's aim of establishing a safer and more environmentally friendly urban setting. This research allows Ecuadorian

legislation to be modified in order to protect lives and avoid traffic accidents. This research facilitates the promotion of road safety measures through legislation and traffic regulations.

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