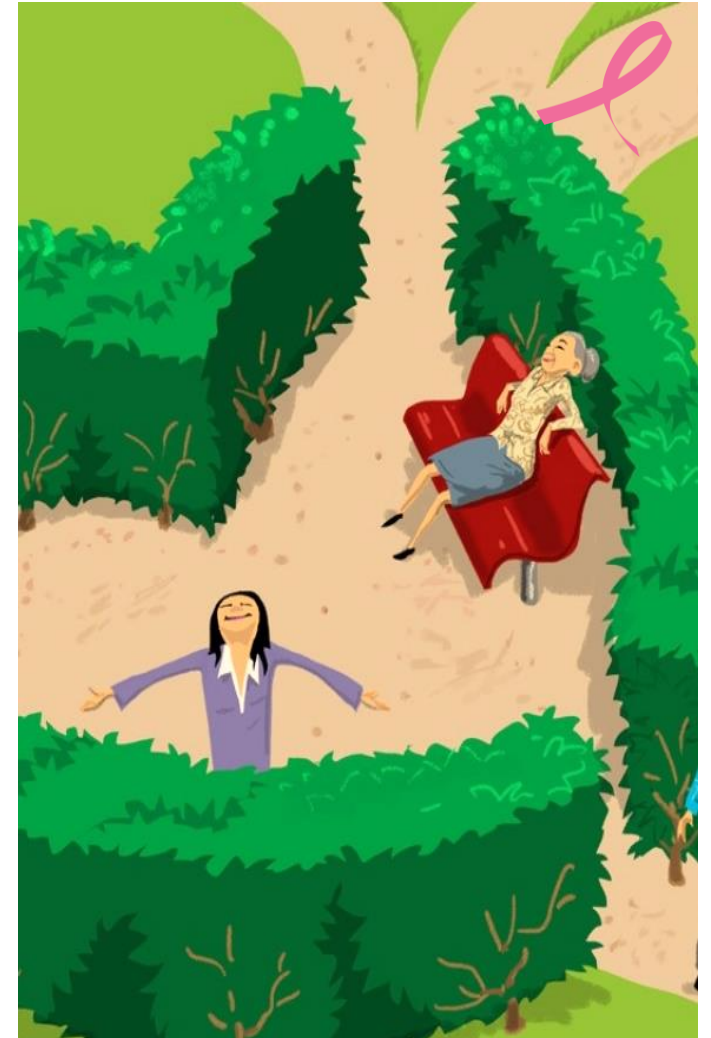


Urban greenness and mental health among middle-aged and older adults of the Canadian Longitudinal Study on Aging (CLSA)

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Increased urban greenness associated with improved mental health among middle-aged and older adults of the Canadian Longitudinal Study on Aging (CLSA)

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ABSTRACT

Objectives: Some studies suggest that residential surrounding greenness is associated with improved mental health. Few of these studies have focussed on middle-aged and older adults. explored the modifying effects of

