GREEN AREA EFFECTS ON HEALTH - BIG GEOSPATIAL DATA APROACH

Carlos Gonzales-Inca[1], Sofia Koskela[1], Niina Käyhkö[1], Jussi Vahtera[2]

[1] Department of Geography & Geology, University of Turku

[2] Department of Public Health, University of Turku

INTRODUCTION

Big geospatial data is providing novel insights on the effects of environmental quality and green space on health. Big geospatial data, particularly satellite imagery collections, allows to map green areas and to characterize long-term urban environmental quality at national level (Merritt et al., 2018). This information, integrated with long-term health data, allows to research the effects of green area and urban environmental quality change on health.

In this study, effects of cumulative exposure to neighborhood green areas on mental disorder and physical activities were evaluated, using geospatial analytics. The output of the research is relevant to enhance the role of green areas and reshape the current urban planning policy towards sustainable and healthy cities in the future, particularly under the stresses of intensive urbanization and climate change.

OBJECTIVES

1) Assess the potential and limitations of big geospatial data applied to health studies.

2) Develop conceptual and methodological approaches in integrating big geospatial, green area and health data.

3) Provide preliminary results of geospatial data-driving research of green space effect on health.

MATERIAL AND METHODS

Big geospatial data, mostly Landsat and Sentinel 2 satellite data, was accessed and analyzed using cloud computing geospatial analytics platforms (Google Earth Engine and CoLab platform for python). A time-series of Normalized Differential Vegetation Index (NDVI), indicating greenness intensity, and sub-pixel classified green areas was used to describe physical environmental quality in Finnish Cities. We generated a dataset of individual-level greenness intensity and relative green areas within different buffer size, e.g. 250m, 500m and 1000m, around the residential place of each individual in the health data base (Fig. 1). This datasets was statistically related to mental health data (Beck depression index, n = 19 994) and physical activity data of a cohort of aging people (metabolic equivalent of task – MET, n = 885). Ordinal regression, Robust mean comparison test, Generalized Linear Mixed model and Bayesian statistical methods were performed (Fong et al., 2010).

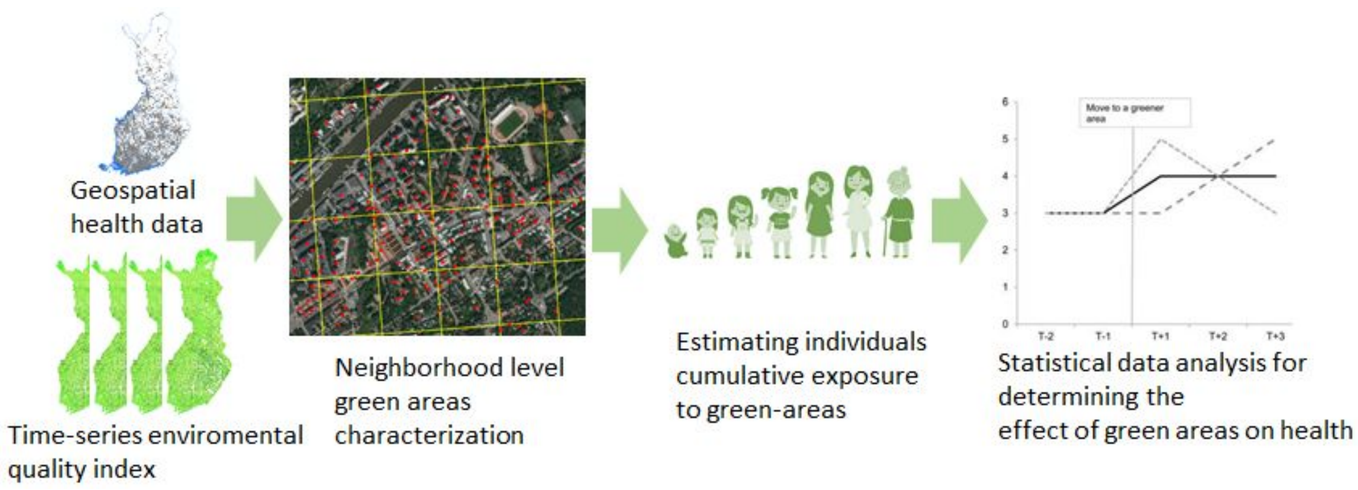

Fig. 1. Conceptual approach to study effects of green areas on health by integrating big geospatial data (environmental quality index) and long-term health data.

PRELIMINAR RESULTS

- A work flow of big geospatial data processing in cloud platform has been developed to extract time series of urban environmental quality indices and green areas (Quantity, quality and access).

- The green areas relative quantity and quality were positively related to mental health. However, the statistical relation was low. Not clear influences of green area on physical activates of aging people was observed. Overall, health data is complex and a better data analytics method need to be developed, to better discriminate the different factors affecting health. For example, to reduce data variability, factors such as education level, life stage, socio-economic conditions, etc., could be considered.

CONCLUSIONS

- Big geospatial data provides new opportunities to study the effects of long-term environmental quality on health.

- Several cloud computing resources are becoming available to facilitate the access to different types of geospatial data with higher temporal and spatial resolution and global coverage.

- Relating the time-series green space data on long-term health data (e.g. mental disorder) appears to be a promising data-driving research approach to study environmental quality effects on health. However, more elaborated data analytics will be needed to explicitly capture the causal relationships between the health and environment.

REFERENCES

- de Almeida Mendes, M., da Silva, I., Ramires, V., Reichert, F., Martins, R., Ferreira, R., Tomasi, E. 2018. Metabolic equivalent of task (METs) thresholds as an indicator of physical activity intensity. PLoSONE13(7): e0200701.

- Fong, Y., Rue, H., Wakef i el d, J. 2010. Bayesian inference for generalized linear mixed models. Biostatistics. 11(3): 397–412.

- Merritt, P., Bi, H., Davis, B., Windmill, C., and Xue, Y. 2018. Big Earth Data: a comprehensive analysis of visualization analytics issues. Big Earth Data 2 (4): 321–350.

- Veerman, J. L., Dowrick, C., Ayuso-Mateos, J. L., Dunn, G. and Barendregt, J. J. 2009. Population prevalence of depression and mean Beck Depression Inventory score. The British Journal of Psychiatry. 195: 516–519.1

Contact information:
Carlos Gonzales-Inca, cagoin@utu.fi

UNIVERSITY OF TURKU