

## **Medibio's Advanced Analytics Cloud Solution Breaks New Ground in Sleep Analysis**

- **Successfully completed initial sleep staging and validation**
- **Breakthrough achieving accuracy of 86-95% for sleep staging using ECG data**
- **Significant development potential for US\$4B sleep test market**
- **Validated using approximately 13,000 hours of ECG files from Johns Hopkins**
- **Compares favourably all previously published results which were in the 70% range**
- **Expected to increase accuracy of depression diagnostics algorithm as well as potentially open a new business opportunity in the area of Home Sleep Monitoring**
- **Demonstration of the power of Medibio's advanced machine learning solution when combined with its large proprietary database of physiologic data**
- **Other collaborative validation work using research partner data is nearing completion**

Medibio Limited (ASX: MEB) ("Medibio" or the "Company") is pleased to announce that it has completed development and validation of a new sleep staging algorithm with the company achieving outstanding results. Using ECG data only Medibio has been able to accurately distinguish between the 5 stages of sleep with diagnostic accuracies of 86-95%. This compares favourably to the numerous previous attempts by researchers to accurately determine the sleep stages using ECG data only. The best published historical results have been in the 70% range for all 5 stages of sleep.

The project is part of the company's Collaborative research and development effort with four leading US universities announced on 14 March 2016. Under this collaboration Medibio secured in excess of 120,000 hours of overnight physiological (ECG, EEG and other biometrics) data files to be analysed by Medibio's Digital Mental Health Platform. This allows Medibio and its research partners to generate proxy-clinical trial outcomes and meta-data analyses from more than 15,000 patients retrospectively. The sleep staging results have been generated and validated using data supplied by the Johns Hopkins University School of Medicine.

Under the project Medibio used advanced machine learning techniques on a randomly selected set of 55,000 hours of overnight ECG files (with corresponding sleep staging information from Johns Hopkins) to develop an algorithm to use ECG data only to place the individual into one of the 5 sleep stages. This algorithm was validated using an additional 13,000 hours of randomly selected files. The sleep stages derived from the new ECG algorithm being validated against the sleep staging data from traditional PSG/EEG methods. The results are tabulated over the page.

### **5 min interval sleep stage classification**

Sleep Stage	Training sample size	Test sample size	Test Accuracy	Test F1-score
0	331,108	141,904	0.86	0.86
1	17,675	7,575	0.95	0.95
2	214,292	91,840	0.90	0.89
3	15,775	6,761	0.95	0.95
4	534	230	0.99	0.99
5	82,831	35,499	0.93	0.93

The prospect of automatic sleep stage classification with using cardiorespiratory signals has attracted increasing attention in medical research with numerous attempts being made to find a method to accurately sleep score using ECG data. In contrast to the traditional manual scoring based on polysomnography, ECG data can be measured using unobtrusive techniques promising the application for personal and continuous home sleep monitoring.

#### **Next Steps**

This is the first in a number of proxy clinical studies and research projects underway using more advanced machine learning techniques and Medibio's extensive data base. Existing algorithms for mental health will be improved by allowing Medibio to investigate new analytical metrics specific to sleep stages. In addition, the ability to accurately distinguish between sleep stages using only ECG data has significant commercial potential in its own right.

Medibio is currently in discussions with an international sleep clinic group to further validate Medibio's sleep staging breakthrough in a prospective study. This prospective study will open the opportunity for the company to commercialise this sleep staging algorithm as a stand-alone business opportunity in the area of home sleep monitoring and sleep clinics.

Medibio is continuing to build a broad base of collaborators to significantly increase its data assets. In combination with its advanced machine learning analytics cloud solution, this will allow the Company to extract new insights regarding the link between mental health and circadian heart-rate architecture.

#### **What is Sleep Staging and stand-alone Commercial Opportunities**

During sleep individuals pass through 5 stages of sleep typically from Stage 1, 2, 3, 4 to REM (stage 5) then begin again with Stage 1. The diagnosis of sleep disorders requires the determination of these sleep stages which is done using Polysomnography (PSG) analysis. PSG includes the collection of EEG, breathing, eye movement, as well as heart rate. It is invasive, expensive, and not suited to the home setting.

The Global Sleep Testing Services Market has been estimated at US\$4.1B increasing to US\$8.1B by 2021. In-lab sleep testing services sub-segment accounted for 69% share of the diagnostic sleep testing services segment share in 2015. However, the focus is sleep diagnostic market is shifting toward home testing with the In-Lab the segment expected to witness reduction in terms of market growth owing to increase in adoption of cost effective and less time consuming home sleep testing services over the forecast period. <sup>(1)</sup>

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(1) *Persistence Market Research 2016*

### **About Medibio Limited**

Medibio (ASX: MEB), is a medical technology company that has developed an objective test to assist in the diagnosis of depression, chronic stress and other mental health disorders. Based on research conducted over 15 years at the University of Western Australia, this test utilizes patented (and patent pending) circadian heart rate variability and cloud based proprietary algorithms delivering a quantifiable measure to assist in clinical diagnosis. Medibio's depression diagnostic is being validated in clinical studies undertaken by Johns Hopkins University School of Medicine and Ottawa University, among others. The clinical trials will potentially enable Medibio's technology to be the first FDA approved, objective, evidence based approach to the diagnosis of mental health disorders. Medibio's technology also provides an objective method for the assessment of stress and mental wellbeing which can be translated to the workplace stress/wellbeing market, wearable technology, and App market. Located in Melbourne, VIC, Medibio is listed on the Australian Securities Exchange.