

SOCIAL VULNERABILITY AND RISKS ASSOCIATED TO THE BALKAN ENDEMIC NEPHROPATHY IN MEHEDIŢI COUNTY

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Abstract

The Balkan Endemic Nephropathy (BEN), commonly known as “the dry kidney disease”, was observed for the first time in 1957 in Erghevița village from Mehedinți County. Although, the phenomenon was mainly studied by doctors for a period of approximately 50 years, the number of cases increased, but the actual cause of the disease was not discovered yet.

Among the mainly incriminated elements, there is to be mentioned the underground water that crosses through the coal deposit located in the Huşnicioara mines.

It is important to notice the fact that this disease affects only the rural space, most of the effective areas of the disease being concentrated around the urban centres like Drobeta Turnu-Severin, Baia de Aramă, Strehaia and Vânju Mare. The respective rural communities are considered to be truly vulnerable to the poor quality of underground waters. Given the fact that new cases of nephropathy are continuously discovered, one of the hypothesis is that the risk induced by the pollution of underground water layers is significant and that the human communities are highly vulnerable to this element.

The present study identifies the actual status regarding the symptoms and the extension of the disease, as well as the economical-social circumstances that favour the occurrence of the cases, representing a strong signal concerning the human communities vulnerable to the pollution of a natural resource that is indispensable to human life – water.

Keywords: *Balkan Endemic Nephropathy, social vulnerability, coal deposits, quality of underground water layers, rural communities, social isolation*

Rezumat

Vulnerabilitatea socială și riscurile asociate Nefropatiei Endemice Balcanică în județul Mehedinți. Nefropatia Endemică Balcanică (NEB) denumită popular și „boala rinichilor uscați” a fost semnalată pentru prima dată în 1957 în satul mehedintean Erghevița. Cu toate că fenomenul a fost studiat, în principal de medici, pe o perioadă de aproximativ 50 de ani, în acest interval numărul de cazuri de îmbolnăvire a crescut, iar cauza reală a apariției bolii nu a fost încă descoperită.

Principala sursă de îmbolnăvire este considerată a fi apa provenită din pânza freatică ce trece prin zăcămintul de cărbune al minelor de la Huşnicioara.

De remarcat este faptul că această boală nu afectează decât mediul rural, majoritatea focarelor fiind grupate în jurul centrelor urbane precum Drobeta Turnu-Severin, Baia de Aramă, Strehaia și Vânju Mare. Comunitățile rurale respective sunt considerate a fi cu adevărat vulnerabile la proasta calitate a apelor subterane. Având în vedere că noi cazuri de nefropatie sunt descoperite în continuare, se apreciază că riscul indus de poluarea apelor subterane este unul semnificativ, iar comunitățile umane prezintă vulnerabilitate ridicată la acest element.

În lucrarea de față se identifică stadiul actual al manifestării și răspândirii maladiei, precum și circumstanțele economico-sociale ce favorizează apariția cazurilor de îmbolnăvire, constituind un puternic semnal de alarmă referitor la comunitățile umane vulnerabile la poluarea unei resurse naturale indispensabile vieții – apa.

Cuvinte-cheie: *Nefropatie Endemică Balcanică, vulnerabilitate socială, depozite de cărbune, calitatea apelor subterane, comunități rurale, izolare socială*

INTRODUCTION

The Balkan Endemic Nephropathy was scientifically identified at the national level by Foarță and Negoescu in 1957. Subsequently, hoping to discover the triggering causes, the researches concerning this endemic disease have enclosed a wide range of studies.

The epidemiological studies are the oldest ones and include the following aspects in the area: generating factors and diagnosis (Gluhovschi Ghe. et al., 2002), the causes and the nature of the disease

(Lăzărescu R., 1966), the variation of the serial complement, as identification factor for BEN (Mustață N. et al., 1968), the etiological problems of BEN (Tatu C.A. et al., 1998), the epidemiology of BEN (Ceovic S. et al., 1992), the influence of the Ochratoxin A in corn and wheat on the occurrence of BEN (Puntaric D. et al., 2001) and the etiology of urothelial tumors (Ivic M., 1970).

The pathological studies are conducted at the national and international level and regard the following aspects: causes and symptoms of the diseases, the viral particularities of the disease

(Georgescu L. et al., 1970), the symptoms and the evolution of the disease (Gluhovschi Ghe., 1973), renal dysfunctions in families with cases of BEN (Arsenovic A. et al., 2005), the urothelial carcinoma associated with the etiology of BEN (Stefanovic V. et al., 2006) and the nephropatic study of the disease (Marc E De Broe, 2003).

The cytogenetic studies concerning BEN preoccupied more the medical specialists and included: the family as a factor in BEN (Zaharia C., 1968), chromosomes transformations in chronic cases of BEN (Tonea T.R. et al., 1967), chromosomes transformations at patients with BEN (Bruckner I. et al., 1971), biochemical transformations in cases of BEN (Gluhovschi Ghe., Sabo I., 1981), the mother-fetus risks for female patients with BEN (Gluhovschi Ghe. et al., 1966), the cytogenetic aspect of the disease (Toncheva D. et al., 1988) and the clinical aspects of the adults within families with cases of BEN (Dimitrov P. et al., 2006).

