Positive health effects on the natural outdoor environment in typical populations of different regions in Europe

Margarita Triguero Mas
• CREAL
  • Health determinants
  • Green spaces and health
    • Phenotype project
• CREAL
• Health determinants
• Green spaces and health
  • Phenotype project
Health determinants

The built environment and health.

Rao M, Prasad S, Adshead F, Tissera H.


Figure: Health map for local human habitat
Based on public-health idea by Dahlgren and Whitehead.
• CREAL
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Green spaces and health

- Perceived general health
- Restoration
- Ability to face problems
- Health complaints
- Stress levels
Green spaces and health: hospitals and prisons

- Painkiller requirements
- Recovery time
- Stress level
- Negative reactions
- Lower need for healthcare
Green spaces and health: non-sedentary population

Mental health

Obesity
Green spaces and health: children

- Concentration in children with attention deficit disorder
- Emotional development
- Motor fitness, co-ordination, balance, agility
- Self-confidence and social skills
- Stress
Green spaces and health

- Social contact, integration, cohesion
- Air quality
- Crime
- Health inequalities
- Urban heat islands

**Figure 1:** Incidence rate ratios for all-cause mortality in groups of exposure to green space, relative to group 1 (least exposure to green space). Error bars indicate 95% CIs.

**Figure 2:** Incidence rate ratios for all-cause mortality (A) and deaths from circulatory disease (B) in income-deprivation quartiles 2–4, relative to income deprivation quartile 1 (least deprived), stratified by exposure to green space. Bars are grouped according to population exposure to green space. Error bars indicate 95% CIs.
Questions to be answered:

- **Comparison** between studies
- **US or North-West of Europe repeated** in other areas?
- **Blue spaces**
- Health effect of the actual **use**
- **Quantitative and qualitative characteristics**
- **Sensitive groups**
- **Differences by social group**
- Mechanisms (together)
- how **policymakers and planners can design**
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• Health determinants
• Green spaces and health
  • Phenotype project
Phenotype project

**PHENOTYPE**
Health from outside in

- **CREAL** - Centre de Recerca en Epidemiologia Ambiental (ES)
- **RIVM** - National Institute for Public Health and the Environment (NL)
- **Staffordshire University** (UK)
- **VDU** - Vytauto Didziojo Universitetas (LT)
- **UNIGE** - University of Geneva (CH)
- **VUA** - Vereniging voor Christelijk Hoger Onderwijs Wetenschappelijk Onderzoek en patientzorg (NL)
- **VGGM** - Public Health Services Gelderland Midden (NL)
- **UCB** - University of California Berkeley (USA)

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Objectives

Investigate the interconnections between exposure to natural outdoor environments, in both rural and urban settings, and better human health and well-being and particularly

• Identify the underlying mechanisms at work
• Examine the effects for different population groups
• Examine the effects of different characteristics of the natural outdoor environment;
• Cover both preventive as well as therapeutic effects of contact with the natural environment
• Address the implications for land-use planning and green space management, specifically focusing on the integration of human health needs, and translating the research outcomes into recommendations for policy makers and guidelines for professional practitioners
Surrounding Greenness and Pregnancy Outcomes in Four Spanish Birth Cohorts

Payam Dadvand,1,2,3 Jordi Sunyer,1,2,3,4 Xavier Basagaña,1,2,3 Ferran Ballester,3,5,6 Aitana Lertxundi,3,7 Ana Fernández-Somoano,3,8 Marisa Estarlich,3,6 Raquel García-Esteban,1 Michelle A. Mendez,9 and Mark J. Nieuwenhuijsen1,2,3

