

Summary:

Managing driver fatigue in occupational settings

A promising way to tackle driver fatigue is to implement programmes in occupational settings. Although the causes of fatigue transcend the driver's home and work life, we find that organisational programmes can contain elements that both minimize fatigue risk due to work-time activity and help the employee manage fatigue at home. Common components of programmes to date, primarily aimed at the occupational driver, are schedule management, education, and sleep disorder screening and treatment. There are few programmes that monitor fitness-for-duty, use employee incentives, promote an open reporting culture, or use competency-based selection and recruitment, as part of the ongoing fatigue management attempt. While many programmes and official guidelines are research-based, more robust and independent evaluations are needed to assess their effect on fatigue-related incidents and accidents. This is important because fatigue management as part of normal HSE activity of all types of companies has the potential to reduce fatigue-related accidents involving professional and private drivers alike.

Fatigue is a major cause of road accidents. It has the potential to affect any driver, but is an increasing problem for professional drivers who must drive further than ever before to enable their employers to compete in an increasingly global 24/7 economy.

Through delivery at organisational level, Fatigue Management Programmes (FMPs) could be more effective than mass media campaigns for tackling the problem of fatigue in professional and private drivers alike. The company is more able to target its employees using tailor-made measures, and it can more effectively monitor and manage fatigue outcomes. Systematic assessment of FMPs carried out to date is lacking, but is needed to evaluate their efficacy and, if appropriate, encourage the wider uptake and implementation of FMPs by relevant road transport companies.

This report is a review of company-based programmes for fatigue management based on a literature search. It aims to:

- Assess the extent to which FMPs are based on current research
- Describe and catalogue various component measures of FMPs
- Assess qualitatively the accident reduction potential of FMPs
- Document knowledge gaps and research needs as a basis for subsequent studies aimed at quantifying the effectiveness of FMPs

Current research on fatigue in occupational driving – influences, outcomes and management

A substantial proportion of professional drivers routinely experience fatigue in a way that influences their performance. The consequences of this are implicit in the high prevalence of bus and truck driver accidents – especially serious ones – in which fatigue is the main cause. To tackle the problem there has been substantial research to identify factors associated with fatigue in private and occupational driving. This finds that a routine, extended, non-interrupted sleep obtained at night is the most effective way fatigue can be limited, implying an important role for the individual driver in fatigue management. Other research suggests that good sleep hygiene and a healthy lifestyle should be promoted among drivers, who should also be screened and treated for health conditions associated with fatigue. Fatigue risks associated with physiological and psychosocial influences during and outside work hours should be carefully considered, as should those risks particular to younger and older drivers.

The most important organizational level influence on fatigue appears to be the driver's schedule, not least because it determines whether the opportunity for sleep is:

- long enough for sufficient recuperative sleep in the context of demands placed on the driver;
- given at a time of day that is appropriate for recuperative sleep; and
- routine and predictable.

A driver's schedule also prescribes the time of day at which the driving is performed, a factor which is strongly linked to self-reported driver fatigue and fatigue-related incidents in operational environments. More general research suggests that by designing jobs organizations also prescribe the extent to which drivers can manage their own fatigue, and the knowledge, information and feedback they are given to do so. The prevailing safety culture of the organization is strongly implied in the level of fatigue risk that will be perceived by the driver as acceptable, and in particular what a driver perceives that other drivers do about fatigue. Research also suggests that fatigue risks will be increased if fatigue-related behaviourally anchored competencies are not used as the basis for driver selection and recruitment. Finally, the monotony of the road on which the driver drives may have particular importance for fatigue development in long-haul trucking.

Various outcomes of fatigue can be measured to guide its management. These include (i) direct reports of fatigue as experienced by drivers; and (ii) the effects of fatigue implicit in cognitive or driving performance, aspects of driver physiology, and various organisational outcomes e.g. near miss incidents and accidents, costs due to lost productivity, absenteeism, turnover, reduced morale, increased wear and tear on equipment, and health and wellbeing.

The company can intervene at four levels to control those factors associated with fatigue and manage associated fatigue outcomes. It can:

- (i) limit the consequences of fatigue on driving performance;
- (ii) prevent a fatigued driver from falling asleep when driving;
- (iii) prevent fatigue developing during driving; or
- (iv) prevent a driver entering a vehicle while fatigued.

