SEAFARERS’ FATIGUE: CONCLUSIONS AND THE WAY FORWARD

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The present paper will present some of the main conclusions from our recent programme on seafarers’ fatigue. Different sectors of the industry experience fatigue for different reasons. The crew of fishing vessels often report excessive fatigue due to long working hours and the physical conditions associated with the job. A second cause of fatigue is the rapid port turnarounds that have to be made by ships transporting dry cargo between ports in Europe. Similar problems occur in other transport sectors and another of our surveys showed that drivers who made the most deliveries reported the greatest fatigue in the road haulage sector. Other causes of fatigue may also occur (e.g. travelling to the ship). Recommendations are given about possible ways to prevent and manage fatigue. Given the variety of causes and consequences of fatigue, it is unlikely that a “one size fits all” approach will be successful and it will be necessary to address fatigue using several different approaches.

A Review of Seafarers’ Fatigue

The potential for fatigue at sea

Global concern with the extent of seafarer fatigue is widely evident everywhere in the shipping industry. Maritime regulators, ship owners, trade unions and P & I clubs are all alert to the fact that in some ship types, a combination of minimal manning, sequences of rapid turnarounds and short sea passages, adverse weather and traffic conditions, may find seafarers working long hours and with insufficient recuperative rest (Smith, Allen and Wadsworth, 2006). A holistic view is needed of the effects of stress and health factors associated with long periods away from home, limited communication and consistently high...
work loads on seafarers. In these circumstances fatigue and reduced performance may lead to environmental damage, ill-health and reduced life-span among highly skilled seafarers who are in short supply (Smith, 2007). A long history of research into working hours and conditions and their performance effects in process industries, road transport and civil aviation, where safety is a primary concern, could be usefully compared to the situation in commercial shipping (Allen, Wadsworth and Smith, in press,a).

The fatigue process
Fatigue is best viewed as a process and one should assess factors that induce fatigue, perceptions of fatigue and the outcomes that are associated with fatigue. These outcomes may influence both health and safety and it is crucial that occupational fatigue is viewed as a major health and safety issue. Indeed, there has been considerable research on fatigue at work and onshore studies show that as many as 20% of the working population experience symptoms that would fall into the category of extreme fatigue (Smith, 2007). Many of the established risk factors for fatigue are clearly relevant for seafarers: lack of sleep, poor quality sleep, long working hours, working at times of low alertness (e.g. the early hours of the morning), prolonged work, insufficient rest between work periods, excessive workload, noise and vibration, motion, medical conditions and acute illnesses. Many of these problems reflect organisational factors such as manning levels or the use of fatigue-inducing shift systems. It is often the combination of risk factors that leads to impaired performance and reduced well-being and few would deny that seafarers are exposed to such high risk combinations (Wadsworth et al., in press).

Effects of fatigue on health and safety
Seafaring is a global, safety critical industry in which the potential consequences of fatigue at work are huge. Indeed, fatigue has been identified as a cause or contributory factor in accidents (Raby and McCallum, 1997) and impaired collision risk awareness (Wellens et al., 2005) at sea over many years, and it is clear that the relationships between fatigue and human error, and consequent safety and health, are crucial in seafaring. The health risks associated with fatigue are well established in onshore populations and there is no reason to believe that such associations do not occur in seafarers, although information on this topic is limited (e.g. Wadsworth et al., in press) and further research is required.

Risk factors for fatigue and the prevalence of fatigue
Surveys have shown that risk factors for fatigue at sea are frequently present, as are reports of perceived fatigue. An ITF report (1997), based on responses from 2,500 seafarers of 60 nationalities, serving under 63 flags, demonstrates the extent of excessive hours and fatigue within the industry. Almost two-thirds of the respondents stated that their average working hours were more than 60 hours per week and 25% reporting working more than 80 hours a week (42% of masters). In addition, 36% of the sample were unable to regularly obtain 10 hours rest in every 24, and 18% regularly unable to obtain a minimum of 6 hours uninterrupted rest. Long periods of continuous watch keeping were also reported, with 17% stating that their watch regularly exceeded 12 hours. Over half the sample (55%) considered that their working hours presented a danger to health and safety. Respondents also provided a wide range of examples of incidents that they considered to be a direct result of fatigue. The early hours of the morning were the most difficult in terms of feeling the effects of fatigue and it is important that safe manning assessments, watch systems and procedures reflect the potential decline in individual performance at these times. More than 80% of the sample reported that fatigue
increased with the length of the tour of duty. Long tours of duty were also common (30% reporting usual tour lengths of 26 weeks or above). This cumulative fatigue may also reflect the reduction in opportunities for rest and relaxation ashore, due to the reduced port turn-around times now required.

Our recent survey (Wadsworth et al., in press) has shown that fatigue is still a major issue offshore and that about 30% of seafarers report that they are very fatigued. Fatigue may be present during work, after work and may even extend into the person’s leave. Fatigue-related symptoms such as loss of concentration are widespread and these have implications for safety. Indeed, about 25% of respondents reported fatigue while on watch, many reported that they had fallen asleep while on watch, and 50% of the sample reported that fatigue leads to reduced collision awareness. The results have confirmed that there are a number of risk factors for fatigue: tour length, sleep quality, environmental factors and job demands were associated with all of the measures of fatigue. Hours of work, nature of shift, and port frequency/turnaround times were associated with fatigue at work. The likelihood of reporting fatigue and impaired health increases as a function of the number of risk factors a person is exposed to (e.g. 1-2 factors doubles the risk of being highly fatigued but 7 or 8 factors increases the risk 30 times). Diary data confirm results from the survey, as does research from New Zealand (Gander, 2005).

