Healthy Trees: Healthy City
benefits of a robust urban forest

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Tree Ambassadors
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So the tree rustles in the evening,

Trees have long thoughts,

long-breathing and restful,

just as they have longer lives than ours.

Hermann Hesse,
Trees: Reflections and Poems
Outline

1. Trees and Human Health
   the evidence?

3. A focus on mental health

3. Dosage, equity & big trees
How are city trees associated with human health?
Health is...

A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity

(World Health Organization, 1946)
Urban Trees & Human Health: A Scoping Review

Purpose:
To carefully collect and synthesize the peer-reviewed evidence concerning urban trees and human health.
Project Team

- Kathleen Wolf, Ph.D., University of Washington
- Sharon Lam, MSc, Ontario Climate Consortium
- Jennifer McKeen, MPH, Simon Fraser University
- Gregory Richardson, MUP, Health Canada
- Matilda Van Den Bosch, M.D, University of British Columbia
- Adrina Bardekjian, Ph.D., Tree Canada
Method

Keyword search (n = 2563)

Abstract review (n = 436)

Quality assessment (n = 215)

Final article set (n = 199) (201 studies)

Synthesize and present findings
Associations between urban trees & health
prepared by Sharon Lam
What did we learn?

Publication Dates by Decade

- 1980-1989: 0
- 1990-1999: 0
- 2000-2009: 40
- 2010-2018: 140
What did we learn?

- single & park trees
- pollen
- image/simulation
- tree canopy/NDVI
- immersion

credit: Univ of Utah
What did we learn?

Health Outcomes Themes:

- Tree Pollen and VOCs
- Active Living/Weight Status
- Psychophysiological Stress
- Excess Heat and Thermal Comfort
- Cardiovascular Function
- Mental Health, Anxiety and Mood
- Air Pollutants and Respiratory Condition
- Other Restoring Capacities (e.g., Birth...)
- Cognition and Attention Restoration
- Other Reducing Harm (Crime, UVR)
- Clinical Outcomes
Urban Forests & Newborns

the natural environment may affect pregnancy outcomes . . .

10% increase in tree-canopy cover within 50m of a house
= lower number of low weight births
(1.42 per 1000 births)

Donovan et al., 2011. Health & Place 2011; Hystad et al., 2014. Env Health Perspectives
ADHD and nature contact

- 17 children aged 7-12 with diagnosed ADHD
- 20-minute guided walks
  - Park
  - Neighborhood
  - Downtown
- Pre-walk puzzles
- Post-walk cognitive test

Faber Taylor & Kuo. 2009. *Journal of Attention Disorders*
Green High School Campuses

- cafeteria & classroom window views with greater quantities of trees and shrubs
- positively associated with:
  - standardized test scores,
  - graduation rates
  - %s of students planning to attend a four-year college
  - fewer occurrences of criminal behavior

Matsuoka. 2010. *Landscape & Urban Planning*

credit: NBC News
Children & Nature Network

**Green Schoolyards Help Kids Feel:**
- Calmer & Less Stressed:
  - Views of green landscapes from classroom windows helped high school students recover more quickly from stressful events.
- Positive & Restored:
  - Forest schools enhanced positive and decreased negative emotions.
- Resilient:
  - Natural areas enhanced feelings of competence and increased supportive social relationships that help build resilience.

**Green Schoolyards Promote Social-Emotional Skills**
- Practice Relationship Skills:
  - Children demonstrated more cooperative play, civil behavior and positive social relationships in green schoolyards.
- Develop Self-Awareness & Self-Management:
  - Green schoolyards can reduce aggression and discipline problems.
  - Gardening at school helped students feel proud, responsible & confident.

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**The Statistics on Children & Nature**
Encouraging Physical Activity

Review of studies of adults, natural environments vs indoors

Results of activity in natural environments:

- greater feelings of revitalization and positive engagement, increased energy
- decreases in tension, confusion, anger, and depression
- greater enjoyment and satisfaction, declared a greater intent to repeat the activity

Coon et al. 2011. *Environmental Science & Technology*
public health officials
moderate activity
recommendations

parks, active living, active transit
Confounders?

- Gender
- Age
- Education
- Prior Conditions
Pennsylvania Horticultural Society
Clean & Green Program

reduced heart rate = less stress
South et al. 2015. American Journal of Public Health

reduced reports of depression & worthlessness
South et al. 2018. JAMA Network
City Trees & Human Health

- newborn & infant health
- increased physical activity for kids
- student therapy
- overall adult health
- social cohesion
- respiratory & cardiovascular health
- reduced depression
- elder care improvements
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Mental health

'A high-risk perfect storm': loneliness and financial despair take toll on US mental health

Lockdowns have caused uncertainty, isolation, grief and economic despair, leading to a sharp rise in calls to helplines

Nina Lakhani
Fri 24 Apr 2020
07:00 EDT

▲ 'In the first wave people were anxious, but now in the second wave people are feeling depressed and isolated, especially very poor people and those in violent situations.' Photograph: Justin Paget/Getty Images

The Guardian
Trees, Parks
Green Space
more than
exercise!

