Impaired cycling and crash involvement in OECD countries

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Περίληψη

Παρά την αύξηση της χρήσης ποδηλάτου σε μεγάλες Ευρωπαϊκές πόλεις, η ποδηλασία υπό την επήρεια αλκοόλ και ναρκωτικών (ΠΥΕ) δεν φαίνεται να έχει προσελκύσει αρκετά το ενδιαφέρον των ερευνητών και των αρχών, ενώ οι σχετικές επιστημονικές μελέτες είναι σχεδόν ανύπαρκτες. Η παρούσα μελέτη αντιμετωπίζει αυτό το κενό γνώσης παρέχοντας μια επισκόπηση της τρέχουσας κατάστασης όσον αφορά στη νομοθεσία, στην εφαρμογή και στα προληπτικά μέτρα για την ΠΥΕ με βάση έρευνα ερωτηματολογίου σε 15 χώρες - μέλη του IRTAD. Προκύπτει ότι η ΠΥΕ είναι ένα αναδυόμενο πρόβλημα που εξελίσσεται παράλληλα με τη χρήση ποδηλάτου, στο οποίο δεν δίδεται η πρέπουσα σημασία, δεδομένου ότι η σχετική επιβολή και πρόβλεψη μέτρων είναι συνήθως ανεπαρκείς: σε πάνω από το ένα τρίτο των χωρών δεν προβλέπεται ποινή για την ΠΥΕ. Η επισκόπηση και η συζήτηση σχετικά με τις πρακτικές αντιμετώπισης της ΠΥΕ αναμένεται να βοηθήσουν στον προσδιορισμό και στην ιεράρχηση των αναγκών αντιμετώπισής της.

Λέξεις κλειδιά: *Ποδήλατο, αλκοόλ, ναρκωτικά, ατυχήματα, έρευνα ερωτηματολογίου*

Abstract

Despite the strong increase in the modal share of cycling in several European cities, cycling under the influence of alcohol and drugs (CUI) does not seem to have attracted enough attention from researchers and authorities, while recent scientific studies are almost non-existent. The present study addresses this gap of knowledge by providing an overview of current situation regarding legislation, enforcement and preventive measures on CUI based on a questionnaire survey on 15 IRTAD member countries. It is evident that CUI is an emerging problem, growing in parallel with cycling itself, not properly addressed since enforcement and provision for measures to prevent it are insufficient: in over one third of the examined countries, there is no penalty for CUI. The overview and discussion on CUI practices is expected to assist in the identification and prioritization of CUI needs.

Keywords: *Cycling, alcohol, drugs, accidents, questionnaire survey*

1. Introduction

1.1 Context

In many European countries, a large increase in bicycle kilometers in urban and peri-urban contexts is recently noticed, attributed mainly to the availability of self-service bike systems, the widespread use of the bicycle for commuting and to make deliveries at home and the use of bicycle for sightseeing tours. Also, a change in mentality is evident, especially of young people who favor active modes and who are less and less motorized. Cycling offers important

benefits, such as improved health and affordable mobility, while reducing negative effects of transportation in terms of environmental pollution, noise and roadway congestion. Cycling is therefore strongly encouraged by governmental policies of many countries and it is expected to become a central part of the mobility solutions in many cities (Stelling-Kończak, 2018). Furthermore, an increasing number of EU countries are adopting national strategies to promote cycling, so it is possible that in recent years more people are choosing cycling as a means of transport (ETSC, 2016). In addition, an even greater increase in bicycle mileage in the near future is expected, as all major cities are in the process of studying or setting up an extensive network of cycle paths.

A cross-analysis of the motives of bicycle trips and the public concerned reveals that a large part of this mileage is realized by young people under 30 for leisure and night outings. It therefore seems reasonable to assume that there are drinking and drugs problems that could make these cyclists more vulnerable. However, Blood Alcohol Content Limits (BACs) rarely target cyclists and the legislation does not seem to be adapted to the particularities of the subject.

It is therefore evident that this target population concentrates three risk-enhancing factors: (i) youth, (ii) alcohol and drugs, (iii) vulnerable users.

1.2 The problem

Driving motor vehicles is a complex activity that mobilizes physical, mental and social skills. The consumption of alcohol and drugs significantly degrades these skills and generates effects such as reduced visual field, longer reaction time, poor "reading" of information and the road environment, increased aggression and risk taking (Christoforou et al., 2012; Christoforou et al., 2013). As a result, drivers who have consumed alcohol and other substances are over-represented in the statistics of involvement in serious and fatal accidents.