Our analysis implies that the organisation should focus on targeting measures at levels (iii) and (iv). Specific measures should be selected by the individual company based on the findings of a needs analysis in which subjective fatigue, driver sleep, behavioural indicators of fatigue and/or driving performance are recorded over a period to inform the subsequent intervention.

Management of fatigue can be assisted by tools and technologies in the following areas:

- Programme implementation – fatigue policy development, needs analysis tools, competency development.
- Driver, manager or other stakeholder education – training modules to increase knowledge and awareness of fatigue, outline coping strategies, or explain how diet and health is connected to fatigue.
- Schedule development and analysis – software packages available based on biomathematical models can help account for sleep history, circadian influences and in some cases sleep inertia; the models predict future fatigue risks.
- Fitness-for-duty measurement – using relatively well-established psychovigilance tasks, which can be performed in the cabin on palm-top computers, and bench-top instruments for pupil analysis.
- Driver performance assistance – eye-closure monitors to warn a driver that he is fatigued; and devices that can help drivers with the physical effort of driving in high winds.

Research shows that the following considerations should be made when using these tools:

- Modular training packages should be adapted to suit the particular organisation in which they are used. Any training should be designed based on a needs analysis for that organisation, outlining the competencies that need to be trained. The effects of training packages on actual behaviour, performance or operational measures are not clear, and directed group discussions may be a more inexpensive alternative.
- Scheduling tools are useful ways to implement evidence-based knowledge on fatigue in ways that managers can understand, and in some cases practicality and functionality has been demonstrated. There are some problems to address. These include manager over-reliance on fatigue risk predictions; that they do not account for considerable inter- and intra-individual variations in fatigue proneness; and that they only consider a few of the many influences on fatigue.
- More field studies are needed to assess the validity of fitness-for-duty indicators.
- Although still in development, technology that can measure and assist driver performance is becoming an increasingly realistic option, especially for large long-haul companies.

Surprisingly, no tool is available that helps managers select FMP elements according to the particular contingencies of the organisation.

Managing fatigue at organizational level – pros and cons

The report details how sectoral developments and increasing recognition about limitations of hours of work regulation has led to the growth of organizational-level management of fatigue and FMPs. Other lines of evidence also support that organisational-level management of fatigue would be beneficial.

However, there are some drawbacks of FMPs. They are expensive to implement, and small companies are likely to be daunted by the staff consultation, policy drafting, technology purchase, documentation, auditing and change in organisational culture that FMP implementation may demand. A challenge for regulatory authorities is therefore how they can encourage companies to take on more responsibility for fatigue management. Recent evidence suggests that this is being achieved increasingly by attempting to persuade companies that they need to manage fatigue like any other risk, within an effective safety management system.

FMP evaluation

A robust evaluation is required to learn whether an FMP has been successful and/or inform its further development. Operational limitations will prevent ideal experimental design, but organisations should at least aim to evaluate a time series of measures recorded over two periods, each lasting at least several months, one before and one after the intervention. Ideally, the change between periods should be compared with a corresponding change at similar sites or that coinciding in organisations where there is no intervention.

Many independent evaluations of FMP interventions need to be carried out and reported to inform regulatory authorities, safety associations, politicians and transport organisations about their effects. Alongside the change in outcomes reported, evaluations should report on the culture and context of the organisation involved. Only then will we be able to begin generalising about the effects an FMP is likely to have for a given organisation.

Analysis of an inventory of FMPs / FMP guidelines

To qualitatively assess FMPs carried out to date, a total of 61 documented FMPs were retrieved and reviewed. The programmes range from a single measure implemented by a single company to comprehensive guidelines issued by a regulatory authority. The FMPs come from North America, Australasia and Europe. Thirty-two are described for the road sector, 14 for aviation, six for rail and seven for the maritime sector. Just under half are pilot or demonstration projects carried out by regulatory bodies, safety associations, research institutes or universities, while a similar number are descriptions or evaluations of manuals, “toolboxes” of elements, codes of practice, standards or guidelines for FMPs issued mostly by regulatory authorities.