BACKGROUND: *Greenspace and health*

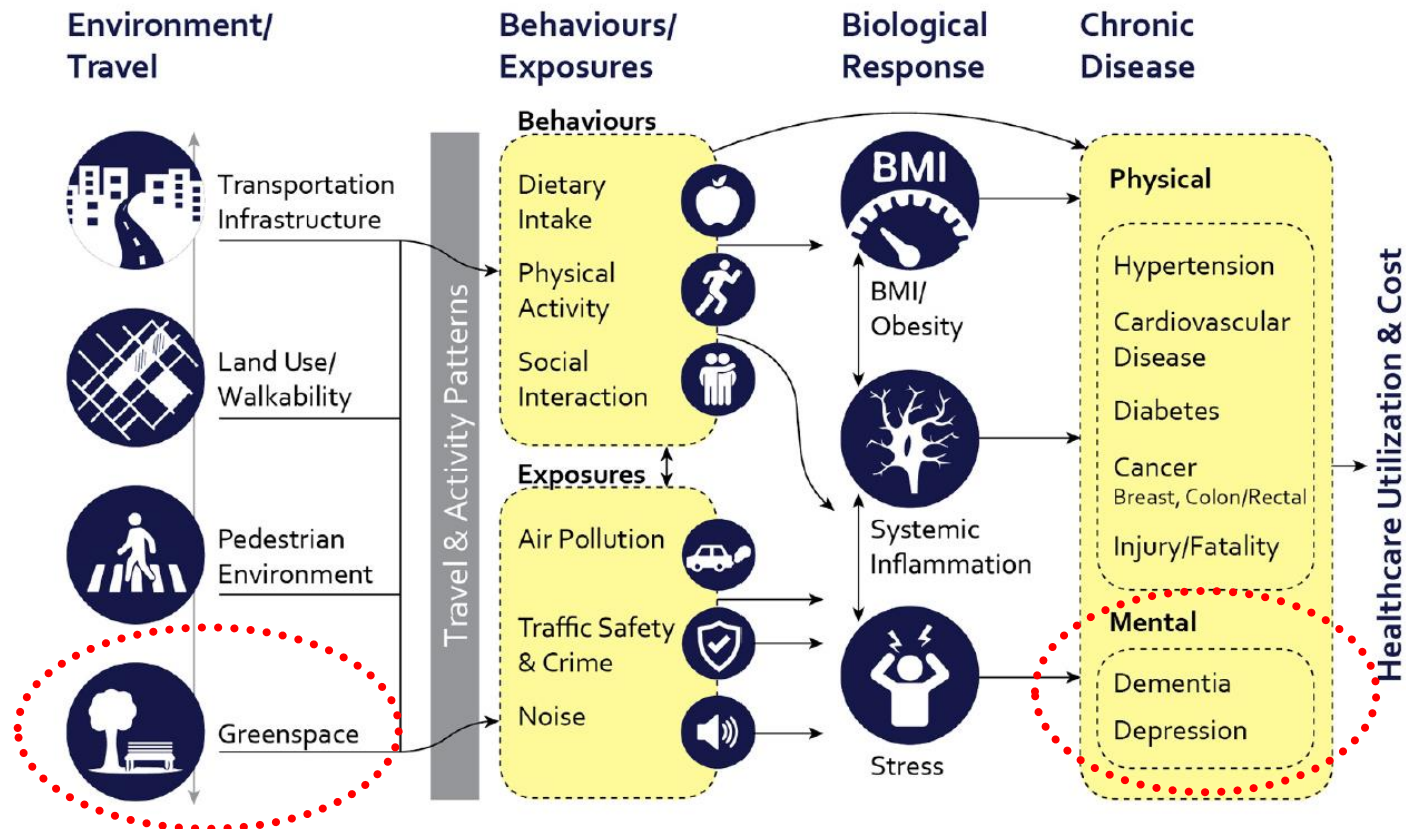


Fig. 1. Causal diagram linking the pathways from the built environment to chronic disease and healthcare costs.

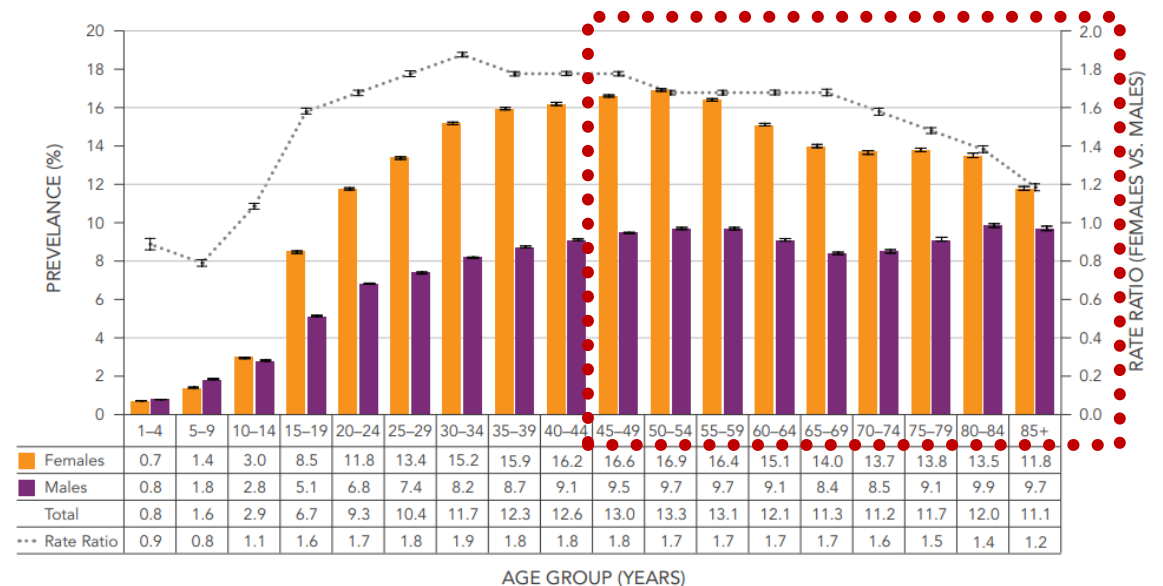
Figure from:

