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Evaluation of Home-Visit Nursing for a Community-Dwelling Patient with Bipolar Disorder Using a Non-Wearable Sleep Sensor (Nemuri Scan): A Case Report

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Abstract

Background: This study explored the application of a non-wearable sleep sensor (Nemuri Scan) to assess and optimize home nursing care for a community-dwelling patient with bipolar disorder experiencing sleep disturbances.

Methods: A male patient in his 50s with bipolar disorder, living alone and experiencing recurrent hospitalizations, received psychiatric home nursing care three times per week. Over 133 days, the patient's sleep patterns were continuously monitored using Nemuri Scan, an under-mattress pressure sensor. Data on total sleep time, sleep latency, and deep sleep percentage were reviewed biweekly with the patient to guide behavioral strategies and medication adjustments. Mood was self-rated daily, and changes in psychiatric treatment were documented.

Results: At baseline, the patient's average sleep latency was 50.2 minutes, deep sleep percentage was 66.2%, and time in bed averaged 13.9 hours per day, accompanied by late wake-up times and persistent fatigue. Implementing structured morning routines improved wake-up times, reducing time spent in bed to 11.0 hours. Medication adjustments-including increased trazodone and nitrazepam, followed by the addition of mirtazapine-enhanced sleep depth and continuity. As a result, deep sleep percentage increased to 90.6%, and sleep latency decreased to 11.1 minutes. Mood fluctuations stabilized, daily activity engagement improved, and the patient remained free from hospitalization. Sharing sleep data facilitated self-monitoring, strengthened treatment adherence, and supported shared decision-making with the psychiatrist.

Conclusion: Integrating Nemuri Scan into home nursing care enabled objective sleep assessment, guiding targeted interventions that enhanced sleep quality and mood stability in a patient with bipolar disorder. Non-wearable sleep monitoring provided valuable real-time data, fostering collaborative care and patient empowerment. This approach may contribute to relapse prevention in community mental health settings.

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Introduction

Although mental health care in many countries has shifted toward community-based treatment, in Japan this transition has only gained momentum in recent decades. Policy reforms and the development of a community-based integrated care system have initiated a shift from prolonged hospitalizations to community support. Consequently, the demand for psychiatric home-visit nursing has increased, with the number of users rising from 13,532 in 2007 to 52,203 in 2015 [1]. The implementation rate of home-visit nursing in mental health care also expanded from 35.5% of communities in 2006 to 58.3% by 2016 [1]. In Japan, psychiatric home-visiting nurses provide a wide range of interventions beyond relapse prevention, including assistance with daily living activities, life skills training, support for interpersonal relationships, and mediation of family issues [2]. This comprehensive home nursing support has been linked to lower hospitalization rates and longer community tenure for individuals with mental illness [3].

For patients with bipolar disorder, home-visit nursing care can significantly reduce symptom severity and lower readmission rates, as demonstrated in a randomized trial in Iran [4]. A 6-month home nursing care program for patients with bipolar I disorder also led to sustained symptom improvement lasting up to 4 months post-intervention [5]. However, bipolar disorder is frequently accompanied by sleep–wake disturbances, which can trigger mood episode relapses [6]. Therefore, supporting patients to maintain a stable daily rhythm and healthy sleep is a key objective in community mental health nursing. Home-visit nurses often focus on normalizing clients' life rhythms and managing sleep hygiene as part of their care plans [2].

Sleep evaluation in patients with bipolar disorder has traditionally relied on polysomnography (PSG) in research settings or subjective measures such as sleep diaries and questionnaires (e.g., the Pittsburgh Sleep Quality Index, Athens Insomnia Scale) in clinical practice [7]. However, continuous PSG monitoring over extended periods in community settings is impractical, and brief nurse observations may fail to capture a comprehensive sleep profile, limiting objectivity. Technological advancements have led to studies exploring actigraphy devices and smartphone applications for sleep monitoring in bipolar disorder [8]. Although this method is promising, actigraphy using wrist-worn motion sensors may not always provide accurate sleep–wake assessments, and some studies have reported that actimetric measurements are unreliable compared with PSG [9].

Nemuri Scan (Paramount Bed Co., Tokyo, Japan) is a non-wearable actigraphy device designed for continuous and unobtrusive home

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sleep monitoring. This device consists of a thin (1.5 cm) pressure sensor pad placed under the mattress that detects body movements and mattress vibrations. The system's algorithms distinguish between sleep and wake states using these signals. Validation studies have shown that Nemuri Scan's automated sleep/wake scoring achieves an overall concordance of 92.2% with PSG, with a sensitivity of 97.1% for detecting sleep and a specificity of 34.2% for wakefulness [10]. Unlike wearable sensors, Nemuri Scan requires no physical attachment to the body, reducing the burden on users. Previous research has employed this device to assess delirium in terminal cancer patients [11]. However, to the best of our knowledge, it has not been applied in patients with bipolar disorder. Given its ability to provide relatively objective, real-time sleep assessment without relying on patient effort or recall, Nemuri Scan is well-suited for continuous monitoring in community settings.