Cycling is an activity that is more challenging than driving because it involves more skills such as balance, physical activity and night vision. In addition, cyclists themselves are less visible to other drivers at night; they are more exposed to weather conditions and have less means of protection against shocks. More than 2,000 cyclists were killed in road crashes in the EU countries in 2015, which constitutes 8% of the total number of road fatalities (European Commission, 2017). They are therefore much more vulnerable than motorists in the event of an accident. Moreover, the effects of blood alcohol levels are increasing for cyclists. Dehydration due to alcohol is more acute and the control of the vehicle and the coordination of the body are much more difficult.

Various statistical studies confirm these last observations. Alcohol consumption is one of the leading causes of accidents among cyclists for single-vehicle crashes (TRL, 2009). Drunk cyclists are primarily injured in the evening, weekend, on their way home from a party, restaurant or bar, and rarely wear helmets (Anderrson & Buketrop, 2002; Kaplan et al., 2014). In addition, it appears that cyclists who have been injured after drinking have suffered more serious injuries, are hospitalized for longer, and have significantly higher health costs (Spaite et al., 1995).

Despite the strong increase in the modal share of cycling in major European cities, the subject of cycling under the influence of alcohol and drugs does not seem to have attracted enough attention from researchers and authorities. Recent scientific studies are almost non-existent,

alcohol control is very limited and the relative legislation has not been adequately adapted. In most cases, the alcohol limit allowed is the same as that applicable for motorists (0,5 g of alcohol per liter of blood). Fines can be different or not. In England, the maximum fine for cycling under the influence of drugs or drunkenness is £ 1.000, which is also the fine for 'lack of attention' when riding a bicycle. The maximum fine for cycling is £ 2.500 and concerns 'dangerous driving'. British cyclists reserve the right to refuse alcohol checks. In Belgium, the police have the right to withdraw the driving license of drunk cyclists. The Netherlands is one of the least alcohol consuming countries in the European Union. However, a recent study by the Dutch Road Safety Institute (SWOV, 2015) found that 68% of cyclists who cycle out in the evening are under the influence of alcohol, while the fine is only 140 €.

Within the aforementioned context, the present study aims to present the results of a questionnaire survey focusing on the collection of information about rules and data concerning driving a bicycle under the influence of alcohol and drugs ("Cycling Under Influence" - CUI). The survey was performed within the framework of the Velivr' research project, funded by the Interministerial Delegate for Road Safety (Délégation à la Sécurité Routière – DSR) of the French Ministry of the Interior and carried out by the French Institute of Science and Technology for Transport, Planning and Networks (IFSTTAR) and the National Technical University of Athens (NTUA).

2. Questionnaire Survey and Results

In order to collect information about rules and data concerning driving a bicycle under the influence of alcohol and drugs ("Cycling Under Influence" - CUI), a questionnaire survey was designed by NTUA and dispatched to IRTAD countries.

The questionnaire comprises of the following 10 **survey topics**:

1) Minimum age for allowing cycling.
2) Obligatory equipment for cyclists and the bicycle.
3) Areas / road types where bicycles are allowed to travel.
4) BAC limit especially for cyclists.
5) Fine or other type of penalty especially for CUI.
6) Results of police controls on CUI.
7) Specific measures applied to prevent the consequences of CUI.
8) Specific measures applied to reduce the consequences of CUI.
9) Study(ies) or research on CUI.
10) Available data.

A total of 15 IRTAD members responded to the survey (Austria, Chile, Czech Republic, France, Germany, Greece, Hungary, Ireland, Luxembourg, Netherlands, Serbia, Slovenia, Spain, Sweden, Switzerland). Results from the survey are reported in the following paragraphs "by topic", and for each topic of the questionnaire aggregated results are provided.

2.1 Minimum age for allowing cycling

According to the responses provided in the survey (Table 1) approximately half of the countries do define a minimum age for allowing cycling on the road (Figure 1). Ten to twelve years old is a common age range for allowing independent cycling. In most of these countries,

accompanied cycling is also foreseen. For example, in Switzerland children may cycle on main roads before the age of 6 but only under the supervision of a person at least 16 years old, while in Serbia a child below the age of 9 is allowed to ride a bicycle in a pedestrian zone and a slow traffic zone if accompanied by a person above the age of 16. In Slovenia children from 8 to 10 normally obtain a bicycle driving license (cycling card) in their school. Children without cycling card under 14 years old, can only drive their bike if accompanied by an adult. Children under 6 years can drive only on pedestrian zones accompanied by an adult. In Germany, children under 8 years of age must use the footway for cycling; older children under 10 years old may use the footway for cycling and they must show particular consideration towards pedestrians. A parent or other guardian may accompany the child on the footway. The children must dismount from their bicycle when crossing a carriageway.

