A Public Health Perspective on Blue-Green Infrastructure

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Health risks from floods in England

Direct

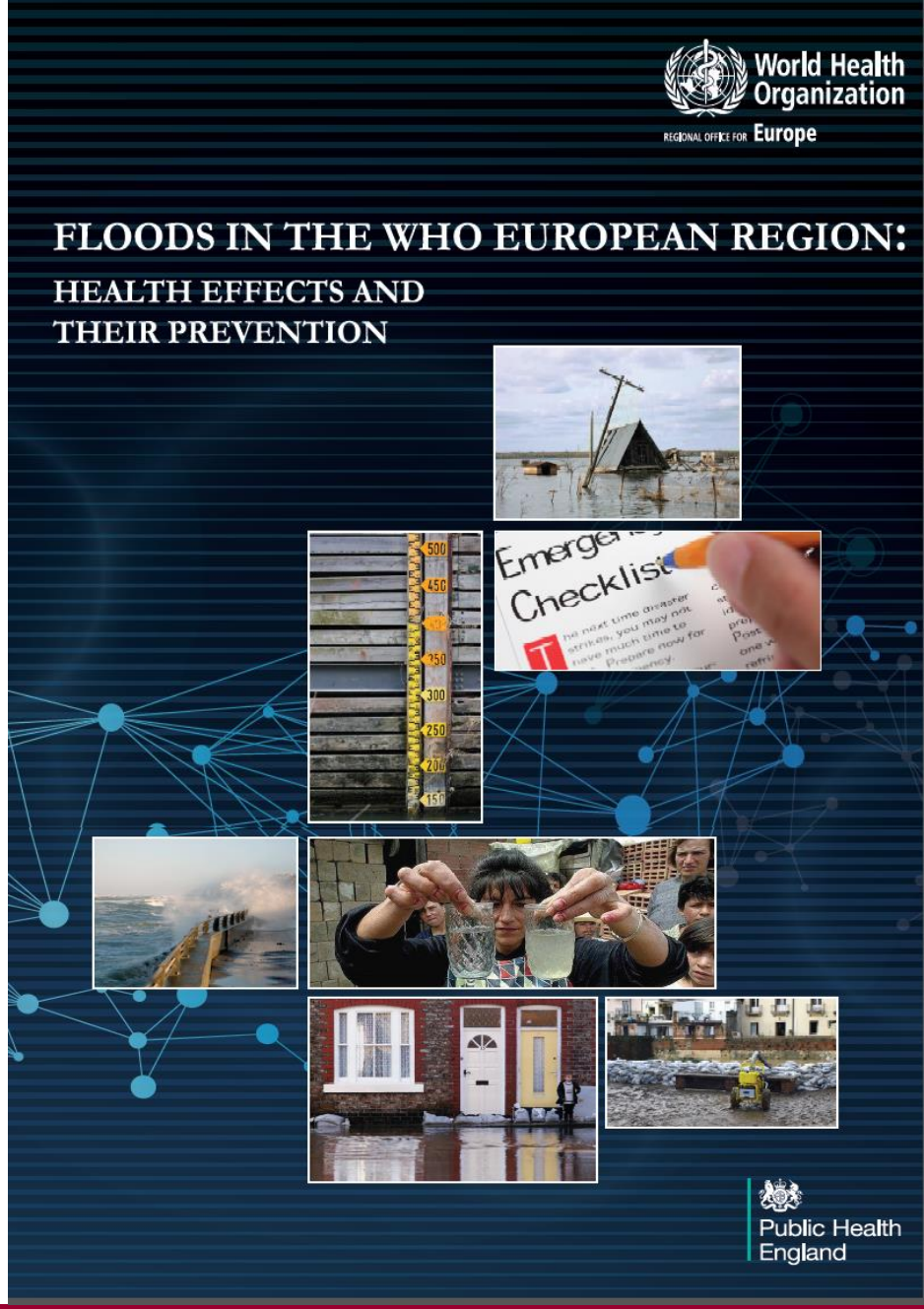
- trauma
- infectious diseases

Indirect

- CO poisoning
- mental health
- displacement
- service/infrastructure disruption

Vulnerable groups

- age, disability, mobility
- tourists, migrants
- social isolation



http://www.euro.who.int/en/what-we-publish/abstracts/floods-in-the-who-european-region-health-effects-and-their-prevention

