Original Paper

Facilitating factors and barriers in the screening and diagnosis process of obstructive sleep apnea in taxi drivers

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ABSTRACT. **AIM: To evaluate the prevalence of morning and day sleepiness and obstructive sleep apnea syndrome (OSAS) among taxi drivers of the Athens airport and to examine the factors that may influence a taxi driver's decision to participate in screening. METHODS: Demographic, sleep and work-related data were obtained for 840 professional drivers through a self-administered questionnaire based on Berlin scale variables; individuals identified at high OSAS risk were thereafter identified and offered cost-free nocturnal pulse-oximeter and sleep study. A qualitative study was subsequently conducted among those who declined participation aiming to identify facilitating factors and barriers to attend screening and diagnosis. RESULTS: One out of 4 participants was identified as high-risk, a ~80% provided further contact details, whereas ~75% of those contacted declined further participation; 17 out of the 22 who attended the diagnosis process suffered OSA. Drivers who declined participation were more likely to smoke, snore loudly and work on night-shifts. Non-participants did not perceive personal health as a priority, acknowledged the need for preventive healthcare but valued its practical uptake as difficult. Exposure to high stress levels along with struggle to combat financial survival was highly prioritized as a barrier, whereas suggestions for facilitating factors to improve participation included on-site examination and monetary incentives. CONCLUSIONS: Drivers were found to be high-risk for OSA but a hard to reach professional group unaware about on the associated personal and societal risk encountered. Increase efforts to raise awareness and tailoring of the medical evaluation process to individual needs are of paramount importance.** ***Pneumon 2015, 28(1):40-47.***

INTRODUCTION

Driving safety in Greece is a dominant public health concern. In 2010

alone, 1 258 deaths have been reported as a result of road traffic crashes (RTCs) accounting for 1.44% of all deaths in Greece, the largest proportion in the EU-19[1,2]. Although death rates from RTCs have been steadily decreasing in the last decade in all European countries Greece presents one of the highest mortality rates in Europe with 13.6 road traffic fatalities per 100 000 inhabitants for the year 2010, second only to Romania[3]. Among RTCs causal factors, driver sleepiness and fatigue have been estimated to contribute to 20% of all injury crashes and an eightfold increase in risk has been associated with drivers' report of sleepiness[4].

Obstructive sleep apnea syndrome (OSAS), a condition characterized by repetitive episodes of complete or partial obstructions of the upper airway during sleep, has been identified as one of the main medical causes of excessive daytime sleepiness and a risk factor for RTCs. It affects 5% of the general population[5], 16-24% of adult men[6] and has been shown to particularly affect commercial motor vehicle drivers, due to their elevated BMI, sedentary lifestyle and smoking habit[7].

Existing literature suggests that OSAS and excessive sleepiness are more prevalent in taxi drivers compared to the general population: in a sample of 241 New Zealand-based taxi drivers the proportion of moderate to high risk of OSAS was estimated to be high[8] whereas a study of Turkish professional taxi drivers revealed that 23.7% of them reported excessive daytime sleepiness[9]. There is also lack of policy framework for efficient regulation of working conditions for taxi drivers, including their requirements for driving license, work hours and shifts. Australia and New Zealand are among the countries where the issue is under ongoing debate, but taxi drivers continue not to be covered by Drivers Hours Regulations[10] with no legal limits on their driving time and the assessment for the individual OSAS patient remains largely a clinical condition.

In the present study, we evaluated the prevalence of excessive morning and day sleepiness and OSAS in a large population of taxi drivers in the Athens area. As the majority of the drivers were reluctant to participate, an evaluation of factors that may encourage or hinder the decision of a taxi driver to participate in a sleep apnea screening process was subsequently realized through qualitative research.

METHODS

Quantitative study

A group of 840 professional taxi drivers filled a one-page questionnaire with questions related to their work and sleep schedule at the Athens International Airport taxi waiting area. Using the Berlin Questionnaire[11] as a tool to detect sleep apnea symptoms in the answers of the sample of drivers, 194 male drivers were identified as high-risk for OSAS and invited to the Sleep Clinic. The two groups of high-risk drivers, those who underwent further examination at the Sleep Clinic and those who declined to do so, were compared in terms of demographic, sleep and work characteristics.

