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# Current Research in Gynecology and Obstetrics (CRGO)

Volume 1 Issue 1, 2020

## Article Information

Received date: May 27, 2020

Published date: June 11, 2020

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## Keywords

Actigraphy; Sleep Medicine; Fatigue

## Mini Review

# Optimizing Sleep/Wake Related Cognitive Efficacy in Laborist Paradigms

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## Abstract

Workload and schedule optimization has been the subject of numerous studies in surgery, emergency medicine, and resident education literature. No studies have been done to evaluate the role of fatigue and cognitive efficacy in the neophyte laborist specialty, though increasing patient safety is an underlying assumption of this model of care. Using a validated actigraphy based wristband, Readiband, and its proprietary analysis algorithm, SAFTE (sleep, activity, fatigue, and task effectiveness), we attempted to quantify cognitive efficacy of laborists during three types of shifts, patterns of efficacy through different rotations of the schedule, and the impact consecutive night shifts on fatigue. After a targeted fatigue avoidance education session, data were collected again. Patterns of improved efficacy and sleep efficiency emerged, which may have implications for designing ideal laborist scheduling and workflow.

## Introduction

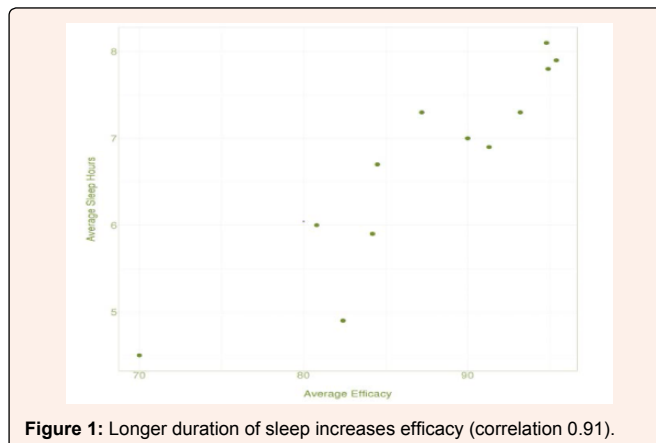
Workload and schedule optimization have been studied in surgery, emergency medicine, and resident education, but not in the laborist model. Scheduling to mitigate fatigue and optimize performance is a major tenet of laborist care, but has not been well evaluated. Laborist models, a variant of hospitalist medicine on labor and delivery units, are designed to ensure timely, focused intrapartum care. One of the underlying tenets is that laborists are alert and focused throughout their shifts. This study was designed as a pilot to describe the relationship between physician efficacy and both sleep and shift patterns using actigraphy. Actigraphy measures activity, sleep quantity, and sleep quality, and is endorsed by the American Academy of Sleep Medicine for use in research [1]. Readiband, an FDA-approved actigraph, and its proprietary analysis algorithm, SAFTE (sleep, activity, fatigue, and task effectiveness), allows validated analysis of sleep patterns and resultant efficacy [2,3]. This methodology has been used in military combat, professional sports, and orthopedic surgery resident research [4], but not in high acuity medical settings (Figure 1).

## Methods

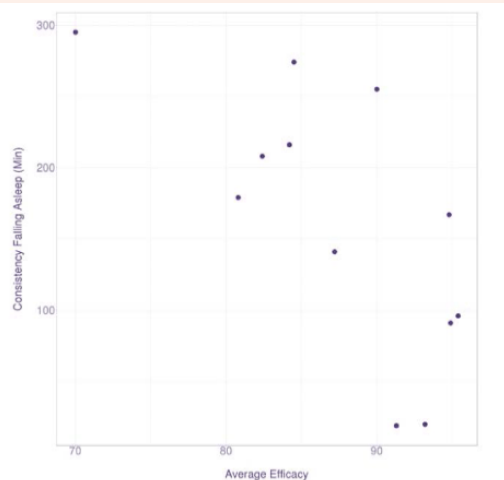
A ten-physician laborist group wore actigraphs continuously for three weeks. IRB approval was obtained and informed consent signed. Fatigue avoidance education was provided, followed by two additional weeks of data collection. Efficacy scores (a proprietary aggregate performance measure of sleep quality, sleep quantity, and overall activity level over time) were calculated and categorized by sleep and shift patterns. Data were plotted by sleep duration, variance in timing of onset of sleep, and variance in timing of waking against efficacy scores [5-9] (Figure 2).

## Results

Results fell into anticipated patterns. Longer mean sleep duration was highly correlated with higher mean efficacy (correlation coefficient 0.91). Lower variance in onset of sleep and time of waking (that is, consistent sleep and waking times) was associated with higher efficacy (CC -0.69). Lower variance in both onset of sleep and time of waking was weakly associated with longer mean duration of sleep; e.g., physicians who were able to go to bed and awaken at a more consistent time also got more sleep (CC 0.58). Unanticipated schedule structure and cohort changes between collection times precluded analysis of the effect of fatigue avoidance education [10,11].



**Figure 1:** Longer duration of sleep increases efficacy (correlation 0.91).



**Figure 2:** A decrease in bedtime variance– i.e., consistent bedtime is associated with higher efficacy (correlation -0.69).

## Discussion

Laborist models are predicated upon providing awake, alert experts in obstetric care. This work begins to elucidate ways to maximize those efforts through strategic scheduling and fatigue avoidance. These data support structuring laborist shifts to minimize wide swings in sleep timing and improve both duration of sleep and efficacy, therefore supporting peak performance.

Strengths of this work include that it is a unique application of both an FDA-approved actigraph and its validated performance measure (rather than self-reported sleep) to hospitalist medicine. Participants were from a single institution, thus subject to the same schedules. Weaknesses include a lack of heterogeneity of providers and schedules given the single institution, schedule and staffing revisions obviated evaluating the effect of fatigue education; and the sample size was small. Quality and safety of laborist models may be bolstered by careful scheduling to decrease sleep variance and minimize sleep deficit. Larger studies with quality data from actigraphy may clarify best practices.

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