National Study of Flooding and Health mental health outcomes: Y1

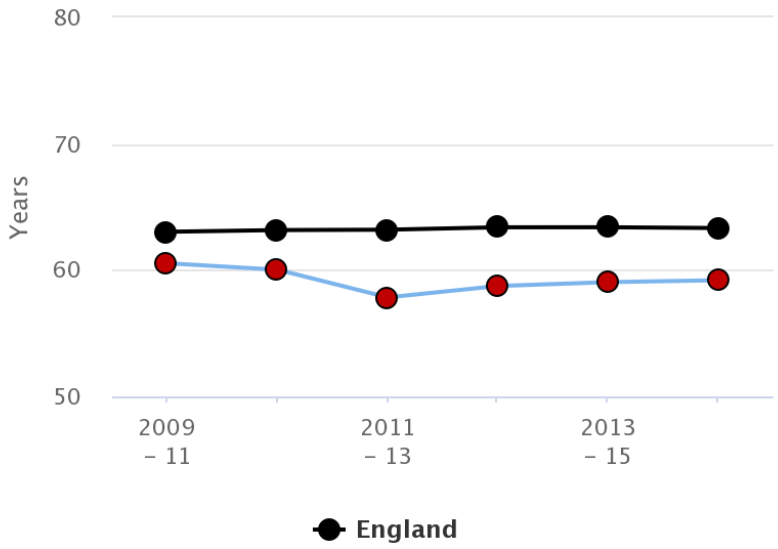
	EXPOSURE GROUP					
	Unaffected		Disrupted		Flooded	
Outcome	Prevalence	n	Prevalence	n	Prevalence	n
Likely depression	**5.8%**	16	**9.6%**	102	**20.1%**	125
Likely anxiety	**6.5%**	18	**10.7%**	113	**28.3%**	169
Likely PTSD	**7.9%**	22	**15.2%**	160	**36.2%**	214

Waite et al (2017). The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one (BMC Public Health)

How access to green and open spaces can affect health

- A study in the Netherlands showed that every 10 per cent increase in exposure to green space translated into a reduction of five years in ["biological"] age in terms of expected health problems ([de Vries] et al 2003) with similar benefits found by studies in Canada (Villenveuve et al 2012) and Japan (Takano et al 2002).
- Green space has been linked with reduced levels of obesity in children and young people in America (Liu et al 2007). There is also strong evidence that access to open spaces and sports facilities is associated with higher levels of physical activity (Coombes et al 2010; Lee and Maheswaran 2010) and reductions in a number of long-term conditions such as heart disease, cancer, and musculoskeletal conditions (Department of Health 2012).
- The proportion of green and open space is linked to self-reported levels of health and mental health (Barton and Pretty 2010) for all ages and socio-economic groups (Maas et al 2006), through improving companionship, sense of identity and belonging (Pinder et al 2009) and happiness (White 2013).
- Living in areas with green spaces is associated with significantly less income-related health inequality, weakening the effect of deprivation on health (Mitchell and Popham 2008). In greener areas, all-cause mortality rates are only 43 per cent higher for deprived groups, compared to 93 per cent higher in less green areas.
- However, people from more deprived areas have less access; children in deprived areas are nine times less likely to have access to green space and places to play (National Children's Bureau 2013).

