DRINKING AND DRIVING BEHAVIOR: A STUDY UNDER THE THEORY OF PLANNED BEHAVIOR

SAMUEL MORGAN TEIXEIRA COSTA

MASTER'S THESIS IN TRANSPORTATION

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MASTER'S THESIS SUBMITTED TO THE GRADUATE PROGRAM IN TRANSPORTATION OF THE DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING OF THE FACULTY OF TECHNOLOGY, AT THE UNIVERSITY OF BRASÍLIA, AS PART OF THE REQUIREMENTS TO OBTAIN A MASTER'S DEGREE IN TRANSPORTATION.

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"When you smile, the whole world smiles with you."

-Unknown author

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A Deus e à Nossa Senhora, primeiramente;
À minha mãe, Iara, pelo incansável incentivo pela minha capacitação acadêmica e
professional;
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ABSTRACT

Driving under the influence of alcohol accounts for almost one-third of traffic crashes worldwide. Although the effects of alcohol on the human body are well-known, the factors that drive people to engage in this behavior still require a more detailed analysis. Through Ajzen's Theory of Planned Behavior (TPB) from 1991, we sought to identify salient beliefs and evaluate the constructs underlying the conduct of driving under the influence of alcohol. Initially, following the TPB method, a pilot study with open-ended belief questions was administered to 192 drivers in the Federal District, Brazil. Subsequently, in the main study, with closed-ended questions to assess beliefs and basic TPB constructs, 745 individuals responded to a new questionnaire. A third and final instrument, aiming at actual behavior, was developed and applied, with 52 returns. The results of the first stage underwent content analysis, identifying and coding salient behavioral, normative, and perceived control beliefs that influence the decision to drink and drive. In the main study, the data underwent statistical procedures through correlations, exploratory factor analysis, and regressions. The results indicated that male drivers, as they age, are more prone to drive under the influence of alcohol. Additionally, significant correlations were found between behavioral and perceived control beliefs regarding the constructs of attitude (ATT) and perceived behavioral control (PBC), and, of these, with the intention (INT) to drink and drive. Subjective norms, while important, had a lesser impact. Therefore, it is suggested that potential road safety interventions should primarily target ATT and PBC constructs, addressing perceptions of risk, legal consequences, the effects of alcohol on the body, the influence of significant others such as victims and traffic authorities, and promoting the use of alternative means of transportation when under the influence of alcohol.

RESUMO

O comportamento de dirigir sob efeito de álcool: um estudo sob a Teoria do Comportamento Planejado

A condução sob a influência de álcool responde por quase um terço dos sinistros de trânsito ao redor do mudo. Embora os efeitos do álcool no corpo humano sejam bem conhecidos, os fatores que motivam as pessoas à prática desse comportamento ainda exigem uma análise mais detalhada. Através da Teoria do Comportamento Planejado de Ajzen – TPB (1991), buscou-se identificar as crenças salientes e avaliar os construtos que subjazem a essa conduta de dirigir sob efeito de álcool. Inicialmente, seguindo o método da TPB, um estudo piloto com questionário de perguntas abertas sobre crenças foi administrado a 192 motoristas no Distrito Federal. Posteriormente, no estudo principal, com perguntas fechadas para avaliar as crenças e os construtos básicos da TCP, 745 indivíduos responderam ao questionário. Um terceiro e último instrumento, tendo como objetivo o comportamento de fato, foi elaborado e aplicado, com 52 retornos. Os resultados da primeira etapa passaram por uma análise de conteúdo que identificou e codificou as crenças salientes comportamentais, normativas e de controle percebido que influenciam na decisão de beber e dirigir. No estudo principal, os dados passaram por procedimentos estatísticos por meio de correlações, análise fatorial exploratória e regressões. Os resultados apontaram que motoristas do sexo masculino, na medida que avançam em idade, são mais propensos a dirigir sob a influência de álcool. Além disso, verificou-se correlações significativas entre crenças comportamentais e de controle percebido face aos construtos da atitude (ATT) e do controle comportamental percebido (CCP) e, desses, na intenção (INT) de dirigir sob a influência de álcool. Normas subjetivas, embora importantes, tiveram menor impacto. Assim, sugere-se que possíveis medidas de intervenções pela segurança viária devem visar, principalmente, os construtos da ATT e do CCP, abordando medidas voltadas à percepção do risco, às consequências legais, aos efeitos do álcool no organismo, à influência de pessoas significativas, como vítimas e autoridades de trânsito, e ao fomento ao uso de meios alternativos de locomoção quando sob efeito de álcool.

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS, NAMES AND ABREVIATIONS

CODEPLAN – Companhia de Planejamento do Distrito Federal
CTB – Brazilian Traffic Code
DETRANDF – Federal District Traffic Department
EMCDDA - European Monitoring Centre for Drugs and Drug Addiction
FD – Federal District
GAO – U.S. Government Accountability Office
IBGE – Brazilian Institute of Geography and Statistic
MS – Ministry of Health of Brazil
SSA – Safe System Approach
SDG – Sustainable Development Goals
UN – United Nations
WHO – World Health Organization

1   INTRODUCTION

Road traffic crashes consequences are an issue of public health worldwide (ALONSO *et al.*, 2015; ROWE *et al.*, 2016; GARRISSON, 2021). The United Nations (UN), aware of this scenario, even encompassed road safety in the set of Sustainable Development Goals – SDG, as targets 3.6 and 11.2 denotes (WHO, 2018)[1]. Recently, in continuance with its long living Agenda, UN enacted Resolution A/74/299/2020, reinforcing previous reports findings and the urge for actions regarding this 8th leading deaths cause and the first for children and young people between 15 and 29 years of age (UN, 2020; WHO, 2021). Last data, from 2016, have accounted for more than 1.35 million people that lost their lives and about 50 million people injured, of what 90% have taken place in developing countries (WHO, 2021; WHO, 2018).

As a middle-income country (WHO, 2015), Brazil is not far from this traffic pandemic scenario. In 2019, as of data from the MH – Ministry of Health of Brazil and IBGE – Brazilian Institute of Geography and Statistic (IBGE, 2023), it was reached 33.716 obits due to road crashes, an average of 16.04 per 100,000 population. It must be observed, though, that this number might be underreported since official Brazilian Government database is still under adjustments. Screwing down to the Federal District – FD context, the Traffic Department data report has registered 274 deaths in 2019 (DETRANDF, 2023), an average of 9,1. As a matter of comparison, world's average, back three years, in 2016, was 18.06, while average for high income countries were found, by the WHO's Global Status Report on Road Safety (WHO, 2018), already was at 8.3.

1.1   PROBLEM DEFINITION

Road safety, as addressed by WHO (2021), implies a Safe System Approach – SSA, under which one of the "core feature" is shared responsibilities. That is aligned with the Vision Zero system, under which humans are taken as fallible, and, as so, commit mistakes day-a-day. Thus, measures of road safety should be thought considering this perception (ELVIK *et al.*, 2023). Accepting that humans naturally commit mistakes and trying to understand its motivations

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[1] Sustainable Development Goals – SDG
3.6: halve road deaths and injuries by 2030.
11.2: providing sustainable transport systems, improving road safety.

plays a crucial spot when dealing with peaceful road environment. That's why the responsibility concept was widened. It is a turning point where all guilty has been taken from road users and spread to everyone that relates to the transit itself, such as the public traffic managers, road engineers and constructors, automobile companies and so on, of course, not excluding the drivers and pedestrians themselves. In this manner, a whole conglomerate starts working together, each one regarding its own attribute, but all connected to the same goal: no deaths are allowed. For that, reducing risks, acting preventively, anticipating human errors, fast emergency rescue, are some of the guidelines adopted (GREEN *et al.*, 2022).

Placing individuals at the core of road safety efforts will automatically make safe mobility a human right (UN, 2020). Therefore, actions must be taken in order to understand the factors that contribute to traffic crashes and direct measures focused on them for great effectiveness. Amongst them, the three general group of contributing factors must still be targeted: road infrastructure, vehicles and humans (GAO, 2003; FORWARD, 2009; MOAN & RISE, 2011). That is even addressed by WHO in its SSA, when renewing Decade of Action for the 2021-2030 period (WHO, 2021). Without lowering the importance of the other, the human factor (human errors) occupies a distinguished place as it is suggested to be partially in 95% and in 65% of the wholly traffic crashes (FORWARD, 2009). However, as literature reviews, the weighty strength on human errors needs to be mitigated as broad traffic environment has to be evaluated as a whole (THILEN, 2002). Road crashes must be seen as failure within a complex system in order that road infrastructure, vehicles and humans must interact between each other in a way that ensures equilibrium and, thus, a high level of safety (BEIL, 2007). Therefore, effective, and chained measures shall be carried out, by the several actors of our society to mitigate unsafety effects.

Reason *et al.* (1990), early in 90's, divide failures into three different groups: lapses, taken as slight slips, which, in general, have consequences only for those who committed them (e.g. forgetfulness); errors, failures in processing information, as of failing to see or misjudgments; and violations, characterized by the deliberate intention to infringe a norm, such as speeding and drinking and driving. Considering that the main crucial human factors that account for car crashes are reported as violations, which are, speeding, drink-driving, driver fatigue, distracted driving, and non-use of safety belts, child restraints and helmets (WHO, 2021), this paper will focus on this facet of human errors. Besides the fact that each leading violation is complex and deeper analyses should be taken separately, due to its significant impact, drinking and driving

(DD), also entitled as driving under the influence of alcohol (DUI) or impaired driving behavior (IDB), will be the targeted behavior under research so on. As for denoting its impact, DD entails as up to 35% of all crash alcohol-related in the world (WHO, 2018), or to say, around one third.

In Brazil, there's a lacking in reliable data to access drink-driving occurrence, as, for a continental developing country size, institutional organization of regional Traffic Departments differs in data collection and availability from each other. FD, however, has solid data from 2019 that indicates that nearly 30% of all traffic crashes with deaths had at least one person involved under the influence of alcohol (DETRANDF, 2021). In Brazil, minimum age to enact a drivers' license is after legal majority (18years old), same as to alcohol consumption. However, besides the lack of any law restrictions regarding time and place, it is of a cultural habit, to start driving, and ingest alcohol, even before legal individual independency, and most of the times, this happens in the core of the families themselves (SANDOVAL *et al.*, 2020). This is a crucial socio-cultural characteristic of the population, which tend to view these behaviors associated into one, that is, driving under the influence of alcohol. Although in the last decades that has been changing, the mix of alcohol and vehicle conducting is still taken as almost ordinary in Brazil.

Insofar, under CTB – Brazilian Traffic Code (1998), since 2008, when Law n° 11.705, known as *Lei Seca* (in Portuguese), or Dry Law, was enacted, it is strictly forbidden to drive under any influence of alcohol. It is considered one of the uppermost law infringements, which leads to sanctions such as ten times the highest regular traffic fine, one year of drivers' license suspension, mandatory educational driving lessons and, as due to the amount of alcohol possibly detected, entails to criminal charges as prison. Despite the criminalization of drunk driving over the last fifteen years, drivers persist in consuming alcohol and operating vehicles, posing substantial threats to road safety and leading to considerable medical expenses for society (GUIMARÃES & SILVA, 2019; YADAV *et al.*, 2022). Last official Government data (MT, 2023) on actual DD or it test refusal entails that, since then, more than 2.5 million traffic fines were delivered. It also shows that, in the majority of DD infractions, which is just about 1 million of all, 80,3% were males and 90% of the drivers were over 30 years old – mean of 42 years old. That can be interpreted as evidence of how the younger drivers are more well informed and willing to comply with the law restrictions than the older ones.

3

Alcohol effects in humans have been under study for long time. Its impacts on the central nervous system, which may gradually increase as grater amount is ingested, and the impairments over the cognitive functions of the drivers are well known (MOSKOWITZ & ROBINSON, 1988; ABERG, 1993; OGDEN & MOSKOWITZ, 2004; WHO, 2004). Steele & Josephs, 1990, gave birth to the Alcohol Myopia Theory, which, in sum, establishes a metaphorical equivalence between the effects of a fuzzy long distance myope vision and the narrowing of attention caused by alcohol consumption. Alcohol limits the driver on focusing in the "most salient aspects of a situation while neglecting peripheral aspects". That is to say, alcohol ingesting results in prejudice to several neurocognitive processes required for day-a-day actions, such as safe driving (MARTIN *et al.*, 2013).

Alcohol, as deeply discussed in a 2008 Report by the German Centre for Addiction Issues (EMCDDA, 2008), sponsored by the European Commission, and as detailed by Alonso *et al.*, (2015), affects humans on a range of cognitive functions deemed important for driving such as (i) divided attention (e.g. maintaining lane position while attending to external stimuli such as traffic signs); (ii) executive functions (e.g. set-shifting - changes in speed and traffic); (iii) perception/vision: (detecting road hazards); (iv) psychomotor functions (braking, steering); (v) reaction time (RT) (skills such as braking quickly to avoid a collision); (vi) vigilance (ability to sustain attention, involving detection and response to specific targets). The majority of drivers acknowledge the risks of operating a motor vehicle while intoxicated (ALONSO *et al.*, 2015) and the plenty of legislation that have been enacted in order to strengthening sanctions, as to criminalizing and rinsing fines (CHAN *et al.*, 2017; MAGALHÃES, 2020). However, among other risk factors, such as speeding, alcohol remains the predominant substance linked to fatal road traffic collisions (STEPHENS *et al.*, 2017; DAVEY *et al.*, 2020).

Therefore, getting to know the decision-making dynamics to engage in drunk driving behavior can be useful in designing effective road interventions focused on the minimization of alcohol-related crashes (YADAV *et al.*, 2022). Under a psychological approach, then, the Theory of Planned Behavior - TPB (AJZEN, 1985, 1991) emerges as a possibles and secure path, largely used, to predict and understand human behavior. In summary, it proposes that an individual's behavior is labelled by intention (INT) to perform the behavior, which is influenced by three key factors: Attitude toward the behavior (ATT), which is the positive or negative evaluation someone has over performing a certain behavior; Subjective norms (SN), that are the perceived social pressure or influence from important others about whether the behavior should or should

not be performed; and Perceived Behavioral Control (PBC), that stands for the perceived ease or difficulty of performing a given behavior. These components are influenced by cognitive elements called "beliefs" formed due to each individual personal information processing, often influenced by personal life experiences, shaped by several socio-cultural reasons.

As far as these authors know, in Brazil, regarding DD behavior, this study is the first of the kind to explore elicitation of beliefs and TBP constructs. Insofar, the problem this study puts forth for research and for the emergence of more efficient measures is "**How road safety can be enhanced by understanding driver's drinking and driving behavior?**"

1.2 RESEARCH GOALS

This study has the objective of understanding DD behavior in the Federal District of Brazil by means of the Theory of Planned Behavior. Main and specific objectives are constructed as follows.

1.2.1 Main Objective

The main objective of this research is to identify the behavioral components that underpin FD population's drink and drive conduct, through the Theory of Planned Behavior.

1.2.2 Specific Objectives

(i)   understand the correlations regarding DD and the demographic variables;
(ii)   identify the main salient beliefs underpinning DD behavior in the population of the FD, in Brazil;
(iii)   evaluate the impact of these beliefs on the TPB basilar constructs;
(iv)   analyze to what extent the ATT, SN and PBC influence intention to drive under the influence of alcohol;
(v)   find out to what extent the model can predict DD actual behavior.

1.2.3 Hypotheses

For TPB elements, some hypotheses can be formulated:

H1 – Higher drunk driving intentions tend to be perceived more among young male than female drivers.

H2 – Drivers that engaged in past drunk driving behavior are likely to show higher DD intentions.

H3 – Intention to drink and drive tend to be weaker in drivers with prior crash history.

H4 – Salient behavioral, normative and control beliefs will strongly correlate with ATT, SN and PBC.

H5 – ATT, SN and PBC strongly explain Intention to drink and drive.

H6 – ATT, SN, PBC and INT to drink and drive significantly correlates to drivers' actual behavior.

1.3 MOTIVE

The high rate of traffic-related fatalities is a global challenge that demands urgent attention and effective solutions. This phenomenon not only impacts public safety but also affects the quality of life for individuals and communities. Moreover, factors such as driving under the influence of alcohol, which can lead to more reckless conduct, most notably, speeding and not use of seatbelts (SHINAR *et al.*, 2001), represent one of the key elements contributing to this alarming scenario. The conjunction of this risky behavior with the Theory of Planned Behavior, considering Brazilian socio-cultural elements regarding this behavior, and the need for more assertive decision-making by traffic managers, are fundamental aspects to be addressed.

This study aims to analyze and understand the intersections between the high rate of traffic-related fatalities, the behavior of driving under the influence of alcohol, and the TPB. The focus is on finding relevant elements that can drive to improving the decision-making of traffic managers when to implement more effective policies, reduce car crashes, and save lives. A deeper understanding of these aspects may result in more effective strategies to tackle these complex and interrelated problems.

The academic relevance of this study lies in the practical application of the TPB to understand and analyze the behavior of driving under the influence of alcohol, in a middle-income country, in one of its main regions, as FD stands for the Capital of Brazil (Brasília), which is over 3 million people. The social contribution is in the possibility of providing more informed guidance for traffic managers, enabling the implementation of more targeted and effective policies, thereby reducing the number of accidents and fatalities. There are indicative studies on drunk driving preventive measures possible leading up to 20% reduction in all accidents (ELIAS *et al.*, 2017).

The research will benefit from an interdisciplinary approach that combines concepts from psychology and transport engineering. Methods such qualitative and quantitative studies, regarding literature review, belief elicitation technique, questionnaire application and content and statistical analysis, will be employed to obtain significant data and solid conclusions.

Therefore, this study is justified by the pressing need to reduce the high rate of traffic-related fatalities, attributed in part to the behavior of driving under the influence of alcohol, for which the Theory of Planned Behavior may offer a deeper understanding. The importance of guiding traffic managers with informed insights is crucial to implement strategies aimed at safer traffic and the preservation of lives.

1.4   THESIS STRUCTURE

This research is constituted of five chapters: (1) introduction of the investigation, (2) literature review, (3) method, (4) results and discussions and (5) conclusions. Research schema with detailed subtopics can be overviewed on **Figure 1.1**, below.

Figure 1.1 – Research schema

2   THEORY OF PLANNED BEHAVIOR - TPB

2.1   BEHAVIORAL THEORIES AND TPB

Some theories have been designed to decrypt attitudes towards acts and behaviors along the 1900's, such as the Theory of Reasoned Act – TRA (FISHBEIN & AJZEN, 1975), Theory of Propositional Control – TPC (DULANY, 1961), Locus of Control – LC (ROTTER, 1954), Health Belief Model – HBM (BECKER, 1974), Integrated Behavioral Model – IBM (MONTAÑO & KASPRZYK, 2008), Protection Motivation Theory – PMT (ROGERS, 1983), the Theory of Planned Behavior - TPB (AJZEN, 1985; 1991) and so on. Despite the goods and odds of each of these models, Ajzen's TPB is a validated social-cognitive model well suited to explain human behaviors in general (ELLIOTT *et al.*, 2005; NIMRI *et al.*, 2017; JACQUES *et al.*, 2018; MOAN & RISE, 2011).

Studies have been designed as for drug use (ARMITAGE *et al.*,1999; BOOTH *et al.*, 2014), use of condom (ASARE, 2015), cheating in online exams (ABABNEH *et al.*, 2022), oral hygiene care (BREIN, *et al.*, 2016), intentions to eat a healthful diet (PAWLAK & MALINAUSKAS, 2008), and counting. Regarding driving behaviors, several studies have been carried out for speeding (PARKER *et al.*, 1992; ELLIOTT *et al.*, 2005; WARNER & ÅBERG, 2008; JACQUES *et al.*, 2018), distracted driving/mobile phone use while driving (NEMME & WHITE, 2010; GAULD *et al.*, 2017; SULLMAN *et al.*, 2018; POPE *et al.*, 2020), drowsy driving (JIANG *et al.*, 2017), dangerous overtaking (PARKER *et al.*, 1992), and DD (PARKER *et al.*, 1992; MARCIL *et al.*, 2001; ARMITAGE *et al.*, 2002; CHAN *et al.*, 2010; ELIAS *et al.*, 2017; POTARD *et al.*, 2018; MOAN & RISE, 2011; YADAV *et al.*, 2022).

TPB undertakes that human beings are rational, so their behavior is founded on a serios of conscious decision-making (CHAN *et al.*, 2010; NIMRI *et al.*, 2017). That is, a person takes into account relevant information available when deciding to perform a given behavior. Subjectively, he/she readily access this information before dully carrying on the behavior. Therefore, to understand how this path is travelled, person by person, from the information processing – formation of personal beliefs, until the behavior perpetrated itself, is the TPB investigator's goal. One of the applications of the TPB, through its elements, is in trying to predict the behavior and, therefore, making it possible to study measures that tend to adjust them (PETERS & TEMPLIN, 2010).

