Drugs, Substance Use Disorder and Driving: Intervention of Health Professionals in the Treatment of Addictions

Drogas, Trastorno por Uso de Sustancias y Conducción: La intervención de los profesionales que trabajan en adicciones

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Without a doubt, driving with the presence of drugs in the body is a real problem associated with a higher risk of being involved in road traffic collisions. Thus, intervention aimed at preventing drug driving is a top priority (Álvarez & González-Luque, 2010; DRUID, 2012; Schulze et al., 2012).

In this article, we use the concept *injuries due to road traffic collisions* and not the inadequate term, *traffic accidents*. Most injuries resulting from road traffic collisions are preventable (Álvarez, 2005; Redelmeier & McLellan, 2013), hence the aim of this article: making professionals aware of the fact that these injuries are avoidable, particularly professionals who treat patients for any Substance Use Disorder (SUD), and that they can and should intervene in the prevention of injuries due to road traffic collisions. Like the slogan of the 2004 World Health Day: "Road safety is no accident" (Álvarez, 2005).

When focusing on drugs and road safety, no doubt the most dangerous culprit is alcohol. Based on the results of the European DRUID project (DRUID, 2012; Schulze et al., 2012), intervention in the field of road safety and drugs other than alcohol cannot be carried out if it implies reducing the amount of alcohol-related interventions (Romano, Torres-Saavedra, Voas, & Lacey, 2014). For all professionals who work in the field of addictions, intervention related to alcohol, drugs and driving should be carried out integrally, and under no circumstances should alcohol be left out.

About the Terminology: Driving with the Presence of Drugs

This article includes the term *driving with the presence of drugs in the body*, which means there are quantifiable amounts of drugs in the driver´s organism, avoiding the term *driving under the effect or influence of drugs*. Some countries practice a *zero tolerance* policy, that is, any amount of drugs detected in the driver´s body is a punishable offence, whereas in other cases, a certain concentration level is established, a cut-off point, and any amount of drugs detected above that level is a driving offence. In other cases, *impairment* is the focus, in which the driver's display of evidence of impairment (driving under the influence or effect of drugs)— detected through the use of various field sobriety tests (coordination tests, etc.) (Álvarez & González-Luque, 2014)— is forbidden, and therefore punishable by law.

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Driving with the Presence of Drugs: Is it a Real Problem?

Previous studies have shown that driving with the presence of drugs is a frequent occurrence (Barlés, Escario, & Galbé, 2014; EMCDDA, 2007; Verstraete & Legrand, 2014), and the results should be analysed taking into account the different populations of drivers included in the study (general population, offenders, injured or killed drivers).

The European DRUID project (DRUID, 2012; Schulze et al., 2012) has provided data for Europe, obtained from random roadside testing: in 8.43% (range: 1.34-15.01%) of the drivers, the presence of alcohol/drugs/certain medications was confirmed, with large differences between countries: Italy (15.01%) and Spain (14.85%) were the countries in which drivers testing positive for these substances were most frequently found. At the European level, without taking into account the association between substances, the most frequently detected drug was alcohol, followed by cannabis (THC) (1.32%) and cocaine (0.42%). The highest prevalence of drivers testing positive for cannabis and cocaine was observed in Spaniards. Furthermore, it is important to highlight that, of all the countries participating in the study, Spain had the highest percentage (7.63%) of drivers with the presence of any of these drugs.

According to a recent study (Fierro, González-Luque, Seguí-Gomez, & Álvarez, 2015) performed using representative samples of vehicle drivers in Spain in 2008/9 and 2013, a decrease was observed in the frequency of drivers with the presence of alcohol (4.92%; 95% CI [4.18, 5.66] in 2008/9, and 3.41% [2.27, 4.07] in 2013) and drugs (6.93% [6.07, 7.80] in 2008/9, and 4.87% [4.09, 5.65] in 2013). The decrease in positive cases for drugs is, to a great measure, due to a decrease in the positive cases for cannabis. The routine use of roadside drug controls may have been a contributing factor in this respect.

Drugs and the Risk of Road Traffic Collisions

Currently, preventive interventions should be developed on the basis of scientific evidence. For this purpose, one of the priorities of the European DRUID projects was to analyse the risk involved in drug driving (serious injuries or deaths) (DRUID, 2012; Schulze et al., 2012).