**Fatigue reported by the crew of fishing vessels**

The crew of fishing vessels often report excessive fatigue due to long working hours and the physical conditions associated with the job. In a small survey of 81 fishermen we have confirmed that fatigue is a major problem in the fishing industry. For example, nearly a third (n=25, 31%) considered their working hours a danger to their own health and safety, and a quarter (n=20, 26%) considered their working hours a danger to safe operations onboard. Most of the fishermen (n=61, 81%) felt that the effects of fatigue increased the longer they were at sea, and 60% (n=48) said their personal safety had been at risk because of fatigue at work. Thirteen (16%) had been involved in a fatigue related accident, 36 (44%) said they had worked to the point of collapse, 33 (41%) had fallen asleep at the wheel, and 34 (43%) had been so tired they had slept on deck or in the gangway (Smith, Allen and Wadsworth, 2006).

**Fatigue induced by rapid port turnarounds**

A case study presented from research onboard a mini-bulker illustrated a number of factors which may be critical when trying to account for fatigue on this class of vessel. Whilst the case study highlights that working hours are justifiably considered a key area of concern when addressing fatigue across all ship types, on certain vessels it may be more profitable to consider the challenging issue of crewing in terms of strategically covering for the disparate demands of port and sea work within a competitive market. Evidence from this case study suggests that ship owners may be inclined (and authorised) to favour leaner ‘open-sailing’ crewing arrangements which inevitably struggle to cope when faced with demanding port turnarounds. A comparison of seafarers and a small sample of road haulage drivers showed some interesting similarities in terms of risk factors for fatigue. Among the seafarers number of port turnarounds was related to fatigue and a similar trend was seen for the drivers, where those who made the most deliveries were more fatigued. This suggests that lorry drivers and seafarers show parallel trends in terms of fatigue and that fatigue can be observed in contexts which are to some extent operationally comparable (Smith, Allen and Wadsworth, 2006).
Prevention and management of fatigue

Given the diversity of activities undertaken in the maritime sector, and the different profiles of fatigue risk factors in different work groups, it is clear that a range of strategies will be needed to deal with fatigue (see Allen, Wadsworth and Smith, in press, b). The International Maritime Organisation has issued guidance material for fatigue mitigation and management but voted against making fatigue education mandatory. Convention 180 of the International Labour Organisation requires that States fix maximum limits for hours of work or minimum rest periods on ships flying their flags. There is a high degree of agreement among prescriptive regimes with regard to minimum rest requirements. They are generally consistent with current scientific understanding about the sleep required, on average, for people to continue to function at a reasonable level.

Problems with existing legislation and guidance
Two studies from the Cardiff research programme suggest that the legislation aimed at preventing fatigue at sea is not particularly effective. The first examined the impact of the Working Time Directive and the second evaluated the IMO fatigue guidelines. With regard to the Working Time Directive, it was clear from the survey data that excessive working hours and inadequate periods of rest are still problematic onboard a range of vessels. Furthermore, hours are likely to be under-recorded, either by management, or by individual seafarers wary of jeopardising their employment by bringing their company under legislative scrutiny. Another paper from the Cardiff programme evaluated the IMO guidelines on fatigue. It concluded that lengthy, all inclusive guidelines are no substitute for specific and implementable recommendations. Other reports have also evaluated possible methods of preventing and managing fatigue at sea. Houtman et al. (2005) found that the measures that were considered most necessary and effective in reducing fatigue were: proper implementation of the ISM-Code; optimising the organisation of work on board vessels; lengthening of the rest period; and reducing administrative tasks on board vessels.

Conclusions

The evidence for fatigue at sea
The first conclusion from this review is that the potential for seafarers’ fatigue is high. An evaluation of the fatigue process shows that seafarers are exposed to many risk factors for fatigue, often report extreme fatigue and may have impaired performance, well-being and health due to fatigue. This statement is supported by a number of studies from different countries, using different samples and methods to evaluate the topic.

Current legislation and guidance is not working
The second conclusion is that current legislation and guidance on fatigue does not appear to have had the desired effect across the industry. One approach to improving the situation is to keep but improve on the current approaches to fatigue (e.g. improve guidance; better enforcement of working time directives).

The way forward
What is obvious from the present review is that fatigue is a health and safety issue. It should be tackled using standard approaches (e.g. appropriate training given; audits etc) and any increased risk dealt with in a similar way to other breaches of health and safety. Industry wide, cultural change is needed to address fatigue. There will always be the debate as to whether legislation or codes of practice are most appropriate for this area.
One approach would be that fatigue policies must be globally in place and that these would be penalised if minimum standards were not met and rewarded if additional desirable features were included. The aim, therefore, would be to have an evolving move towards “best practice” in fatigue prevention and management. The complementary approach is to remove the “worst case” scenarios and “at risk” vessels, such as the minibulkers, have been identified as those which need to change manning levels and shift patterns. Fatigue is a complex issue and its prevention and management may require a number of different approaches. The first stage of dealing with fatigue is to get the relevant people to acknowledge that there is a problem to address. The evidence base for this view is strong and has been developed by multi-disciplinary research studying a wide variety of ships in different countries. A second step is to discuss fatigue and how it is influenced by organisational practices and individual factors. Fatigue awareness training and the development of measures to identify fatigue and counter it are becoming common place in other transport sectors and may be a useful part in any package developed to prevent and manage fatigue at sea. However, their efficacy needs to be evaluated. Future research should, therefore, not be restricted to demonstrating that fatigue exists but be concerned with evaluation of methods of preventing and managing seafarers’ fatigue.

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