2.2   TPB FRAMEWORK

2.2.1   TPB Constructs

The basilar stand for TPB is the idea that any behavior is determined by behavioral intentions, which is its most important and direct determinant (AJZEN, 1991). In other words, the model seeks to find how much someone wishes to carry out a given behavior, and one's likely (how much effort) to make it happen. Intentions are functions of three main constructs: attitude toward the behavior (ATT), subjective norm (SN), and perceived behavioral control (PBC). It is to say, the three elements determine the behavior via intention (WARNER, 2021). And, also authors consider it as a proxy measure of actual behavior (ARMITAGE *et al.*, 2002). It is important to stress that PBC can, together with intention, be used to directly predict behavior (AJZEN, 1991). Direction is that the more favorable the ATT, the SN and PBC, the stronger should be the person's intention to perform the behavior in question (STECKER *et al.*, 2007). According to Ajzen (1991), the effect of the TPB components is expected to differ across populations, behaviors and situations, once each one of them has a different information background – general circumstances, conditions, or context on which it exists. So, it is not always the case when each variable will stand in a significant contribution in predicting intention and, thus, behavior.

Attitude toward a behavior refers to individual's perception regarding the behavior, which could be favorable or unfavorable, positive or negative. Subjective Norms are the perceived pressure from significant others to commit the behavior, that is, one's perception of how they would view certain behaviors (e.g., whether parents, peers, social organizations, other significant personal groups would approve or disapprove of a particular type of behavior). And PBC refers to one's perceptions of his/her ability to perform a given behavior, its ease/difficulty.

2.2.2   Beliefs and Background Factors under the TPB

Beliefs are one's evaluation about an issue (object/behavior), which might take into account social, economic, cultural elements. The characteristics of an object, associated with each one's unique life experiences, personality traits, demographic characteristics, life values, and other similar variables, results in the formation of the beliefs. Thus, beliefs may vary from one person to another, from a population to the other (AJZEN, 1991). It also can be inferred that, since a specific group of people may have several common elements of formation – i.e., a group of

families that lived in the same neighborhood, so, same country, same province, same city, same area, children attending zone schools, leisure being at similar places, cultural and economic characteristics being much alike, and many other similarities – it may lead to very close beliefs regarding a given behavior/object. As told before, consumption of alcoholic beverages is part of Brazilian culture, and so is DD, despite this notion has been decreasing along the last decades (AQUINO & MORAIS, 2023).

After all, beliefs can be understood as antecedents of the TPB variables, and so, in final analyses, can somehow determine intentions and actions. Ajzen (1991) explains that ATT, SN and PBC have reasonably bound to behavioral, normative and control beliefs, respectively. Despite being regarded as *indirect measures* of the basilar TPB constructs, it is more appropriate to say that the composite of the beliefs are *formative indicators* of ATT, SN and PBC (AJZEN, 2020). That is because the actual effect of the beliefs on intentions, and, thus, on behavior, depends on empirical research. For that, employing reflective indicators (sets of items) that correlates them with ATT, SN and PBC respectively, provides direct measures of the components.

Behavioral beliefs entail to the benefits/concerns of performing a given behavior (DD, in the present study) someone might have in mind. Ajzen (1991) disserts, regarding behavioral beliefs and attitude toward the behavior (ATT), taking into account the sense of positive or negative evaluation:

> In the case of attitudes toward a behavior, each belief links the behavior to a certain outcome, or to some other attribute such as the cost incurred by performing the behavior. Since the attributes that come to be linked to the behavior are already valued positively or negatively, we automatically and simultaneously acquire an attitude toward the behavior. In this fashion, we learn to favor behaviors we believe have largely desirable consequences and we form unfavorable attitudes toward behaviors we associate with mostly undesirable consequences.

Subjective norms can be measured by normative beliefs that are split in two different branches: injunctive and descriptive normative beliefs. When dealing with a given referent (individual or group) subjective expectation or probability, injunctive normative beliefs are at concern. That

is when someone bases his intention of performing or not a task based on what a significant referent believes he/she should do. Their approval/disapproval, support/oppose, plays an important role for the decision-making. HEUCKMANN *et al.* (2018), in their "teaching about cancer" research, mention the injunctive normative belief as the "perceived social pressure that a referent (e.g., student) expects teachers to teach about cancer in the classroom". Making it short, it is to say, I will do what the (significant referent) thinks I should do. Descriptive normative influences, on the other hand, refer to what significant others are perceived to do. It is how much someone wants to be like the significant other or wants to do what the significant other does. As for example, in their study regarding parent's use of Gluten free/Casein free (GFCF) diets in Autism Spectrum Disorder (ASD) children, Marsden *et al.* (2019), investigated if the significant people (friends with ASD children that implemented the diet) would actually impact respondents in carrying on the diet treatment. That means, once my friends do (they implement the diet), as I trust them (they are significant referents to me), I will probably do (carry on the treatment on my child).

Control beliefs, at last, regard to factors that may facilitate or impede the execution of a behavior (FISHBEIN & AJZEN, 2010). It has to be mentioned, beforehand, though, that there are also two paths to be analyzed: situational and personal control beliefs. A person can be influenced by external factors (situational) or beliefs about himself/herself (personal skills/ability). In Heuckmann *et al.* (2018), the availability of teaching resources could be an example of a situational (external) factor that can facilitate/impede the teaching performance, that is, it is not up to the teachers themselves. Personal capacity/ability regarding the theme to be addressed to the students, however, would be an internal factor that could facilitate/make more difficult for a teacher to perform the lesson. Valuable information can be injected, by background factors, towards possible precursors of behavioral, normative, and control beliefs. This information, might be mistaken for being formed under irrational premises, personal motives or other biased notes, reflecting the reality in an untrue manner. Elicitation of beliefs, thus, is of crucial importance as the beliefs may be incorrect, they may reflect wishful thinking or be biased in other ways and may be unrepresentative of the information that is considered important in a given behavioral domain (AJZEN *et al.*, 2011).

A person's beliefs about a given behavior orientates the decision regarding whether or not proceed in performing it (STECKER *et al.*, 2007), but a person can only access a few at any certain moment about a given behavior, not all of them (AJZEN, 1991). Warner & Åberg, 2008,

states that understanding the main beliefs (salient beliefs) that support a behavior implementation is of unique characteristic of the TPB, as "it can provide a framework for predicting, changing and understanding what leads to the occurrence of a behavior".

Despite their crucial importance, only few of the TPB studies have scrutinized beliefs that give gleam the main TPB constructs (MIDDLESTADT, 2012; NIMRI *et al.*, 2017). Table 2.1 shows some of the studies that, reliyng on TPB, beliefs were elicited, indicating, also, their respective behavior targeted and the country population in which the research took place – tendency shows most of them in England and in the United States. For driving under the influence of alcohol, as far as this author's knowledge, only Parker *et al.* (1992) and Rowe *et al.* (2016), have done so.

Table 2.1 – Studies in which elicitation of beliefs was performed

STUDY	BEHAVIOR	COUNTRY
Parker *et al.*, 1992	Drinking and driving/ driving over speed limit/ close following driving/ dangerous overtaking while driving.	England
Aberg, 1993	Drinking and driving	Sweden
Elliott *et al.*, 2005	Compliance with the speed limit	England
Stecker *et al.*, 2007	Veterans engage in mental health care treatment	United States
Chan *et al.*, 2010	Drinking and driving	China
Zoellner *et al.*, 2012	Soft beverage drinking	United States
Rowe *et al.*, 2016	Drinking and driving/ driving over speed limit/ driving holding a mobile/ fatigated driving	England
Nimri *et al.*, 2017	Consumer's purchasing green hotel	Australia
Jung *et al.*, 2017	Fruit and vegetable consumption	United States
Jacques *et al.*, 2018	Compliance with the speed limit	Brazil
Wikes *et al.*, 2018	Weight loss	United States
Heuckmann *et al.*, 2018	Teaching about cancer	Germany
Moshki *et al.*, 2019	Pedestrians red light crossing	Iran
Marsden *et al.*, 2019	Use of Gluten free/Casein free (GFCF) diets in Autism Spectrum Disorder (ASD) children	England
Bertazzo *et al.*, 2020	Choice of transportation mode	Brazil
Warner, 2021	Cyclists drinking and driving	Sweden
Etika *et al.*, 2021	Driving over speed limit	Nigeria
Present study, 2023	Drinking and driving	Brazil

2.2.3 Expectancy-value products (EVPs) considerations

Ajzen (2020) explains that TPB relies on an expectancy-value formulation/products (EVPs) to designate the formation of the constructs. This is a mathematical procedure, as oriented back in 1975, by Fishbein & Ajzen (1975), when featuring the former Reasoned Action Theory, with the purpose to achieve components traits through the beliefs elicited. ATT, SN and PBC would be directly proportional to an index that takes into account the experience or outcome's subjective *expectation* (expectancy) and the experience or outcome's subjective *evaluation* (value). By subjective expectation, also treated as "belief strength", it can be understood as a person's belief about the likelihood of achieving a particular outcome if he/she performs the behavior. High expectancy means the individual believes the behavior is likely to lead to the desired outcome. Experience or outcome's subjective evaluation, in its turn, refers to the intensity or importance someone personally attaches to a specific aspect of a given behavior. It is the degree of conviction that a person holds regarding a specific belief about the behavior. For example, someone who highly (degree of conviction) believes that regular exercise (behavior) leads to better health (belief), holds a deep thought in the connection between exercise and health. It reflects how much an individual values or considers the outcomes as significant or desirable.

When speaking of attitude toward the behavior, see equation 2.1, below, the behavioral **outcome (b)** is the subjective expectation a person has over the likelihood reaching a specific outcome or result if performing the given behavior. It is represented by a person's readily accessible belief that performing behavior "X" would lead to outcome or provide a certain experience *i*. For that, the person takes into account his/her own experiences, together with the object/behavior's attributes to form opinions about it. For example, if the behavior is "to exercise", and the belief elicited is that "exercise is good for the health", someone could totally agree that this could be (*likelihood*), in fact, an outcome to the given behavior (to exercise). Another example could be someone's subjective evaluation whether "the belief that wearing a heart monitor (behavior) can detect heart arrhythmia (the outcome) or is inconvenient (the experience)" (AJZEN, 2020). Reminding that all procedures encompass a personal consideration, that is, an individual perspective.

$$ATT \propto \Sigma b_i e_i \qquad\qquad \text{Equation 2.1}$$

On the other hand, each belief regarding a given behavior has a degree of certainty (conviction) under a personal point of view, meaning its **value (e)**. At a personal evaluation, someone might think a specific belief attribute occupies a small (or a great) spot regarding his/her attitude toward the given behavior/object. This is called *outcome evaluation*. Considering the behavior of "exercise" and the belief elicited outcome, "become healthier", used before, for example, someone could evaluate it as agreeing with that particular outcome, or not, when questioned about it (i.e. "If I exercise, I will become healthier"). The evaluation usually takes place on a rating scale with the semantic endpoints *good* and *bad* (AJZEN, 1991; PARKER *et al.*, 1992).

Thus, the expectation one puts into that specific belief outcome or experience (b), multiplied by the subjective evaluation of the belief's attribute (e), summed over *n* salient beliefs, is a direct proportional measure to a person's ATT. And this procedure applies similarly to subjective norms and PBC.

For SN, normative beliefs can be seen from two perspectives: motivation to comply (MC) or identification with the referent (IR). Called as injunctive normative, MC is related to the behavior someone has based on what an important referent thinks would be the best way to perform. Is the expectation a given referent approves or disapproves. "I do what (the referent) thinks I should do". On the other hand, as descriptive normative, IR regards a behavior performed by someone based on what (the referent) actually do, so, that is an identification with what the referents themselves perform. It is a slight difference, but shall be mentioned. Then, as shown in equation 2.2, the EVP would be the composite of referent beliefs (***n***) and motivation to comply/identification with the referent, that is, referent's importance or significance (***s***).

$$SN \propto \Sigma n_i s_i$$

Equation 2.2

PBC in its turn would be the control factor belief strength (c), which is someone's view on how powerful a specific factor will lead to the behavior performance. In other words, it is the product of "a person's subjective probability that a given facilitating or inhibiting factor will be present

in the situation of interest", times the perceived power of control factors (p), which is the degree of certainty on the belief elicited (AJZEN, 2020). Equation 2.3 below represents it.

$$PBC \propto \Sigma c_i p_i$$

<div align="right">Equation 2.3</div>

For example, if the behavior is, again, "to exercise", and the belief elicited is "having expensive equipment at disposal", someone would measure how likely the availability of the equipment would lead to executing the exercise (c). And, also, would evaluate the power this factor means to him/her in order to actually perform exercises (p). At this point, it might be pointed a slight controversy risen regarding "health locus of control theory" (ROTTER, 1966). Under these understandings, the factors are split in two paths, an internal one and an external. While the latter means personality traits, abilities or skills, external factors would entitle, for instance, the behavior of third parties, money, instruments, and weather. However, under TPB, PBC concept is assumed to already congregate both types of circumstances.

Through the years, the majority of researchers that suited their research on TPB method have investigated solely the direct measures (TPB constructs), once, in part, constructing an instrument for belief-based evaluation entails much more effort than doing so for direct measures (HEUCKMANN *et al.*, 2018). Although an important method for statistically analyzing the relationship between beliefs and the TPB constructs of attitude, subjective norm, and PBC, there are studies that have not employed this statistical solution. Sullivan *et al.* (2008), write down a paper in which disserts about reasons for the possible misusages of the model, or even identifying the multiplicative composites (belief expectations times evaluations of outcomes) as unnecessary for final correlations to the TPB constructs. It is a theme that requires time and careful debate, once conceptual and statistical arguments shall be considered. But that is not the aim in this research to go thru the implications and theories behind this matter. It is, though, identify how other studies were driven and have an introspective analysis for the application here.

Some authors either tried the entire EVP procedure or opted for a different solution. Marsden *et al.* (2019), on the study about parent's use of Gluten/Casein Free (GFCF) diets, applied the entire EPVs model, while Heuckmann *et al.* (2018), for instance, when studying teaching cancer education, decided to access only belief likelihood (expectation/belief strength). In the Brazilian context, for example, Bertazzo *et al.* (2020), when studying choice of transportation amongst

<div align="right">17</div>

the students of a specific school of the FD, applied the entire pack. Jacques *et al.* (2018), in their turn, trying to understand speeding behavior, opted to include in the questionnaire only items regarding belief expectancy, letting aside belief evaluations. Among DD studies, Parker *et al.* (1992), opted to follow the entire procedure. Rowe *et al.* (2016), however, also followed the implementation of questions regarding only belief likelihood.

In the present study, it was also applied the shorten EVP model, considering only belief strengths, for some reasons, following some of the arguments pointed out by Sullivan *et al.* (2008), Rowe *et al.* (2016), Jacques *et al.* (2018), and Heuckmann *et al.* (2018). First, it important to address that the focus of the present paper is in making relations between the beliefs and the direct measures of TPB, rather than testing the expectancy-value interaction hypothesis. Although a valuable information, ascertaining how much an expectation that a given behavior leads to an outcome (expectancy) is moderated by the extent to which someone evaluates that outcome (value), is not under investigation. Sullivan *et al.* (2008), in his research conclusions, even indicates that using beliefs without multiplicative composites allows "unproblematic interpretation of the extent to which beliefs predict the ATT, SN and PBC" and that "there was no statistically significant difference in the correlation between" beliefs and the direct TPB measures for composites. Acknowledging this uncertainty of the EPVs model in providing statistically significant interactions, Elliott et al. (2005), describing the results found in other studies while introducing his speeding behavior research, stated: "In sum, the evidence for the expectancy-value underpinnings to TPB components is at best mixed". Apart that, the main reason in the present case for narrowing the beliefs expectancy-value process is that the instrument of research to be applied would increase significantly its length if the whole procedure was applied (from 15 to 30 belief questions). That could render more time to complete due to twice as many questions to be answered. Plus, could drive to fatigue respondents, causing misunderstandings and possible (and unwilled) evasion. That leads to another important reason, which is the population under observation. As in Jacques *et al.* (2018) study, the population target of the present study is the entire FD drivers, which is close to 1.9 million people (DETRANDF, 2023).

Therefore, as explained in chapter 03 ("Method") below, the sample size reaches hundreds of people, turning out to be an exhausting and challenging task to be achieved since this author did not count on sponsorships or a team to conduct the questionnaire applications. Along with that, people, in general, seemed to be not really open to answering research questions, let alone,

large instruments, for several reasons, as to say, laziness, distrust, unwillingness to participate and so on. Back to Jacques *et al.* (2018), study, then, despite focusing on different behaviors (speeding x DD), once the studies characteristics (participants and region) are potentially similar, it is fairly logical to maintain as much as possible the salient beliefs elicitation procedures as implemented in Jacques *et al.* (2018). Additionally, the majority of the studies available aiming at DD behavior only gather information about the TPB components itself, jumping over the belief stage. Hence, once the present study tried to accommodate items of value and expectancy randomly, it is reasonable consider its results altogether.

2.2.4   Drinking and Driving studies under TPB – Literature Review

This section aims to present a detailed bench of the main DD studies that counted on TPB to analyze this unwilling traffic behavior. This literature review was conducted through CAPES scientific research tool available to researchers, through partnerships with universities, which embraces several scientific databases such as Scopus, PsycINFO, Pub Medline and Web of Science. Double check in these four main research domains were executed. Input words and terms were "TPB", "theory of planned behavior", "road safety", "drinking and driving", "driving under the influence of alcohol" and "impaired driving", in intercalations with Boolean Operators (OR, AND) to combine search terms in the library databases. Matching the willing criteria of studies of DD behavior under TPB, after all detailed filtering, only 12 scientific articles were found. Of these, only 10 matched the criteria and two were unavailable, being discarded. Table 2.2 downwards seeks to relate them as well as relate their main findings regarding TPB framework.

Table 2.2 – DD studies under TPB

STUDY	EB	EVPs	SALIENT BELIEFS ELICITED				TPB CONSTRUCTS		DEMOGRAPHICS *vs* INT	BEHAVIOR (r)
			BB	NB	CB	SS	ATT/SN/PBC vs. INT (β and R²)		---	---
Parker *et al*., 1992	Y	Y	*Not mentioned*	• Police; • Respondent's spouse or partner; • Other drivers on the road at the time; • Respondent's immediate family; • "Typical young male driver"; and • Friends.	*Not mentioned*	881	• ATT: .08* • SN: .26** • PBC: .48** (control belief) • R²= .42**		• Gender (older 35yld males).	*Not evaluated*
Armitage *et al*., 2002	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	124	• **ATT: .36**** • SN: .41** • PBC: .18* • **R²= .47****		• Gender (older males)	*Not evaluated*
Marcil *et al*., 2001	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	113	• **ATT: .51**** • SN: .16* • PBC: .24** • **R²= .64****		• Gender (young males)	• Correlation of INT with frequency of DD during the past year: r =.38
Chan *et al*., 2010	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	124	• **ATT: .28*** • SN: .15* • PBC: .17*** • **R²=** not mentioned.		• Gender (men)	*Not evaluated*
Moan & Rise, 2011	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	879	• ATT: not mentioned. • SN: not mentioned. • PBC: not mentioned. • **R²= .79******		• Gender and age (young males)	*Not evaluated*
González-Iglesias *et al.*, 2015	N	N	*Not Available*	*Not Available*	*Not Available*	--	--		--	--
Rowe *et al*., 2016	Y	Y	• hurting other road users; • injuring myself; • having an accident;	• My family • My parents • Other road users	• Having no alternative way to get home • Having friends with me.	72	• **ATT: .72**** • SN: .08** • PBC: .10**		*Not mentioned*	*Not evaluated*

20

	EB		BB	NB	CB	SS		BEHAVIOR
							R²= .68**	
			- impair my driving performance; - losing control of the car; - losing control of the car; - put me in a good mood; - advantage over other road users; - convenient for me	- Sensible people - Most people - My friends. - The police/ authorities. - People such as chavs a drinking problem; - Foolish people (e.g. idiots)	- Being in an emergency situation. - The presence of the police - Knowing a victim of a road accident - Having thought about the risks - Having passengers in the car			
Lheureux *et al*., 2016	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	642	- ATT: .23** **SN: .34**** - PBC: .05** **R²= .43****	*Not evaluated*	Correlation of INT with frequency of DD in the past: r =.59
Elias *et al*., 2016	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	299	**ATT: .44** - SN: not sig. - PBC: not sig **R²= .25**	Gender (men)	*Not evaluated*
Potard *et al*., 2018	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	368	- ATT: .54 - SN: .52 **PBC: .58** **R²= .43**	Gender: young males	*Not evaluated*
Vankov & Schroeter, 2021	N	N	*Not Available*	*Not Available*	*Not Available*	--	--	--	--
Yadav *et al*., 2022	N	N	*Not evaluated*	*Not evaluated*	*Not evaluated*	252	**ATT: .69**** - SN: .06* - PBC: .18* **R²= .68**	Gender (not specified)	*Not evaluated*

Notes:
1. Y: yes; N: no.
2. EB: If there has been conducted Elicitation of Beliefs – BB: Behavioral Belief; NB: Normative Belief; CB: Control Belief.
3. SS: Sample Size of the main study.
4. BEHAVIOR: In some studies, behavior was approached through correlations between past behavior questions and INT, while some others applied an "actual behavior" questionnaire, which a stage done after the main study with the porpoise to identify if the respondents in fact carried out the given behavior.
5. *p-value <.01
   **p <.001
   ***Marcil *et al*. only cite R² for the extended TPB model (.79).

