

MONITORING THE HEALTH STATUS OF THE POPULATION LIVING IN THE VICINITY OF NUCLEAR POWER PLANTS

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Abstract: In 1999, the Radiation Hygiene network established a methodology to monitor the health status of the population groups living in the vicinity of nuclear facilities. The present report is part of a larger survey on four population groups residing in the neighbourhood of important nuclear facilities. The results presented in this paper were drawn for the year 2010, for the Cernavoda area, and from all the data analyzed during the interval 1999-2010. The study population included all the inhabitants residing in the communities within 30 km around the NPP Cernavoda. The total number of persons was 85.867. For the year 2009, we estimated the overall mortality rate, specific mortality rate from solid cancer, specific mortality rate from blood malignancies, the incidence rate of solid cancer, and the incidence rate of blood malignancies. In 2010, the overall mortality rate was of 8.39‰ (for the year 2009, the overall mortality rate for Romania was of 11.98‰). The mortality rate from solid cancer was of 133.7 ‰/0000 (the ratio O/E 49.6). The mortality rate from blood malignancies (leukemia and lymphomas) was of 12.02 ‰/0000. The incidence rate of solid cancer was of 140.58 ‰/0000 (O/E 44.35). The incidence of blood malignancies was of 7.64 ‰/0000. Between 1999 and 2010, among the population living in the Cernavoda area, the overall mortality rates, and the specific mortality rates from solid cancer had values that were constantly lower than the corresponding rates for the entire country. The mortality rates from blood malignancies have increased during the years 2009 and 2010; compared to the corresponding rates for the other population groups included in the survey, the values for the Cernavoda area were the highest. During the entire time interval, the incidence of solid cancer was lower than the incidence for the entire country. The incidence of blood malignancies was the highest in 2009.

Cuvinte cheie: rețeaua de Igiena radiațiilor, supraveghere stare de sănătate, obiective nucleare

Rezumat: În anul 1999, în activitatea rețelei de igiena radiațiilor a fost adoptată o metodologie de supraveghere a stării de sănătate a populațiilor care locuiesc în vecinătatea unor obiective nucleare. Prezenta lucrare face parte dintr-o sinteză mai amplă, de supraveghere a patru grupuri populaționale rezidente în localități situate în vecinătatea unor obiective nucleare majore. Rezultatele prezentate în această lucrare au fost obținute din datele pentru zona Cernavoda din anul 2010 și din datele care au fost analizate pentru intervalul 1999-2010. Populația supravegheată cuprinde toți locuitorii cu domiciliul stabil în localitățile situate pe o rază de 30 km în jurul CNE Cernavoda. Numărul total de persoane este de 85.867. S-au calculat, pentru anul 2010: mortalitatea generală și specifică (prin tumori maligne solide și leucemii/limfoame); incidența tumorilor și a leucemiilor/limfoamelor. Mortalitatea generală a fost 8.39‰ (mortalitatea generală la nivelul întregii țări în anul 2009 a fost de 11,98‰). Mortalitatea prin tumori solide a fost de 133,7 ‰/0000 (raport O/E de 49,6). Rata mortalității prin leucemii/limfoame a fost de 12,02 ‰/0000. Incidența tumorilor solide a fost de 140,58 ‰/0000 (raport O/E de 44,35). Incidența leucemiei a fost 7,64 ‰/0000. La populația din zona Cernavoda, mortalitatea generală și mortalitatea specifică prin tumori solide au avut valori constant mai mici decât valorile pentru întreaga țară pe tot parcursul intervalului 1999-2010. Se înregistrează o creștere importantă a mortalității prin leucemii/limfoame în anii 2009 și 2010, acestea fiind cele mai mari valori comparativ cu celelalte obiective supravegheate. Pe tot parcursul intervalului de supraveghere, incidența tumorilor solide s-a situat la valori mai mici de jumătate din valorile pe țară. Incidența leucemiei/limfoamelor a înregistrat valoarea maximă în anul 2009.

INTRODUCTION

Every nuclear facility is a potential hazard for human health in case of malfunction or incident.

In Romania, nuclear facilities have been located in the midst of human communities during a regime that did not even consider the need for population approval. Among the populations living in the vicinity of nuclear facilities, there have

always been worries, or anecdotal reports, regarding certain medical conditions – especially cancer – attributed to ionizing radiation.