Frank, L., Iroz-Elardo, N., MacLeod, K., & Hong, A. (2019). Pathways from built environment to health: A conceptual framework linking behavior and exposure-based impacts. *Journal Of Transport & Health*, 12, 319-335. doi: 10.1016/j.jth.2018.11.008

BACKGROUND: *Mental health and greenspace*

- 1 in 10 Canadians use health care services to manage mood and anxiety disorders annually
- Rapidly aging population
- Recent studies have suggested links between greenspaces and improved health → Few studies on this topic have focussed on older adults

FIGURE 4: Age-specific annual prevalence (%) and rate ratios of the use of health services for mood and anxiety disorders among people aged one year and older, by sex, Canada,* 2009/10



NOTES: The 95% confidence interval shows an estimated range of values which is likely to include the true prevalence 19 times out of 20. *Data do not include NU and YT.

SOURCE: Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, as of September 2013.

RESEARCH QUESTION

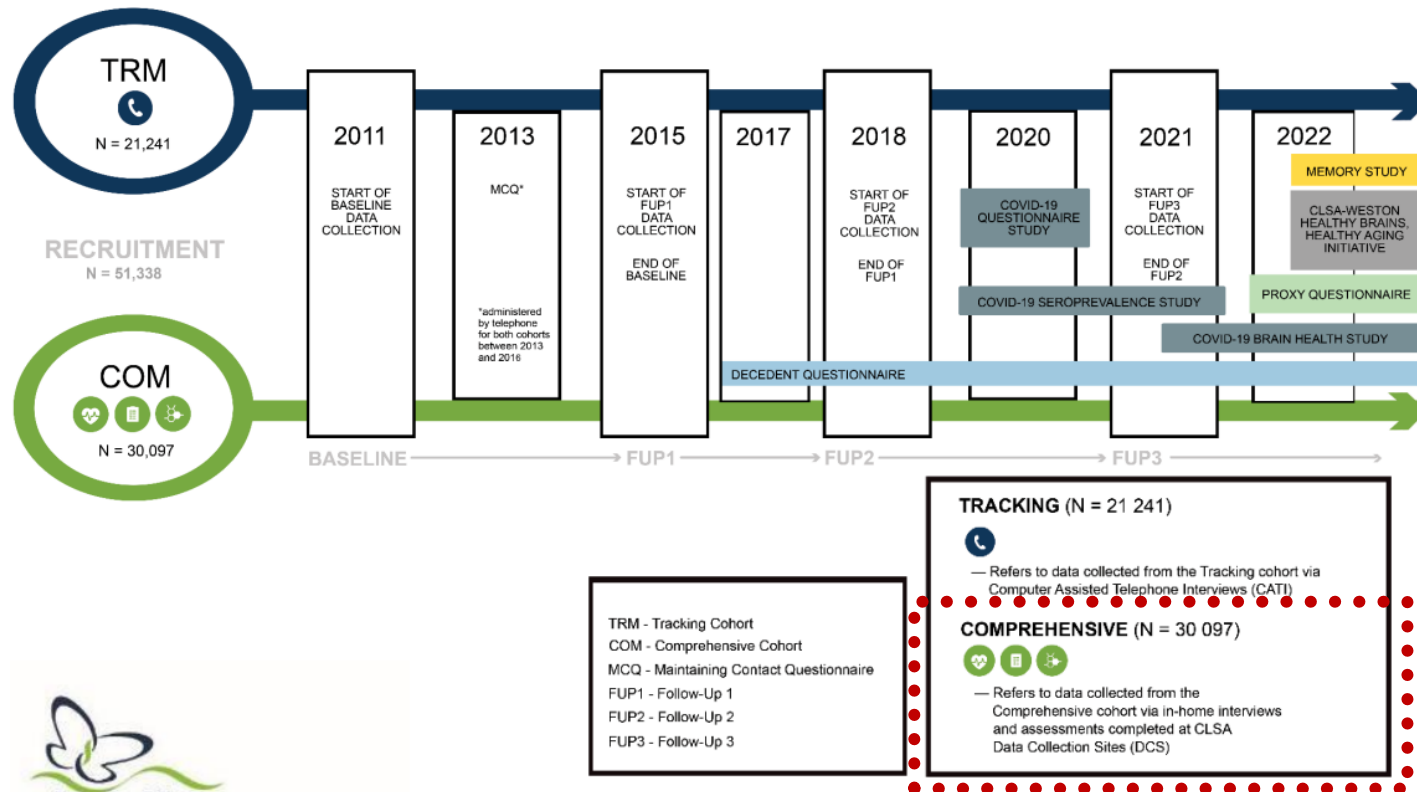
Is Urban greenness associated with mental health among Canadian adults?

