Alexandrina D. CRUCEANU
"Al.I.Cuza" University - Iasi, Doctoral School
of Chemical and Life Science and Earth -
Faculty of Geography-Geology
Gianina Maria COJOC
Siret Water Basin Administration, Bacau
Danut-Gabriel COZMA
"Al.I.Cuza" University - Iasi, Faculty of Chemistry

WHEN THE WEATHER REALLY INFLUENCES OUR HEALTH STATE ?

Case study

Keywords
Population health state
Chronical and infectious diseases
Climatic values
Incidence and prevalence

Abstract

If, at national and international level there is a consensus regarding the beneficial influence or the negative effects of climatic conditions on health state, we would like here to highlight whether this postulate is valid or not and in what way, for the upper basin of the Moldavian Bistrita.

The human communities' health state is dependent on a series of natural and anthropic factors that determine, influence or include the spacial and temporal evolution of health state, the reason why we try to identify as exactly as possible, the determinism, the postulate and the princely character of the factors involved in the fluctuations and the contiguity of incidence and the prevailance of different medical affections.

In the present approach we wished to highlight the measure, the way and the degree in which the climatic factors (like atmospheric pressure, temperature, humidity, wind's speed and atmospheric condensation) determine and influence the population's health state in the upper basin of the Moldavian Bistrita.

1. Introduction

The present article is part of the medical geography field and it contains some of the results of a case study realized in the upper basin of the Moldavian Bistrita (Vatra Dornei area and other 10 rural areas), (Figure 1) regarding the physico-geographical determinants of the human communities' health state in this geographical area in general, and the climateric determinants in particular.

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The meaning of medical/health geography term especially implies the establishment of causality relations between the environment's components (natural and anthropic elements) and the population's health state, with certain features differing from one author to another. Thus, Bailly (1984,2008), considers that, by using this discipline, we can realize a spacial analysis of the population's health state in relation with the physical, biological, economical behavioural and cultural environment and the design of models based on the frequency and accessibility of medical services, depending on the distance/time connection.

Thus, if health should be treated in at least two perspectives-disease geography and health systems geography (Barbar-Bussière, 2009), the redundance of the phenomena explained in this way, also implies the knowledge of the elements regarding: the individual's influence on his lifestyle and his attention to the natural habitat (Rougerie, 2007) as well as the totality of the functional and structural changes in the environment, climatic, hydrological, edaphic ones or others.

At international level, many studies have focused especially on the identification, classification and explanation of climatic changes effects on health, or the evaluation of the scenarios regarding the climatic changes (Moss et al., 2010), the development of the telemedicine in certain geographical areas, like Africa and Asia (Lecka, 2011), the change of the planetary ocean level, different human activities like deforestations, urbanization, industrialization, pollution) (Mohanty, 2013), ozone concentration in the environment (Bell & Goldenberg,2007), technological and political factors (Moss et al., 2010).

At national level, the studies in the knowledge and explanation of the population's health state and its determinants, refer to: the bioclimate of Romania's balneo-therapeutic resorts (Teodoreanu&Dacos-Swoboda, 1984, Teodoreanu, 2004), designing balneo-climatology encyclopaedias (Berlescu, 1996) and treatises on medical geography (Ionac, 2000), evaluating population's health state and its determinants by using questionnaires (Dumitrache&Armas, 1998 , Cruceanu et al, 2014a,b), the psychological effects of the floods in different regions of the country (Ciobanu&Grozavu, 2009), the catastrophical effects of the abundant rain-falls (Chelaru et al. 2013) and the floods in Moldavia region (Romanescu&Nistor, 2005).

Also, we mention some studies regarding the access to the public services of salubrity (Mihai et al. 2012a) and throwing domestic waste along or in the rivers (Mihai et al. 2012b), the effects of blizzard and snow accumulations on different economical sectors (Sfică and Andrei, 2013), geographical disparities in the rate of infantile mortality in Neamt County (Burlea&Muntele, 2013, Burlea&Muntele, 2012), climatic changes effects and established strategies and public policies for using green energy (Ciomos, 2014, Ioan, & Luca, 2014), food consumption and its effects on population's health conditions (Constandache et al., 2014) or health sector in Romania (Almaashi, 2014).

The specialty literature highlights the climate's role in the genesis and dynamics of some geographical phenomena and processes which involve the anthropic subsystem, especially in the medical geography perspective. This role can be divised into three types of constrains and favourabilities such as: thermic, pluviometric and hygrometric (Muntele, 2005) and their influence may be diffuse or concentrated, with a strong local specificity.

