



Prevalence and Perception of Depressive Symptomatology Among Spanish Drivers and Its Relation to Driving Safety

Francisco Alonso, Cristina Esteban, Sergio A. Useche, Mireia Faus

DATS (Development and Advising in Traffic Safety) Research Group - INTRAS (University Research Institute on Traffic and Road Safety), University of Valencia, Valencia, Spain

Email address:

Francisco.alonso@uv.es (F. Alonso), cristina.esteban@uv.es (C. Esteban), sergio.useche@uv.es (S. A. Useche), mifausre@alumni.uv.es (M. Faus)

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Abstract: Depression is currently the most frequent mental disorder and one of the main causes of losing years of healthy life. This disorder entails a cognitive and motor deterioration that is seriously detrimental to driving. From the analysis of the interviewed drivers' attitudes, knowledge and behaviors, the objective of this paper was the following one: detect the impact of depressive symptoms on a driver's sample and its relationship with several variables related to driving and road safety. A sample of 1.200 Spanish drivers ranging from 18 to 64 years was used, 666 men and 534 women were asked to answer a questionnaire composed by a set of items structured in different sections. The only selection criteria were to be in possession of any type of driving license for vehicles other than motorcycles and drive frequently. 21.9% of the drivers showed signs or symptoms linked with a depressive disorder. There were found significant contingences between the presence of depressive symptoms and a lower risk-taking while driving. It is necessary to propose establishing systems that fulfil two essential requirements: on the one hand, to inform, train and make the drivers aware of detecting and managing the symptoms linked to depression; on the other hand, to detect the drivers that show cognitive and motor deterioration linked to depressive symptoms, and to promote their self-regulation, taking into account the negative implications of driving under depressive symptomatology for performance and road safety in general.

Keywords: Depression, Drivers, Epidemiology, Public Health, Driving Safety, Road Safety

1. Introduction

It has been estimated that approximately one third of the general population suffers, or will suffer any mental disease at some point of their lives [1, 2]. Epidemiological studies show that depression is, probably, the most common mental disorder nowadays.

Depression is an important public-health problem and one of the leading causes of disease worldwide, because it presents a high morbidity with other illnesses. Up to 4% of men and 8% of women suffer from a clinically significant major depressive disorder, although depressive symptoms are much more common. Depending on the way it is defined depression can be seen as a state of mood, as a symptom, as a syndrome or as a clinical diagnosis [3].

In primary care, under recognition and under treatment of

depressive disorders are common, despite their relatively high prevalence, which accounts typically for more than 10% of patients [4]. On the other hand, it appears that only 25% of depressed patients are prescribed antidepressant medications [5]. In addition, a study showed that, even when within the primary care, physicians set that one of their patients suffers from a depressive disorder, the inadequate treatment or non-treatment are quite common within the healthcare systems [6]. A partial explanation for this circumstance may be due to the fact that approximately half of the depressions arise from the appearance of a physical disease.

Depression as mood disorder is characterized by a pervasive sense of misery, feeling of sadness, loss of interest or pleasure in nearly all activities, feelings of hopelessness and thoughts or self-blames [7].

The depressive state is characterized by a cognitive,

emotional, motivational, behavioral and motor deterioration, and its main symptoms are: anhedonia (the inability to experience pleasure) related to deficits in reward-related processing and considered critical components that contribute to dysfunctions in decision-making of depressed individuals [8], sadness, slower thinking, negativism, low self-esteem, feelings of uselessness, guilt, anger, aggressiveness, anxiety, loss of interest, sudden changes of weight, loss of interest in sex, sleep disturbances and reduction of the level of alertness, which give rise to an increase of errors in the performance. Recent studies have found that depression also leads to significant loss of productivity mainly due to reduced performance rather than absence from work [9]. Depression tends to have a chronic course and produces disability; it is associated with suicide [10].

Attention and psychomotor functioning are impaired when someone has depression [11] and it has been associated with impaired functioning on cognitively demanding tasks [12], and concurrent information-processing biases [13].

Sad mood, in both healthy participants and those with present clinical depression, has been demonstrated to influence the activity of a common set of prefrontal and limbic brain regions. Many of these areas are, also, involved in cognitive functions. The overlap between the brain areas modulated by sad mood and cognition is consistent with a shared, interactive neural architecture for cognition and mood. This suggests that mood has a pervasive effect on cognition [14].