Here, we present a case in which Nemuri Scan was used to monitor sleep in a community-dwelling patient with bipolar disorder receiving regular home nursing visits. The home nurse and patient reviewed the objective sleep data approximately every 2 weeks. These data were used to guide tailored interventions, including behavioral strategies and collaboration with the prescribing psychiatrist for medication adjustments. We describe the patient's clinical course over 4 months and assess the outcomes of this approach. This case report aimed to illustrate how integrating objective sleep monitoring into community nursing care can enhance sleep patterns and potentially help prevent relapse in bipolar disorder.

Methods

Design and patient

This study is a single-case report with an observational design. The patient was a man in his 50s with bipolar disorder, living alone in the community. The patient had a history of multiple psychiatric hospitalizations, primarily caused by severe depressive episodes accompanied by functional decline. During past depressive relapses, his appetite significantly decreased, leading to poor nutritional status necessitating inpatient stabilization. Each hospitalization resulted in improvements in mood and appetite, allowing for discharge after recovery. However, following discharge, the patient frequently experienced another depressive downturn, marked by appetite loss and weight reduction, perpetuating a cycle of readmission.

Clinical background

After his most recent hospital discharge in February X, the patient made efforts to maintain his health by ensuring he ate at least one delivered meal (a catered dinner) daily and attending a psychiatric day-care program (life skills training center) on days when he felt well. He also continued regular outpatient visits. Because he tended to forget to take his medications when feeling unwell, he used a pillbox to organize his daily doses. The patient's activities of daily living were largely independent.

In April X, the patient's depressive symptoms worsened again. He experienced intense fatigue and largely stopped cooking or eating, aside from delivered meals. Weekends were particularly difficult—he felt "confused" about how to spend his time when structured activities were lacking. At this point, psychiatric home-visit nursing care was initiated to support him at home and, ideally, prevent another hospitalization.

The home-visiting nurse established care goals in collaboration with the patient: (1) to help him manage his depression in daily life by structuring daytime activities and developing coping strategies, and (2) to monitor and prevent early signs of hypomania. Importantly, in past episodes, improvement in the patient's depression often led to excessive activity levels, sometimes exhibiting mania warning signs, such as engaging in an overwhelming number of tasks. Therefore, an additional goal of treatment was to help the patient maintain a balanced activity level in accordance with mood fluctuations.

By July X, the patient reported that his sleep routine felt highly irregular, which he and the nurse suspected was negatively affecting his mood and energy levels. Therefore, an objective sleep monitoring regimen using the Nemuri Scan device was introduced that month.

Intervention and Monitoring Procedure: The Nemuri Scan, a non-wearable sleep sensor, was placed under the patient's mattress to continuously record his sleep/wake patterns. Monitoring was conducted over 133 days (approximately 4.5 months). The device recorded key sleep parameters each night, including total time in bed, total sleep time, sleep latency (time to fall asleep), wake periods after sleep onset, and "deep sleep" percentage—a proprietary metric reflecting sleep depth and quality.

During the monitoring period, the patient continued to receive home-visit nursing three times per week as part of routine care, with each visit lasting approximately 30–60 minutes and provided by a psychiatric nurse from a community nursing station. Additionally, approximately every 2 weeks, one of these visits was dedicated to downloading and reviewing the Nemuri Scan sleep data. The nurse brought a tablet computer to retrieve the stored data from the sensor and discussed the sleep results with the patient in real time during the visit. Together, they examined the patient's sleep patterns, identified any issues (such as prolonged time in bed or nighttime awakenings), and considered possible strategies to address them.

The patient also self-monitored his mood daily using a simple diary, rating each day's predominant mood as "good," "normal," or "poor." The home-visit nurse tracked the patient's functional status and daily activities through visit notes while also ensuring that he recorded his mood and any notable events or behaviors.

Throughout the study period, the patient continued routine outpatient psychiatric visits. The psychiatrist was kept informed of the patient's progress. Notably, the patient chose to share his sleep data printouts with the psychiatrist during appointments, which facilitated informed decisions about medication adjustments. Changes to psychotropic medications were made by the treating psychiatrist in response to the patient's condition (including both subjective complaints and objective sleep data). We recorded any medication changes and the timing relative to the monitoring phase.

