AIM: explore obesity and disturbed sleep in the noise exposure space: assess whether spatial dependent cases of Body Mass Index (BMI) and Self-Reported Insomnia (SRI) are associated with higher level of nighttime noise exposure, in the canton of Geneva using a large population-based cohort.

Obesity is an important public health burden and evidence is rising regarding its link with the built environment. In the literature, obesity is reported to be associated with higher noise exposure in half of the studies while the other half reports no association. Noise exposure is a major environmental stressor in Europe, second only to air pollution. Since insomnia is usually assessed as covariate in cardiovascular risk factors studies, and it can be caused by noise disturbance, the spatial distribution has been assessed.

Prevention in Public Health can not being confined to Health-care alone: the impact of the (Built) environment rises new interrogatives which may guide urban planning and the management of the territory to a healthier future.

DATASETS
Bus Santé study: geo-referenced participants, N > 15000 in the canton of Geneva, on cardiovascular diseases, ongoing from 1993. Every year, 1000 participants are recruited in order to be representative of the demographic and distribution of the population (for age, gender and postal code).
SonBase: night-noise (7 pm to 7 am) geo-data throughout Switzerland , computed by road and rail traffic, resolution 10 m².

PREVALENCE IN SWITZERLAND
• 10% obese population: percentage doubled from 1992 to 2012.
• Obesity and sleep disorders make it spatially dependent.
• 13% of the population is exposed to noise levels over 50 dB(A) during the night, and 34% to 45 dB(A) (WHO recommendation).
• 31.3% of the population suffers of insomnia symptoms,
• 22500 hospital days given by noise exposure (or 6000 years of life lost) per year,
• CHF 1174 million: Health cost and loss of rent in 2000 given by the noises.

METHODS
The analysis was performed using Python® (3.7.1) and GeoDa® (1.8.16) for the spatial analysis.
Nighttime noise exposure is calculated from the modelled dates using the following:
\[ t_{\text{nighttime}} = 10 \log_{10}(10^{-10} + 10^{10}) \text{dB(A)} \]
Statistics of noise exposure were calculated within 25m around the place of residence of participants, the median noise level has been used in this analysis.

Obesity is easily identified through BMI (weight/height²) above 30 (overweight above 25). Insomnia is evaluated from SRI of participants that reported “few” or “a lot” cases of insomnia. BMI and SRI were adjusted using multivariate linear regression using multiple covariates as age, gender, median annual income, education level, smoking habits or physical activity. Normality has been obtained with Box-Cox power transformation. BMI and SRI categories were statistically adjusted using multivariate linear regression using multiple covariates as age, cardiovascular diseases, ongoing from 1993. Every year, 1000 participants are recruited in order to be representative of the demographic and distribution of the population (for age, gender and postal code).

RESULTS
Heterogeneous distribution: 64% and 22% of participants belong to spatial clusters (BMI and SRI respectively).
10.4% are obese and 43.2% overweight.
48.9% reports insomnia and 10.6% frequent insomnia.
28% are exposed above 50 dB(A) and 62% above 45 dB(A).

Nighttime noise exposure is significantly different among LISA clusters, p<0.001.
Low-Low clusters of BMI are characterised by higher noise level compared to the High-High (e.g. 48.47 vs 45.9 dB(A) of mean noise level, unadjusted). An reversed association compared to the literature is observed.

CONCLUSIONS AND OBSERVATIONS:
BMI is highly clustered and spatially segregated. SRI is weakly clustered but segregated. Association of BMI and noise pollution are weak (and reversed) and major factors may explain the BMI spatial dependency. Town center is characterised by low values of BMI and exposed to high nighttime noise levels. A better housing (and sound proofing) may explain the result, but it is usually associated with higher income: adjustment by median income does not affect the results. Insomnia HH clusters are exposed to higher noise levels (and consistent) compared to the LL clusters. Despite higher exposure to noise, the core of the town center does not show any pattern of insomnia. The SRI measure is not an official measure of Insomnia and has a low variability. Factors as sensitivity to noise, habits of sleeping with open windows, location of the bedroom and sleep medicaments consumption are important variates that should complete this analysis.

REFERENCES