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Healthy Urban Planning:
Body Mass Index association with exposure to night-time noise in the canton of Geneva

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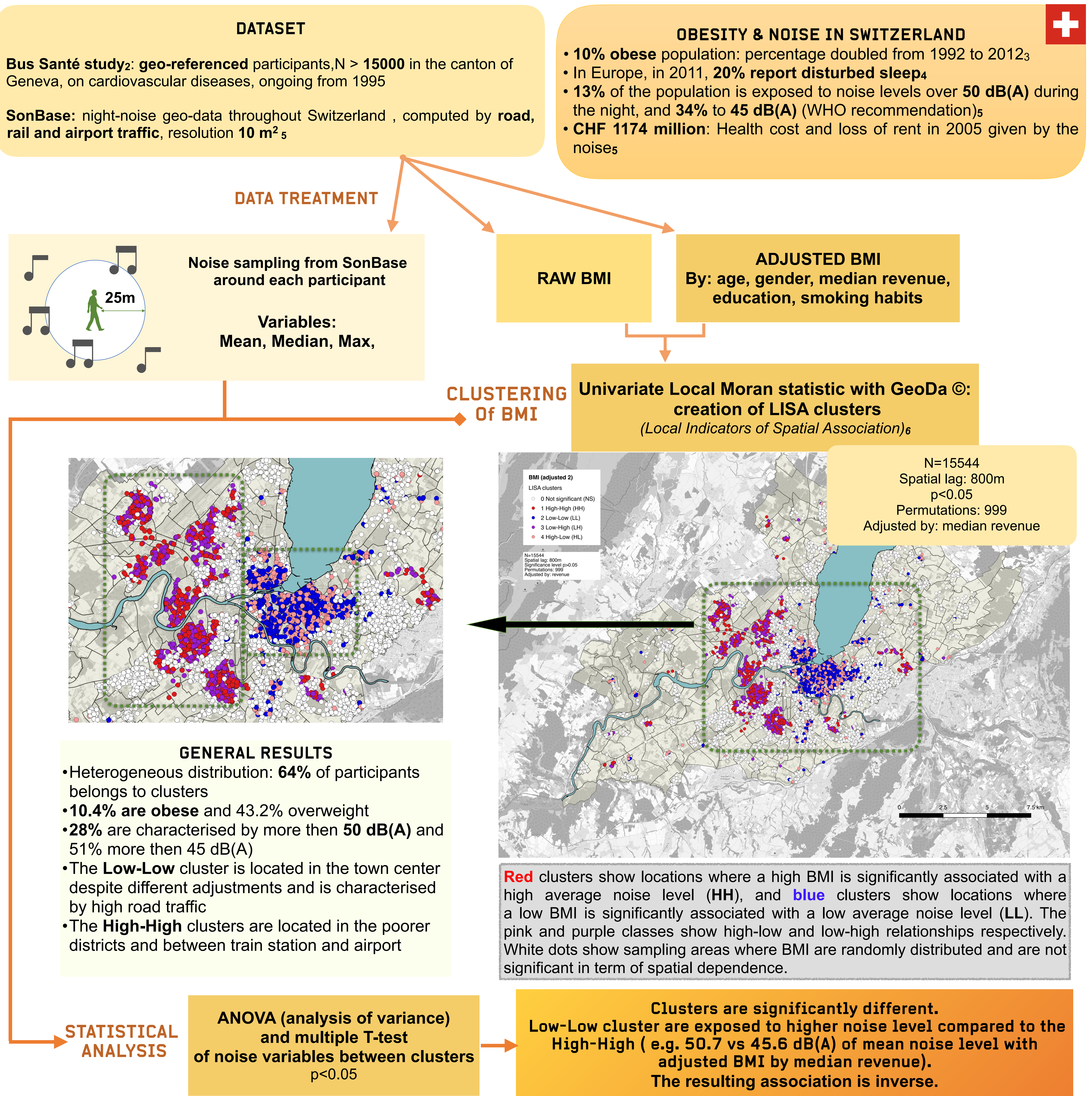2 Unit of Population Epidemiology, Division of Primary Care Medicine, Department of Community Medicine, Primary Care and Emergency Medicine, Geneva University Hospitals, Geneva, Switzerland
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Health and Land-Use Planning project (HeLP):

The HeLP project purpose is to produce an improved and adapted tool for urban planning to make Switzerland healthier; promoting healthy housing, active travel, healthy environment and vibrant neighbourhoods[1]. The study of the spatial dependence of health determinants, e.g. obesity, and the study of the association with patterns of urbanization, allow us to validate the approach and identify the priorities.

DATASET

Bus Santé study[2]: geo-referenced participants, N > **15000** in the canton of Geneva, on cardiovascular diseases, ongoing from 1995

SonBase: night-noise geo-data throughout Switzerland, computed by **road, rail and airport traffic**, resolution 10 m^2 [5]

OBESITY & NOISE IN SWITZERLAND

- **10% obese** population: percentage doubled from 1992 to 2012[3]
- In Europe, in 2011, **20% report disturbed sleep**[4]
- **13%** of the population is exposed to noise levels over **50 dB(A)** during the night, and **34%** to 45 dB(A) (WHO recommendation)[5]
- **CHF 1174 million**: Health cost and loss of rent in 2005 given by the noise[5]

DATA TREATMENT

Noise sampling from SonBase around each participant

25m

Variables: Mean, Median, Max,

RAW BMI

ADJUSTED BMI By: age, gender, median revenue, education, smoking habits

CLUSTERING Of BMI

Univariate Local Moran statistic with GeoDa ©: creation of LISA clusters *(Local Indicators of Spatial Association)*[6]

N=15544
Spatial lag: 800m
p<0.05
Permutations: 999
Adjusted by: median revenue

GENERAL RESULTS

- Heterogeneous distribution: **64%** of participants belongs to clusters
- **10.4% are obese** and 43.2% overweight
- **28%** are characterised by more then **50 dB(A)** and 51% more then 45 dB(A)
- The **Low-Low** cluster is located in the town center despite different adjustments and is characterised by high road traffic
- The **High-High** clusters are located in the poorer districts and between train station and airport

Red clusters show locations where a high BMI is significantly associated with a high average noise level (**HH**), and **blue** clusters show locations where a low BMI is significantly associated with a low average noise level (**LL**). The pink and purple classes show high-low and low-high relationships respectively. White dots show sampling areas where BMI are randomly distributed and are not significant in term of spatial dependence.

STATISTICAL ANALYSIS

ANOVA (analysis of variance) and multiple T-test of noise variables between clusters p<0.05

Clusters are significantly different. Low-Low cluster are exposed to higher noise level compared to the High-High (e.g. 50.7 vs 45.6 dB(A) of mean noise level with adjusted BMI by median revenue). The resulting association is inverse.

Observations:

- Geneva is listed as one of the city with the best **quality of life** in the world (8th[7]): no health impact of noise pollution due to the presence of other **positive health determinants** located in the town center
- Annoyance from noise may be caused by **high variability** when mean is under the thresholds[8]

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