Moreover, emotions associated with depressed or anxious individuals tend to influence cognitive processes such as free associations, imaginative fantasies, social perceptions and snap judgment about other personalities [15]. From the evolutionary perspective, emotion is characterized in terms of response tendencies [16]. Furthermore, the prolonged exposure to negative or positive stimuli has an effect on people's affective state and processing style [17, 18].

The performance of complex activities like driving is seriously jeopardized, and can be sometimes worsened due to the side effects of the pharmacological treatment (drowsiness, blurred vision or alterations of the behavior) to treat this disorder.

Research on driving has shown that individuals who have been diagnosed with depression tend to show, for example: disturbances in attention, impaired information processing and judgment, psychomotor retardation, diminished concentration and memory ability, decreased reaction time, sleep disturbances and fatigue, and suicidal ideation [19].

In the specific context of traffic, emotions while driving were related to emotional traits and to traffic events [20] to evaluations of risk, behavior tendencies and current self-reported driving behavior [21].

Armstrong & Whitlock found out that the risk of having an accident was significantly higher in a group formed by drivers with different psychiatric disorders, comparing with a sample of patients with physical diseases [22]. Likewise, 60% of the drivers that suffered from any kind of mental disorder, compared to the 23% of those suffering from physical

alterations, stated that they had experienced more problems while driving. However, it has to be borne in mind that the psychiatric group ingested a greater quantity of psychoactive substances. There is good evidence that many drugs prescribed by psychiatrics impair driving [23].

From the few studies available, it appears that truck drivers experience symptoms of depression more frequently. Depression was identified in 13.6% of truck drivers; it was classified as minimal (58.5%), mild (22%), moderate (14.6%) and severe in 4.9% of individuals. It is independent of age and is connected with drug abuse and the use of stimulants [24].

In a study using a depressive sample free of anti-depressant medication participants showed slower driving reaction moments for all the tests and a higher number of accidents in the trials, having checked the age and the hours of sleep compared to the control group [12]. The individuals that presented non-treated depressive symptoms showed an impaired performance in simulated driving. In this study, the gender was not significantly related to any of the driving variables studied. In contrast, age was significantly associated with both steering reaction time and the number of crashes.

Although SSRIs are associated with a different adverse effect profile compared to other antidepressant medication, they can also affect psychomotor and cognitive functions and, consequently, have the potential to impair fitness to drive. Based on current evidence, it was concluded that more experimental and epidemiologic research is needed to elucidate the relationship between SSRI use and traffic safety [25].

1.1. Study Framework

Connections between traffic and illnesses are strong and complex, and they are beyond the existing relation of the ability to drive and the probability of being involved in a traffic crash. Health, beyond the absence of any illness, entails the full self-perceived biopsychosocial state of well-being [26].

From this approach, road health has to be treated from a comprehensive perspective, i.e. taking into account the biological, psychological, and social aspects [26, 27]. Moreover, it is important to understand the health-related causes of drivers that may impair driving in order to prevent motor vehicle collisions and, also important, for drivers to be aware of this risk. So, this is why this article was framed within a large-scale project based on "road safety and health" to raise people's awareness regarding this matter [27, 28, 29].

This global research into health and driving used a questionnaire made up of a set of items in different sections. First of all, the questionnaire was used to collect socio-demographic data on drivers

There were also subsections to collect information related to four areas: "subjective incidence of health in driving"; "drivers' psychological state (condition)" (including symptom scales for depression, fatigue, anxiety, and daily and work stress); "medication and driving" and "the system of selection of drivers" (view and proposal).

The study described in this article is based on data found in

the section “drivers’ psychological state (condition)” (including symptom scale for depression) and part of “subjective incidence of health in driving” [27].

1.2. Purpose and Significance of the Study

The main purpose of this research was to describe the relationship between the prevalence, perception and incidence of depressive symptomatology on Spanish drivers, and its incidence on self-reported assumed risky behaviors.

As specific objectives, there have been established: First, to describe the risk perception regarding the influence of depression on driving performance; Second, to determine the prevalence of depression in drivers, assessing the most frequently symptoms of this disorder among them; Third, to identify the relation of the groups of drivers with and without depression symptoms with the reported and subjective incidence of health in driving, the type of discomfort that causes the situation, the decision to keep driving (or not) in such circumstances, and the manner in which their driving performance was affected when they decide to drive. Finally, and referring to the significance of this research, it has been proposed to provide a further understanding of the socio-demographic and psychosocial characteristics of drivers related to depression, conceiving this phenomenon as a high risk factor.

