Fatigue in Offshore Oil and Gas Workers

Fatigue in workers is a critical occupational hazard that has serious ramifications in terms of safety, disrupted productivity and economic losses estimated to be $18 billion every year. Workers in the oil and gas industry are typically exposed to long work durations, intense physical and mental workload and exertion and intensive shift patterns, and it was reported that from 2003 to 2014 the annual fatality rate of oil and gas workers was seven times higher than that for all other U.S. workers. Fatigue is multifaceted with the physiological implication of reduced mental and physical capability as a result of sleep problems, circadian phases, cognitive and physical workload. The far-reaching implications of fatigue have warranted considerable interest in the investigation of this problem in the industry however, there continues to exists areas which require empirical research to provide support to guidelines to reduce the impact of fatigue in the industry.

The Ocean Energy Safety Institute facilitated a pioneering collaboration between an Offshore Drilling Company, The Mary Kay O’Connor Process Safety Center, the Texas A&M University School of Public Health, The Center for Remote Health Technologies and Systems, and the Department of Environmental and Occupational Health at Texas A&M University. to study the physiological impact of fatigue and assess the subjective and objective methods of assessing fatigue by facilitating a field based study involving researchers engaged in a data gathering effort with oil and gas workers on a Deepwater drill ship in the Gulf of Mexico. The project involved operators onboard the drill ship recruited using a protocol approved by the Texas A&M University’s Institutional Review Board. Ten operators were recruited who participated in the data gathering effort. Various tools were employed including physiological monitoring (EQ02 LifeMonitor, EquivitalTM, Cambridge, UK) capable of logging data including as electrocardiography, respiratory inductance plethysmography, posture/activity, and skin temperature collected at 250 Hz. The operators were instrumented with the sensors using a sensor belt worn across the chest and deployed at the start of the 12 hour shift and returned at the end of the shift. In addition the operators completed several paper-based questionnaires available in the fatigue literature. These include the Swedish Occupation Fatigue Inventory (SOFI), Occupational fatigue Exhaustion Recovery (OFER), Fatigue related symptoms Questionnaire (F-RSQ) and the Fatigue Scale (FAS). Also an additional questionnaire on working environment was administered.
The study found that physiological responses were higher during ambulatory activities as compared to stationary activities and found significant difference in the maximum heart rate for the day and night early in the hitch. Further the maximum ambulatory heart rate generally increased over the hitch. Correlation analysis performed to identify whether the indicators of fatigue across objective and subjective methods measured operator fatigue similarly. It was found that except for the physical discomfort sub-scale from SOFI, none of the other fatigue scales, or work –risk factor surveys were significantly correlated with the HR Variables.

These findings, while exploratory and preliminary, highlight an important gap that an oil and gas industry specific fatigue assessment method is needed which is validated with physiological outcomes of fatigue. In addition a separate literature review identified gaps in fatigue research that include:

- Understanding the effect of offshore work schedules (including overtime and irregular work patterns on fatigue, acute and chronic health of the workers)
- Effect of fatigue on performance, and the specific effects of physical and cognitive load on fatigue
- Translational research to develop and test fatigue mitigation and interventions.

Papers and reports:
Human factors and Ergonomics in Offshore Drilling and Production: The implications for Drilling safety, Ocean Energy Safety Institute, December 2016

Figure: Maximum ambulatory HR by Time of first shift (Day/Night earlier in hitch), Time of second shift (Day/Night later in hitch), and change during the hitch (Earlier/Later). Error bars represent the standard error of the mean. N = 10. (Mehta et al, 2017)