Regarding beliefs, as showed in Table 2.2, only two studies, Parker *et al.* (1992), and Rowe *et al.* (2016), conducted the elicitation procedure. The first one only presented the findings related to normative beliefs, while the latter detailed the whole set of all three belief branches – BB, NB and CB. As for the relations between the constructs of attitude, subjective norms, PBC and intentions, Table shows the statistical results obtained by each study after regression models. In general, ATT and PBC entails higher betas coefficient (β) taking INT as the determinant variable. R^2 shows how much is data variation of the constructs explained by the model in each study. Demographic variables are also presented in the Table stressing the most prominent variable found, by each study, considering the INT to DD, after correlation statistical methods were applied. Finally, the Table shows a last column of actual behavior, stressing in which of the research it was actually undergone, and their respective correlation (r) found.

3   METHOD

All the TPB components can be influenced by behavioral, normative, and control beliefs, which are formed by background information processing in each one. For a better understanding of the theory and how the hypotheses are linked and were tried to be answered, see schematic representation of the TPB model on Figure 3.1.
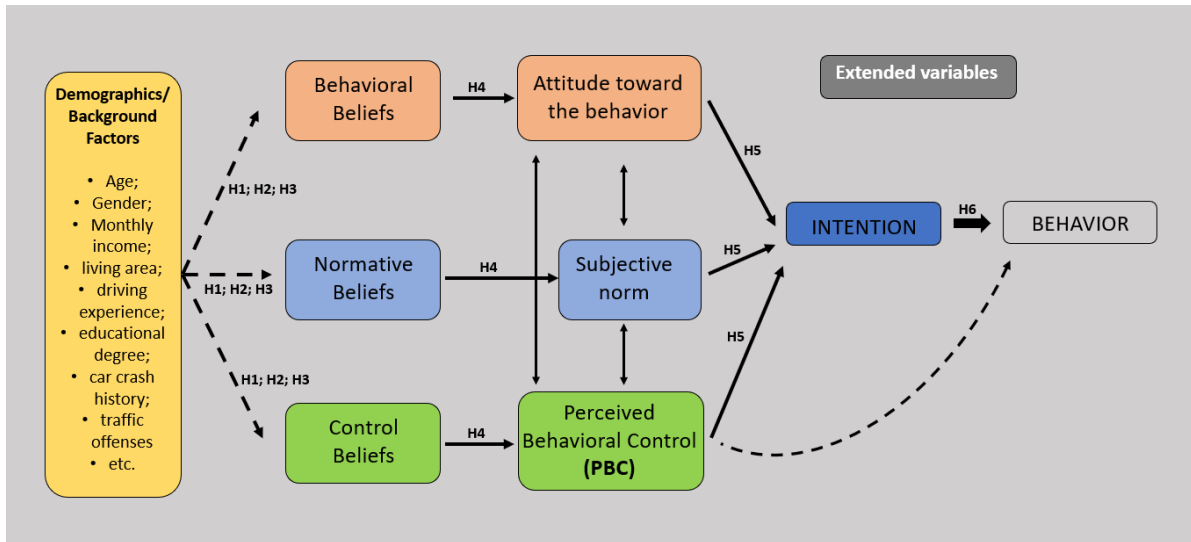
Figure 3.1 – Framework of the TPB model (inspired from AJZEN, 1991)

Following this this framework research, as presented in Figure 3.1 below, which is a summary of the whole method employed, was conducted following Ajzen's guidelines (1991, 2020). First, an elicitation of salient beliefs, second, the main research, regarding belief's evaluation and the TPB constructs, and third, the last phase, a behavioral study, when tried to capture the actual behavior of the respondents. Three questionnaires were administered for each step: one for the first part of the study ("Pilot Study" or "Elicitation Study"), another, based on the answers of the first and complemented with items about TPB basilar constructs – ATT, SN, PBC and INT, and, lastly, a third one regarding actual behavior ("Behavioral Study") to complete the whole task proposed by the theory. The instruments contained, before all, information about the research origin, procedure and target, as well as an Informed Consent Form (ICF) to be checked. Also, respondents were advised of their anonymity.

	ELICITATION STUDY	MAIN STUDY	BEHAVIORAL STUDY
INSTRUMENT	Open-ended questionnaire	Likert agreement scale (1-5) items	Likert agreement scale (1-5) items
DATA GATHERING	Online and physical forms, handed online and in person	Online and physical forms, handed only online	Online
SAMPLE	179	745	51
DATA ANALYSIS	Content analysis	(i) Spearman correlations; (ii) Exploratory Factor Analysis - EFA (iii) Linear regression	(i) Spearman correlations; (ii) Exploratory Factor Analysis - EFA (iii) Logistic regression

Figure 3.2 – Summary of the method employed in the present study (AJZEN, 1991)

As the study was conducted in Brazil, the questionnaires were applied in Portuguese, so translation of Ajzen's original items was required. As taught by Bradburn *et al.* (2004), pretest interviews and peer feedback of draft questionnaire were conducted, being firstly applied to few people, including transport and psychologist professors and students, traffic professionals, and people without any transport formation. For that, in some cases, it was used "Think Aloud" technique (PETERS & TEMPLIN, 2010). Result answers and feedback of the items did not require any significant adjustments, but merely orthographically mistakes and introductory inputs. Also, the study took into account past TPB road safety belief studies (JACQUES *et al.*, 2018; BERTAZZO *et al.*, 2020) that were conducted in the same Brazilian region (FD), and aimed at behaviors related to transportation, as the present research. It can be fairly accepted that the items were already gone through validation of its comprehension and final application.

3.1 SURVEY OF SALIENT BELIEFS – STEP 1

3.1.1 Instrument and Data Gathering Procedure

An elicitation questionnaire was constructed in Ajzen's (1991) guidelines containing open-ended qualitative items regarding the three ordinary TPB beliefs (i.e., behavioral beliefs, normative beliefs, and control beliefs) and demographic questions (place of living, gender and age). The data was collected else online, through social media dissemination (*Google Forms*)

and in person, when the respondents had the opportunity to either fill the instrument in the paper or through the online link.

For more independent and unbiased answers, it was chosen to proceed within individual responses, rather than group data collection. That is to say, the TPB method seeks elicitation of those individually readily accessible beliefs (AJZEN, 1991), which means, those that comes to mind most instantaneous, without further breakthrough, which could be somehow orientated in an interview or group work. A focus group, for instance, though not a forbidden technique, could lead to a belief selection list put forth by few vocal dominants (NIMRI *et al.*, 2017). Concluding, in Ajzen's own words (2020), "beliefs that come readily and spontaneously to mind", "may not be the beliefs identified when employing focus groups".

As mentioned before, the instrument contained an informative introduction about the study and the targeted behavior, in which the importance of answering all the questions truthfully was stressed. Also, criteria questions of eligibility such as ICF and whether or not the participant's driver license was enacted in the FD were included. Negative answer to any of these immediately represented end of survey responses.

Table 3.1 provides an overview of the questions used in the questionnaire, following Jacques *et al.* (2018) study. For behavioral beliefs, two questions were designed in order to catch respondent's opinion concerning advantages/disadvantages and another two about the reasons to consider the behavior of DD good or bad. As for perceived social pressure, two questions were set forth, regarding referents that would approve or disapprove the behavior. Finally, control beliefs were elicited through two items addressed perceived factors or circumstances that enable or prevent engagement in the DD behavior.

Table 3.1 – Beliefs' elicitation questions

Questions of the Pilot Study
1. Behavioral Beliefs
1.1. "What are the advantages of drinking and driving?"
1.2. "What are the disadvantages of drinking and driving?"
1.3. "Why is it good to drink and drive?"
1.4. "Why is it bad to drink and drive?"
2. Normative Beliefs
2.1. "Which people or groups would approve you drinking and driving?"
2.2. "Which people or groups would disapprove you drinking and driving?"
3. Control Beliefs

3.1. "What factors or circumstances would probably make you decide to engage in a drinking and driving behavior?"

3.2. "What factors or circumstances would probably make you refrain from engaging in a drinking and driving

Answerers were collected from in the first semester of 2023 and the whole questionnaire administered, in Portuguese version, with authors comments, can be found in Appendix I.

3.1.2   Sample Size – Pilot study

Most of similar studies regarding belief elicitation under TPB followed the saturation criteria, that is, when similar opinions are repeatedly given. Ajzen & Fishbein (1980)'s even led to this criterion and many studies followed this manner (ELLIOTT *et al.*, 2005; JACQUES *et al.*, 2018; MOSHKI *et al.*, 2019; WARNER, 2021). Explaining better, as an epistemological instrument – a framework designed to investigate knowledge, *saturation* stands for the line over which no more observations are necessary because no new more elements arise expanding the number of properties of the object under investigation. Therefore, it can be said that saturation is the sufficient number of observations reached to elicit the most commonly held beliefs associated with the targeted behavior – DD.

Table 3.2 presents some of the studies and the saturation sample size reached in each of them. In the present study, in order to avoid questioning of low representativeness, it was decided to select a bigger sample compared to the past studies, recruiting participants through snowball sampling (PATTON, 2002). Insofar, for the present study, a sample of 192 drivers answered the questionnaire, of which 179 met the eligibility criteria and completed the whole items. Besides online dissemination through social media, along with some university fellows in help, places such as the main bus station in the center of the FD (*Rodoviária do Plano Piloto*), the University of Brasilia - UnB, Traffic Department's public school, shopping centers, street markets and bars along *Brasília*, *Gama* and *Ceilândia*, which are the most populous regions in the FD (CODEPLAN, 2020), were visited for the data collection. These selected sites are regionally known for its diversity of gender, age and people's place of living, serving as a decent sample for the present data collection.

Table 3.2 – Sample size of studies in which elicitation of beliefs were conducted

STUDY	SAMPLE SIZE	STUDY	SAMPLE SIZE
Parker *et al.*, 1992	240	Wikes *et al.*, 2018	21

Elliott *et al.*, 2005	16	Heuckmann *et al.*, 2018	33
Stecker *et al.*, 2007	20	Moshki *et al.*, 2019	30
Zoellner *et al.*, 2012	54	Marsden *et al.*, 2019	23
Rowe *et al.*, 2016	15	Bertazzo *et al.*, 2020	24
Nimri *et al.*, 2017	15	Warner, 2021	34
Jung *et al.*, 2017	25	Etika *et al.*, 2021	13
Jacques *et al.*, 2018	35		
		Present study, 2023	**179**

3.1.3   Content Analysis

Once responses were collected, a content analysis was carried out under Fishbein & Ajzen's (2010) orientations for systematically coding. For that, it was taken into consideration concepts and directions of Bardin (2010), along with a few other TPB studies procedures detailed up front in the explanation below.

This qualitative research content analysis was done through data coding, under classificatory type, in descriptive categories, from the particular to general (BARDIN, 2010). To enhance the reliability on the procedure adopted and put aside any argumentation of biased effect (STECKER *et al.*, 2007; NIMRI *et al.*, 2017; WIKES *et al.*, 2018), three independent examiners code the data. The researchers elaborated an orientation guide with procedures to the content analyses. Considering the scope of the research, in a concept-driven way (deduction inference), the examiners were asked to established categories, taking as a lead the basilar TPB's belief variables. Then, in a data-driven (inductive inference) process, they should identify amongst respondent's answers, sets of common components, which might be gathered in order to compose belief subcategories. These components, called *meaning units* or *registration units*, are "the smallest part of the content in which an element can be identified" (BARDIN, 2010), which may be composed of a word, a sentence or a phrase. For that, some strategies used by Stecker *et al.* (2007) could be employed, such as "searching the text for main ideas", "putting themes together", "identifying repetition among respondents" and "searching for confirming and disconfirming evidence of themes". After that, critic insights were carried to reach a unanimous coding scheme. Next, it was performed a frequency count to arrange the elements in descending order (BARDIN, 2010).

At last, Ajzen & Fishbein (1980) suggest three approaches to identifying the salient set, taking into account the frequency ordering (MIDDLESTADT, 2012; MOSHKI *et al.*, 2019): (1) take the 10-12 most frequently mentioned salient consequences, referents, or circumstances, (2) use the salient items mentioned by 10 or 20% of the participants; or (3) select items that account for at least 75% of the responses. For the present study, as it can be seen in Chapter 4 ("Results"), **Erro! Fonte de referência não encontrada.**, after this content analysis procedure, it was coded salient belief categories subthemes that reached frequency mentions up to 95% of all answers.

3.2   MAIN SURVEY – STEP 2

3.2.1   Instrument and Data Gathering Procedure

Once undergone Step 1 (Pilot Study or Belief Elicitation), a second questionnaire, named Main Study (Step 2), was elaborated for the main part of the research. This form aimed at (i) collecting demographic factors, (ii) evaluating the salient beliefs elicited in Step 1, and (iii) gathering data regarding the TPB constructs (attitude, subjective norm, PBC and intention).

As declared before, at first, the instrument contained an informative introduction about the study and the targeted behavior, in which the importance of answering all the questions truthfully was stressed. Next, two criteria questions of eligibility had to be answered. One regarding ICF, and the then, another item on whether the respondent's driver's license was enacted in the FD or if he/she use to drive on its venues. Negative answer to any of these questions immediately represented end of survey responses, working as excluding criteria. Recommended whenever possible, beliefs and direct TPB items were inserted randomly. That was done to reduce potential biases by logical ordering or learning process (BRADBURN *et al.*, 2004; CHOI & PAK, 2005) once respondent's answers to questions can be led by prior items responses.

Answerers were collected in the second semester of 2023. The whole questionnaire administered, in Portuguese version, but with authors guidance comments, can be found in Appendix II – Main Study Questionnaire.

(i)   Demographics

Nine questions compose this investigation. It was asked the respondents to inform region of living, gender, age, income, educational degree, driving experience, car crash history (In how many car crashes have the respondent be involved in the last 3 months that resulted in injured people? Answers ranging from 1 to 5 or more), DD behavior (Have often have you driven after an event in which had been drinking in the last 3 months? Answers ranging from always-usually-sometimes-rarely-never), and use of alternative way of transport (In the last 3 months, how often did you use alternative way of transport, such as riding, public or app transport, to avoid driving while under alcohol effect? Answers ranging from always-usually-sometimes-rarely-never).

(ii)   Salient beliefs evaluation

Once elicited accessible behavioral, normative, and control beliefs about DD in Step 1, the salient beliefs were inserted in the main study in terms of separate items. As explained before (section 2.2.3, Chapter 2), although a useful method, the expectancy-value model (a way to verify the relations between the beliefs and the main TPB basilar constructs), was not implemented in this study fully, but only regarding outcomes.

In total, 15 items were elaborated, 05 regarding behavioral beliefs, 04 on normative beliefs and 06 questioning about control beliefs, following Ajzen (1991)'s orientations and taking into account other TPB transportation studies questionnaires (ELLIOTT *et al.*, 2005; ROWE *et al.*, 2016; NIMRI *et al.*, 2017; ELIAS *et al.*, 2017; JACQUES *et al.* 2018; BERTAZZO *et al.*, 2020). As an example of salient behavioral belief, the outcome "euphory" was questioned: "Driving under the influence of alcohol makes me fell light, happy and brave" (Instrument question nº 27 – BB 02). As for salient normative belief, the outcome "friends and family that banalize DD" item was: "Family and friends who drink and drive approve of me driving under the influence of alcohol" (Instrument question nº 09 – NB 01). Regarding salient control belief, "no alternative way of transport", question was: "When there is no other way to leave an event/celebration, I am likely to drive after consuming alcohol" (Instrument question nº 03 – NB 02).

Despite the number of salient beliefs elicited (20 in total), as described in Chapter 4 of the present study ("Results"), see **Erro! Fonte de referência não encontrada.**, items could be written in way to embrace in the same question more than one belief. **Table 3.3** provides a

reference list of the items for better understanding how beliefs were incorporated in the questions. Item 11 (NB 04), for example, contemplates referents "authorities" and "victims".

Table 3.3 – Reference list of elicited beliefs

TPB Belief	Belief #	Instrument Question	Variables (Belief attribute elicited)	# of items	# of varibles
BB	1	4	Convenience (A)	1	1
	2	27	Euphory (A)	1	1
	3	16	Saving time and Money (A)	1	1
	4	22	Risk to personal and other's physical integrity (car crash) (D) and Psychomotor impairment (D)	1	2
	5	14	Traffic enforcement consequences (D)	1	1
			Total	**05**	**06**
NB	1	9	Family and friends that banalize DD	1	1
	2	17	General Society (inconsequent and irresponsible ones)	1	1
	3	20	Family and friends (if less than 2 doses)	1	1
	4	11	Authorities + Victims	1	2
			Total	**04**	**05**
CB	1	18	Emergency situation (life risk) (F)	1	1
	2	3	No alternative way of transport (F) and (D)	1	2
	3	7	Alcohol ingestion (if less than 2 doses) (F) and (D)	1	2
	4	23	Money saving (F)	1	1
	5	25	Responsibility (D) and Risk perception (D)	1	2
	6	28	Social events (F)	1	1
			Total	**06**	**09**
			Total Sum	**15**	**20**

It was adopted Likert agreement scale (ELIAS *et al.*, 2017), ranging from 1 to 5, where 1 meant TOTALLY DISAGREE and 5, FULLY AGREE, despite Ajzen's guidelines of 1-7 point. That is because it has been found that, apart from those of 2- and 3-point scales, it is irrelevant the range used as they propose few points of freedom and do not affect the internal consistency, nor its concurrent or predictive validity of its scale (PASQUALI, 2010). Also, after the pre-testing of the questionnaire, when a 1–7-point scale was presented, respondents externed their worry about the length of this range, indicating a smaller one could drive to a better understanding and response of the items.

    (iii)   TPB standard variables

Summed up, the questionnaire contained 13 TPB standard variables questions, all of them under Likert agreement scale, ranging from 1 to 5, where 1 meant TOTALLY DISAGREE and 5, FULLY AGREE (YADAV *et al.*, 2022). Higher scores indicated riskier attitudes (ROWE *et al.*, 2016). Items also followed later studies already mentioned as inspirations, such as Elliott *et*

al. (2005); Jacques *et al.* (2018); Bertazzo *et al.* (2020); Rowe *et al.* (2016); NIMRI *et al.* (2017).

To measure *attitude toward behavior*, the use of four semantic differential items under Osgood (1964) orientations, rating on seven-point bipolar scale (-3 to +3 scores) ended on pairs of adjectives – (1) Pleasant – Unpleasant, (2) Harmful – Beneficial, (3) Negative – Positive, (4) Wise – Foolish, was dropped in the present work for reasons of more logic and orientated statistical analysis. That is, it was a strategy for avoiding biased answers due to the length of a questionnaire, as respondents know the questionnaire parameter and don't make misperceptions regarding what are the endpoints (PASQUALI, 2010). In this manner, as for the range (1 to 7), during the items pre-tests, when semantic items were employed, it was found difficulties in the participants to understand and dually respond ATT questions compared to the rest of the questionnaire. Seven-point scales, were also dropped, as explained in item ii (salient beliefs evaluation) before, confirmed by the respondents, who were unanimous affirming seven degrees were a vast spectrum for choosing the answer and making an opinion.

Attitude toward behavior was measured by 04 items, trying to hold all four semantic adjectives towards riskier behaviors: (1) "Driving under alcohol effect is pleasant"; (2) "It is safe to drive a vehicle under the influence of alcohol after an event with friends and family"; (3) "Driving under the influence of alcohol is positive"; and (4) "Driving under the influence of alcohol is a wise attitude".

Subjective norms, *PBC* and *intention*, 03 items each. For SN items were: (1) "People close to me (my family) support me driving under the influence of alcohol"; (2) "Most of my friends agree that I drive under the influence of alcohol after an event"; and (3) "If I drive my car after consuming alcoholic beverages at a party/celebration, the majority of people who are important to me (parents, children, grandparents, spouse, friends) will approve of my decision".

As for PBC, items were: (1) "I have good control of driving even after consuming alcoholic beverages at an event/celebration"; (2) "I drive under the influence of alcohol without any issues"; (3) "I can easily drive even after consuming alcoholic beverages at a party".

For INT, it was elaborated the following: (1) "In the coming weeks, I plan to drive after consuming alcohol at an event"; (2) "In the coming weeks, I will likely drive after consuming

alcoholic beverages at a party with friends and/or family"; and (3) "It is possible that I may choose to drive after consuming alcoholic beverages at a celebration with friends and/or family in the coming weeks".

3.2.2 Cronbach's Alpha

Cronbach's alpha is calculated to check if the constituent items of the questionnaire are measuring the same construct, which is, the reliability of each measure (CORTINA, 1993). Alpha values range between 0 and 1 with higher scores (α >0.7) indicating greater internal consistency (NUNNALLY, 1978, *apud* CORTINA, 1993). It might be seen that same question is being asked once and again, but each construct is probed with a set of defined items, managing to cover all aspects of the construct (ROWE *et al.*, 2016). Cronbach's alpha formula is shown in equation 3.1 below, where N is the number of items, c is the mean covariance between items and v is the mean variance.

$$\alpha = \frac{N * \overline{c}}{\overline{v} + (N - 1) * \overline{c}}$$
Equation 3.1

For the belief items proposed in the Main Study, overall Alpha was 0.898, which is considered quite high and suggests a robust internal consistency among the items of the scale. As for each belief category individually, behavioral belief items Alpha was 0.773, normative beliefs α =0.787, and control beliefs α =0.838, all of them showing accepted internal consistency.