0.1i – Healthy life expectancy at birth (Male) – Newcastle upon Tyne



0.1i – Healthy life expectancy at birth (Female) – Newcastle upon Tyne

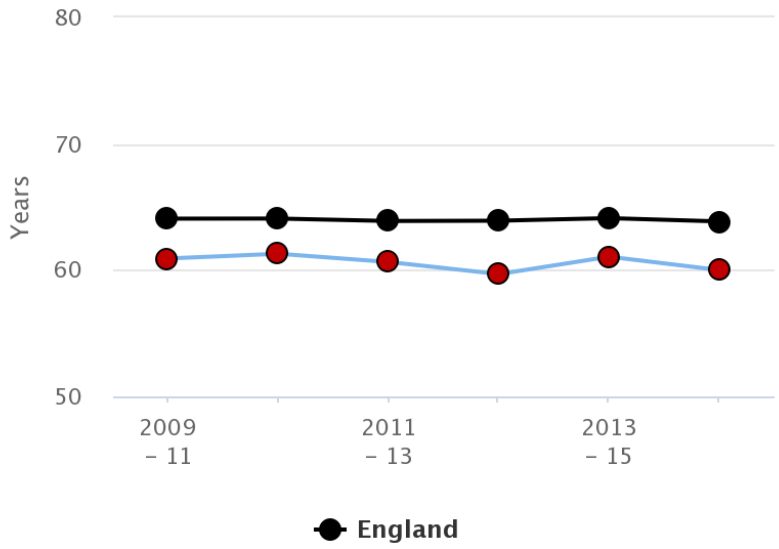
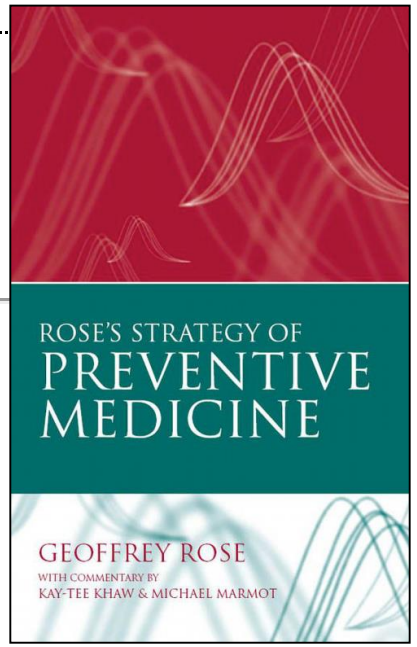


Table 5 Strategies of prevention

Individual based	**Population based**
Identify individuals at high risk: screening	Identify important risk factors for the community (prevalence)
Intervene only in individuals at high risk	Policy to reduce risk factor irrespective of individual risk
Risk–benefit balance individually ssessed	Risk–benefit balance for whole community

	Individual intervention	**Population intervention**
Individuals identified	Yes	No
Potential benefits for individual	Large	Small
Potential benefits for population	Small	Large
Understanding of effects	Good	Poor



From the Commentary on Rose's Strategy of Preventive Medicine – Kay-Tee Khaw and Michael Marmot

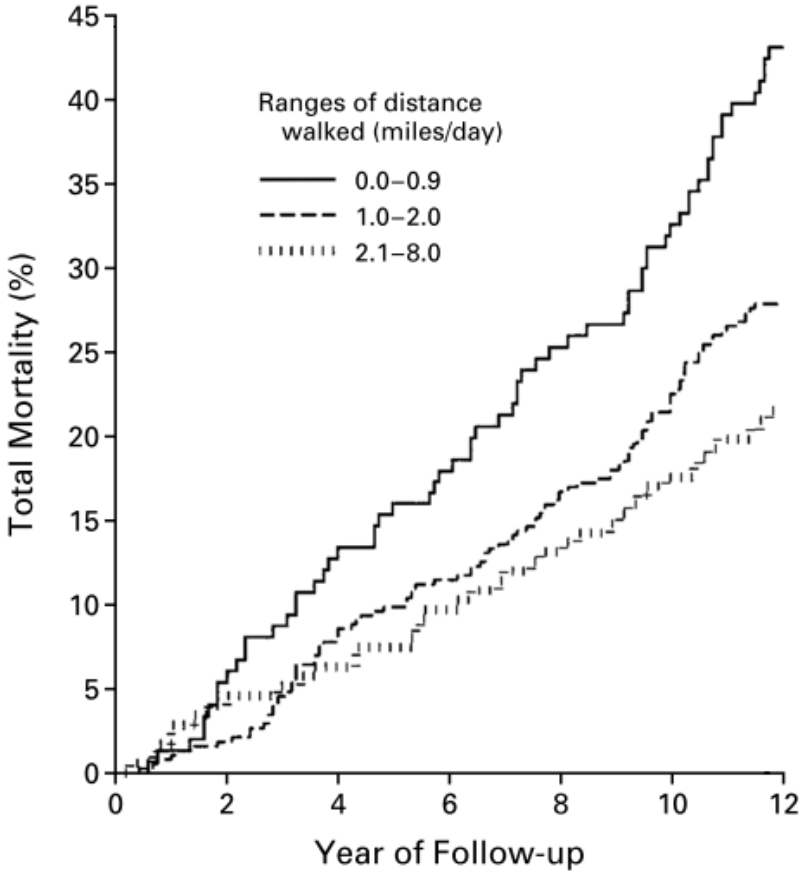


TABLE 1. UNADJUSTED AND AGE-ADJUSTED 12-YEAR CUMULATIVE MORTALITY ACCORDING TO DISTANCE WALKED PER DAY.