Can greenness reduces socioeconomic disparities in mental health among Canadians?

Is there effect modification by sex, age, household income, and frequency of interactions with neighborhood?

METHODOLOGY: STUDY POPULATION

CLSA Data Collection



- Cross-sectional analysis of the CLSA comprehensive cohort → availability of all variables of interest (esp. frequency of interaction with the neighborhood)

METHODOLOGY: FINAL SAMPLE

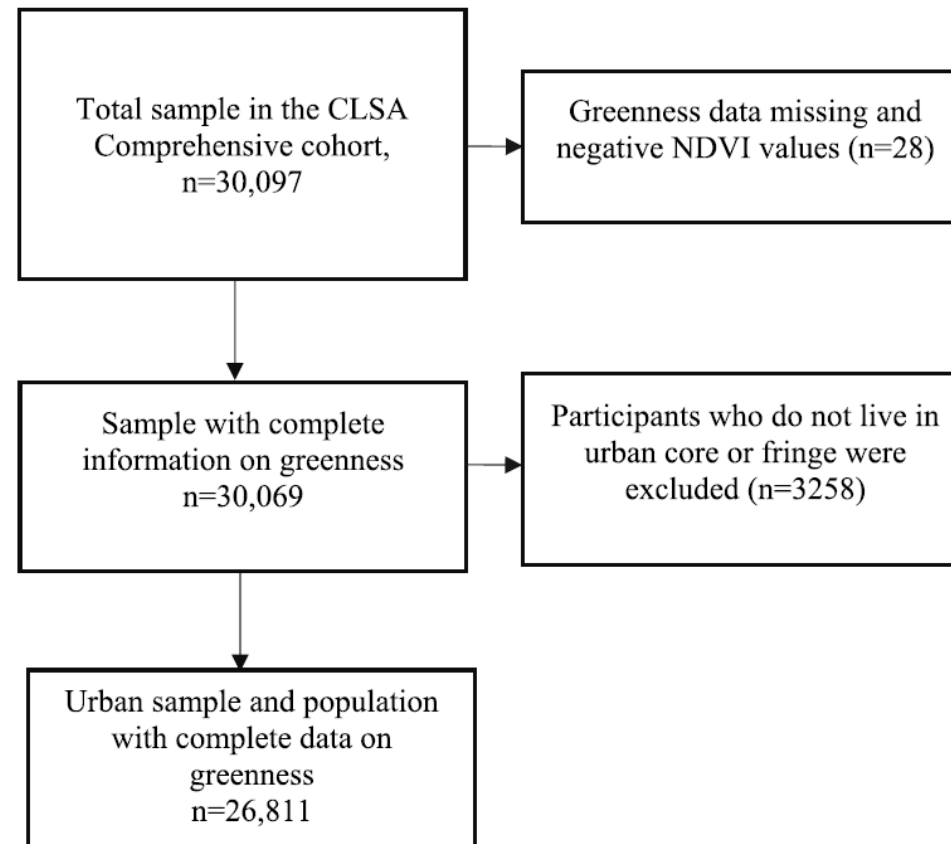


Fig. 1. Study flowchart of CLSA participants used to assess association between surrounding greenness and mental health.

