

Assessing Subjective–Objective Sleep Discrepancy in Major Depressive Disorder with a Multimodal Platform Integrating Wearable Devices and Clinical Scales

Wei-Chen Kao^{1,*}; Yu-Xuan Zeng¹; Chia-Chen Wang¹; Jui-Chieh Hsu¹; Chin-Ting Ho¹; Tien-Yu Chen, M.D., Ph.D.^{2,3,4,5}; Chieh-Wen Chen, Ph.D.^{5,6,7}; Cheng-Han Wu, Ph.D.^{1,5,*}

¹ Department of Information Management, National Taipei University of Nursing and Health Sciences;

² Department of Psychiatry, Tri-Service General Hospital, ³ School of Medicine, National Defense Medical Center; ⁴ Institute of Brain Science; ⁵ Sleep Research Center, National Yang Ming Chiao Tung University; ⁶ Institute of Neuroscience; ⁷ Research Center for Mind, Brain and Learning, National Chengchi University, Taipei, Taiwan

Objective: Patients with major depressive disorder (MDD) frequently report disturbed sleep, but subjective complaints may not correspond to objective measurements. We developed a multimodal platform integrating wearable devices and clinical scales to examine subjective–objective sleep differences under everyday living conditions. **Methods:** The platform combined automated wristband synchronization, daily ecological momentary assessment through a LINE Bot, standardized questionnaires and non-wear reminders. Eight patients meeting DSM-5 criteria for MDD and eight healthy controls underwent one week of monitoring. Sleep staging used the manufacturer’s proprietary algorithm. Between-group differences were assessed using Mann–Whitney U tests and Hedges g effect sizes. **Results:** Median age was 49 years in the MDD group and 22 years in controls; all patients and no controls were medicated. Nightly sleep recordings and daily assessments had high completion rates. All participants completed standardized scales and synchronized electrocardiography with phonocardiography; a subset also contributed continuous single-lead electrocardiography. Pittsburgh Sleep Quality Index and Insomnia Severity Index scores were significantly higher in patients, with very large effect sizes. Median objective total sleep time was similar (446.5 versus 433.0 minutes), and sleep efficiency, wake after sleep onset, awakenings and Sleep Regularity Index did not differ significantly. Sleep midpoint showed the largest objective effect, although this remained smaller than the smallest subjective effect. Both groups reported shorter sleep duration than measured objectively, without a significant between-group difference in this discrepancy. **Conclusion:** Subjective questionnaires distinguished patients from controls more strongly than objective sleep measures. The platform supported concurrent acquisition of sleep, questionnaire and physiological data in daily life. Interpretation is limited by the small sample, age and medication differences, and proprietary sleep staging without polysomnographic validation in this population. Larger, better-matched studies are needed to clarify the relationship between subjective complaints and objective sleep.

中文題目：整合穿戴式裝置與臨床量表的多模態平台評估重鬱症患者主客觀睡眠差異

作者：高偉宸⁺、曾羽旋、王家宸、許睿桀、何晉廷、陳田育、陳玠文、吳承翰^{*}

服務單位：國立臺北護理健康大學資訊管理系、三軍總醫院精神醫學部暨國防醫學院醫學系、國立陽明交通大學腦科學研究所、國立陽明交通大學睡眠研究中心、國立政治大學神經科學研究所、國立政治大學心智、大腦與學習研究中心