P1.13 THE DEVELOP AND APPLICATION OF *DIBREAKIB* METHOD IN ORDER TO STUDY THE RELATIONSHIPS BETWEEN ATMOSPHERIC DINAMIC AND FLU RATE IN THE CITY OF VITORIA IN THE EXPANSION PERIOD OF THE VIRUS

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1. INTRODUCTION. INFLUENZA AND TEMPERATURE

Influenza is an infectious illnes that is originated by viruses whose main property is their instability. They mutate easily, so their treatment can be complicated. In this sense, sometimes the illnes can afects human beings for a long period of time, from a few days to several weeks.

Flu infections are more usual in autum or winter time than in spring or summer. In these periods, when we feel the same symptons as with influenza, we speak about colds or coughs becacuse there is no virus working against our body. In other words it can be established that influenza is a stational illnes.

Influenza can become a serious illness. Generally it can be treated with some medicine and a few days in bed but there are several groups of people (retired, people with cronic illnes like diabet, asma, AIDS, heart problems…) that can have troubles to recover from the flu.

Each year, millions of people get influenza all over the world and many of them must be hospitalized. According to Steven Mostow from the University of Colorado, influenza and their complications can provoke catastrophic efects in population. In that way it was expressed in an interview with CNN International.

Influenza epidemics have a direct impact on health services that in many cases can collapse. The number of infected people at any given moment is so high that it is not possible to correctly attend the patients demands.

2. HYPOTHESIS, DATA AND METHODOLOGY

2.1 Hypothesis

High frecuency temperature variability and atmospheric circulation types behaviour determined the number of influenza cases that were registered during the spreading phase of the illnes in the city of Vitoria.

This initial hypothesis is analized under two frames. On one hand, it has been considered that flu infecctions are produced in the same week there is a diagnostic by the doctor.

On the other hand, it has been supposed that there is an average delay of seven day between the infecctions and the moment the medical diagnostic is given.

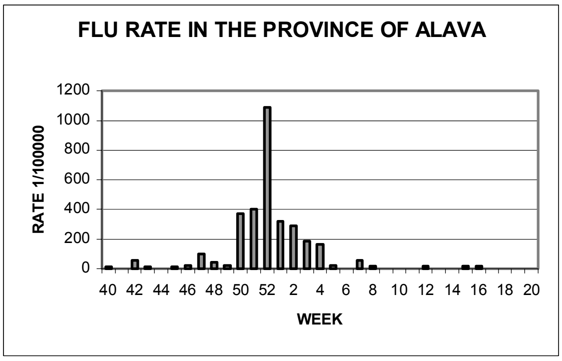

Figure 1: Diagnosed influenza cases per week per 100.000 inhabitans. Source : Basque Goverment Public Health Service. (Vitoria 1999-2000)

Both frames have been studied in two different thermic scenes:

- The first one is described by the 1008 temperature measurements that were registered in each epidemiologic week. (Frecuency =10 minutes).
- The second one, more restrictive than the first one, was defined by weekly temperature data that was registered from 8:00 AM to 22:50 PM each day of a epidemiologic week.

2.2 Sources of data

The main sources of data for the elaboration of this project have been:

- Firstly, temperature values registered with a frecuency of ten minutes by the E040 meteorological central that is located in the city of Vitoria. It belongs to the Basque Country Meteorological Service Automatic Network. Data is expressed in decimal degrees.

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- Secondly, the number of influenza cases registered by the Basque Country Health Service through the Influenza Centinel Doctors Network. It must be considered that each influenza case that was noted had previously been analised in a Laboratory and the flu virus had been identified.

- Thirdly, in order to define the types of atmospheric circulation that affected Vitoria in the period of study, the Daily Pressure Surface Maps at 12:00 PM published by the National Meteorologic Institute of Spain were used and the Jenkinson and Collinson (1977) classification adapted to the Iberian Peninsula by Rasilla,D. (2000).

2.3. Methodology

Research was started defining the "epidemiologic week" as temporary analysis unit. This decision was taken due to the fact that data was registered by the Influenza Centinel Doctors Network every seven days.

Firstly, descriptive statistical analysis (minimun and maximun temperature, standard deviation, variability coefficient...) was applied to the meteorological data in order to express the temperature behaviour numerically in the epidemilogic weeks.

The second step was to apply different Correlation Thecnics (Pearson, Kendall, Spearman) between the numer-rate of influenza cases and thermic scenes that were mentioned before in both hypothetical frames.