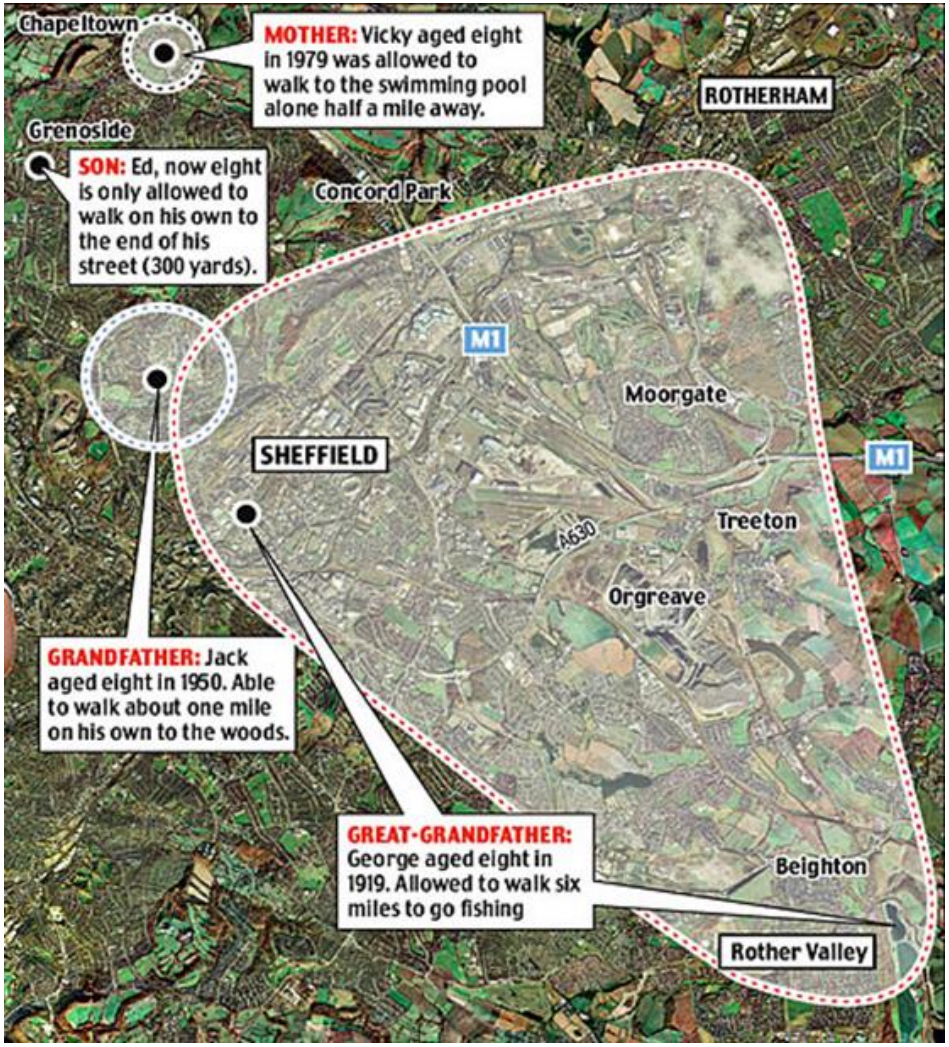
CAUSE OF DEATH AND DISTANCE WALKED (MILES/DAY)*	AGE†	MORTALITY RATE	
		UNADJUSTED	AGE-ADJUSTED
	yr	% (no. of deaths/ total no.)	%
All causes			
0.0–0.9	69.8±5.2	43.1 (65/151)	40.5
1.0–2.0	69.0±5.1	27.7 (105/379)‡	27.4§
2.1–8.0	67.9±4.6	21.5 (38/177)‡	23.8¶
P value for trend		<0.001	0.002
Coronary heart disease or stroke‖			
0.0–0.9	69.3±5.0	6.6 (8/122)	6.2
1.0–2.0	68.9±5.1	5.6 (18/321)	5.5
2.1–8.0	67.9±4.6	2.1 (3/145)	2.3
P value for trend		0.102	0.143
Cancer**			
0.0–0.9	69.6±5.2	13.4 (19/142)	12.8
1.0–2.0	68.8±5.0	9.4 (34/361)	9.4
2.1–8.0	67.7±4.4	5.3 (9/169)††	5.6‡‡
P value for trend		0.008	0.013

