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How exposure to urban green and blue spaces affects sleep and mental well-being

Submission date	Recruitment status	[ ] Prospectively registered
20/02/2026	No longer recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
20/02/2026	Completed	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
20/02/2026	Mental and Behavioural Disorders	[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Poor sleep and reduced mental well-being are increasingly common among adults living in urban environments. Growing evidence suggests that spending time in natural environments, such as parks and green spaces, may improve sleep and psychological health. This study aims to investigate whether walking in environments with different levels of natural exposure can improve sleep quality and mental well-being, and whether these effects vary across seasons.

Who can participate?
Adults aged 18 to 50 years who experience poor sleep but are otherwise generally healthy and able to participate in light to moderate walking activities

What does the study involve?
Participants will be randomly assigned to one of four groups, each representing a different level of exposure to natural environments. They will take part in structured walking sessions over a defined period. Sleep, activity, and environmental exposure data will be collected using wearable devices and questionnaires.

What are the possible benefits and risks of participating?
Participants may experience improvements in sleep and mood from spending time outdoors. The risks are minimal and mainly related to light physical activity, such as mild fatigue or minor discomfort during walking.

Where is the study run from?
The study is conducted in urban outdoor environments and affiliated research institutions in Chengdu, China.

When is the study starting and how long is it expected to run for?
March 2025 to March 2026

Who is funding the study?
This work is supported by the National Natural Science Foundation of China (3227140499), the Chengdu Science and Technology Talent Support Program (2024-RC02-00010-CG), and the Doctoral Training Grants from Sichuan Agricultural University (China)

Who is the main contact?
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Study information

Scientific Title
Effects of exposure to urban green and blue spaces on sleep quality and psychological well-being

Study objectives

This study aims to design and implement a multi-setting, multi-season, multi-round randomized controlled trial to systematically evaluate the effects of nature-based walking interventions at varying exposure dose levels on sleep quality and mental health among adults experiencing poor sleep. By integrating multidimensional environmental, behavioral, and physiological data, the study seeks to elucidate the mechanisms linking natural environments to health outcomes.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 10/03/2025, Academic Ethics Committee of Sichuan Agricultural University (Room 608, No.1 Teaching Building, Sichuan Agricultural University, Chengdu Campus, No.211 Huimin Road, Wenjiang District, Chengdu, 611130, China; +86 (0)28 8629 3017; cncggl@163.com), ref: 20250659

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Dose comparison

Assignment
Parallel

Purpose
Health services research, Prevention

Study type(s)

Health condition(s) or problem(s) studied
Poor sleep and psychological well-being in urban adult populations

Interventions
This study employed a repeated measures design comprising four phases: baseline assessment (T0), environmental exposure intervention (T1), short-term assessment (T2), and follow-up assessment (T3). Over the 1-year study period, eight intervention cycles were implemented monthly across all four seasons, spanning March to December. The months of July and August (extreme heat) and January and February (extreme cold) were excluded due to equipment shutdowns caused by excessive temperatures and adverse effects on participants. Each intervention round comprised standardised 100-minute light walking (15:00–16:40, including a 20-minute rest from 15:40 to 16:00), with participants in four dose-level groups (low dose: minimal exposure to blue-green spaces; moderate-dose group: moderate exposure to blue-green spaces; medium-high-dose group: higher exposure to blue-green spaces; high-dose group: very high exposure to blue-green spaces) engaging in direct natural contact at designated locations. Participants were randomly allocated to the four exposure groups using a sequence

generated with an online random number generator (https://www.randomizer.org/). The allocation was implemented by an independent researcher responsible for randomisation and not involved in outcome assessment, ensuring allocation concealment. All interventions were synchronised over weekends to minimise systematic bias from circadian rhythms, personal schedules, and weather conditions. Interventions occurred under consistent weather parameters (temperature 15–30°C, no precipitation, wind speed <3 m/s), with walking speed controlled at 3.5–4.5 km/h to ensure uniform participant exertion levels. In each experimental round, 100 participants completed data collection before the intervention and 6 hours post-intervention to obtain baseline measurements and immediate post-intervention effects. A follow-up assessment was conducted 24 hours post-intervention before proceeding to the next experimental round.

