

Spatial analysis of cancer incidence in Guadeloupe (F.W.I): link with pesticides and other environmental risk factors.

Bernard Bhakkan¹, Julien Dugas², Jacqueline Deloumeaux¹, Danièle Luce²

¹ Registre général des cancers de Guadeloupe, ² INSERM, U1085-IRSET, Guadeloupe

CONTEXT

Guadeloupe is a French Caribbean archipelago of 395 000 inhabitants. Soil and water, and the consequent contamination of food with chlordecone (kepone), an organochlorine pesticide used in banana plantations between 1973 and 1993, was suggested to be related to the high incidence of prostate cancer in this region. Possible associations with other cancer sites were later mentioned.

In 2008, a population-based cancer registry was set up for the monitoring of cancer incidence in the aftermath of the environmental pollution with chlordecone. The resulting contamination of the population has raised major public health concerns

OBJECTIVES

- To describe geographical variations in cancer incidence, and to identify geographical clusters of high incidence areas
- To explore the underlying environmental risk factors, with a focus on soil and water contamination by chlordecone

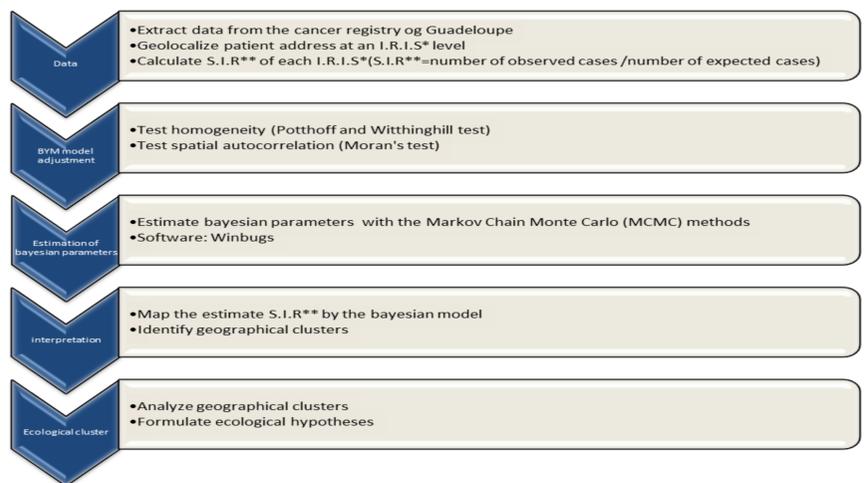
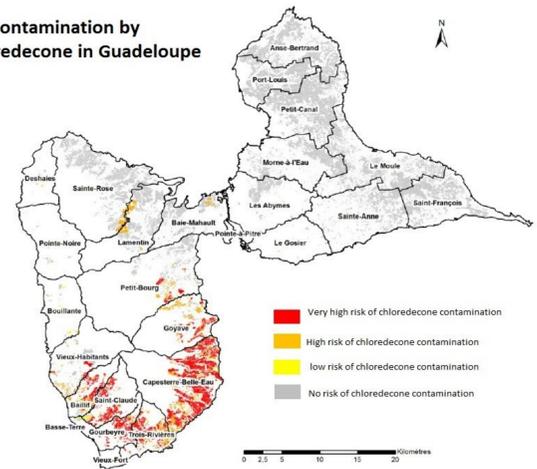
METHODS

We realized a spatial analysis of cancer incidence and studied all new cases of cancer registered by the cancer registry of Guadeloupe between 2008 and 2015. We used hierarchical Bayesian (Besag, York and Molié modeling) which allows to take into account spatial correlation between neighboring areas and an unstructured random effect.



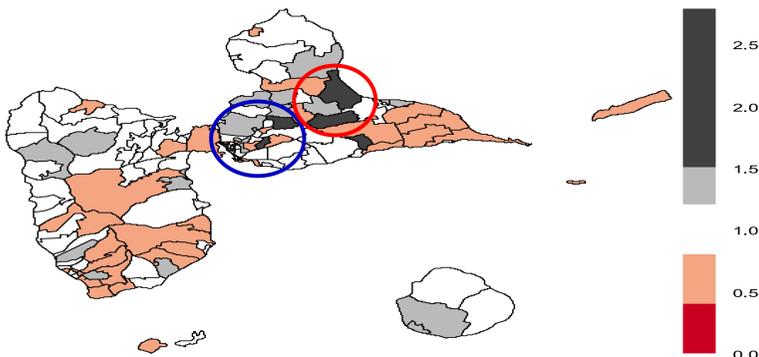
**I.R.I.S: (Merged Islet for Statistical Information), it's the smallest geographical census unit available in France. There are 136 I.R.I.S in Guadeloupe ; ** S.I.R: Standardized Incidence Ratio*

