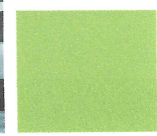
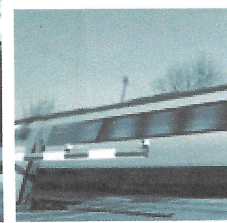
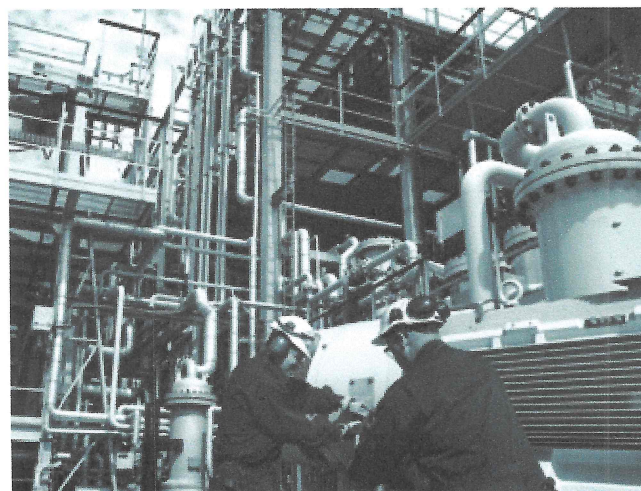
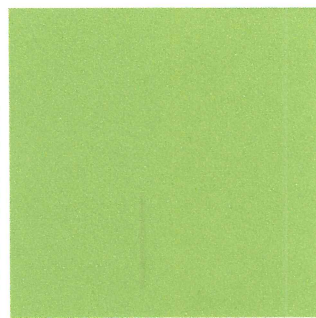
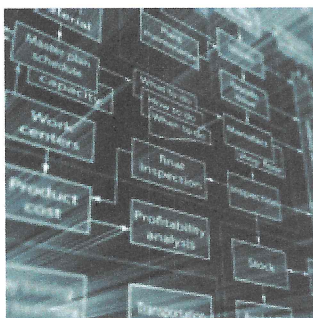


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Editors: Rebecca Charles and John Wilkinson



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Preface

This collection of papers forms the proceedings of the international conference, Ergonomics & Human Factors 2018, held in April at the Hilton Birmingham Metropole in the UK. The new, more central and accessible venue reflects the annual conference's growing attraction as a major international event both for the UK's CIEHF and the wider world's ergonomics and human factors community.

This year we invited full and short papers, poster presentations, and proposals for workshops and discussions. The digital proceedings allow for a much greater reader and researcher usability for searching, and have allowed more flexibility, both in length and format of papers to better suit the increasing range of topics and approaches.

In addition, we especially invited practitioner papers, leading to a new session: What works and doesn't work in practice. This has drawn a very interesting mix of papers describing problems that have been solved using human factors approaches and highlighting a number of issues still to be answered. Many challenges can be best tackled through a cross-sector approach, and this aspect of our field continues to be a key conference aspect.

All submissions were peer-reviewed before being considered for inclusion by the event's Programme Committee. We once again received submissions from a wide variety of domains including transport and healthcare and covering an increasing range of topics including vigilance and fatigue, virtual reality, and automation. The Life in the Smart Age stream considers autonomous driving and haptic technology, which are no longer just theoretical notions. This stream also attracted workshops on topics such as intelligent mobility and the value of virtual and augmented reality on human factors research and design. Healthcare continues to show real applications, and an increase in sector-developed tools. Large, complex projects with integrated human factors also continue to increase, presenting an invaluable learning opportunity for practitioners and academics alike.

The papers in these proceedings include those accepted for both oral and poster presentation and are categorised according to sector. Workshops and discussions are also listed.

Becky and John

Training to prevent and manage fatigue in the rail industry

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ABSTRACT

Fatigue is a major health and safety issue in the rail industry and it also reduces the wellbeing of staff. Mathematical modelling is often used to schedule working hours to prevent fatigue, but there are other risk factors for fatigue (e.g. workload; lifestyle) that need to be addressed by a fatigue policy. The research described in this article came after an audit of fatigue in a train operating company. The company developed a policy to prevent and manage fatigue and one aspect of this, fatigue training, was developed and assessed. The key features of the training were: education; consideration of the personal experience of fatigue; small changes to prevent and manage fatigue; and commitment to preventing and managing fatigue. A pilot version of the course was given to a small group (N=22) of staff and modified according to feedback. Even at this stage, the general response was that such a course could be extremely beneficial. The course was then incorporated into the Safety Training Update Delivery (STUD) programme and delivered by an experienced trainer from the rail company. General information on fatigue was supported by specific video footage incorporating the experience of rail staff. The training was evaluated within three months of delivery, and the results showed that it was perceived as one of the best parts of the training. The aim for the future is to make the training available to other train companies.

