URBAN SOLUTIONS AND SUSTAINABILITY

R&D CONGRESS 2023

BUILDING SUSTAINABLE, RESILIENT, AND LIVEABLE CITIES OF TOMORROW

4TH – 5TH OCTOBER 2023

YEO BOON KHIM
MIND SCIENCE CENTRE

A research centre of:

NUS National University of Singapore

NUHS National University Health System

Nurture by nature: interventions for improving health and wellbeing in the urban city

ASSOCIATE PROFESSOR JOHN WONG CM

LIN JO YAN AND YEO BOON KHIM PROFESSOR IN MENTAL HEALTH & NEUROSCIENCE

DIRECTOR, YEO BOON KHIM MIND SCIENCE CENTRE, NATIONAL UNIVERSITY OF SINGAPORE

SENIOR CONSULTANT PSYCHIATRIST, DEPT OF PSYCHOLOGICAL MEDICINE, NATIONAL UNIVERSITY HOSPITAL

Nurture by nature:
interventions for improving health and wellbeing in the urban city

Synopsis

Does urban nature improve physical health and mental well-being?

- delves into the biophilia effect, which highlights the benefits of connecting with nature in close proximity.
- focuses on how this effect applies to unique populations, including individuals with special needs and the elderly.
- explores the concept of therapeutic gardens within natural landscapes and their combination with therapeutic activities, supported by insights from medical studies conducted in national parks

Biophilia Hypothesis

- Innate emotional affiliation of human beings to other living organisms

- Human beings are genetically predisposed to respond positively to natural environments

Urban Nature's impact on Well-being

Physical Wellbeing

- Urban nature provides **biophysical ecological effects** that enhance health & wellbeing (Shanahan et al., 2015).
    - Direct effect: vegetation filters air pollutants & urban heat effect, reducing prevalence of respiratory illness or heat-related illnesses.
    - Indirect effect: Urban nature encourages positive health behaviours where people are more inclined to exercise in nature with interesting and pleasant surroundings.

Physical Wellbeing

- Physical Benefits (Population level studies)
  - In neighbourhoods with higher levels of green space:
    - ↓ all-cause mortality &
    - ↓ mortality from cardiovascular disease
  - Reduced asthma prevalence
  - Enhanced general or self-reported health

- Physical Benefits (Individual level studies)
  - strong associations between exposure to nature and improved healing times
  - Reduced allergies
  - Enhanced social cohesion
  - Reduced stress
  - Improved cognitive ability
  - Enhanced happiness

Psychological Wellbeing

- Additional restorative effects from contact with nature (Mitchell, 2013)
  - Physical activity in a natural environment was found to produce greater mental health benefits than physical activity elsewhere
  - **Stress reduction theory, SRT (Ulrich, 1991)**
    - Looking at scenery containing natural elements like greenery or water creates positive emotions and feelings like interest, pleasure, and calm, and has a restorative effect, easing our state of alert following a stressful situation.

Psychological Wellbeing & Physical Biomarkers

Impact of nature using physical biomarkers like cortisol to measure stress levels has been widely studied (Jones et al., 2021)

Olafsdottir et al. (2020) found **positive effects** of nature using psychophysiological stress and mood responses

Compared effects of nature exposure through 3 Interventions and across 2 stress conditions:

Walking in Nature	Watching a Video of the same Nature Scenes	Walking on a Treadmill in a Gym
Under Academic Stress vs No-Stress Conditions		

Measures:

Socially Evaluated Cold-Pressor Test; Cortisol Assays; Cardiac Data (HR and HRV) from ECG; Positive and Negative Affect Scales (Assess Mood)

Results:

- Individuals walking in nature had LARGEST decrease in cortisol levels when under high stress; Passive viewing had the least decrease
- Only those walking in nature reported significant increases in positive affect => supporting previous findings on the benefits of nature exposure on mental health

Biophilia Effect on Children with Special Needs

Behavioural Problems

Higher daily exposure to woodland was associated with higher cognitive development scores and a lower risk of emotional and behavioural problems in adolescents
(Maes et al., 2021)

1. **Woodland** had a greater effect than grassland (vegetation < and > 1m respectively) and blue space

2. Audio-visual exposure through vegetation and animal abundance provides psychological benefits

3. Informs urban planning decisions in considering the type of natural environment that optimise ecosystem benefits

ST PHOTO: LIM YAOHUI
Claire Gillo/PhotoPlus Magazine/Future

Behavioural Problems

Several studies explore **wilderness family therapy programs** as a treatment approach (Overbey, Dieckmann & Lekies, 2021).