2. Methods

2.1. Sample

Participants were part of a wide-ranging research on different aspects of health that affect driving. The sample used consisted of 1200 Spanish drivers ranging from 18 to 64 years of age, 666 men (56%) and 534 women (44%). The starting sample size was proportional by quota to the Spanish population segments of age and gender. The number of participants represents an error margin for the general data of ± 2.9 with a 95% confidence interval in the most unfavorable case of $p=q=50\%$.

Drivers completed a telephone-based survey. Interviews were completed for 1200 drivers and the response rate was 92.8%; as it was a survey dealing with social matters, the vast majority of people were willing to collaborate. There were 93 (7.2%) people who did not wish to participate in the interview.

2.2. Procedure and Design

This national survey was conducted by telephone. Each household was screened to determine the number of adult (age 18 or older) drivers in the household. The only selection criteria were being in possession of any type of driving license for vehicles other than motorcycles and driving frequently. One eligible driver was systematically selected in each eligible household by the interviewers, using the computer-assisted telephone interviewing (CATI) system. For this type of study, a consent statement is not required. The importance of answering honestly to all the arisen questions was emphasized, as well as the non-existence of wrong or right answers.

In order to address the first objective (to discover the risk perception of drivers among of depression in driving), and as part of the questionnaire, a selection of eight items from Spanish adaptation of Goldberg’s Anxiety and Depression Scales [30] was included, with the aim of detecting the predisposition of the drivers to suffer from depression. The depression subscale was divided into two parts, so that the four starting items (Yes/No) were aimed at determining the probability of suffering from depressive symptoms. If the participant answered "Yes" to two or more of these first questions, he/she were asked to answer the remaining four items (Likert-type, whose aim was to detect the frequency in which these symptoms appear).

In addition, in the section of the questionnaire named “subjective incidence of health in driving” participants were asked how often they had thought, "Today, I should not be driving". They were asked to mention the type of indisposition. In order to understand the behaviour of participants, items related to the decision to keep driving or not in these circumstances, and whether they considered their driving was affected by these conditions, were also included. It was also interesting to learn about the consistency between driving and sick leaves (considered as an actual condition of indisposition), so participants were also asked whether they kept driving when they were on sick leave.

Furthermore, the questionnaire was used to collect data by asking questions to establish a profile of the interviewee as a driver, with the aim of detecting the distinguishing characteristics that define their inclusion in a certain group(s). These variables focused, principally, on socio-demographic and psychosocial characteristics grouped as: Demographic variables, Driving Habits and Experience/Risk.

Demographic variables: Gender (man/woman); age (Grouped in six intervals; 18-25 26-35, 36-45, 46-55, 56-65, and over 65); Population size where live (Strata considered are as follows: in less than 10,000; from 10,001 to 20,000; 20,001 to 100,000; 100,001 to 500,000; and more than 500,000); Work Activity (Grouped in active, not active, housework); Profession (Grouped in Self-employed, management, other employees employed); Working time (Day, night, and shifts).

Driving Habits: Day/Night Driving (By day, by night, either); Continuous Driving by journey (Grouped in Less than 1 hour; for 1 to 2 hours; 2 or more hours); Type of road most frequently used for driving (Grouped in Urban zones; conventional roads; highway); Type of vehicle used (Grouped in utilitarian vehicles -conventional cars, sports cars and family- and commercial or transportation vehicles -vans, trucks, buses, etc.-).

Risk Exposure: To determine the level of risk exposure of the driver interviewed, it was taken into account both the average miles driven per year as well as the frequency driven. The combination of both variables have led to a classification of drivers in five groups: Exposure to very low risk: includes mainly sporadic drivers (low frequency and / or few Kms/year). Exposure to low risk: includes drivers who made sporadic but long trips (e.g. vacation), or even those who drive frequently but made very few Kms/year. Average risk

exposure: includes regular drivers who do not average many Kms/year, as their movements are not excessively long (e.g. urban trips or weekend outings). Exposure to high risk: includes the usual drivers averaging significant Kms/year because their movements are relatively long (i.e. their commute to and from work). Exposure to very high risk, including those who drive frequently and that in turn make many Kms/year (e.g. professional drivers, commercial, delivery, etc.).

Complimentarily, participants were asked about their main reason for driving. This variable was grouped in-itinere (on the way to or from work), during work, leisure and/or personal, regardless labor or leisure.

Experience/Risk: Years of driving experience. Experience has been defined as the time that the respondent has been driving on a regular basis. This variable is complementary to the risk exposure, since both variables are an indicator of learning situations (both positive and negative) that the respondent has been able to experience in their driving history. (Grouped in Less than 1 year, 1-2 years, 3-10 years, 11-20 21-30, over 30 years).

