The population's health state and its determinants. Case study -Bistrita's upper basin

Key words: health state, physico-geographical determinants, human geographical determinants, epidemiologic inquiry, physico-chemical analysis, life style, individual characteristics, socio-economic status, medical affections.

The studies regarding the population's health state and its determinants are numerous and complex, and one of the most representatives is the one realized by Orstein&Sobel (1999) in which the question was why Utah and Nevada states (although similar from the geographic, climatic, economic, educational and industrial point of view), are so different from the population's health state's point of view. Even if the number of doctors and beds in hospitals per inhabitant was similar, the mortality rate of adults was 40% higher in Nevada than in Utah.

Other similar studies realized by Rosenberg, Wilson & Gender (2000), Wilkinson (1999, 2006, 2010), McNeill, Kreuter & Subramanian (2006), Zimmerman & Bell (2006), Abbott & Freeth (2008), Feldman, Molarius and collab. (2007) Darmon & Drewnowski (2008), Vafaei and collab. (2010), Wolff and collab. (2010), Herman and collab. (2012, 2013), Reeves & Rafferty (2005), Balia &Jones (2007), Dumitrache (1998, 2002, 2008), etc., also showed that the economic and psycho-social factors can be relevant determinants of the population's health state.

FUNDAMENTAL THESIS: The individual's socio-economical status influences in a higher degree his/her health state, comparatively to the individual factors (for eg. life style, the quality of interpersonal relationships, etc.),which can rather influence the individual's perception regarding own health state.

Research Hypothesis 1. The declared health state (the presence or absence of disease) **is a predictor of the way in which the individual evaluates it ?**

Dependent variable: **Health state autoappreciation.**

Independent variable: **The individual's present health state.**

The null H0 hypothesis: there is no connection between the individual's health state and health state autoevaluation.

Research Hypothesis 2. The residential area (urban/rural) "imposes" certain behavioural patterns responsible for the presence/absence of medical affections.

The hypotheses will try to determin certain **connections between the residential area and the questionnaire's items that measure the attributes of personal life quality** (for our study –the declared health state and its evaluation by the respondents, different life style attributes).

Research hypothesis 3. Does the quality of physico-geographical environment influence the population's health state in Bistrita's upper basin?

The research methodology used in this study is one adapted after the models offered in the specialty **scientific** studies, more precisely:1) **epidemiologic inquiry,** for the evaluation of human-geographical determinants, 2) **physico-chemical parametres analysis** for the evaluation of environment's quality-as possible population's health state determinant.

For **epidemiological investigation**, it was taken into account:

-the statistic observation contained the realization of a questionnaire in order to get information about the population`s health state (real or declared) and its determinants and the analysis of the statistic data was accomplished through parametric and non parametric tests of the inferential descriptive statistics. The questionnaire used in this inquiry is adapted after the model offered by Liliana Dumitrache in her book Medical geography. Analysis methods and techniques" (2002), model to which we added new elements, determined by our present research hypotheses, theories and directions.

-thus, it contains five main parts, each of them devised in secondary parts meant to bring out accurate, relevant and pertinent information by answering the questions with pre-established and open answer.

-the questionnaire was pre-tested on a sample to 30 subjects, and it was obtained an Alpha Chronbach coefficient value of 0,604

-the sampling was accomplished through Cochran formula (for the volume of sample), and it were obtained an initian standard error of 4%. The initial sampling criteria also regarded the heterogeneity of socio-professional categories and also of age and gender categories, of residential environment. In this inquiry, the urban residential environment is represented by Vatra Dornei town and the rural one by ten rural areas placed (except one) from geographical point of view in the Moldavian Bistrita river basin, and from administrative point of view, in Suceava county.

-therefore, this was applied between October 2013-May 2015 on a sample of approximate 1500 persons, especially Vatra Dornei citizens and other ten rural areas but also non-residents from country and abroad.

Thus, the main method used in our study is the **epidemiological method**, method which consists in correlative study of phenomena related to factors known or suspected to be the main cause of risk for the occurrence of certain morbidity aspects, accidents.