At the start of sleep monitoring in July 20XX, the patient's psychiatric medications included paroxetine 50 mg/day, sulpiride 150 mg/day, trazodone 37.5 mg/night, lithium carbonate 100 mg/day, zolpidem tartrate 10 mg/night, and nitrazepam 5 mg/night. This regimen was prescribed for bipolar depression and insomnia. During the monitoring period, adjustments to sedative-hypnotics and antidepressants were made, as detailed in the Results section.

Ethical considerations

The patient was informed of the purpose and procedures of this intervention both in writing and verbally, and provided written

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informed consent to participate and have his case details published with his identity protected. He was assured that participation was voluntary and that he could request to discontinue monitoring at any time. The case study protocol was approved by the Institutional Review Board of the author's affiliated institution (Approval No. 27-4).

Results

During the 133-day home monitoring period, the patient's sleep data and clinical status progressed through several distinct phases, each marked by adjustments in interventions-both behavioral and pharmacological-in response to his needs. Below, we describe each phase, detailing the objective sleep metrics alongside relevant clinical interventions and events.

Phase 1 (Day 1–13; Baseline Observation)

In the first 2 weeks of monitoring, with no new interventions beyond standard care, the patient's average time in bed was 13.9 hours per day, indicating extremely prolonged bedrest. As shown in Figure 1, the patient's mean total sleep time was 9.2 hours per night, suggesting that a significant portion of his time in bed was spent awake—either resting or struggling with low energy. As shown in Figure 2, average sleep latency (time to fall asleep after going to bed) was 50.2 minutes, and bedtime was consistently around 21:00. However, because of frequent awakenings and likely morning inertia, the patient's wake-up times were significantly delayed; on 3 out of the 13 days, he remained in bed past 15:00.

The results shown in Figure 3 revealed that the Nemuri Scan recorded an average "deep sleep" percentage of only 66.2% during this phase,

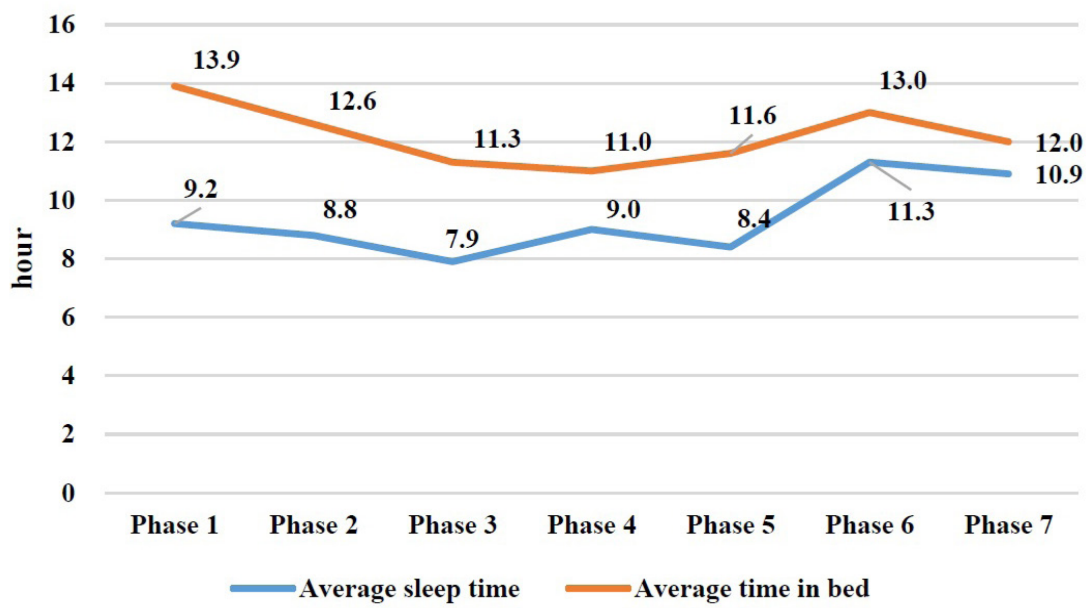

Figure 1: Average sleep time and bedtime by phase.