Considering only items regarding ATT, SN and PBC, alpha close to 0.90 (total construct's alpha = 0.896). Subscales follows the same way, although intention items have a slightly lower alpha value: ATT =0.742; SN = 0.816; PBC = 0.866; and INT = 0.693.

3.2.3 Sample Size

Here it is important to stress that the targeted sample size was evaluated under two spectrums.

(i) First, using Cochran's (1977) formula shown below:

$$n = \frac{Z^2 pq}{d^2}$$

<div align="right">Equation 3.2</div>

Here, **d** is the margin of error (5%), **p** is the target population, **q** = 1 – p, and **Z** = 1.96 for 95% confidence interval. The present study targeted people that have driver's license enacted in the FD and those that in any way usually conduct motor vehicles in its roads, which, according to FD Traffic Department (DETRANDF, 2023), there are almost 1.9 million drivers. Therefore, completing the equation above, the sample size will be 384.16, that, rounding up to the next cent, once the population is over a million, reaches 400 (four hundred) people (equation 3.3).

$$n = \frac{1.96^2 \cdot 0.5 \cdot (1-0.5)}{0.05^2}$$

<div align="right">Equation 3.3</div>

In this study, 1.007 respondents participated, which is 2.5 times Cochran's borderline.

(ii) Factorial analysis sample size

The other perspective of the sample size, that is, the confidentiality of a factorial analyses, one of the statistical methods used in this research. Factor analysis is amongst the most powerful psychometric methods for reducing the complexity of a large number of variables into a relatively simple structure, consisting of a smaller number of factors. The factors are linear combinations of observed variables. This method is widely used in research fields such as psychology, sociology, economics, education, and other disciplines that deal with the collection and analysis of complex data. Another vital usage of factor analysis occurs in the process of validating psychological instruments (Jacob, 2012). In this regard, could be mentioned lesson: "Factor analysis is closely related to the issues of validity in psychological instruments. Factor analysis is at the core of measuring psychological constructs" (NUNNALLY, 1978, *apud* JACOB, 2012). Nowadays, factor validity denotes construct validity. And heterogeneity samples brigs better results than homogeneous ones when trying to represent the whole extension of the targeted population (CLARK & WATSON, 1995).

That being said, some brief considerations shall be mentioned regarding the sample size itself. First, it must be pointed out that literature is not unanimous regarding this matter. While some authors (GUADAGNOLI & VELICER, 1988; WOLINS, 1995) claims that there's no theoretical nor empirical basis supporting the relationship between the number of participants and the number of variables, others defend it. Sample size should take into account the number of variables of a given study, and as numerous they are, the larger must be the parameters to be estimated (PASQUALI, 2010; MATOS & RODRIGUES, 2019). A minimum of 10 observations for each variable is one of the recommendations (Crocker & Algina, 1986; PASQUALI, 1999; COSTELLO & OSBORNE, 2005). Other researchers point to a minimum of five (GORSUCH, 1983; HAIR *et al.*, 2009). Giving a little bit of complexity, other group argues that factorial weights should be considered (GUADAGNOLI & VELICER, 1988; FIELD *et al.*, 2012), and the sample size can diverge due to several points. Despite all these findings and rules, one general orientation can be said to be unanimous: for a stable and trustable factorial analyses, as larger as the sample, the better it is. Pasquali, 1999, says that below 200 observations, an analyses can hardly be considered; Hair *et al.*, 2009, says at least 100; Field *et al.*, 2012, argue as low as 300 minimum; and Comrey & Lee (1992) even establish a classification in which 300 would be "good", 500 (very decent), and 1.000 as "excellent".

For the present study, the main questionnaire (Appendix II – Main Study Questionnaire) was filled with 28 items of which, 30 TPB variables (salient beliefs elicited and TPB constructs) were to be analyzed. Also, after filtering the excluding criteria questions in the questionnaire, from 1.007 participants, the eligible answers went to 745. Therefore, if considering Hair *et al.* (2009) and alike for the variable x observations rule, the aimed would be 150 respondents (5 times). The present study reached 4.97 (almost 5) times more than needed. This number is even reasonable if considering the "ideal 10", set forth by Pasquali (1999) and alike, which would claim for at least 300 observations, while present study went up 2.49 times higher. When taking the sample size approach orientations, this research also applies to the parameters reasonably, as it is close to the "excellent" number of a thousand responses. Taking other studies as parameter, as well, such as Parker *et al.* (1992), and Jacques *et al.* (2018), that tried to represent entire country regions populations, it can be said that this study sample size is fair enough. While the first aimed to study England's whole driving population, reaching 881 participants, Jacques *et al.* (2018), tried to represent Brazilian FD's entire drivers, same as the present research, and collected 914 answers. In a shorter period, due to the research deadlines and other limiting obstacles, as already pointed out, this work's total 745 responses can be decently

accepted for a factorial analysis. In conclusion, considering items (i) and (ii) of this section underlines, regardless of under which approach is followed, this study's sample size is fairly exhaustive and in accordance with other similar studies.

3.2.4   Statistical Analysis

As mentioned, Pilot Study provided a set of salient beliefs after a content analyses, and then, they were evaluated in the Main Study questionnaire, under a Likert agreement scale. Still in this last instrument, through same scale, TPB components of ATT, SN, PBC and INT were measured.

As variables are classified as ordinals[2], that is, provide an order, but the magnitude of differences between categories is not precise or uniform, it was employed Spearman's rank correlation. Unlike Pearson's correlation (a measure of the linear relationship between two continuous variables), Spearman's rank correlation method is particularly suitable for calculating correlations between ordinal variables because it is based on the order of the data rather than their exact values. In other words, the Spearman's method is a non-parametric correlation measure that assesses the monotonic relationship between two variables. It ranges from -1 to 1, where "1" refers to a perfect positive correlation (as one variable increases, the other also increases monotonically), "-1", perfect negative correlation (as one variable increases, the other decreases monotonically), and "0" indicates no linear correlation.

Later, as results showed a strong correlation between the items reveled in the elicitation study, it was conducted Exploratory Factor Analysis – EFA, to combine related beliefs into scales (ROWE *et al.*, 2016). In factor analysis, factor loadings are coefficients that indicate the relationship between the observed variables (or indicators, items, questions) and the latent factors identified during the analysis (constructs). In simple terms, factor loadings represent the strength and direction of the association between each variable and each factor. When EFA is conducted, the goal is to identify underlying patterns in the data by grouping observed variables into latent factors. Factor loadings indicate the contribution of each variable to each factor. Despite other studies have conducted a Confirmatory Factor Analysis – CFA, this path was not

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[2] This author is aware of the debate that encompasses the nature of the data when classifying it as ordinal or interval. Regardless of the important arguments risen in this regard (see Kemp and Grace, 2021; Knapp, 1990), for the present research it is been followed the branch that alleges this data as being of ordinal categorization.

chosen in the present study. That is because the instrument, despite relying in TPB concepts and incorporating expressions from similar DD behavior studies from overseas, was elaborated taking into account beliefs elicited in a particular region, in Portuguese language, and with adaptations to the local country reality. Therefore, it can be said it is a new questionnaire designed towards TPB and, so, EFA is more appropriate to elucidate its performance measuring the given construct for this specific sample (DAMASIO, 2012).

Following some of Jacques *et al.*, 2018, Rowe *et al.*, 2016, and Yadav *et al.*, 2022, procedures, with slight differences, factor solutions were led in the following order:

(a) Factor adequacy: in order to verify whether the data matrix was capable of factorization, analysis through response redundancy, Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity Test were conducted.

(b) Factor assessment: the number of suitable factors was chosen based on the assessment of Scree Plot graph (Cattell's test)[3] and oblique (Oblimin) rotation.

(c) Reliability Index: once scales were formed the reliability of them were reexamined using Cronbach's alpha.

Rounding up statistical analysis, linear regression was used to investigate the impact of demographics, beliefs and TPB variables towards INT. All calculations of the data analysis were performed using *R* application. Detailed information can be seen in Chapter 4.

3.3 BEHAVIORAL STUDY – STEP 3

3.3.1 Instrument and Data Gathering Procedure

As the last part of the study, as Ajzen's (1991, 2020) recommendations and questioning inspirations, this questionnaire aimed to verify the actual compliance with the behavior in order to make correlations to study in Step 2. Only respondents that manifested the intention to participate in this final part of the research, were emailed with the requirement to do so. Answers were collected for a week, when the researcher contacted respondents three times

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[3] It also was tried the Horn criteria through parallel analysis, but the results found, despite indicating three-division elements, brought a very mixed and complex arrangement.

reminding them to fill the form. Almost a month was the period between the last response for the Main Study and the beginning of the collection of this last step's questionnaire.

Questionnaire was composed of three parts (Appendix III – Behavioral Questionnaire). First, introduction and ICF, when it was stressed the importance of delivering honest answers and the security of the data – not publishing names and answers. Second, two eligible questions on 1. "Do you drive motor vehicles?", on "yes"/ "no" answer, where "no" directs to the end of form, and 2. "How often do you consume alcoholic beverages?", answers ranging from always-usually-sometimes-rarely-never, in which "never" as answer entails to end of fulfillment. Finally, four questions aimed to know whether if the respondent had indeed engaged into the DD behavior into the last month, as follows: 1. "In the past few weeks, have you driven a car after consuming alcohol?", a most direct and plain questions; 2. "Have you driven a car under the influence of alcohol in the past few weeks, either for the thrill of it, the enjoyment of driving in that state, or simply out of convenience (not relying on another means of transportation)?", when attitudinal characters were inserted; 3. "Have you driven a car under the influence of alcohol in the past few weeks due to someone else's influence?", when SN elements were undergone; and 4. "In the past few weeks, was there any situation that led you to drive after consuming alcoholic beverages?", evocating perceived control concept. This strategy was taken in order to try to fill possible gaps that "desirable social answers" could bring to the research and, so, try to really reach the aim: DD, regardless of how, was, in fact, carried out?

3.3.2   Sample and Statistical Analysis

Ased to voluntarily participate on the behavioral study, then, 246 people left their email address for contact. Out of them, only 78 returned answers, and 51 met eligible criteria to participate in the research. For statistical analyses, Spearman's method was employed for correlations between variables and actual behavior. After, a regression analysis of TPB components and intention was carried out in order to evaluate to what extent they are able to explain actual behavior.

4 RESULTS AND DISCUSSION

Section is divided in two subcategories, Step 1 (Belief's Elicitation), and Step 2 (Main Study).

4.1 SALIENT BELIEFS ELICITATION – STEP 1

Most respondents (64,4%) are male (**Figure 4.1**-a), between 26-50 years old (66,5%) (**Figure 4.1**-b).
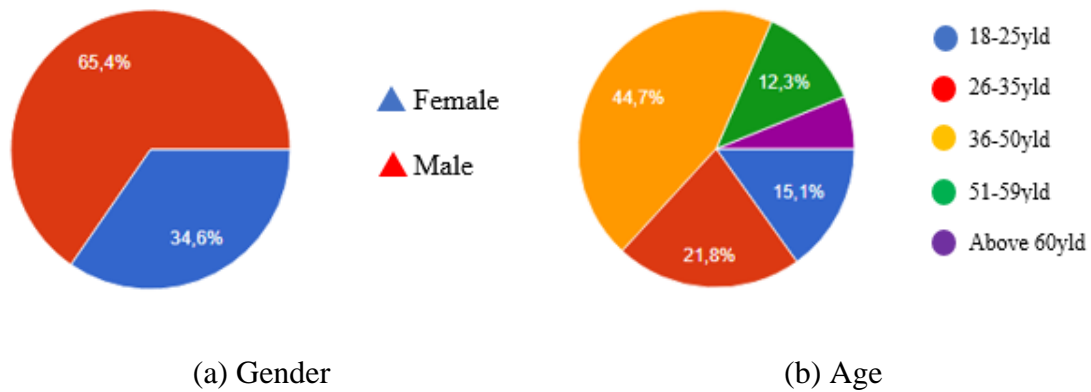
(a) Gender   (b) Age

Figure 4.1 – Gender and age of the respondents

Results are in accordance with FD licensed drivers' profile[4]. Table 4.1, below, shows that in the FD there are almost 1.9 million licensed drivers, most of whom are male (60%) and between 36-50 years old.

Table 4.1 – Federal District licensed drivers, regarding gender and age

AGE (ranges)	AGE (ordinal)	% AGE (total)	MAN	% MAN (total)	WOMAN	% WOMAN (total)
18-25	114958	6%	67739	6%	47219	6%
26-35	354105	19%	200427	18%	153678	20%
36-50	655606	35%	369925	33%	285681	38%
51-59	301340	16%	181772	16%	119568	16%
60+	448377	24%	301802	27%	146575	19%
				100%		100%
Total	**1874386**	**100%**	**1121665**	**60%**	**752721**	**40%**

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[4] Data not publicized yet, but obtained under author's petition through email for the specific purpose of this research.

As for the place of residence, most of the respondents (~50%) lives in *Plano Piloto*, RA I, 17,3%, *Gama*, RA II, 16,2%, *Ceilândia*, RA IX, (6,7%) and *Taguatinga*, RA III, 6,7%, that are representative areas of the FD in terms of population density and traffic jam during rush hours (CODEPLAN, 2020), see Figure 4.2.
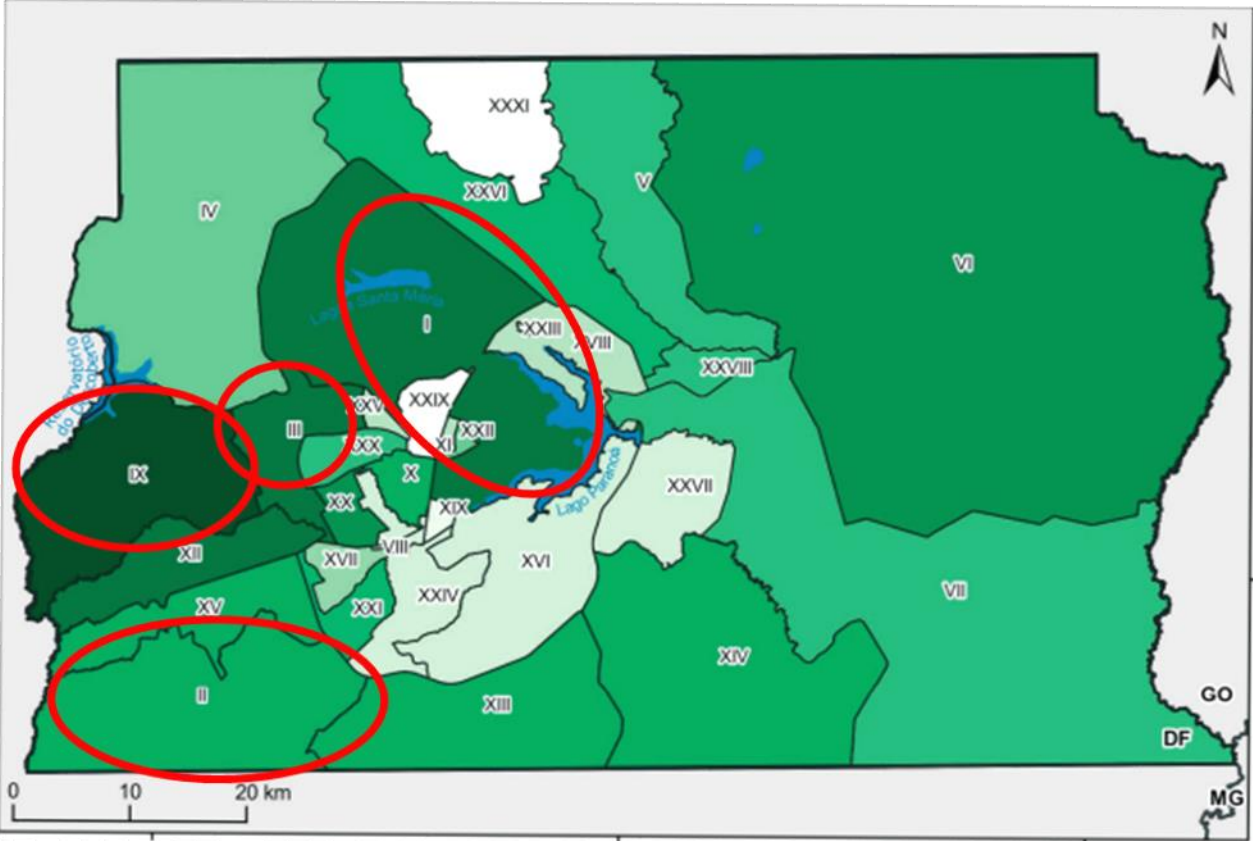
Figure 4.2 – Residence of Respondents

The findings regarding the content analysis shall be explained in some edges, firstly, before being actually presented – see Figure 4.3. As explained in Chapter 3, "Method', content analysis was carried out by three independent examiners, whom, despite have being briefed by TPB framework and respective pillars, had not a deep understanding of it, what made them follow a very objective categorization.
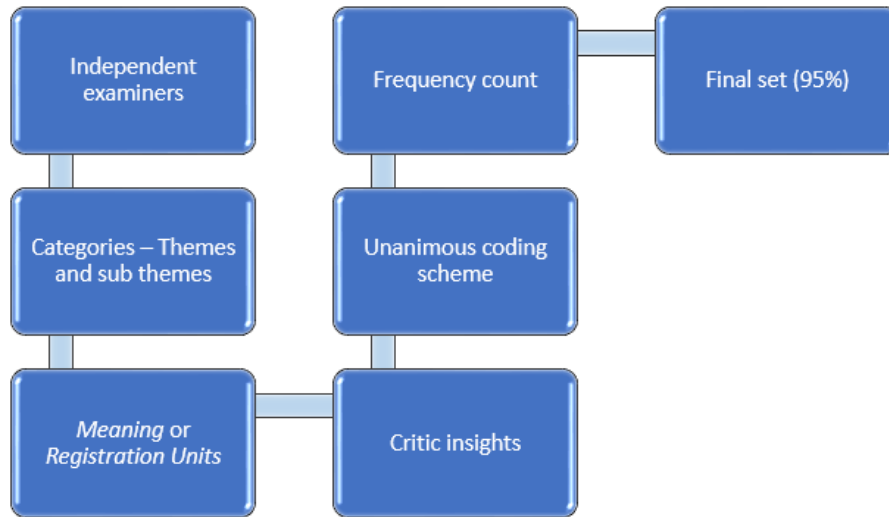
Figure 4.3 – Content Analysis procedures

At the beginning, they excluded answers such as none/all and low frequency responses. Then, they considered the meaning units (words, expressions, phrases) given as answers to each of the belief open-ended items of the elicitation questionnaire administered to start building the categorization. They considered as the main categories each type of beliefs, and identified, for each one, two subcategories, as follows: (i) Behavioral Beliefs: advantages and disadvantages; (ii) Normative Beliefs: approval and disapproval; and (iii) Control Beliefs: inductive and deterrent factors. Only the ones that reached frequency mentions up to 95% of all (Salient/Total) inside each respective subcategory were considered. This author did not influence in the group coding decision during the categorization procedures. Table 4.2 below, elaborated under their considerations, shows the coded salient belief.

Table 4.2 – Belief coding – salient beliefs after content analysis

Belief Categories	Frequency	Registering Units (examples)
Behavioral Beliefs		
Salient/Total	*636/636*	
Advantages (Benefits)		
Salient/Total	*67/67*	
Convenience	30	"do not depend on someone else's ride (…)" (R3); "do not depend on uber to get back home when it is dark at night and there's no public transport available" (R10); "drive my own car" (R75); "there will be no need hold yourself from drinking and enjoying with friends at a party" (R76).
Euphory	25	"Happiness" (R11); "Confidence and encouragment" (R90); "false confidence sensation" (R120).
Saving (money and time)	12	"(…) money and time saving (…)" (R41); "don't spend money with uber (…)" (R95); "don't need to keep waiting" (R155); "don't need to pay uber or cab" (R163); "saving app money" (R166).
Disadvantages		
Salient/Total	*569/569*	

Risk to personal and other's physical integrity	316	"(…) car crash risk" (R2); "put yourself and others in great danger" (R10); "put your life and the life of others at risk" (R27); "kill or be killed" (R78); "death risk" (R123); "danger, threat to life" (R189).
Psychomotor impairment	202	"lack of attention, drowsiness, irritation" (R1); "psychomotor impairment" (R37); "decreased reflexes, diminished sense of direction, recklessness" (R50); "Losing the basic skills of driving a vehicle safely" (R99); "decreased reflexes and loss of motor skills (…)" (R102).
Traffic enforcement consequences	51	"civil, criminal and administrative risks" (R45); "(…) getting driver's license arrested" (R112); "the fine" (R167).

