Tenth International Conference on Managing Fatigue: Abstract for Review

“Managing drowsy driving risk using information-rich data from fatigue detection systems”

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Problem

The availability of fatigue detection data is relatively new, having arisen from the development of fatigue detection systems by several commercial organisations. The high volume of data, and the possibility of correlating it with other measures (geolocation, vehicle telematics, shift rostering, etc) to create multi-dimensional data sets offers the prospect of better understanding the effects of fatigue at both population and individual levels, the ability to use the data to measure and improve operational safety, as well as positively influence safety and regulatory legislation and guidelines.

Method

Drowsiness data was collated from several fleets of vehicles using Optalert’s Eagle drowsiness detection systems in multiple geographical locations (Australia, Africa, South America) over the course of 3-6mths. This record set amounted to several million data points containing timestamps, vehicle and driver identifying information, and drowsiness level as measured by the Johns Drowsiness Scale (JDS). The data was de-identified prior to statistical analysis.

Results

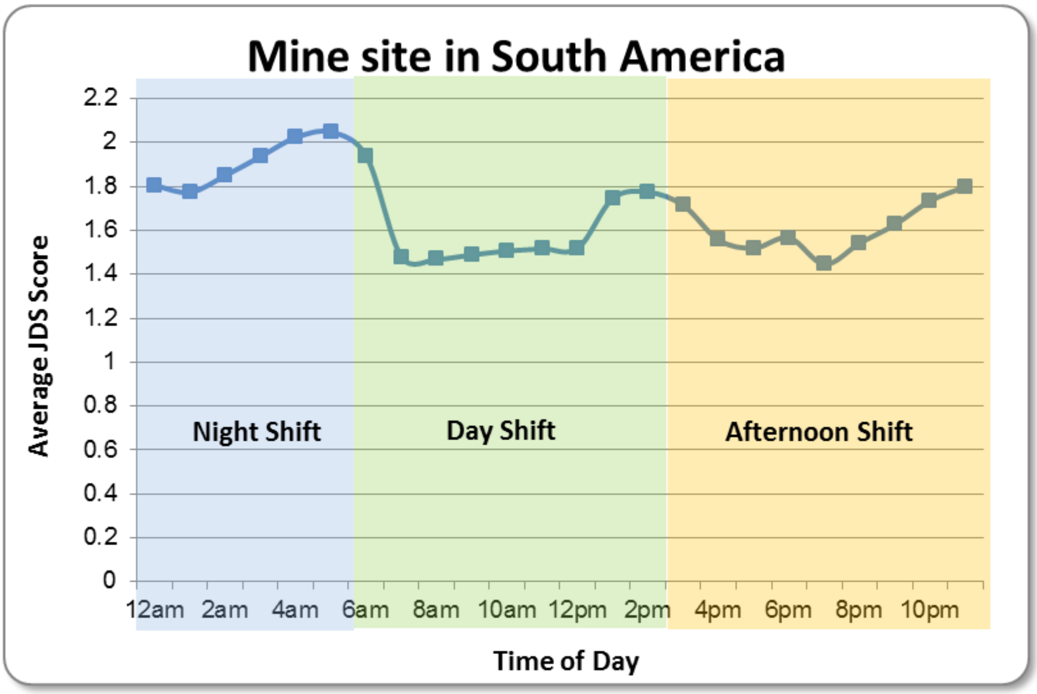
Time-of-day (circadian) effects were visible in the data, as well as similarities and differences across timezones. Shift-related data showed those operators working at night had significantly higher average JDS scores and higher frequency of Medium Risk and High Risk Warnings (drowsiness scores associated with high relative risk of performance failure) than operators on day shifts. Examination of data recorded on days prior to and after shift changes (Day-to-Night, and Night-to-Day) showed increased levels of drowsiness compared to days in the middle of shift rotations (continuity of shift pattern). Time-on-shift effects were also evident showing an increase in drowsiness towards the end of shift rotations.
Geolocation data showed “hotspots” of fatigue which were associated with time-of-day, shift type (Day vs Night) and time-on-shift, as well as operational characteristics of mine sites, such as slow and monotonous sections of haul roads.

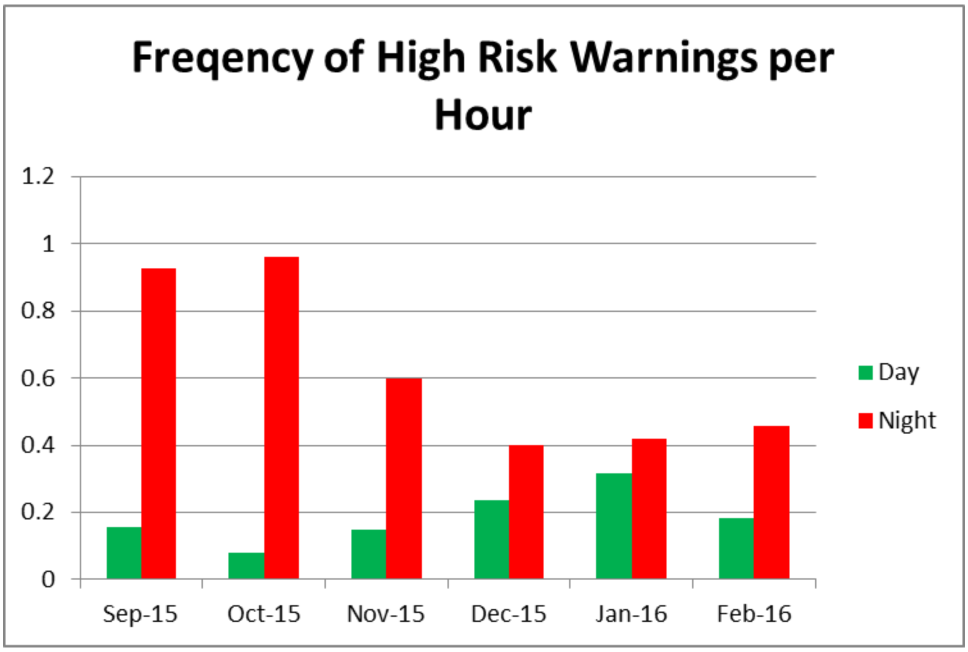
Discussion

Circadian and shift-related data revealed expected patterns of higher risk of drowsiness-related incidents at night, particularly during the early hours of the morning (typically 2am-6am). The shift-change and time-on-shift data also showed patterns of higher risk that were consistent with known effects of shift work on fatigue.The geolocation data revealed epochs of high risk fatigue levels in various locations and times-of-day. All of these types of analyses could be used to improve decision-making for mining and road transport planning and operations, and allow better management of periods and locations of highest risk to improve overall operational safety. The ability to identify geographical "fatigue hotspots" may be of significant interest to regulators of public roads and road safety organisations. Future analysis of this type of fatigue-detection data could examine if fatigue levels between different shift rosters exist, with a view to informing shift-roster design or identifying optimal shift patterns to help mitigate against fatigue.

Summary

The data available from fatigue detection systems, like other forms of data generated by human interaction with technology, is rich and multi-dimensional, especially when captured during the course of normal everyday human activities (naturistically). This data, in concert with knowledge from fatigue practitioners, offers the possibility of a greater level of insight into the real-world application of fatigue management and the understanding of how human operators behave and react to fatigue in complex environments.




Freqency of High Risk Warnings per Hour
1.2
1
0.8
0.6
0.4
0.2
0
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Day
Night