Table 1: *Minimum age for cycling on the road alone or accompanied*

Country	Cycling Alone Minimum Age (y.o.)	Cycling Accompanied
Austria	12 y.o. (10 y.o. with cycling license)	<12 y.o. (<10 y.o. with cycling license)
Chile	no minimum age	no restriction
Czech Rep.	10 y.o.	<10 y.o.
France	no minimum age	no restriction
Germany	8 y.o. (outside footways)	no restriction
Greece	no minimum age	no restriction
Hungary	12 y.o. (only for main roads)	no restriction
Ireland	no minimum age	no restriction
Luxembourg	10 y.o.	from 6 y.o. to 10 y.o.
Netherlands	no minimum age	no restriction
Serbia	12 y.o. (public roads) 9 y.o. (pedestrian zone, slow traffic zone, zone "30", school area, unclassified road)	< 9 y.o. (for pedestrian and slow traffic zone)
Slovenia	8 y.o (with cycling card)	< 14 y.o. (without cycling card) < 6 y.o. (only on pedestrian zone)
Spain	no minimum age	no restriction
Sweden	no minimum age	no restriction
Switzerland	6 y.o. (on main roads) no (on other roads provided the child can cycle seated)	< 6 y.o. (on main roads)

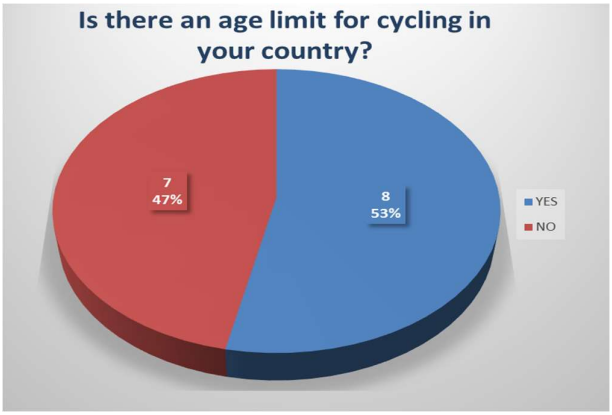

Figure 1: *Existence of age limit for cycling in each country*

2.2 Obligatory equipment for cyclists and the bicycle

Regarding the obligatory cyclist equipment (Figure 2) in half of the countries, a helmet is mandatory but only up to a certain age. In Czech Republic and Slovenia helmet is obligatory up to the age of 18, in Austria and France up to the age of 12 and in Sweden of 15. In Chile in addition to the helmet, it is also mandatory for the cyclist to wear reflective vest, harness or shoulder strap from half an hour after sunset until half an hour before sunrise. As for Hungary, reflective vest is obligatory only outside built-up areas and under low visibility conditions, and helmet is obligatory only outside built-up areas and for roads with a speed limit higher than 40km/h. In France, it is mandatory for cyclists to wear reflective vests, outside the cities, only at night and under low visibility conditions.