Normative Beliefs

Salient/Total *274/283*

Approves

Salient/Total *101/106*

General Society	36	"Delinquents, irresponsible people" (R14); "the inconsequential ones" (R131); "people that don't care about the others" (R185).
Family and friends that banalize DD	30	"My friends that drive under the influence of alcohol" (R20); "friends that drink and drive"(R35); "(…) male realtives that DD" (R49).
Friends	23	"My friends" (R25); "party friends"(R35); "some of my friends" (R163).
Family and friends (if less than 2 doses)	12	"family and friends when low amount is ingested (…)" (R103); "(…) if only a drink, family and friends would not disapprove" (R1)

Disapproves

Salient/Total *173/177*

Family	88	"my children, my mom" (R1); "mom and dad" (R91); "family" (R97); "my family-children, husband, mom and dad" (R112); "mom, dad, family" (R175)
General Society	55	"…traffic officers" (R12); "responsible and ethic people" (R14); "people that don't drink and drive" (R104); "people that don't drink (…)" (R113); "car crash victims" (R130)
Friends	30	"everyone that chillout with me" (R123); "all of my friends" (R179); "(…) friends (…)" (R23).
Authorities	10	"(…) traffic officers" (R11); "(…) road safety enforcement groups" (R16); "(…) enforcement agencies" (R82)
Victims	05	"victims due to DD behavior" (R28); "people who have had loved ones dead due to drunk driver car crash" (R121); "car crash victims" (R130).

Control Beliefs

Inductive factors	145/150	
Emergency situation (life risk)	67	"emergency" (R9)"; "emergency in places without availability of public transport or apps" (R33); "family emergency and life risk" (R50)
No alternative way of transport	35	"impossibility of getting a ride or calling an uber" (R13); "(…)no ride at disposal" (R18); "at an event where uber is not avaliable" (R79); "when the event is far away and no transport is avaliable"(R94); lack of safe public transport" (R176)
Social events	35	"going to an event/celebration" (R107); "if I am far away from home" (R168); "friends gathering at a place with alcohol consumption" (R192)
Alcohol ingestion (if less than 2 doses)	11	"if I drink little alcohol" (R155); "(…) drinking just a little" (R95); "(…) if I have drunk only a glass of wine (…)" (R47); "I am fine, drank just a little, I can drive" (R42); "drinking two cans only" (R41)
Money saving	7	"…high cost of alternative transport" (R49); "if I have no money to call an uber" (R156); "save money" (R166)
Deterrent factors	201/210	
Risk perception	99	"risk to personal and to others' physical integrity" (R3); "afraid of killing someone" (R26); "car crash risk" (R58); "death risk" (R60)

Responsibility	74	"responsibility and love" (R77); "if I am with someone I love" (R87); "responsibility with the other" (R102); "consciousness of imminent risk" (R120); "leaving the car at home (…)" (R138); "being an example to my kids" (R46)
Alcohol ingestion (if over 2 doses)	16	"if I would drink too much" (R155); "if I were too drunk and feeling not able to drive" (156); "if I had had too much to drink" (R187); "excessive alcohol ingestion, example, more than 3 cans" (R41)
Alternative way of transport available	12	"if there's available transport home and to other places" (R176); "if there's available transport home at night/down" (R165); "if there are other ways of transport available" (R10)

As for the first set – behavioral beliefs/advantages, respondents believe it is *convenient* to drive under alcohol effect justifying this thought in ways of not depending on someone else, on taxi/app rides, on public transport or even because driving own car is more practical. As well, there are answers that account for just being able to enjoy the event they are at without needing to worry about controlling themselves on drinking alcohol. *Euphory sensation* was identified as another subtheme as regarded to happiness or courage feelings. *Money saving* also was identified as a benefit propelling the DD behavior. For the other hand, when it comes to disadvantages of DD, beliefs regarding personal and other's *integrity risks* were mainly elicited, such as getting involved in car crashes, being injured or even passing away. *Psychomotor impairment* (i.e., lack of attention, decrease reflexes, drowsiness) and *legal consequences*, such as being fined or having the driver's license suspended, were also readily accessed.

Normative beliefs were also coded in two categories, separating among those who (i) approve and those that (ii) disapprove the DD behavior. Respondents, in majority, assign to the *society in general* the behavior approval, meaning the irresponsible/careless ones and young/immature people. Likewise, those *friends and family* that ingest alcohol and find it a normal conduct (*banalize*) supports the behavior. Important credits must be done, still, to the approval granted by *family and friends* when *little amount of alcohol* ("two doses", or "a can") is consumed. A few not significant relatives were also identified, but not as to compose a salient belief. As for those that influence respondents to not engage in DD behavior, *family, general society, friends, authorities* (i.e. traffic officers, police, government) and *victims* (people that have suffered a loss or an injured close one due to DD) are the most indicated. While coding, the examiners understood that, despite the repetition of "family" and "friends" on the answers, these important ones were slightly differentiated by the respondents, which led to a coding that tried to capture each of the circumstances mentioned, i.e. *family and friends* that banalize DD, *family and friends* that supports little amount of alcohol ingestion, and friends in general, not specified.

Lastly, control beliefs were classified into (i) factors that induce the DD behavior and (ii) deterrent factors. *Emergency situation* (i.e., life risk) plays the most significant role as to be a factor that in respondents' opinion would allow DD. Having *no alternative way of transport* available, *attending a social event*, *ingesting little amount of alcohol* (less than two doses) and *money saving* are also revealed as factors that would make the behavior more probable to be executed. On the other side, *risk perception*, as of being aware of the consequences involved in the DD behavior (integrity, danger), *sense of responsibility* (i.e. to be an example for the children, plan leaving the car at home when knowing that will ingest alcohol at an event), *existence of alternative way of transport available* and *over alcohol ingestion* ("over two doses") are seeing as barriers for driving under the influence of alcohol. Table 4.3 below summarizes the coding final scheme.

Table 4.3 – Final coding results schema

CATEGORIES	SUBCATEGORIES
BEHAVIORAL BELIEFS	*ADVANTAGE*: convenience, euphory and savings of money/time *DISADVANTAGE:* risk perception, legal consequences and psychomotor impairment
NORMATIVE BELIEFS	*APPROVAL*: inconsequent, family/ friends that DD and up to 2 doses) *DISAPPROVAL*: family, friends, authorities and car crash victims
CONTROL BELIEFS	*INDUCTIVE:* emergency, alternative transport, social events, low amount of alcohol, money saving *DETERRENT*: risk perception, responsibility, over two doses, availability of alternative way of transport

Some subthemes, such as *convenience,* coded under behavioral belief category, might be seen as mistaken, once should be part of control beliefs due to its dual characteristics. Could be seen as an advantage for carrying on DD, or else, as a factor the pushes for the practice of the behavior. However, *convenience* was seen, for codification purposes, under examiners analysis, as an element perceived by the respondents as an advantage do DD, so, as a "leaf" of the behavioral belief advantage "branch", subcategory. The same understanding must be applied to the whole categorization, once, indeed, some themes/subthemes can be seen by the readers as mistakenly inserted. *Risk perception* and *money/time saving* also follows the same way of interpretation. This last one, for instance, is a belief raised by respondents as answers for two different categories: behavioral and control beliefs. In the primer, the meaning was in the sense of a perceived advantage for engaging into DD behavior, while, as a control belief, it is accessed

as a factor that contributes to one's positive perception toward practicing DD. And this difference was crucial for the categorization applied by the examiners.

As also found in later studies (PARKER *et al.*, 1992; MOSHKI *et al.*, 2019) it must be said that much more negative beliefs were recognized, which reflects how this behavior is seen as inappropriate under social norms. In this regard, respondents to this research tend to believe DD as delivering more disadvantages than advantages. It shall be noticed, however, that the convenience of not depending on others or on alternative ways of transport, the sense of joy that DD develops, and economic issues, still appear as thoughts that entails the behavior. That could be interpreted when considering Brazilian socio-economic-cultural middle-income characteristics, once public transport still lacks efficiency and security; the average income of the population is not sufficient for service expenses such as paying a cab or an app ride; and alcohol consumption and DD conduct are seen as ordinary.

4.1.1 Possible Interventions

Measures, then, could start in proposals of mobility polices targeting this public. Identify the main leisure alcohol areas in the city, in which enterprises offer alcohol, what days, hours, people most attend, what are their coming and going routes and profile, in order to create solutions to discourage DD behavior. In that way, increase in the availability of public transport, incentive for designated driver, implementation of regular shuttles back and forth to the main transport stations, are some solutions to be evaluated.

As in the Etika *et al.* (2021) and Jacques *et al.* (2018), the sense of euphory was also identified in present study. For this, stress the necessity of interventions focused on the risk that the driver puts himself and the others around, either life or legal sanctions. Thus, actions that would call drivers' attention to the misbehave, to the danger involved, to the false sense of control over the vehicle due to reduce of motor skills, could be highlighted. That would make drivers more mindful about driving under the influence of alcohol (ETIKA *et al.*, 2021).

For normative beliefs, this study points out the people or groups of people that most influence someone's decision to DD. Amongst those that approve, participants recognized either friends or relatives that practice the conduct. DD intervention, thus, should focus in arguing if those close people, in fact, really care about oneself, that is, drawing driver's perception on who really want their safety. Another important data is about the approval regarding little amount of

alcohol consumption, leading to an inference that some part of the population thinks only great quantities of alcohol can impair driving, causing psychomotor alterations. In this regard, should be enhanced the impact of the alcohol in an organism, showing not only the motor skills alteration, but also the psychologic inputs that leads to integrity risks, life risk included, while driving. On the other hand, it could be seen that family exerts strong influence when it discourages. Namely, people take into account relatives' judgements when forming personal concepts about DD, mother, father and children, primarily – see Table 2. Likewise, general enforcement authorities represent a significative group to dissuade one's mind to get into DD behavior. Traffic officers and enforcement agencies were mainly mentioned. People who have had traffic crashes experiences, should not, under participants' views, approve irresponsible driving behaviors. That suggests interventions should appeal to the sensible side of the people, bringing to the front the significant ones and also those that lost a close one due to traffic violence to show empathy. Along that, strengthen the crucial duty of the enforcement of the law.

Control beliefs, in its turn, show how likely people would relativize DD rules and their own perceptions in some circumstances. Emergency situations, as found in some other road safety studies (ROWE *et al.*, 2016; JACQUES *et al.*, 2018; WARNER, 2021, ETIKA *et al.*, 2021), is a primary factor that can induce people to engage into risk. It can be contradictory as, for reason of saving someone's life, one would, even knowing his/her particular psychomotor weak conditions, go for a drive under the influence of alcohol. Interventions, then, could illustrate this side effect neglected when this urgency might occur. Along that, again, economic-socio-cultural aspects underpin additional inductive factors elicited. If no alternative way of transport is available, if a social event takes place, if the ride cost is considered out of the budget, or even if one considers that the amount of alcohol ingested does not influence his/her own reflexes, attention and other psychomotor skills, there is a sense that would be no reason to avoid DD.

The findings suggest the participants think they are in control if the conditions seem safe to DD. To demystify these notions must be the goal of an intervention that aim to modify such beliefs. An attempt, as pointed by Forward (2009), is to "portray this behavior as less normal" and diminish the allure of engaging in violations, mainly, among the youth, who the adventure felling is effervescent, but also on adults (great part of the present respondents), that can be more confident on their driving skills even under alcohol effect. In this matter, previous studies have suggested interventions such as bolstering negative beliefs and countering positive ones

about risky driving (ROWE *et al.*, 2016). Should be stressed, then, the obedience to the norm, as, maybe, the measures so far implemented are too much driven to car crashes and violations itself (FORWARD, 2009).

Another point of view, as brought by Etika *et al.* (2021), when studying speeding behavior in Nigeria, is that circumstances, rather than values, may motivate the beliefs elicited. Responses regarding risk perception and the sense of responsibility in this study achieve a convergent understanding to that. Participants' replies suggest they might deter from DD for understanding why this action can put him/her at risk and what is their role in the society they live in, their responsibility before a head of a family, his/her children, before a cyclist, before the society in general. Therefore, interventions should emphasize, for instance, the unpredictability of some events, forcing drivers to keep in mind the necessity to maintain their mental and physical conditions for the full control over the direction, to be able to react in any adverse disorder and avoid fatalities. Despite that, in a minor frequency, though, answers that confirm common senses of avoiding DD for being afraid of the fine itself, putting aside the danger consequences, were elicited, and shall be targeted in educational type of interventions.

It must be pointed that the findings of this study should be interpreted within the context of its limitations. Despite the prepared procedures to data collection, recruitment strategy could be a problem incurring in some bias in the sampling. This work was prepared to not fall into this mistake, once it was reached a geographically and diverse distinguished population, in person and by means of online form. As most of the population has access to mobile phones and internet, minimum social restrictive problem was expected. Important attention also must be stated regarding reliance on self-reported data, which is known to potentially cause bias (HUEMER, 2018). Because of the possibility for socially desirable responses, the questionnaire's orientation notes were as clear as possible, asking for truthful responses. In addition, questionnaire was of voluntary and anonymous contribution, so that respondents did not have to worry about someone checking their answers.

4.2   MAIN SURVEY – STEP 2

4.2.1   Descriptive analysis - Demographics

The response database indicates that a total of 1007 answers were collected between the dates of September 23, 2023, and October 23, 2023. Within these, 745 responses were eligible,

composed by 45,9% of women and 53,56% men. These data show some similarities to government licensed drivers' database (**Erro! Fonte de referência não encontrada.**), granting reliability to the sample collected, although not a probabilistic sample. That does not work that well when comparing the first and the last two ranges of age. 33,15% of the sample are young individuals aged 18-25, while in DETRAN-DF drivers' data it accounts to only 6%; between 51-59 years old, sample returned 9,9%, while official database shows 16%; and above 60 years old, sample is composed by only 6,6%, when in governments' data the elderly are 24%. Aside that, when it comes to the ranges of 26-35 and 36-50 years old, the present study sample fits quite close: 17% of the sample are between 26-35 against 19% of the official numbers; and 33,3% of the respondents are between 36-50, when DETRAN-DF reaches 35%. That can be explained once data collection has undergone, considerably, in universities *campus*, which are mainly composed by young people from the 18-25 years old spectrum.

Figure 4.4 presents the place of residence of the majority of the respondents and shows similarities to the FD drivers' population (CODEPLAN, 2020) It contemplates reasonably the most populous and traffic related regions (*Plano Piloto, Ceilândia, Taguatinga, Gama, Guará, Águas Claras*), as mentioned in Section 4.1 before.
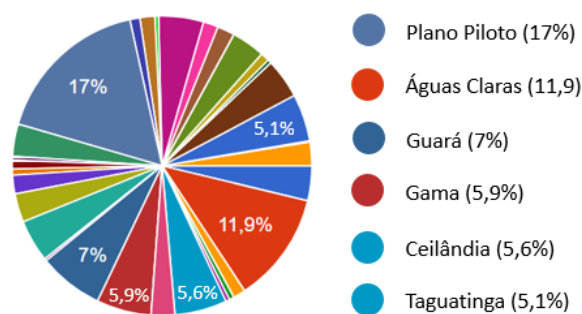
Figure 4.4 – Residence of the respondents, Main Study

As for the respondent's income regarding Brazilian minimum wage as an index, Figure 4.5 Figure 4.5 shows a wealthy condition as majority answered they receive more than 5 times the minimum wage – above R$ 6600,00, while Figure 4.6, regarding educational degree, indicates that most of the respondents finished graduation and postgraduation, such as college or university (60,2%). Results can be interpreted as reliable founding once being able to buy and maintain an automobile (mechanical and taxing factors) requires enough affordability, which is not easily accessible considering price of standard cars and equipment, taxes tickets, interest

and average population income. Summing up, supposing most of the licensed drivers owns vehicles, or are in families that owns it, being in the possession of a motor vehicle generally presupposes a healthy financial condition. In the same manner, higher education in Brazil is associated with opportunities that are still more available to people that are able to afford it, being able to pay private schools or universities.
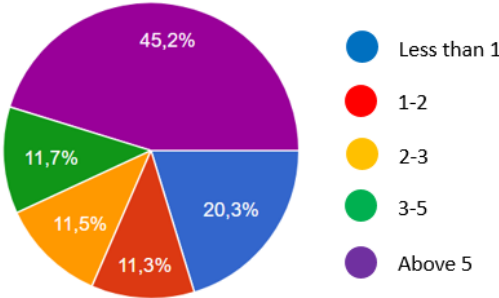
Figure 4.5 – Income of the respondents, Main Study (minimum wage of R$ 1320,00)
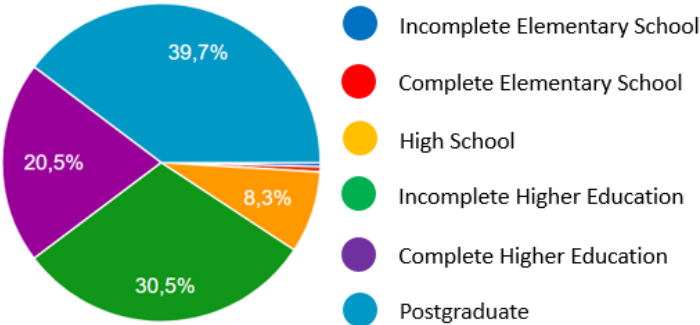
Figure 4.6 – Educational degree of the respondents, Main Study

As for driving experience, 12,3% of the sample are pre-drivers (first year of license), 21,3% have from 1 to five years of experience, and the majority, 66,3%, are already much familiar with driving once they are on the roads for more than 6 years. As for car crash history, that is, involvement in car crashes in which injured people outcomes were seen, 94,5% answered that did not get involved in any. This surprising result, regarding the pandemic road safety scenario, can be interpreted in the limits of the question, which set a 3 previous month analyzed period, not a lifetime experience.

When it comes to DD behavior, asked if have driven under alcohol influence in the last 3 months, results show that most of the sample (65,6%) has not engaged in DD, see Figure 4.7.

This answer has to be interpreted considering that in this portion there are some people that don't drink alcohol at all and, thus, it cannot be extracted the knowledge regarding those that really did not perform the targeted behavior. On the other side, results show that more than one third (34,4%) of the respondents have gone through DD, which fits to traffic organizations' data (WHO, SENATRAN and DETRAN-DF) evidence of the presence of alcohol in car crashes and mentioned in Chapter 1 of this study.
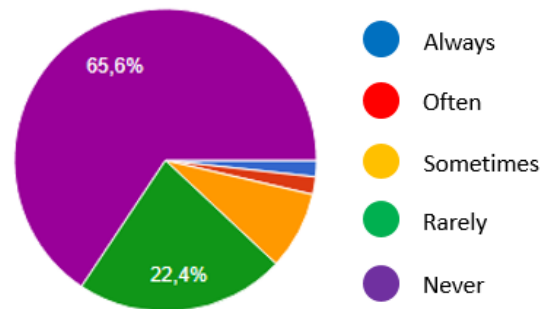
Figure 4.7 – DD past behavior of the respondents, Main Study

Regarding alternative way of transport after drinking alcohol, participants were asked about how often it was used in order to avoid driving under this circumstance. The majority (29,4%) avoided the practice of using public transport, a friends' ride, or even calling an app ride in order to not drink and drive. Initially that can be interpreted as most of the respondents confessing their intoxicated driving, however, as pointed out in the last question, some people are not alcohol users, so it cannot be said that the total of these part of the respondents in fact carried out this unsafe behavior. More than 70%, though, show that alternative ways of going to their destinies are part of their ordinary behavior, some more often, some less. For one side it can be positively viewed, as this practice can reduce the risk of car crashes due to alcohol drivers, but for another, still shows some resistance in understanding the possible unwilling consequences of DD.

4.2.2 Statistical analysis – Salient Beliefs

Statistical analysis of the salient beliefs are as follows, considering method explained in advance in the Chapter 3, section 3.2.4. (i) Sperman's correlations and (ii) EFA, constituted by (a) factor adequacy (response redundancy, KMO and Bartlett's Sphericity Test); (b) factor assessment (Scree Plot and Oblimin rotation); (c) reliability index (Cronbach's Alpha).

