

# How to Objectively Measure The Quality of Sleep

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Sleep is of paramount importance for resetting brain and body function. While newborns tend to sleep most of their day hours, geriatric population often suffers of lack of enough sleep. Most of the people will subjectively complain about their sleep, at least at one point in their life. While life requirements and schedule might play a major aspect in this, other sleep disorders should be ruled out. There is thus a need to use objective measures to better assess sleep quality and quantity. We will briefly review some of the most interesting modalities in our opinion.

**Actigraphy** is the most simple but still quite informative equipment. During sleep we tend to move less than awake; thus, by measuring the sequences of lengths of intervals that lack movement, in addition to the breath, we could grasp quite a lot of information about duration and frequency of our sleep.

**Heart rate variability (HRV)** is a simple and powerful stress quantifier, both in acute and chronic situations. Sympatho-vagal balance is perfectly described by the relative amount of low and high frequency components in the HRV spectrum<sup>1</sup>. Thus, a low or impaired HRV signifies high risk of cardiovascular complications and even elevated risk of death. It can be impaired in individuals with insomnia and those having obstructive sleep apnea.

A bit more invasive requiring blood samples, **hormone deconvolution** assess the nano-metric pituitary secretion driving the hormone feedback

loops<sup>2</sup>. For example, growth hormone (GH) peaks are known to be synchronous with dreams at about 90 minutes interval, especially during the slow wave sleep, with few minute delay. However, with sleep deprivation, females, older individuals and those struggling with psychiatric disorders, this might be less observed. Other hormone level measurements can similarly provide valuable information about sleep.

Central nervous system analysis via electroencephalogram or **Near Infra Red Spectra** (NIRS; Magnetoencephalograms and functional Magnetic Resonance Imaging seem out of ergonomy) looks a bit less comfortable<sup>3</sup>. Coherence among different brain areas activation is quite helpful in describing our unconscious behavior. In particular, NIRS is a modality to measure the cerebral hemodynamic properties through assessing oxygenation state of the haemoglobin. This latter measure has been correlated to the cerebral blood flow and its oxygen metabolic rate. During sleep, an increased oxygenation level was found during rapid eye movement stage (REM) compared to a decrease during slow wave stage.

Such a simple battery of consolidated tools, in addition to the standard qualitative and quantitative observation (not discussed here), could be of great help in better objectively assessing sleep. This in turn can help in better diagnosing and even monitoring therapy modalities for sleep disorders.

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