Fatigue Factors Affecting Metropolitan Bus Drivers: A Qualitative Investigation.

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Abstract

Metropolitan bus drivers daily face work in a stressful and draining work environment, exposing them to the serious risk of driver fatigue. However, there has been a dearth of information exploring the unique antecedents and effects of such fatigue. To date, much of the research into metropolitan bus drivers has been under the umbrella of large heavy vehicle driving studies, which include a disproportionally large population of long-haul drivers, who are likely to face a significantly different set of fatigue factors [1]. The present study aimed to investigate which work and environmental factors may cause fatigue in metropolitan bus drivers by seeking drivers' own perspectives on the issues. To this end, focus groups were held at five bus depots in Sydney and Newcastle, with an effort made to include a stratified sample of drivers at each. Each of the groups were invited to nominate what factors they felt were most salient, with a number of common factors emerging across the depots. Key themes identified were: support from management; ticketing and related issues; interaction with passengers; cabin ergonomics; tight route schedules; turn-around and shift irregularity; extended shift cycles; interactions with other road users; and extended commute times.

Keywords: Bus drivers, fatigue, stress, scheduling, commute times.

Introduction

To date, there has been a dearth of academic research specifically addressing the effects of fatigue on metropolitan bus drivers. This gap in the research is surprising, given not only the well-established dangers of driver fatigue generically, but also the shear numbers of people who rely on this form of public transport in Australia. This paper seeks to go some way toward filling the knowledge gap in this area.

Examination of the recent incident statistics for Australian urban bus drivers provides some illuminating information about the unique risk factors. The majority of serious bus crashes have been observed to have involved urban drivers travelling standard, short routes (58.7 percent of all bus-related deaths), and often in speed zones of sixty kilometres per hour or less (57.6 percent of all deaths; 70.9 percent of all hospitalisations). These incidents typically involved the presence of another road user, with the point of impact predominantly frontal. The most common times of day for fatal accidents were mid-morning and mid-afternoon [2]. These trends demonstrate the inadequacy of appropriating a heavy vehicle incident study for the urban transit sector; such studies focus on issues such as inverted sleep cycles and loading cargo, concerns that are clearly not relevant to metropolitan drivers and certainly not to urban bus drivers [1]. Thus, there is significant work to be done in identifying the unique antecedents of incidents in this sector.

Fatigue in the Australian Metropolitan Transit Bus Industry

One possible contributing factor to stress and fatigue is the unique nature of fatigue experienced by metropolitan bus drivers. Fatigue is difficult to observe and leaves no physical evidence, often leaving its influence to be subjectively inferred and, as a result of the negative connotations involved, routinely underestimated [3,4]. Allowing for these difficulties, fatigue is estimated to have played a role in 10 percent of all incidents that involved heavy vehicle drivers, cumulatively costing the Australian

commercial driving industry an estimated $250 million per year [5,6]. When it is further considered that as many as one-third of heavy vehicle drivers consider their performance to be negatively affected by fatigue [7], the immediate need for further investigation becomes clear.

The Nature of Fatigue in Metropolitan Bus Driving

Fatigue has been posited to be a state highlighted by impaired performance and subjective feelings of tiredness, brought on by factors including inadequate rest, prolonged wakefulness and environmental stressors [5]. Two major physiological factors are postulated to generate fatigue are sleep loss and circadian rhythm disruption [8]. Beyond these explanations, other fatigue antecedents observed include time on task, extended concentration and boredom [9], as well as stress and various environmental factors [10]. Various resulting deleterious effects on driving behaviour identified include impaired reaction times, decreased attention to safety behaviours, reduction in visual scanning behaviour, fluctuations in driving speed, failure to stay within lanes and, ultimately, falling asleep at the wheel [5]. In terms of outcomes, the effects manifest themselves not only through incidents, but also in higher rates of self-reported attentional lapses and near misses [11].

In considering unique fatigue antecedents, the level of job stress experienced by drivers may be a significant factor. Urban bus driving has been identified as one of the more stressful occupations [12]. This is said to be due to the nature of the work; the conflict of pressures to maintain tight schedules and drive safely, while having little control over their external environment [13]. Research suggests that this kind of sustained job strain is significantly related to mental and physical exhaustion in commercial drivers [14]. Therefore, bus driver stress may be expected to be a salient factor in the investigation.

