

Identification of Emergency Medicine Fatigue At-Risk Periods Using Actigraphy and Computer Modeling: A Pilot Study

PURPOSE

Medical error is the third leading cause of death in the United States. An Institute of Medicine publication on resident duty hours stated, “the science on sleep and human performance is clear that fatigue makes errors more likely to occur” (2).

However, the incidence and severity of Emergency Department (ED) resident fatigue is unclear.

The objective of this study was to identify, using a commercially available actigraphy and computer software, the occurrence of less than optimal resident effectiveness (marker of fatigue) during typical clinical rotation shifts in the ED.

METHODS

This was a prospective pilot study of 5, second year Emergency Medicine residents during a typical one-month clinical rotation at an academic ED. Residents were issued a wrist actigraph device (ReadiBand™, Fatigue Science) which they wore continuously for one month. Residents worked a typical variety of shifts during the month.

METHODS (cont)

At the end of the month, data was downloaded from the devices and analyzed using Sleep Activity and Task Effectiveness (SAFTE™, Fatigue Science) software. The software analyzes the amount and quality of sleep and includes factors for circadian rhythms, sleep-reservoir and sleep-inertia, then calculates the mental effectiveness (fatigue level).

Ideally effectiveness should be greater than 90%. As effectiveness drops below 80%, the risk of making errors increases. An effectiveness of 70% is similar to an individual with a blood alcohol of 0.08%.

RESULTS

Overall effectiveness for the 5 residents’ during the rotation was greater than 80% (range 88 to 96%).

All residents had intervals of effectiveness in the 70 to 80% (range 3.4 to 10.5% of the rotation)

Four of the 5 residents had intervals of effectiveness dropping below 70% (range 0.8 to 3.8% of the rotation).

Effectiveness frequently dropped below 80% and neared 70% especially for shifts ending at 3 AM. (Figure)

CONCLUSIONS AND CLINICAL IMPLICATIONS

This pilot study demonstrates the real time effectiveness (fatigue) of residents during typical clinical shifts in the ED as measured by a wearable actigraph device and calculated by commercially available software.

Decreased effectiveness (below 80%), and the potential increase for errors, occurred in all 5 residents at some point during clinical shifts.

Decreased effectiveness is an issue with our current method of scheduling EM residents during their ED rotation.

Opportunities to improve the level of effectiveness may exist through changes in shift scheduling and/or optimizing sleep patterns.

This data and potential changes to maximize effectiveness may also be beneficial in the scheduling of practicing emergency physicians and other shift workers.

References

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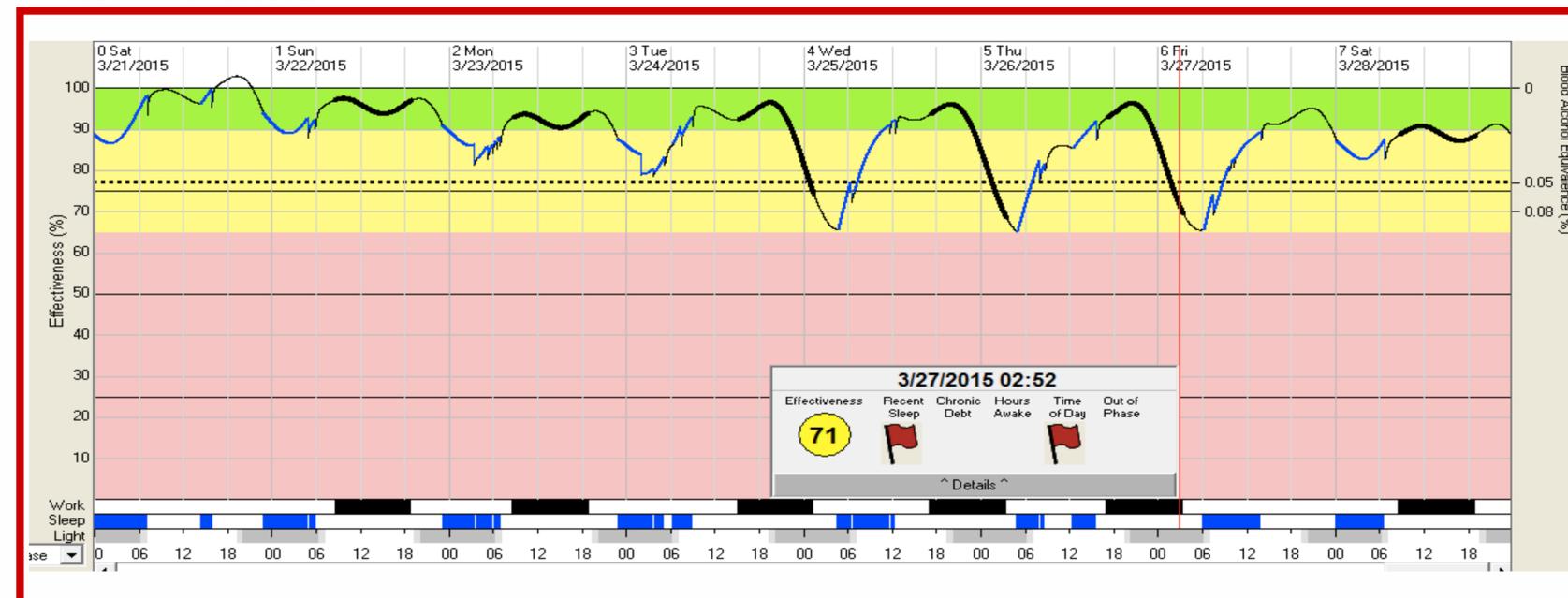


Figure: Example percent effectiveness graph from one resident for one week