



Checklist:

Essential
Questions for
DHT Vendor
Selection

CORE MEASURES *of* SLEEP



Digital Measures Development

<https://dataacc.dimesociety.org/core-measures-sleep/>



*Digital Health Measurement
Collaborative Community*



What should I ask a DHT vendor?



What is your method of sleep monitoring, and which signals are being recorded and used?

Different technologies can estimate sleep staging using data collected from different sensor-based sources (e.g., EEG, actigraphy, ballistocardiography, etc.). Each technology type has different properties that impact the estimation of sleep staging. Understanding the technology used to collect the data and its strengths and limitations is important for later interpretation of, and confidence in, the arising results.

What granularity of sleep data do you estimate?

The estimations of sleep staging are at the heart of the Core Digital Measures of Sleep. The Core Measures: Sleep Measurement System provides three levels of sleep staging, from coarse grain awake vs asleep, to fine grain N1-N3 and REM staging. The needs will vary based on the context of use and research question employed, so it is important to know the resolution of sleep stage estimation.



What should I ask a DHT vendor?



What is the epoch length for sleep annotations?

Different technologies interpret sleep staging and other sleep events at different time intervals called epochs. Polysomnography uses 30-second epochs, but digital health technologies (DHTs) may have a different resolution. Although a fine resolution can be more sensitive, increased sensitivity isn't necessary for all purposes. It is important to know what epoch length the selected DHT uses, as it informs the interpretation of the results and comparability to other existing research.

What thresholds have you set for confirming events (e.g., sleep onset, sleep offset, etc.)?

When following the Core Measures: Sleep Measurement System, it is important to be able to detail the certainty in the data. For example, if an individual is recorded as asleep for a single 30-second epoch, is this length of time enough to be confident that they were asleep? Instead, several epochs estimating sleep may be more appropriate before determining that the individual has reliably achieved sleep. Asking the vendor what rules they have in place for all relevant variables is an important step for future interpretation of results.

What should I ask a DHT vendor?



What level of data do you transmit to clients?

Some DHT providers offer epoch level data. Others provide summary data. Summary data may already be labelled in line with the core measures (such as “wake after sleep onset” or “total sleep time”). To align with the Core Digital Measures of Sleep, epoch level data is preferable. This data can be used alongside the Core Measures: Sleep Measurement System to both define the Core Digital Measures of Sleep, and other measures that may be pertinent to the research question and study under development.

While being provided with summary data is not an issue, there are limitations to the further analysis that can be conducted with summary data. For example, it limits comparison between two measurement systems. In addition, it is important to understand how the summary data is created and the similarity to the definitions laid out in the Core Digital Measures of Sleep. If a provider offers summary data it is important to ask them for descriptions of the estimation process to derive the summary data and assess whether this is in line with the Core Digital Measures of Sleep.



What should I ask a DHT vendor?



Are your algorithms run along with signal recording or as a post-processing?

Some technologies estimate sleep continuously. Others estimate sleep during defined “rest periods”. Depending on the study needs can be an important consideration (for example detecting typical sleep versus narcoleptic episodes)

What evidence do you have in support of your algorithms for sleep staging?

Sleep staging algorithms are often proprietary by nature. This is not an issue, but evidence for the validity and reliability of the estimated sleep stages is important to have confidence in the results arising from the use of the technology.

A vendor should be able to provide evidence, which could include peer-reviewed manuscripts. However, a wealth of information can be found in the technical documentation the vendor provides. Where conference abstracts exist, they may be able to share further information for inclusion into, for example, regulatory documents.