Four risk levels were established to interpret the results:

Slight increase in risk (RR=1-3): Risk associated with driving with a blood alcohol concentration between 0.1 and <0.5 g/L, and with the presence of cannabis.

Medium increase in risk (RR=2-10): Driving with a blood alcohol concentration between 0.5 g/L and < 0.8 g/L, or with the presence of cocaine, illegal and medicinal opiates, benzodiazepines, and Z-hypnotics (without mixing one drug group with another).

High increase in risk (RR=5-30): Driving with a blood alcohol concentration between 0.8 and <1.2 g/L, as well as the presence of amphetamines and a mixture of different drugs.

Extremely high increase in risk (RR=20-200): Driving with a blood alcohol concentration ≥ 1.2 g/L, and with the simultaneous presence of alcohol and drugs.

The data showed that driving with the presence of alcohol (blood alcohol concentration ≥0.8 g/L) in combination with other drugs or multi-drug consumption (alcohol + drugs or an association of drugs) correlates with a higher risk of road traffic collisions.

Most of the available information is about cannabis, which could be used to establish a relationship between concentration and risk (Asbridge, Hayden, & Cartwright, 2012; Laumon et al., 2006; Verstraete & Legrand, 2014). Recently, Elvik (2013) and Verstraete & Legrand (2014) have updated the available information related to alcohol, drugs and certain types of medicines and risk of road traffic collisions.

Driving with the presence of Drugs: Legal Issues

In most countries, driving with the presence of drugs is an offence (EMCDDA, 2015). In the case of Spain, it is regulated as an offense in the administrative area, as well as a crime under criminal law, although both sanctions cannot occur simultaneously. The model differentiates between "presence" and the abstract danger referred to in administrative laws (zero tolerance criterion) and "influence" (impairment criterion) and the specific danger stipulated by the Penal Code (Álvarez & González-Luque, 2014).

Recently, Spanish legislation has introduced relevant changes (Ley 6/2014) involving:

- The prohibition of driving with the presence of drugs in the body, in other words, the "zero tolerance" principle in the matter of drugs and driving.
- Consideration of the Saliva Test, using an authorized device as the preferred way to detect the presence of drugs in the person's body *in situ* and as the chosen means of post-analysis confirmation.
- The fine for driving with the presence of drugs in the person's body, or for refusing to undergo the detection tests, is established at €1,000, along with the loss of 6 driver's licence points.

Roadside Tests for the Detection of Drugs: Saliva versus Blood

Until the present, and due to great extent to the legal and practical issues of taking blood samples, performing roadside tests to detect the presence of drugs in drivers was unusual. Currently, however, it is possible to detect the presence of drugs in saliva samples, or more specifically

"oral fluid," through non-invasive methods. These systems are already available and are being used on a routine basis. Although there are some limitations, especially in relation to sensitivity, specificity, and cut-off values (Verstraete, 2005), drug detection through oral fluid is reliable when the roadside test is linked to a subsequent laboratory confirmation analysis, as in the case of Spanish legal regulations.

Different devices are used for roadside testing; currently, in the case of Spain, the Dräger DrugTest® 5000, DrugWipe®, and Alere™ DDS®2 Mobile Test System are being employed. With these devices, various types of substances can be detected: cannabis, opiates, cocaine, amphetamines and their analogues, benzodiazepines, etc. These devices detect the active substance in the person's oral fluid, confirming the recent use of the drug.

Project DRUID established a core list of detectable substances (27) and their cut-off values for the confirmatory tests and quantification with chromatography, with the principle aim of using them in epidemiological studies. The available information about substance concentration equivalence in blood and saliva (oral fluid) is limited, and the information from the Project DRUID is currently used as a reference (DRUID, 2012; Schulze et al., 2012). Recently, equivalences of blood and oral fluid have been proposed for 12 key substances (Gjerde, Langel, Favretto, & Verstraete, 2014).

The practice of performing drug tests on drivers' oral fluid is already being adopted in developed countries.

What Can Health Professionals Do?

So far, in this article, we have only referred to drivers in general as well as driving with the presence of drugs. However, professionals who treat addictions attend to patients with SUD (Substance Use Disorder). Why is driving important for these professionals and relevant to their clinical practice? Why should they intervene actively?