Components include learning outdoor skills, hiking extensive distances, overnight camping, being away in remote areas, and individual and group therapy sessions. There may also be a family component, in which parents participate in therapy.

Program Outcomes: (Bandoroff & Scherer, 1994; Lambie et al., 2000):

- Reported ability to:
  - Avoid high-risk situations
  - Take responsibiltiy for behaviour
  - Have victim empathy
  - Have appropriate social relationships

- Decrease in problem behaviour

Image: Second Nature

Attention-Deficit Hyperactivity Disorder (ADHD)

Tillman et al.'s (2018) review of how interaction with different types of nature, found significant positive effects in children with ADHD

- Increased accessibility and exposure to nature were associated with improvements in ADHD symptoms
- A significant positive relationship was also found between nature and emotional well-being
- Demonstrated nature's ability to reduce stress in children and teenagers

Kuo & Taylor's (2004) study found that exposure to nature may be widely effective in reducing ADHD symptoms across diverse sub-populations of children

- Benefits of nature were found across different ages, genders, income groups, community types, and US geographic regions
- Positive effects of nature found within rural children => indicating that positive effects in urban children are not a result of novelty
- Positive effects within ADD children indicates that positive effects of nature cannot wholly be attributed to an expulsion of hyperactive energy

Autism Spectrum Disorder (ASD)

Ramshini et al. (2018) found that family-based nature therapy helped reduced some sensory problems of ASD children

- Sample: Fourteen 3-7 year old ASD children
- 10 Sessions of Nature Therapy which aimed to:
  1. Engage child in nature
  2. Being in nature and doing different assignments (Horticultural activity, Communicating with Animals, Carrying out Physical Activities)

Flick (2012) denoted the possible positive effects of horticultural therapy for children with ASD

- Using natural materials (soil, sand, water, seeds, plants and other related materials) to encourage social interaction by engaging in activities that promote sharing and turn taking
- Engaging and stimulating both hyper and hypo-sensitive ASD children
- Possibility of curating horticultural therapeutic activities for ASD children

Autism Spectrum Disorder (ASD)

Barakat et al. (2019) proposed the development of a sensory garden for ASD children.
Nature found to be healing:

Cognitive Benefits

1. Helps in observation and being more creative
2. Increase in imagination, sense of wonder and reinforces collaborative skills language
3. Improves intrapersonal and interpersonal learning skills and abilities

Mental Benefits

4. Reduce stress
5. Reinforces positive feelings with each other
6. Improved concentration

Physical & Other Benefits

7. Better motor fitness and reduction in accidents
8. Social Development => Outdoor play helps with parallel play
9. Emotional Development => Solitude of nature provides essential privacy experience

Therapeutic Effects of Nature Playgardens on Children (ASD & ADHD)