Risky behavior: The risk assumption is calculated by 5 items. The objective of this factor is to rate drivers for certain risk behaviors (Exceeding speed limits and not keep a safe distance, making a rushed or improper pass, driving after drinking alcohol, using a mobile while driving without using a hands free device). For each behavior considered, have applied the classification criteria of risk- no risk [31], principally used by the study SARTRE 3 [32, 33], depending on how often they engaged in these behaviors. Taking these criteria into account, drivers have been classified into three groups: "No Risk" Group: drivers that have not been classified in any of the risk behaviors considered; "Medium Risk" Group: drivers who have been classified in one or two risk behaviors considered; "High Risk" Group: drivers of risk are classified in more than one of the considered behaviors. *Traffic Violations*: Number of penalties received in the last three years, excluding parking offenses (None; one; more than one penalty). *Crash history*: Number of accidents occurring throughout a driver's life, focusing primarily on accidents suffered as a driver. (None; one; more than one accident).

2.3. Data Processing

In the case of this study, descriptive analyzes (frequencies and central tendency measures) were taken, in order to describe and characterize the prevalence of factors associated with depression among drivers. In addition, comparative analyzes using One-way Analysis of Variance (ANOVA) were performed to discriminate the results according to the socio-demographical characteristics and habits of participants. Furthermore, Chi-square analyzes were conducted to establish potential statistical relationships between categorical study variables.

Once the data was obtained, the relevant statistical analyzes were performed using © IBM SPSS (Statistical Package for Social Sciences), version 22.0.

2.4. Ethics

For this type of study, ethical approval and formal consent are not required. The research type described in the manuscript did not require the official intervention of the Ethics Committee in Experimental Research, (consultative and advisory body of the University of Valencia), as no personal data are used and the participation was anonymous. However, the Research Ethics Committee for Social Science in Health of the University Research Institute on Traffic and Road Safety at the University of Valencia was consulted, certifying that the research subject to analysis responds to the general ethical principles, currently relevant to research in Social Science, and issued a favorable opinion to carry out such research in Spain.

3. Results

In the scale designed to evaluate the symptoms or depressive signs, the most frequent symptoms that participants had during the last months were linked with waking up too early (25.9%, $n=144$), feelings of slowness (8.1%, $n=45$), loss of energy (7.3%, $n=87$), and concentration problems (7.2%, $n=40$). On the other hand, among the less frequent symptoms it is possible to find: loss of weight (4%, $n=22$), loss of interest in things (2.7%, $n=32$), despair (2.3%, $n=28$) or loss of self-esteem (1.7%, $n=20$) (Figure 1).

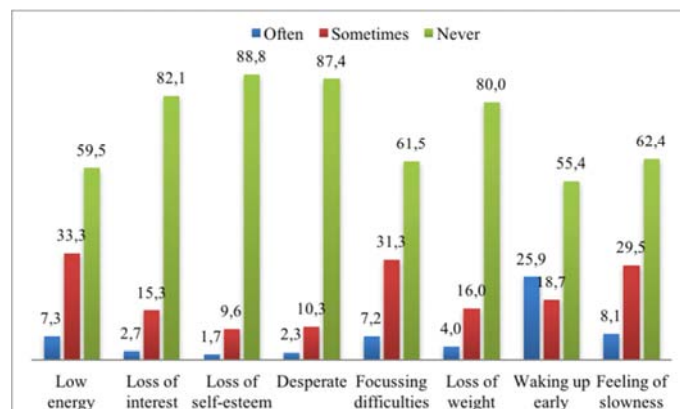


Figure 1. Distribution of drivers according to the frequency of specific symptoms of depression over the past 3 months.

Regarding the impact of depression on participants, it was observed that 21.9% ($n=263$) of them showed signs or symptoms related to a depressive disorder.

Differences and associations between groups

The presence of depressive symptoms was not related to age; however, it was related to gender ($\chi^2=13.293$; $p\leq 0.01$) since women had had more depressive symptoms than men. Moreover, drivers with symptoms of depression perceived and

stated that depression has less impact on driving compared to those drivers without such symptoms. Most of the drivers who admitted suffering from symptoms of depression, lived in towns of more than 500,000 inhabitants ($F_{(4,1049)}=4.386$; $p\leq 0.05$). Table 1 shows the frequency and percentage of each gender and population size group with or without depressive symptoms.