All 45 drivers who attended an appointment at the Sleep Clinic filled-in a 7-page questionnaire with questions related to their work and sleep schedule, smoking habits, self-reported snoring and apnea symptoms, self-reported morning and day sleepiness and filled-in the Epworth Sleeping Scale questionnaire (ESS)[12]. Subjects were invited to use the nocturnal pulse-oximeter at home as a means of first-line testing for sleep apnea. Twenty-three did not show up for their appointment, 5 underwent pulse-oximetry with a normal result and 17 participants (38%) had positive results. Participants with a positive pulse oximetry result were invited to undergo physical examination, including a blood pressure evaluation, a measurement of neck, waist, and hip circumference, a spirometry and a sleep study. Sleep studies were conducted between 22:00 and 06:30. Airflow was monitored by combined oronasal thermistors, while arterial oxyhemoglobin saturation was monitored by a finger pulse oximeter. Thoracic cage and abdominal motion were recorded by inductive plethysmography. The flow chart of the study protocol is shown in figure 1.

Qualitative study

A qualitative study was conducted to determine the reasons why, 75% of the taxi drivers considered high-risk for sleep apnea and offered a cost-free examination at the Sleep Clinic, opted to decline. Drivers were recruited randomly from the above mentioned group and one-to-one semi-structured interviews were conducted. Seven drivers declined to participate and recruitment continued a data saturation point was reached.

A brief explanatory form of the study background, aim and methodology as well as a consent form for participation were provided. Each interview lasted from a minimum of forty to a maximum of sixty minutes and topics addressed included the participant's views on personal health and preventive medicine defined as measures to maintain their well-being, their time prioritization and their suggestions to improve the participation rate in the screening process. All interviews were audio-taped, transcribed

