

Title: MODIS Satellite Data and GAM Models to Examine Urbanization as an Independent Predictor of Endothelial Dysfunction in a Large Southeast Asia Population

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Abstract:

Background: Rapid urbanization is occurring in Southeast Asia with corresponding increases in prevalence of cardiovascular disease. Endothelial dysfunction is the initial step of atherosclerosis and is an independent predictor of cardiovascular events. Here we use satellite based land cover data and distance to urban center (UC) as a measure of the impact of urbanization on flow mediated dilatation (FMD) of brachial artery, a measure of endothelial function, in the participants in the PURSE-HIS study, Tamil Nadu, India.

Methods: Participant residence was geolocated and used to calculate Euclidian distance to the UC and joined with satellite-derived land cover data. Land cover was classified into urban, crops, trees/shrubs, grass and other. The cross-sectional analysis was of 8080 people (mean age 41 years; 56% women) spread over 78.5 km from the UC. Various measures included FMD by ultrasound. All models controlled for age, sex, BMI, blood pressure, blood sugar, socioeconomic and smoking status, physical activity, anxiety and stress levels.

Results: In multilinear regression models, a 1 km increase in distance from the UC was associated with a 0.04% increase in FMD ($p < 0.001$) with 0.03% ($p < 0.001$) increase in men and 0.05% ($p < 0.001$) increase in women. Other than sex, age was identified as a significant effect modifier on the relationship between distance from UC and FMD: a 1 km increase in distance from the UC resulted in 0.07% increase in FMD ($p < 0.001$) in participants in 20-38 years age group when compared to 0.02% ($p = 0.02$) increase in the 48-76 years age group. The land cover analysis that compared residents in urban areas to the other land types demonstrated that FMD was 4.7%, 4.3% and 3.8% higher in residents in grass, trees/shrubs, crop areas, respectively ($p < .001$).

Conclusion: Urbanization is an independent predictor of endothelial function. Further research will elucidate components in the urban environment that may be contributing to endothelial dysfunction.