1. Do Our SUD Patients Drive?

Previous studies (Álvarez, Gómez-Talegón, & Marcos, 2010) have indicated that SUD patients frequently drive, and data from the multi-centre Spanish study, PROTEUS (Roncero et al., 2013) have confirmed that: a significant percentage (52%) of opiate dependent patients (in treatment) drive. Ninety-four percent of those patients were being treated, with average doses of 60 mg/day of methadone. At this level of dosage, methadone interferes—or could potentially interfere—with driving. The patients who drove were found to have fewer legal problems, which could be explained by the fact that driving may be a part of the "normalization" process for the patient and, in some cases, indispensable for professional activity. Therefore, it is important to ensure these patients can drive safely.

2. SUD Patients, Neuropsychological Deficits and Driving Ability

Regular drug use is associated with deficits in various neuropsychological domains or areas. Furthermore, SUD patients frequently present medical comorbidity and psychiatric comorbidity. Finally, SUD patients receive specific treatment for their addiction, commonly including adjunctive psychopharmacological treatment, which could interfere with psychomotor performance and adequate driving fitness.

Within the global treatment/re-integration process of SUD patients, the following three aspects should be taken into account: (a) the disease itself, the addiction, and the neuropsychological deficits; (b) comorbidity; and (c) the pharmacological treatment (Baldaccino et al., 2012; Lorea et al., 2011; Lundqvist, 2005; Soler, Balcells, & Gual, 2014).

European legislation (CD 439/1991/EEC) and Spanish legislation (Real Decreto 818/2009) establish the minimum requirements when assessing driving fitness. In the case of Spain, testing driving fitness is carried out at the Medical Driver Test Centres (in Spanish, Centros de Reconocimiento de Conductores, hereafter, CRC). Being diagnosed with SUD does not in itself indicate a deterioration of driving fitness. In any case, evaluation of drivers with SUD must be performed individually in the above-mentioned centres along with a necessary medical report about the patient.

The assessment of driving fitness and reports to the CRC are problematic in clinical practice. Sometimes, the health professional must present a report about the patient to the CRC, either at the request of the patient, the CRC itself, or the authorities. The role of the health professional treating these patients does not include determining whether or not the patient can drive, but rather reporting the patient's clinical status. The patient's analysis must include: diagnosis, patient's treatment adherence, dates of remissions or relapses, suicide risk and behaviour, length of time in a stable condition, and possible side-effects of the medication involved, and whether or not the patient consumes other types of drugs (for example, results of urine analyses, etc.) (Álvarez & González-Luque, 2014).

Another issue related to, yet independent from, the above-mentioned aspect of assessing driving fitness is the medical advice that must be offered to the patient at every visit to the doctor, in particular, whether or not the patient should drive, or whether the patient should limit his/her driving activity, all based on the patient's clinical state. These aspects will be analysed in greater detail in section 6.

3. Do SUD Patients Run a Higher Risk of Road Traffic Collisions?

Drivers with certain psychiatric pathologies present a higher risk of road traffic collisions than healthy drivers. In a meta-analysis (Vaa, 2003) in which the risk of traffic collisions was analysed in relation to the medical and

neuropsychiatric disorders outlined by the European Directive CD 91/439/EEC, having a mental disorder was one of the conditions with the highest risk of suffering a road traffic collision (RR= 1.72, 95% CI [1.48, 1.99]), along with alcohol abuse or dependency (RR = 2.00, 95% CI [1.89, 2.12]) and drug abuse or dependency (RR = 1.58, 95%, CI [1.45, 1.73]).

On the other hand, many studies (Álvarez, Gómez-Talegón, & Marcos, 2010; Gomes et al., 2013) have shown that patients with SUD have more accidents in general, not only road traffic collisions, and that the road traffic collisions contribute to a higher mortality rate in this group of patients, even if the accidents are not the main cause of death (Degenhardt el al., 2014).

4. Prescription Drugs for SUD Patients and Driving

The use of pharmaceuticals to treat underlying pathologies (SUD) and medical and psychiatric comorbidity leads to frequent use of prescription drugs in these patients, as mentioned above.