EXPOSURE: GREENSPACE

- NDVI (Normalized Difference Vegetation Index) index → range of - 1 to 1
- CANUE (The Canadian Urban Environmental Health Research Consortium) data repository
- NDVI assigned to each participant → six-character postal code
- Maximum of surrounding annual mean NDVI, within a 500 m buffer of participants' place of residence → main measure
- Sensitivity analysis with 250m and 1000m buffers

OUTCOME: MENTAL HEALTH

The Center for Epidemiologic Studies Depression Scale (CES-D-10)

Perceptions of mental health (Likert scale)

Satisfaction with Life Scale (SWLS)

Self-reported clinical depression

ANALYSIS

- Multivariable logistic Regression models → association b/w greenness and mental health outcomes
- Spline analyses → shape of the exposure-response function
- Stratified analyses → effect modification
- Confounder selection for the models → disjunctive cause criterion (p-value 0.20)

RESULTS

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Table 3

Adjusted odds ratios (ORs) for an interquartile range increase in greenness ^a for selected mental health measures among urban participants of the Canadian Longitudinal Study of Aging (n = 26,811).

Mental health outcome		Participants	Model 1		Model 2		Model 3	
			OR	95% CI	OR	95% CI	OR	95% CI
Depression ^b	No	22,152	1.0		1.0		1.0	
	Yes	4205	0.89	0.86–0.93	0.93	0.89–0.97	0.95	0.90–0.99
Clinical diagnosis of depression	No	22,300	1.0		1.0		1.0	
	Yes	4376	0.94	0.90–0.98	0.97	0.93–1.01	0.97	0.92–1.01
Perception of mental health	Excellent	7457	1.0		1.0		1.0	
	Very good	11,185	0.96	0.92–0.99	0.96	0.92–1.00	0.99	0.94–1.03
	Good	6638	0.90	0.86–0.93	0.93	0.89–0.98	0.96	0.91–1.01
	Fair/Poor	1508	0.87	0.81–0.93	0.93	0.86–1.00	0.93	0.86–1.01
Satisfaction with Life ^c	Satisfied	22,709	1.0		1.0		1.0	
	Neutral	538	1.04	0.93–1.16	1.06	0.94–1.19	1.03	0.90–1.16
	Dissatisfied	3241	0.89	0.85–0.93	0.95	0.90–0.99	0.94	0.89–0.99

Model 1: Adjusted for age and sex.

Model 2: Adjusted for age, sex, race, household income, mobility issues, alcohol consumption, smoking status and physical activity.

Model 3: Adjusted for age, sex, race, household income, mobility issues, alcohol consumption, smoking status, physical activity, frequency of interaction with neighbourhood, province at recruitment, perceived noise disturbance and NO₂ concentration 1-year average prior to first interview date.

^a Based on maximum of annual mean NDVI within a 500 m circular buffer from the centroid of their residential postal code at the time of interview.

^b Those with a CES-D-10 score of 10 or higher were classified as depressed.

^c Extremely dissatisfied, dissatisfied and slightly dissatisfied were classified as dissatisfied.

