


## Invited Perspective: A Natural Prescription for Hypertension?

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Poets, artists, and naturalists have long extolled the beauty of natural landscapes and their ability to rejuvenate and inspire. However, this love of “nature” is partial to “natural spaces”; that is, wild landscapes like those now found in nature preserves around the world. However, although urbanization and lifestyle changes have reduced the possibilities of direct, everyday contact with nature “out there,” nature’s influence does not end at the boundaries of nature parks. It is everywhere with us—within the cities we build, near the houses we live in, and around the roads we travel every day. Even in urban surroundings, nature works its magic. Living in urban areas of higher surrounding greenness is associated with lower levels of stress, depression, insulin resistance, diabetes, stroke, all-cause mortality, and cardiovascular mortality.<sup>1,2</sup> In areas of low greenness, well-positioned vegetation, such as street trees, can reduce air pollutants known to have adverse health effects.<sup>3</sup> Adding to this body of knowledge, in this issue of *Environmental Health Perspectives*, Zheng et al.<sup>4</sup> report potential protective effects of neighborhood greenness against incident hypertension.

Zheng et al. compared levels of residential greenness in Taiwan and found that people living in neighborhoods with lower levels of greenness had a higher risk of hypertension compared with those living in neighborhoods with more green space. These findings are particularly noteworthy because they are derived from a large cohort of 125,537 participants recruited over a 15-y period. They strengthen the evidence for an association between exposure to greenness and blood pressure previously reported in cross-sectional studies.<sup>5–7</sup> The effect sizes are also comparable. The 24% lower risk of hypertension for each 0.1-unit increase in normalized difference vegetation index reported by Zheng et al. is similar to estimates previously reported, ranging from 17%<sup>8</sup> to 36%<sup>6</sup> lower odds of hypertension. Even though these findings collectively support the notion that living among greener surroundings may lower the risk of hypertension, it is not clear why and how this might be so.

The authors found the potential antihypertensive effect of greenness could not be attributed to a reduction in exposure to ambient fine particulate matter [PM<sub>2.5</sub> in aerodynamic diameter (PM<sub>2.5</sub>)]. Exposure to PM<sub>2.5</sub> has been extensively linked to high blood pressure and excess cardiovascular disease risk.<sup>9</sup> In previous work, we found that the association between PM<sub>2.5</sub> exposure and arterial stiffness was weakened by residential greenness,<sup>10</sup> and that the association between PM<sub>2.5</sub> and cancer mortality was mitigated

at high levels of greenness.<sup>11</sup> Thus, it seems the relationship between greenness and air pollution may be sensitive to the types of exposures and outcomes measured, or perhaps the effects of greenness are more specific, that is, they are restricted to the removal of near-roadway pollutants or limited to population subgroups. For instance, in prior work, we found the protective effects of greenness on PM<sub>2.5</sub>-associated mortality were evident only in highly active individuals,<sup>12</sup> which reinforces the idea that the effect of greenness may vary with individual and neighborhood characteristics.

We have been studying the effects of greenness on health for many years. We have found specific quantifiable effects of greenness in protecting against exposure to volatile organic compounds,<sup>13</sup> ozone,<sup>10</sup> and PM.<sup>12</sup> However, it is likely that the presence of green spaces in urban environments could have more profound effects that we are yet to decipher. In our own lives we find that trees around our homes bring comfort and tranquility. They protect us from harsh urban noise and glaring lights of neighborhood streets, promoting better sleep. They even prevent excessive heating in summer and cooling in winter and are home to myriad birds and insects that remind us, on a daily basis, of our interconnectedness with nature and the many ways in which greenness affects our health.

Clearly, more intensive work is required to identify *a*) how the potential beneficial health effects of greenness vary at the neighborhood scale as opposed to the household scale, and *b*) specific types and configurations of greenery, individual characteristics, and behavior patterns associated with health benefits of greenness. Further, greenness is only one aspect of a complex ecosystem; if this complexity is unaccounted for, the result could be an incomplete picture of the direct and indirect benefits of greenness.<sup>14</sup> Such work is becoming increasingly urgent in view of climate change and the progressive increase in global temperature.<sup>15</sup> Trees and shrubs in urban locations can prevent urban heat islands, reduce energy and water consumption, sequester carbon, support biodiversity, and decrease levels of noise and artificial nighttime light<sup>16</sup>—a panoply of benefits that are crucial in mitigating the effects of climate change. Hopefully, the impressive work of Zheng et al. reported here will inspire others to study our dissoluble bond with nature and how the resources of nature can be used to mitigate some of the environmental damage we have caused and to create healthier living environments.

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