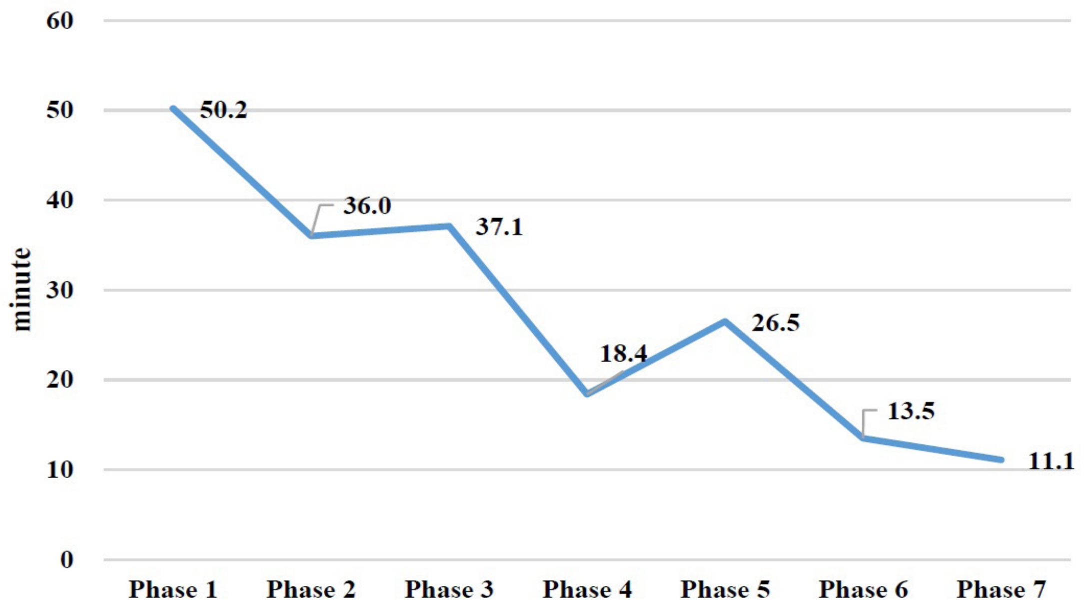

Figure 2. Average time to fall asleep by phase.

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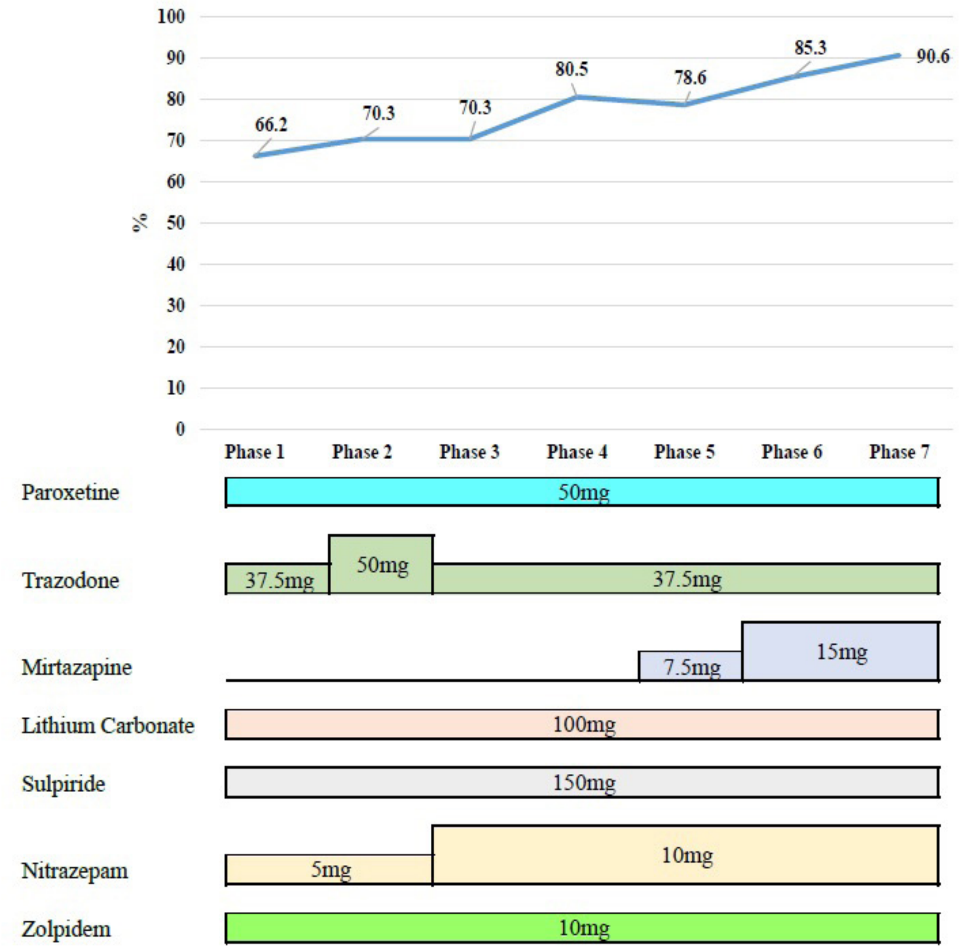

Figure 3: Deep sleep level and psychotropic drug dosage by phase.

indicating relatively poor sleep quality characterized by shallow, fragmented sleep. Clinically, the patient exhibited marked fatigue and low motivation. He had little inclination to go out-although he managed to leave home approximately every other day to buy food at a convenience store, on other days, he remained indoors. He rated his mood as "poor" every day throughout this period. Given these baseline findings-particularly the erratic sleep-wake pattern, prolonged time in bed, and persistently low mood-the nurse and patient identified a need to establish a more structured morning routine.