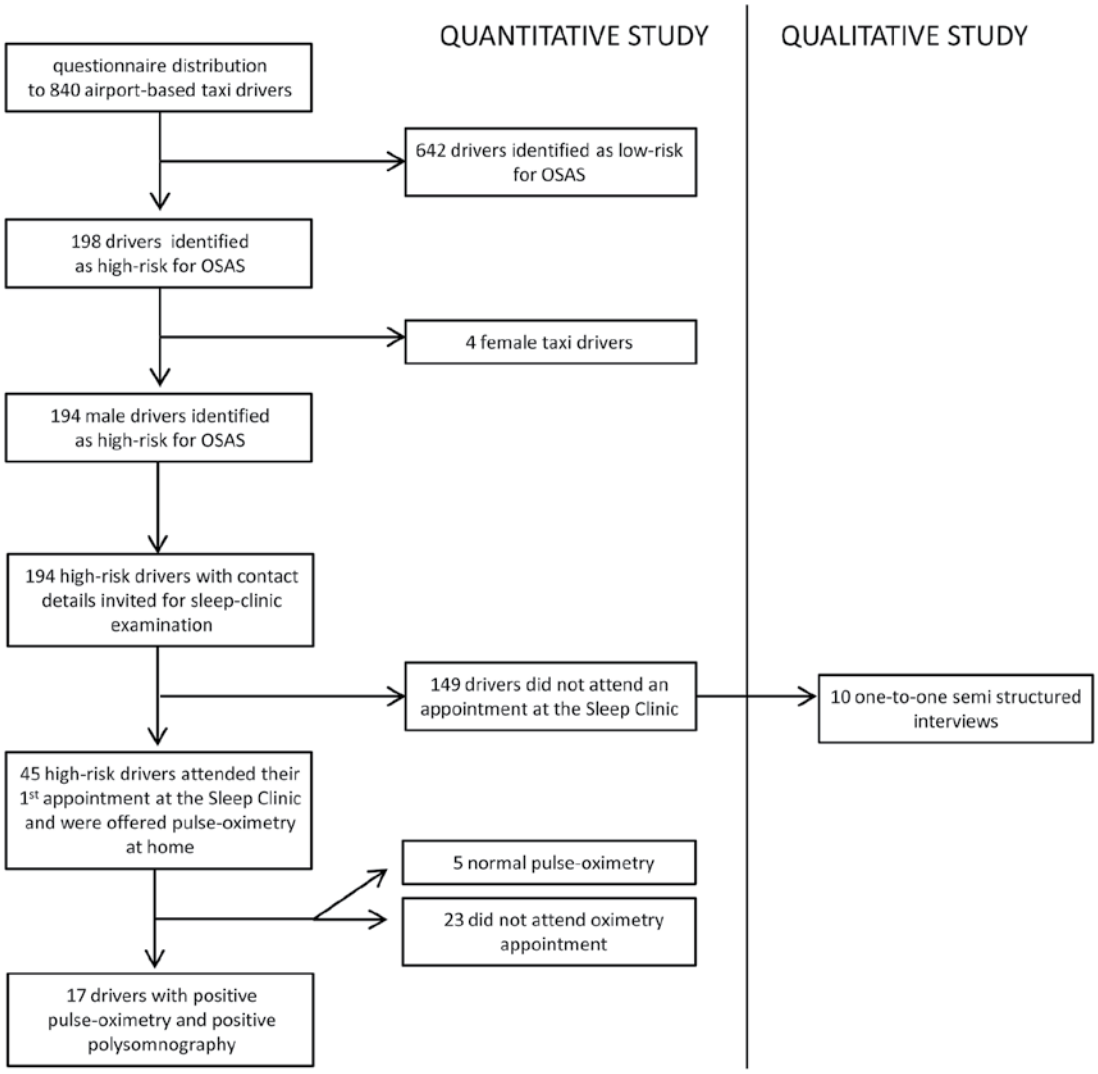

FIGURE 1. Flow-chart of the study protocol.

verbatim and checked for accuracy. Transcribed one-to-one interviews were formally analyzed using Thematic Analysis[13], a qualitative analytic study that involves the exploration of the participant's personal experience and perception of a certain subject and is concerned in interpreting this perception through the researcher's lenses. Line-by-line analyses were used to generate common themes and patterns addressing the research question and theoretical connections between them.

RESULTS

Quantitative study

The sample consisted of 840 professional taxi drivers. Ninety-seven percent of the drivers were male, mostly overweight (mean BMI 29.1kg/m^2), middle-aged (mean age 44.5 yrs) and active smokers (68.1%). They worked an average of 11.6 hours per day and most (57.2%) worked 7 days per week, with the most frequent working shift being the day shift -from 05.00 to 17.00- (54.3%), followed by the night shift and alternate shift -one week of day shifts followed by a week of night shifts working from 17.00 to 05.00. Approximately half of the drivers (51.3%) reported snoring with one out of four reporting very loud snoring (23.7%). One out of five drivers (19.7%) reported perceived apneas whereas more than half of the participants (57.7%) reported some degree of morning sleepiness. Their demographic, work and sleep characteristics as determined by answers to the questionnaire

are shown in table 1.

Out of the 194 eponymous, male taxi drivers identified as high-risk for sleep apnea who were invited for further examination at the Sleep Clinic, 45 came to the Sleep Clinic. A comparison between the group of drivers who did not undergo further examination and those who

TABLE 1. Distribution of the demographic, work and sleep characteristics of Athenian taxi drivers by participation in the invitation for further screening and OSAS diagnosis

Variables	Total sample N= 818		Declined Sleep Clinic participation examination N= 149		Accepted Sleep Clinic participation N= 45 (full participation N=22)		p-value[1]
	mean	SD	mean	SD	mean	SD	
Age (years)	44.5	10.35	45.5	9.39	47.3	9.16	0.28
BMI (kg/m^2)	29.1	4.91	31.6	5.00	32.7	6.41	0.31
Work hours (h)	11.6	2.18	11.6	2.34	11.7	2.18	0.95
Sleep duration (h)	6.8	1.43	6.8	1.47	6.7	1.55	0.92
	N*	%	N*	%	N*	%	p-value[2]
Smoking							0.01
non smokers	165	20.2	23	15.4	14	31.1	
ex-smokers	96	11.7	18	12.1	7	15.6	
current smokers	557	68.1	108	72.5	24	53.3	
Days of work							0.34
<6 days	45	5.5	8	5.4	0	0.0	
6	305	37.3	43	28.8	22	48.9	
7	468	57.2	98	45.8	23	51.1	
Shift							0.15
day	444	54.3	78	52.4	29	64.5	
night/alternate	374	45.7	71	47.6	16	35.5	
Snoring							0.0001
no snoring	398	48.7	5	3.4	10	22.2	
light as talking	226	27.6	21	14.1	12	26.7	
very loud	194	23.7	123	82.5	23	51.1	
Apneas							0.95
never	657	80.3	83	55.7	24	53.3	
<3 times/month	48	5.9	7	4.7	5	11.1	
1-4 times/week	101	12.3	50	33.6	13	28.9	
nearly every day	12	1.5	9	6.0	3	6.7	
Morning sleepiness							0.86
never	346	42.3	45	30.2	9	20.0	
1-2 times/month	79	9.7	17	11.4	4	8.9	
1-2 times/week	221	27.0	35	23.5	20	44.5	
3-4 times/week	116	14.2	33	22.2	11	24.4	
nearly every day	56	6.8	19	12.8	1	2.2	
Day sleepiness							0.93
<3 times/month	402	49.2	49	32.8	12	26.7	
1-2 times/week	294	35.9	43	28.9	18	40.0	
>2 times/week	122	14.9	57	38.3	15	33.3	