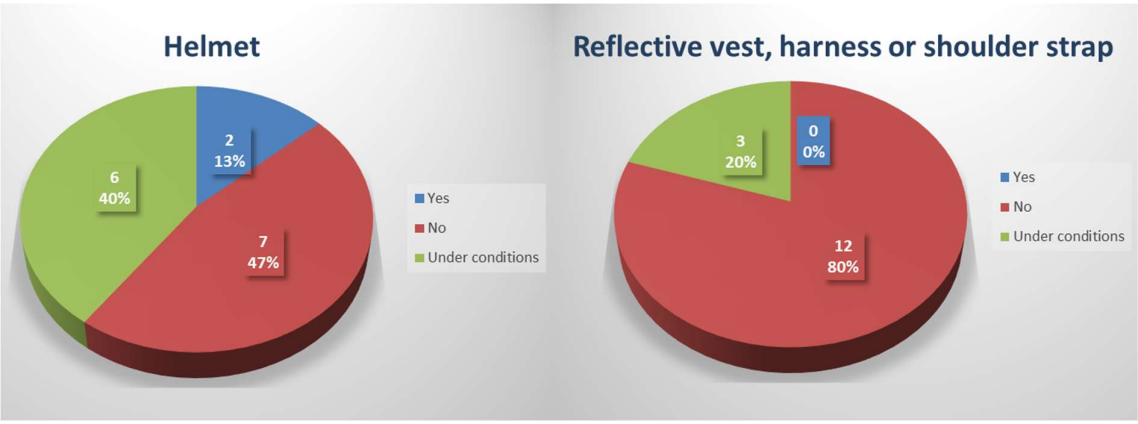

Figure 2: *Type of obligatory equipment for cyclists*

Concerning the obligatory equipment for the bicycle in all countries, almost the same bicycle equipment is required. That is two break systems, white front light and red rear light,

reflective elements and sound device. Analytically the mandatory bicycle equipment for each country is presented in Table 2.

Table 2: *Obligatory bicycle equipment*

Country	Mandatory equipment for the bicycle
Austria	2 independent brake systems, reflective elements on the front, rear, pedal and wheels, sound device
Chile	frontal light, rear red light, reflective elements, sound device
Czech Rep.	brakes, lights
France	lights, bell and reflective devices on the pedals and the wheels
Germany	2 independent brake systems, lighting, spotlights, sound device
Greece	2 independent brake systems, white/yellow front light, red light, reflective backlight, side and pedal reflectors
Hungary	2 independent brake systems, lights, reflectors, sound device
Ireland	2 brakes, white front - red rear light, sound device
Luxembourg	white/yellow front - red rear light, rear, pedal and wheel reflectors
Netherlands	lights (front/rear), wheel/tyre/fender, pedal and rear-reflection, sound device
Serbia	2 brakes, white front - red rear light, wheels reflectors, sound device
Slovenia	front and rear brake, white front - red rear light, rear, wheels and pedal reflectors, sound device
Spain	lights, reflectors
Sweden	brake, lights and reflectors only in darkness, sound device
Switzerland	2 brakes, lights, reflectors, tyres of approximately the same elasticity

2.3 Areas / road types where bicycles are allowed to travel

In most of the countries, there is provision for the safe movement of bicycles on dedicated paths or at least on specific areas or roads (Figure 3). In many countries such as Netherlands bicycles are generally allowed on all roads, unless it is specifically prohibited. In most of the countries, cyclists travel on cycle paths (Austria, Chile, Czech Rep., Hungary, Ireland, Luxembourg, Serbia, Slovenia, Switzerland) if these exist, and in the absence of cycle paths they use either the hard shoulders (e.g. Spain) or the right side of the road (Chile, Slovenia and Sweden). In some countries, there are regulations regarding cycling on the sidewalks or pedestrian zones. In Ireland, cyclists are not allowed to proceed into a pedestrianized street or area, unless there is a cycle track provided and they must cycle on a contra-flow cycle track in the direction indicated by it. As for France, it is forbidden for cyclists to travel on sidewalks (except for children under the age of 8 years old) or on pedestrian roads.

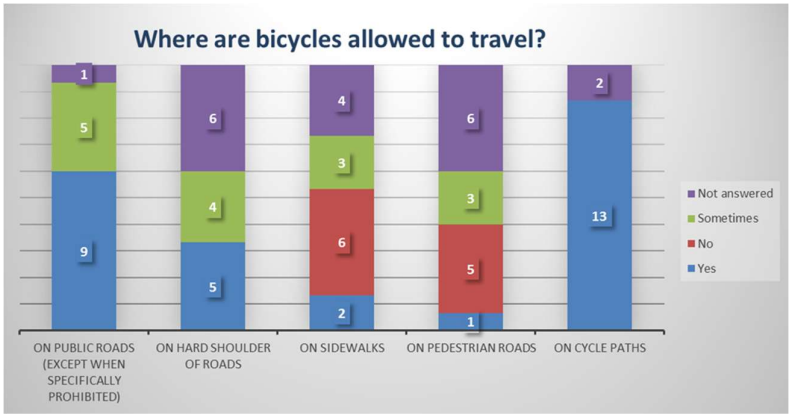

Figure 3: *Areas/road types allowed for bicycles*

2.4 BAC limit especially for cyclists

According to the questionnaire survey (Figure 4 and Table 3), most of the responding countries have defined a Blood Alcohol Content Limit (BAC) for cyclists. In Greece, Hungary and Ireland there is no BAC limit for cyclists. In Sweden, in principle, there is no BAC limit for cycling; according to the Swedish Traffic Regulations, anyone able to cycle safely is acceptable on the road. The assessment of "safely" is performed on a case-by-case basis. In Austria and Germany BAC limit for cycling is higher than the standard limit for drivers and in Slovenia lower. In Switzerland BAC limit for cyclists is 0,5‰. In all other countries, BAC limit is the same for drivers of all types of vehicles, including cyclists.