Intervention after Phase 1: At the nursing visit on Day 14, the home nurse introduced strategies to encourage earlier awakening and morning activity. Together, the nurse and patient agreed on simple actions upon waking-such as playing music, preparing breakfast, or taking a morning walk-to help him get out of bed and start his day at a reasonable time. The goal was to reduce excessive time in bed and reinforce a structured day-night routine, which could, in turn, enhance nighttime sleep quality.

Phase 2 (Day 14–26; After Initiating Morning Activity Plan)

Following the implementation of the morning activation intervention, the patient's sleep-wake pattern showed some improvement. Notably, during Days 14-26, there were no instances in which the patient stayed in bed past 15:00. His average daily time in bed decreased slightly to 12.6 hours, suggesting a reduction in idle time spent lying down.

Nemuri Scan data showed that the patient's average total sleep time during this phase was 8.8 hours, slightly shorter than that in Phase 1—possibly reflecting a decrease in excessive daytime sleep or napping. Sleep latency improved to an average of 36.0 minutes, indicating that the patient was falling asleep faster at night. Additionally, the average deep sleep percentage increased to 70.3%, suggesting better sleep depth and quality compared with baseline.

Despite these objective improvements, the patient continued to report a "poor" mood each day. Subjectively, he felt he was not obtaining restorative sleep; additionally, the patient expressed complaints of waking up unrefreshed and taking a long time to feel fully alert after getting up. Around Day 26, the patient took an important step by bringing his Nemuri Scan sleep reports to his outpatient psychiatrist appointment. He conveyed to the doctor that his sleep was "shallow" and shared printed data showing relatively low deep sleep percentages. In response, on Day 26, the psychiatrist adjusted the patient's medication regimen—specifically, the dose of trazodone (an antidepressant often used for improving sleep) was increased from 37.5 mg to 50 mg at bedtime to enhance sleep continuity and depth.

Because the patient reported physical and mental exhaustion after pushing himself to go grocery shopping post-appointment, the nurse reinforced the importance of moderating daily activity. During the nursing visit on Day 26, the nurse and patient agreed on a guideline of "one significant activity per day" to avoid overexertion. For example, if the patient had an outing or an essential chore on a given day, he would not pressure himself to complete other major tasks that same day. This strategy aimed to conserve energy and prevent exacerbation of fatigue and mood downturns.

Phase 3 (Day 27–39; After First Medication Adjustment)

In the 2 weeks following the increase in trazodone, the Nemuri Scan data did not show significant improvements, and some aspects indicated a slight regression. From Days 27–39, the patient's average sleep duration was 7.9 hours per night, slightly shorter than in Phase 2. The patient's average time in bed decreased to 11.3 hours, which may constitute a positive sign that he was not remaining in bed as long. However, he continued to experience persistent nighttime awakenings. The patient's average deep sleep percentage remained at 70.3%, unchanged from Phase 2, suggesting that increasing trazodone alone had not led to further improvements in sleep depth.

Clinically, by the end of this phase, it became evident that the patient was still struggling with unrefreshing sleep. During an outpatient visit on Day 39, the patient reported to his psychiatrist that although he was making an effort to wake up earlier, he often fell back asleep after his initial morning awakening—a pattern he described as "morning re-sleep."

In response, the psychiatrist decided to make a more substantial adjustment to his sleep medications on Day 39. The nitrazepam (a benzodiazepine hypnotic) taken at night was increased from 5 mg to 10 mg to address middle and late insomnia (difficulty staying asleep until morning). Simultaneously, the trazodone dose was reduced from 50 mg back to 37.5 mg, possibly to avoid excessive sedation in combination with the higher-dose nitrazepam or because the trazodone increase had not produced the desired effect.

Notably, the Nemuri Scan data from Phase 3, just prior to this adjustment, showed an average sleep latency of 37.1 minutes and a deep sleep percentage of 70.3%, confirming that the patient's sleep quality issues persisted. These objective findings supported the decision to modify the medication regimen. After Day 39, the home nurse continued to monitor the patient closely for the effects of the new treatment.

Phase 4 (Day 40–53; After Second Medication Adjustment)

In the 2 weeks following the psychiatrist's adjustment of hypnotic medications, the patient's sleep metrics showed significant improvement. The patient began to perceive better sleep quality, remarking that his sleep felt deeper and more restorative.

Although the patient continued to rate his mood as "poor" each day during this phase, there were encouraging signs: he engaged in more daytime activities and, importantly, remained mindful of not overexerting himself. He noticed physical lethargy when he pushed too hard, so he actively tried to pace himself-demonstrating improved insight into balancing activity and rest.