1: p-value derived from T-test, 2: p-value derived from Chi-square, *: figures on table apply to available information for each variable

accepted to do so was realised. The two groups did not differ in age, body-mass index, work hours or sleep hours, although the group consisting of drivers who declined to participate presented a higher percentage of smokers and reported more snoring, with differences being significant and reported more apneas during their sleep and more morning sleepiness, albeit with no difference being significant. The characteristics of both groups are shown in table 1.

Seventeen of the 45 taxi drivers who showed up for their appointment at the Sleep Clinic had a positive oximetry result and consented to undergo further examination and were subjected to a physical examination and a sleep study. Their characteristics are shown in table 2. All 17 drivers were found to have breathing dysfunction, defined as an AHI of more than five events of apnea or hypopnea per hour, with a mean AHI score of 57 events per hour with one single driver presenting fewer than 15 events per hour. They had a mean neck circumference of 45.9±4.2cm, a mean waist circumference of 125±17.4cm and a mean hip circumference of 127.8±18.9cm. Their reported sleepiness, as measured by the ESS, was within the normal range (8.3±6.2). CPAP therapy was suggested and initiated to all of the 17 drivers.

TABLE 2 - Mean values (± standard deviation, SD) of somatometrics and sleep study parameters of the 17 radio-taxi drivers who were diagnosed with OSA

	mean ± SD	normal range
Physical examination		
Neck circumference, cm	45.9 ± 4.2	≤39
Waist circumference, cm	125.4 ± 17.4	≤94
Hip circumference, cm	127.8 ± 18.9	NA
BMI (Kg/m^2)	36.8 ± 6.5	18.5 - 25
Breathing function in awake		
FEV1 % predicted	96.8 ± 15.2	≥80
FVC % predicted	96.7 ± 12.2	≥80
Sat O_2	96.6 ± 1.1	97%
Subjective sleepiness		
Epworth Scale score	8.3 ± 6.2	0 - 9
Breathing function in sleep		
AHI	57.0 ± 26.6	0 - 5
Minimum SpO_2, %	68.6 ± 11.6	92
Average SpO_2, %	92.2 ± 3.1	>94
t <90, %	21.0 ± 18.4	30

Abbreviations: BMI: body mass index; FEV1: forced expiratory volume (1st second); FVC: forced vital capacity; $SatO_2$: oxygen saturation; AHI: apnea hypopnea index; t<90%: percentage of total sleep time with $SatO_2$ <90%.

Qualitative study

The aim of this research was to explore the perceptions and attitudes of professional taxi drivers regarding their personal health. In particular, the qualitative study sought to listen to their opinion in order to identify facilitating or encouraging factors for their participation in screening programs. Their responses were grouped and categorized within each of the four major topics: areas of attitude towards their personal health, their stand on prevention, health issues prioritization and drivers' suggestions for effective participation in research projects.

Drivers were found not to consider personal health a priority and, as a consequence to dedicate little or no time on maintaining it. In response to the question, 'How do you take care of your own health?' participants cited only a basic daily routine and care of personal hygiene. When asked, 'When scheduling your time, what is your top priority?', drivers described taxi-driving job in general as a profession that leaves little or no time for extra-curricular activities. Work is generally prioritized over family time ('*When I started out, my priorities were my family, my home and then work, but lately this has changed, now my top priority is work in order to pay my bills*'). Participants also explained how making a living as a taxi driver has become increasingly difficult in the last years ('*It is obvious that our priority is work. The financial responsibilities are such that you cannot allow yourself to think about anything else, the debts are chasing you, you practically have no choice')*. When experiencing a health problem they tend to sort the problem out themselves without seeking professional help.