Soil contamination by Chlordecone in Guadeloupe



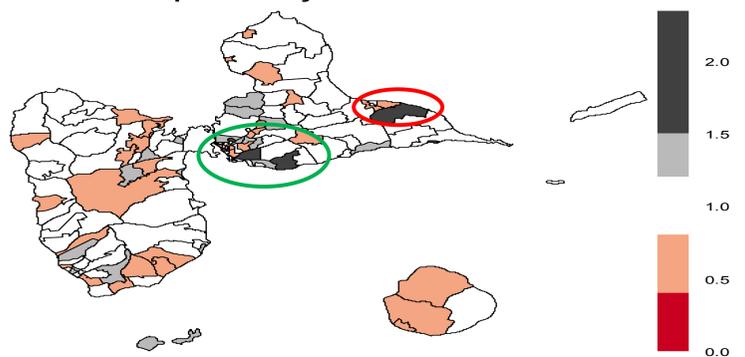
RESULTS

Spatial analysis for prostate cancer



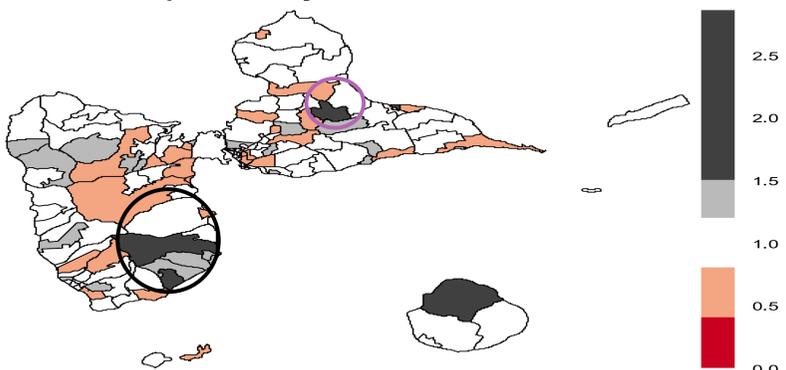
Clusters in the blue circle are situated around a landfill. Clusters in the red circle are near two factories (sugar cane and bagasse and coal-fired power plant). We make the hypothesis that the landfill pollution and the factories pollution could explain the observed over-incidence. For the last cluster no hypothesis could be suggested.

Spatial analysis for breast cancer



Clusters in the green circle are in high population density areas. Clusters in the red circle are near two factories (sugar cane and bagasse and coal-fired power plant). We make the hypothesis that the urban pollution and the factories pollution could partly explain this over-incidence.

Spatial analysis for stomach cancer



Clusters in the black circle are in areas with high chlordecone contamination. We make the hypothesis that the chlordecone contamination could be involved in this over-incidence. For the last clusters, no hypothesis could be suggested. We highlight a common cluster for both colon and stomach (purple circle).

Spatial analysis for colon cancer



Colon cancer clusters are in areas with high population density and disadvantaged populations. It is therefore difficult to formulate an environmental hypothesis. We highlight a common cluster for digestive cancers: both colon and stomach

CONCLUSION

Through this study, we identified three potential environmental risk factors: chlordecone-contaminated areas for stomach cancer, pollution of two factories for prostate cancer and breast cancer, landfill pollution for prostate cancer. Surprisingly, we found no clusters for prostate cancer in chlordecone-contaminated areas, although this cancer has been associated with this organochloric pesticide, in Guadeloupe and other regions. The next step is to improve the model by adding possible confusion variables such as: deprivation index, medical density, population density. Analytic research projects should be implemented to verify these ecological hypotheses. Moreover, thanks to this study we identified an area which is a common cluster pour two digestive cancers: colon cancer and stomach cancer. We were not able to make ecological hypothesis for this area. So further investigations are needed to explore the over incidence in this particular area.