

Green Space Accessibility Helps Buffer Declined Mental Health during the COVID-19 Pandemic: Evidence from Big Data in UK

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Kwan Ok Lee, Mike Mai, and Souneil Park

National University of Singapore and Telefónica

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Background

- The World Health Organization noted this year that anxiety and depression increased by 25 percent across the globe in just the first year of the Covid-19 pandemic.” (New York Times, 12 November, 2022).
- “Rates of depression among students have increased since the onset of the Covid-19 pandemic” (BBC, 25 November, 2021).

Background

- Hospital patients with a view of natural vegetation recovered a day faster from surgery than those whose only view was brick and concrete (Ulrich, 1984).
- This nation-wide study covering >900,000 people shows that children who grew up with the lowest levels of green space had up to 55% higher risk of developing a psychiatric disorder independent from effects of other known risk factors (Engemann et al., 2019).

Introduction

Research
Framework

Data &
Methods

Results

Conclusions

UK
Longitudinal
Survey

Wave 1

Wave 2

Wave 3

Wave 4

Wave 5

Wave 6

Wave 7

Wave 8

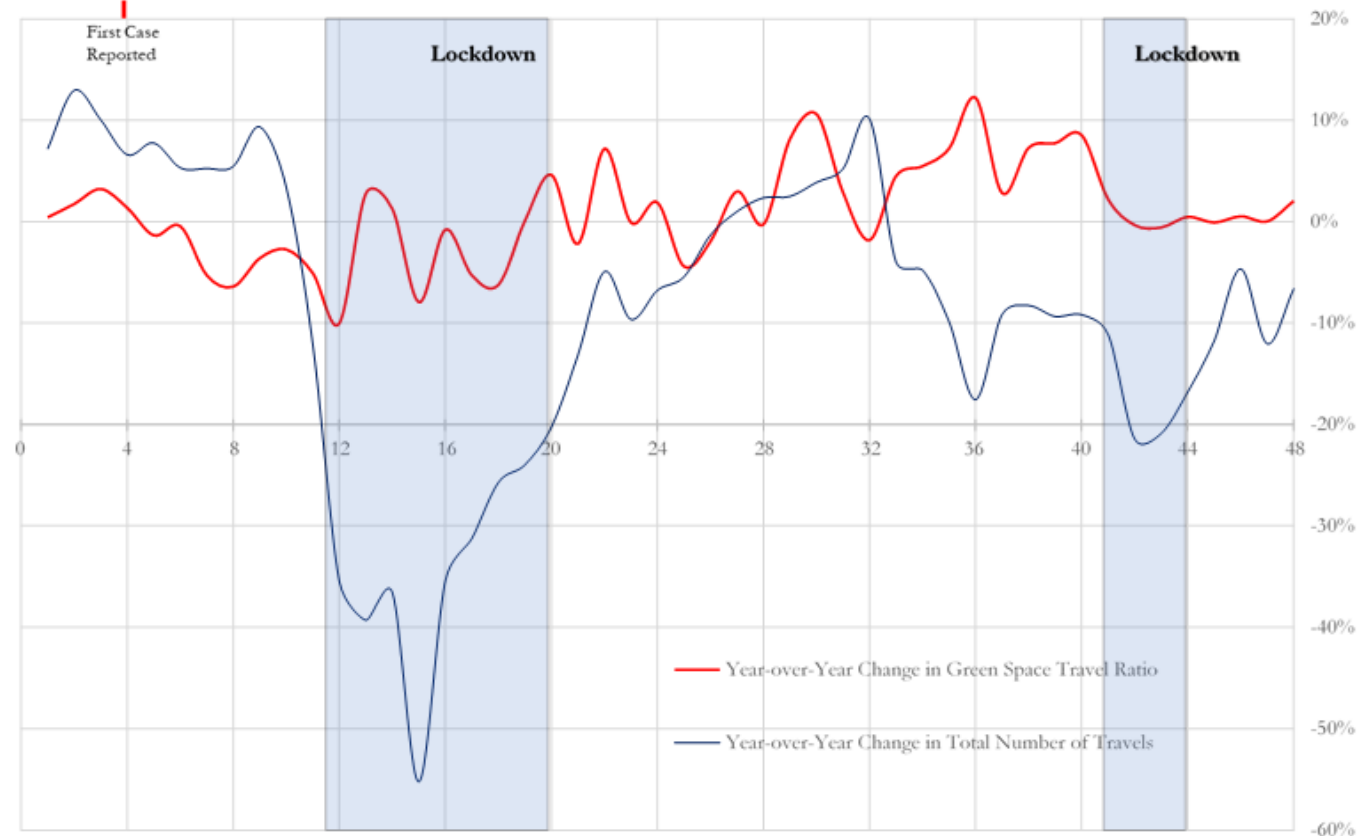
Lockdown

Mar26 - May31

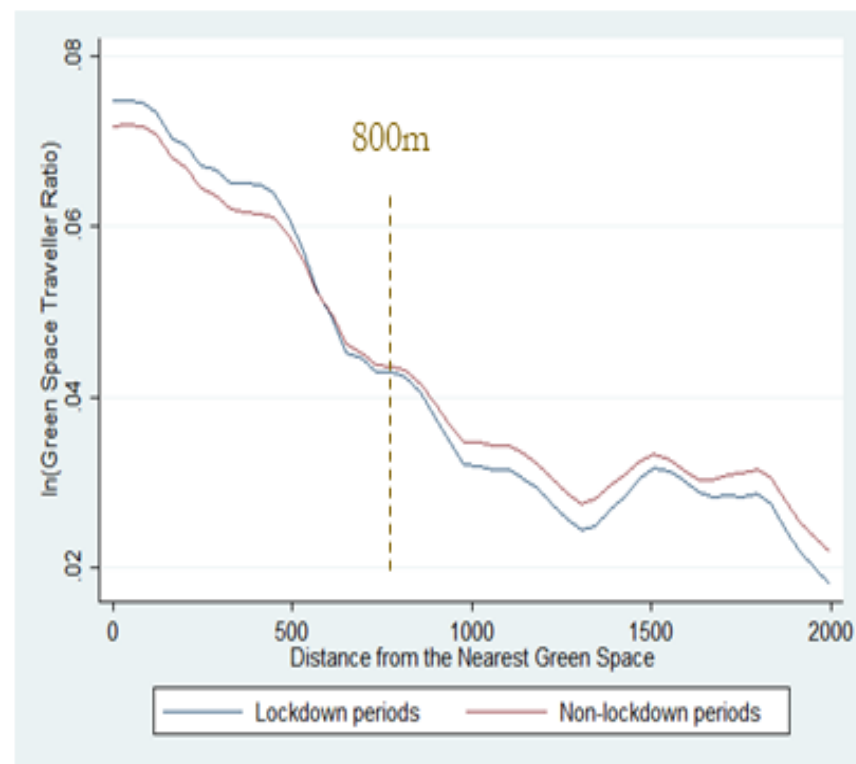
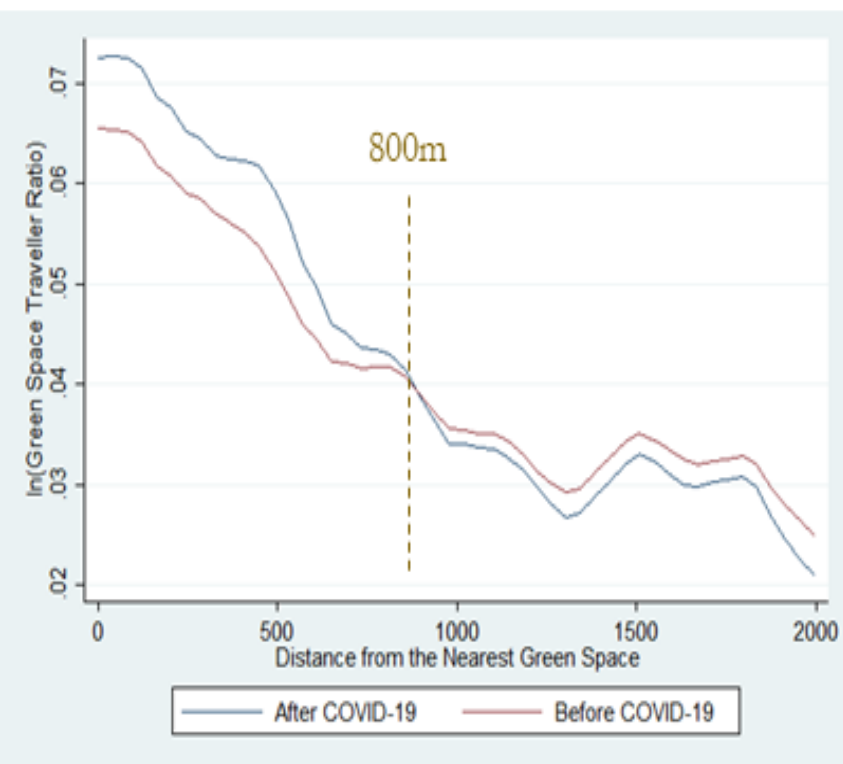
Nov5
- Dec2

Jan6 - Mar26

'20 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec '21 Jan Feb Mar Apr



Background



Research Questions

- Can green space accessibility be a potential remedy for the negative effect of the COVID-19 pandemic on public mental health?
 - Do people residing near green space experience the lower level of mental distress?
- Is the mental health of some individuals more adversely affected by the COVID-19 pandemic and lockdowns than others due to unequal accessibility to green spaces?
 - Are people residing near green space more likely to travel to green spaces after COVID-19 and during lockdown periods?