Objectively, Phase 4 data from Days 40–53 showed an average deep sleep percentage of 80.5%, a marked increase indicating significantly deeper sleep compared with earlier phases. The average sleep latency dramatically shortened to 18.4 minutes, suggesting that with the adjusted medication regimen, the patient was able to fall asleep much more quickly at night.

Interestingly, the average total sleep time increased slightly to 9.0 hours, while the average time in bed decreased further to 11.0 hours per day. This suggests that the patient was spending less non-sleep time in bed while achieving a higher proportion of deep sleep—providing objective evidence of improved sleep efficiency and quality

Phase 5 (Day 54–94; Gradual Improvement and Life Rhythm Challenges):

Over the next 6 weeks, the patient's mood and daily functioning underwent gradual changes. Although his mood ratings continued to fluctuate, there was a clear trend toward improvement. He began experiencing more days rated as "normal" rather than "poor," especially as the weeks progressed.

Correspondingly, the patient's activity level increased—he gained confidence in doing more both at home and outside. For instance, he invested in a new rice cooker and started cooking rice, which led to increased food intake. This was a particularly positive development, given his history of poor appetite during depressive phases.

However, with increased activity came the risk of overexertion. On days when the patient felt slightly better, he sometimes became overly ambitious, attempting to schedule or complete multiple tasks. When the patient engaged in two or more substantial activities in a single day, he often experienced intense fatigue and a downturn in mood by the evening or the following day, frequently reverting to a "poor" mood rating.

Recognizing this pattern, the home-visiting nurse continually coached him on setting priorities and limits. Together, they developed strategies to distribute activities more evenly—for example, if the patient planned to do laundry on a given day, he would avoid other demanding tasks that same day. The nurse reminded him that his "daily energy supply" was limited and that structuring his week with designated tasks could help prevent burnout.

By sharing the Nemuri Scan data and mood logs during biweekly reviews, the nurse was able to highlight the correlation between excessive activity and subsequent poorer sleep or mood, reinforcing the importance of balance. They agreed that maintaining a steady and sustainable pace of recovery was more important than pushing himself too hard.

During this phase, around Day 91, the patient experienced a significant emotional setback. During a home visit, he confided that he felt "the worst I have ever been." He was deeply distressed by the gap between the life he had envisioned for himself and his current reality. This existential frustration-comparing his ideal self to his present limitations-triggered a surge of hopelessness and anxiety. It was a critical moment, as such feelings could have precipitated a deeper depressive relapse.

In response, the psychiatric team decided to augment his antidepressant regimen. On Day 95, the psychiatrist added mirtazapine (Remeron) 7.5 mg at bedtime, a low dose intended to improve mood and potentially enhance sleep regulation. Concurrently, during nursing visits, the nurse provided psychological support, helping the patient reframe his thoughts. She emphasized that he was not "lazy" or at fault for needing rest—rather, these were symptoms of his illness. They discussed the importance of recognizing that taking breaks and allowing himself to rest was a valid and necessary part of managing bipolar disorder.

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or at fault for needing rest—rather, these were symptoms of his illness. They discussed the importance of recognizing that taking breaks and allowing himself to rest was a valid and necessary part of managing bipolar disorder.

Phase 6 (Day 95–115; After Adding Mirtazapine)

Following the introduction of mirtazapine 7.5 mg on Day 95, the patient's condition showed notable positive changes. His mood began to improve-he experienced fewer "poor" days and reported an increased sense of well-being.

Importantly, the patient started to feel genuinely rested upon waking, something he had not experienced in a long time. He remarked that the "quality" of his sleep seemed better, aligning with mirtazapine's intended effect of enhancing sleep in depressed patients.

By Day 116, based on the patient's feedback and the nurse's observations, the psychiatrist decided to further increase the mirtazapine dose to 15 mg nightly to continue supporting mood improvement. During Phase 6 (Days 95–115, a period of 2 to 3 weeks on 7.5 mg of mirtazapine), the Nemuri Scan data indicated an average deep sleep percentage of 85.3%-one of the patient's highest recorded levels-suggesting very good sleep quality. The average sleep latency was 13.5 minutes, a notably short duration, implying that the patient had little difficulty falling asleep.

Interestingly, the average total sleep time increased to 11.3 hours, with time in bed increasing to 13.0 hours. This extended sleep duration may reflect the combined sedative effects of the enhanced medication regimen (nitrazepam + mirtazapine) or the patient's conscious decision to allow himself more rest as part of his recovery. This may also be a residual effect of fatigue lifting—when depression begins to improve, patients may initially sleep more to restore lost energy.

Despite the increase in time spent in bed, the exceptionally high deep sleep percentage suggests that much of that time was indeed restorative sleep.

