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Construction of an environmental quality index for public health research

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Abstract

Background: A more comprehensive estimate of environmental quality would improve our understanding of the relationship between environmental conditions and human health. An environmental quality index (EQI) for all counties in the U.S. was developed.

Methods: The EQI was developed in four parts: domain identification; data source acquisition; variable construction; and data reduction. Five environmental domains (air, water, land, built and sociodemographic) were recognized. Within each domain, data sources were identified; each was temporally (years 2000–2005) and geographically (county) restricted. Variables were constructed for each domain and assessed for missingness, collinearity, and normality. Domain-specific data reduction was accomplished using principal components analysis (PCA), resulting in domain-specific indices. Domain-specific indices were then combined into an overall EQI using PCA. In each PCA procedure, the first principal component was retained. Both domain-specific indices and overall EQI were stratified by four rural–urban continuum codes (RUCC). Higher values for each index were set to correspond to areas with poorer environmental quality.

Results: Concentrations of included variables differed across rural–urban strata, as did within-domain variable loadings, and domain index loadings for the EQI. In general, higher values of the air and sociodemographic indices were found in the more metropolitan areas and the most thinly populated areas have the lowest values of each of the domain indices. The less-urbanized counties (RUCC 3) demonstrated the greatest heterogeneity and range of EQI scores (−4.76, 3.57) while the thinly populated strata (RUCC 4) contained counties with the most positive scores (EQI score ranges from −5.86, 2.52).

Conclusion: The EQI holds promise for improving our characterization of the overall environment for public health. The EQI describes the non-residential ambient county-level conditions to which residents are exposed and domain-specific EQI loadings indicate which of the environmental domains account for the largest portion of the variability in the EQI environment. The EQI was constructed for all counties in the United States, incorporating a variety of data to provide a broad picture of environmental conditions. We undertook a reproducible approach that primarily utilized publically-available data sources.

Keywords: Environmental quality, Air quality, Water quality, Land quality, Built environment, Sociodemographic, Rural–urban status

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