OLDER DRIVERS' RISK OF ROAD TRAFFIC COLLISIONS

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Abstract

Road Traffic Collisions (RTCs) are not necessarily the main cause of death or injury for older people, nonetheless relative to their proportion of the overall driver population persons aged sixty-five years and above are over-represented in RTCs. Moreover, as population demographics depict an ageing but many are 'active' population the number of drivers aged 65+ is projected to increase significantly over the course of the next forty years. As a consequence, this segment of the driver population of travel behaviour patterns and associated road safety assumes greater pertinence.

The aim of this study is to investigate the magnitude of collision risk among older drivers to establish if age is an actual indicator in collision involvement. Older drivers are exposed to greater risk of collision involvement as a result of their sleep patterns and ailments due to aging. A content analysis of the literature depicting the general sleep patterns of this target group highlights the changes in sleep/wake patterns with aging. Indeed, it has been proven on many occasions that the sleep of the elderly is different than that of younger people. Whilst this is significant in respect of driver safety other factors must also be considered such as activity, stress, strength, stamina, mobility and cognition.

The methodological framework applied to this investigation encompasses two distinct phases. The theoretical underpinning will inform and guide the empirical phase of the investigation which will comprise analytical interpretation and evaluation of Police Service of Northern Ireland (PSNI) data associated with RTCs across Northern Ireland over the thirty year period 1981-2010. Initial evaluation at the macro level will explore correlations between age and frequency of RTCs across different age groupings relative to driver population densities. Additionally exploration of the data at the micro level will include detailed evaluation of RTCs involving drivers aged 65 years and over in respect of determinant variables including; road classification, time of day/seasonal variation, no of vehicles involved, passenger densities and extent of injuries. The qualitative interpretation emanating from the PSNI data is supplemented by a question based survey reflecting the views and opinions of a respectable sample of drivers aged 65+.

Keywords: older drivers, road traffic collisions, sleep deprivation, sleep patterns, sleepiness, and stress.

1 Introduction

The presence of drivers aged 65 years and above accessing the traffic network will increase rapidly throughout the world during the next two decades as a consequence of several trends, namely increasing cohorts in the older age bracket (demographic trends), reliance on private car usage depicting accessibility and mobility challenges, [1, 2, 3, 4].

Older drivers within the context of this research paper is defined as drivers aged 65 to 75 and above and is consistent with previous research in this area [5,6].

In the opinion of Lam *et al* (2003) it is a natural progression in life that as one grows older bodily parts become more fragile and functions with less ease. This is all part of growing old – a factor that cannot be avoided. Additionally, biological ageing ensures that illness tends to be more widespread in older age groups than younger groups and can result in a propensity to transformatic shifts in sleep patterns. Older people generally have disturbed sleep and can be more restless throughout the day and the result is a quandary for road safety.

The relationship between RTC's and sleep patterns amongst older drivers is currently under represented. This paper will seek to address and add to this information debate by considering the impact of sleep deprivation on driver performance in the driver cohort aged 65+ in Northern Ireland. This paper is compartmentalised as follows, section 2 discusses population demographic trends and the projections for the next two decades and how this will placed emphasis on services such as transportation. Section 3 features literature that refers to sleep patterns particularly for older adults. This section focuses on the intricate connection between restless nights and daytime sleepiness and the effect for driving performance. Section 4 illustrates the methodology adopted throughout the data collection process. Whilst Section 5 and 6 portrays the results found and analysis conducted, highlighting some keys points of the question based surveys.

2 Population Demographic Trends

Northern Ireland (NI) demographics highlight future shifts in population, particularly the older population and the increases faced [3,8]. Predictions infer that the NI population is expected to experience a major shift in that older people will comprise a larger proportion of the population [9]. In the opinion of Cooper, (1990) when taking into account illnesses and functional impairments (vision, cognition and mobility) associated with older persons, allied with the increased demand for mobility, added concern will be placed on road safety and injury collision rates [11, 28].

The ageing population trends in the UK mean that many older people now and in the future will rely on driving as a way of maintaining independence and as a channel to full participation in society.

It is noteworthy that the number of drivers aged 80 years old and over has now reached 1,012,399 in the UK and 25,019 in NI [12]. This depicts an ageing but increasingly active / mobile older person's cohort within the UK and NI. Remarkably, there are also 122 (UK) licence holders over the age of 100, of which 6 have residence in NI. The number of older drivers in NI has soared in recent decades; in 2010 records noted there were 211,789 drivers over the age of 60 and 25,019 drivers over the age of 80 in the province an increase of 424% since 1990 [9, 12].

