

Wearable Technology-facilitated Dementia Care In Rural Taiwan - Protocol and Preliminary Results From A Dyadic Feasibility Study

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- 1. Assessing and treating behavioural and psychological symptoms of dementia (BPSD) both face challenges, especially in rural, resource-limited ageing communities .
- 2. Wearable technologies may offer an objective, continuous and accessible approach for symptoms monitoring while delivering interventions.
- 3. In this study, using actigraphy and light-therapy goggle to assess and manage sleep, mood, and other BPSD among patient–caregiver dyads appears to be feasible.

INTRODUCTION

In Taiwan, the transition to a super-aged society intensifies the societal and economic burdens brought by the increasing population of people living with Alzheimer's disease (AD) who experience behavioral and psychological symptoms of dementia (BPSD), including depression, agitation, apathy, and sleep disturbances, which significantly increase caregiver stress, particularly in rural areas where care resources are limited. Current assessments rely on caregiver-reported tools, which may be less reliable due to caregivers' own age-related cognitive decline.

Wearable technologies offer a promising alternative by enabling objective, continuous tracking of sleep and activity. Devices like Geneactiv provide validated longitudinal measures, while metrics such as the sleep regularity index are associated with health outcomes. Non-pharmacological interventions, particularly light-based therapies, are increasingly recommended. The Re-Timer, a wearable light-emitting device, may help regulate circadian rhythms and improve symptoms.

METHODS

This study uses an eight-week, mixed-methods approach combining Geneactiv monitoring and Re-Timer intervention in dementia caregiver-patient dyads in rural Taiwan. It primarily evaluates feasibility and acceptability, while also exploring potential impacts on circadian rhythms, BPSD, and caregiver burden.

We recruited 20 participants (n=10 AD patients; n=10 caregivers) communities in rural Taiwan. Participants wear Geneactiv continuously for 8 weeks and Re-Timer ≥30 min/day for 4 weeks (Fig 1). Device-based data are processed with GGIR. Questionnaire assessments include Pittsburgh Sleep Quality Index (PSQI), Neuropsychiatry Inventory Questionnaire (NPI Q), Caregiver Burden Inventory (CBI), and a semi-structured interview based on the Taiwanese version of Quebec User Evaluation of Satisfaction with Assistive Technology (T-QUEST) (Fig 2).





Figure 1. Timeline of the study.
Q: Questionnaire assessments.

Ten patient-caregiver dyads were recruited successfully (see Table for baseline characteristics). The patients were predominantly female with low educational attainment (mean 5.7 years and 30% illiterate). In contrast, carers were evenly split by sex, more socioeconomically diverse, and better educated (mean 13 years). Clinically, patients exhibited moderate AD (MMSE 17.5, CASI 53.9) with notable BPSD and sleep disturbances.

In both arms, 9 patients and 9 caregivers fully adhere to the study protocol during the entire study period. Wearable data indicated that patients had lower physical activity (lower ENMO and M5) and more disrupted circadian rhythms (higher IV, lower IS) compared with carers. Carers, while more active and rhythmically stable, experienced moderate caregiving burden. Patients were less active and had less stable daily rhythms than carers, indicated by a much lower sleep regularity index (SRI).

RESULTS

CONCLUSIONS

Measurement and therapeutic wearables appear to be feasible and acceptable for both people living with moderate dementia and significant BPSD, as well as their caregivers. Metrics derived from wearables provide novel perspectives complementing questionnaire-based measurements. Confirmatory studies are needed to validate the signals derived from therapeutic wearables.

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