Considering the elements of Table 3.3 (salient beliefs items), by means of Spearman's method, correlations are shown in Figure 4.8 that presents values on a visual scale. The more correlated they are, the items are depicted in darker shades, facilitating identification.
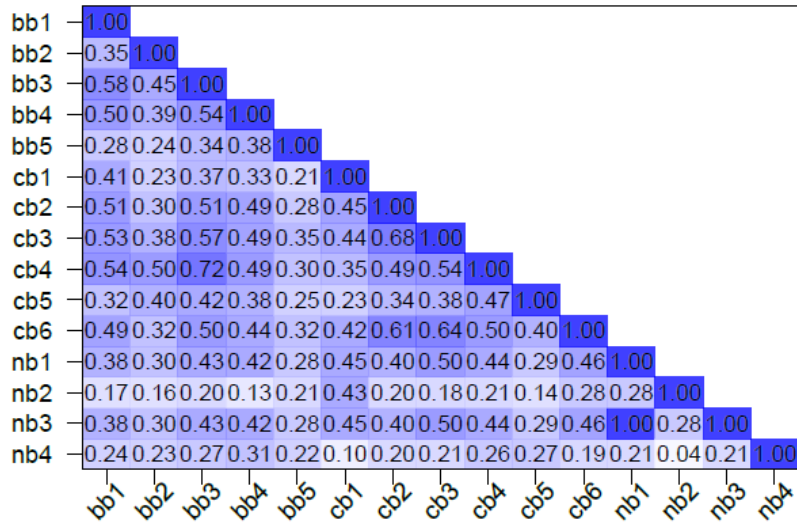
Figure 4.8 – Spearman Correlation Matrix between variables

Amongst the items, the most notable ones are *nb1* (family and friends that banalize DD approval) and *nb3* (family and friends DD approval if less than 2 doses), showing a perfect correlation, meaning they obtained identical responses for all interviewees, which is understandable once people that are used to DD are not really worried whether how much it was ingested. Items *cb4* (money saving as facilitating factor) and *bb3* (saving time and money as a positive view over DD) have a correlation of 0.72, what makes sense when considering the DD context as a whole. Ajzen (2020) talks about this possibility of more than one belief being represented in more than one of the belief categories. Other strong correlation can be seen in *cb6* (social events as a contributive factor to DD) with *cb2* (absence of alternative way of transport as contributive factor), of .61, and with *cb3* (alcohol ingestion if less than 2 doses as contributive factor to DD) with correlation 0.64. For that, a possible understanding also regards the context of going out for a celebration and the transport back after drinking, when it can be said that people tend to take the risk if low amount was ingested considering the fact that alternative way of transport such as public system does not offer a decent availability under their view: one factor pulls the other. Lastly, cb2 and cb3 strongly correlates, .68, what can also

be understood as a behavior that takes the risk considering the low availability of alternative transportation. After all, the perfect correlation between *nb1* and *nb3* is one of the justifications for excluding one of them (*nb3*) for the next step.

(ii)   Factor analysis

a. Factor Adequacy (response redundancy, KMO and Bartlett's Sphericity Test)

The following table (Table 4.4) presents the relative frequencies of respondents for each question regarding the Likert Scale 1 to 5.

Table 4.4 – Belief distribution of responses

	1	2	3	4	5	miss
bb1	0.744	0.085	0.060	0.052	0.059	0
bb2	0.879	0.052	0.030	0.016	0.023	0
bb3	0.816	0.082	0.046	0.028	0.028	0
bb4	0.848	0.078	0.036	0.012	0.026	0
bb5	0.757	0.066	0.044	0.036	0.097	0
cb1	0.305	0.083	0.176	0.156	0.281	0
cb2	0.647	0.117	0.109	0.066	0.062	0
cb3	0.616	0.106	0.093	0.083	0.102	0
cb4	0.824	0.081	0.047	0.016	0.032	0
cb5	0.859	0.051	0.039	0.019	0.032	0
cb6	0.630	0.115	0.078	0.082	0.095	0
nb1	0.683	0.114	0.111	0.043	0.048	0
nb2	0.444	0.047	0.128	0.099	0.282	0
nb3	0.683	0.114	0.111	0.043	0.048	0
nb4	0.965	0.013	0.007	0.003	0.012	0

We can observe that in 3 items, *bb2* (0.879), *cb5* (0.859), and *nb4* (0.965), there is a very high concentration (>85%) of responses in the first category "1-Strongly Disagree". These were excluded from the factor analysis due to low variance, along with question *nb3*, which showed perfect correlation to *nb1* in Spearman's evaluation.

Therefore, to assess the suitability of data for factor analysis, indicating whether the data is good enough to justify the application of statistical method, Kaiser-Meyer-Olkin (KMO) measure was used. Its value ranges from 0 to 1. The closer it is to 1, the better the data's suitability for factor analysis. Generally acceptable values start around 0.6, but higher values, such as 0.7 or more, are preferable, while a very low KMO may indicate that factor analysis

might not be appropriate for the data. For beliefs items matrix it was found KMO = 0.91, as shown in Figure 4.9 below, indicating factorability of the data matrix.

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: psych::KMO(r = cor0)
## Overall MSA =  0.91
## MSA for each item =
##  bb1  bb3  bb4  bb5  cb1  cb2  cb3  cb4  cb6  nb1  nb2
## 0.96 0.92 0.92 0.87 0.89 0.91 0.92 0.92 0.95 0.93 0.73
```

Figure 4.9 – KMO for beliefs distribution

Bartlett's Sphericity Test verifies whether there is sufficient correlation among the variables to justify the application of factor analysis using statistical measures such as chi-square. It compares the observed correlation matrix with an identity matrix. If the resulting p-value from the test is significant, the correlations between the variables might be different from zero. Thus, the matrix would be considered suitable for factor analysis. On the other hand, the appropriateness of the factor analysis may be questioned if the p-value is not significant. In the present analyses, Chi-Square was 6575.01 for a p-value < 0,001. In conclusion, both methods (KMO and Barlett) indicate that the matrix is adequate to be factorized.

b. Factor Assessment (Scree Plot or Cattell's criterion and Oblimin rotation)

As graphic representation, the Scree Plot shows the eigenvalues of the components extracted in a factor analysis. It is typically used when necessary to determine the appropriate number of components to retain. The resulting curve typically exhibits a sharp drop (scree) after which the eigenvalues start decreasing ("elbow"). The point where this drop occurs is often interpreted as indicative of the number of factors/components to be retained in the analysis.

Through the Scree Plot below, Figure 4.10, it can be observed that 2 factors are adequate to describe the variance found in respondents' answers (with 2 components above the horizontal line – "elbow"). Under TPB concepts, however, it was expected that three components would be observed for the supposed TPB constructs (behavioral, normative and control beliefs). Horn's parallel analysis was also carried, as explained in Method's Chapter before, when 3 factors were found. However, it was discarded after results indicated a very mixed composition, what drove this author to stick with the first findings.
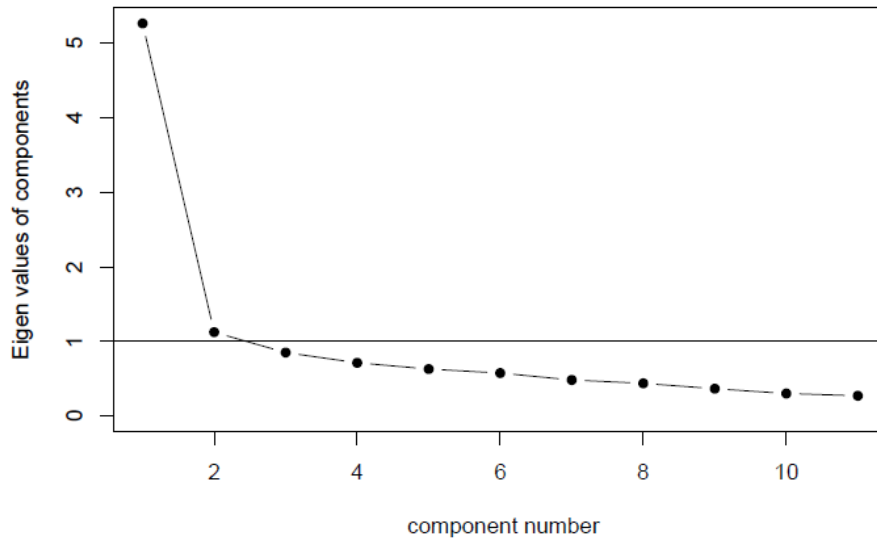
Figure 4.10 – Scree Plot for beliefs distribution

To simplify and interpret complex patterns in the data, oblique factor rotation technique was used. Oblique factor rotation is often used in situations where the relationship between factors is not expected to be strictly independent, as of in the present case when dealing with TPB components (DAMÁSIO, 2012). Factor loadings above 0.3 were compiled into Table 4.5 below.

Table 4.5 – Factor loadings after Oblimin rotation for beliefs

	Q1C1	Q1C2
bb1	0.761	
bb3	0.841	
bb4	0.776	-0.120
bb5	0.456	
cb1	0.305	0.646
cb2	0.743	
cb3	0.798	
cb4	0.799	
cb6	0.681	0.187
nb1	0.498	0.340
nb2		0.908

In factor analysis, higher factor loadings indicate a stronger association between the variable and the corresponding factor, suggesting that the variable is a good representative of that factor. As shown, it was found that, for the first component (Q1C1), the questions with factor loadings above 0.3 were bb1, bb3, bb4, bb5, cb2, cb3, cb4, cb6, and nb1, conceptually indicating that this factor corresponds to a construct that aggregates the two concepts of behavioral beliefs and

perceived control beliefs. The second component (Q1C2) shows significant loadings on items cb1 and nb2, indicating correspondence to a construct of normative beliefs aggregated with the concept of perceived control beliefs.

c. Reliability Index (Cronbach's Alpha)

Cronbach's Alpha calculated for the two new groups indicated a stronger consistency for the first set (Q1C1 α= 0,87), once second one, Q1C2, presented α= 0,60.

4.2.3   Statistical analysis – ATT/SN/PBC/INT

Following the same analysis carried out for the beliefs, in this section first correlations under Sperman's technique are presented, then EFA, and, finally, linear regression considering the components of ATT, SN, PBC over the latent variable of INT.

(i)   Sperman's Correlations

In the reflective measures of ATT, SN, PBC and INT, which are the supportive elements of the intention to DD, after Spearman's procedure (Figure 4.11), it was found the high correlations between items *int2* ("In the coming weeks, I will likely drive after consuming alcoholic beverages at a party with friends and/or family"), and *int3* ("It is possible that I may choose to drive after consuming alcoholic beverages at a celebration with friends and/or family in the coming weeks") with 0.72. Outstanding correlations also could be found in between PBC's items: .63 for *pbc1* ("I have good control of driving even after consuming alcoholic beverages at an event/celebration") x *pbc2* ("I drive under the influence of alcohol without any issues"); .74 for *pbc1* x *pbc3* ("I can easily drive even after consuming alcoholic beverages at a party"); and a correlation of 0.68 for *pbc2* x *pbc3*. After all, it can be said that items regarding PBC and intentions suggest a strong correlation.
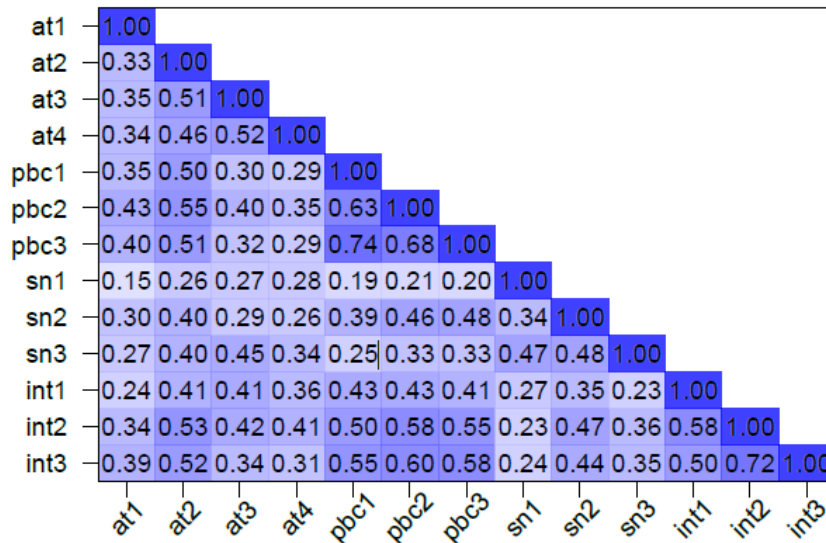
Figure 4.11 – Spearman Correlation Matrix between ATT, SN, PBC and INT variables

(ii)   Factor analysis

a. Factor Adequacy (response redundancy, KMO and Bartlett's Sphericity Test)

To validate the assumed three-component structure within the items of Attitude, Perceived Behavior, and Subjective Norm, it was not necessary to go over redundancy questions, as no perfect correlations were found.

After calculus, overall KMO found was 0.9, and the lowest among the questions turned to be 0.85 (*sn3*), indicating evidence that the correlation matrix is decomposable. This decision is supported by the Bartlett's test, which rejected the null hypothesis and points in the direction of factorability (chi-square of 7699.41 for $p<0.001$). See Figure 4.12 below.

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: psych::KMO(r = cor0)
## Overall MSA =  0.9

## MSA for each item =
##  at1  at2  at3  at4 pbc1 pbc2 pbc3  sn1  sn2  sn3
## 0.92 0.93 0.86 0.93 0.89 0.93 0.89 0.90 0.91 0.85
```

Figure 4.12 – KMO for ATT, SN, PBC and INT items' distribution.

b. Factor Assessment (Scree Plot or Cattell's criterion and Oblimin rotation)

According to Cattell's criterion, the appropriate number of components for the second questionnaire's items is two, see Figure 4.13.
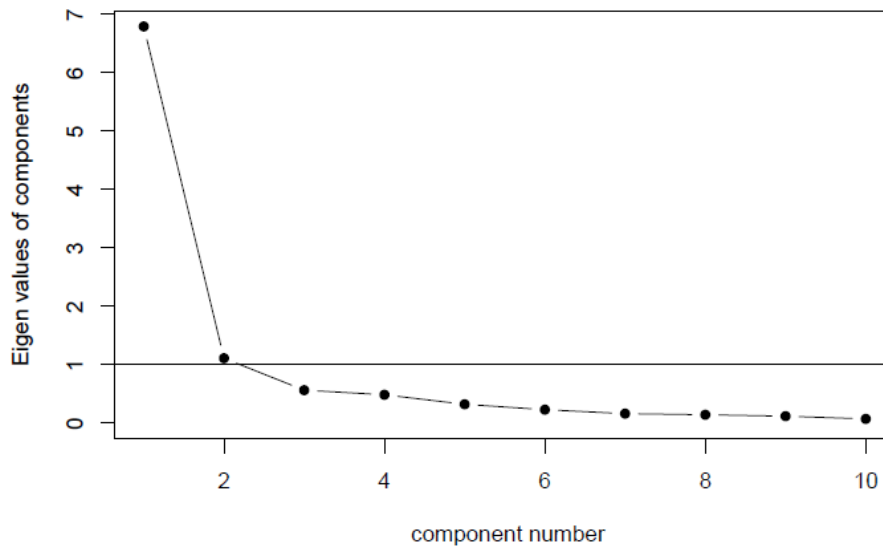
Figure 4.13 – Scree Plot for TPB constructs

Under Oblimin rotation, the components together accounted for 69.7% of the total variance contained in the responses, as can be seen in **Erro! Fonte de referência não encontrada.**. In this way, it was found that component one (Q2C1) contains the questions *at1*, *at2*, *pbc1*, *pbc2*, and *pbc3*, representing an aggregate of Attitude and PBC components. Component two (Q2C2), composed of questions *att3*, *att4*, *sn1*, *sn2*, and *sn3*, encompasses the components of Attitude and Subjective Norms. It is noteworthy to mention that questions *at2*, *at3*, *at4*, and *sn2* (underlined in boxes in the Table 4.6) have factor loadings greater than 0.3 in both components found, compromising the interpretability of the components given.

Table 4.6 – Factor loadings after Oblimin rotation for TBP constructs

	Q2C1	Q2C2
at1	**0.713**	0.157
at2	**0.682**	0.332
at3	0.505	**0.550**
at4	0.416	**0.544**
pbc1	**0.990**	-0.152
pbc2	**0.904**	
pbc3	**0.950**	
sn1	-0.159	**0.961**
sn2	0.380	**0.516**
sn3	0.115	**0.858**

c. Reliability Index (Cronbach's Alpha)

Cronbach's Alpha calculated for the two new groups indicated a high consistency for both sets (Q2C1 α= 0.84 and Q2C2 α= 0.75).

4.2.4 Correlations between beliefs and TPB constructs components

Through regression models it was possible to establish correlation between intention and the two belief components (Q1C1 and Q1C2) and with the two new ATT/SN/PBC (Q2C1 and Q2C2) components found in the factor analyses. Figure 4.14 shows the results.
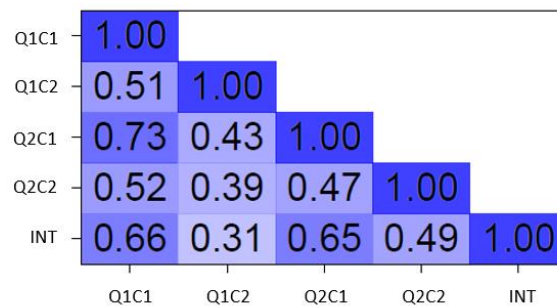
Figure 4.14 – Correlations between components of belief and TPB, and INT

Q1C1 is the belief component that contains aggregates of behavioral beliefs and of the majority of the control beliefs, while in Q1C2, items *cb1* (emergency situation as impelling DD) and *nb2* (inconsequent and irresponsible ones approves DD) are jointed, indicating correspondence to a construct of perceived control beliefs aggregated with the concept of normative beliefs.

Q2C1 for its turn is composed of questions of *at1* (DD is pleasant), *at2* (it is safe to DD), *pbc1*(I have good control when DD), *pbc2* (I DD without any issues), and *pbc3* (I can easily DD), representing an aggregate of ATT and PBC components. In component two (Q2C2), questions *at3* (DD is positive), *at4* (DD is wise), *sn1* (Family approval of me DD), *sn2* (Most of friend's approval of me DD), and *sn3* (Most people that are important to me approval of me DD), incorporates the components of ATT and SN.

It can observe that there is high correlation between the first components of the beliefs (Q1C1 – behavioral and control beliefs) and of TPB constructs (Q2C1 – ATT and PBC components)

57

groups (0.73), indicating that they have similar information. This finding suggests that the behavioral and control beliefs elicited are strongly correlated to direct measures of ATT and PBC. Similarly, these first two components of the groups of items are highly correlated with INT (Q1C1 = .66 and Q2C1 = .65). This data indicates that behavioral and control beliefs have strong correlations with intentions to drive under the influence of alcohol, as well as, and in almost the same degree, as ATT and PBC constructs. Most of the SN components are in Q2C2 component, which correlates with INT on .49, meaning this is the weakest TPB construct when regarding the intention to DD.

As result, hypothesis H4 ("Salient behavioral, normative and control beliefs will strongly correlate with ATT, SN and PBC") can be validated.

4.2.5 Correlations between demographic variables, beliefs and TPB constructs components, and the intention to DD

The purpose of the TPB is to offer a comprehensive explanation of the evolution of behavioral intention, and therefore, it should serve as a mediator in accounting for the impact of age and gender, as well as any other variables external to the model (PARKER *et al.*, 1992).

Through Sperman method it was calculated the correlations between the components of beliefs (Q1C1 and Q1C2) and TPB variables (Q2C1 and Q2C2) found after statistical analysis, and the demographic variables. As closer to 1.0, stronger is the proportion of the correlation, as closer to -1.0, the weakest it is, and as closer to zero, suggests absence of correlation. Results are on Figure 4.15.
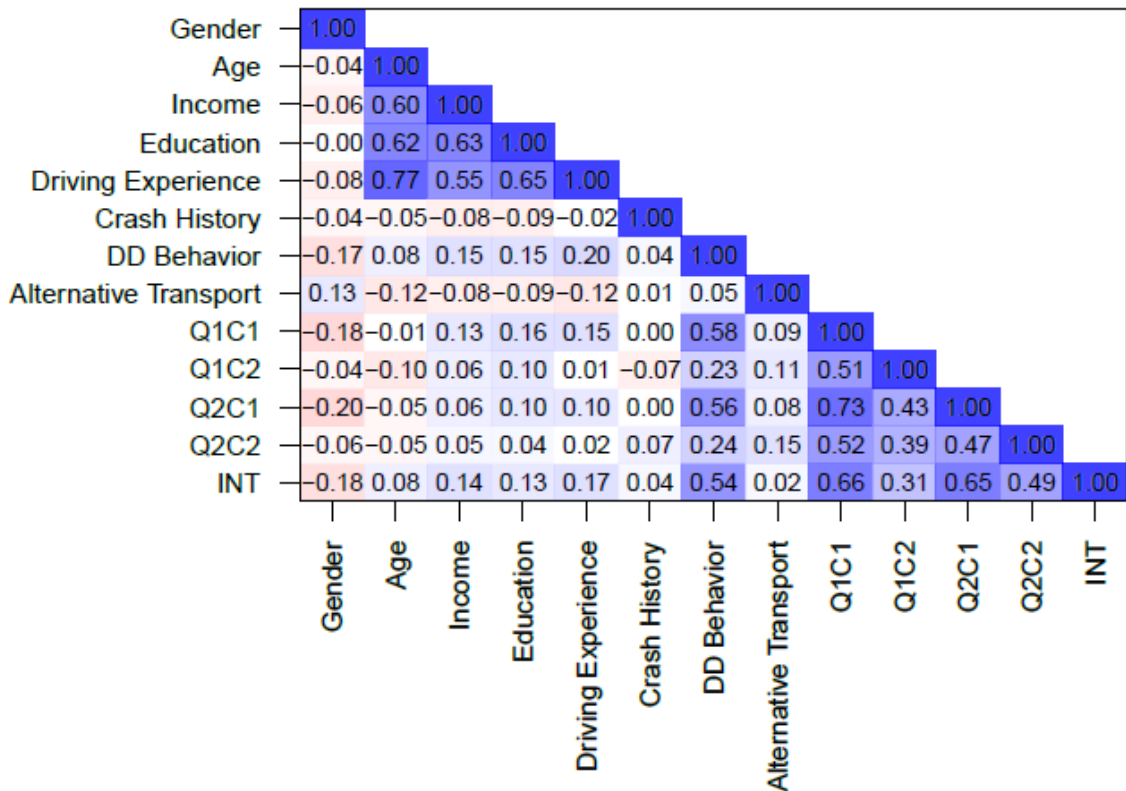
Figure 4.15 – Correlations between demographic variables, beliefs and TPB constructs components and the intention to DD

Regarding demographic elements, young males are more likely to engage in drink and driving behaviors (e.g. MOAN & RINSE, 2021, on Norwegian drivers; CHAN *et al.*, 2010, on Chinese drivers; YADAV *et al.*, 2022, on Indian drivers; POTARD *et al.*, 2018, on French drivers; ALONSO *et al.*, 2015, on Spanish drivers). In the present case, findings follow the same way. When talking about gender, when man is (-1) and woman (1), being a woman is negatively correlated with overall variables of DD behavior, which confirms H1 hypothesis ("Higher drunk driving intentions tend to be perceived more among male drivers than female"). Still in gender, it can be seen that women are more correlated to the use of alternative way of transport than man (.13). As for age (young-old), it is negatively correlated (-.05) to crash history, suggesting that, in last 3 months, there were more involvement of younger drivers in car crashes than older ones. Also, younger drivers tend to use alternative way of transport less than older ones in order to avoid DD (-.12). This can be interpreted as an economic issue, when considering that as older someone gets, in general, labor possibilities naturally arises and, thus, the person could be able to afford an alternative way of transport. Results suggest, for the other hand, that it could not be seen as being more aware of the risks as older as one gets, because when crossing data with DD behavior, it points to .08 correlation, that is, more engagement in

DD as older as the driver gets. Data also suggests that as higher the income (.15), the education degree (.15), the driving experience (.20), more the respondents engaged in DD behavior in the previous 3 months of the questionnaire application. As for car crash history, as younger (-.05), as lower the income (-.08) and as less educational degree (-.09), the highest is its occurrence.