KEYWORDS

Fatigue, rail industry, training

Introduction

There has been an increase in the importance of human factors in the rail industry (Norris et al., 2004; Wilson et al., 2001). Fatigue is a major issue for the transport sector and the rail industry has been aware that it is necessary to prevent and manage it. This approach forms the basis of a fatigue policy, and prevention and management must address safety, health and the wellbeing of staff. Prevention is often based on the use of mathematical models (e.g. the HSE Fatigue Index) which are used to schedule working hours. However, it is often necessary to work schedules that differ from those based on the model (e.g. overtime; rest day working), and this leads to the risk of an increase in fatigue. Fatigue has been linked to incidents that are a risk to safety (e.g. Signals passed at danger (SPADs); fatigue is a possible cause in over 25% of rail incidents; Bowler and Gibbon, 2015). Specific cases demonstrate the impact of fatigue. For example, in 2010 an uncontrolled freight train ran back for 3.5 km between Shap and Tebay before the driver braked. The cause of this was the driver being fatigued as a result of his shift pattern. Another example is related to a fatigued conductor. A passenger train was driven over a level crossing in Llandoverly while the crossing was open to road traffic. The conductor was fatigued due to lack of sleep for the two days before the incident.

There are some risk factors other than working hours (Dorrian et al., 2007), with workload being a major cause of fatigue (Pickup et al., 2005). Smith and Smith (2017) surveyed over 1000 staff of a passenger rail company, the aim being to identify risk factors for fatigue and the consequences of it. The main job types in the sample were train drivers, conductors, engineers, station staff, administrators, managers and catering stewards. Job demands, a measure of workload, were significantly correlated with fatigue (Fan and Smith, 2017a, b). Not surprisingly, shift-work was associated with higher fatigue. Demands were also associated with reduced efficiency at work and fatigue was also associated with reduced performance. These were not the only predictors of fatigue; it was also predicted by lifestyle, control/support at work, and noise (Smith, 2017). A multiple regression put all of these predictors of fatigue into an analysis to predict performance. High job demands, an unhealthy lifestyle, shift work, and low control/support predicted poor performance. Lifestyle can influence fitness for work (and fatigue) in several ways. An obvious example is that activities that reduce sleep will make the person more tired when they report to work the next day.

Guidance from both the Office of Rail and Road (ORR) and the Rail Safety Standards Board (RSSB) advocates the development of a fatigue risk management system that drives continuous improvement in fatigue risk. This process involves the development of a fatigue policy and processes which allow management of working hours and fatigue risk. Auditing fatigue is a crucial part of this process, as is fatigue awareness training. A holistic approach is required, and use of the fatigue risk index and fatigue training alone would not be an appropriate way of preventing and managing fatigue. However, safety training is well accepted in the rail industry and yet there have been few attempts to develop fatigue training packages. Development of educational packages can take several forms, and the next section describes the development of the fatigue training module.

Method

The fatigue leaflet

The fatigue training developed here aimed to provide a holistic approach to the causes of fatigue rather than focusing on working hours. This 'educational' approach was based on a leaflet on fatigue that was produced earlier in the research. This leaflet described the impact of fatigue on transport operations and the importance of fatigue awareness training and tools to audit fatigue. It also stressed the importance of appropriate communication about fatigue which requires interaction between all stakeholders (e.g. the regulator, the company, unions and individual employees). Established risk factors for fatigue were described: loss of sleep; poor quality sleep; having to work at 'low points' in the circadian cycle; long working hours; high workload; poorly designed shift-work; and inadequate breaks. Individual sensitivity to certain types of fatigue (e.g. sleep deprivation; working at night) was also described, as were possible reasons for this (e.g. personality and age). The symptoms of fatigue were described as:

- Early warning signs e.g. rubbing the eyes
- Moderate fatigue e.g. frequent yawning and blinking
- Severe fatigue e.g. difficulty keeping eyes open and long blinks

The possible after-effects of fatiguing work were also presented (e.g. an increased risk of a road accident after a long night shift). Countermeasures for acute fatigue were also discussed. These included having caffeine or taking a nap, and it was shown that these are only successful in the short term and that chronic fatigue can best be prevented by using standard health and safety approaches (e.g. proper planning of working hours and workloads; adopting a lifestyle that does not impair fitness for work).