The geological and hydrogeological researches are recent as a preoccupation in cases of BEN and enclose various aspects, such as: the influence of the altered coal deposits upon the occurrence of BEN (Feder G. L. et al., 2002), the relation between the coal deposits and the etiology of BEN (Feder G. L., 1991), the vegetal associations which generated the Neogene coal (Țicleanu N., 1984), correlations between the environment, geochemistry and etiology of BEN (Orem W.H. et al., 2002), the role of the fluorescent organic

compounds in shallow ground water in BEN (Goldberg M.C. et al., 1994); the lecithin cholesterol acyltransferase enzyme and organic substances from coal in the areas with BEN (Orem W.H. et al., 2004), the contamination of the potable water that washes the Pliocene coal deposits (Voice T. C. et al., 2006) and the nephropathy, the role of the organic compounds derived from the Pliocene lignite and the etiology of BEN (Tatu C.A. et al., 2000).

Regarding the etiological factors, BEN is a chronic affection that develops in a latent stage, is hereditary and occurs predominantly in the rural space. Gh. Gluhovschi paid a special attention to the genetic factors reporting, from the total number of patients under observations, a share of 25.7 percent of the cases when two or more members of the family developed the disease (Gluhovschi Ghe., 1973).

The geological studies regard the correlation between the presence of the Pliocene lignite layers and the geographical occurrence of the disease.

At the level of Mehedinți County, most of the settlements that registered cases of BEN are located along the piedmont valleys and in the plains with altitudes lower than 250 meters (the area extended among Drobeta Turnu-Severin, Corcova, Strehaia, Bălăcița and Batoți settlements) (Fig. 1). Their geology is characterized by the presence of the old tertiary layers (clay, sand and Pliocene lignite) covered by Quaternary sediments (gravels, sands, clays and loess deposits).

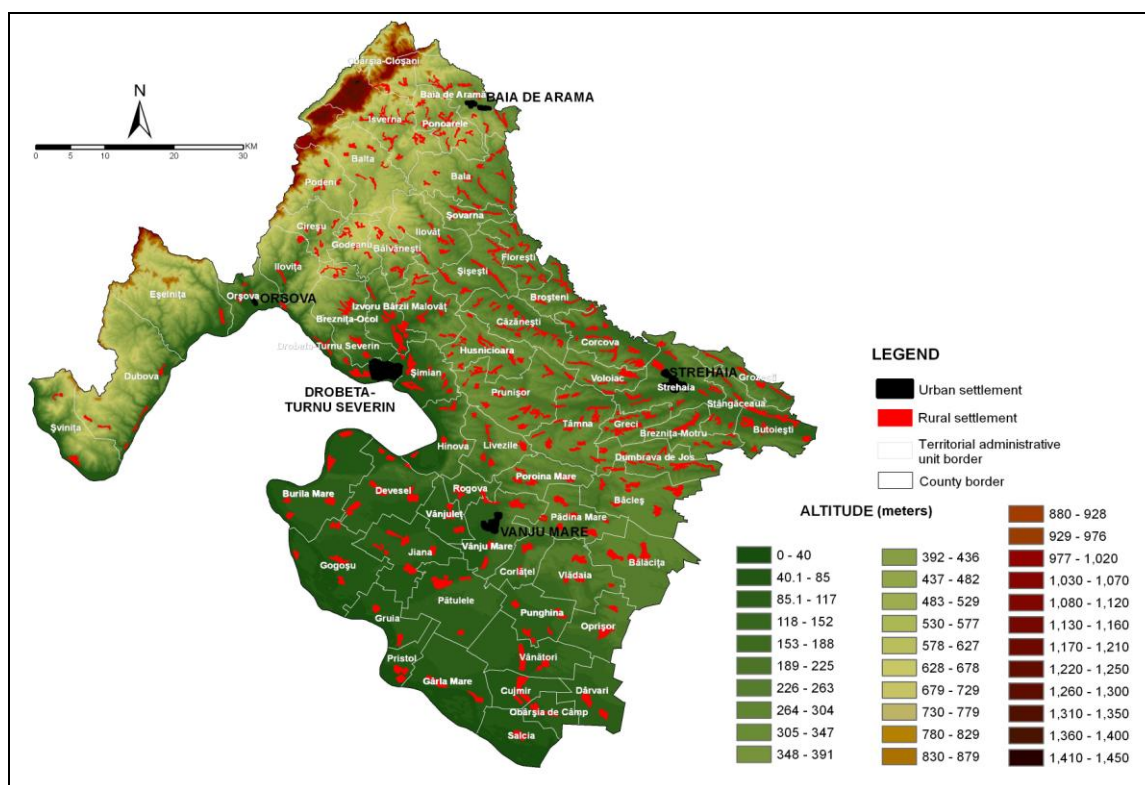


Fig. 1 The hypsometry of Mehedinți County

The occurrence of the paleo-species of *Nyssa-Taxodium*, *Myricaceae-Cyrillaceae* and *Sequoia* among which the most disseminated during the Tertiary was *Glyptostrobus europaeus*, could have contributed to the enrichment of the organic

compound specific to the Pliocene lignite within the endemic villages (Țicleanu N., 1984).