Figure 1. INMA birth cohorts and biogeographic regions across the Iberian Peninsula. Source: Mapa de series de vegetación de España, Spanish Ministry of Agriculture, Food and Environment (1987).
Table 2. Regression coefficients (95% confidence interval) for 1-IQR\(^a\) increase in average of NDVI in buffers of 100 m, 250 m, and 500 m around each maternal residential address separately for birth weight, head circumference, and gestational age at delivery.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>NDVI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100-m buffer</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td>31.9 (7.7, 56.1)*</td>
</tr>
<tr>
<td>Adjusted(^b)</td>
<td>36.1 (16.4, 55.7)*</td>
</tr>
<tr>
<td>NO(_2)-adjusted(^c)</td>
<td>28.5 (4.3, 52.7)*</td>
</tr>
<tr>
<td>Birth head circumference (mm)</td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td>1.1 (0.2, 2.0)*</td>
</tr>
<tr>
<td>Adjusted(^d)</td>
<td>1.2 (0.4, 2.0)*</td>
</tr>
<tr>
<td>NO(_2)-adjusted(^e)</td>
<td>1.2 (0.2, 2.0)*</td>
</tr>
<tr>
<td>Gestational age (days)</td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td>−0.3 (−1.1, 0.4)</td>
</tr>
<tr>
<td>Adjusted(^f)</td>
<td>−0.3 (−0.9, 0.3)</td>
</tr>
<tr>
<td>NO(_2)-adjusted(^g)</td>
<td>−0.5 (−1.2, 0.3)</td>
</tr>
</tbody>
</table>

\(^a\)0.162 for 100-m buffer, 0.188 for 250-m buffer, and 0.233 for 500-m buffer. \(^b\)Adjusted for gestational age, maternal age, ethnicity, socioeconomic status, education level, parity, sex of infant, maternal BMI, and season of conception. \(^c\)Adjusted for gestational age, maternal age, ethnicity, socioeconomic status, education level, parity, sex of infant, paternal BMI, and season of conception. \(^d\)Adjusted for gestational age, maternal age, ethnicity, socioeconomic status, education level, parity, sex of infant, paternal BMI, season of conception, and average maternal NO\(_2\) exposure during the entire pregnancy. \(^e\)Adjusted for gestational age, maternal age, ethnicity, socioeconomic status, education level, height, smoking, alcohol consumption, parity, sex of infant, maternal BMI, season of conception, and average maternal NO\(_2\) exposure during the entire pregnancy. \(^f\)Adjusted for gestational age, maternal age, ethnicity, socioeconomic status, education level, height, smoking, alcohol consumption, parity, sex of infant, paternal BMI, season of conception, and average maternal NO\(_2\) exposure during the entire pregnancy. \(^g\)Adjusted for maternal age, ethnicity, socioeconomic status, education level, smoking, alcohol consumption, parity, sex of infant, and season of conception.
# Surrounding Greenness and Pregnancy Outcomes in Four Spanish Birth Cohorts

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<table>
<thead>
<tr>
<th>Outcome</th>
<th>Brain size</th>
<th>IQ</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂-adjusted</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Birth head circumference (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
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<tr>
<td>Adjusted</td>
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<td></td>
</tr>
<tr>
<td>NO₂-adjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂-adjusted</td>
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</tr>
</tbody>
</table>

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Differences by SES

Physical activity

Air pollution
### Table 2. Regression coefficients (95% CIs) of change in personal exposure and microenvironmental pollutant levels (µg/m³) associated with an IQR² increase in the average NDVI within the buffers of 100 m, 250 m, and 500 m around maternal residential addresses.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>100-m buffer</th>
<th>250-m buffer</th>
<th>500-m buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression coefficient (95% CI)</td>
<td>p-Value</td>
<td>Regression coefficient (95% CI)</td>
</tr>
<tr>
<td><strong>Personal (unadjusted)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM&lt;sub&gt;25&lt;/sub&gt;</td>
<td>-5.2 (-9.4, -0.9)</td>
<td>0.02</td>
<td>-2.4 (-5.0, 0.1)</td>
</tr>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>-2.6 (-15.3, 10.1)</td>
<td>0.88</td>
<td>-2.3 (-9.7, 5.1)</td>
</tr>
<tr>
<td><strong>Personal (adjusted)ᵇ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM&lt;sub&gt;25&lt;/sub&gt;</td>
<td>-5.9 (-10.0, -1.8)</td>
<td>&lt; 0.01</td>
<td>-2.4 (-4.8, 0.0)</td>
</tr>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>-5.1 (-13.6, 3.4)</td>
<td>0.45</td>
<td>-3.0 (-10.7, 4.6)</td>
</tr>
<tr>
<td><strong>Home-indoorᶜ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM&lt;sub&gt;25&lt;/sub&gt;</td>
<td>-6.1 (-10.6, -1.6)</td>
<td>&lt; 0.01</td>
<td>-1.9 (-4.6, 0.8)</td>
</tr>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>-9.5 (-24.4, 5.3)</td>
<td>0.20</td>
<td>-4.5 (-13.3, 4.2)</td>
</tr>
<tr>
<td><strong>Home-outdoorᵈ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM&lt;sub&gt;25&lt;/sub&gt;</td>
<td>-4.4 (-9.5, 0.7)</td>
<td>0.08</td>
<td>-3.2 (-6.6, 0.2)</td>
</tr>
<tr>
<td>NO&lt;sub&gt;x&lt;/sub&gt;</td>
<td>-5.8 (-17.6, 6.0)</td>
<td>0.33</td>
<td>-5.3 (-14.0, 3.4)</td>
</tr>
</tbody>
</table>