At present, drivers in the UK have to re-apply for their driving licence at the age of 70, and every three years thereafter. Nonetheless it is pertinent that drivers do not have to undergo any kind of test or inspection – medical or motoring – and there is no upper age limit at which drivers must relinquish their driving licence and cease to drive [12, 29].

3 Sleep Patterns

The literature base depicting the sleep patterns of older drivers is longitudinal and diverse in nature. Factors that effects all ages include, sleep deprivation, disturbances in sleep, potential sleep disorder, individual sleep environment, boredom, and stress. However, it must be noted that some of the aforementioned will be more dominant in older persons. Early studies by Hobson & Pemberton, (1955), Weiss *et al*, (1962) have previously highlighted the changes in sleep/wake patterns with aging. Moreover, it has been proved on many occasions that the sleep of the elderly is different than that of younger people [15,16]. Other factors must be considered such as activity, stress, strength, stamina, mobility and cognition. More recent investigations by Milia *et al* (2011) reports that aging results in changes to the structure of sleep, the research highlights that increasing age concludes greater number of awakenings, shorter sleep duration and inferior sleep quality.

Moreover, many studies have interconnected disturbed sleep and ageing, Dement & Vaughan (1999) clearly indicating that older persons generally have shorter sleep than younger individuals and sleep is marked by numerous waking intervals – two indicators that the person will suffer from excessive daytime sleepiness. As a result of poor sleep many tend to compensate (for any disturbed sleep experienced) by spending more time in bed or 'lying on'. Webb and Swinburne (1991) identified this to be as long as 12 hours a day. Reports suggest that such attempts are highly ineffective as the continuity of sleep (gaining all 4 stages of sleep) maybe as important to daytime well being (recuperation) as amount of sleep [20].

Other factors that would be more prevalent with older people are change (reduction) in physical activity, physical and mental illness, loneliness and social isolation / exclusion, excessive bed rest and the use of hypnotics and other Central Nervous System (CNS) medications (such as depressant drugs that induce drowsiness) [26].

Miles and Dement (1980) also highlight that older drivers do seem to be quite dissatisfied with their sleep, their studies indicate that complaints of non-specific sleep disturbance, awakenings during the night, and the use of sedative-hypnotic medications all increase with age. In one of the earlier studies of sleep and age, Hobson and Pemberton (1955) found that sleep complaints were quite frequent in the elderly, with 35% of those over 60 years old claiming to wake up several times throughout the night. A survey by McGhie and Russel (1962) of 2,466 subjects of various ages (15 years old and above) reported that respondents over the age of 65 years old reported an increase more than any other age group of morning tiredness, daytime tiredness and frequent night time awakenings [14, 22]. In subjects over 65 years old, 25-30% reported 'frequent night wakening', early morning awakening was also reported more often in the elderly, with as many as 15% aged between 65-75 years old reporting wakening before 5.00am.

Maycock (1996) and Horne and Reyner (1995) confirm studies that fatigue is a significant contributor to road traffic accidents and can be a causal factor in up to 15-20% of accidents [27]. Older drivers are more prone to sleep-related accidents, due to the nature of their lifestyle (early morning awakening, disturbed night time sleep, excessive daytime sleepiness and increase use of medication) and their high level of exposure to all of these '*fatiguing*' elements.

4 Methods

There are two distinct phases to the empirical investigation. Phase one will comprise analytical interpretation and evaluation of Police Service of Northern Ireland (PSNI) data set [25]. Initial evaluation at the macro level will explore correlations between age and frequency of RTCs across different age groupings relative to driver population densities. Additionally exploration of the data at the micro level will include detailed evaluation of RTCs involving drivers aged 65 years and over in respect of determinant variables including; road classification, time of day/seasonal variation, no of vehicles involved, passenger densities and extent of injuries. Phase two will be developed from an intensive questionnaire aimed at the target driving cohort. This questionnaire extrapolates information regarding sleep

patterns, activity levels, stress levels and lifestyle and explores any linkage related to the impact upon driver performance and collision risk.