Defined as the multiannual mean of weather forecasts, reflected in the medium values of the climatic elements (temperature, rain-falls, winds), for a period of at least 30-33 years (Grozavu et al., 1999), the climate of a geographical area can be analysed according to the continuous components (pressure, temperature, humidity, aerosols) and discontinuous (solar radiation, wind, haziness, rain-falls) (Lamarre&Pagney 1999).

The main aspects related to the climatic changes with negative results on health are: the fast multiplication of vectors, polluting substances release, rising of the ozone concentration and of the planetary Ocean level (Swan, 2013), air pollution (Luca &Ioan, 2012), the body's tolerance and adaptability to the environment's aggressions (Teodoreanu, 2011), the annual medium temperature rising and icebergs melting, the high risk for some social categories, the productivity of the workers exposed to the thermic stress (Nearlander, 2009).

To the elements above we add those related to the possible social, economical and demographical perturbations (Mc Michael, et all., 2012), reducing poverty and social/gender inegalities, malnutrition, infantile and maternal mortality (Mihai et al. 2012b), the uncertainty about the extension and/or reappearance of epidemies, the high vulnerability of certain geographical regions (among which those in the temperate zones), the effects of the heat islands in cities (Patz et al., 2005), or the mortality's political perception (Ionac, 2000a).

The direct and visible effects of the phenomena and/or of the climatic changes are among the most various, the consequences of which are often measured in terms of economical and even human losses and the examples are, unfortunately quite numerous, at both national and international level.

This is the case of the floods in the summer of 2005 registered in the hydrographic basin of Siret river, resulting 58.000.000 affected hectares, 24 human losses and thousands of dead domestic animals, losses in value of over 2 million euros (Romanescu&Nistor, 2011), or the abundant rain-falls in the period 22-27 July 2008 in the north and north-east of Moldavia (Apostol &Machidon, 2009), the snowstorms in the open areas and blocking infrastructure (Sfica et al., 2013) in the east, north-east and south-east of Romania and those in May 2014 on the river Putna in Vrancea County.

Affections like skin cancer, cataract or blinding, weak immunitary system (Swain, 2013), photodermathosis, actinodermathosis, cutaneous allergies, nostalgia, melancholy, nervousness (Teodoreanu&Dacos-Swoboda 1984), medical services quality and health infrastructure, (Dumitrache&Armas, 1998), the rising of frequency and intensity of dog days (Ionac, 2012a), the "microclimate" of working spaces and offices (Ionac, 2012b) or even the individual's subjective perception on his health state, highlights, even more, the complex and at the same time paradoxal character of the factors involved in the evolution of the health state of different human communities.

Despite all the negative or positive, long or short-term, catastrophic or superficial effects, another extremely important role is played by the public authorities' reaction and the human communities directly affected by the natural calamities. An appropriate example is the research realized in three geographical regions in Romania, affected by floods, on the perception of the inhabitants and the public authorities regarding the causality of these disasters. Thus, as main causes for the floods and the losses after, the inhabitants indicate the low implication/reaction of the authorities and low management of the hydrological resources, while the local authorities indicate meteorologic factors (Ciobanu&Grozavu, 2009). The externalization of negative effects and responsibility, seems to be an unanimous feature (at least for these studied areas), whether the decision factors are accused (the inhabitants affected by calamity), or the climatic/meteorologic ones (the local authorities).

At the same time, the population's percentage with access to the salubrity services (growing lately) (Mihai et al. 2012b), the reduction of the forestry areas and changing of the initial destination (for agricultural fields, pastures or building designed perimeters) (Chelaru et al., 2013), growing investments in the rural areas and the changing of the population's socio-demographic profile in this area (Matei, Chiriță, 2011), growing touristic attractions and the tourism practiced in this geographical space (VatraDornei and the neighbouring areas) (Iațu et al., 2011a,b), the multiple treatment possibilities offered by the resort's treatment base (Berlescu, 1996), come to accomplish the "explanatory model" of the factors that determine and influence the population's health state in this geographical area-more exactly the upper basin of the Moldavian Bistrita.

II.MATERIALS AND METHODS

The theoretical and methodological approach in our research is meant to accomplish the national and international efforts regarding the study of the population's health state and its determinants, with a special focus on the climatic factors' influence on the incidence of medical affections in the upper basin of the Moldavian Bistrita.