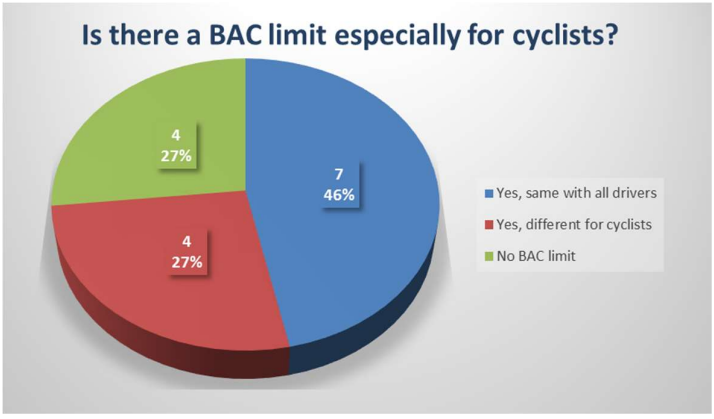

Figure 4: *Existence of BAC limit for cyclists*

Table 3: *BAC limit for cyclists*

Country	BAC Limit
Austria	0,8
Chile	same as for drivers
Czech Rep.	same as for drivers (0)
France	same as for drivers
Germany	1,6
Greece	no BAC limit
Hungary	no BAC limit
Ireland	no BAC limit
Luxembourg	same as for drivers
Netherlands	same as for drivers (0,2-0,5)
Serbia	same as for drivers (0,2)
Slovenia	0
Spain	same as for drivers (0,25)
Sweden	no BAC limit
Switzerland	0,5

2.5 Fine or other type of penalty especially for CUI

According to the responses provided in the survey in most of the countries, there is no special fine for CUI (Figure 5). In Austria, Czech Republic, France, Hungary, Serbia and Slovenia the fine for cycling under the influence of alcohol is the same as for all vehicle drivers, while in Chile, Greece, Luxembourg, Netherlands and Sweden there is no fine at all. In Germany, if a cyclist is driving with 1,6BAC or higher there is a fine; however the height of the fine not mentioned in the German response. In Spain, the fine imposed on a cyclist who exceeds the blood alcohol level is 500€ and in case of recidivism within one year 1.000€. Furthermore, in case of presence of drugs in cyclists' blood the fine is 1.000€. In Ireland, there is a fine up to 2.500€ and in Switzerland up to CHF 10.000 (approximately the equivalent of 8.800€).

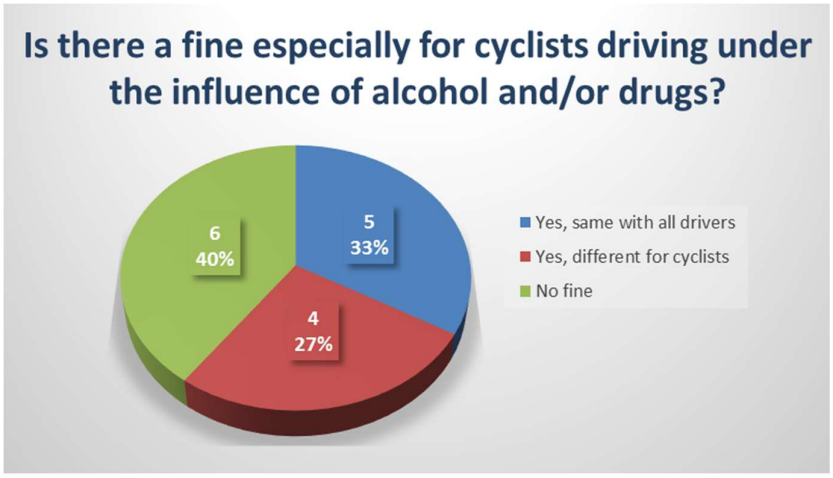

Figure 5: *Existence of special fine for cyclists driving under the influence of alcohol and/or drugs*