The Present Study

The present study is an exploratory, qualitative study that aims to identify the factors influencing the fatigue levels experienced by metropolitan bus drivers. Conducted with the cooperation of a major Australian transit provider operating in New South Wales, the study consisted of five semi-structured focus groups with bus drivers employed by the provider, based at various depots around Sydney and Newcastle. The aim of the study was to identify the commonly emergent fatigue-related themes.

Methodology

In consultation with the transit provider, five bus depots were chosen as targets for focus groups. Each of these depots was chosen as representative of a different set of potential fatigue issues that may affect the wider fleet, such as broken shift scheduling, regional location, longer routes, high density traffic and extended commute times.

Participants in the focus groups were employees, of the transit provider drawn from various classes of jobs that involved a bus operation component. Participants included bus drivers, trainers, assessors, and customer service consultants. Participation was voluntary, with a stratified sample of employees across various roles and shift-types approached by either depot managers or union delegates to participate. Each focus group was held on-site and employees were remunerated at their standard rate for their participation.

The focus group sessions each lasted approximately one hour and twenty minutes. The sessions were semi-structured to guide discussion through topics hypothesised to be fatigue antecedents and other allied factors. Each was recorded using a digital voice recorder, with transcriptions of the sessions then subjected to visual thematic analysis to identify the emergent themes.

At various stages of the project, further guidance on various pertinent issues was sought from subject matter experts outside the research team. These included members of the transit provider management, delegates from the appropriate union and representatives from the Road Transit Authority (RTA), the licensing and certification body overseeing the regulation of bus transport drivers and operators in NSW.

Results

Throughout the five focus groups, a number of common themes emerged as prominently featured. In addition to these specific themes, some important contextual understandings were reached. There was general consensus across the groups that fatigue was generated not only by the structural aspects of work, such as scheduling, but also through more personally-oriented processes, such as the accumulation of stress. There was further consensus regarding a perceived causal linked between experienced levels of stress and associated levels of fatigue, as well as a perception that fatigue was a more serious issue for more inexperienced drivers.

Regarding specific fatigue factors, the most prominent to emerge were: a) support from management; b) ticketing and related issues; c) interaction with passengers; d) cabin ergonomics; e) tight route schedules; f) turn-around and shift irregularity; g) extended shift cycles; h) interactions with other road users; i) and extended commute times. The frequency with which they emerged is chronicled in Table 2 below.

TABLE 2

Frequency of Emergent Fatigue Factors.

Fatigue Factors	No. of Depots
a) Support from Management	5
b) Ticketing & Related Issues	5
c) Interaction with Passengers	5
d) Cabin Ergonomics	5
e) Tight Route Schedules	4
f) Turn-around, Sleep Debt & Shift Irregularity	4
g) Extended Shift Cycles	3
h) Interactions with Other Road Users	3
i) Extended Commute Times	2

Discussion

Semi-structured focus groups held with metropolitan bus drivers from five STA bus depots in Sydney and Newcastle provided significant insight into this population's experiences with fatigue. Emergent themes are discussed below.

Support from Management. Level of support for the driver displayed by management was a factor mitigating fatigue reported at all depots. Drivers reported that managerial support was important both in reducing the amount of stress experienced and carried by drivers following negative job episodes, as well as in predicting the likelihood that a driver would feel comfortable taking steps to prevent driving fatigue. This result appeared to be supported by the observation that depots that report positive relationships with management reported less fatigue than those that reported negative relationships.

The idea that managerial attitudes affect safety climate in organisations has been robustly supported across industries, with the heavy vehicle sector being no exception [3,15]. In the urban transit sector, with its emphasis on rigid timeframes, drivers may consider that their well-being is considered secondary to efficiency of operations. Furthermore, past studies have described the industry's managerial style as authoritative, confrontational, blaming and strictly task-focused [5]. Such situations are likely to lead to feelings of helplessness, precipitating stress and resulting in driver fatigue.

Ticketing and Related Issues. Another issue cited across all depots as a source of fatigue was the 'policing' of ticketing, concessions and passenger entry. Drivers suggested that the practice of issuing tickets, checking concessions, handling cash and validating passes at every stop was often cognitively draining. Exacerbating the fatigue caused by such tasks was stress caused by the competing priorities of revenue protection opposed to providing safe and efficient service.