A pilot film

The passive educational approach was perceived as an initial part of the fatigue policy. To facilitate greater awareness, it was suggested that the leaflet was made into a video and incorporated into standard training procedures. This was done, and the video was provided using an online link to a panel of 22 volunteers. After viewing the video, the volunteers, who carried out a range of jobs within the company, completed a brief survey asking about satisfaction with the film and recommending any changes. The results showed a high level of satisfaction with content (100% found the film useful) and utility of the video for a staff in general (100% thought it would be applicable for a variety of staff). The most common recommendation for change was to use examples which were more directly relevant to rail staff. There were also some comments on including a more practical ‘problem solving’ approach which suggested how specific issues might be resolved. Finally, there was a suggestion that a ‘talking heads’ approach might also be included with contributions from union and safety representatives. The volunteers provided examples of their own experiences of fatigue and some possible solutions. Commitment to preventing and managing fatigue was strong, but there was also a concern that the approaches advocated in the film may be difficult to put into practice. Incorporating fatigue training into the well-established Safety Training Update Days was suggested as a possible way forward.

Pilot training sessions

At the same time as the present study, the author was also involved in a study of management of fatigue in cancer patients (Courtier et al., in press). This study used a behavioural intervention (Armes et al., 2007) with the following stages:

- Knowledge – of antecedents and consequences
- Emotion – self-assessment of affect
- Behavioural regulation – self-monitoring and adjustment
- Beliefs about capabilities – boosting commitment and self-efficacy, action planning

This approach was adapted for an occupational training situation, and a pilot study with training groups suggested that the format was applicable. Again, it was suggested that comments from safety representatives or union officers might make the topic more relevant. The final stage of development involved making the package appropriate for the specific safety training context, and this led to initial training courses at the start of 2017.

Fatigue training

The pilot versions of the training were given to the company safety trainers and specific film clips added to the presentation. The training package was then delivered by trainers in different geographical locations and feedback on the courses collected using online surveys. A facilitator’s guide was also developed which gave information on the type of activity (e.g. PowerPoint; video; facilitator-led discussion) at different stages in the training session. The training was also linked to personal development (e.g. development of situational awareness; workload management; decision making; conscientiousness; communication; cooperation and working with others; and self-management). Film clips with comments from safety representatives were shown in several parts of the training. The presentation started with the use of a risk assessment about possible fatigue and preparation for duty. Fatigue was then defined:

“What do we mean by fatigue? – A state of weariness that can result from prolonged working, heavy workload, insufficient rest and inadequate sleep” (ORR, 2012).

Following this, the importance of a company policy and management guidelines were presented as was the importance of individual responsibility for rest, sleep and other external factors. This led to

information about sleep (why we need it; how much is necessary; the consequences of sleep deprivation; and ways to have appropriate sleep). The next part of the training introduced other factors which cause fatigue (e.g. time of day; workload; prolonged work; illness; inadequate rest breaks; lifestyle – such as a poor diet and lack of exercise). Stages of fatigue were then discussed, and this provided an opportunity for individuals to describe the symptoms they experience when fatigued. While prevention of fatigue was seen as the key message, it was also acknowledged that there might be occasions when countermeasures (e.g. taking a break; ingestion of caffeine; and napping) may be needed. Participants were then reminded that the effects of fatigue do not disappear once the shift has ended. Night workers are seven times more likely to be involved in a road traffic accident. At this point, participants were asked about personal experiences of fatigue influencing their drive to and from work. Fatigue can have a large effect on work-life balance, and this was discussed next with participants suggesting what they should do to create a regime of good sleep hygiene and developing lifestyles that led to wellbeing at home and work. The company commitment to providing a working environment for its staff where fatigue levels are managed to a level that is as low as reasonably practicable was then presented. This will be achieved by:

- Providing all safety critical staff and their managers with education on fatigue, its effects, causes and support measures.
- Continuing to conduct research to identify and understand the causes of fatigue and methods of preventing and/or reducing its effect.
- Introducing a procedure designed to monitor and manage fatigue and risk levels in employees which can be further developed as the information obtained from research becomes available.
- Ensuring all base rosters are subject to assessment via suitable software to warrant that a fatigue threshold is not breached.

The final part of the presentation put prevention and management of fatigue into the overall company strategy:

“By working as partners with a shared responsibility we will improve the welfare and working environment for all our staff, leading to improved performance with increased customer satisfaction and a potential growth in customer numbers due to an enhanced company reputation. Our people are at the centre of the strategy and vital to the success of the business.”

Feedback and evaluation forms were completed at the end of the training session and then by an online survey completed three months after the fatigue training had been given.