For the analysis of environment's quality it was taken into consideration:

1) the longitudinal study of physico-chemical factors, such as pH, dissolved oxygen, ammonium, nitrites and nitrates and total iron, factors that can particularly influence Bistrita river's waters (the analysis of the data offered by the Basinal Water Administration Siret, Bacau and

2) a transversal study of the environment's quality from the study area based on two main components: **drainage (**surface and underground waters) and **air** (own data).

For the surface and drinking waters over 100 field measurements were realized, using a certificate multiparameter prospecting hole, produced by HANNA Instruments, provided with sensors for detecting DO% (saturated oxygen), DO mg/L (dissolved oxygen),ORP.

(oxide-reducing potential), pH, TDS (dissolved solids), conductivity, salinity and water temperature.

For the analysis of air and soil components the focus was on the presence of Gamma radiations from the mining areas, taking into consideration that in the study area there is a very important area for uranium exploitation (Crucea, Suceava county).

The device used for measuring is the Geiger-Gamma check radiation detector, which detects rapidly the radiation dose in u Sv/h. Thus, it can be determined the possible radioactive contamination of nutriments, equipment, building materials or environment.

in comparison to the natural radiations level.

As comparison standard, present legislation was used, more exactly Law number 458 from 8th July 2002 regarding drinking water quality and Order no.161 from 16th February, 2006 regarding the classification of surface water quality for establishing the ecological state of solids in water and Order no.1978/19.11.2010 regarding the approval of The Organization and Functioning Regulations of the National Network of the Environment's Radioactivity Supervising.

Chapter 1. Life quality as population's health state predictor, refers to the components of the physico-geographical frame (relief, climate, hydrography, geological structure, fauna and vegetation), susceptible of influencing life quality as possible determinant of population's health state from Bistrita's upper Basin.

Chapter 2. The geographical study of population's health state and its determinants presents the main physico-geographical and human-geographical components which correlate with population's health state in general and of the population in Bistrita's basin in particular.

Chapter 3. The epidemiological inquiry for the evaluation of human-geographical determinants of the population's health state. The results after the epidemiological inquiry in this study area are exposed and also the methods and statistical techniques used. The results of a comparative study between Bistrita's upper basin and two other geographical areas from Poland is also presented (gmina -Grodzisk

Mazowieski and Warsow).

Chapter 4. The valorization of physico-geographical and human-geographical resources as a premise of population's health state in Bistrita's upper basin. In this chapter we analyzed the role of economic sectors in general and of medical/balneal tourism in particular in the valorization of cure factors (hydromineral resources, the peat mud, moffettes, etc.) used in the treatment bases in the balneoclimateric resort Vatra Dornei.

Chapter 5. The quality of the physico-geographical environment as potential determinant of the population's health state in Bistrita's upper basin. This last chapter presents the results of the physico-chemical parametres analyzed for the components water, air and soil (such as: saturated oxygen, Ph, ammonium, nitrates, nitrites, the oxide-reducing potential, the dissolved solid material, salinity, conductivity and water temperature and also of the Gama radiations-given the fact that in the study area there is an important mining center of uranium exploitation).

The results obtained after the epidemiological inquiry show that:

Regarding the presence of the chronic disease,according to the data from the Public Health Direction Suceava, it results that between 2008/2012 there has been a high incidence of hyper blood pressure,chronic obstructive broncho/pneumonia, diabetes, goiter, cirrhosis and hepatitis and less articulatory rheumatism, vasculary affections, ulcer, anaemia,etc.

If until recently Vatra Dornei has been associated to rheumatismal affections, the fact was not because of the high incidence of disease in the area but rather because of the therapeutic practices used in the treatment bases in prophylactic and curative sense and of course because of the social and cultural stereotypes related to the resorts in general and the affections treated here, especially.

For the **Research Hypothesis 1 The declared health state** (the presence or absence of disease) **is a predictor of the way in which the individual evaluates his health state?**,

It was obtained a correlation value Kendall of 0,288 and a correlation value Spearman of 0,325, which suggests that **there is a statistical connection** between the qualitative variables “Health state autoappreciation ”and “The person’s health state” (The item “Do you suffer or have you suffered any disease in the last two years?”), **but not significant enough statistically speaking**.

