**Obstructive Sleep Apnoea and Driving Safety**  
*Implications for Reduction in Road Traffic Accidents*  
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1. Abstract
Obstructive sleep apnoea (OSA) causing excessive daytime sleepiness (EDS) is a significant contributor in many road traffic accidents. Its high prevalence, increasing incidence, and substantial proportion of undiagnosed cases are important considerations for road safety policymakers and implementers. Importantly, its treatability offers great potential for reducing the number of road traffic accidents. As a relatively recent addition to Irish and EU medical fitness-to-drive guidelines, there is an apparent lack of awareness and knowledge regarding OSA among the general public. Similarly, the significance of OSA in terms of road safety seems underappreciated among some physicians. In order to realise optimal road safety in relation to OSA, public awareness campaigns and physician education are essential. In addition, current sleep specialist resources in Ireland are sparse. The establishment of dedicated and accessible sleep specialist services are paramount to achieving greater road safety.

2. About Obstructive Sleep Apnoea
Obstructive Sleep Apnoea (OSA) is characterised by the repeated partial or complete collapse of the upper airway during sleep. It is a common yet underdiagnosed, treatable condition estimated to affect between 2-5% of the population [1,2]. While OSA can affect people of all ages, race, size and gender; obesity [3] and male gender [4] are prominent risk factors. It is therefore unsurprising that rates of the condition are expected to rise in view of the increasing obesity incidence. Epidemiological data for the Irish population is not available. However, UK and US figures suggest that, despite adequate access to healthcare services, up to 85% of OSA sufferers are not diagnosed and therefore not treated [5,6].

The consequences of untreated OSA are both serious and wide-ranging including cerebrovascular disease, hypertension, diabetes and of course, increased risk of road traffic accident (RTA) [7,8].

The symptomatic profile of OSA varies from patient to patient. Some of the most recognised features of the condition are: snoring, witnessed sleep apnoea, excessive daytime somnolence and fatigue [9]. The driving task is a complex process that requires a variety of skills that can be impaired by symptoms of OSA, for example: attention and concentration, judgement, and reaction times [10]. Hence, OSA poses a significant risk to road-user safety.

The diagnosis of OSA is typically accepted as an Apnoea-Hypopnoea Index (AHI) ≥5 with symptoms or ≥15 regardless of symptoms. The AHI is the average number of disordered breathing events per hour of sleep and is determined by overnight polysomnography (PSG) testing [11]. The severity of the condition may be categorised based on AHI as mild (5-14), moderate (15-29) and severe (≥30) [11]. However, the profile of symptoms are also important when describing the severity of the condition. Subjective assessment of excessive daytime sleepiness (EDS) may be aided by questionnaires such as the Epworth Sleepiness Scale.

The gold standard of OSA treatment is nocturnal continuous positive airway pressure (CPAP). The National Institute for Health and Care Excellence (NICE) recommends the use of CPAP for moderate to severe symptomatic OSA [12]. In 2006, a Cochrane Review concluded that CPAP can improve sleepiness, quality of life and daytime sleepiness in those with moderate to severe OSA [13]. Most importantly, in the context of this essay, it has been shown that CPAP improves driver performance within 2-7 days of treatment initiation in patients with OSA [14].

3. Obstructive Sleep Apnoea and Driving
Driving is a complex task requiring the integration of an array of skills to ensure competency and safety on the road. Among these skills, alertness and concentration are paramount. Excessive daytime sleepiness (EDS), as the principal daytime manifestation of OSA, understandably impairs driving performance. Indeed, the risk of RTA in OSA subjects exceeds that of many other medical conditions highlighted in medical fitness-to-drive guidelines [15].
The link between RTAs and OSA has been described for nearly three decades. In 1988, Findley et. al. [16] found OSA drivers had a 7 times greater rate of RTA than healthy counterparts and concluded that “impaired drivers with sleep apnea may cause many preventable auto accidents”. More recent studies corroborate this increased risk, albeit to varying degrees. A recent meta-analysis of 18 such studies reported an increased risk of 2.43 among people with OSA compared to individuals without the condition [17].

Rather importantly, many studies attribute the increase in RTA risk among OSA drivers to excessive daytime sleepiness (EDS) as opposed to the objective severity of the condition according to AHI [18,19]. Nevertheless, evidence suggests that EDS does indeed correlate to condition severity as measured by AHI and oxygen desaturation index (ODI) [20,21]. In fact, ODI and minimum sleeping SpO2 were found to be greater predictors of EDS than AHI [20-22].