Legacy Health, Portland OR
Nature & Mental Health

experiences & pathways to psychological benefit

Bratman et al. 2019. Science Advances
General Wellness

Therapy & Treatment

credit: UK National Health Service
Urban Trees & Green Space for Mental Health

general wellness:
school performance
stress reduction
attention restoration
creativity
job burnout prevention

therapy:
attention deficit
emotional therapy
depression reduction
dementia & cognitive disorders
special situations
Nature & Stress Response

8 week long experiment, 36 urban adults - chose the time of day, duration, and the place of nature experience based on personal preference and changing daily schedules

Results:

salivary cortisol – stress biomarker, ~ 21% less
20-30 minutes nature experience optimal

salivary amylase – stress biomarker, ~ 28% less
for adults who were least active

Hunter et al., 2019. *Frontiers in Psychology*
Improving Depression

20 adults with major depression walk in park setting or built setting

• 50-minute walks one week apart

• before-after testing:
  • Mood: Positive and Negative Affect
  • Cognition: Backward Digit Span

Berman et al. 2012. *Journal of Affective Disorders*

cognitive and affective improvements after walking in a nature setting
Group Walks Improve Mental Health

England, Walking for Health national program test Nature Group Walkers vs Non Group Walkers

**results:**

- lower depression, perceived stress, negative affect
- enhanced positive affect and mental well-being
- group walks synergize with physical activity to improve positive affect and mental well-being

Marselle et al. 2014. *Ecopsychology*
How Walking in Nature Changes the Brain

**rumination**: Maladaptive self-referential thoughts, heightened risk for depression and other mental illnesses

*90-min walk in a natural setting decreased*

- self-reported rumination
- neural activity in the subgenual prefrontal cortex
- no reduced effects from built environment walks

Bratman et al. 2015. *Proceedings of the National Academy of Sciences of the USA*
Attention Restoration Theory

• directed attention
• cognitive fatigue
• outcomes? frustration, impulsive, aggression

Rachel & Stephen Kaplan, University of MI
ART Design Elements

- being away
- ‘soft’ fascination
- extent
- compatibility

Rachel & Stephen Kaplan, University of MI
Outline

1. Trees and Human Health
   the evidence?

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3. Dosage, and
   the role of big trees
Tree Planting for Health

Views from Within

Connect Experiences

Create Refuge

Nearby Nature in Community

Equity and Accessibility :: 10 Minute Walk
Biodiversity & Mental Health

vegetation cover & afternoon bird abundance

Results:

lower prevalence of depression, anxiety & stress:

- less depression – more than 20% cover
- less anxiety – more than 30% cover
- less stress – more than 20% cover

images of canopy cover varied 0-60%

Urban Forest Canopy Cover & Stress Response
lab measures of stress after viewing images

Urban Forest Canopy Cover & Stress Response

Forest Bathing & Therapy  *Shinrin yoku*

more than a decade of research – Japan, South Korea, northern Europe
Forest Bathing

immersion experiences, hours to days, often guided

- improved mood, reduced anxiety
- reduced stress, lower cortisol
- improved nervous system activity, less fight or flight response
- improved diabetes symptoms, reduced blood glucose
- improved pulse rate, blood pressure

Park et al., 2010. *Env Health and Preventive Medicine*
Li et al. 2006. *Immunopharmacology and Immunotoxicology*
The medicine of being in the forest
We are the leading global voice for forest bathing and forest therapy

Santa Rosa, California
How can green space planning protect & promote human health?
DOSAGE

STRESS
20-30 min session

DEPRESSION
BLOOD PRESSURE
> 30 min per week

DEPRESSION
1 garden visit per week (peak 4-5)

HIGH
WELL BEING
120 min per week (peak 200-300)

Shanahan et al. 2016 *Scientific Reports*
Cox et al. 2017 *Int J of Environmental Research & Public Health*
White et al. 2019 *Scientific Reports*
2016 Seattle Urban Tree Canopy Analysis

LiDAR imagery

goal 30%, now 28%

report at: http://www.seattle.gov/trees/canopycover.htm

thanks to Sandra Pinto de Bader
City of Seattle
2016 Seattle Urban Tree Canopy Analysis

degree of existing tree canopy for each of Seattle’s neighborhoods
2016 Seattle Urban Tree Canopy Analysis

Map Key for each Seattle Census tract

% people of color (color intensity within tract)

% tree canopy (size of circle)
Environmental Equity

Forest canopy

Trees

Parks

Natural areas

Figure 14. Figure describing percent tree canopy in relation to people of color. Each dot represents an EEA polygon.
The tree which moves some to tears of joy is, in the eyes of others, only a green thing that stands in the way.

Some see nature all ridicule and deformity . . . and some scarce see nature at all.

But to the eyes of the man of imagination, nature is imagination itself.

William Blake
Summary

- City trees & nature provide benefits for human health - protective therapeutic
- More & larger trees provide more benefit – evidence!
- Address equity & health social determinants
- Tree retention & promotion policies?