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ᵃ0.049 for 100 m buffer, 0.031 for 250 m buffer, and 0.042 for 500 m buffer. ᵇAdjusted for the time spent at home (sum of time spent at home-indoor and home-outdoor), smoking (active and passive), use of gas-cooking appliances, time spent in transfer, and MEDEA index of neighborhood deprivation. ᶜAdjusted for the temperature at home-indoors on the first day of sampling round, the use of gas-cooking appliances, smoking (active and passive), the number of inhabitants, and MEDEA index of neighborhood deprivation. ᵈAdjusted for the traffic intensity in the buffer of 100 m around maternal residential address, the height of the monitor, and MEDEA index of neighborhood deprivation.
Table 4

Education level-specific adjusted regression coefficients (95% confidence interval) of a 10% increase in average of NDVI in 100 m buffer around each maternal residential address (NDVI-100 m) and living within 500 m of a major green space (Proximity-500 m) for birth weight.

<table>
<thead>
<tr>
<th>Education level</th>
<th>Birth weight (gram)(^a)</th>
<th>NDVI-100 m</th>
<th>Proximity-500 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>No education completed</td>
<td>436.3 (43.1, 829.5)</td>
<td>189.8 (23.9, 355.7)</td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>-80.2 (-172.9, 12.5)</td>
<td>-39.5 (-82.9, 3.9)</td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>-85.3 (-171.3, 0.7)</td>
<td>-36.5 (-72.2, -0.7)</td>
<td></td>
</tr>
<tr>
<td>Higher education</td>
<td>57.7 (-28.3, 143.7)</td>
<td>15.9 (-20.4, 52.1)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Adjusted for gestational age at delivery, neighborhood SEP, degree of urbanization, distance of residential place to major roads, maternal booking weight, age, ethnicity, academic level, occupation, smoking, alcohol consumption, parity, history of obstetrical–gynecological pathologies, diabetes, and sex of infant.
Positive health effects on the natural outdoor environment in typical populations of different regions in Europe.

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PHENOTYPE project launch
On 1st January 2012, PHENOTYPE, a full Positive Health Effects of the Natural Outdoor environment in Typical Populations in different... Read more...

PHENOTYPE kick-off meeting
The PHENOTYPE project kick-off meeting will be held from 30th May – 1st June 2012. An open seminar introducing background... Read more...

PHENOTYPE Launch - Open Seminar

BENEFICIARIES

CREAL - Centre de Recerca en Epidemiologia Ambiental (ES)

PHM - Peking University Health Science Centre (CN)

Staffordshire University (UK)

VU-University (NL)

UNIBAS - Università della Svizzera Italiana (CH)

ABOUT PHENOTYPE

Indications exist that close contact with plants, trees, and other aspects of the natural outdoor environment in typical populations in different European countries has a positive effect on health. Research has been conducted in the UK, Europe and USA. This leaves a need for evidence-based approaches to the interaction of human health and natural outdoor environments.

Furthermore, personal variation in indications for green contact often makes it difficult to compare results.

PHENOTYPE is intended to provide an understanding of the potential interaction of human health needs...