Another lightning data is that it is possible to identify that both Q1C1 and Q2C1 are similarly correlated with the intention scores (0.66 and 0.65) and with the variable DD behavior (0.58 and 0.56). These correlations point to an interpretation that recommends behavioral and control beliefs, as well as ATT and PBC components, to have roots in the previous performance of this behavior and should be targeted in order to avoid new practices. Lastly, intention to DD, the most prominent TPB construct, is seen to be more correlated as older drivers get (.08) and as high the income (.14), educational degree (.13) and the driving experience (.17) reaches. Shall be noted the relation between INT and DD behavior (.54), suggesting past behavior to be highly correlated to intention to DD, that is, as many respondents executed the DD behavior in the past, higher it gets the intention to do it over again. That can be seen as a view of past success in the behavior, leading to a feeling that no harsh consequences can be caused due to DD, granting the thought that new journeys can be carried out that way.

Results and discussions conducted in this section allows hypothesis H2 (Drivers engaged in past drunk driving behavior are likely to show higher DD intentions) and H3 (Intention to drink and drive tend to be greater in drivers with prior crash history) to be positively responded.

4.2.6 Regression for predicting intention to DD from beliefs and from TPB components

As a general rule, the more favorable the attitude and subjective norm and the greater the perceived control, the stronger should be the person's intention to perform the behavior in question (STECKER *et al.*, 2007; AJZEN, 2020). And that was the expectation for the results outcomes of the questionnaire's responses in the present research. In regard, as stated Warner (2021), the TPB suggests that behavioral intention is the most important and direct determinant of an individual's behavior. And, using regression, it was possible to identify the influence of beliefs TPB components extracted in factor analysis in the intention do DD under p-values >0.001 in this study.

For belief components, Q1C1 represents .24 (p-value >0.001) in variance to explain INT to drink and drive. For Q1C2, it is -.06, for p-value >0.01, that is, those who answer questions with higher responses in this context tend to have lower intent to DD. That can be interpreted as a component that refers to prudence or responsibility in emergency situations (*cb1*), for example, and prudent individuals tend to have a lower intention to DD. Regarding TPB components, β for Q2C2 is = .31, the highest, while concerning Q2C2, β =.25. Table 4.7 summarizes the results.

Table 4.7 – Regression analysis to predict intentions to drink and drive

Component	Component description	β
Q1C1	aggregate of behavioral beliefs and of the majority of the control beliefs	.24**
Q1C2	items *cb1* (emergency situation as impelling DD) and *nb2* (inconsequent and irresponsible ones approves DD)	-.06*
	R² total	.58
Q2C1	an aggregate of ATT and PBC components	.31**
Q2C2	mix of components of ATT and SN	.25**
	R² total	.56

* p-value >0.01
** p-value >0.001

From that, it can be said that behavioral and control beliefs exert major influence when trying to predict DD intention. In the same manner, ATT and PBC significantly can explain respondent's intention to drive under the influence of alcohol. These findings are in accordance with the ones presented in Table 2.2., in which the beta weights are more evident for ATT and PBC, and weaker when considering SN. Parker *et al.*, 1992, concluded PBC is useful in predicting intention, indicating respondents "protect their self-esteem or social esteem" when considering themselves still able to drive under alcohol effect without losing driving control. Armitage *et al.* (2002), Marcil *et al.* (2001), Chan *et al.* (2010), Rowe *et al.* (2016), Potard *et al.* (2018) and Yadav *et al.* (2022), also stress perceived control elements play significant role in the theory. They bring to light that drivers feel they have good control over their driving skills, even under the influence of alcohol being more confident to engage in risky driving behavior. SN, as has been found, is the weakest element in predicting INT. Despite this result corroborates meta-analyses of the TPB that have demonstrated that subjective norm is typically the weakest predictor of intention (ARMITAGE *et al.*, 2002). It doesn't mean to say that it must be dismissed. In its work, for instance, Armitage *et al.* (2002), found beta (.41) more significant

precisely for ATT. Among the studies that were carried out on the basis of TPB, Moan & Rise, 2011, is one of the most emblematic as has brought best results. TPB model explained 79% of variance in intention to drink and drive. In the present case, considering the TPB constructs components, they are able to explain 56% of the variance in intention do DD.

After all that was gone through, H5 hypothesis (ATT, SN and PBC strongly explain Intention to drink and drive) can be regarded as accomplished.

4.3 BEHAVIORAL STUDY – STEP 3

4.3.1 Correlations between demographic variables, beliefs and TPB constructs' components, INT, and actual behavior

Figure 4.6 below shows the correlations between actual behavior and demographic, belief, TPB components and INT.
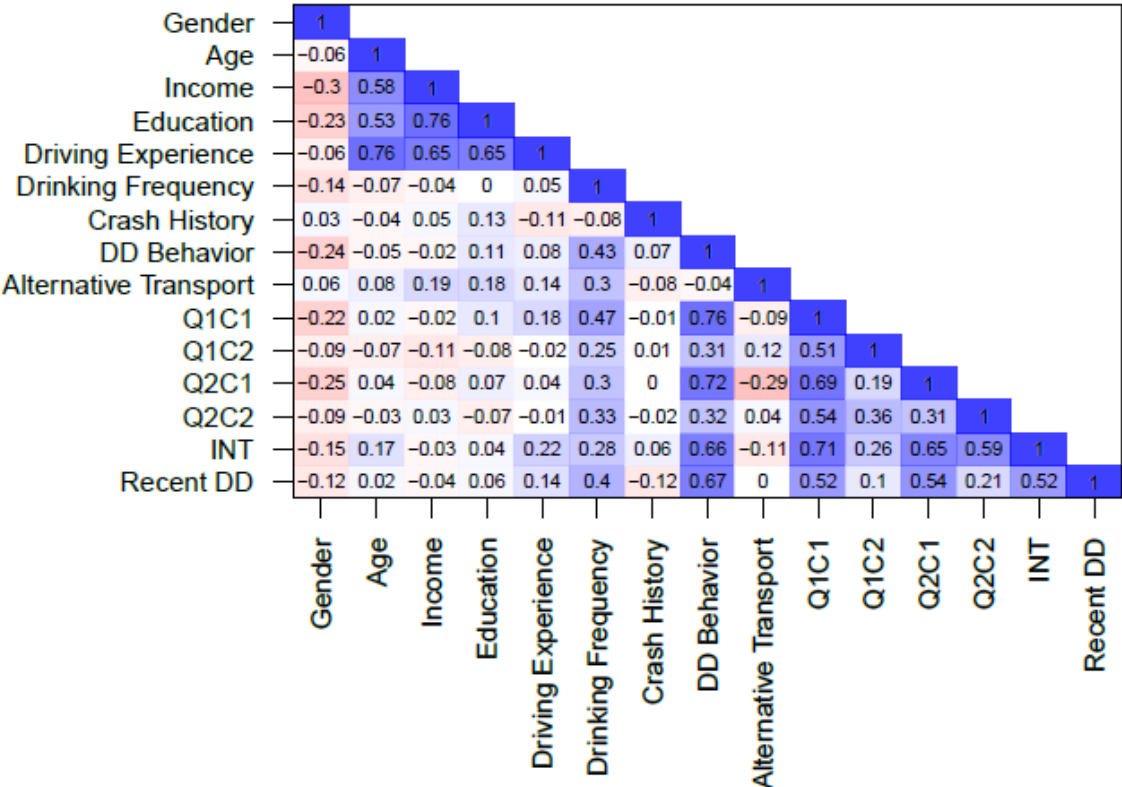

Figure 4.16 – Correlations between actual behavior and demographic variables, beliefs and TPB constructs components and the intention to DD

Results indicate that men (-.12) are most correlated to the behavior itself than women. As older (.02), as higher the education degree (.06), the driving experience (.14), the frequency of DD (.4), and the DD past behavior (.67), greater is the correlation to the actual behavior. It is possible to argue that the longer is the driver licensed, more he/she feel they are able to engage in DD behavior, possibly because of the confidence in not falling under bad circumstances, either damages or legal consequences. And that, possibly because having experienced this behavior before, seems to encourage even more the respondents to repeat it. For the other side, driving under the influence of alcohol follows an inverse correlation with respondents' income (-.04) and with crash history (-.12), indicating people that have already been into a tragic crash scenario tend to be more inclined to avoid putting themselves into risky driving such as DD.

As for belief, TPB components and INT, DD actual behavior follows the same way as found regarding INT before. Q1C2 (.1) and Q2C2 (.21) components, which carry normative beliefs and SN elements in its aggregates, respectively, have significant correlation with actual DD. But, not as much as the first belief component (Q1C1, .52), which entails to behavioral and control beliefs items, and TPB component (Q2C1, .54), composed of ATT and most of PBC items, which are strongly correlated to DD behavior. At last, INT to DD correlated to the actual DD on .52, also indicating that it is an important construct of the theory to influence the actual behavior.

That said, hypothesis H6 (ATT, SN, PBC and INT to drink and drive significantly correlates to drivers' actual behavior) is affirmatively answered.

4.3.2 Regression for predicting actual DD from beliefs and from TPB components (ATT, SN, PBC and INT)

For belief components, Q1C1 represents .24 (p-value >0.001) in variance to explain actual DD to drink and drive. For Q1C2, it is -.06, for p-value >0.01. TPB components follows: β for Q2C1 is = .31, while for Q2C2, β =.25. Table 4.7 presents the results.

Table 4.6 – Regression analysis to understand actual behavior of drinking and drive

Component	Component description	β
Q1C1	aggregate of behavioral beliefs and of the majority of the control beliefs	**.34***
Q1C2	items *cb1* (emergency situation as impelling DD) and *nb2* (inconsequent and irresponsible ones approves DD)	**-.35***
Q2C1	an aggregate of ATT and PBC components	**.40***
Q2C2	mix of components of ATT and SN	**-.005***

* p-value 1
** p-value >0.01
*** p-value >0.001

Results explain that, when considering actual DD behavior, behavioral and control beliefs exert major influence when trying to understand the variance. Q1C1 is positively related on .35, for p-value > 0.01, while Q1C2 belief component indicates a reverse relation of .35, for a p-value> 0.01. That is, Q1C1 component inputs .34 for the behavior to actually takes place on, and on the other way, Q1C2 component deters on .35 the DD behavior to actually happens. For TPB components, Q2C1 inputs .40 do DD behavior and Q2C2, reversely (negative), pushes .005 on to not performing the behavior of driving under the influence of alcohol.

5   CONCLUSIONS

Risky driving is known to be carried out by young males (*H1*), who is the population profile which mostly should be aimed at the construction of safety measures of behavioral change. This DD behavior study, however, points to reverse direction regarding age of the conduct, once results show that as older someone gets, more correlation there is with driving under the influence of alcohol. Also, this research's conclusion is that past behavior should play a significant role in the intention to drink and drive (*H2*), and that intention to drink and drive tend to be weaker in drivers with prior crash history (*H3*).

Ajzen's TPB suggests that beliefs are the immediate determinants of basilar theory's constructs. Changing them, can be a way to lead for changing behavior, which is not easy to reach (ELLIOTT *et al.*, 2005). Considering that accessing the spontaneous beliefs that firstly comes to one's mind is the best way to eliciting a population's salient beliefs regarding a given behavior (AJZEN, 1991), the scope of this study was limited to identifying the behavioral, normative, and control beliefs connected to DD through an open-ended questionnaire followed by a content analysis. The results obtained indicate that the participants see benefits (convenience, euphory and savings of money and time), but also disadvantages (risk of personal and other integrity, of legal consequences and of psychomotor impairment) regarding DD. Respondents believe family and friends that DD would approve the behavior, while family, friends, authorities, and car crash victims' opinions exert high influence on their perception for disapproval. Furthermore, they identified factors inducing DD – emergency occasions, absence of alternative way of transport, social event gathering, ingestion of low alcohol amount (less than two doses) and money saving. Deterrent factors completed the list of beliefs elicited, such as risk perception, social responsibility, ingestion of alcohol (over two doses) and the availability of alternative way of transport. After factor analyses, two main components were found, grouping them into 2 different categories.

As a result, beliefs follow the same path as direct constructs, once component Q1C1 found in factor analyses, that was composed mostly of behavioral and control beliefs, had the strongest correlation with INT. And this component also presented significant correlation with ATT and PBC, suggesting these beliefs can make important pushes on them (*H4*). It must be added that ATT also plays an important role along with PBC in the INT to DD, and, although weaker, SN also must be considered (*H5*). The TPB suggests that behavioral intention is the most important

and direct determinant of an individual's actual behavior, then, it is what the study should probably suggest (*H6*). Figure 5.1 below shows the correlations.
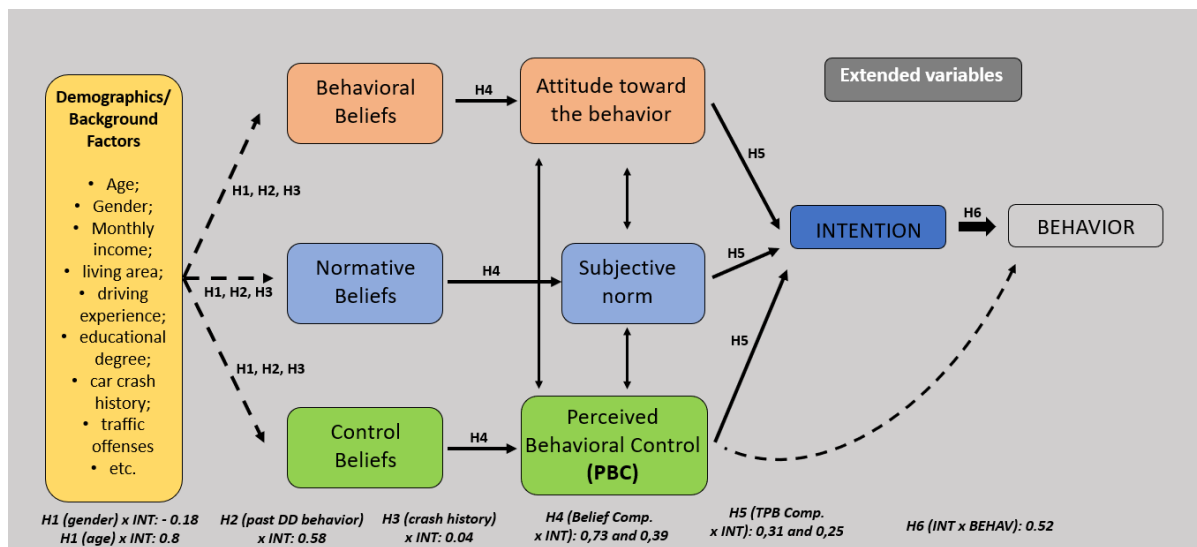
Figure 5.1 – TPB and hypotheses results framework

Lastly, it must be said that this study is one of the only ones regarding road safety that reached the last step of the TPB, that is, seeking the actual behavior. In Brazil, that's the first regarding DD behavior. Despite other studies have demonstrated theory's validity, actual behavior "is not always equivalent to past behavior or behavioral intention" (POTARD *et al.*, 2018). Therefore, follow-up behavior and new studies are desirable in order to establish a confirmatory base for the theory.

In conclusion, this study reaches important findings to contribute to the literature based on TPB and for the construct of effective intervention measures as will be seen ahead.

5.1 POSSIBLE INTERVENTIONS

As affirmed in the beginning of this study, present work provides scientific data to guide traffic management institutions towards measures that discourage drivers to put themselves and the others around into risk. Precisely, when driving under the influence of alcohol, is the aim conduct behind the research notations. As many are the possibilities, it is not in the scope, however, to drain all of them, but solely, give assertive insights of possible interventions based on this study findings and other research's information. Previous studies, then, have suggested interventions such as bolstering negative beliefs and countering positive ones about risky

driving (ROWE *et al.*, 2016). As for beliefs, some interventions have already been presented in section 4.1.1 when dealing with beliefs elicitation, but also summarized on Figure 5.2 below.

Behavioral Beliefs
- Study on main leisure alcohol areas
- Proposals of mobility policies: designated driver, public transport/shuttles/integration
- Euphory could be faced by actions on the risk and on legal sanctions
- Challenging alcohol myths

Normative Beliefs
- Re-think about important referents
- Appeals to the sensible side of the people, bringing to the front the significant ones
- Enhance those that lost a close one due to traffic violence to show empathy
- Bring to light authorities guidelines

Control Beliefs
- Discourage DD: the alcohol effects and psychomotor alterations
- Side effect negligence
- Strengthen the crucial duty of the enforcement of the law

Figure 5.2 – Possible interventions suggested for behavioral beliefs

Now, a list of other possibilities, considering this study results (PBC and ATT as the most evident elements), and laying on other similar studies as parameters, is presented. Nonetheless, such safety measures are not evaluated by these studies, neither it is the intention in here. The intent is only to suggest interventions that needs further validation studies on their effectiveness. Strict enforcement of harsher penalties and law procedures (PARKER *et al.*, 1992; MAGALHÃES & AGUIAR, 2020); promoting driver training and road safety propaganda/campaigns, composed by factual elements, that shows how driving skills tend to be inflated when under alcohol effect for purpose of reducing the self-esteem to a more realistic level (MARCIL *et al.*, 2001); employment of more interactive and creative elements such as computer (mobiles and other technology) games "to demonstrate how one's actual control over driving would be severely impeded" (CHAN *et al.*, 2010); use of crash videos and case studies related to drunk driving disasters (YADAV *et al.*, 2022); might be appropriate strategies to minimize the PBC and ATT of the drivers, warning the negative aspects of the misbehavior and highlighting the potential advantages and drawbacks of engaging in this violation . Also has to be mentioned Bandura's guidelines (*apud* MOAN & RINSE, 2011). The author establishes three ways of working on possible measures. One would be avoiding potential situations that could lead to DD, by instance, the person could take an alternative transport (a bus or a taxi) to the destination of interest instead of conducting the car himself/herself. Another possible strategy could be taking putting important ones ahead of a campaign program, such as modeling famous personalities who will certify their conduct against DD clearly, so, potentially influencing the audience. Lastly mentioned are the standard persuasive techniques already

vastly used on product selling advertisements. Subjective norms could be accessed through billboards/warning instruction displays on roadsides with direct messages, for instance, "Car crash relatives' victims will not approve/worry about of your drunk driving behavior" (GARRISSON *et al.*, 2021); adopt a driving safety mobile phone application in the context of safe driving, and, after all, applying technology applications into the process (POPE *et al.*, 2020).