For research **Hypothesis 2.The residential area (urban/rural) “imposes” certain behavioural patterns responsible for the presence/absence of medical affections**, different graphics were used, through the software application SPSS 14

The residential area, health state and the reason for going to the family doctor.

We get the following information: People from both urban and rural areas, who don't suffer any disease, go to the family doctor for a check first of all, and then for treatment or illness, prescription or more of them, comparatively to those suffering certain medical affections who go to the doctor rather for treatment than for a check or more of these services.

The residential area, health state and nutrition. The respondents without any affections declared at a higher degree than those in the second category, that they have a combined various nutrition (meat products, but also vegetables and fruits, milk products, etc.), the same situation for both residential areas (with accent on the rural area). It also seems that meat consumption is characteristic for healthy people and vegetables and fruits for those less healthy. This result seems to be in contradiction with the theories that recommend a rather vegetarian nutrition for a good health state. Of course, the explanation could be that doctors recommend to sick people a nutrition rich in vegetables and fruits.

The residential area, health state and smoking. Both respondents from the urban area and those from the rural (predominantly), who don't suffer any disease, declared, at a higher degree than the respondents in the opposite situation, that they don't smoke. Thus, smoking seems to be in our case a good health state predictor, especially in the situation of the persons suffering from certain affections and who declared they had smoked in the past, at a higher degree than those without health problems.

The residential area, health state and alcohol. Even in this case, healthy people declared at a higher degree than unhealthy people that they occasionally or never drink alcohol. With small differences between the two residential areas, the healthy people from the rural area declared they never drink alcohol and the healthy persons from the urban area declared they occasionally drink alcohol.

The residential area, health state and the problems that can affect emotional state. The respondents without medical affections, from both residential areas, declared in a very big proportion, that they haven't had lately problems to affect their emotional state, comparatively to those less healthy, whose answers to the question "I haven't had such problems" are significantly lower. The individuals with various affections complained most about health problems (especially those in the rural area) or "more of them. The healthy ones seem to complain more about familial problems, from both residential areas and not necessarily those with various affections, like we said, declared that the medical problems affected their emotional state a lot.

Research hypothesis 3. Does the quality of the physico-geographical environment influence the population's health state in Bistrita's upper basin ?

For Bistrita's superior hydrographic basin (represented by its superior course and its main

affluents-Dorna and Neagra), there were no deviations from the first class quality framing, for the main physico-chemical indicators evaluated: Ph, dissolved oxygen, CBO5, CCO-Mn, CCO-Cr, ammonium, nitrates, nitrites, total iron (evaluated in the longitudinal study), and DO% (saturated oxygen), DO mg/L, (dissolved oxygen), Ph, TDS (dissolved solid materials), conductivity, salinity and water temperature (evaluated in the transversal study). This fact can be explained by the less human interventions in this sector where,comparatively to the middle and inferior sector, there were no significant changes of the water course and no high pollution level either

For the transversal study:

-for Bistrita river it was noticed that:

-the values of the indicator *dissolved oxygen saturation* were between 79.3-101.5% places the water corps in first class quality. The indicator dissolved oxygen with values between 9.85-13.23 mg/L,places the water corps in first class quality.

-the Ph values were between 8.1-9.16 (for an environment considered unaffected, its values should be between 6.5-8.5). In the present study the value 9.16 was met in the populated area and the 8.1 value characteristic to the unaffected areas.

-the ORP values (the oxide-reducing potential) even if it doesn't standardize to characterize the water corps 'health, it still offers information related to the reactions that take place in the water. At the analyzed stations the oxidation reactions are generally characteristic, but in certain areas (S4,S5,S6,S7,S8), the reducing reactions of certain components from anthropogenic sources are specific.

-salinity varied between 0.08-0.12 units, noticing a sudden increase of salinity, once with Bistrita entering the populated areas. This increases downstream but it decreases at the confluence with other affluents which bring waters with a low amount of salts.

-the TDS- (dissolved solid materials) had values between 88.2-127.6 ppm, the lowest value being upstream. Once with the appearance of human settlements, the values suddenly grow but they don't overpass the maximum value specific to the mountainous spring waters, the value of 170 ppm.