Results

Feedback about the course was collected from over 200 train drivers. Over 70% scored the fatigue section of STUD as “very good” or “excellent”. Of those who answered the question “Describe the key elements, from this session, you feel will be of most importance to you in your role as an Arriva Trains Wales driver” (N=144), 40% have identified fatigue. The following comments identify the positive views associated with the fatigue training:

“Video seeing rail workers discussing fatigue”.

“Fatigue awareness. Explanations of why fatigue occurs.”

“Learning of ways to cope with fatigue”.

“Fatigue and how to overcome it”.

“Fatigue – to see the company’s point of view”.

“Receiving information on fatigue awareness and being informed of the best ways to deal with stress and fatigue. This will give me a better plan for future shift-work”.

“Handling fatigue – relevant to everyday duties”.

“Sleeping patterns reminder”.

“Fatigue. We have to deal with it on a regular basis in our job”.

“Fatigue awareness because of the risk of an incident”.

“Fatigue awareness, as I try and work early shifts”.

“Fatigue, very interesting, very useful”.

There was some negative feedback about the course and also some constructive criticism. One of the trainers summarised the view of some groups as:

“They have heard it all before and nothing will change. It is shiftwork and we get on with it”.

“How can they tell us about fatigue when certain diagrams [schedules] are now extended more into the early hours and finish later”.

“I’ll believe it when I see it attitude”.

“Not having the company policy signed off and therefore not being able to use this as reference did make things a little more trying. There is now some expectation that the company will introduce positive steps to reduce fatigue through review of diagrams and links etc.”.

In summary, the fatigue education was received fairly well but there was also a feeling that it needs to be backed up with some action from the company and that fatigue needs to remain high on the agenda.

Discussion

This article aims to trace the development of fatigue training in a UK train operating company. The need for this was initially demonstrated by conducting a large-scale survey and identifying the prevalence of fatigue, risk factors for it, and the consequences of it. Training was identified as an appropriate vehicle to prevent and manage fatigue. One reason for this was that training forms a large part of health and safety of rail crew and the infrastructure for providing such a course (e.g. trainers; allocation of time for courses) is already in place. Consideration of fatigue training in other groups (e.g. patients) has shown that there is more to training than education. Even the education component needs to be presented in a way that leads to engagement by the participants. Indeed, previous communications about fatigue using leaflets appeared to have little success. Pilot assessment of a fatigue video suggests that this was a suitable form although some comments suggested that it should be more specifically related to the jobs of rail staff. This was achieved by getting rail safety representatives and union staff to discuss fatigue-related issues and by including clips of these discussions at the relevant points in the training.

It was also found that it was important for participants to think about their own personal experiences and methods they have used to prevent and manage fatigue. This was quite difficult for the trainers to achieve because most courses do tend to advocate a ‘one size fits all’ approach. The variation in the jobs of categories of rail staff is very apparent. For example, train drivers may be on a mainline route, a local service or even a route with a very short turnaround time. The causes of fatigue on these different routes may be very different and may require detailed consideration of the impact of working hours, workload and even boredom. Unfortunately, discussions about fatigue often focus on specific issues such as shift-work and breaks. A more holistic approach must consider factors outside of work, and the issue of work-life balance is a topic that needs further consideration in training courses. Fatigue does not go away when a person leaves work; similarly, fatigue due to lifestyle may influence the extent to which a worker is fit for duty. These both represent effects of acute fatigue, but research has shown that chronic fatigue will also impair well-being and lead to chronic health problems. Again, these chronic effects of fatigue probably need greater emphasis in the training course.

The fatigue training course can become an important element of an overall fatigue policy. Further developments are necessary and a fatigue risk management system is something that is continuously improving over time. One area that will be developed is the assessment of the impact of the courses. At the moment there is a focus on satisfaction and perceived utility but in the future it will be possible to look at more objective indicators. Another planned development will be training for those who have to manage fatigue. Some of the frustration of the participants was based on the lack of integration of the fatigue training with other aspects of the policy (e.g. working schedules and breaks). Indeed, as pointed out in the introduction, focusing on training/education without a wider set of measures being implemented is not the best way forward. The final point is to put the fatigue training in a much wider context. Discussion with other train operating companies has shown that fatigue training is now a 'must have' part of fatigue prevention and management. The aim now is to disseminate the knowledge gained in developing the course to these companies. However, one must also remember that the UK rail industry has other parts than the passenger train services. The freight train industry and Network Rail appear to also have bigger issues with fatigue, and the training developed here should be applied in all sectors with the aim of improving the health, safety and wellbeing of UK rail staff.

Acknowledgement

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