Additionally, as told by Chan *et al.* (2010), mass media regular reports on detailed official statistics "such as the prevalence of injuries, deaths, and traffic accidents associated with driving after alcohol use" and also in regard to age, gender, level of alcohol intake and occupancy of the offender and of the victims to "increase people's perception of vulnerability toward the actual negative consequences", could be attempted. As for that, interventions should also consider the population characteristics regarding alcohol, which is regarded as a social problem in Brazil. The indiscriminate consumption of alcohol poses a significant challenge in the social context of Brazil, representing a problem that goes beyond individual boundaries and affects society as a whole (RAIZER *et al.*, 2020). This phenomenon is intertwined with various issues such as public health, safety (both public and on the roads), and family dynamics. The impacts of alcoholism manifest in different spheres, ranging from the physical and mental health of individuals to the rise in rates of violence and accidents related to uncontrolled consumption. Moreover, alcohol often serves as an escape for deeper issues, such as socio-economic stress and a lack of access to educational and professional opportunities. Addressing the issue of road safety related to drinking and driving, therefore, necessarily involves tackling alcoholism in Brazil. A comprehensive approach is required, encompassing preventive measures, effective public policies, and accessible treatment programs, aiming to mitigate the negative impacts of this social challenge (SILVA *et al.*, 2021). Measures of narrowing age and time of alcohol purchase and consumption, avoiding the indiscriminate selling by establishing specific stores authorized to do so, and reinforcing policies for the treatment of alcoholics are some ways to combat this social challenge that can even help avoiding DD behavior. Figure 5.3 below presents the possible interventions suggested to overcome DD behavior.

POSSIBLE INTERVENTIONS	
ELEMENT TARGETED	**INTERVENTION SUGGESTED**
ATT/PBC	promoting driver training more realistic, i.e., use of "drug" glasses, video glasses and simulators
ATT/PBC	strict enforcement of harsher penalties, considering well designed and employed
ATT/PBC	road safety propaganda/campaigns/education, composed by factual elements
ATT/PBC	employment of more interactive and creative elements, such as computer (mobiles and other technology) games
ATT/PBC	use of crash videos and case studies related to drunk driving disasters
ATT/PBC	investing in alternative way of transport to avoiding potential situations that could lead to DD, as public transport and partnerships with private entrepreneurs
ATT/PBC	persuasive techniques, i.e., selling techniques
ATT/PBC	applying technology applications into the process as driving safety mobile phone applications
ATT/PBC	adopt a vehicle safety equipment, such as "alcohol sensor detection"
SN	bringing important ones ahead of a campaign program, i. e., famous personalities, victims, authorities
SN	billboards/warning instruction displays on roadsides with direct messages, for instance, "Car crash relatives' victims will not approve/worry about of your drunk driving behavior"
SN	mass media regular reports on detailed official statistics, such as the prevalence of injuries, deaths, time and place of traffic crashes, profile of the victim and offender associated with DD
Social	narrowing age and time of alcohol purchase and consumption
Social	avoiding the indiscriminate selling, i.e., by establishing specific stores authorized to do so
Social	reinforcing policies for the treatment of alcoholics

Figure 5.3 – Possible interventions suggested regarding TPB and social elements

5.2   RESEARCH LIMITATIONS

Limitations are presented in the matter of possible inappropriateness of the model due to cultural differences that could be neglected once the environment landscape could bring particular elements to be taken into account (CHAN *et al.*, 2010). For example, how likely is a young population access to alcohol drink, how local moral norms accepts or denies the behavior of DD, how much blood alcohol concentration is socially seen as acceptable, and so on. But, for that, the questions were structured to adequate the Brazilian culture and social view. Other limitation could take place once the study was held in the English language (YADAV *et al.*, 2022), but that seems that did not represent a problem as the questionnaire was presented in Portuguese for widely comprehension and tested before application to eliminate misinterpretations.

Moreover, recruitment strategy, undertaken as for convenience, can also be a problem (HUEMER, 2018) as there could be some bias in the sampling. For that, some actions were prepared to minimize possible misrepresentation. To avoid it, data was collected targeting most distinguished population as possible, regarding residence, gender, age. Most of the FD regions were visited and data gathered in places such as universities, restaurants, street markets, shopping malls, bus and metro stations, local business areas, and so on. Obstacles such as

unsafety in some very local areas, respondent's unwilling or even concern of having personal data exposed, restriction on data collection in bars and restaurants by their managers, and bureaucracy for being allowed to walk around some institutions and enterprises to get answers, can be cited as some obstacles faced during the journeys. Nonetheless, as showed in the exploratory analysis before, respondents' profile came to be much alike Federal District Traffic Department Driver's license database, indicating that the results can be reasonably accepted as representing the whole FDs population despite not being a random sampling. Despite that, the behavioral study did not reach numerous returns, and has to be interpreted inside the limits of its borders.

Other possible barring element of the research shall be addressed to the reliance on self-reported data, mainly when dealing with behaviors that are self-evidently socially undesirable, which is known to potentially cause bias (PARKER *et al.*, 1992; HUEMER, 2018). Because of the possibility for socially desirable responses, the answers might not represent the real world. In a way to minimize bias, participants were assured of the confidentiality of their responses as the questionnaires' orientation notes were written to make it as clear as possible, and to make sure participants understood how important it was to give truly answers (MIDDLESTADT, 2012; MOSHKI *et al.*, 2019). Also, questionnaires were under voluntary consent and anonymous, in order that knowing data would not be identified made people more comfortable to provide truthful answers. For research Step 2, additionally, collecting online answers was another strategy adopted, as face to face interviews could lead to socially desirable manners. As most of the population has access to mobile phones and internet, online questionnaire was not a social restrictive problem.

5.3   FURTHER RESEARCH RECOMMENDATIONS

Present study does not contemplate perceptions that explore the beliefs elicitation results and correlations of the sample deep into its specific subpopulations, i.e., people that are under DD legal sanctions, people at bars that most probably have being drinking alcohol, recently licensed drivers, university students and so on. Present study may also inform the design of longitudinal research that can track proper interventions that could be implemented more precisely having in mind the belief elicitation and the TPB constructs analysis (ROWE *et al.*, 2016). Investigating other constructs previously explored by the literature as extended variables to TPB, such as perceived invulnerability (CHAN *et al.*, 2010; POTARD *et al.*, 2018), past

behavior (POTARD *et al.*, 2018; YADAV *et al.*, 2022), risk perception (ELIAS *et al.*, 2017; YADAV *et al.*, 2022), moral norms (MOAN & RINSE, 2011; YADAV *et al.*, 2022), conformity tendency (YADAV *et al.*, 2022), traffic fatalism (ELIAS *et al.*, 2017; YADAV *et al.*, 2022), sensation seeking (YADAV *et al.*, 2022), can be another interesting direction for further research. Last but not least, a Confirmatory Factor Analysis – CFA, could be conducted in order to analyze its products and suitability to TPB.

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APPENDIX I – Beliefs Elicitation Questionnaire

Pesquisa sobre o comportamento de motoristas do Distrito Federal no trânsito

Caro(a) condutor(a),

Este é um convite para participação em pesquisa realizada pelo Programa de Pós-Graduação em Transportes da Universidade de Brasília-UnB.

Sua **colaboração** é importantíssima para os rumos e futuros do nosso país! Seu anonimato é garantido!

Não existe resposta **certa ou errada** às perguntas deste questionário.

Estamos interessados apenas em conhecer sua **VERDADEIRA** opinião, para entender quais as suas crenças sobre a combinação entre direção e ingestão de álcool.

Responda de forma franca, verdadeira, sem se preocupar com o que seja socialmente aceitável. Não existe resposta **certa ou errada** às perguntas deste questionário.

Se você tiver qualquer dúvida em relação à pesquisa, pode entrar em contato pelo e-mail samuel.morgan@aluno.unb.com.br

Dirigir sob efeito de álcool: é a direção de veículo automotor por condutor que tenha ingerido QUALQUER quantidade de bebida alcoólica.

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO.

Esta pesqisa tem o caráter exclusivamente científico. As informações serão mantidas em absoluto sigilo e a individualidade das respostas será preservada porque os dados serão agregados para depois serem analisados.

Sua participação é voluntária e livre de qualquer remuneração ou benefício. Você é livre para recusar-se a participar, retirar seu consentimento ou interromper sua participação a qualquer momento.

Concordo em participar da pesquisa: *

○ SIM

○ NÃO

HABILITAÇÃO EM VEÍCULO AUTOMOTOR.

Responda à pergunta abaixo.

Você possui CNH (Carteira Nacional de Habilitação) emitida no Distrito Federal? *

○ SIM

○ NÃO

Section 1: Introduction.
1.1. Research institution, response guidelines, theme, contact, basic concepts.

1.2. ICF – Informed Consent Form.

Section 2: Criteria Question.
If respondent has drivers' license in FD.

80

PERFIL DO RESPONDENTE

Queremos saber um pouco mais sobre você! Responda os itens a seguir.

Em qual Região Administrativa você reside? *

Escolher

Qual seu gênero? *

○ Feminino

○ Masculino

○ Outro

Qual sua idade? *

○ 18 a 25 anos

○ 26 a 35 anos

○ 36 a 50 anos

○ 51 a 59 anos

○ Acima de 60 anos

**Section 3:
Demographics.**
3.1. Residence region.
3.2 Gender
3.3. Age

CRENÇAS DE ATITUDE

Para cada uma das questões a seguir, pedimos que liste os pensamentos que vierem imediatamente à sua cabeça (enumerar quantos quiser). Lembre-se que o questionário é anônimo e queremos que responda com

SINCERIDADE. Mesmo que você não faça consumo de bebida alcóolica, deixe sua opinião.

Quais são as VANTAGENS de dirigir sob efeito de álcool? *

Sua resposta

Quais são as DESVANTAGENS de dirigir sob efeito de álcool? *

Sua resposta

Por que é BOM dirigir sob efeito de álcool? *

Sua resposta

Por que é RUIM dirigir sob efeito de álcool? *

Sua resposta

Section 4: Behavioral Beliefs.
4.1. Advantages.
4.2 Disadvantages
4.3. Why is good to DD
4.4. Why is bad to DD

CRENÇAS DE NORMATIVAS

Para cada uma das questões a seguir, pedimos que liste os pensamentos que vierem imediatamente à sua cabeça (enumerar quantos quiser). Lembre-se que o questionário é anônimo e queremos que responda com

SINCERIDADE.

Mesmo que você não faça consumo de bebida alcóolica, deixe sua opinião.

Quais pessoas ou grupos APROVARIAM que você dirigisse sob efeito de álcool? *

Sua resposta

Quais pessoas ou grupos DESAPROVARIAM que você dirigisse sob efeito de álcool? *

Sua resposta

CRENÇAS DE CONTROLE

Para cada uma das questões a seguir, pedimos que liste os pensamentos que vierem imediatamente à sua cabeça (enumerar quantos quiser). Lembre-se que o questionário é anônimo e queremos que responda com **SINCERIDADE**. Mesmo que você não faça consumo de bebida alcóolica, deixe sua opinião.

Quais fatores ou circunstâncias mais provavelmente fariam você DIRIGIR sob efeito de álcool? *

Sua resposta

Quais fatores ou circunstâncias mais provavelmente fariam você EVITAR DE DIRIGIR sob efeito de álcool? *

Sua resposta

Section 5: Normative Beliefs
5.1. Approve.
5.2 Disapprove

Section 6: Control Beliefs
6.1. Facilitators.
6.2 Barriers

83

APPENDIX II – MAIN STUDY QUESTIONNAIRE

Pesquisa sobre comportamento no trânsito do Distrito Federal

Caro(a) condutor(a),

Este é um convite para participação em pesquisa realizada pelo Programa de Pós-Graduação em Transportes da Universidade de Brasília-UnB.

Sua **colaboração** é importantíssima para o futuro do nosso país!

Seu **anonimato** é garantido!

O objetivo é entender um pouco mais sobre o comportamento de dirigir sobre influência de bebida alcoólica (qualquer quantidade de álcool).

Os resultados poderão orientar a sociedade e os órgãos gestores de trânsito.

Em caso de dúvidas: samuel.morgan@aluno.unb.com.br

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO.

Esta pesquisa tem o caráter exclusivamente científico. As informações serão mantidas em absoluto sigilo e a individualidade das respostas será preservada porque os dados serão agregados para depois serem analisados.

Sua participação é voluntária e livre de qualquer remuneração ou benefício. Você é livre para recusar-se a participar, retirar seu consentimento ou interromper sua participação a qualquer momento.

Concordo em responder às perguntas a seguir: *

○ Sim

○ Não

HABILITAÇÃO EM VEÍCULO AUTOMOTOR.

Responda à pergunta abaixo.

Você possui CNH (Carteira Nacional de Habilitação) e dirige nas vias do DF e/ou entorno? *

○ SIM

○ NÃO

Section 1: Introduction.
1.1. Research institution, response guidelines, theme, contact, basic concepts.

1.2. ICF – Informed Consent Form.

Section 2: Criteria Question.
If respondent drives and has drivers' license in FD.

PERFIL DO(A) RESPONDENTE

Em qual Região Administrativa você mora? *

Escolher ▾

Gênero *

○ Feminino

○ Masculino

○ N/A

Qual sua idade? *

○ 18 a 25 anos

○ 26 a 35 anos

○ 36 a 50 anos

○ 51 a 59 anos

○ Acima de 60 anos

Renda mensal (SM - salário mínimo) *

○ Até 1 SM (R$ 1.320,00)

○ 1 a 2 SM (R$ 2.640,00)

○ 2 a 3 SM (R$ 3.960,00)

○ 3 a 5 SM (R$ 6.600,00)

○ Mais que 5 SM (acima de R$ 6.600,00)

Escolaridade *

○ Ensino Fundamental Incompleto

○ Ensino Fundamental completo

○ Ensino Médio Completo

○ Ensino Superior Incompleto

○ Ensino Superior completo

○ Pós-graduação

Section 3: Demographics.
3.1. Residence region.
3.2 Gender
3.3. Age

3.4 Monthly income (minimum wage as index)

3.5 Formation Degree (Fundamental, High School, Superior, Post-graduation)

Há quanto tempo você possui habilitação para dirigir? *

◯ Até 1 ano.

◯ 1 a 5 anos

◯ Acima de 6 anos

Em quantos sinistros de trânsito ("acidentes") você se envolveu nos últimos 3 meses em que houve pessoas feridas? *

◯ Nenhum

◯ 1

◯ 2

◯ 3

◯ 4

◯ 5 ou mais

Com qual frequência você dirigiu após um evento em que tenha ingerido bebida alcóolica, nos últimos 3 meses? *

◯ Sempre

◯ Frequentemente

◯ Algumas vezes

◯ Raramente

◯ Nunca

Nos últimos 3 meses, com qual frequência você utilizou o transporte por aplicativo, ou outro meio de transporte (público, carona, etc), para evitar dirigir sob efeito de álcool? *

◯ Sempre

◯ Frequentemente

◯ Algumas vezes

◯ Raramente

◯ Nunca

3.6 Length of license (years)

3.7. Car crash history in which resulted in victims (injured or dead)

3.8 DD past behavior.

3.9. Frequency alternative transport use to avoid DD.

1. Nas próximas semanas, eu pretendo dirigir após ingerir bebida alcoólica em um evento. *

	1	2	3	4	5	
Discordo totalmente	○	○	○	○	○	Concordo totalmente

2. Pessoas próximas a mim (minha família) apoiam que eu dirija sob influência de álcool. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

3. Quando não há outro meio para ir embora de um evento/comemoração, eu provavelmente dirijo após consumir bebida alcoólica. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

4. É mais cômodo dirigir sob influência de álcool para ir embora de uma festa e não ter que depender de outra pessoa (carona, uber, táxi, transporte público). *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

5. Eu tenho bom controle de direção mesmo após ingerir bebida alcóolica em um evento/celebração. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Section 4: Beliefs and TPB constructs of ATT, SN, PBC and INT.

87

6. Dirigir sob influência de álcool é uma atitude sábia. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

7. Quando consumo até 2 doses de bebida alcoólica em uma festa, eu dirijo meu *
próprio veículo.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

8. É seguro conduzir um veículo sob influência de álcool após um evento com *
amigos e familiares.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

9. Família e amigos que bebem e dirigem aprovam que eu dirija sob efeito de *
álcool.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

10. Seu eu dirigir meu carro após ingerir bebida alcoólica em uma *
festa/celebração, a maioria das pessoas que são importantes para mim (pais,
filhos, avós, cônjuge, amigos) aprovarão minha decisão.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Section 4: Beliefs and TPB constructs of ATT, SN, PBC and INT.

11. As autoridades e as vítimas de sinistros de trânsito ("acidentes") aprovam * que eu dirija após consumir bebida alcoólica.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

12. Dirigir sob influência de álcool é positivo. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

13. É possível que eu escolha dirigir após consumir bebida alcoólica em uma * celebração com amigos e/ou familiares nas próximas semanas.

	1	2	3	4	5	
Discordo totalmente	○	○	○	○	○	Concordo totalmente

14. Para mim, as consequências da fiscalização (ser multado, ter a CNH * suspensa, ser preso, etc) não são impedimento para que eu dirija sob influência de álcool.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

15. Eu dirijo sob efeito de álcool sem problemas. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Section 4: Beliefs and TPB constructs of ATT, SN, PBC and INT.

16. Prefiro dirigir meu carro, sob efeito de álcool, depois de uma festa, para economizar tempo e dinheiro. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

17. Pessoas de comportamento inconsequente ou irresponsável, aprovam que eu dirija sob influência de álcool. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

18. Em situações de emergência eu conduziria um veículo após ingerir bebida alcóolica (risco de vida, por exemplo). *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Section 4: Beliefs and TPB constructs of ATT, SN, PBC and INT.

19. Dirigir sob influência de álcool é legal (prazeroso). *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

20. Família e/ou amigos aprovam que eu dirija após consumir no máximo 2 doses de bebida alcoólica. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

21. Nas próximas semanas, eu provavelmente vou dirigir após consumir bebida *
alcoólica em uma festa com amigos e/ou familiares.

	1	2	3	4	5	
Discordo totalmente	○	○	○	○	○	Concordo totalmente

22. Na minha opinião, dirigir um veículo após consumir bebida alcoólica não leva *
a sinistros de trânsito ("acidentes"), pois não afeta meus movimentos e minha
percepção (reflexos, atenção, tempo de reação, irritação, sonolência).

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

23. Vou embora de um evento dirigindo após consumir álcool, para economizar *
dinheiro (não gastar com outro meio de transporte).

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

24. A maioria dos meus amigos concordam que eu dirija sob influência de álcool *
após um evento.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

25. Por irresponsabilidade e por desconhecer os riscos envolvidos, dirijo sob *
efeito de álcool.

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Section 4: Beliefs and TPB constructs of ATT, SN, PBC and INT.

91

26. Consigo dirigir tranquilamente mesmo após consumir bebida alcoólica em uma festa. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

27. Me sinto leve, feliz, corajoso(a) quando dirijo um veículo sob efeito de álcool. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

28. Ir a um evento social (encontro de trabalho, festa, aniversário) aumentam minhas chances acabar dirigindo sob efeito de álcool. *

	1	2	3	4	5	
Discordo totalmente.	○	○	○	○	○	Concordo totalmente.

Caso tenha interesse/disponibilidade em participar, preencha abaixo, por gentileza, seu e-mail para receber o formulário daqui um mês.
Sua colaboração é muito importante e por isso agradecemos seu empenho e participação!

Sua resposta

Espaço para comentário livre.

Sua resposta

APPENDIX III – BEHAVIORAL QUESTIONNAIRE

Pesquisa sobre comportamento no trânsito do Distrito Federal

Caro(a) condutor(a),

Este é um convite para participação na **Etapa Complementar** da pesquisa sobre comportamento no trânsito realizada pelo Programa de Pós-Graduação em Transportes da Universidade de Brasília-UnB.

O tempo de resposta leva, em média, 1 minuto.

Informações serão guardadas em sigilo, responda com SINCERIDADE.

Apenas aqueles que demonstraram interesse, registrando o e-mail de contato, participam desta etapa.

Obrigado pela contribuição.

Dúvidas: samuel.morgan@aluno.unb.com.br

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO.

Esta pesquisa tem o caráter exclusivamente científico. As informações serão mantidas em absoluto sigilo e a individualidade das respostas será preservada porque os dados serão agregados para depois serem analisados.

Sua participação é voluntária e livre de qualquer remuneração ou benefício. Você é livre para recusar-se a participar, retirar seu consentimento ou interromper sua participação a qualquer momento.

Concordo em responder às perguntas a seguir: *

○ Sim

○ Não

Section 1: Introduction.
1.1. Research institution, response guidelines, theme, contact, basic concepts.

1.2. ICF – Informed Consent Form.

INGESTÃO DE BEBIDA ALCOÓLICA

Informações serão guardadas em sigilo, responda com SINCERIDADE.

Com qual frequência você faz ingestão de bebida alcoólica? *

○ Sempre

○ Frequentemente

○ Algumas vezes

○ Raramente

○ Nunca

Section 2:
Criteria
Question.
How often
respondent
ingest alcohol
(Always –
never). Never as
exclusionary.

Nas últimas semanas, você dirigiu um carro após ingestão de bebida alcóolica? *

○ NÃO

○ SIM

Section 4:
Actual
Behavior.
Whether
respondent drove
or not under the
influence of
alcohol in the
past weeks.

Você conduziu algum carro sob efeito de álcool, nas últimas semanas, para se
sentir bem, pelo prazer de conduzir nessa condição ou mesmo por comodidade
(não depender de outro meio de transporte)? *

○ NÃO

○ SIM

Você dirigiu algum carro sob efeito de álcool nas últimas semanas pela influência *
de alguém?

○ NÃO

○ SIM

Nas últimas semanas, teve alguma situação que o levou a dirigir após ter   *
ingerido bebida alcoólica ?

○ NÃO

○ SIM