The geology of the endemic regions helps to explain the high concentrations of aromatic compounds found in the lignite deposits located close to the surface (Fig. 2).

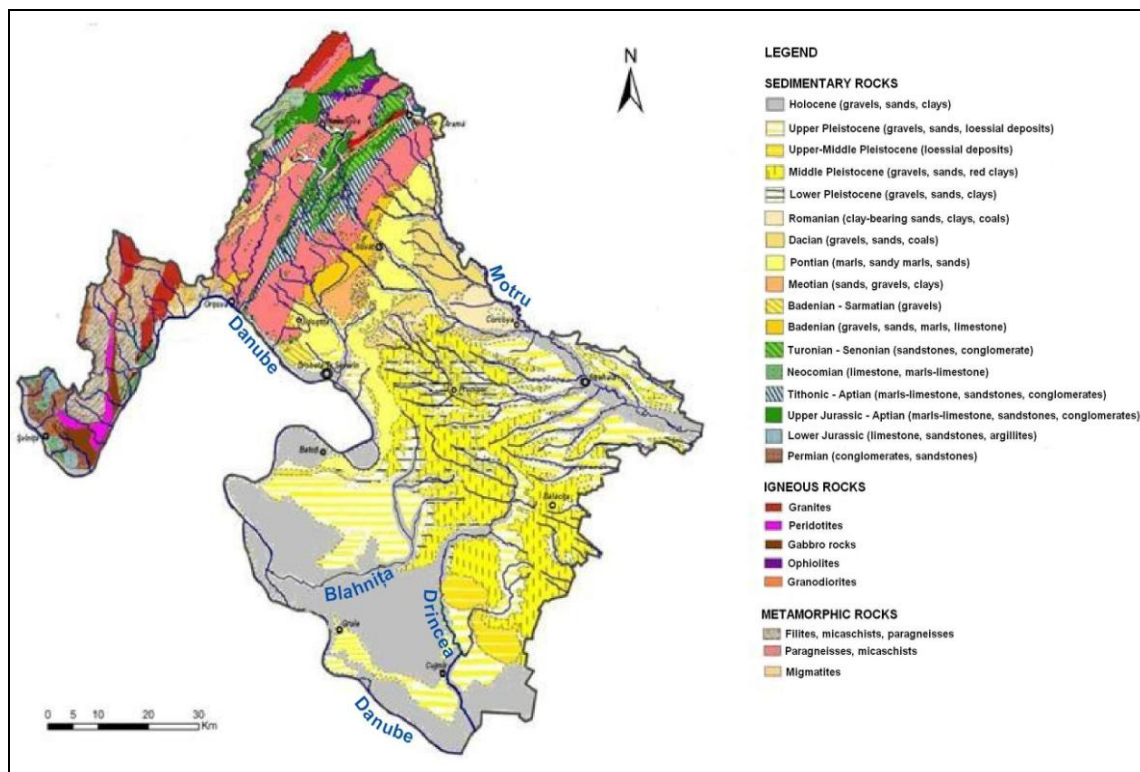


Fig. 2 The geology of Mehedinți County

The Pliocene lignite deposits within the perimeter enclosed by the Motru, the Coșuștea, the Hușnița and the Drincea rivers have been economically exploited in the mines from Pietriș, Hușnicioara Livezile, which are located immediately near the endemic settlements (Pietriș, Erghevița, Bistrița, Livezile, Hinova, Tâмна, Prunișor and Hușnicioara).

Comparative studies regarding the geology and the hydrology of the endemic and non-endemic villages in Mehedinți County had been performed by Feder G. L. and Orem W. H. in 2002. Thus, in 2002, Feder G. L. et al. tried to explain the endemic character of the Balkan nephropathy (the geographical restriction) in the studies concerning the “geochemical composition of the Pliocene lignite (pelicular organic composition) associated with the distribution areas of BEN and the hydrogeological environment from the affected spaces (rich in phenols and other aromatic structures which are initially derived from the lignite)”. In one research conducted in 1991, the same authors support the hypothesis that “by washing the Pliocene lignite

deposits and those of clayey lignite there result soluble organic compounds that are transported by the system of deep underground water layers supplying the underground water table from the wells people are using”.

The existence of endemic and non-endemic villages located at only a few kilometres distance one from another may be the result of the variations in the concentration of toxic organic compounds within the wells (the underground water layer is maximum 15 meters deep). Thus, “the relative small concentrations of toxic organic compounds discovered in the potable water from the endemic villages can explain the occurrence of BEN pursuant a long period of exposure” (10 - 30 years or even longer) (Feder G. L. et al., 2002).