Hakim AA, Petrovitch H, Burchfiel CM, et al. (1998) Effects of Walking on Mortality among Nonsmoking Retired Men. N Engl J Med 338:94–99. doi: 10.1097/00042752-199807000-00022

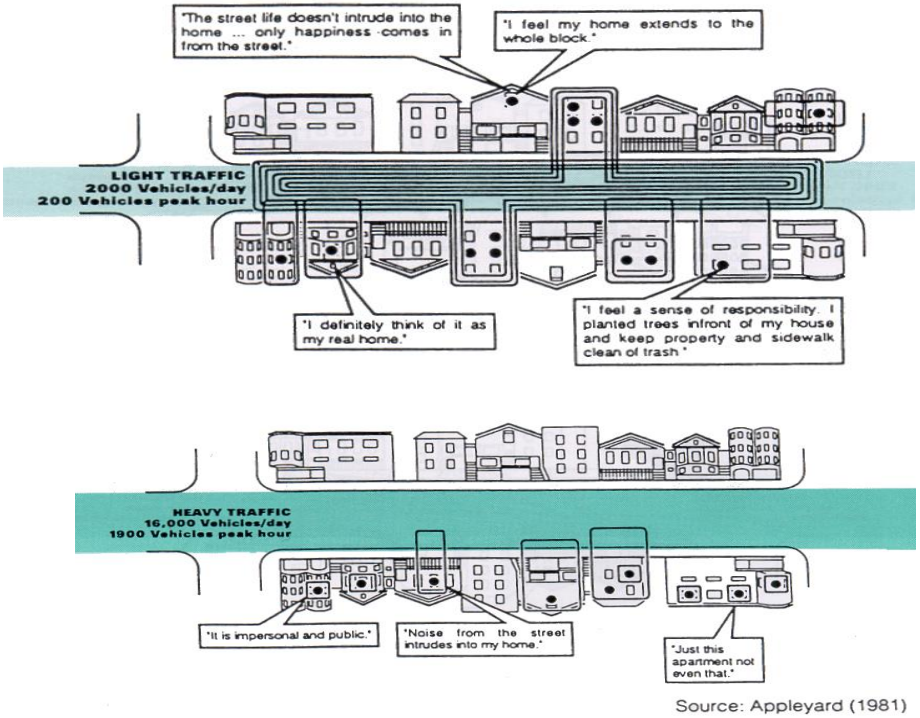
Physical activity in relation to urban environments in 14 cities worldwide: a cross-sectional study

James F Sallis, Ester Cerin, Terry L Conway, Marc A Adams, Lawrence D Frank, Michael Pratt, Deborah Salvo, Jasper Schipperijn, Graham Smith, Kelli L Cain, Rachel Davey, Jacqueline Kerr, Poh-Chin Lai, Josef Mitáš, Rodrigo Reis, Olga L Sarmiento, Grant Schofield, Jens Troelsen, Delfien Van Dyck, Ilse De Bourdeaudhuij, Neville Owen