Regarding other types of penalties applied to cyclists driving under the influence of alcohol and/or drugs, most countries responded negatively (Figure 6). In Austria, in case of repeat offences or in case of very high BAC, the license can be revoked and driver improvement and psychological assessment may be required. In Germany, if a cyclist is driving with 1,6BAC or higher, except for the fine, a penalty points system may be applied and a medical-psychological assessment may be requested. In Hungary, in case of an accident involving serious injury or fatality caused by a cyclist under the influence of alcohol, a criminal procedure will be initiated. In Switzerland, driving license may be withdrawn in the suspicion that cyclist has a structural drinking problem until proven otherwise. Finally in France, a cyclist found driving with 0,8BAC or higher, is prosecuted in court.

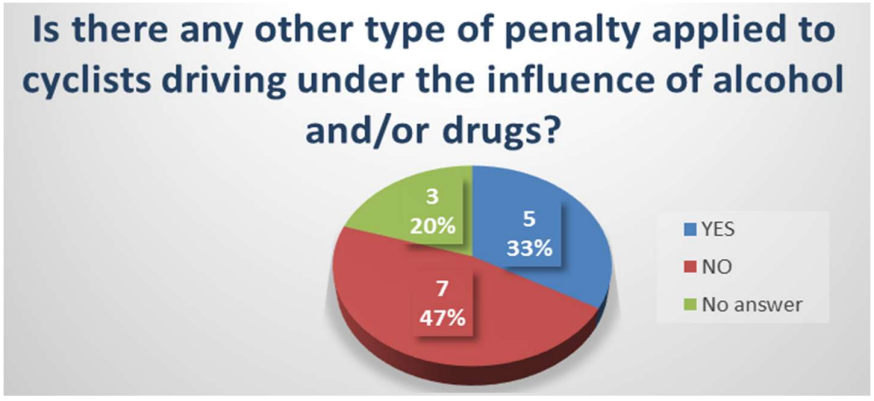

Figure 6: *Existence of other type of penalty for cycling under the influence of alcohol and/or drugs*

2.6 Results of police controls on CUI

As shown in Figure 7 below, in most countries results of police controls on CUI are either not available or not distinguished from other police control data. Only in Netherlands and Switzerland, the results are obtainable. Austria, Luxembourg and Sweden did not respond to the specific question.

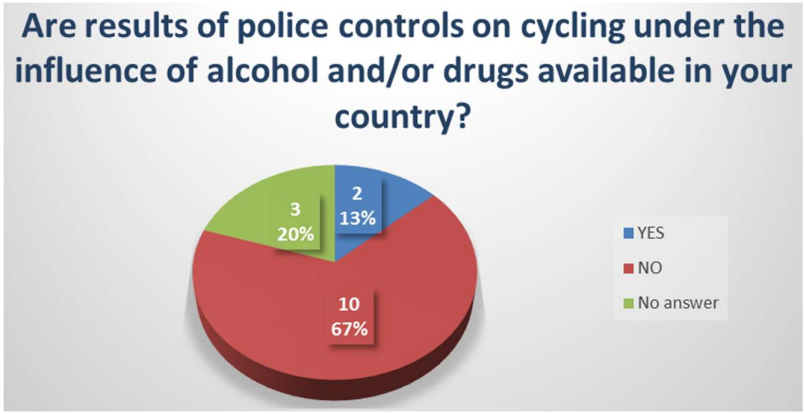

Figure 7: *Availability of police control results on cycling under the influence of alcohol and/or drugs*

2.7 Specific measures applied to prevent or to reduce the consequences of CUI

Regarding specific measures applied to prevent CUI, most countries either responded negatively (Chile, Czech Republic, France, Greece, Netherlands and Switzerland) or did not answer at all (Austria, Hungary, Luxembourg and Sweden) (Figure 8). In Slovenia and in Spain, reported measures concern education and information of all drivers but not cyclists in particular. In Germany, communication measures are applied to prevent CUI. In Serbia, prevention measures comprise information campaigns and traffic controls.