DATA AND METHODS

The natural environment of Mehedinți County was analysed starting from the by hypsometric map (based on the digital terrain model SRTM at 30 meters), the geological map (the geological sheets scale 1:200,000 were georeferenced and processed)

the hydrographical and demographic elements, which were put in connection with the areas of disease occurrence.

The demographic analysis at the level of the communes where cases of BEN were registered relies on processing, integration and interpretation methods applied to the statistical data from 2002 and 2009. This information regards the number of patients and doctors; the population on gender and age structure of the population groups; BEN outpatients under dialysis, gender and age structure of the population etc.

In estimating the population vulnerability in relation with BEN (Fig. 3), the first element is the physical exposure (facilities – medical cabinets, water supply, free transportation for dialysis) and the social one (the structure of the population on age groups and the social conditions), a fact which is going to be proved in the section of results. The third category, the economic exposure, is less evident for the analysed communes (economic activities – industrial platforms and dangerous industrial activities).

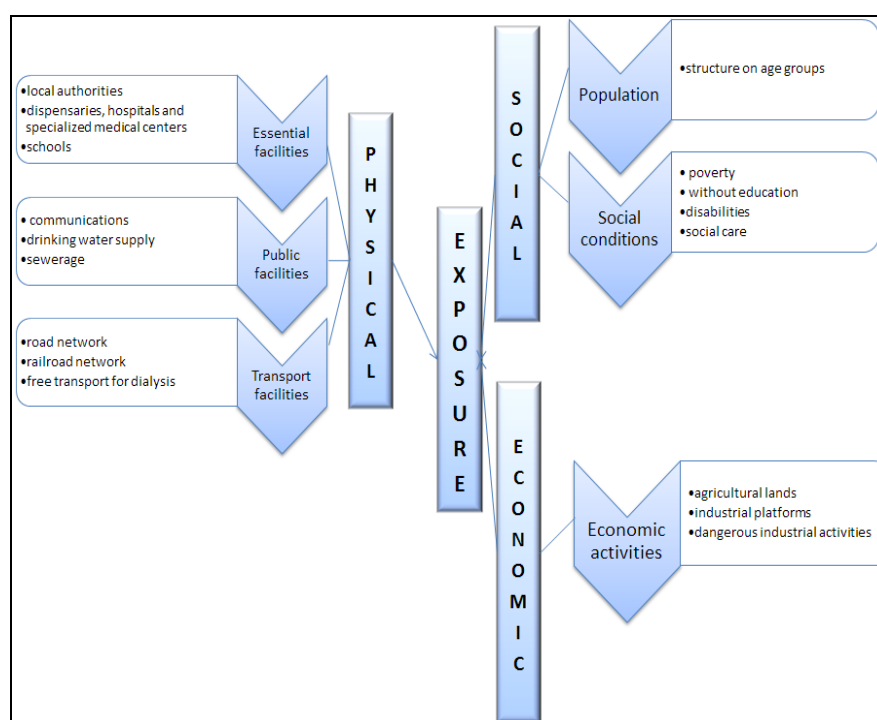


Fig. 3 Important elements in assessing the vulnerability in relation with BEN related vulnerability

In addition, a social survey was conducted during the field investigation in Rogova village (Rogova commune), Bistrița village (Hinova commune) and Prunișor village (Prunișor commune) for a better emphasis of the demographic and social problems regarding the disease.

The analysis of the questionnaire applied and the 29 items that were used offered significant information concerning the subjects' opinions and the behaviours regarding BEN, but they pointed out especially the social needs to which the local authorities have to answer in order to reduce the population vulnerability to this disease.

RESULTS AND DISCUSSIONS

In order to clearly understand the demographic and social context in which the officially registered BEN cases appeared and evolved, the number of these instances is analyzed in relation with the population

(total population, on age groups and sexes) and the number of doctors to which the total number of population is reported in each of the 22 territorial-administrative units taken into consideration.

The analysis considered the dynamics of these elements during the period 2002 – 2009.

The comparative analysis of the patients number and the communes affected by the Balkan Endemic Nephropathy in Mehedinți County (Fig. 4 and Fig. 5) evidences a first significant aspect: while the reduction in the number of population and doctors is observed in the quasi-totality of the cases (one of the most notable exceptions being represented by Drobeta Turnu-Severin city, where the tendencies concerning the two elements are contradictory, the population increasing in number), the number of BEN patients under dialysis is rising continuously, reaching from 32 patients in 2002 to 4 patients in 2009. The greatest number of communes under

analysis have a population between 2,000 and 4,500 inhabitants (10 TAUs in 2002 and 2009), to the opposite pole being the urban centres or the communes in their immediate area (Drobeta Turnu-Severin – 107,248 inhabitants in 2009, Strehaia – 11,726 inhabitants, Șimian – 9,998 inhabitants), with the highest values, and the communes from the

central-southern part of the county, with the lowest values (Poroina Mare – 1,246 inhabitants in 2009, Rogova – 1,440 inhabitants, Corlățel – 1,446 inhabitants etc.).