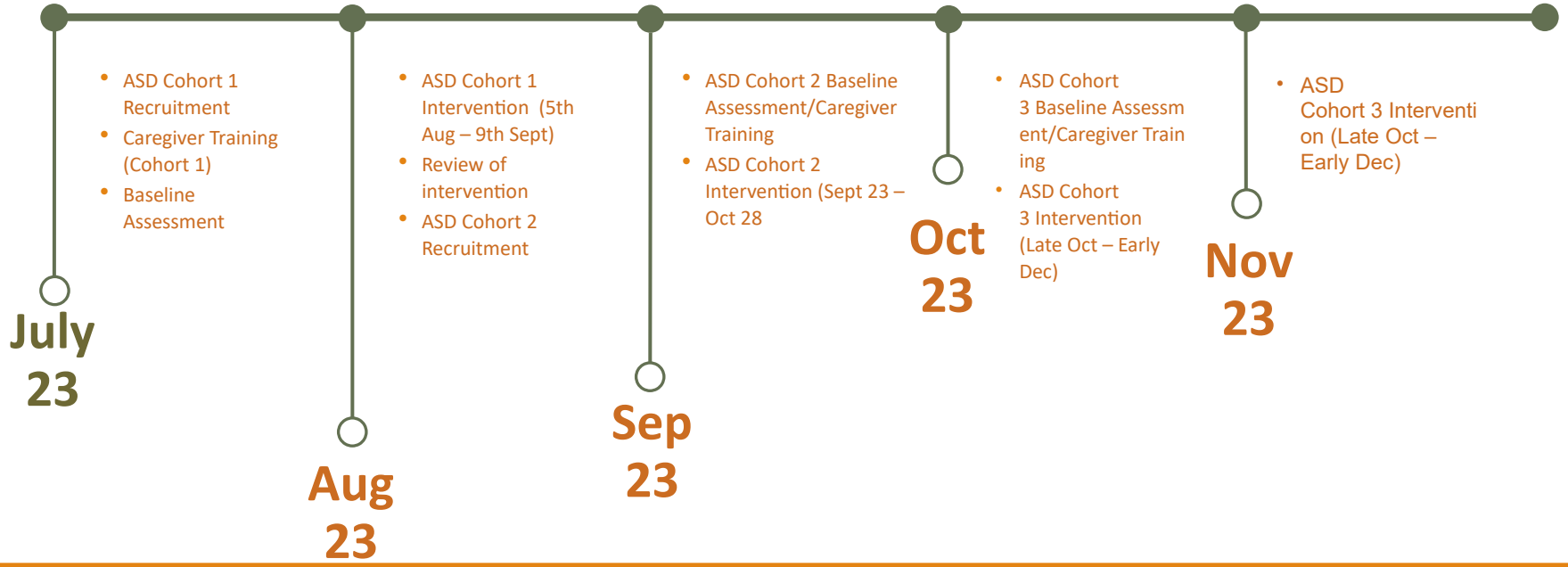
The Therapeutic Effects of Nature PlayGardens on Children with Attention-Deficit/Hyperactivity Disorder (ADHD) & Autism Spectrum Disorder (ASD) Study is a study in collaboration with National Parks Board to understand the effects of clinical nature-based intervention in ASD and ADHD boys aged 5-9

1. Enhancing children's **emotional regulation** (sense of well-being)
2. Building **pro-social behaviour** (through group collaborative play)
3. **Improvement in caregiver well-being** (active caregiver-child interaction)

STUDY MILESTONES

6 Weekly Intervention Sessions

Activities Optimize Nature and Sensory Engagement



ASD Cohort 1 Intervention

Warm-up/Cool-down

- Connecting with each other and nature
- Introduction of calming/regulation techniques