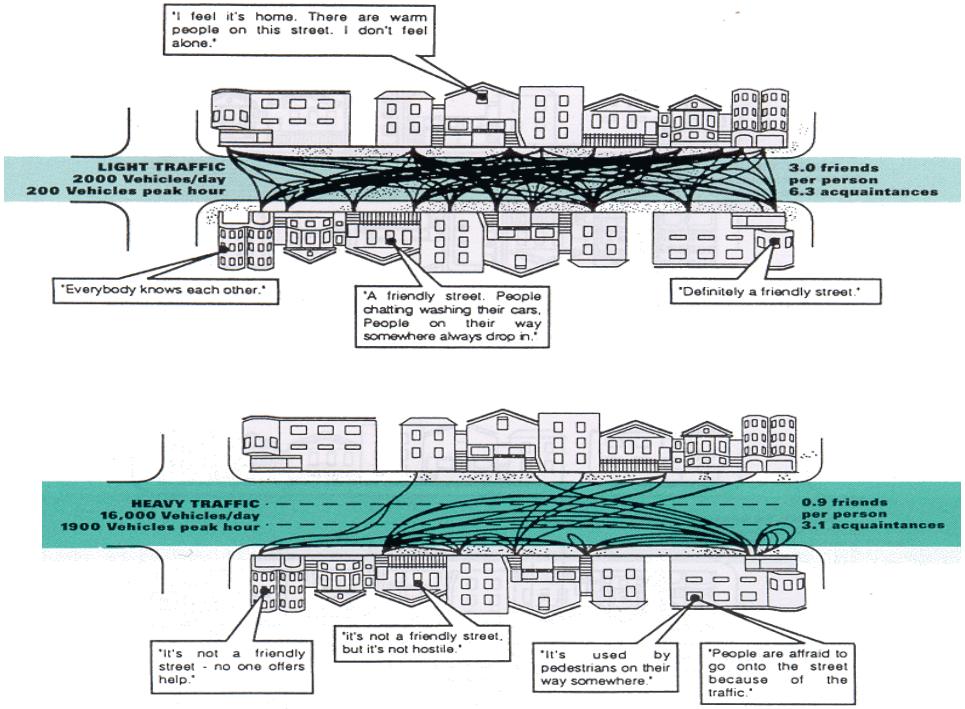
Results Four of six environmental attributes were significantly, positively, and linearly related to physical activity in the single variable models: net residential density (exp[b] 1·006 [95% CI 1·003–1·009]; p=0·001), intersection density (1·069 [1·011–1·130]; p=0·019), public transport density (1·037 [1·018–1·056]; p=0·0007), and number of parks (1·146 [1·033–1·272]; p=0·010). Mixed land use and distance to nearest public transport point were not related to physical activity. The difference in physical activity between participants living in the most and least activity-friendly neighbourhoods ranged from 68 min/week to 89 min/week, which represents 45–59% of the 150 min/week recommended by guidelines.


Chapeltown
MOTHER: Vicky aged eight in 1979 was allowed to walk to the swimming pool alone half a mile away.
ROTHERHAM
Grenoside
SON: Ed, now eight is only allowed to walk on his own to the end of his street (300 yards).
Concord Park
M1
Moorgate
SHEFFIELD
M1
Treeton
A630
Orgreave
GRANDFATHER: Jack aged eight in 1950. Able to walk about one mile on his own to the woods.
GREAT-GRANDFATHER: George aged eight in 1919. Allowed to walk six miles to go fishing
Beighton
Rother Valley

Decent neighbourhoods



Source: Appleyard (1981)



Source: Appleyard (1981)

TABLE 1 England: baseline population, modelled population-weighted mean concentrations (μg m^{-3}) and estimated effects on annual mortality in 2010 of anthropogenic $PM_{2.5}$ air pollution

Area	Population age 25+ (x 10^3)	Deaths age 25+	Mean anthropogenic $PM_{2.5}$ (μg m^{-3})*	Attributable fraction† (%)	Attributable deaths‡ age 25+	Associated life-years lost§
ENGLAND	**35878.0**	**458743**	**9.9**	**5.6**	**25002**	**264749**
NORTH EAST	**1795.3**	**26090**	**8.1**	**4.6**	**1199**	**12336**
County Durham UA	355.3	5231	7.5	4.3	223	2268
Darlington UA	70.6	1044	8.0	4.5	47	481
Hartlepool UA	62.3	920	8.3	4.7	43	451
Middlesbrough UA	91.4	1363	8.8	5.0	68	695
Northumberland UA	227.0	3254	6.9	3.9	128	1284
Redcar and Cleveland UA	96.9	1368	7.8	4.5	61	664
Stockton-on-Tees UA	131.0	1662	8.2	4.6	77	872
Tyne and Wear (Met C)						
Gateshead	135.3	2021	8.6	4.9	99	962
Newcastle upon Tyne	180.6	2553	8.6	4.9	124	1320
North Tyneside	141.5	2112	8.4	4.8	101	998
South Tyneside	107.4	1675	8.8	5.0	84	864
Sunderland	196.1	2874	8.7	5.0	143	1477