Generally, the number of the medical personnel follows the demographic share, but there are some notable exceptions.

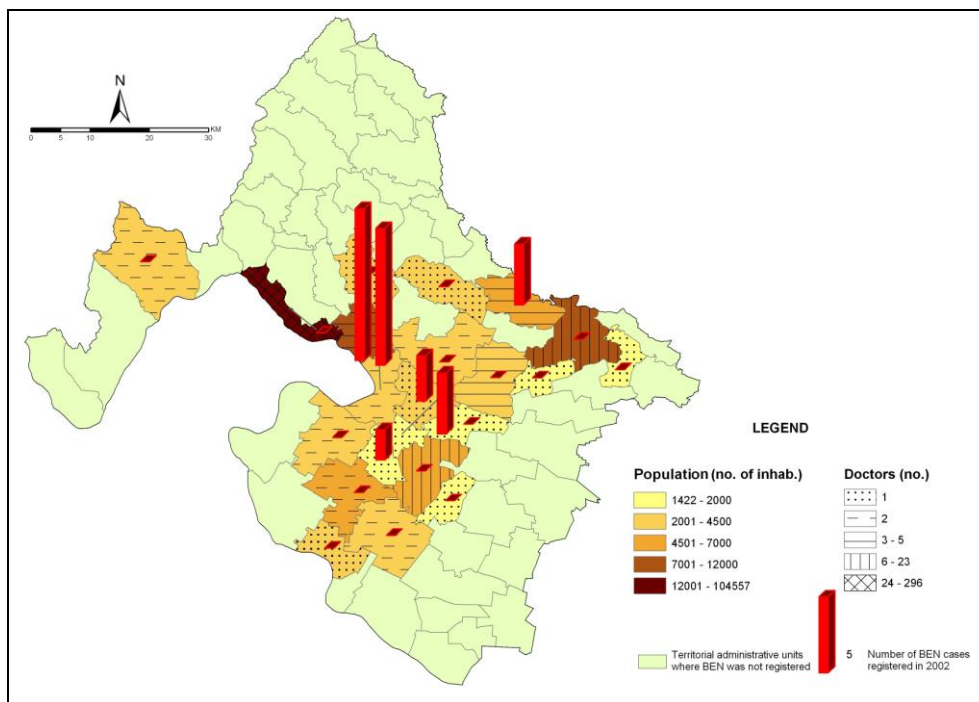


Fig. 4 The number of patients and doctors in the communes affected by the Balkan Endemic Nephropathy in Mehedinți County (2002)

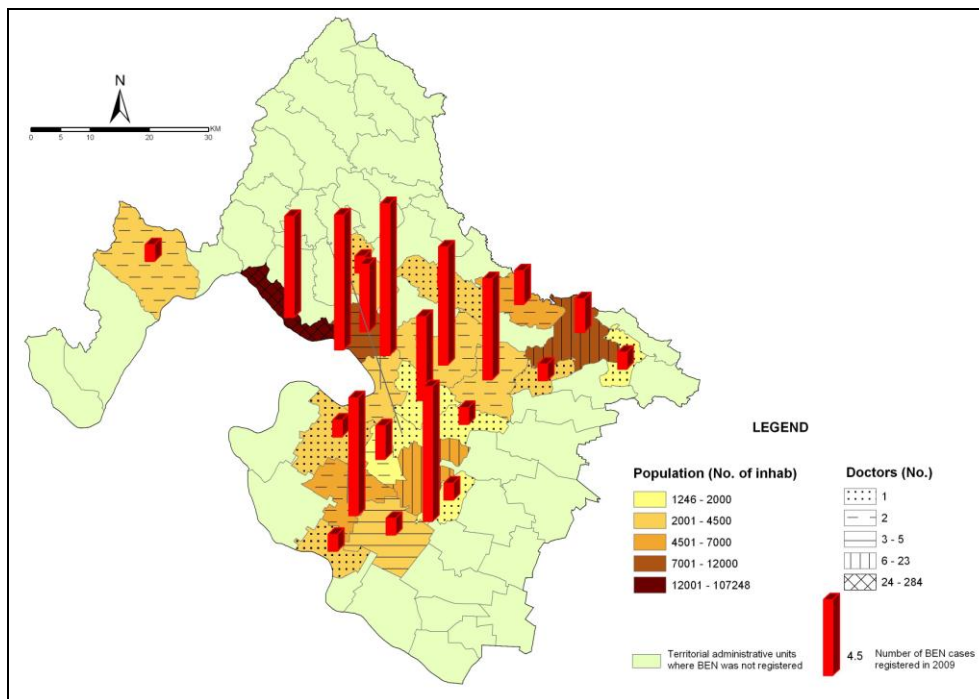


Fig. 5 The number of patients and doctors in the communes affected by the Balkan Endemic Nephropathy in Mehedinți County (2009)