Overall, although drivers viewed prevention positively, they valued the practical implementation of preventive health care as difficult ('*Prevention is better than cure but only in theory, in practice every time I try to do it, it never works. I tell myself that I am going to start walking and I never do')*. The lack of feasibility regarding implementing preventive measures was attributed to the health system organization, their own lack of motivation but also to the fear of what they might discover when undertaking medical exams ('*The issue of prevention seems to me very valid and we should all have been more involved in it. But our health system and the little free time we have from work do not help at all. It takes time and sometimes it even takes money which it shouldn't. Sometimes I will have to pay for*

health services because when you call up (in the public sector) and the next available appointment is in six months then you have to pay to get examined faster (in a private clinic)'.

A continuous exposure to high levels of stress afflicted almost every driver interviewed, attributing it to their increased feeling of insecurity due to financial troubles and difficulty to make ends meet ('*Everyone now is stressed out. We wake up in the morning and we don't know what will become of us')*. Among older drivers in particular some were aware of possible long-term effects of intense emotional stress on a driver's personal life and family. A key point and prevalent theme was that drivers are inclined to blame psychological stress as a contributing factor to bad health. (*'My work partner is 35 years old and has been to the hospital 4-5 times with arrhythmias, with problems that started from being so stressed out)*.

Another health problem reported as common is urinary problems, attributed to the unavailability of toilets in their parking space ('*Everyone suffers from prostate problems, because we have no place to go and urinate. It is illegal to urinate in the street and sometimes in order to keep working you have to restrain yourself from urinating for over 4 hours')*. Finally, obesity was perceived as a health issue on the rise due to the sedentary nature of their profession and unhealthy habits, such as frequent junk food eats, hasty eating and overeating, often used as coping strategies for stress and fatigue. ('*I think a lot of colleagues are overweight, eating helps us to cover our stress and the many hours we need to stay awake')*.

Asked about sleep quality, most responders commented firstly on their snoring, which they attribute to weight gain ('*My quality of sleep is OK, only in the last 3-4 years I snore. Maybe it's because I gained some extra kilos, I quit smoking 6-7 years ago*'). Another comment regarded day sleepiness which the participants relate to their, at times negative, psychological status (*'Sleepiness I think is due to my not feeling well psychologically. Other periods that I slept fewer hours I remember I felt better. As soon as the flow of work changes I begin to feel better.')*

Taxi drivers' suggestions on ways to approach their professional group more effectively and yield better participation in future screening programs revealed an effort to by-pass directly or indirectly their most common and shared problem which was not making enough money on a daily basis to cover their needs. Drivers suggested the possibility of arranging for medical exams or doctor's visit at a site close to their work environment and more specifically near their waiting or parking area. Participants cited also the possibility of offering monetary incentives as well as no waiting time for the test to drivers who complete the screening process. (*'I think a free voucher for exams, a blood test or an X-ray, may help, in the sense that the driver will know that with this paper he will go to the hospital, will be given priority and will finish quickly without wasting a lot of time away from work')*.

However, some participants argued that this approach would waste valuable resources needed elsewhere in the community and would prevent drivers from making a more conscious step towards their well-being - through paying for it. Finally, some participants offered no suggestions whatsoever as they felt their professional group would not collaborate to research. This conviction was attributed to the opinion that taxi drivers have other priorities or even have no choice but to deny themselves any action that may improve their health status. In conclusion, they felt that no further steps could be taken to approach them effectively. (*'There is no other way than the one you already used. The hours we work are so long that even if someone works as a partner and shares the vehicle with someone else, as soon as he finishes work rests a bit, eats and then tries to spend time with his family. It is not that your approach is wrong; it is the drivers who have no possibility to do something for their health')*.

DISCUSSION

Our results show that day sleepiness was very common among Greek radio-taxi drivers (64%), a finding similar to that of Gülbay et al[9] who studied Turkish taxi drivers. Snoring was reported by half of the participants (51%) and was characterized as "very loud" by one-quarter of the sample, which is somewhat lower than that of the Gülbay study. Approximately half of the drivers reported apneas during their sleep (46.8%), which is higher compared to previous studies of other professional drivers, namely interstate bus drivers[14,15], train divers[16,17] and commercial drivers[18]. High-risk drivers for OSAS, identified through the Berlin questionnaire, were invited for further examination in the Sleep Clinic with only 17 drivers undergoing a sleep study, which led to an OSAS diagnosis in all 17 cases.