Of the medicines authorized in the treatment of addictions, bupropion, varenicline, naltrexone, buprenorphine, and methadone include the pictogram warning of driving-impairing medicines in Spain (Fierro, Gómez-Talegón, & Álvarez, 2013), whereas nicotine, acamprosate, carbamide, disulfiram, or nalmefene do not include such a pictogram (AEMPS, 2015; Álvarez & González-Luque, 2014). However, the summary of product characteristics and patient information leaflets include information about the effect of these medications on driving (Ravera et al., 2012).

Although the pictogram's purpose is only to inform, one should pay attention to the fact that it is present and always make the patient aware of this, especially when the majority of SUD patients are undergoing treatment with psychotropic drugs: of the 198 active substances authorized in group N in Spain, 180 include a pictogram concerning medicines and driving on the package (AEMPS, 2015; Álvarez & González-Luque, 2014).

Recently, patients in maintenance programs with an opioid agonist (methadone and buprenorphine) and who drive vehicles have been the focus of attention (Strand, Fjeld, Arnestad & Morland, 2013; Soyka, 2014). Both medicines can affect a person's ability to drive safely, and this information is provided in the summary of product characteristics, patient information leaflets, and also shown in the driving-impairing medicines pictogram on the medicine package in the case of Spain. Buprenorphine has been shown to have some advantages (Roncero et al., 2013), for example, the deterioration of the psychomotor performance of opiate dependent SUD patients is lower than for methadone (Rapeli, Fabritius, Kalska & Alho, 2011; 2012).

The key factors are the pathology, the neuropsychological deficits and the medical and psychiatric comorbidity. Medication is an added factor: it could interfere negatively at the beginning of treatment, but as the patients improve their clinical situation, the effect may be positive. Special attention should be paid to prescription drugs for these particular patients and the possibility of drug interactions that could consequently increase the sedative effects on the central nervous system, anticholinergic effects, and effects on vision. The consumption of alcohol and other drugs should also be avoided (Álvarez & González-Luque, 2014).

Furthermore, health professionals should inform their patients, especially in the area of addictions, about which medications (opiates, benzodiazepines, etc.) could screen positive in roadside drug testing.

5. Treatment Reduces the Rate of Traffic Accidents in SUD Patients

There is increasing evidence that treatment programs for SUD patients help to reduce their involvement in road traffic collisions (Darke, Kelly, & Ross, 2004; Gómez-Talegón & Álvarez, 2006).

A Norwegian study (Bukten et al., 2013) spanning 9 years, in which data was collected before, during and after treatment on collisions and road traffic infractions specific to patients being treated with substitute opiates, observed that these particular patients reduced road traffic collisions and infractions by 40%.

6. Drugs, Addictions, and Driving: Information and Advice Given to Patients with SUD

We now present the key points, in our opinion, concerning information and medical/healthcare advice for patients with SUD.

- Based on scientific evidence about SUD patients and driving (change in behaviour at the wheel and road rage; Benavidez, Flores, Fierro, & Álvarez, 2013), frequent involvement in road traffic collisions and other types of injuries (Álvarez, Gómez-Talegón, & Marcos, 2010; Coghlan & Macdonald, 2010; Darke, Kelly, & Ross, 2004; Macdonald et al., 2004), and a higher risk of road traffic collisions (Schulze et al., 2012; Verstraete & Legrand, 2014)), patients should be fully informed that if they drive with the presence of drugs, they are choosing high risk behaviour not only for themselves but for other people on the road (Álvarez & González-Luque, 2010; 2014).
- Patients should be informed that illnesses, comorbidity, etc., and the side- effects of medication can influence their ability to drive safely. In this regard, studies have supported the fact that doctors' advice to patients who are potentially unfit to drive helps reduce traffic collisions (Redelmeier et al., 2012).
- Prescribing medication that interferes less with psychomotor performance is a top priority. It is also impor-

tant to avoid and prevent pharmacodynamic interactions that intensify sedative side-effects, anticholinergic side-effects and vision impairment. To this end, the patient should also be informed that he/she should not consume alcohol and/or drugs, not only to avoid driving with the presence of drugs, but also to avoid possible interactions with the different medications.

- Patients should be informed that treatment not only improves their pathological processes but is also associated with less frequent involvement in road traffic collisions.
- Furthermore, patients must be informed that the devices currently used in roadside testing detect the presence of drugs and certain medicines (opiates, benzodiazepines, etc.) in saliva, and, in the case of positive detection, the individual will be penalized. In Spain, a future regulation to avoid the sanction is foreseen if the patient is undergoing medical treatment and fulfils certain criteria.