The questionnaire used in the study consisted of four component parts. Section 1 was simply a 'about you' section and it requested information about the driver, namely sex, age range, profession and driving history etc. This section also captured the opportunity to ask drivers about their collision history, driving experience and use of other forms of transport. These replies were essential to build a clearer picture of individual habits and induced fatigue. Section 2, requested information on sleep patterns, disturbed sleep and average nightly sleep. Whilst Section 3, further exploited the area of sleep quality and daytime sleepiness and consisted of the Epworth Sleepiness scale [21], which gives a measure of excessive daytime sleepiness. Section 4 concluded the questionnaire requiring details relating to activity and stress levels.

5 Results

A total of 16 older drivers (age 65+) participated in the pilot study. The sample comprised of 8 males and 8 females. Of the 16 participants, 8 (50%) were retired, 4 (25%) were in part time work, 2 (12%) working voluntary and 1 (6%) was Self Employed and 1 (6%) was Professional (Figure 1). In terms of self declared medical conditions, 81% noted that they had some medical conditions with 19% stating no medical conditions. Driving experience amongst the sample population ranged from 20 to 48 years with a mean of 35.19 years (SD 8.976).

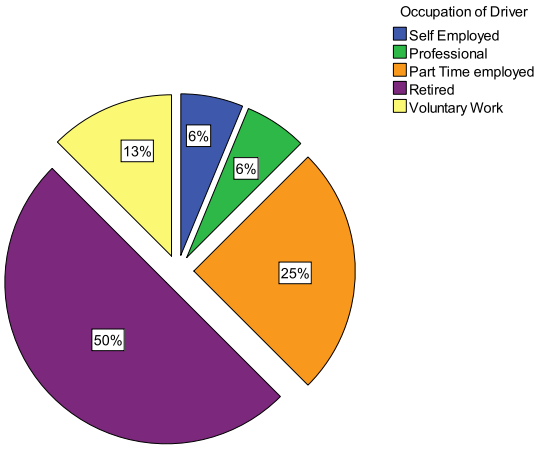

Figure 1 Occupation of Driver

With regards sleep patterns figure 2 below highlights the average nightly sleep of this older driver cohort. Nightly sleep ranges from 5-6 hours to 10+ hours, it can be noted from the study that 5 (63%) of men tend to sleep more hours, namely 8-9 and 10+ whereas women tend to sleep fewer hours than their male counterparts 6 (75%) sleep 5-6 and 7-8 hours nightly.

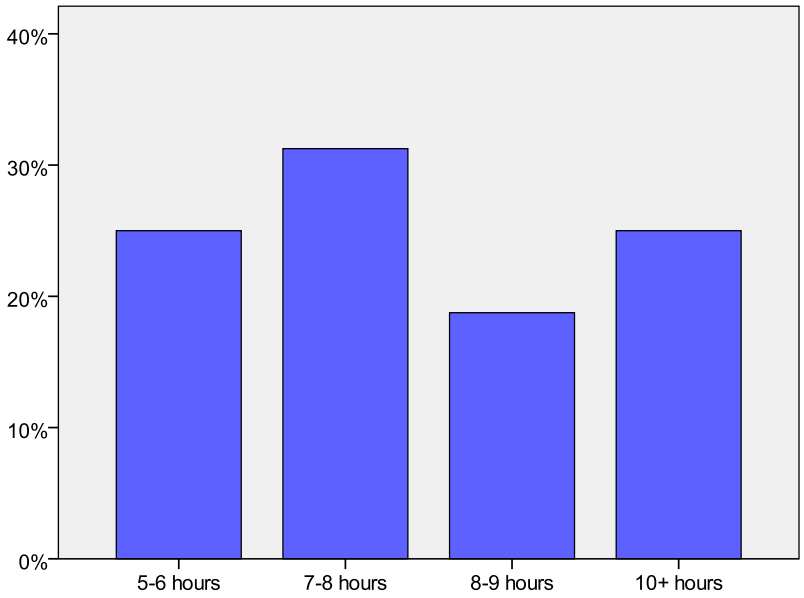

Figure 2 Average nightly sleep

Figure 3 refers to the Epworth total which depicts if there is an indication of excessive daytime sleepiness. This highlights that as many as 9 (56.3%) of the study group express a definite cause of concern for considerable and excessive daytime sleepiness (5 females, 4 males). When considering medical conditions in relation to excessive daytime sleepiness 8(50%) of the drivers whom expressed concern for daytimes sleepiness also prescribed to having medical conditions that may induce these situations.