The most commonly implemented FMP components are:

- schedule management
- education
- sleep disorder management

In other words the FMPs reported employ elements described in the research literature as serving to tackle the causes of fatigue. Encouragingly, this suggests that current FMPs are evidence-based.

Furthermore several FMPs incorporate additional elements, which research suggests promotes the management of fatigue by the driver. These include feedback on sleep or fatigue levels, with personal or training advice on coping strategies that might be effective. Sleep contracts are also used in some FMPs, and there is some research basis for this.

Guidelines on FMPs have been issued by authorities or institutes. Although they are nearly always evidence-based, the effect of implementing the guidelines is not normally evaluated. The guidelines emphasise the three core elements above. Commitment to fatigue policy and a need to address the work environment are also emphasized, and these elements are not uncommon in FMPs actually implemented by organisations.

Several guidelines recommend measures that do not often appear in reports by organisations actually implementing FMPs. These include the following:

- fitness-for-duty monitoring
- promotion of an open reporting ('just') culture
- competency-based selection and recruitment
- procedures to ensure the fatigue of temporary or contract personnel is addressed
- employee incentives
- evaluation and refinement of the programme against stated aims

For FMP implementation, resistance to change is a recognised issue. Transport companies have attempted to tackle this using nominated fatigue management coaches or champions; visibly effective demonstration projects; involvement of all stakeholders from the outset; multi-level, multi-disciplinary project teams; and end-user participation in FMP design.

Most FMP evaluations are not controlled. The time the evaluation measures were taken in relation to the programme roll-out is often not clear. Many of the available evaluations are not independent. Most outcome measures reported are training outcomes or reports of subjective fatigue. Evaluations of organisational context coinciding with FMP implementation are wholly lacking.

Recommendations

The following research needs are highlighted:

- A better understanding and explicit demonstration of the causative relationship between fatigue and safety outcomes.
- Knowledge of the normal variability in fatigue levels within and between individual drivers.
- Mapping of fatigue effects as they diffuse through organisational systems.
- A better understanding of the drivers and limiters of FMP uptake.
- An industry survey to chart safety culture in EU road transport companies and link this to the way they manage fatigue.
- A better understanding of the organizational contingencies for different FMP elements.
- A better understanding of how different influences on fatigue interact.

- Demonstration evaluations of guideline implementation.
- Development and publication of a simple-to-use evaluation tool to standardize and promote robust evaluations to help reach valid conclusions about FMP effects.
- A study of the effectiveness of incentives and sleep contracts as FMP elements.

Recommendations for road transport companies designing and implementing FMPs include the following:

- Underpin the FMP with a clear fatigue policy.
- Policy should explicitly set out how managers and drivers should deal with the paradox between need for punctual delivery by driver and driver need for rest (conflict between fatigue management and logistics)
- Organizational conditions important to FMP acceptance and effectiveness should be explicitly considered and changed if necessary e.g. management trust, openness of reporting culture, driver autonomy.
- Set out procedures to explicitly address the fatigue of temporary or contract personnel
- As part of implementation there should be up-front consultation with key stakeholders, and procedures to manage resistance to change
- Behaviourally anchored competencies should be described and used as a basis for recruitment and selection in line with fatigue policy
- Address how to increase the visibility of driver fatigue as an issue to all stakeholders
- Select FMP measures to prevent employees entering a vehicle while fatigued; and prevent fatigue developing during driving
- Consider in addition to core FMP elements (schedule management; education; health monitoring and treatment) the exploitation of valid, usable, accepted, reliable, cost-effective technologies to assess fitness for duty as they become available
- Ensure through training that those using scheduling software do not over-interpret group-based predictions of fatigue risk
- Evaluate the intervention independently, using a battery of implicit and explicit measures of fatigue, and use to evolve the FMP towards stated aims

While a competitive organisation may have little reason to openly report the results of FMP evaluation, we recommend that regulatory bodies encourage open reporting by transport companies through promotion and funding of independent evaluations.

Finally, recommend that the incorporation of FMPs as part of normal HSE management in *all types* of companies (i.e. not just road transport companies) be considered as a way to improve the limited impact of road safety campaigns on employee fatigue during private driving.