Feelings Communication Board

"Porcupine Monster" with natural dough/materials

ASD Cohort 1 Intervention

Group Collaborative Activities/Play

- Building of pro-social behaviours
- Expansion of caregiver-child interaction

Watering of plant beds with sponge

Race to fill up egg trays

Caterpillar Walk with threaded leaves

ASD Cohort 1 Intervention

Child-led Activities/Play

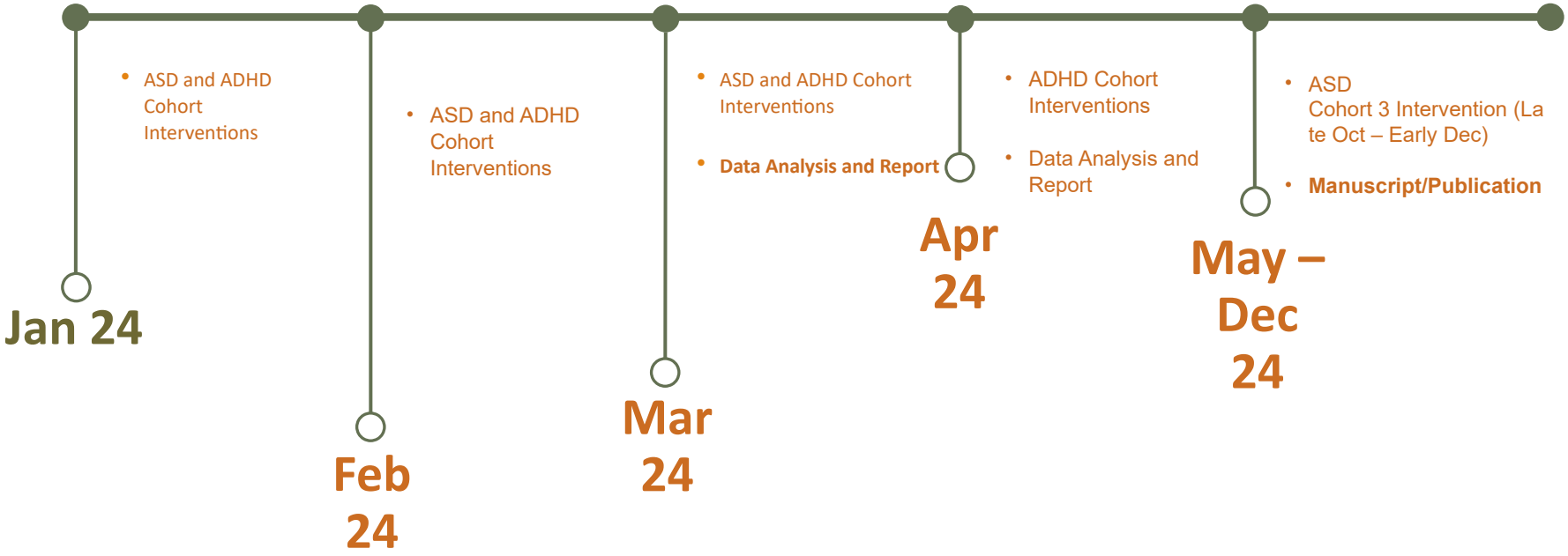
- Sensory experience and expansion
- Nature expansion and interaction

Gravel Sensory Play

Sand Play with Caregiver

ASD Cohort 1 Graduation

MOVING FORWARD



WP4: The Underwater Nature and Health Study

Visitors viewing one of the study exhibits

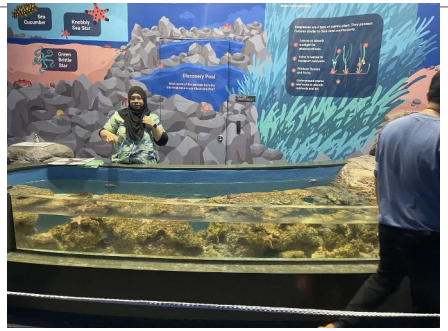
The Underwater Nature and Health Study is a single-arm, 'open-label' study that involves a one-time visit to SEA Aquarium. The study seeks to investigate the effects of viewing selected SEA Aquarium exhibits on wellness (physical and psychological) and social bonding between dyads. Critical success factors for neuro-conservation are identified.

Study populations:

1. 130 Healthy adults (18-30 y/o)
2. 30 Child-caregiver dyad (5-7 y/o neurotypical children, with caregivers above 21 y/o)
3. 30 Elderly-caregiver dyad (Cognitively intact elderly above 60 y/o, with caregivers above 21 y/o)

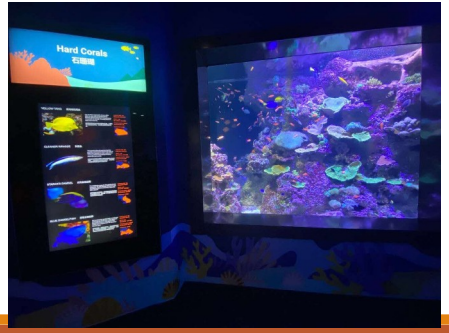
Study Exhibits: Participants will view each exhibit for 10 mins