Phase 7 (Day 116–133; After Increasing Mirtazapine to 15 mg)

In the final phase of monitoring, following the increase in mirtazapine, the patient continued to make progress. There was a further increase in the number of days rated as "normal" mood, and the patient became more engaged both socially and in daily activities. He started going out more frequently and actively participating in hobbies.

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The home nurse's role remained crucial in preventing over-activation. Even as the patient felt better, she consistently reminded him to pace himself. Together, they reinforced the guideline of maintaining one primary activity per day to prevent excessive exertion, avoid triggering mania, and sustain the patient's recovery. The patient experienced occasional physical fatigue-on some days, he spent extra hours lying down during the daytime because of bodily exhaustion. However, the nurse used these instances as learning opportunities. During their biweekly data reviews, the nurse and patient examined the patterns and discussed how mood fluctuations correlated with behavior. By recognizing these trends, the patient became more aware that overexerting himself on a "good" day could lead to a "crash" later. Together, they adjusted his activity planning, which helped prevent hypomanic over-activity and promoted a more stable recovery. By the end of Phase 7, the patient reported minimal nighttime awakenings and expressed satisfaction with his sleep. Given the sustained improvement in both sleep parameters and mood stability, the team decided to conclude intensive sleep monitoring on Day 133.

The data from Days 116 to 133 showed an average total sleep time of 10.9 hours per night and time in bed of 12.0 hours, indicating that the patient was still getting ample rest. His average sleep latency was 11.1 minutes-remarkably short-suggesting that his insomnia symptoms were effectively resolved. The average deep sleep percentage reached 90.6%, the highest of any phase, demonstrating excellent sleep quality. These figures represent a dramatic improvement from baseline (Phase 1), when deep sleep was approximately 66% and the patient often remained in bed for half the day. Crucially, throughout the entire 133-day period, the patient did not require hospitalization-marking a significant break from his prior pattern of cycling in and out of the hospital because of mood episodes. By the end of monitoring, the patient's mood was predominantly stable at "normal," and he had developed improved self-management habits for both sleep and daily activities.

Overall, integrating objective sleep monitoring with regular home nursing visits enabled dynamic adjustments to the patient's care. Behavioral interventions-such as structuring morning routines and managing daily activity levels-combined with timely medication adjustments, informed in part by sleep data, contributed to improved sleep–wake regularity and enhanced sleep quality, which appeared to support mood recovery. This case highlights that, even in a single patient, a personalized, data-driven approach can yield significant clinical benefits over a relatively short period, potentially preventing relapse.

Discussion

This case study illustrates how sharing objective sleep data between a patient and a nurse, combined with collaborative care decisions, can improve outcomes for a community-dwelling individual with bipolar disorder. Over the course of 4 months, the patient's sleep–wake schedule became more regulated, and his sleep quality significantly improved, coinciding with mood stabilization and the avoidance of hospital readmission. Several key insights emerged from this case.

First, regular sleep monitoring and feedback is likely to have empowered the patient. By reviewing the Nemuri Scan results with the nurse every 2 weeks, the patient gained insight into his own sleep patterns. This self-monitoring experience may have enhanced the patient's sense of control and involvement in his treatment. Rather than relying solely on external direction, he became an active patient, adjusting his behavior—such as adopting morning routines and pacing daily activities—on the basis of objective data.

This engagement can be viewed through the lens of patient empowerment. Previous research has shown that self-management tools can improve patient outcomes; for example, a study using a self-guided mental health smartphone application reported significant improvements in patients' symptoms, quality of life, and feelings of empowerment [13].

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In the current case, even when the patient's mood remained consistently low, he accepted the home nurse's support and continued to follow through with agreed-upon actions, such as maintaining a balance between activity and rest. This sustained engagement, despite ongoing depression, suggests that the combination of a supportive therapeutic relationship and a data-driven approach helped foster motivation.

Moreover, it is noteworthy that home nursing in this case was provided by an independent visiting nurse station rather than a hospital-affiliated service. A previous study in Japan reported that clients of independent home-visit nursing agencies perceived significantly higher levels of "support that empowers the self" compared with those receiving care from hospital-affiliated visiting nurse services [12]. This difference may stem from independent agencies adopting a more client-centered, recovery-oriented approach.

In this case, leveraging sleep data gave the patient's voice greater clarity and influence in his treatment plan. The psychiatrist was able to respond to tangible evidence-for instance, adding mirtazapine when both the data and the patient's report indicated persistently unrefreshing sleep and depressive symptoms-and the outcomes of those decisions were then objectively tracked. This iterative feedback loop likely played a crucial role in preventing relapse. It was not solely the technology or the medication, but rather the collaborative process that made the difference.