Intervention Type
Behavioural

Primary outcome(s)
1. Sleep quality measured using Pittsburgh Sleep Quality Index (PSQI) at prior to T0 for participant screening and at T3 post-intervention follow-up

2. Sleep efficiency measured using wearable devices (HUAWEI BAND 8) at T0, T1, and T2 for each round of the intervention

3. Sleep score measured using wearable devices (HUAWEI BAND 8) at T0, T1, and T2 for each round of the intervention

4. Depressive symptoms measured using Patient Health Questionnaire-9 items (PHQ-9) at T0, T1, and T2 for each round of the intervention, with each assessment completed approximately 5 minutes before sleep

5. Anxiety symptoms measured using Generalized Anxiety Disorder-7 (GAD-7) at T0, T1, and T2 for each round of the intervention, with each assessment completed approximately 5 minutes before sleep

6. Affective state measured using the Positive and Negative Affect Schedule (PANAS) at T0, T1, and T2 for each round of the intervention, with each assessment completed approximately 5 minutes before sleep

7. Perceived stress measured using 14-item Perceived Stress Scale at T0, T1, and T2 for each round of the intervention, with each assessment completed approximately 5 minutes before sleep

Key secondary outcome(s))
1. Step count measured using wearable devices (HUAWEI BAND 8) at T1

2. Average heart rate measured using wearable devices (HUAWEI BAND 8) at T1

3. Duration of physical activity measured using wearable devices (HUAWEI BAND 8) at T1

4. Total energy expenditure measured using wearable devices (HUAWEI BAND 8) at T1

Completion date

15/03/2026

Eligibility

Key inclusion criteria
1. Age between 18 and 50 years
2. Reported poor sleep quality, defined as a Pittsburgh Sleep Quality Index (PSQI) score of ≥8, meeting criteria for clinically significant sleep disorders
3. Be in good physical health and be able to independently complete a walk of approximately 4 kilometres
4. No history of serious mental illness (e.g., schizophrenia or bipolar disorder)
5. No diagnosis of sleep disorder requiring medical intervention
6. Not being on long-term use of sleeping medication, antidepressants, or anxiolytics (e.g., e.g., benzodiazepines, zolpidem, melatonin, ghrelin, antihistamines, tetracyclic antidepressants, and selective 5-hydroxytryptamine reuptake inhibitors) at the time of enrolment to avoid confounding effects of medication on the effectiveness of the intervention

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
50 years

Sex
All

Total final enrolment
100

Key exclusion criteria
1. Night shift work or severe circadian rhythm disorders
2. Use of any sedative-type medication or sleep aid/anti-anxiety medication within the current week
3. Presence of a physical disease or disorder that limits the ability to walk outdoors
4. Participation in the full year trial cycle cannot be guaranteed and those expected to miss ≥2 interventions will be excluded

Date of first enrolment
11/03/2025

Date of final enrolment
14/03/2025

Locations

Countries of recruitment
China

Sponsor information

Organisation
Sichuan Agricultural University

ROR
https://ror.org/0388c3403

Funder(s)

Funder type

Funder Name
National Natural Science Foundation of China

Alternative Name(s)
Chinese National Science Foundation, Natural Science Foundation of China, National Science Foundation of China, NNSF of China, NSF of China, National Nature Science Foundation of China, Guójiā Zìrán Kēxué Jījīn Wěiyuánhuì, , NSFC, NNSF, NNSFC

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
China

Funder Name
Chengdu Science and Technology Talent Support Program

Funder Name
Sichuan Agricultural University

Alternative Name(s)
SICAU, SAU

Funding Body Type
Government organisation

Funding Body Subtype
Universities (academic only)

Location
China

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available