-water conductivity varied between 177-255 u S/cm, with the lowest value upstream, the human activities contributing significantly to Bistrita's water charging.

-the water temperature rises once with altitude decreasing.

As a result of *radioactivity analysis*, the following aspects were noticed:

For the area between Ostra_Mining Exploitation and Brosteni_Bistrita, the flow values of gamma dose at ground was between 0.17-0.34 u Sv/h, with the lowest for Neagra_Brostenilor station 1, Holda_Sat 2 and Ostra_Mining Exploitation 2 and the highest for Neagra_Brostenilor station 2. At the

level of 1.5 m in the air, the gamma dose was about 0.13-0.34 u Sv/h, with the highest value for Neagra_Brostenilor station 1.

The areas overpassing the threshold of attention at the level of 1.5 m are Ostra_Mining Exploitation 1 and Neagra_Brostenilor station 1. For these areas the measurements must be repeated for a long term monitorization. At ground, 5 stations overpass the warning threshold. The rock itself can contaminate the environment, but vegetation has also the capacity of absorbing and eliminating gamma radiations in the environment. There is no danger for the population but monitorizations are necessary.

The second area of radioactivity study was between Lesul Ursului and Crucea. The gamma values at ground were between 0.06-0.47 u Sv/h, with the highest value in the present study at Spring_5 Crucea, in Crucea. In this area, at ground, almost all values overpass the warning threshold, continuous monitorizations for these stations being necessary, but the danger for the population regarding contamination is very low. The measurements realized at 1.5 m height from the ground showed a high level of maximum 0.37 u Sv/h in Lesul Ursului area, values overpassing the warning threshold, the source of these radiations being atmospheric, the particles concentrating from a source which is not from the area. The area must be monitorized on long terms, even if the population is not exposed to dangerous contaminations.

The third study area was between Cojoci and Poiana Stampei. Vatra Dornei town was also included in this area. At ground there were measured overpasses of the warning threshold at Cojoci and Vatra Dornei. Vegetation and geological substratum can be the explanation for the stations at Cojoci and for Vatra Dornei town-the cement in the buildings can represent a source of gamma radiations. In the other areas there were no overpasses registered. At the measurement of 1.5 height from the ground, the only overpass of this threshold was at Vatra Dornei park and at Cojoci station 2. The areas overpassing the first threshold require the repetition of measurements and long term monitorization.

The fourth study area was between Coverca village (Panaci) and Saru Dornei, comprising Ialovita, Paltinis and Dragoiasa. At ground there were registered overpasses of the warning threshold for Ialovita and Dragoiasa_3, but for the measurements of 1.5 m from the ground, there were no overpasses of gamma radiations registered in the air. The area doesn't require long term monitorization of gamma doses flows comparatively to the other studied areas.

The gamma radiations measurements for 2.5 minutes for the four study areas don't standardize. These show that there is no source of contamination representing a danger for the population, the values being very low. There are different values, according to station and at ground, respectively at 1.5m from the ground.

Conclusions

In Bistrita's upper basin there were registered, in general, values that can be placed in the first class quality for the main physico-chemical indicators: Ph, dissolved oxygen, ammonium, nitrates, nitrites, total iron, dissolved oxygen saturation, ORP (the oxide-reducing potential) the TDS (dissolved solid materials, water conductivity).

Therefor, the quality of environment (through indicators analyzed), can´t be a good predictor for the population´s health state from the upper basin of Bistrita river, given the high incidence of cardiovasculat diseases, cirrosis and hepatitis, diabetes – disesease related especially to the individual´s life style. This latter factor (life style) is mainly a consequence of the socio-economic status of the indivial, and to a lesser extend – to the physical environment.

The personal contributions in this approach especially refer to the research methodology (the realization and application of questionnaires on a sample of about 1500 respondents) as well as the adaptation and utilization of descriptive and inferential statistics methods in the geographical study of population's health state in the study area.

The analyses of the main physico-chemical parametres to determin the environment's quality, are also part of the personal contributions brought to the geographical study regarding the population's health state in Bistrita's upper basin.