The use of a non-wearable sleep sensor (Nemuri Scan) also has important practical implications. The device's minimal burden on the patient was a key factor in enabling continuous monitoring for over 4 months. Wearable devices, such as wrist actigraphs or smartphone apps, require daily compliance-wearing the device, charging it, remembering to start and stop recordings-which can be challenging, especially in psychiatric populations. Research has shown that sustained use of wearable trackers heavily depends on user motivation and consistency [6].

Mood fluctuations are a defining feature in bipolar disorder; during depressive phases, patients may lack the energy or initiative to use technology consistently, while during manic phases, they may abandon routine tracking altogether. As a result, continuous monitoring becomes difficult when relying on patient-operated devices. In our case, aside from occasionally forgetting to turn on the sensor, the patient could essentially "set it and forget it"-the sensor automatically collected data without requiring any nightly effort on his part. This represents a major advantage of this system for long-term monitoring in community settings.

The high sensitivity of Nemuri Scan to sleep allowed it to function as an early warning tool for subtle changes. For example, when deep sleep percentage plateaued or sleep latency increased, it signaled the need to adjust the care plan-either behaviorally or medically. Such objective indicators could potentially alert providers to impending mood deterioration before a full relapse occurs. This aligns with the growing interest in digital phenotyping in mental health-the concept of using data from sensors and digital devices to track behavioral and physiological patterns to detect early signs of psychiatric illness exacerbation [16]. In bipolar disorder, monitoring changes in sleep, activity levels, and mood is particularly important, as these factors can serve as early warning signs of a shift into depression or mania.

Recent studies and reviews highlight the value of combining sleep and circadian rhythm data with other metrics—such as activity and mood tracking via smartphone apps—to predict mood fluctuations in bipolar disorder [16]. In the present case, we primarily focused on sleep; however, integrating non-wearable sleep monitors with additional digital tools could enhance overall assessment. For instance, using a smartphone app to track mood and activity (e.g., step count, phone usage) alongside Nemuri Scan's sleep data might provide a more comprehensive digital phenotype of the patient's condition, improving the ability to foresee and prevent relapses.

Because this is a single-case report, the findings must be interpreted with caution. Generalizability is limited, as the interventions were tailored to one individual's circumstances, and bipolar disorder manifestations vary widely between patients. Additionally, while we utilized an objective sleep-monitoring device, we did not incorporate other objective measures, such as actigraphy or physiological sensors, to assess daytime activity or circadian rhythms. As a result, we were unable to quantitatively evaluate the patient's activity levels beyond anecdotal reports. Unlike actigraphy, the under-mattress sensor does not capture daytime movement or physical activity, restricting its scope to periods when the patient is in bed.

Many recent studies have employed smartphone-based ecological momentary assessment (EMA) approaches to simultaneously track mood, activity, and sleep [16]. Integrating Nemuri Scan with such technology in future research could provide a more comprehensive assessment, allowing both rest and activity patterns to be evaluated in tandem.

Furthermore, our report does not include standardized psychiatric rating scales for mood symptoms or validated sleep quality questionnaires, which could have provided additional confirmation of the observed improvements. Instead, we relied on the patient's self-rated mood scale ("good," "normal," or "poor") and objective sleep metrics. Incorporating standardized measures, such as the Hamilton Depression Rating Scale or the Pittsburgh Sleep Quality Index, could strengthen the evidence in future studies. Despite these limitations, the current case offers valuable insights for clinical practice. Even with a single patient, we observed that targeted nursing interventions, guided by objective data, may help disrupt a cycle of relapse.

Future research should involve a larger sample of bipolar patients with sleep disturbances to determine whether similar approaches-home nursing combined with non-wearable sleep monitoring-consistently yield improved outcomes. Such studies may be helpful for clarifying which specific nursing interventions are most effective and how technology can be optimally integrated into home care. Identifying effective strategies for managing sleep disturbances in bipolar disorder is crucial because persistent sleep problems often undermine long-term recovery.

Conclusions

The current case report demonstrates that integrating a non-wearable sleep monitoring device into community mental health nursing enabled objective sleep assessment and informed timely interventions, leading to improved sleep quality, mood stability, and prevention of rehospitalization in a bipolar patient. Regular data review enhanced self-management, patient engagement, and SDM with the psychiatrist. For nursing practice, this approach highlights the value of real-time sleep monitoring in guiding behavioral and pharmacological interventions. By visualizing home sleep patterns, nurses can provide personalized, recovery-oriented care that supports daily rhythm regulation and relapse prevention.

Competing Interests

The authors declare that they have no competing interests.

Author Contributions

SY designed and conceptualized the study. KM and SY contributed to the acquisition and analysis of data. SY drafted the manuscript with intellectual input and revisions from KM and TT. All authors were involved in the interpretation of data and critically revising the manuscript for important intellectual content. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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