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Exposure to green spaces and all-cause mortality: limitations in measurement and definitions of exposure – Authors' reply

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We thank Samuel Trethewey and Ella Reynolds for their Correspondence about our Article.¹ We appreciate their comments because they offer the opportunity to clarify some issues on the exposure definition of green spaces and the complex relationship between green spaces and health.

As Trethewey and Reynolds highlight, the normalised difference vegetation index (NDVI) is limited as an exposure definition because it does not measure the quality of greenness nor accessibility to such green spaces. At the same time, the NDVI is widely used among epidemiological studies because it provides a harmonised definition of vegetation that is freely available for any location worldwide.^{1, 2} With all of its limitations—similar to those that PM_{2.5} has in its indicator role for air pollution (ie, an inherently dynamic measure that changes over time)—NDVI is still able to provide a measurement of the greenness of a place.

More and more health studies incorporate vegetation in their analyses to understand the interaction between nature and health. In this regard, tools such as systematic reviews and meta-analyses can provide essential guidance on where the evidence is pointing to. Having exposure metrics that are comparable among epidemiological studies is a crucial factor to be able to conduct meta-analyses. NDVI worldwide availability and use among cohort studies have helped us to better understand where the evidence is directing us. We believe that NDVI is an important metric to study the relationship between nature and health, and we encourage epidemiological studies to continue using this metric in their analysis. We also believe that NDVI should be accompanied by exposure metrics that could reflect other dimensions of green spaces, such as accessibility, quality, usage, and type. Suggestions for other metrics to be used in epidemiological studies for exposure to greenness are welcome.

Regarding the result of the meta-analysis, we acknowledge the importance of heterogeneity in the interpretation of our results. Our analyses found that an increment in NDVI resulted in a reduction in risk of all-cause mortality. The results also describe a high level of heterogeneity, implying that although the exposure metric and health outcomes among the cohort studies included were the same, there are still significant differences among the studies. This might be partly explained by differences in green space type and quality. The meta-analysis aims to provide an orientation about the possible direction (risk or benefit) and the magnitude of the relationship between green spaces and all-cause mortality. But we acknowledge that current studies are not enough to provide a complete answer to this question, primarily due to the level of heterogeneity found. And further cohort studies should be done using similar exposure metrics and health outcomes to increase the body of evidence.

Overall, our study supports the need for more longitudinal epidemiological studies on green spaces, using harmonised and comparable exposure metrics such as NDVI, in addition to other exposure metrics, to advance in this field.

We declare no competing interests.

References

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