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Study of a mobile health intervention to promote healthy light exposure in older adults in Singapore

Submission date
04/09/2025

Recruitment status
Recruiting

Registration date
05/09/2025

Overall study status
Ongoing

Last Edited
15/09/2025

Condition category
Nervous System Diseases

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
As people get older, changes in daily light exposure can disrupt their internal body clock, which can affect sleep, mood, memory, and overall health. This study aims to test whether a new mobile health app called LightUP can help older adults improve their daily light exposure and, in turn, support healthier sleep, mood, cognition, and wellbeing.

Who can participate?
Older adults aged 60 years and above, living in the community in Singapore. Participants must own a smartphone and be able to use it, be independent in daily activities, and be able to provide informed consent.

What does the study involve?
Participants will first complete a 4-week baseline period, then be randomly assigned to one of two groups. One group will use the LightUP app for 12 weeks, which provides personalised feedback, goal setting, and education about light exposure. The other group will use a version of the app that collects information but does not include the active features and guidance meant to change behaviour. All participants will wear a small logger sensor around the neck and a wrist-worn activity tracker to monitor daily light, sleep, and activity. After completing the 12-week intervention, participants will undergo a follow-up assessment 12 weeks later, which includes 2 weeks of extended monitoring.

What are the possible benefits and risks of participating?
Participants may benefit by learning how to improve their daily light exposure, which could support better sleep, mood, memory, and health. There are no known risks, although wearing the devices may cause minor discomfort.

Where is the study run from?
The study is run by TUMCREATE Ltd. at five Lions Befrienders Active Ageing Centres in Singapore.

When is the study starting and how long is it expected to run for?
The study enrolment started in August 2025 and will run until June 2026, including recruitment, intervention, and follow-up.

Who is funding the study?
The National Research Foundation Singapore under the LightSPAN project (“Optimizing environmental light exposure at scale to support eye and brain development and health across the lifespan”).

Who is the main contact?
Prof. Dr. Manuel Spitschan, TUMCREATE Ltd., manuel.spitschan@tum-create.edu.sg

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
NRF2022-THE004-0002 (Funding reference)

Study information

Scientific Title
A randomised, double-blind trial of a chronotherapeutic mobile health behaviour change intervention targeting optimal light exposure among older adults aged ≥60 years in Singapore (LightSPAN)

Acronym
LightSPAN

Study objectives
General Objective
To evaluate the effectiveness of the LightSPAN mHealth intervention in optimizing light exposure behaviour and improving physiological outcomes among community-dwelling older adults in Singapore.

Specific Objectives
1. To evaluate the effectiveness of the LightSPAN mHealth intervention in optimizing light exposure behaviours among community-dwelling older adults

2. To assess the effectiveness of the LightSPAN mHealth intervention in improving the rest-activity cycle, sleep quantity and quality, mood, and cognitive function among community-dwelling older adults

3. To evaluate the effectiveness of the LightSPAN intervention in improving frailty status, physical activity levels, and Vitamin D synthesis among community-dwelling older adults

4. To evaluate the feasibility, acceptability, usability, and user satisfaction of the LightSPAN mHealth intervention among community-dwelling older adults

5. To explore the acceptability and user experience of the ActLumus light logger wearable device among community-dwelling older adults

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 18/06/2025, Parkway Independent Ethics Committee (PIEC) (HarbourFront Tower One, 1 HarbourFront Place #03-02, Singapore, 098633, Singapore; +65 6277 8272; piec@ihhhealthcare.com), ref: PIEC/2024/041

Study design
Community-based randomized double-blind parallel-group controlled trial

Primary study design
Interventional

Study type(s)
Quality of life, Efficacy

Health condition(s) or problem(s) studied
Circadian rhythm disruption, sleep disturbances, mood and cognitive decline, frailty, and vitamin D deficiency associated with suboptimal light exposure in older adults

Interventions
This study is evaluating the effectiveness of a mobile health intervention (LightUP app) compared with a placebo app in optimizing light exposure behaviour and improving physiological, cognitive, and psychosocial outcomes among community-dwelling older adults in Singapore.

Randomisation will be conducted using computer-generated block randomisation with the R package blockTools, stratified by age, sex, and recruitment location to ensure balanced allocation across key demographic variables. Study staff responsible for conducting assessments will be blinded to group assignment to minimize bias.

Intervention arm: Participants use the LightUP mobile health app for 12 weeks. The app integrates behaviour change techniques (self-monitoring, goal setting, personalised feedback, and education) based on daily light exposure measured with a pendant-worn ActLumus light logger. Participants also wear a Garmin Vivosmart 5 activity tracker to monitor rest–activity cycles, sleep, and physical activity.

Control arm: Participants use a placebo version of the LightUP app for 12 weeks. The placebo app records light, sleep, and mood data but does not provide feedback, prompts, or behaviour change features. Participants also wear the ActLumus light logger and Garmin activity tracker, as in the intervention arm.