Green Space Accessibility and Green Space Travels during COVID-19

- Change in time spent visiting green space after COVID-19 and during lockdowns (Burnett et al., 2021; Venter et al., 2021; Dobbie et al., 2022)
- Higher demand for visiting green space – increase in Google search after lockdown (Kleinschroth & Kowarik, 2021)
- Mismatch between demand and supply of green spaces, especially in high-density urban areas (Haaland and van Den Bosch, 2015; Boulton et al., 2018)
- Our study: more precise and direct analysis with big data of residents' mobility and at the refined geographic level (vs. Google mobility report)

Green Space Accessibility and Mental Health during COVID-19

- Diverse research from public health, environmental studies, urban studies, and planetary studies (Das & Gailey, 2022; Narea et al., 2022; Marcelo, et al., 2022)
- Lack of evidence from the rigorous mobility data with that from the panel data of a relatively large, representative sample using a validated mental health scale
- Our study: thorough empirical examination with mobility big data and the multi-wave longitudinal survey data & highlighting green space accessibility as a crucial feature for green space travels and mental well-being

Data

UK Household
Longitudinal Survey
Psychological distress

Respondents residing in
UK LSOAs $\leq 800\text{m}$
(Treatment group)

Respondents residing in
UK LSOAs $> 800\text{m}$
(Comparison group)

*Consistent
accessibility
measure*

ONS/CDRC/MHCLG
*Demographic &
socioeconomic controls*

Origin Residential LSOAs
in London $\leq 800\text{m}$
(Treated LSOAs)

Origin Residential LSOAs
in London $> 800\text{m}$
(Comparison LSOAs)

Telefónica
*Weekly mobility
from each residential
LSOA*

Historic England
*Whether the destination is
green space or not*

Non-green space
destination in London

Green space
destination in London

Decide whether the distance $< 800\text{m}$

Identification Strategy

- Difference-in-Difference (DID) Design

	Homes within 800 m (treated areas)	Homes in other areas (comparison areas)
Before COVID-19 Non-lockdown periods	$\text{treat}=1, \text{treat}*\text{after}=0$	$\text{treat}=0, \text{treat}*\text{after}=0$
After COVID-19 Lockdown periods	$\text{treat}=1, \text{treat}*\text{after}=1$	$\text{treat}=0, \text{treat}*\text{after}=0$

	Residents within 800 m (treatment)	Residents in other areas (comparison)
Non-lockdown periods	$\text{treat}=1,$ $\text{treat}*\text{non-lockdown}=0$	$\text{treat}=0,$ $\text{treat}*\text{non-lockdown}=0$
Lockdown periods	$\text{treat}=1,$ $\text{treat}*\text{lockdown}=1$	$\text{treat}=0,$ $\text{treat}*\text{lockdown}=0$

Descriptive Stats of Travel Data in London

Variables	LSOAs within 800m from the nearest green space (Treated)		LSOAs farther from the nearest green space (Comparison)	
	Mean	Std. Dev	Mean	Std. Dev
Total number of travellers during non-work hours	1,316.92	1559.24	1,234.88	1431.24
Total number of green space travellers during non-work hours	78.33	287.04	36.27	102.09
% green space travellers out of all travellers during non-work hrs	5.96%	10.95%	2.90%	2.90%
% green space travellers out of all travellers before COVID-19	5.67%	5.67%	3.01%	4.84%
% green space travellers out of all travellers after COVID-19	6.31%	12.85%	2.77%	5.70%
% green space travellers during non-lockdown after COVID-19	6.26%	12.07%	2.84%	2.84%
% green space travellers during lockdown periods after COVID-19	6.46%	14.94%	2.58%	6.46%

Demographic characteristics (2019, 2020)

