

CARTOGRAPHY AND COMPUTING APPLICATIONS FOR  
EPIDEMIOLOGICAL RESEARCH IN BRITTANY

Louis M.F. Massé  
Michel Gallou  
Basavanneppa Tallur  
Ecole Nationale de la Santé Publique  
35043 Rennes Cédex France

In Rennes, at the National School of Public Health, we have used maps in many studies. Sometimes these maps were used for the study of the spread of health care facilities, and of the catchment area of customers by health institutions (hospitals, out patient clinics, nursing homes for the handicapped etc...). Other times they were used for a more classic epidemiologic analysis of the distribution of causes of death, diseases, or of environmental factors. Usually these studies were done in Brittany, a western, celtic, province of France in which the school is located.

As regards this last activity, we used maps most extensively for the study of brucellosis, multiple sclerosis, cancer and natural irradiation.

Brucellosis: the study on brucellosis dealt with the present and past morbidity of farmers and their relatives. It was carried out on a sampling basis, in 1975 and 1976, among the 32 farms of the "Ille et Vilaine" department. Maps were used to help draw the sample of cantons ( a canton is an aggregate of 5 - 10 villages), to secure that the sample thus selected was representative of the studied area and to make the necessary replacements of areas. This use of maps was done without the help of any computer (7).

Multiple sclerosis: there is, so far, no specific test to ascertain the diagnosis of multiple sclerosis. Consequently, the computation of a reliable prevalence ratio of multiple sclerosis for any area is rather difficult. We were asked, however, to study its prevalence in Brittany, in order to analyse two classic hypotheses:

- the existence of a north to south degradient;
- the existence of significant clusters.

For the completion of such a study, the computer has been used at several stages:

a) as a tool for record linkage, in order to sift out all the multiple counts of the same person. This sifting leads to a set of listings of sick persons by villages and "cantons". These listings were made either on the basis of place of birth, or on the basis of place of residence, thus making it possible to draw maps showing either the first location or the second location or a combination of both.

b) as a tool for computing age standardized prevalence ratios by "canton". On this basis the statistical significance of some of the clusters can be computed.

c) as a direct tool to produce maps, by "canton" of the prevalence of multiple sclerosis.

We failed, however, to produce maps using an automatic drawing table and had to instead use the classic print-out program.

This study produced two interesting results, one is the absence of a north to south significant gradient and the other is the presence of four distinct significant clusters that we are planning now to investigate by a genetic and clinical field survey(8).

Cancer: in 1968, we started investigating the epidemiology of cancer of the esophagus in Brittany, at the request of Docteur A. Tuyns of the International Agency for research on cancer (Lyon, France). This study started with an analysis of causes of death, for which, very fortunately we could secure a repertory covering all the cancers and some other causes between 1958 and 1966. With the help of a small computer just hired by the school we could draw maps with a very simple minded

program (the print-out was made letter by letter). The results were satisfactory though and reliable because we could use standardized rates. We did not use, at that time, the 1200 villages, but rather the 120 "cantons", each canton being an aggregate of villages or a part of a city.

With these maps we were able to find a very significant cluster of cancer of the esophagus on the border line between the Ille et Vilaine department and the Cotes du Nord department, crossing Brittany on a north-south line. We also found marked decrease of this cancer westward (1,2,3).

In 1972, a morbidity study was performed on a part of Brittany confirming the findings reached by a survey of maps of mortality. In particular, these findings were based on the foci of high incidence (4,5).

Natural irradiation: by 1974, the study on cancer had reached most of the intended goals for which the mapping had played a major role. Therefore, at that time we started to explore some unexpected variables, one being natural irradiation (6,9).

In the study on natural irradiation, carried out with the help of the "Commissariat a l'Energie Atomique" two methodological problems, related to mapping activities were found:

a) Sampling: when the survey on natural irradiation started, it was thought that a correct method of sampling could be done without computer assistance. This turned out not to be true due to the small size of the spots of natural irradiation. Thus, the study is now a systematic survey with a continuous recording of measurement made by a scintillometer whose sensitive chamber is carried on a long wooden beam on the rear of a station wagon driven through the countryside. The results of this survey must then be analyzed using the computer.

b) Correlating exposure with biological facts: when trying to sort out the relationship between cancer and natural irradiation we discovered the need to reduce the size of the aggregate population for every distinct unit. In this regard, the canton level does not produce significant results, although the village level

does.

The reason for the reduction of the size of the aggregate is to avoid diluting the correlation between spots of natural irradiation and cancer. It is probably one of the reasons of the failure to produce results in some previous studies.

As a result, the use of the computer is absolutely necessary:

- to produce standardized rates, keeping in mind that for 1200 villages and 2 sexes, 17 distinct causes of death are analyzed;
- to compute multivariate correlations;
- to draw maps.

Unfortunately in regard to the production of maps by computer, the programs existing at the canton level cannot be used at the village level. The programs at the village level are too time consuming to write. Therefore, we are now looking for outside help.

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