While a necessity under current industry practices, this 'policing' is often cited by drivers as one of the more tiring and stressful parts of their role [10]. Due to their cognitively involving and unpredictable nature, as well as their frequency, these tasks can divert significant cognitive and attentional resources away from driving, resulting in driver fatigue [16].

Interaction with Passengers. All five depots also nominated driver interactions with passengers as a factor affecting fatigue. The three major interactions that featured were conventional passenger demands (such as requests for directions), aggressive passenger behaviour (such as verbal or physical aggression) and perceptions of constant passenger vigilance of driver performance notwithstanding that these might be imagined to some extent and/ or exaggerated. The first two forms of interaction

were said to cause fatigue through distraction and acute stress respectively. The third type, passenger vigilance, can be seen to facilitate fatigue through causing an enduring concern about one's performance, with the ensuing maintenance of high levels of self-vigilance leading to deleterious fatigue effects. The severity of the effects of this third type of interaction is likely to be linked to perceptions of support from management.

These results fit with previous research, with a report by Arrowhead Space & Telecommunications [8] identifying passenger vigilance and personal vigilance as fatigue risks. It is likely that these factors are in fact related; drivers, aware of their obligation to provide safe and efficient transport, may feel that their performance is being constantly monitored by passengers, causing them to place undue pressure on themselves to perform. Together with the pressures from the conflicting nature of performance objectives, this is likely to manifest itself in a significant stress build-up for the driver [17].

Cabin Ergonomics. Another fatigue factor that achieved consensus at all five depots was that of cabin ergonomics, despite considerable variation across depots as to which design features were implicated. Most commonly identified was exposure to heat and glare, as a result of the design of the windshield. Drivers also identified the inadequacy of thermostatic control in the driver's cabin, as well as neck, back and shoulder pain generated from seating fit-out as affecting fatigue levels. Noise and exposure to passenger vigilance, both as a result of the openness of the driver's cabin, were also raised at some depots.

In the wider heavy vehicle ergonomics literature, several of these factors have been previously linked to fatigue. Continuous exposure to chronic lower back pain has

been seen to result in elevated levels of physical fatigue over time, with associated deleterious effects on driving performance [18]. Furthermore, exposure to heat, noise and vibration has been linked to driver fatigue and impaired performance, with exposure to heat having the most acutely negative impact [19].

Tight Route Schedules. Drivers at four of the five depots visited posited unrealistically tight route schedules, and a corresponding restricted availability of shift breaks, as being significant factors affecting fatigue levels. These concerns were reported as prevalent in depots that serviced high-density traffic areas, those with variable traffic volume, and those with longer driving routes. The tight shift schedules were reported to cause fatigue by producing time pressures, and therefore reducing the ability of the driver to utilize lay-over breaks. Interestingly, it appears that the severity of the effect of time pressure appeared to be mitigated by perceptions of managerial support, with depots reporting high levels of managerial support reported fewer related fatigue problems.

The nature of urban transit means that drivers are often required to adhere to timetables that are difficult to achieve consistently, leaving little margin for delays due to variations in traffic and environment. Bus drivers have previously nominated such inflexible schedules as a primary stressor involved in transit driving [8]. Furthermore, the restricted availability of breaks is itself significant; even after relatively short time on task, performance deficits have been observed among heavy vehicle drivers [20]. In bus drivers, it is likely that this reduction in task performance capacity is due to a combination of physical fatigue and stress accumulated from an inability to address hunger, thirst, stretching and toilet needs.

Turn-around and Shift Irregularity. Another fatigue factor identified at four of the five depots was a relationship between fatigue and accumulated sleep debt, stemming

from adverse turn-around periods between shifts and irregularity of shifts. The majority of drivers perceived some impairment resulting from working variable shifts week to week. Even minimal differentials were suggested to have significant ramifications for drivers' daily routine, demonstrated in changing meal times, sleep cycles and altered work/life balance, which were reported to spill over into driver fatigue levels. It was suggested that newer drivers, whose shifts commonly change dramatically on a regular basis, are more severely affected.

While it is essential for operational effectiveness to allow for flexibility in scheduling, the example of the long-haul transit industry, where drivers are commonly exposed to variable shifts, has shown that it can lead to the accumulation of sleep debt [11]. Of further concern is that the more inexperienced 'scrap' drivers are likely to be exposed to more frequent and significant variability, yet almost certainly lack the experience to identify the resulting symptoms of fatigue [8]. Hence, the practice of maintaining a corps of inexperienced drivers who routinely work irregular shifts may create drivers more at risk to fatigue.