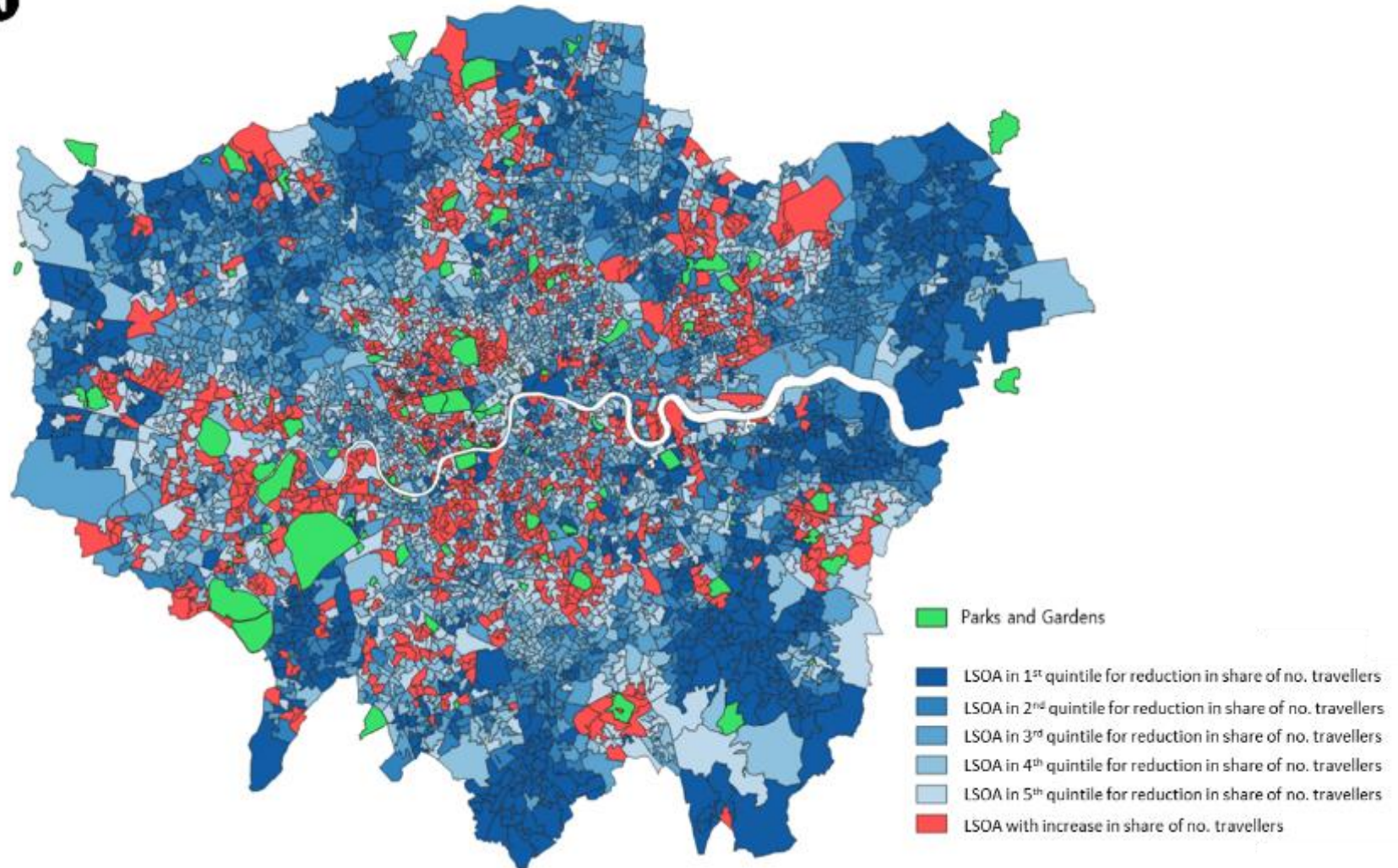
Population	1,867.71	441.81	1,849.58	527.33
Share of male population	0.46	0.50	0.43	0.50
Share of population of 40 to 59 years old	0.26	0.04	0.26	0.03
Share of Asian	0.16	0.14	0.21	0.17
Share of Black	0.06	0.05	0.07	0.06

Socioeconomic characteristics (2019)

Index of multiple deprivation (IMD) score	20.67	10.77	22.16	10.97
Income score (rate)	0.13	0.08	0.14	0.07
Employment score (rate)	0.08	0.05	0.09	0.05
Education, skills and training score	10.25	8.84	15.31	10.26
Health deprivation and disability score	-0.44	0.79	-0.34	0.63
Crime score	0.27	0.58	0.25	0.56
Barriers to housing and services score	30.03	9.18	32.89	9.99
Living environment score	31.81	10.96	27.15	10.37
Income deprivation affecting children index score (rate)	0.17	0.10	0.18	0.09
Income deprivation affecting older people index score (rate)	0.23	0.14	0.23	0.13
Number of LSOAs	2,149		2,686	
Number of LSOAs*weeks (96 weeks)	206,063		257,198	