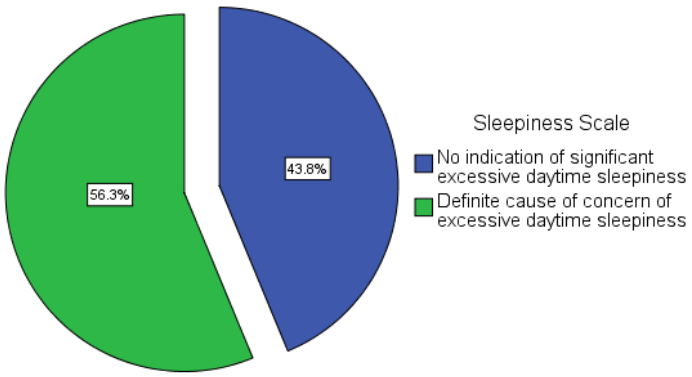

Figure 3 Excessive Daytime Sleepiness

The matrix (figure 4) below draws attention to the situations or scenarios where the study group declared their chances of dozing. It is worth noting that the values marked in red depict drivers that have indicated some level of dozing whilst in the subsequent scenarios. It is interesting to observe that 'sitting and reading' induces 15 (94%) of the group to doze. Remarkably 16 (100%) of drivers questioned indicated that they would definitely doze when 'watching TV'. Other scenarios also had some level of dozing with this cohort, namely,

'sitting in a public are ie cinema or theatre' 11 (69%) and 'as a passenger for an hour without a break' 13 (81%) and 'lying down to rest in the afternoon' 15 (94%). In contrast, the scenarios that almost proved to provide no daytime dozing were 'sitting and talking to someone' 15 (94%) reported no chances of dozing, as well as, 'in a car while stopping for a few minutes of traffic' 14 (88%).

Scenario	0 – No chance of Dozing	1 – Slight Chance of Dozing	2 – Moderate Chance of Dozing	3 – High Chance of Dozing
Sitting and Reading	1	5	8	2
Watching TV	0	5	6	5
Sitting inactive in a public area (i.e Cinema, Theatre)	7	6	2	1
As a passenger for an hour without a break	3	7	3	3
Lying down to rest in afternoon	1	3	5	6
Sitting and talking to someone	15	1	0	0
Sitting quietly after lunch without alcohol	4	6	5	1
In a car, while stopping for a few minutes of traffic	14	2	0	0

Figure 4 Epworth Scale Scenario Matrix

The results of the Spearman rho test vis a vis a driver's chances of dozing and their indication of excessive daytime sleepiness, indicate that a relatively strong correlation at the 0.01 level (r_s =0.637, p=0.008). This would be expected as a driver increase his/her chance of dozing in different situations then there indication of being excessively sleepy throughout the day would be highly probable.

Furthermore, there were moderate correlations and positive relationships highlighted between 'feeling drowsy whilst driving' and 'medication needed to sleep' (r_s =0.408, p =0.116). Two further tests indicated moderate relationships when correlated, 'feeling drowsy whilst driving' correlated with 'difficulty concentrating and remembering' (r_s =0.462, p=0.071) and 'sleeping pills required to aid sleep' correlated with 'difficulty concentrating and remembering' (r_s = 0.453, p=0.0781). There was no significant relationship between 'gender of driver' and 'number of collisions', a weak correlation was displayed (r_s =0.257, p=0.337).

Negative correlations are also apparent between, 'collision involvement' which reveals a negative coefficient when correlated with 'driver experience' (r_s = -0.290, P=0.276). There is a significant relationship between these variables however, the correlation is highlighting negativity, this could be explained whereby, this is a small cohort of the target population and there is an under representation of collisions could be because there is a reluctance to reveal this involvement.

6 Discussion

This study has concentrated on the content analysis and interpretation of data from questionnaire based research. Self-report data obtained from the drivers, was analysed to include the driving experiences of a random population of older drivers in Northern Ireland, and to relate to patterns of sleep behaviour and other characteristics such as, activity and stress levels.

Many studies have highlighted the significant increase of ageing populations within society and the impact that this will have on amenities and services, namely the transportation network. It is, however, fundamental to this debate that all areas of concern with the older drivers are discussed, namely, fragility, collision risk, activity levels, mobility, stress levels and sleep patterns. This study has drawn attention to issues of sleep and proneness of individuals to sleep or doze throughout the waking day.

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