The statistical observation has contained, at first stage, the inventorying for a period of at least 30 years, of certain climatic values (like the annual average values of atmospheric pressure, of temperature, relative humidity, the wind's average and top speed and atmospheric condensation) and also the incidence of certain medical conditions in this geographical area and the total number of hospitalizations in VatraDornei hospital.

The necessary data for this study were obtained from the The National Institute of Statistics - The Statistics Direction of Suceava County; The Public Health Direction of Suceava County; VatraDornei hospital; The National Meteorological Administration - The Regional Meteorological Center Moldova-Iasi; The National Administration "Romanian Waters"- Siret-Bacau.

The statistical data processing and analysis were realized by parametrical and non-parametrical tests of the descriptive and inferential statistics, more exactly the statistical correlation using the software application of the statistical program SPSS 14.

The correlations obtained led to the comprehension of the existing causality relations between different climatic factors and the

presence/absence of different medical affections, the reason why the analysis of the phenomenon in study is realized especially by using this method.

The study's experimental design contains a general research hypothesis and more working hypotheses, taking into account that this complex process-health state, can be explained and understood by means of a lot of factors and even a cumulus of independent and interdependent factors.

Research hypothesis 1. *There is a correlation between the population's health state* (the incidence of medical conditions and total number of inpatient care) *and the average values of the climatic factors*.

The dependent variable: The population's health state (the incidence of medical conditions and total number of inpatient care).

Independent variables: The annual average values of climatic factors, like: atmospheric pressure; temperature, humidity, wind's average and top speed, rain-falls.

The null Ho hypothesis: There is no correlation between the population's health state and the climatic factors.

Working hypotheses - *There is a correlation between: the average value of atmospheric pressure (I), air's average temperature (II), relative humidity (III), the wind's average speed (IV), the wind's top speed (V), rain-falls (VI) and certain medical affections.*

III. RESULTS AND DISCUSSIONS

For **the research hypothesis I**: *There is a correlation between the population's health state (incidence of medical affections and the total number of inpatient care/hospitalizations) and the average values the climatic factors*. The research method used was the statistical correlation obtained through the software application of the statistical program SPSS 14, independently used method for each working hypothesis.

Working hypothesis 1.*There is a correlation between the annual average value of atmospheric pressure and populations health state*

Thus, there was fount a correlation between this independent variable (the annual average value of atmospheric pressure) and the total number of inpatient care/hospitalization

It where obtain a correlation coefficient Pearson of 0,448 which suggests that between the qualitative variables "the annual average value of atmospheric pressure" and "the total number of inpatient" there is a significant statistical relation.

The value of the significance level associated to the test, noted Sig., equal to 0,008 was obtained, so there are 1% fewer chances to be wrong if we state that there is a significant statistical relation between the two variables.

Working hypothesis 2.*There is a correlation between the annual average temperature and medical conditions/the total number of inpatient.*

This time, reversed statistical correlations were registered, between this independent variable and myocardial infarction.

A Pearson correlation coefficient of -0,799 were obtained, which suggests that there is a significant reversed statistical relation between the qualitative variables "*the annual average temperature*" and "myocardial infarction". Thus, a variable's growing level is in inverse proportion to the other variable's value.

The value of the significance level associated to the test, noted Sig., equal to 0,017 illustrates that a significant correlation coefficient of 0,005 was obtained, so there are 5% chances to be wrong if we state that there is a statistical relation between the two variables.

Working hypothesis 3.*There is a correlation between the annual average humidity value and different medical affections/the total number of inpatient*

It where obtain a correlation coefficient Pearson of 0,634 which suggests that between the qualitative variables "The annual average value of atmospheric pressure" and "the total number of inpatient" there is a significant statistical relation.

The value of the significance level associated to the test, noted Sig., equal to 0,000 was obtained, so there are 1% fewer chances to be wrong if we state that there is a significant statistical relation between the two variables.

Working hypothesis 4.*There is a correlation between the variable "the wind's annual average speed" and medical conditions/the total number of inpatient care.*

In this case a Pearson correlation coefficient of -0,559 were obtained, which suggests that there is a strong reversed statistical relation between the qualitative variables "the wind's annual average speed" and "the total number of inapatient care".

The value of the significance level associated to the test, noted Sig., equal to 0,004 was obtained, so there are 1% fewer chances to be wrong if we state that there is a strong reversed statistical relation between the two variables.

Working hypothesis 5.*There is a correlation between the variable "the wind's maximum speed" and different medical affections.*

There weren't significant statistical correlations for these variables, which implies accepting the null hypothesis (there are no correlations between the annual average temperature and certain medical affections) and rejecting the research hypothesis (there are correlations between the mentioned variables).