Gowers AM, Miller BG, Stedman JR (2014) Estimating Local Mortality Burdens associated with Particulate Air Pollution. London

One Tree Per Child

Environmental Pollution 178 (2013) 395–402

Contents lists available at SciVerse ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Modeled $PM_{2.5}$ removal by trees in ten U.S. cities and associated health effects

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ARTICLE INFO

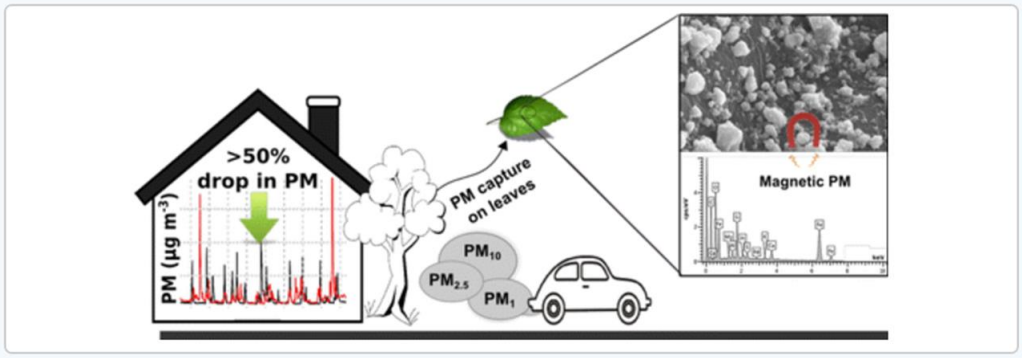
Article history:
Received 5 November 2012
Received in revised form
23 March 2013
Accepted 25 March 2013

Keywords:
Urban forests
Air pollution removal
Particulate matter
Mortality
Human health

ABSTRACT

Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on $PM_{2.5}$ concentrations and human health are modeled for 10 U.S. cities. The total amount of $PM_{2.5}$ removed annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with annual values varying from $1.1 million in Syracuse to $60.1 million in New York City. Most of these values were from the effects of reducing human mortality. Mortality reductions were typically around 1 person yr^{-1} per city, but were as high as 7.6 people yr^{-1} in New York City. Average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta. Understanding the impact of urban trees on air quality can lead to improved urban forest management strategies to sustain human health in cities.

Published by Elsevier Ltd.



Garden Village
The Story of a Community

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Children in England 'among unhappiest in world'

19 August 2015 | Education & Family

Lottee: "I thought [school] would be a good experience... but it didn't turn out right"

Children in England are among the unhappiest in the world, behind countries such as Ethiopia, Algeria and Romania, research suggests.

The Children's Society report, which looked at 15 diverse countries, ranked England 14th for life satisfaction of its young people, ahead of South Korea.

INDEPENDENT | News | Voices | Culture | Lifestyle | Tech | Sport | Daily Edition | Charity Appeal

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The anxiety epidemic: Why are children so unhappy?

Education Editor, Richard Garner | Tuesday 11 March 2008 00:00 GMT | 0 comments

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Teachers are to take the extraordinary step of calling for an independent Royal Commission to investigate why so many of Britain's children are unhappy.

Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood

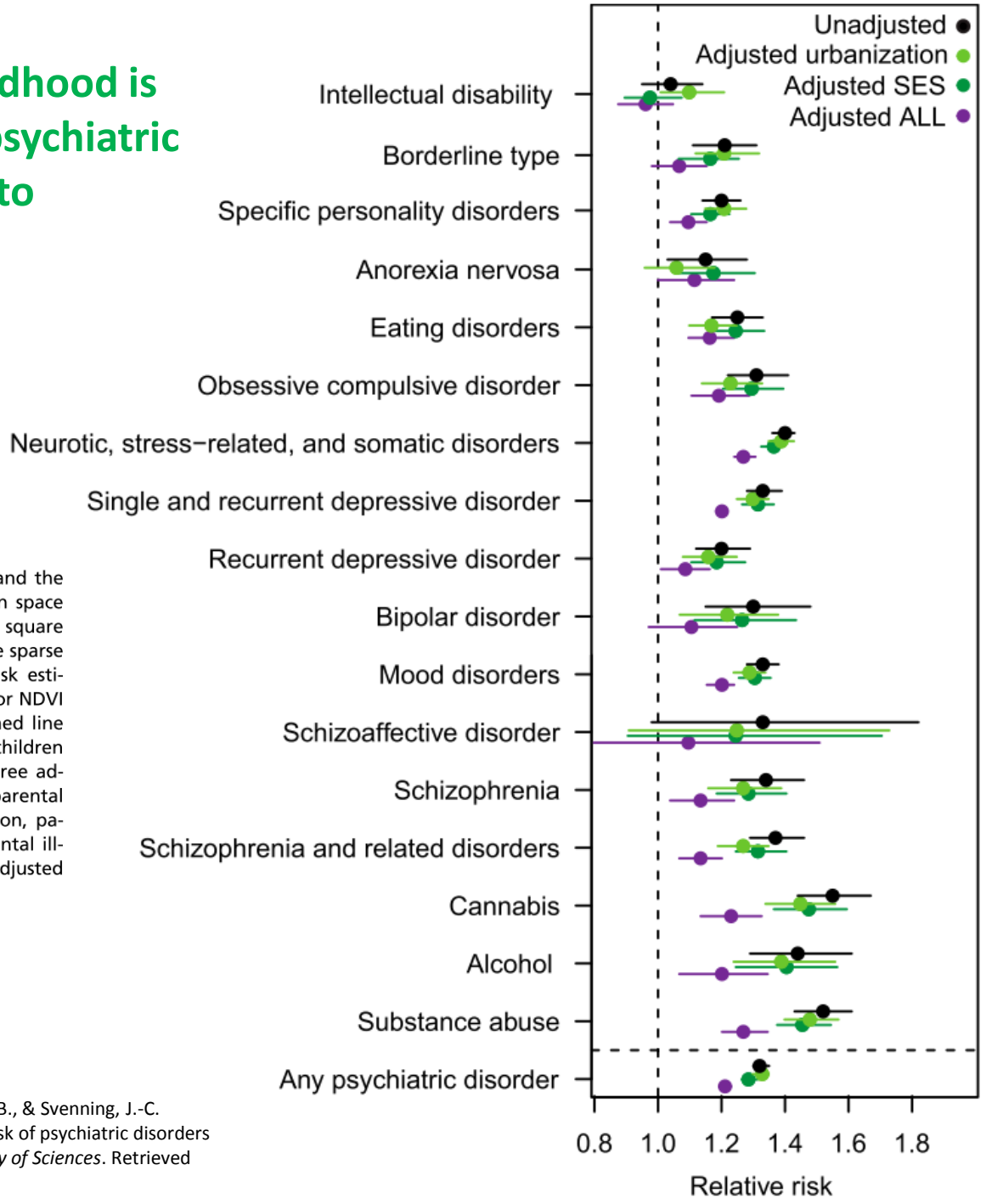

Fig. 1. The association between childhood green space presence and the relative risk of developing a psychiatric disorder later in life. Green space presence was measured as the mean NDVI within a 210 × 210 m square around place of residence (n = 943,027). Low values of NDVI indicate sparse vegetation, and high values indicate dense vegetation. Relative risk estimates are relative to the reference level (set to the highest decile) for NDVI fitted as numeric deciles in classes of 10. Estimates above the dashed line indicate higher risk of developing a given psychiatric disorder for children living at the lowest compared with the highest values of NDVI. Three additional models were fitted to adjust for the effect of urbanization, parental socioeconomic status (SES), and the combined effect of urbanization, parental and municipal socioeconomic factors, parental history of mental illness, and parental age at birth on risk estimates. All estimates were adjusted for age, year of birth, and gender and plotted with 95% CIs.

Engemann, K., Pedersen, C. B., Arge, L., Tsirogiannis, C., Mortensen, P. B., & Svenning, J.-C. (2019). Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. *Proceedings of the National Academy of Sciences*. Retrieved from https://www.pnas.org/content/early/2019/02/26/1807504116

Thank you for listening
Any questions?