Marine Macroalgae

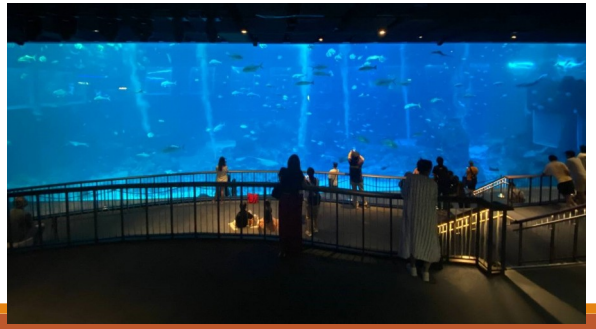


Touch pool (for children)

Moon Sea Jellies



Hard Coral Tank



Open Ocean Habitat

Measures & Procedures

Physical Wellness

- Salivary cortisol
- Wearable device

Emotional Wellness

- Self-report mood
  - 3 time points while viewing exhibit (0, 5, 10 mins)
- Perceived Restoration
- Connection with Nature
- Experience of awe

Social bonding

- Social bonding survey (dyads only)

Conservation

- Environmental attitudes towards conservation
- Conservation intent after visit

Profiling of exhibits: adapted Contemplative Landscape Questionnaire

Biophilia Effect on Elderly

The role of urban green spaces in care facilities for elderly people across European cities (Artmann et al., 2017)

- **Sample:** 126 questionnaires filled by administrators of care facilities across Europe

- **Findings**
  - Most important **physical activities** done in the garden**:** Walking (95%), contact with nature through picking plants/gardening (64%)

  - **Social wellbeing:** Seniors use garden with other seniors (32%) and with nurses (26%).

  - **Passive recreation:** personal interactions such as enjoying the sun (90%), chatting (60%), and observing nature (56%)

The Effects of Urban Natural Environments on Preference and Self-Reported Psychological Restoration of the Elderly (Qiu et al., 2021)

- **Sample**: 300 participants, 60-79 years old without cognitive and communication difficulties, who were using open/green spaces in their residential areas.

- **Methods**:
  - Participants shown photos of 4 selected environments (Open Green Space (OGS), Partly-Closed Green Space (PCGS), Closed Green Space (CGS), Blue Space (BS)).
  - Participants rated preference level of photograph, perceived sensory dimensions (PSD), perceived restorativeness.

- **Key Findings**
  - Elderly preferred blue spaces, and blue spaces had higher restorative potential.
  - Elderly preference for green spaces had a significantly positive correlation with their psychological restoration

Open green space (OGS)

Partly-closed green space (PCGS)

Closed green space (CGS)

Blue space (BS)

Green spaces and People with Dementia (Mmako et al., 2020)

- Using **Attention Restorativeness Theory (ART)** to understand benefits of nature for people with dementia
  - People with dementia have compromised executive functioning and attention --> resources for maintaining attention exhausted more easily
  - Green spaces can provide rest, help restore the senses and improve overall mental wellbeing.
  - Elderly with dementia can use green spaces to escape some of the difficulties of human functioning that dementia can bring.

Active Engagement for people with Dementia (Mmako et al., 2020)

- Green spaces provide space for **meaningful engagement**
  - Attending to plants & animals
  - Nature inspired crafts
  - Exercise & social interaction
  - Walking outdoors

- Active engagement in green spaces **boosts self-worth & social connections**

- Enhanced **social engagement**
  - Through shared tasks with others
  - Informal conversations on common topics originating from shared spaces (Hall et al., 2018)

- Green space programs facilitates **active citizenship**
  - Olsson et al. (2013) reported that people living with dementia enjoyed their independence even by passively observing the outdoor environment without interference from others.

Effectiveness of Therapeutic Gardens for People with Dementia (PWD): A Systematic Review (Murroni et al., 2021)

Findings:

- Studies on therapeutic gardens, wander gardens, sensory gardens, Japanese gardens, and a renovated natural garden all showed improvements in one or more areas: Engagement, Behavior, Medication, Falls, Agitation, Quality of life, Stress, Depression/Mood, Cognition, and Self-Consciousness.