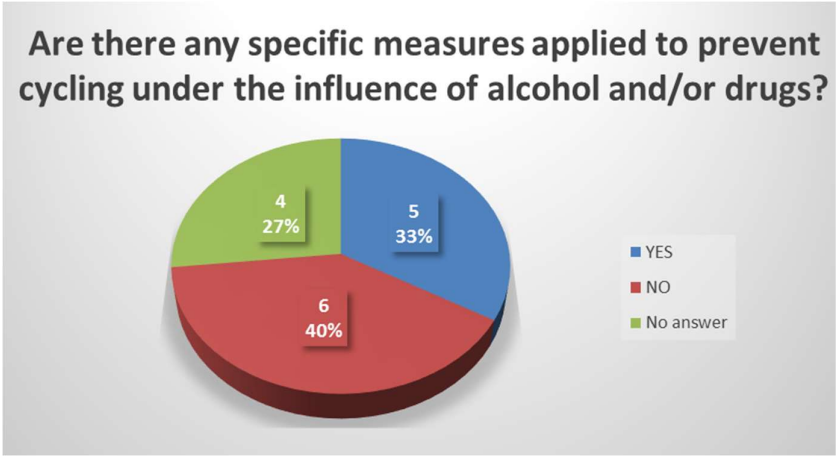

Figure 8: *Existence of measures applied to prevent cycling under the influence of alcohol and/or drugs*

Concerning specific measures applied to reduce the consequences of CUI (Figure 9), the high number of negative responses and no answers indicates a lack of activity in this field. In Slovenia, there is a preventive campaign for cyclists that may reinforce awareness among them. In Spain, the measures applied to reduce the consequences of cycling under the influence of alcohol and/or drugs are control and monitoring actions.

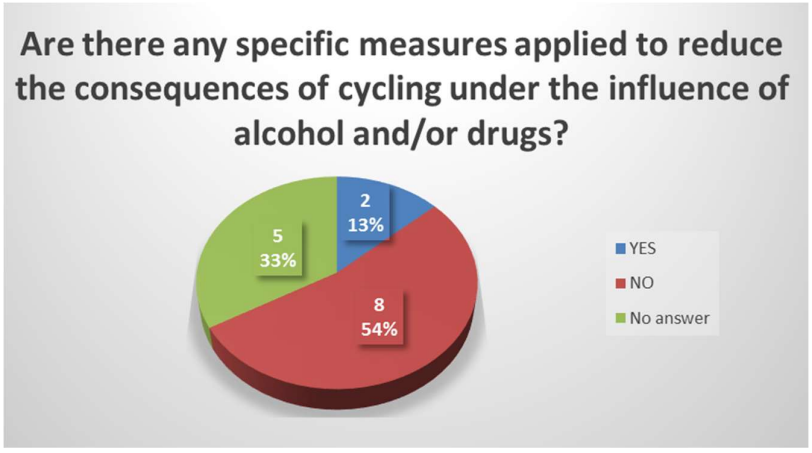

Figure 9: *Existence of measures applied to reduce consequences of cycling under the influence of alcohol and/or drugs*

Therefore, measures concerning cycling under the influence of alcohol and/or drugs are implemented in only a few countries. The reported measures mostly concern education and information, targeted however to all drivers and not cyclists in particular.

2.8 Study(ies) or research on CUI

Regarding studies or research on CUI, most countries either responded negatively (Chile, Czech Republic, France, Greece, Hungary and Slovenia) or did not answer at all (Austria, Luxembourg and Serbia). An indicative list of studies related to cycling under the influence of alcohol and/or drugs is presented below, according to the responses from the rest of the countries.

- Martínez Ruiz, V., Jiménez Mejías, E., Amezcua Prieto, C., Olmedo Requena, R., Pulido Manzanero, J., & Lardelli Claret, P. (2015). **Risk factors for provoking collisions between cyclists and pedestrians in Spain, 1993-2011**. Gaceta Sanitaria, 29, pp.10–15.
- Ariane von Below (2016). **Road safety of cyclists - Analysis of motives relevant for security, settings and behaviour patterns**. ISBN: 978-3-95606-234-6.
- **Analyse der Velounfälle 2005 bis 2014 - Personen- und infrastrukturbezogene Auswertungen** (Chapter 4.3)
- **Forschungspaket VESPA**, especially Massnahmen und Potenziale im Bereich Verkehrsteilnehmende (especially pp. 62, 88 ff.)
- https://www.bfu.ch/de/bestellen/alles#k=2.092 (pp. 98ff)

In Ireland and Sweden, there are research programs involving cycling under the influence of alcohol, that have not completed yet.