Table 1. Frequency and percentage of drivers with or without depressive symptoms according gender and population size.

Group Variable	Value	With depressive symptoms		Without depressive symptoms	
		Frequency (n=263)	Percentage	Frequency (n=937)	Percentage
Gender	Women	143	54.4	391	41.7
	Men	120	45.6	546	58.3
Population size	less than 10.000	64	23.8	205	21.9
	10.001-20.000	24	18	109	11.6
	20.001-100.000	64	20.2	253	27
	100.001-500.000	56	19.7	228	24.3
	more than 500.000	55	27.9	142	15.2

Significant contingences were also observed in relation to the exposure to risk ($\chi^2=10.940$; $p\leq 0.05$), Risk exposure decreased with the presence of depressive symptoms.

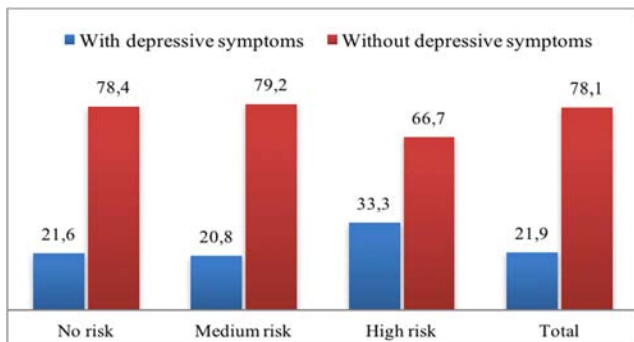


Figure 2. Percentage distribution of drivers with or without symptoms of depression according to the level of assumed risk.

Regarding the level of assumed risk, there are significant statistical associations according to the performed non-parametric test ($\chi^2=6,721$; $p\leq 0.05$). The percentage of drivers with symptoms of depression is 33.3% ($n=27$) for the "high risk" group, while the percentage for "medium risk" group and "no risk" group is 20.8% ($n=148$) and 21.6% ($n=88$), respectively (Figure 2). It was not possible to establish a significant relationship with the other variables studied.

Relationship between depressive symptoms and other variables

Opposed to those who did not have symptoms of depression, 28.8% ($n=151$) of the drivers with such symptoms admitted they thought they were not in appropriate conditions to drive a vehicle safely ($\chi^2=25.555$; $p\leq 0.001$) (Figure 3).

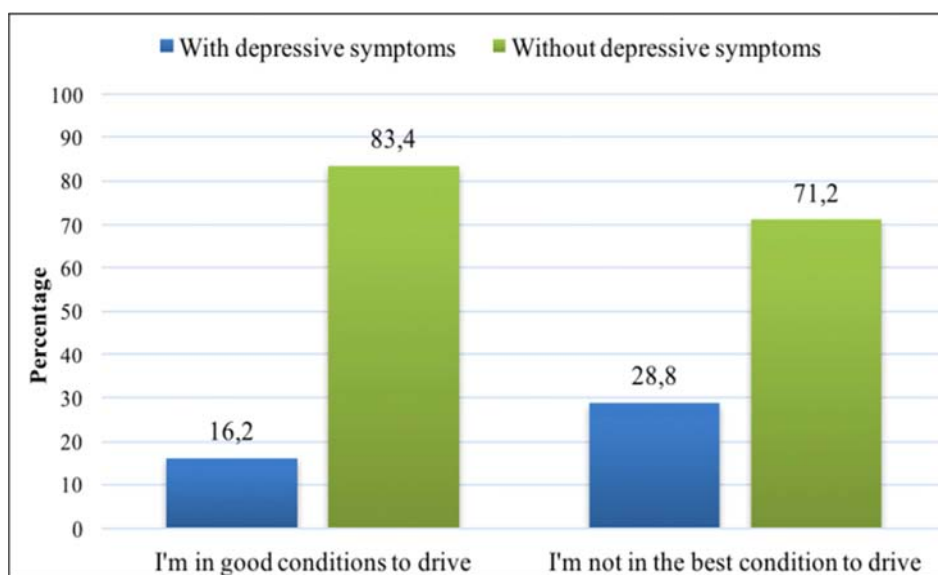


Figure 3. Percentage distribution of drivers according to their perception about conditions to drive with or without depressive symptoms.