Thridly, the following types of atmospheric circulation were considered: A (Anticiclonic),N (North), E (East), S (South), NW (North West), C (Ciclonic),NE (North East), SE (South East), SW (South West), W (West) and it was assigned one type of circulation to each day of the week.

Lastly, three parameters that sum up the weekly evoluciόn of types of circulation were defined:

- *Diversity*: (DI) The number of different types of atmospheric circulation that are registered during one epidemic week.
- *Breaks*: (BREAK) The number of changes of types of atmospheric circulation there is in a week.
- *Intensity of breaking*: (IB) The number of 45 degree angles we have to move to pass from one type of atmospheric circulation to the new type next day.

Finaly, a comparative analisys was applied between the weekly evolution of atmospheric circulation types and the number-rate of flu in the spreading period of the epidemic.

3. PRESENTATION OF RESULTS

3.1 Influenza and thermic behaviour

From a general point of view two significative facts can be pointed out:

In week 45 it can be shown an important decrease in the standard temperature deviation. This is the week in which the first influenza virus is isolated among the population of Vitoria, so is the week in which one person was infected in the city of Vitoria according to the first hypothetical frame but if we have a look at the second frame, this fact (infection) corresponds with week 44 where one of the highest values of thermic deviation was registered.

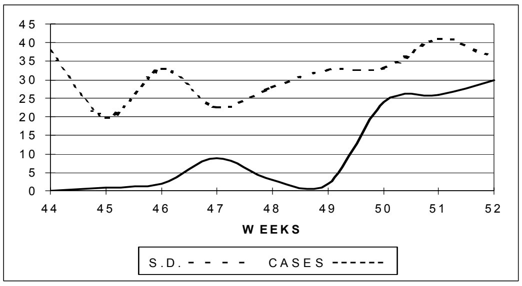

Figure 2 : First hypothetical frame - Thermic Scene 2

Results obtained under the first hypothesis show a relationship between minimum temperatures, their standard deviation and the flu-rate values and the number of cases

	T_MIN	S.D.
CASES	,2570	,4068
TAX	,4032	,3543

Table 1: First hypothetical frame. Thermic Scene 1

but much more significant are the statistical relationships (Pearson Coef.) obtained with the second hypothetical frame.

	RANGE	V.C	S.D
CASES	,3142	,5404	,5478
TAX	,4256	,2519	,6042

Table 2 : Second hypothetical frame. Thermic scene 1

	RANGE	V.C.	T_MIN	S.D.
CASES	,3512	,4334	,4874	,6231
TAX	,4638	,1336	,4723	,4524

Table 3 : Second hypothetical frame. Thermic scene 2

In this sense, minimun temperature, standard deviation and variation coeficient can be considered indicators that help us to understand the spreading of the influenza virus between week 44 and 52 in 1999 in the city of Vitoria

Also mentionable is the significant decrease in the number of diagnostics in week 49. In that week there was a secuence of 5 non working days in which a high percentage of the population were on holidays.

It should be considered, from a sociological point of view, the fact that in this hollyday-time the number of influenza diagnostics did not increase as it was suppose to do it but one week later there was the highest increase.

When it is applied a seven day delay (3 days due to the time the virus needs, to take effect and 3 or 4 days in which we try to overcome the illness with traditional methods) curves are quite similar in temporal evolution. We should consider that in this figure the line of cases represents the moment of the infections.

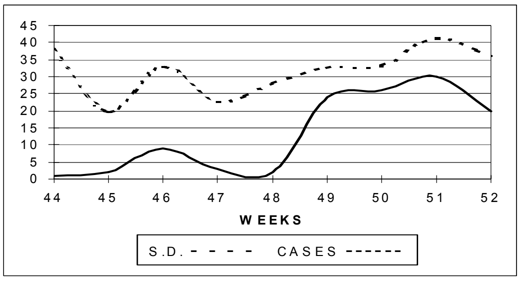

Figure 3 : Second hypothetical frame - Thermic Scene 2

3.2 Influenza and types of atmospheric circulation

It must be considered that types of atmospheric circulation affect a wide area of the North Iberian Peninsula and sometimes a different type of localy circulation can be found. The following figures shows the weekly secuence of types of circulation.