- Domains most impacted by exposure to/use of therapeutic gardens:

  - **Behavior**: reduction in aggressive behaviors, agitation, falls
  - **Mood**: Lower levels of depression and stress, enhancements in positive affect.
  - **Reduced use of medication**, probably due to improvements in the behavioral area.
  - **Cognition**, self-consciousness (self awareness).
  - **Quality of life and wellbeing**, and **sleep.**

Building preventive strategies is crucial to tackle risk factors and early detection of cases

1 in 4 Singaporeans will be 65 years or older in 2030

Singaporeans are living longer, but live 10.6 years in ill health

Dementia affects 1 in 10

Prevalence of depression 11.4%

High prevalence of suicide in older adults aged 50 and above

Seniors are more vulnerable to COVID-19 and social isolation

10-year Jurong Ageing Study

Population-based approach to dementia prevention

RESEARCH

JURONG AGEING STUDY (JAS)

Training and Research Academy at Jurong Point (TaRA@JP) 2011

Cohort Study Diet Study 2012

JAS 1 Pilot Study 2012

JAS 2 Mindfulness Awareness Programme (MAP) 2014

Cohort Study Diet Study Follow-up 2017

JAS 3 Art & Music Therapy & Reminiscence 2016

JAS 4 Horticulture Therapy I 2016 — JAS 4 Horticulture Therapy II 2017

JAS 5 Choral Singing I 2015 — JAS 5 Choral Singing II 2017

JAS 6 Chinese Ink Painting 2020

Decrease in depressive symptoms
Decrease in anxiety symptoms
Improvement in life satisfaction

SERVICE & EDUCATION

Dementia Prevention Programme (DPP) 2015 — Age Well Every Day (AWE) 2017

Train-the-Instructor & Trainers Workshop 2015 → AWE E-Portal 2019

Age Well Everyday (AWE)

"Active Ageing in the community, by the community, for the community."

- Evidence-based, volunteer-driven community programme
- Aims to promote mental resilience, prevent or delay the onset of dementia and improve the quality of life of seniors

Scan the QR code to find out more

AGE WELL EVERYDAY (AWE)

Programme Structure

Volume 1: Introduction
12 sessions (weekly/fortnightly)

Volume 2: Maintenance
12 sessions (monthly)

Volume 3: Advance
12 sessions (monthly)

Same topics but with increasing depth in the content across volumes

Physical Activity*
(30-60mins)

Complement Partner's existing physical activities

For e.g. brisk walking, tai chi, qigong, line dance, meridian flapping, HAPPY

Health Education
(15-30mins)

Lifestyle Management
Hypertension
Diabetes
Healthy Diet
Falls Prevention
Depression
Dementia
Stress and Insomnia

Mindful Awareness Practice
(15-30mins)

Mindfulness of the Breath
Mindfulness of the Senses
Mindfulness in Daily Activities
Mindfulness of the Body & Movement
Mindfulness of the Surroundings
Loving-Kindness and Compassion

Horticultural Therapy

Self-designed by Partners with MSC's and NParks' guiding notes

Art & Music Reminiscence

Self-designed by Partners with MS guiding notes

Therapeutic Forest

Therapeutic Forest
Mindful Walking

AWE in Action

KMSPKS

Queenstown

RSVP

Tampines-Changkat

Eunos

Horticultural Activity and Mental Well-being

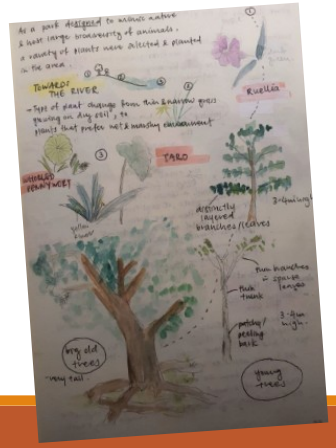
Therapeutic Gardens in National Parks

Therapeutic Rainforest Programme

(Pilot study in collaboration with Alice Lee Centre for Nursing Studies)

Objectives:

- Enhance mental resilience of NUS Students
- Impart lifelong skills to prevent mental health problems
- Evaluate the effects of nature walk through the use of the therapeutic forest in promoting mental and physical well-being among university students
- Develop and implement therapeutic rainforest programme for our future leaders to be mentally resilient, care for the green environment and make Singapore a better place to live in



Tuesday, March 30, 2021

THE STRAITS TIMES

Mindfulness on a forest walk can boost one's health: Local study

Walking mindfully in the forest can improve one's mental, physical and social health, as some seniors in a recent study found.