Thus, the Șimian commune, with a numerous population, benefits from the services of only 4 doctors. In the same time, territorial-administrative units with a similar demographic potential are strongly differentiated concerning the aspect of the medical personnel (for example, Vânju Mare – 6,406 inhabitants and 14 doctors in 2009 and Corcova commune – 6,084 inhabitants and 2 doctors, in the same year). It is notable the fact that the medical personnel is under-numbered in relation to the number of inhabitants, 10 of the 22 analysed communes benefiting from the services of only one doctor. On the other hand, the number of cases of BEN does not overlay, as localization, with the most populated communes. For example, certain nuclei where this disease was discovered are territorial-administrative units with a moderate number of inhabitants (Hinova – 9 persons under dialysis in 2009, reported to a total

population of 2,824, Rogova – 8/1440, Jiana – 7/7486, Prunișor – 6/2213, etc.).

The comparative analysis at the level of the two years, 2002 and 2009, outlines the fact that beside the nuclei of occurrence existing in 2002 and maintained in 2009 (Hinova, Rogova, Livezile, Șimian, Corcova, Vânjuleț), during this last year also other centres of BEN occurrence appeared (Vânju Mare, Jiana, Prunișor, Tâmnă, Drobeta Turnu-Severin etc.).

The analysis of *the gender structure of the population* residing in the communes where BEN cases were registered in 2009 reveals the fact that the share of men and women is balanced, their number being almost equal in 85.72 percent of the 21 territorial administrative units. The exceptions are represented by Tâmnă commune (with a high share of Roma), where the male gender accounts for 51 percent, while in the communes of Poroina Mare and Rogova the women are more numerous (Fig. 6).

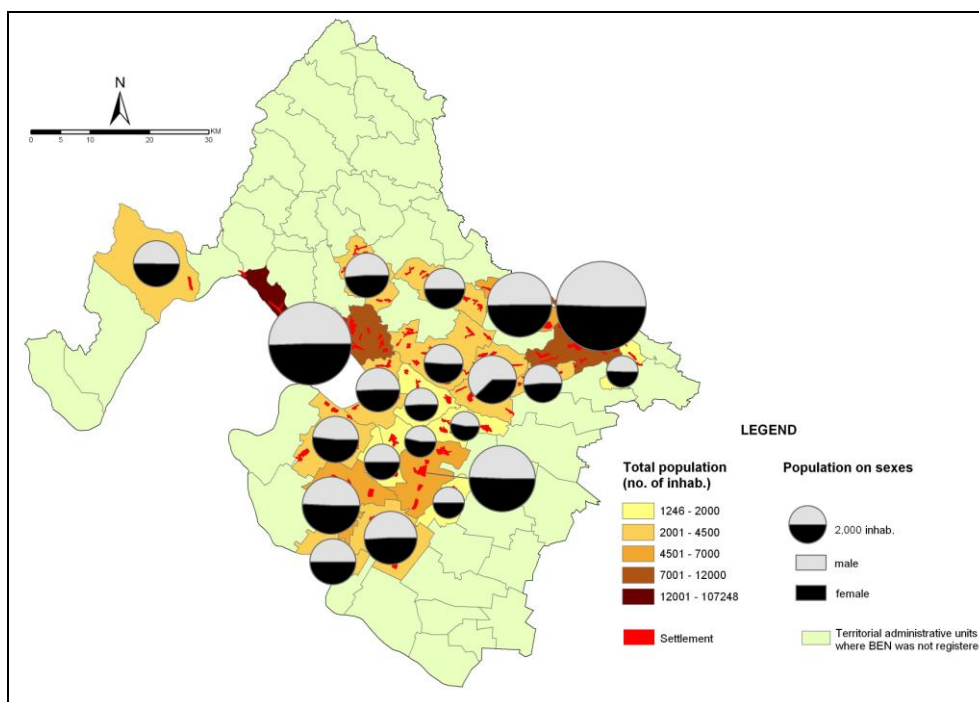


Fig. 6 Gender structure of the population residing in the communes affected by BEN within Mehedinți County (2009)

In 2009, the gender repartition of the population affected by BEN showed that the disease is mostly encountered among women (55.40 percent of the total registered cases). Thus, in Rogova (87.50 percent), Jiana (57.14 percent), Tâmnă (71.42 percent), Prunișor (66.60 percent) and Livezile communes, the women over 50 years of age are affected by the disease in the above-mentioned proportions. Nevertheless, there are some territorial administrative units where the part of the persons under dialysis because of BEN is higher among the male population: Drobeta Turnu-Severin,