An important aspect is the advice or recommendation of whether or not to drive: no doubt, the most critical moments are at the start of the treatment. Patients should be told not to drive, or to limit driving as much as possible (only short journeys, frequent rests, etc.). This recommendation should be updated at every visit at the beginning of the treatment, according to the clinical evolution of each patient. Adequate information will allow the patient to be aware of the risk both to him/herself and to other road users.

Another aspect is whether or not the patient is fit to drive (see point 2). This should be evaluated by the competent organism, in the case of Spain, by the CRC. In any case, this does not mean that, as health professionals, we should not inform the patient with SUD when necessary and recommend not driving or performing other activities that may pose a risk.

A triptych including some aspects that SUD patients should know about drugs and driving has been created (Álvarez & González-Luque, 2014).

Conclusion

Operating a vehicle is a good prognostic factor for the social integration of an SUD patient, and interventions should be developed for their implementation, favouring and encouraging these patients to drive safely under medical-psychological supervision. Health professionals should be actively involved, informing their patients and giving them advice (Redelmeier & Tien, 2014) as well as choosing the correct medication to prescribe.

Conflict of Interest

The authors confirm that there is no conflict of interest.

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References

AEMPS (2015). Medicamentos y conducción. Retrieved at http://www.aemps.gob.es/industria/etiquetado/conduccion/home.htm

Álvarez, F. J. (2005). La prevención de las lesiones derivadas de las colisiones de tráfico. *Semergen – Medicina de Familia, 31,* 151-153. doi:10.1016/S1138-3593(05)72904-X.

Álvarez, F. J., Gómez-Talegón, T., & Marcos, A. (2010). Accident rates for drug-dependent patients in treatment for substance dependence: a pilot trial. *Traffic Injury Prevention, 11,* 460-465. doi:10.1080/15389588.2010.492844.

Álvarez, F. J. & González-Luque, J. C. (2010). Illicit drugs and driving. *Medicina Clinica (Barc), 135,* 549-551. doi:10.1016/j.medcli.2009.05.033.

Álvarez, F. J. & González-Luque, J. C. (2014). Drogas, adicciones y aptitud para conducir. 3ª Ed. Valladolid: Universidad de Valladolid. Retrieved at http://www.drogasyconduccion.com/otros.php?seccion=3

Asbridge, M., Hayden, J. A., & Cartwright, J. L. (2012). Acute cannabis consumption and motor vehicle collision risk: systematic review of observational studies and meta-analysis. *British Medical Journal, 344,* -e536. doi:10.1136/bmj.e536

Baldacchino, A., Balfour, D. J., Passetti, F., Humphris, G., & Matthews, K. (2012). Neuropsychological consequences of chronic opioid use: a quantitative review and meta-analysis. *Neuroscience & Biobehavioral Reviews, 36,* 2056-2068. doi:10.1016/j.neubiorev.2012.06.006

Barlés Arizon, M.J., Escario, J.J., & Galbé Sánchez-Ventura, J. (2014). Predictors of driving under the influence of alcohol among Spanish adolescents. *Adicciones, 26,* 96-105.

Benavidez, D. C., Flores, A. M., Fierro, I., & Álvarez, F. J. (2013). Road rage among drug dependent patients. *Accident Analysis & Prevention, 50,* 848-853. doi:10.1016/j.aap.2012.07.010.

Bukten, A., Herskedal, A., Skurtveit, S., Bramness, J. G., & Clausen, T. (2013). Driving under the influence (DUI) among patients in opioid maintenance treatment (OMT): a registry-based national cohort study. *Addiction, 108,* 1954-1961. doi:10.1111/add.12275.