Interviews with drivers revealed that their choice to participate or not in the screening process reflected their health behavior in general, with most participants limiting their health maintenance strategies to a basic daily personal hygiene routine. When faced with a pressing health issue, a tendency to self-cure remedies as low-cost and quick alternatives to traditional health care service utilization. The reluctance to visit a doctor has been de-

scribed before in relation to taxi drivers in particular[19], and has been attributed to the cost of consultation and medications prescribed as well as the loss of income from being off the road in order to attend their appointment.

Work prioritization by the drivers emerged as an important contributing factor to our low participation rate, with a rising pressure to work harder due to a progressive decrease in customers in recent years which has led to an imperative need to work longer hours in order to provide financially for their families. The men in our study reported a reversal in their attitude concerning time prioritization that stemmed from an increasing difficulty to find work; their focus has gradually shifted from family to work.

This qualitative exploration of the attitudes of taxi drivers at high risk of OSAS has highlighted a number of areas where strategies could be implemented to improve participation rates in a sleep apnea screening process and promote driver health and safety. Our finding that taxi drivers fail to associate OSAS with cardiovascular risk and poor sleep quality supports what Firestone et al[19] found, namely the problem minimization in the taxi driving culture. Our study's participants, although aware that the sedentary nature of their profession and unhealthy eating habits contribute to chronic conditions such as obesity and cardiovascular disease, fail to associate these risk factors to OSAS. As drivers tend to attribute common symptoms such as sleepiness and snoring to their lifestyle and working conditions, awareness-raising may be an effective target for future interventions seeking to improve taxi drivers' safety. The continuous education of professional drivers on OSAS and sleepiness, including topics such as working hours/rest period regulations, has been proposed by the European Commission[20] but has yet to be implemented in Greece. Also, successful awareness-raising interventions may involve the drivers' sleep partners, general practitioners as well as taxi companies, as radio-taxi drivers are all employed by companies which provide communication and branding.

The reluctance of the taxi drivers to participate in the screening process emerged as an important finding of this study, suggesting they are a professional group which is hard to reach by public health professionals. In order to overcome this challenge, a tailoring of the medical evaluation process based on their schedule and needs may allow for their more active participation, for example arranging for medical exams or a doctor's visit at a site close to their working area.

An additional way of encouraging more drivers to participate in the screening process may be to incorporate such a process into the renewal process of their driving license, which takes place at regular time intervals. This has been suggested by the European Commission[20] and is already implemented in certain countries, such as Australia. In the Australian context, commercial vehicle drivers suspected with a sleep disorder are referred to a specialist sleep physician for further assessment and investigation and drivers who are diagnosed with OSAS and need treatment are required to receive an annual review by a sleep specialist in order to ensure that adequate treatment is provided[21]. In Greece, according to the Ministry of Transport regulations, taxi drivers to be issued a license are required to undergo examination by an ophthalmologist and an internal medicine specialist who review their blood test results, ECG and thorax X-ray but no driving license renewal process is required[22].

Also, financial incentives, suggested by the drivers themselves under the form of free medical tests, have been found to act as an effective mechanism to encourage behavior change albeit on a short-term[23] given that studies have shown that as soon the incentive is removed, individuals tend to relapse into previous behavior patterns. Lastly, given that drivers view psychological stress as a central problem of their professional life, the presence of a mental health counselor available at their work environment could help to identify underlying issues and findings ways to cope.

Although our study contributes to a better understanding of the reasons behind drivers' reluctance to access sleep screening procedures, nevertheless certain limitations ought to be acknowledged. A non-validated Greek translation of the Berlin Questionnaire was used, as at the time of the initial phase of the study a greek validated version[24] had not been published. Also, to be able to elicit the thoughts and perceptions of a professional group which has rarely been studied before and which is reluctant to participation, we used a random sampling method in order to yield a series of semi-structured interviews. Although some of our findings are confirmed by other studies conducted in members of the same professional group in geographic locations distinct from our study location, our sampling method may have limited the generalizability of our results. Because an objective evaluation of day sleepiness was not feasible, our participants self-evaluated the possibility of falling asleep and may have given a lower rating in their answers. Finally, the time interval between the conduction of the quantitative and qualitative part of the study was large due to repeating difficulties in recruiting drivers willing to participate, which could have led to recall bias on the

part of the interviewees. During the period of this study, a dramatic economic downturn has unfolded in Greece which has led to a significant reduction of all population visiting sleep clinics[25]. This may have placed an additional emphasis on the economic motives that led to low participation in the quantitative part of the stud, leading to an ulterior decrease in participation.

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CONFLICT OF INTEREST

All authors state that there is no conflict of interest related to this paper.

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