Extended Shift Cycles. A fatigue factor reported by three of the five depots concerned extended shift cycles. At some depots, drivers are given the option of working cycles of shift cycles up to 12-days on, 2-days off. Drivers at depots where this was available reported that, while different drivers are differentially equipped to handle extended work periods, the act of working twelve continuous days generally resulted in the accumulation of fatigue and impaired driving performance. It was generally agreed that drivers who work such shift patterns do so for economic motivations.

While urban transport may provide more opportunity for small breaks than long-haul driving, extended schedules are not without their dangers. It has previously been

demonstrated that industrial shift-workers obtain less sleep on work days than on off-days [21]. When this pattern results in workers getting less than eight hours of sleep daily, the result is fatigue as a function of accumulated sleep debt, which further increases with every additional night of insufficient sleep. Such a debt is unable to be countered by a single night of 'normal' sleep, requiring longer periods of sleep over a period of days [22]. Thus, the extended shift schedules may result in worsening driver fatigue, as it stretches the amount of time that passes before the driver can achieve restorative sleep and reduce the sleep debt.

Interactions with Other Road Users. Three of the five depots also reported that impediment and lack of consideration from other road users were partially responsible for the fatigue they experienced. Such fatigue was reported to stem from stress, both that of ensuring passenger safety and that of maintaining the route schedules, in the face of the often erratic and unpredictable behaviour of other motorists. Chief offenders to this end were motorists failing to give way as required, vehicles parking in bus lanes, taxis and cyclists.

It has been suggested that the practice of routinely dealing with unpredictable, heavy traffic represents a chronic stressor that is likely to manifest itself through accumulated fatigue effects [23]. This consequence is hypothesised to happen both as a result of having to maintain intense concentration for extended periods, and the build up of stress resulting from aggravation and frustration [12]. Furthermore, interactions with other road users are likely to play a part in fuelling the fatigue effects associated with tight route schedules [10].

Extended Commute Times. A further fatigue factor reported in the focus groups was that of extended driver commute times. Though reported in only two of the five depots, there is reason to believe that this factor may have significant prominence.

In the Sydney area, it is not uncommon for some depots to employ significant numbers of drivers from remote areas, who may face commutes as long as 1.5 hours to and from work each day. Effectively extending the work day by as much as 3 hours, a 12 hour shift accordingly becomes 15 hours long, making it unlikely that these drivers can achieve the required 8 hours of sleep required. It was suggested to the participants that such drivers are more likely to suffer fatigue. However, it should be noted that commute times appeared to be a controversial topic; after discussing the possibility of accumulated fatigue, drivers often vehemently stressed that one can 'adapt' to the extended commute times and, on one occasion, showed an unwillingness to entertain the topic at all.

In the metropolitan transit industry, drivers frequently service areas in which they may not live. This is especially true of routes that run through more affluent areas of Sydney where the housing prices are likely to exclude typical drivers from purchasing or renting.. The resulting extended commute distances may affect driver fatigue in a number of ways. For example, if the driver drives his or her own vehicle to work, more time is spent behind the wheel and time on task fatigue becomes an important consideration [9]. Commute distance is also relevant in light of the evidence relating to sleep debt, whereby workers getting less than eight hours of sleep daily show incremental increases in fatigue as time goes on [22]. In the case of drivers that live a long way from the area they service, this may necessitate waking earlier and returning later, making it difficult for them to achieve a healthy amount of sleep.

Given this empirical basis, it is worth considering why this factor was not more prominently featured. Two factors must be considered. First, not all depots are likely to have significant numbers of drivers commuting from outlying communities. Second, it may well be that the participants were motivated to downplay commute times because they perceived that if commute times came to management notice

that drivers who lived a long way from their depot may be made redundant to allay management concerns about fatigue.

Conclusion

Driver fatigue in metropolitan bus drivers has been somewhat of a neglected research topic, often subsumed under the umbrella of long-hauled trucking research. This paper represented an attempt to identify the unique antecedents of driver fatigue in this population through consultation with the drivers themselves. To this end, bus driver fatigue has been identified as stemming from personal factors, such as stress and perceptions of support, as well as the more traditional structural aspects of the job, relating to scheduling and work environment. Taking the information gleaned from this research, it would be useful undertake further investigation to refine and quantify the effects of driver fatigue.

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