RESULTS

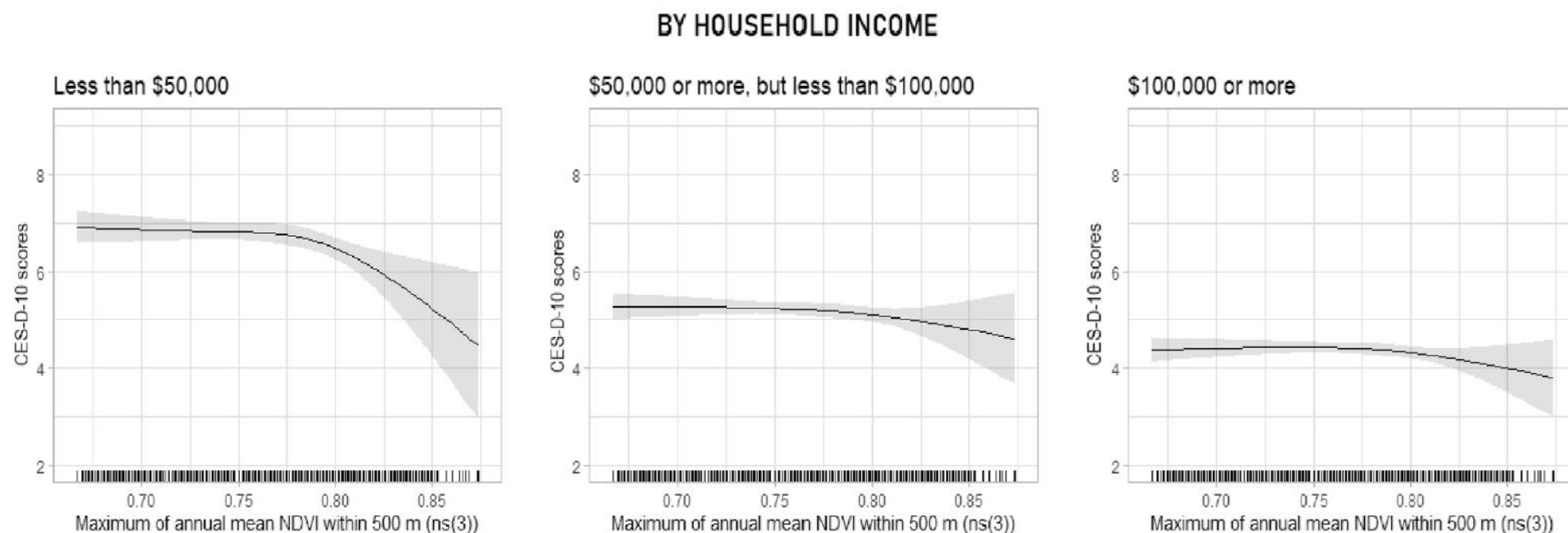


Fig. 4. Adjusted* exposure–response curves for greenness and CES-D-10 scores (solid lines) and 95% CIs (shaded areas) based on natural spline (ns) models with 3 df, by household income and frequency of interactions in neighbourhood. * Adjustment was made for sex, age, race, household income, mobility issues, alcohol consumption, smoking status, physical activity, province at recruitment, number of interactions with neighbourhood, perceived noise disturbance and NO₂ concentration 1-year average prior to first interview date (restricted to upper 95% of data points (n = 25,533)).