Vânju Mare and Hinova (Fig. 7). The part of one gender or of the other can be of 100 percent within the communes that account for a low number of BEN occurrences (under three). Such examples are offered by Eșelnița, Strehaia, Devesel, Gruia and Pătulele, where only male persons are registered with BEN and are currently under palliative treatment, while in the communes of Malovăț, Căzănești, Corcova, Stângăceaua, Greci, Poroina Mare and Corlățel, 100 percent of the persons diagnosed with BEN are women. All cases of “dry kidneys” registered at the

level of these communes, except for Corcova, were discovered after 2000. In that specific year, only four persons living in Corcova were under dialysis as a consequence of BEN, while in 2009 all mentioned communes accounted for at least one person diagnosed with this disease and following the treatment. Although from the statistical point of view, most of the BEN occurrences are officially registered among women, this aspect can be explained by the fact they are much more sensitive to the medical advices concerning the performance of detailed investigations that could establish the

correct diagnostic and they are more willing to follow a treatment. Further analysis was conducted taking into account *the age structure of the BEN outpatients under dialysis* and it revealed that the greatest frequency of these cases is registered among the aged population between 60 and 80 years or beyond this age. Nevertheless, in 2010, in four of the communes affected by the occurrence of this disease (Gruia, Pătulele, Corlățel and Eșelnița – one case in each commune), the age of the outpatients is comprised between 30 and 40 years (Fig. 8).

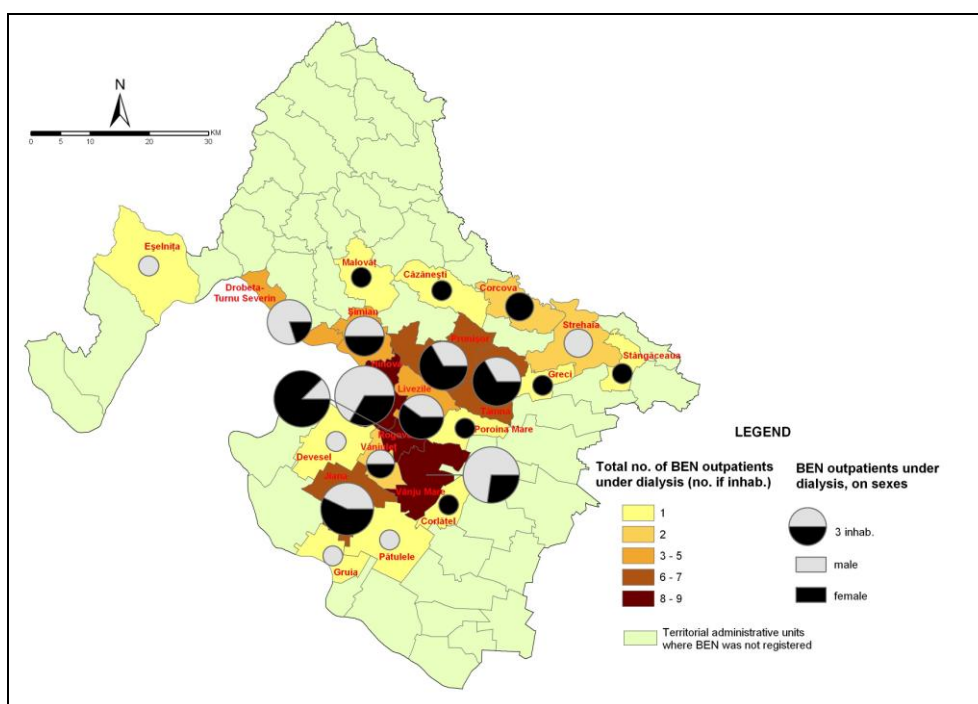


Fig. 7 Gender structure of the BEN outpatients under dialysis living in the affected communes, Mehedinți County (2009)

The administrative units with the most numerous BEN official occurrence cases are: Hinova, with 9 instances of which 6 are registered in the village of Bistrița and 3 in that of Hinova; Rogova, with 8 instances of which 7 in the homonym village and one in Poroinița, and Vânu Mare town, with 8 instances of which 3 in the urban core and the rest in the villages of Orevița Mare (4 cases) and Traian (1 case). The age of the persons affected by this disease and undergoing dialysis three times per week is comprised between 50 and 60 years in Hinova and Vânu Mare, the lower age limit descending to 40 years at the level of Rogova commune (Fig. 9). Regarding the situation of the occurrences in Vânu Mare and Rogova, it changed significantly since 2000, when no BEN case was registered in Vânu Mare, until 2009, when 8 cases were identified, while Rogova faced a duplication of the BEN occurrences

during the above mentioned interval (4 outpatients in 2000 and 8 in 2009). The same dramatic change concerning the BEN registered cases is obvious at the level of Jiana, Prunișor, Tâmba rural administrative units and in Drobeta Turnu-Severin urban centre, where no person was officially diagnosed with BEN in 2000, while in 2009 the number of registered occurrences ranged between 5 and 7. This statistical change can be explained through the campaigns conducted by a medical and researching team that offered free analyses and consultations in all settlements located within the area of manifestation of the disease. Moreover, during the same campaign conducted in 2008 and 2009, there were taken samples of water that were subsequently analysed with the hope of tracing the causes of the illness. According to the 2009 statistical data, the three administrative units mentioned above

The above-mentioned conclusion also raises from the correlation of the statistical data analyses with *the perception of the population on the Balkan Endemic Nephropathy*, which has been determined by means of a social survey.