DI 3 - 3 - 3 - 3 - 3 - 2 - 3 - 4 - 3
B 2 - 2 - 6 - 2 - 2 - 3 - 4 - 4 - 3
IB 3 - 2 - 4 - 2 - 2 - 3 - 4 - 4 - 3

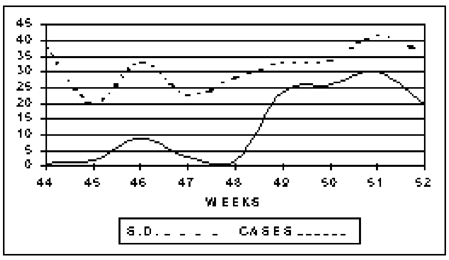

Figure 4 : Diversity (DI) , Breaks (BREAK) and Intensity of Breakings (IB) in the types of atmospheric circulation during the influenza spreading periodo in the city of Vitoria. (1999-2000)

If we have a look at Figure 4, we can be check that week 46´s dominant atmospheric circulation types were E, NE, and NW and there were 6 breakings in it. Changes in the breaks intensity were higher than the previous and next weeks. In these circunstances the infuenza rate increased to 96.4 per 100.000 people.

Under the second hypothetical frame, there was an important number of breakins during weeks 49 and 51. The intensity of breakings in these weeks took the highest values of the whole analized period in direct relation with the moment in which the infection is produced.

The predominant atmospheric circulation in these mentioned weeks were air from NW (usually air with a high humidity level and not very cold) and from NE (dry and cold air from the North or Europe).

4 - CONCLUSIONS

Results show significant statistical coincidences between the standard deviation of ten minute measurement data, their variability and the number of flu cases registered under the second hypothetical frame, mainly with the second thermic scene.

From a biometeorological point of view it can be said that high frecuency temperature variability, which is not perceptable, stimulates influenza virus difusion, either because this microbiological climatic conditions promote virus activity, or because the thermic contrasts increase virus receptivity in human beings.

Regarding the influence that types of circulation have, it should be pointed out that atmospheric inestability improves virus diffusion. Frecuency in changes of the types of circulation and, above all breaks intensity affect the number of influenza cases there are in the epidemic expansion period.

We are bound to remember that this is a complex multivariated topic and new analisys should be done to generate general laws. In this sense is important to apply the method in different places and times.

If we carried out an indirect reading of the results have been shown, it could be said that, in a expansion period, according to the temperature data registered every ten minutes and the types of atmospheric circulation there are in one week, a number of influenza cases for the next week may be estimated. Without being exact, this method could be used within the environmental researching line of influenza studies.

5 - REFERENCES

ARTEAGOITIA, J.M., 2000
"Vigilancia Epidemiológica. Red de Médicos Vigías de la Comunidad Autónoma del País Vasco" Congreso Salud y Trabajo: prevención integrada. Bilbao 6 y 7 de Abril de 2000. Dirección de Salud Pública. Departamento de Sanidad. Gobierno Vasco.

BOLETÍN EPIDEMIOLÓGICO DE LA COMUNIDAD AUTÓNOMA DEL PAÍS VASCO. Núm. 4 -Trimestre 4 Año1998 "Enfermedades de declaración obligatoria. Datos correspondientes a las semanas 1-44 de 1998".

BOLETÍN METEOROLOGICO, 1999
Ministerio de Medio Ambiente. Instituto Nacional de Meteorología. Núm. 305 a 365

BULLEN, N., MOON G, JONES, K. (1996)
"Defining localities for health planning: a GIS approach". Soc. Sci. Med. Num. 42 Pages 801 - 816.

GESLER, W (1986)
"The uses of spatial analysis in medical geography: a rewiew". Social Science & Medicine. Num 23. Pages. 963-973

JENKINSON, A.F. COLLISON, P. (1977)
"An initial climatology of Gales over thr North Sea" Sinoptic Climatology Branch. Memprandum Nº 62, Meteorological Office. London, 18pp.

SALAZAR, A. et al (1999)
"Sistema de Información Geográfica en salud pública. Una herramienta para la vigilancia". Boletín epidemiológico semanal. Ministerio de Sanidad y Consumo. Proyecto financiado por el Institut Valenciá d´estudis en Salut Pública: Nº 004/19998 y 001/1999.

RUIZ URRESTARAZU, E. (1982): La transición climática del Cantábrico oriental al valle medio del Ebro. (Tesis Doctoral) Editores: Diputación Foral de Alava. Vitoria-Gasteiz

WEBS

http://www.terra.com.mx/noticias/nota/20000119/091030.htm
http://www.diariomedico.com
http://www.intergaleno.com/prevencion/p-gripe.htm
http://www.montefiorecentral.com/webfinal/niños/influegripa.htm
http://dgsp.san.gva.es/SSCC/Epidemiologia/Centinelas/gripe/evol9798.htm