RESULTS

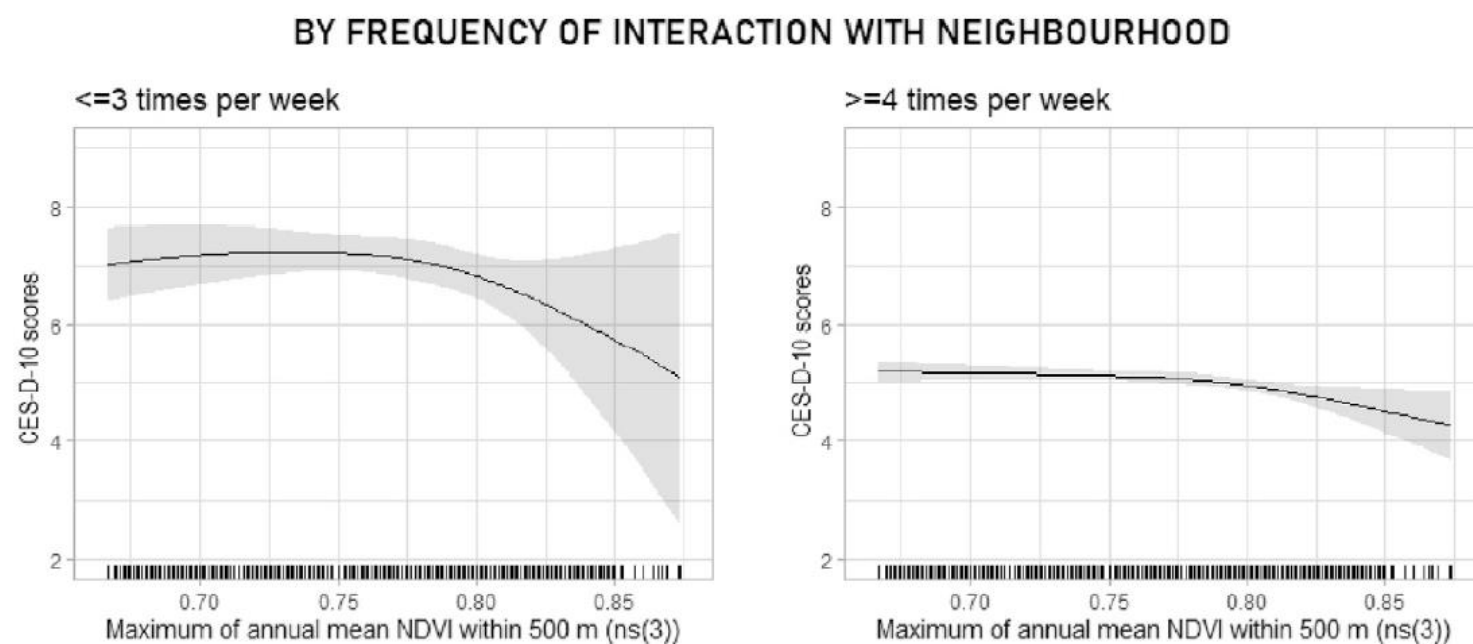


Fig. 4. Adjusted* exposure–response curves for greenness and CES-D-10 scores (solid lines) and 95% CIs (shaded areas) based on natural spline (ns) models with 3 df, by household income and frequency of interactions in neighbourhood. * Adjustment was made for sex, age, race, household income, mobility issues, alcohol consumption, smoking status, physical activity, province at recruitment, number of interactions with neighbourhood, perceived noise disturbance and NO₂ concentration 1-year average prior to first interview date (restricted to upper 95% of data points (n = 25,533)).

STRENGTHS & LIMITATIONS

STRENGTHS

- Large number of participants
- Ability to adjust for confounders → not available in past studies
- Consistency of findings

LIMITATIONS

- Possible → self-selection bias
- Cross-sectional nature of data → limited ability to draw causal inferences
- NDVI unable → capture different types of vegetation, biodiversity, and accessibility to greenspaces

CONCLUSION

- Residential greenness → protective for mental health among Canadian adults
- Greening interventions → strategy to mitigate socio-economic health disparities
- Stronger associations between greenness and mental health outcomes → low-SES populations and those who frequently interact with their neighbourhoods

ACKNOWLEDGMENT

Co-authors

Paul J. Villeneuve, Parminder Raina, Lauren E. Griffith, Daniel Rainham, Robert Dales, Cheryl E. Peters, Nancy A. Ross, Daniel L. Crouse

Collaborators

- Canadian Longitudinal Study on Aging (CLSA) team
- CANUE (Canadian Urban Environmental Health Research Consortium)

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Paper presented today and link:

Abraham Cottagiri S, Villeneuve PJ, Raina P, Griffith LE, Rainham D, Dales R, Peters CE, Ross NA, Crouse DL. Increased urban greenness associated with improved mental health among middle-aged and older adults of the Canadian Longitudinal Study on Aging (CLSA). Environ Res. 2022 Apr 15;206:112587. doi: 10.1016/j.envres.2021.112587. Epub 2021 Dec 22. PMID: 34951990.

Link: <https://pubmed.ncbi.nlm.nih.gov/34951990/>

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Figures

Slide 4: Frank, L., Iroz-Elardo, N., MacLeod, K., & Hong, A. (2019). Pathways from built environment to health: A conceptual framework linking behavior and exposure-based impacts. Journal Of Transport & Health, 12, 319-335. doi: 10.1016/j.jth.2018.11.008

Slide 6: Canadian Longitudinal Study on Aging (no date) Canadian Longitudinal Study on Aging | Étude longitudinale canadienne sur le vieillissement. Available at: <https://www.clsa-elcv.ca/data-collection> (Accessed: April 10, 2023).

APPENDIX A: BY HOUSEHOLD INCOME

Table 5

Adjusted odds ratios (ORs) for an interquartile range increase in greenness ^a for selected mental health measures among urban participants of the Canadian Longitudinal Study of Aging by household income (n = 26,811).