CPAP is an effective treatment for OSA and elimination of its daytime symptoms [13]. Many studies have successfully demonstrated a substantial reduction in RTA risk for OSA drivers adherent to CPAP therapy [14, 23-27]. A 2001 report by George [26] compared RTA rates among people with OSA 3 years before and after CPAP initiation with healthy controls. The results indicated RTA risk normalised to that of the control group on CPAP therapy. Karimi et. al. (2015) [27] found that appropriate compliance with CPAP (>4 hr/night) conferred a 70% reduction in the risk of RTA while conversely, non-compliance (<4 hr/night) or no therapy resulted in a 54% risk increase over a 5-year period.

4. EU Directive on Medical Fitness-to-Drive and OSA

The observation of OSA symptoms far predates the advent of automobiles yet apnoeic episodes in sleep were first recorded on polysomnography in 1965 [28]. The latter half of the 20th century saw an increase in sleep apnoea research. The detrimental relationship between OSA and driving has been known for some 30 years.

In light of the growing body of evidence in more recent years and the identified need for conformity among member states [29,30], the EU driving licence committee established a Working Group on OSA in 2012. On foot of the Working Group’s recommendation, the most recent EU directive on medical fitness-to-drive was published in June 2014 which included OSA in its Annex III – medical conditions to be considered in licensing. The directive made the following three stipulations [31]:

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Figure 1: Timeline of developments in OSA and associated traffic medicine
1. ‘Applicants or drivers in whom a moderate or severe obstructive sleep apnea syndrome is suspected shall be referred to further - 4 -authorized medical advice before a driving licence is issued or renewed. They may be advised not to drive until confirmation of the diagnosis.

2. Driving licences may be issued to applicants or drivers with moderate or severe obstructive sleep apnea syndrome who show adequate control of their condition and compliance with appropriate treatment and improvement of sleepiness, if any, confirmed by - 4 -authorized medical opinion.

3. Applicants or drivers with moderate or severe obstructive sleep apnea syndrome under treatment shall be subject to a periodic medical review, at intervals not exceeding 3 years for drivers of group 1 (i.e. non-commercial drivers) and 1 year for drivers of group 2 (i.e. commercial drivers), with a view to establish the level of compliance with the treatment, the need for continuing the treatment and continued good vigilance.’

5. Irish National Guidelines

In 2008, Alonderis et. al. [30] published the results of their survey of driving licensing regulations in Europe relating to OSA. At that time, Irish guidelines did not hold specific provision for EDS or OSA. Since then, the Road Safety Authority’s Slainte agus Tiomaint has had specific guidance on OSA and driving included and the most recent edition from April 2015 reflects this [10].

The standards relate to moderate (AHI of 15-29) and severe (AHI≥30) OSA causing excessive daytime/awake time sleepiness. The requirements state that, for both group 1 (private) and group 2 (professional) drivers, “driving must cease until satisfactory control of symptoms has been attained with ongoing compliance with treatment, confirmed by medical opinion”. For group 1 drivers, a 1-3 year licence may be granted subjected to periodic medical review. Group 2 drivers are subject to more regular (normally annual) review. Both groups must notify the National Driving Licence Service (NDLS) [10].

6. Public Awareness of Obstructive Sleep Apnoea

Successfully reducing the rate of RTAs caused by OSA and EDS hinges on public awareness of the condition and its risk to road safety. Recent RSA “Stop, Sip, Sleep” radio and TV campaigns highlighting the dangers of and appropriate countermeasures (e.g. naps and caffeine consumption) for fatigued driving are certainly invaluable in informing the public and improving road safety. While evidence supports the benefits of naps and coffee in reducing physiological sleepiness; drivers, often not wanting to delay, still employ less effective, in-car countermeasures (e.g. playing music and opening the window) [32].

A 2012 survey [33] of people with OSA in the UK reported that 56% of sufferers had not heard of the condition prior to diagnosis. In addition, the median time from first recognising symptoms to seeking medical advice was 20 months. Although, those who were aware of OSA sought help an average of 10 months before their naïve counterparts. Furthermore, the percentage of hidden cases is significant (as high as 85% as previously stated). This is further indication that awareness of OSA is relatively poor among the general public.

Raising public awareness of OSA will positively affect RTA rates related to driver sleepiness through increased diagnosis and effective treatment. Conversely, as drivers become more informed of the potential impact on their licence eligibility, they may be inclined to underreport or underestimate their symptoms. This is particularly true for group 2 drivers who rely on their licence for the livelihood.
A 2012 case-control study by Strohl [34] compared Epworth Sleepiness Scale (ESS) scores of commercial drivers before and after CPAP with that of non-commercial controls. A pattern of lower ESS scores among commercial drivers emerged throughout the study. This led the author to speculate that professional drivers may downplay their symptoms for fear of losing their licence.