Likewise, these drivers related this indisposition to the experience of emotional or psychological discomfort compared to physical discomfort or both of them ($\chi^2=12.133$, $p\leq 0.01$) (Figure 4). However, the presence of symptoms of depression in the case of "feeling indisposed" (*I am not in good conditions to drive*) did not have any influence when carrying out this task. When they "decided to drive" even though they were not in good conditions to do so, the presence of depressive symptoms did not have an influence on the evaluation of whether driving was affected or not.

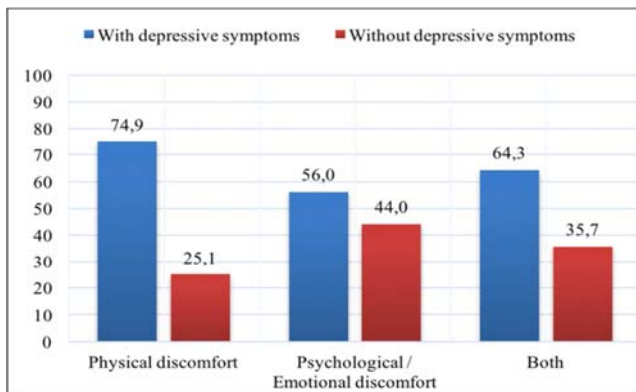


Figure 4. Type of discomfort among drivers with or without depressive symptoms, what made them think that they were not in good conditions to drive.

4. Discussion

Over recent decades, the scientific literature has shown that mental health of drivers is essential to strengthen road safety for different road users [34, 35, 36]. Depression, which often affects drivers, alters the abilities to drive and, consequently, the risk to be involved in traffic accidents [37]. It is clear that the impact of symptoms linked to depression on driving is frequent and serious enough to propose establishing systems that accomplish with two essential requirements:

On the one hand, to inform, train, and make drivers aware of detecting, recognizing and managing the symptoms linked to depression.

On the other hand, the limited assessment that the general population of drivers (approximately the fourth part) have on the effect of depression on driving shows the need to inform, train, and make drivers aware of the cognitive and motor deterioration caused by this alteration, as well as the risk of driving under depressive symptoms, in accordance with what other studies have documented [38, 39].

Consistent with results shown by the Spanish population of drivers, there is a need for a greater control of health by the health and the traffic systems in order to diagnose and control the driving that might be altered because of depression, given that this group of population presents higher risk levels in terms of road safety than those reported by others, including patients with any other disorder or mental illness symptomatology [40, 41].

Concretely, if we focus on the group of drivers that shows depressive symptoms, the fact that they consider that this symptomatology barely affects driving might be due to the effect of habituation and reiterative repetition of the task [42]. This has to be another objective on which information, training, and awareness should be focused in order to increase road safety and health [43].

The fact that the drivers who show depressive symptoms are, at the same time, those that keep on driving although not feeling in good conditions to do so, confirms the need to implement measures in order to increase the perception of risk when driving under an inappropriate state of psychological health [44, 45, 46].

The relatively high impact of the depressive symptoms on drivers shows that driving is, often, performed under a negative condition, and it has to be borne in mind that among the negative effects of depression on driving are: difficulties to select the important information and to keep the level of alertness or to focus, sensory, perceptual, and emotional alterations, memory problems, impoverishment of the decision-making strategies, as well as the deterioration of the execution that causes an increase of the reaction time, nervousness, irritability, fear or even aggressiveness [11, 12, 37]. For all of these reasons, to the implicit risk of the driving task itself, it has to be also added the significant influence of these symptoms that affect driving performance at the physiological, cognitive, and motor levels, taking into account the aforementioned psychological and emotional conditions of drivers with depressive symptomatology, especially if they are taking any medication to treat this disorder [47, 48].

Regarding drivers that decide to drive in spite of not fulfilling the optimal conditions to perform the task, and consider that driving is not affected, it allows us to detect the existence of a group with a potential high risk on the road. This is illustrated by the limited risk perception linked to driving under a state of indisposition [46, 49, 50], as well as by the vital need to fulfill work or personal duties that may imply the task of driving (often seen, in other words, as an adaptive response to daily vital demands), even when they are being aware of the fact that they are not optimally fit to drive.

5. Conclusion

In conclusion, in order to achieve the aforementioned objectives, it is necessary to design and implement formal and systematic intervention measures specifically addressed to the different groups of drivers, according to their psychological and risk-behavioral profile, as well as the use of media campaigns and advertising aimed at educating drivers on the biological, cognitive, emotional, and social deterioration related to depressive symptoms. On the other hand, it is also important to promote self-regulation and, finally, to facilitate avoiding drivers to continue driving under such circumstances through legal and technical strategies.

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