Share of Travellers to Green Spaces during Lockdowns vs. Pre-COVID Periods

N



Impact of Proximity to Green Spaces on the Proportion of Green Space Travellers

	Cross-sectional			Difference-in-Difference			Cross-sectional (post-COVID-19 periods)			Difference-in-Difference (post-COVID-19 periods)		
	Coef.	S.E.	P	Coef.	S.E.	P	Coef.	S.E.	P	Coef.	S.E.	P
LSOAs located within 800 meters of the nearest green space	0.014	0.002	0.000	0.010	0.002	0.000	0.016	0.003	0.000	0.015	0.002	0.000
After COVID-19 outbreak				-0.003	0.000	0.000						
Lockdown										-0.002	0.000	0.000
LSOAs within 800 meters of the nearest green space & After COVID-19				0.009	0.001	0.000						
LSOAs within 800 meters of the nearest green space & lockdown										0.005	0.001	0.000
Observations	463,261			463,261			212,411			212,411		
R-squared	0.227			0.232			0.237			0.237		
Demographic controls	Yes			Yes			Yes			Yes		
Socioeconomic controls	Yes			Yes			Yes			Yes		
Local authority FE	Yes			Yes			Yes			Yes		
Month FE	Yes			Yes			Yes			Yes		

Descriptive Statistics of Matched Household Survey Data in the UK

Variables	Individuals living within 800m from the nearest green space (Treatment)		Individuals living farther from the nearest green space (Comparison)	
	Mean	Std. Dev	Mean	Std. Dev
Total score of mental distress	2.36	3.32	2.26	3.29
Total score of mental distress during lockdown periods	2.49	3.33	2.45	3.35
Total score of mental distress during non-lockdown periods	2.14	3.30	1.95	3.17
Demographic characteristics				
Age	54.21	16.94	54.96	16.33
Gender (male vs. female)	0.43	0.49	0.42	0.49
White	0.03	0.16	0.02	0.13
Black	0.87	0.34	0.91	0.29
Number of household members	1.63	1.25	1.64	1.22
Number of children	0.38	0.80	0.35	0.73
Having a partner	0.71	0.45	0.72	0.45
Economic characteristics				
Household monthly earning	4,189.67	14,503.48	3,415.81	12,780.11
Individual monthly earning	1,716.01	6,298.52	1,414.13	5,310.86
Having financial difficulties	0.04	0.19	0.05	0.21
Health status				
Having long-term health issues	0.40	0.49	0.41	0.49
COVID-19 infection	0.01	0.08	0.01	0.09
Number of days doing moderate activities	2.69	2.60	2.61	2.57
Moderate/heavy drinker	0.46	0.50	0.47	0.50
Smoker	0.07	0.25	0.07	0.26
Number of individuals	2,496		2,496	
Number of individuals × survey waves	15,529		15,730	

Impact of Living Closer to Green Spaces on Psychological Distress

	(1)			(2)			(3)		
	Cross-sectional			Difference-in-Difference (all UK respondents)			Difference-in-Difference (London respondents)		
	Coef.	S.E.	P	Coef.	S.E.	P	Coef.	S.E.	P
Living within 800 meters of the nearest green space	0.071	0.072	0.324	0.129	0.080	0.109	0.405	0.251	0.106
Lockdown				0.605	0.059	0.000	0.734	0.190	0.000
Living within 800 meters of the nearest green space & Lockdown				-0.106	0.050	0.035	-0.378	0.163	0.021
Observations		31,259			31,259			3,314	
R-squared		0.097			0.112			0.134	
Demographic controls		Yes			Yes			Yes	
Socioeconomic controls		Yes			Yes			Yes	
Local authority FE		Yes			Yes			Yes	
Month FE		No			Yes			Yes	
Demographic controls		No			Yes			Yes	

Summary of Findings

- Increased travels to green spaces of London residents when mobilities were restricted by lockdown measures during the COVID-19 pandemic, especially for residents who lived closer to green spaces
 - Add empirical evidence on the role of green space accessibility to green space travels during lockdowns
- Higher level of aggravating psychological distress for those who cannot access green space easily
 - Combine public mobility data with the longitudinal household survey and systematically examine how lockdowns affect the level of public mental distress with a focus on exposure to green spaces

Implications

- Opportunity to identify and support the population with a higher volatility of psychological distress especially during lockdowns
 - With green space accessibility
- Benefits of providing a place with a view of green spaces, vertical greenery, or plasma display of nature view for quarantine orders
- Important role of equal access to green spaces for cities to be resilient during similar future pandemics
 - Paris and Singapore