In order to optimise the benefit to road safety, continued public awareness campaigns highlighting the dangers and precautions for sleepy driving are strongly advised. In addition, public education regarding OSA, namely its symptoms, dangers and available treatments, is paramount. Drivers should be encouraged to seek medical advice for chronic daytime sleepiness and emphasis should be placed on differentiating this from once-off fatigue. Finally, drivers must have confidence that health services can diagnose and treat their OSA in a timely and effective manner so as to minimise their time spent off road.

7. Role and Challenges for the Physician and Healthcare Services

The recent EU directive and national guideline developments for OSA and driving will undoubtedly improve road safety but will also present challenges to physicians and the health service alike. Firstly, physicians (both generalists and specialists) must possess the knowledge to suspect, diagnose and treat OSA. Secondly, sleep specialist services may anticipate an increase in referrals and should be equipped to cope with the workload. Thirdly, adequate CPAP compliance and symptom control should be defined. Lastly, physicians have a responsibility to patients to ensure an acceptable timeframe for diagnosis and treatment initiation so as to minimise time off the road.

Mets et al. [35] (2012) survey of sleep specialists yielded varying opinions on fitness to drive for people with OSA. Only 32% of respondents suggested that an untreated OSA patient’s fitness to drive depended on their EDS symptoms while 49% said untreated OSA patients should not drive regardless of EDS. 11% felt that even CPAP treated patients should not drive. Dwarakanath et al. [36] (2015) reported “considerable variability in clinicians’ opinions regarding whether a person with OSA should drive or not”. Such studies indicate a lack of consensus among physicians regarding OSA patients’ fitness to drive thus highlighting the need for greater training and education in the area. In order to optimise road safety, physicians should have the appropriate knowledge to suspect, refer or investigate, diagnose and treat OSA.

Ireland does not currently possess the dedicated sleep specialist services to efficiently deal with the current and anticipated increase in demand that OSA screening and awareness will bring. A 2013 Oireachtas report acknowledged that no national structure for dealing with OSA exists in the public health system while only one HSE hospital offered dedicated sleep disorder beds [37]. The report went on to question how RSA guidelines on OSA and driving could be enforced with the current ‘ad-hoc’ services [37]. The Irish Thoracic Society also places the spotlight on the need for improved services. They estimate that Ireland would require 8 dedicated sleep specialists where currently there are only 2 [38]. Evidently the sleep specialist services are some way off catering for the current and anticipated rise in referrals related to OSA screening and driver safety.

CPAP has been shown to be an effective treatment for OSA, essentially normalising the risk of RTA [26]. The recent EU directive stipulates regular assessment (3-yearly for group 1 and yearly for group 2 drivers) of patient compliance and control of symptoms. This poses a further challenge for health professionals. While subjective questionnaires (e.g. ESS) afford inexpensive and quick assessment of driver sleepiness; such methods are at risk of reporting bias for fear of licence revocation. On the other hand, subjective tests (e.g. Multiple Sleep Latency Text) are costly and burdensome to sleep specialists. Nevertheless, the ESS can be an appropriate indicator of daytime sleepiness [39]. The key, once again, lies in education. Educating the public that OSA diagnosis is not synonymous with a driving
ban. On the contrary, successful treatment facilitates safer driving and by extension, a more enjoyable driving experience and improved quality of life.

Correctly educating people on the benefits of OSA treatment with CPAP should theoretically extinguish driver concern regarding being deemed unfit to drive. Nevertheless, drivers, especially those in group 2, will not wish to be inconvenienced by long waiting times for diagnosis and treatment. Hence, clinicians and the health service are presented with the challenge of timely processing of OSA investigations. The British Lung Foundation survey (2014) found that 46% of patients commenced CPAP therapy within 1 week of diagnosis, 77% by 1 month and 94% by 3 months [33]. Every effort should be made to ensure near immediate initiation of treatment in order to promote confidence among prospective patients.

While current and future doctors often overlook cost, we must be cognisant that healthcare funding is finite. The potential from increased education about OSA as well as increased diagnosis and treatment of the condition represents a significant economy of scale within the health service and wider society through reduced RTA rate and reduced demands on other health services related to OSA comorbidities [8] and improved quality of life.

### 8. Conclusion

Sleepiness at the wheel is a factor in a significant number of road traffic accidents [40]. The reported risk of serious injury or death in an RTA involving a tired driver is threefold greater than other accidents [41]. Obstructive sleep apnoea, in often causing excessive daytime sleepiness, represents a substantial source of driver sleepiness. As a recent addition to the EU directive on medical fitness to drive and also to Irish guidelines as well as being a relatively underdiagnosed condition, OSA diagnosis and treatment offers great potential for improved road safety. While identifying OSA drivers impaired by EDS is not without challenge, successful education of doctors and the public and the provision of appropriate diagnostic and therapeutic services are invaluable in achieving optimal road safety.

### 9. References