Coghlan, M. & Macdonald, S. (2010). The role of substance use and psychosocial characteristics in explaining unintentional injuries. *Accident Analysis & Prevention, 42,* 476-479. doi:10.1016/j.aap.2009.09.010

Council Directive 91/439/EEC of 29 July 1991 on driving licences. Official Journal, 1991; L 237: 0001-0024. Retrieved at http://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX:31991L0439

Darke, S., Kelly, E., & Ross, J. (2004). Drug driving among injecting drug users in Sydney, Australia: Prevalence, risk factors and risk perceptions. Addiction, 99, 175-185. doi:10.1046/j.1360-0443.2003.00604.x

Degenhart, L., Larney, S., Randall, D., Burns, L., & Hall, W. (2014). Causes of death in a cohort treated for opioid dependence between 1985 and 2005. *Addiction, 109,* 90-99. doi:10.1111/add.12337

DRUID (2012). Final Report: Work performed, main results and recommendations. Revisión 2.0. Cologne: BAST. Retrieved at http://www.druid-project.eu/Druid/EN/Dissemination/downloads_and_links/Final_Report.html?nn=613800

Elvik, R. (2013). Risk of road accident associated with the use of drugs: a systematic review and meta-analysis of evidence from epidemiological studies. *Accident Analysis & Prevention, 60,* 254-267. doi:10.1016/j.aap.2012.06.017.

EMCDDA (2015). Legal approaches to drugs and driving. Retrieved at http://www.emcdda.europa.eu/html.cfm/index19034EN.html.

EMCDDA (2007). Drugs and Driving. Luxembourg: Office for Official Publications of the European Communities, 2007. Retrieved at http://www.drugsandalcohol.ie/6368/1/EMCDDA_Selected_issue_2007_Driving.pdf

Fierro, I., Gómez-Talegón, T., & Álvarez, F.J. (2013). The Spanish pictogram on medicines and driving: The population's comprehension of and attitudes towards its use on medication packaging. *Accident Analysis & Prevention, 50,* 1056-1061. doi: 10.1016/j.aap.2012.08.009.

Fierro, I, González-Luque, J.C., Seguí-Gómez, M., & Álvarez, F.J. (2015). Alcohol and drug use by Spanish drivers: Comparison of two cross-sectional road-side surveys (2008-9/2013). *International Journal of Drug Policy, 26,* 794-797, doi:10.1016/j.drugpo.2015.04.021.

Gjerde, H., Langel K., Favretto, D., & Verstraete, A.G. (2014). Estimation of equivalent cutoff thresholds in blood and oral fluid for drug prevalence studies. *Journal of Analytical Toxicology, 38,* 92-98. doi:10.1093/jat/bkt122.

Gomes, T., Redelmeier, D. A., Juurlink, D. N., Dhalla, I. A., Camacho, X., & Mamdani M. M. (2013). Opioid dose and risk of road trauma in Canada: a population-based study. *JAMA Internal Medicine, 173,* 196-201. doi:10.1001/2013.jamainternmed.733

Gómez-Talegón, M. T. & Álvarez, F. J. (2006). Road traffic accidents among alcohol-dependent patients: the effect of treatment. *Accident Analysis & Prevention, 38,* 201-217. doi:10.1016/j.aap.2005.09.006

Laumon, B., Gadegbeku, B., Martin, J. L., Biecheler, M. B., & SAM Group (2006). Cannabis intoxication and fatal road crashes in France: population based case-control study. *British Medical Journal, 332,* 1298. doi:10.1136/bmj.332.7553.1298

Ley 6/2014, de 7 de abril, por la que se modifica el texto articulado de la Ley sobre Tráfico, Circulación de Vehículos a Motor y Seguridad Vial, aprobado por el Real Decreto Legislativo 339/1990, de 2 de marzo. Retieved at http://www.boe.es/diario_boe/txt.php?id=BOE-A-2014-3715

Lorea, I., Fernández-Montalvo, J., Tirapu-Ustárroz, J., Landa, N., & López-Goñi, J. J. (2010). Neuropsychological performance in cocaine addiction: a critical review. *Revista de Neurología, 51,* 412-426.

Lundqvist, T. (2005). Cognitive consequences of cannabis use: comparison with abuse of stimulants and heroin with regard to attention, memory and executive functions. *Pharmacology Biochemistry & Behavior, 81,* 319-330. doi:10.1016/j.pbb.2005.02.017

Macdonald, S., Mann, R. E., Chipman, M., & Anglin-Bodrug, K. (2004). Collisions and traffic violations of alcohol, cannabis and cocaine abuse clients before and after treatment. *Accident Analysis and Prevention, 36,* 795-800. doi:10.1016/j.aap.2003.07.004

Ravera, S., Monteiro, S., de Gier J. J., van der Linden, T., Gómez-Talegón, T., Álvarez, F. J., & the DRUID Project WP4 Partner (2012). A European approach to categorising medicines for fitness to drive: Outcomes of the DRUID project. *British Journal of Clinical Pharmacology, 74,* 920-931. doi:10.1111/j.1365-2125.2012.04279.x.