Working hypothesis 6.*There are correlations between the annual average precipitations'value and different medical affections/the total number of unpatient care*

For these variables we observed a situation similar to the variables "the average air temperature's value" and "*the wind's maximum speed*", in the way that there were no significant correlations between these variables.

IV. Conclusions

As we mentioned at the beginning, in the present approach we wished to highlight the measure, the way and the degree in which the climatic factors (like atmospheric pressure, temperature, humidity, wind's speed and atmospheric condensation) determine and influence the population's health state in the upper basin of the Moldavian Bistrita, more precisely the incidence of infectious and chronic disease.

From our results we can conclude that:

There are significant correlations (direct and reversed) between certain climatic parameters and medical affections/number of unpatient care, such as: atmospheric pressure and the total number of inpatient care (direct correlation); the temperature and myocardial infarction (reversed correlation); humidity and the total number of spitalization (direct correlation); the wind's average and the total number of inpatient care (reversed correlation).

The were not found significant statistical correlations between climatic indicators like: the wind's maximum speed and *the annual average precipitations'value* and medical conditions/the total number of inpatient care.

For our geographical area, the greatest influence seems to have: temperature, followed by humidity, the wind's average and atmospheric pressure.

The study of the influence of climatic factors on the population's health state can be realized in connection to the hydrographic ones, of relief, fauna and vegetation, edaphic, the economical development, medical politics and health system, lifestyle, the genetic and phylogenetic, historic, social, cultural factors, etc., factors that often influence, synchronically, the evolution of population's health state.

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Annex

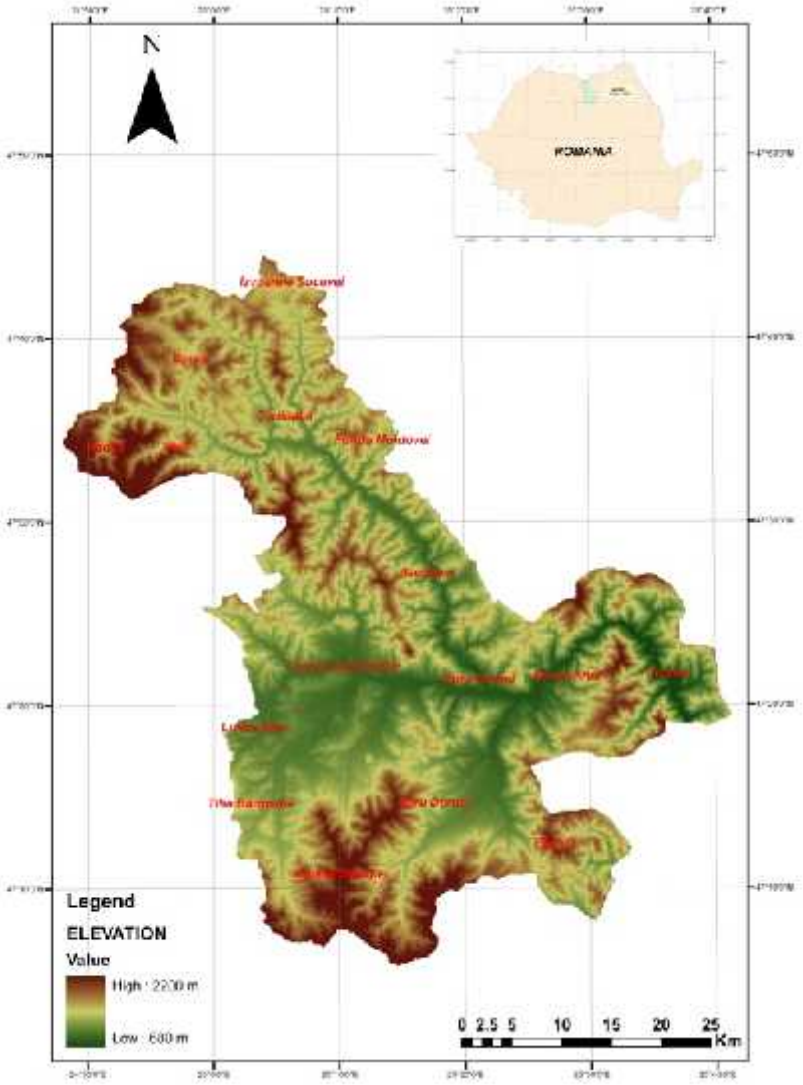

Fig.1 *The upper basin of Moldavian Bistrita*