The present research is based on the premise that within a region characterised by a significant number of BEN occurrences and in which the detailed information concerning the effects of fountain water consumption are not enough, the vulnerability of the population represents a very significant component of the general medical risk and especially of the risk related to the kidney diseases; thus, the detailed informing and the measures taken to reduce these particular risks are of great importance.

The study concerning the perception of the Balkan Endemic Nephropathy in the communes within Mehedinți County was based on a questionnaire with 29 items; these elements tried to reveal the rural, social-economic and demographic context of the subjects, the level and the quality of BEN-related information, the opinions on the relation between the non-drinkable water consumption and the alteration of the personal life, the assessment of the willingness to seek special medical help and of the support possibilities for tracing down the disease etc.

This kind of research has a relative character, which is due, on the one hand, to the number of items used in the survey and, on the other hand, to the frequently unsubstantial relation between the subjects' opinions and their effective behaviour. Nevertheless, the analysis of the *face to face* survey in the villages within Mehedinți County can offer initial information that is useful for the improvement of the measures taken by the authorities to support the decrease of the population's vulnerability to BEN, subsequently leading to an earlier tracing of the disease and to the possibility of medical support for more persons.

The social survey was conducted during the August – October, 2009 period, the population sample being represented by 315 persons residing in three of the villages that account for the highest number of BEN outpatients under dialysis: Rogova (Rogova commune) – 120 persons, Bistrița (Hinova commune) – 120 persons and Prunișor (Prunișor commune) – 75 persons. The study attempted to ensure a balanced population sample from the viewpoint of their gender (44.4 percent male and 55.6 percent female) and of their age (28.5 percent – under 30 years of age, 41.3 – between 30 and 55 years and 30.2 percent - over 55 years). Regarding the educative level, the balance is clearly inclined towards the persons who only followed the

elementary school, which are followed by those who finished ten classes, the last place being occupied by the higher education graduates (teachers, doctors, retired persons) that only account for 2.9 percent.

The results of the survey revealed the fact that the population does not have clear information concerning BEN or the quality of water sources (53 percent of the interviewed persons do not know if there have been realised analyses of the water within the communal wells or what were the results of such analyses), the risk of the disease being, nevertheless, felt in the framework of the local tradition that the water is not good and the residents are destined to die from “uraemia”. Despite this, even after the appearance of the drinking-water network, a considerable share of the questioned persons admitted that they continue to consume water from the wells (36.5 percent). The medical problems are sometimes worsened by the social isolation of the families in which BEN cases are registered. This type of segregation is sometimes translated into the interruption of the relations with the descendents of families that registered “uraemia” cases. 84.1 percent of the interviewed persons responded that they do not have relatives with BEN or with other kidney conditions. However, a significant part of them admitted that they know certain persons (sometimes members of the same family) who suffer of this disease. Most of the subjects of this social survey (79 percent) declared that they would not change the place of residence even in the framework of the possible danger represented by the water in wells. One explanation of this situation lies in the strong bonds with their environment and with a certain life style, in the lack of money for another residential area, other reasons being the age of the respondents or the hope in certain alternatives that would reduce the risk of becoming ill.

CONCLUSION

The evolution of the Balkan Endemic Nephropathy is slow and the illness arrives at its clinical manifestation through decompensate chronic kidney insufficiency. At the level of the 2000 - 2002 period, the age of the ill persons was comprised between 30 and 50 years. In accordance with the latest data from 2009, the outpatients have between 30 and 80 years and even beyond this age (the most numerous are comprised between 60 and 80 years, 55 persons respectively). The statistical division on genders reveals that the women are the most affected (44 women and 32 men were registered and undertook dialysis at the end of 2009), while the repartition on living environments shows that the most affected areas are the rural ones

and outpatients living in urban centres also originate in the affected rural communities.

Although the transportation and the palliative treatment at the dialysis centres in Drobeta Turnu-Severin are free of charges, because of the advanced age and of the lack of education, numerous persons affected by this illness refuse to see a doctor or to follow the treatment that could extend their lives. As the statistical data shows, in 2010, 86.49 percent of the registered outpatients reside in rural areas and only 13.51 percent live in the urban environment. Moreover, it is worth mentioning the fact that, regardless the age of the ill persons, they come to see a doctor and start the dialysis only in the final stage of the disease. The present study confirms the idea that BEN is a *family disease* (there were reported numerous instances in which members of the same family were ill), but one of the enigmas that continues to the present refers to the fact that there are affected rural settlements in the neighbourhood of others that are not touched by “uraemia”. One of the identified weaknesses consists in the fact that the population is not well informed with regard to the disease and to the importance of the quality of potable water. At the same time, certain prejudices and old mentalities, as well as a feeling of shame lead to the social isolation of the families with BEN occurrences and to the retardation or refusal of the analyses and treatment.

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