Rapeli, P., Fabritius, C., Kalska, H., & Alho, H. (2011). Cognitive functioning in opioid-dependent patients treated with buprenorphine, methadone, and other psychoactive medications: stability and correlates. *BMC Clinical Pharmacology, 21,* 11-13. doi:10.1186/1472-6904-11-13.

Rapeli, P., Fabritius, C., Kalska, H., & Alho, H. (2012). Do drug treatment variables predict cognitive performance in multidrug-treated opioid-dependent patients? A regression analysis study. *Substance Abuse Treatment, Prevention, and Policy, 2,* 7-45. doi:10.1186/1747-597X-7-45.

Real Decreto 818/2009, de 8 de mayo, por el que se aprueba el Reglamento General de Conductores. Retrieved at http://www.boe.es/boe/dias/2009/06/08/pdfs/BOE-A-2009-9481.pdf

Redelmeier, D. A., Yarnell, C. J., Thiruchelvam, D., Tibshirani, R. J. (2012). Physicians' warnings for unfit drivers and the risk of trauma from road crashes. *The New England Journal of Medicine, 367,* 1228-1236. doi:10.1056/NEJMsa1114310

Redelmeier, D. A. & McLellan, B. A. (2013). Modern Medicine Is Neglecting Road Traffic Crashes. *PLoS Medicine, 10,* e1001463. doi:10.1371/journal.pmed.1001463

Redelmeier, D. A. & Tien, H. C. (2014). Medical interventions to reduce motor vehicle collisions. *Canadian Medical Association Journal, 186,* 118-124. doi:10.1503/cmaj.122001.

Romano, E., Torres-Saavedra, P., Voas, R. B., & Lacey, J. H. (2014). Drugs and alcohol: their relative crash risk. *Journal of Studies on Alcohol and Drugs, 75,* 56-64.

Roncero, C., Álvarez, J., Barral, C., Gómez-Baeza, S., Gonzalvo, B., Rodríguez-Cintas, L.,… Casas M (2013). Driving and legal status of Spanish opioid-dependent patients. Substance *Abuse Treatment, Prevention, and Policy, 8,* 19. doi:10.1186/1747-597X-8-19.

Schulze, H., Schumacher, l. M., Urmeew, R., Auerbach, K., Álvarez, F. J., Bernhoft, I. M.,… Zlender B. (2012). Driving under the influence of drugs, alcohol and medicines in Europe — findings from the DRUID project. European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). Publications Office of the European Union, Luxembourg. doi:10.2810/74023. Retrieved at http://www.emcdda.europa.eu/attachements.cfm/att_192773_EN_TDXA12006ENN.pdf

Soler González, C., Balcells Oliveró, M., & Gual Solé, A. (2014). Alcohol related brain damage. State of the art and a call for action. *Adicciones, 26,* 199-207.

Soyka, M. (2014). Opioids and Traffic Safety – focus on Buprenorphine. *Pharmacopsychiatry, 47,* 7-17. doi:10.1055/s-0033-1358707

Strand, M. C., Fjeld, B., Arnestad, M., & Morland, J. (2013). Can patients receiving opioid maintenance therapy safely drive? A systematic review of epidemiological and experimental studies on driving ability with a focus on concomitant methadone or buprenorphine administration. *Traffic Injury Prevention, 14,* 26-38. doi:10.1080/15389588.2012.689451.

Vaa, T. (2003). Impairments, diseases, age and their relative risks of accident involvement: Results from meta-analysis. Oslo: Institute of Transport.

Verstraete, A. G. (2005). Oral fluid testing for driving under the influence of drugs: history, recent progress and remaining challenges. *European Journal of Forensic Sciences, 50,* 143-150. doi:10.1016/j.forsciint.2004.11.023

Verstraete, A. G. & Legrand, S. A. (2014). Drug use, impaired driving and traffic accidents. 2nd Ed. EMCDDA Insights 16. Luxembourg: Office for Official Publications of the European Communities. Retrieved at http://www.emcdda.europa.eu/attachements.cfm/att_229259_EN_TDXD14016ENN.pdf