The Nature and Mindful Awareness Study, a 10-week qualitative study led by prominent psychiatrist Kua Ee Heok, gathered 20 participants with a mean age of 65.5 for Saturday morning walks in green spaces such as the Singapore Botanic Gardens.

The study ended in 2019, but its members continue to walk together every week, often staying for chats over coffee afterwards.

Such group walks can make people more appreciative of nature, as well as foster social connectedness, which is "protective against anxiety and depression", says participant Vincent Chong, 67, who is a visiting consultant at the National University Hospital.

The study was supported by the National University Health System and NUS Yong Loo Lin School of Medicine's Mind Science Centre.

Participants of the Nature and Mindful Awareness Study, which found walking mindfully in a forest can improve one's mental, physical and social health, on a morning walk at the Singapore Botanic Gardens. ST PHOTO: NG SOR LUAN

Housewife Wee Geok Hua, 67, who leads the group on the hour-long walks, says such sessions encourage people to focus on the here and now.

"Most of the time when we walk, we will either be plugged into our mobile phones or chatting with a friend. Sometimes when you've finished, you can't even remember the route you have taken.

"When you do mindful walking, you want to bring your focus to whatever is happening in the present," she says.

Mrs Wee, who compares mindfulness practice to a "mental gym", says: "You are simply being aware.

We try not to validate whether an experience is good or bad. The sound coming from a car is neither good nor bad. You are just listening to what it is."

There is nothing religious about the way the group practises mindful walking, even though mindfulness has roots in Buddhist philosophy, she adds.

Studies have shown that mindfulness offers a host of benefits, not least helping people cope with conditions such as depression, anxiety and chronic pain.

Next year, Prof Kua and his colleagues will mount a 10-year longitudinal study of the impact of nature and mindful awareness on university students.

The Therapeutic Rainforest study, as it is called, is distinct from forest bathing and will take students on guided mindful walks in the rainforest around Kent Ridge Park for 10 weeks, before maintaining contact with them over the ensuing years. A pilot study will kick off later this year.

The Effect of Therapeutic Horticulture on the Psychological Wellbeing of Elderly in Singapore: A Randomised Controlled Trial (Sia et al., 2018)

Sample: 59 elderly (60-85)
Treatment group: 15-session therapeutic horticulture program vs. Waitlist control group

Activities included:

- A guided walk in the Singapore Botanic Gardens, Gardens By the Bay (Flower Dome, Cloud Forest), Sungei Buloh Wetland Reserve
- Planting of vegetables & simple maintenance tasks at Chinese Gardens

A significant improvement was observed in the subscale "**positive relations with others**" of the Ryff Scales of Psychological Well-Being (SPWB) when comparing mean change between the treatment and control groups

Image: Sungei Buloh Wetland Reserve/National Parks Board

Therapeutic Garden With Contemplative Features Induces Desirable Changes in Mood and Brain Activity in Depressed Adults (Olszewska-Guizzo et al., 2022)

Sample:
- adults aged 21–74 (n = 92)
- 24 clinically depressed and 68 healthy participants

Methods:
- Examined effects of in-situ passive exposure to three urban spaces on brain activity and self-reported momentary mood
  - **Therapeutic Garden with high Contemplative Landscape scores (TG) - Hort Park**
  - Residential Green (RG)
  - Busy Downtown (BD)

Results: self-reported pre- post-mood was significant only at the TG ($p = 0.032$), with possibly different pathways of mood improvement

Image: HortPark/National Parks Board

Guided tour

Sungei Buloh Nature Reserve

Thank you!