2.9 Available data

In the majority of the examined countries, road safety outcomes concerning CUI are available. More specifically in Serbia, in 2017, there were 170 traffic accidents involving cyclists being under the influence of alcohol; in these accidents, 9 cyclists died, whereas 168 were injured. Furthermore in Hungary, the number of injury accidents caused by cycling under the influence of alcohol were: in 2015 381, in 2016 370, in 2017 308 and in the first half of 2018 148, which means a 23,3% increase in comparison with the same period of the previous year.

On the other hand, cycling exposure data, such as cycle-kms and person-kms, are very limited. Only in Germany, Netherlands, Sweden and Switzerland cycling exposure data are available; as for Slovenia, cycling exposure data are only available in the municipalities of Ljubljana and Maribor.

Regarding performance indicators data on CUI, only in Sweden it is mentioned that there are available data in the in-depth studies of fatal accidents.

Except for Slovenia, no other country provided information about the availability of data for inside or outside urban areas and during daylight or night-time. According to the Slovenian response, in 2017 there were 11 fatalities among cyclists, 2 of them under influence of alcohol. In the same year, cyclists under influence of alcohol caused 107 traffic accidents; 89 of them were in urban areas and 65 of them were during daylight. In 2017, just 1 cyclist was under the influence of drugs.

The availability of CUI statistical data of the examined countries is presented in Table 4 below.

Table 4: *Availability of CUI statistical data*

Country	Accidents	Fatalities	Injuries	Exposure data	Performance Indicators
Austria	-	-	-	-	-
Chile	no	no	no	no	no
Czech Rep.	yes	yes	yes	no	no
France	yes	yes	yes	-	-
Germany	yes	yes	yes	yes	no
Greece	yes	yes	yes	no	no
Hungary	yes	-	-	-	-
Ireland	yes	yes	only serious	no	no
Luxembourg	yes	yes	yes	-	-
Netherlands	no	no	no	yes	no
Serbia	yes	yes	yes	-	-
Slovenia	yes	yes	yes	specific municipalities	-
Spain	no	no	no	no	no
Sweden	yes	yes	yes	yes	yes
Switzerland	yes	yes	yes	yes	no

3. Synthesis and conclusions

The present paper comprises of an overview of contemporary situation on Cycling Under Influence (CUI), based on a questionnaire survey with responses from 15 IRTAD member countries, in order to collect detailed data and information from relevant stakeholders.

The most important remarks that originate from the survey results are the following:

- In many countries, safe cycling is beginning to attract growing attention; related **rules and legislation** regarding various aspects of cycling have been adopted, namely for obligatory cyclist and bicycle equipment, for BAC limits, etc., and delimited cycle paths are being constructed.
- On the other hand, the vulnerability of cyclists is not fully realized, as shown by the **lack of mandatory protective equipment**; in half of the countries, a helmet is mandatory only up to a certain age and in twelve out of fifteen countries no other protective gear is required.
- The need for specific cycling skills is recognized only in approximately half of the responding countries, as implied by the **minimum age** restrictions. The most common minimum age for allowing independent cycling on the road is ten to twelve years old.

- The **CUI problem is not appropriately addressed in most countries**. In four countries there is no BAC limit at all; in seven countries BAC limit for cyclists is the same as the one for drivers, not taking therefore into account the increased effects of alcohol and/or drugs to cyclists as well as their inevitable vulnerability as road users. A special fine or other type of penalty for cyclists driving under the influence of alcohol and/or drugs exists only in nine countries, and in most countries respondents did not report any specific measures aiming to prevent or reduce the consequences of CUI.

Therefore, it is evident that despite the strong increase in the modal share of cycling in many countries, the subject of cycling under the influence of alcohol and drugs does not seem to have attracted enough attention from researchers and authorities. In addition, an even greater increase in bicycle mileage in the near future is expected, as all major cities are in the process of studying or setting up an extensive network of cycle paths, and active transport is becoming an important part of urban mobility. Cycling under the influence of alcohol and/or drugs is a problem growing in parallel with cycling itself.

The overview and discussion on CUI practices is expected to assist in the identification and prioritisation of CUI needs. The **legislative treatment** of cycling issues that include minimum age for cycling, the use of cycle paths, the definition of BAC limits and assorted sanctions and the mandatory use of protective equipment can help tackle the problem of CUI and reduce its consequences. Furthermore, **analyses of the existing data** on CUI related road safety outcomes and **collection of cycling exposure data** and **performance indicators** are necessary to better understand the problem of CUI and identify evidence-based solutions.

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