Mental health outcome		Participants	< \$50,000 (n = 6983) ^d		\$50,000 - \$100,000 (n = 8802) ^d		> \$100,000 (n = 9260) ^d		Overall (n = 26,811) ^e	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Depression ^b	No	22,152	1.0		1.0		1.0		1.0	
	Yes	4205	0.92	0.85–0.99	0.95	0.87–1.03	0.99	0.90–1.1	0.95	0.90–0.99
Clinical diagnosis of depression	No	22,300	1.0		1.0		1.0		1.0	
	Yes	4376	0.93	0.86–1.00	0.99	0.92–1.08	0.97	0.89–1.06	0.97	0.92–1.01
Perception of Mental health	Excellent	7457	1.0		1.0		1.0		1.0	
	Very good	11,185	0.96	0.88–1.04	0.99	0.92–1.06	1.00	0.93–1.07	0.99	0.94–1.03
	Good	6638	0.94	0.86–1.02	0.91	0.83–0.98	1.05	0.97–1.15	0.96	0.91–1.01
	Fair/Poor	1508	0.86	0.75–0.97	0.99	0.85–1.14	0.99	0.83–1.18	0.93	0.86–1.01
Satisfaction with Life ^c	Satisfied	22,709	1.0		1.0		1.0		1.0	
	Neutral	538	1.02	0.82–1.27	0.97	0.78–1.21	1.07	0.83–1.14	1.03	0.90–1.16
	Dissatisfied	3241	0.90	0.83–0.98	0.98	0.89–1.08	0.99	0.87–1.12	0.94	0.89–0.99

^a Based on maximum of annual mean NDVI within a 500 m circular buffer from the centroid of their residential postal code at the time of interview.

^b Those with a CES-D-10 score of 10 or higher were classified as depressed.

^c Extremely dissatisfied, dissatisfied and slightly dissatisfied were classified as dissatisfied.

^d Adjusted for age, sex, race, mobility issues, alcohol consumption, smoking status, physical activity, frequency of interaction with neighbourhood, province at recruitment, perceived noise disturbance and NO2 concentration 1-year average prior to first interview date.

^e Adjusted for age, sex, race, household income, mobility issues, alcohol consumption, smoking status, physical activity, province at recruitment, frequency of interaction with neighbourhood, perceived noise disturbance and NO2 concentration 1-year average prior to first interview date.

APPENDIX B: BY FREQUENCY OF INTERACTION WITH NEIGHBORHOOD

Table 4

Adjusted odds ratios for an interquartile range increase in greenness ^a for selected mental health measures among urban participants of the Canadian Longitudinal Study of Aging by frequency of interaction with neighbourhood (n = 26,811).

Mental health outcome		Participants	≤ 3 times per week (n = 2835) ^d		≥ 4 times per week (n = 23,965) ^d		Overall (n = 26,811) ^e	
			OR	95% CI	OR	95% CI	OR	95% CI
Depression ^b	No	22,152	1.0		1.0		1.0	
	Yes	4205	0.92	0.80–1.06	0.95	0.91–1.00	0.95	0.90–0.99
Clinical diagnosis of depression	No	22,300	1.0		1.0		1.0	
	Yes	4376	1.03	0.89–1.18	0.96	0.92–1.01	0.97	0.92–1.01
Perception of mental health	Excellent	7457	1.0		1.0		1.0	
	Very good	11,185	1.04	0.89–1.22	0.98	0.94–1.03	0.99	0.94–1.03
	Good	6638	1.02	0.87–1.20	0.96	0.91–1.01	0.96	0.91–1.01
	Fair/Poor	1508	0.94	0.76–1.16	0.94	0.86–1.02	0.93	0.86–1.01
Satisfaction with Life ^c	Satisfied	22,709	1.0		1.0		1.0	
	Neutral	538	1.33	0.89–1.98	0.99	0.86–1.1	1.03	0.90–1.16
	Dissatisfied	3241	0.87	0.74–1.01	0.96	0.90–1.01	0.94	0.89–0.99

^a Based on maximum of annual mean NDVI within a 500 m circular buffer from the centroid of their residential postal code at the time of interview.

^b Those with a CES-D-10 score of 10 or higher were classified as depressed.

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