Each participant undergoes 4 weeks of baseline monitoring before randomisation, 12 weeks of intervention, and a 12-week follow-up period, including 2 weeks of monitoring.

Participants receive a mid-intervention booster session to support continued engagement.

Intervention Type
Behavioural

Primary outcome(s)
1. The effectiveness of the LightUP app in improving light exposure behaviour in older adults, measured using data collected from the ActLumus light logger over the 4-week baseline period,

the 12-week intervention period, and the 2-week follow-up monitoring period
3. Daily time above 250 lx melanopic equivalent daylight illuminance (minutes/day) during daytime, measured using the ActLumus light logger over the 12-week intervention, corrected to baseline and analysed with linear mixed models, as well as long-term differences, assessed in the follow-up monitoring period relative to baseline

Key secondary outcome(s))
1. Sleep parameters (total sleep time, sleep efficiency, sleep onset latency, wake after sleep onset) measured using the Garmin Vivosmart 5 actigraphy and sleep diaries continuously over the study period.
2. Sleep quality measured using the Pittsburgh Sleep Quality Index (PSQI) at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28).
3. Circadian rest-activity rhythms (interdaily stability, intradaily variability, relative amplitude) measured continuously using Garmin data over the study period.
3. Mood states measured using the Brief Mood Introspection Scale (BMIS) at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28).
4. Daily mood ratings measured using the Single-Item Mood Scale (SIMS) throughout the study period.
5. Weekly mood ratings measured using the Visual Analogue Mood Scale (VAMS) over the 12-week intervention period.
6. Cognitive performance measured using the NIH Toolbox at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28), including Dimensional Change Card Sort, Flanker Inhibitory Control and Attention, Oral Symbol Digit, Picture Sequence Memory Form A or B, Rey Auditory Verbal Learning, Rey Auditory Verbal Learning Delay, and Pattern Comparison Processing Speed Test.
7. Frailty measured at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28) using five criteria: unintentional weight loss, exhaustion identified with two items from the Centre for Epidemiologic Studies for Depression Scale (CES-D), low physical activity assessed with the Physical Activity Scale for the Elderly (PASE), slowness assessed with the 5-meter walking time test, and weakness assessed with dominant hand grip strength.
8. Physical activity (daily step count, moderate-to-vigorous activity, sedentary behaviour) measured continuously using Garmin data throughout the study period and PASE.
9. Body composition (weight, height, body fat percentage, muscle mass, bone mass, body mass index) measured using standard procedures at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28).
10. Vitamin D status measured using 25(OH)D concentration from dried blood spot (DBS) samples and standard procedures at baseline (week 4), mid-point (week 10), endpoint (week 16), and follow-up (week 28).
11. Usability of the LightUP app measured using the mHealth App Usability Questionnaire (MAUQ) at endpoint (week 16).
12. Acceptability of the LightUP app measured using an adapted Technology Acceptance Model (TAM) questionnaire at endpoint (week 16).
13. Acceptability of wearable devices measured using an adapted Technology Acceptance Model (TAM) questionnaire at endpoint (week 16).

Completion date
17/06/2026

Eligibility

Key inclusion criteria

1. Aged ≥60 years
2. Residing in Singapore; community-dwelling and not institutionalised or living in nursing homes
3. Capable of independent mobility (with or without assistive devices)
4. Capable of functional independence (Lawton Instrumental Activities of Daily Living [IADL] score: >8 for females, >5 for males)
5. Proficient in communication, reading, and writing in English
6. Owns a smartphone
7. Not currently enrolled in other ongoing mobile health interventional studies

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
60 years

Sex
All

Key exclusion criteria
1. Cognitive impairment (Montreal Cognitive Assessment [MoCA] <26 education-adjusted)
2. Depressive symptoms (Geriatric Depression Scale [GDS] short form score >6)
3. Significant physical impairment impacting daily activities
4. Severe terminal illness or psychiatric condition interfering with daily function
5. Visual impairment, diagnosed eye diseases, or ocular abnormalities as assessed by a licensed optometrist
6. Uncorrected hearing impairment

Date of first enrolment
18/08/2025

Date of final enrolment
27/01/2026

Locations

Countries of recruitment
Singapore

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TUMCREATE Ltd.
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Sponsor information

Organisation
TUMCREATE Ltd.

Funder(s)

Funder type
Government

Funder Name
National Research Foundation Singapore

Alternative Name(s)
National Research Foundation-Prime Minister's office, Republic of Singapore, Singapore National Research Foundation, National Research Foundation of Singapore, National Research Foundation, Singapore, National Research Foundation, Singapore (NRF), nrfsg, NRF Singapore, NRF

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
Singapore

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated and/or analysed during the current study will be published as a supplement to the results publication and/or connected dataset.

IPD sharing plan summary
Published as a supplement to the results publication

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?

Study website	Study website	11/11/2025	11/11/2025	No	Yes