In Romania, the frequency of cancer cases is increasing, as it is all around the world. Of course, exposure to ionizing radiations is not the main risk factor, but it is probably the most dreaded, because it is not habitual (like food or tobacco

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smoking), and because it cannot be detected by human senses. Fear is permanent, even when the nuclear facility is working normally.

In order to evaluate a potential impact on human health, the existence of a benchmark is very important – a population health status prior to a potential incident.

The Radiation Hygiene Network has established a methodology to monitor the health status of the populations living in the vicinity of nuclear facilities. According to this methodology, demographic and medical data regarding these populations are analyzed each year at the Radiation Hygiene Laboratory of the RCPHB. The data are collected by the Radiation Hygiene Laboratories in the regions concerned.

OBJECTIVES

The assessment of the health status of the populations residing in the vicinity of nuclear facilities aims at drawing an instant description of the morbidity and mortality patterns, and at monitoring the development of these indicators over time. A baseline evaluation is important in the cases where the health status of a certain population may change after long periods of time (10 – 20 years).

MATERIALS AND METHODS

This paper is part of a larger survey, including four population groups residing in the vicinity of important nuclear facilities: the Bechet area, located within the area of influence of NPP Kozlodui; the Cernavodă area – within 30 km around NPP Cernavoda; the Feldioara area – in the vicinity of the R Facility; and the Mioveni area – in the vicinity of the NFP Pitesti.

The population included in the study consists of all the inhabitants permanently residing in the Cernavoda area. In 2010, the total number of persons was 85.867, residents of the towns Cernavoda and Medgidia, and a number of rural communities within a distance of 30 km.

The following variables were analyzed: age and gender distribution of the population group; general mortality and specific mortalities from solid tumours and leukaemia/lymphoma; the incidence of solid tumours and the incidence of leukaemia/lymphoma.

The data are collected at the territorial Radiation Hygiene Laboratories from the general practitioners, the local oncology offices, the regional cancer registry (where such a registry is active), and from the county statistics offices.

Data analysis is based on the computation of crude and standardized rates, using the 2009 Statistic Yearbook for the reference data.

RESULTS

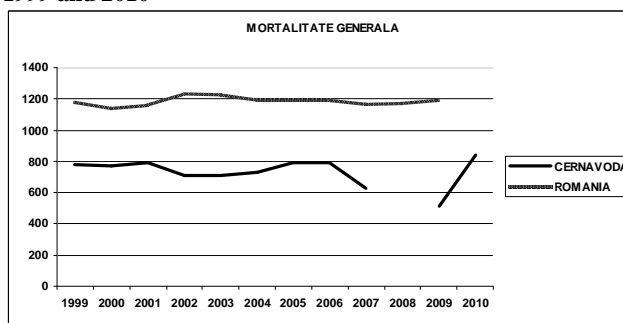
The age distribution of the studied population shows proportions of children (0-14 years old) and young adults (<40 years old) larger than those found in the general Romanian population.

Overall mortality

During the year 2010, a number of 543 deaths from all causes were reported for the Cernavoda area, resulting in an overall mortality rate of 8.39‰ (in 2009, the overall mortality rate in Romania was of 11.98‰). When we applied the age-specific mortality rates of the general population to the age groups in the studied area, the expected number of deaths for the Cernavoda area was 815.14. Thus, the observed/expected ratio was of 66.61, far below the rates for the entire Romanian population.

As illustrated in Figure no. 1, the overall mortality rates for the Cernavoda area have been lower than the country rates throughout the monitoring interval 1999 – 2010.

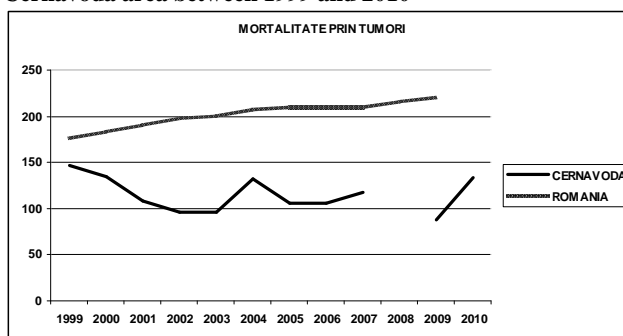
Figure no. 1. Overall mortality in Cernavoda area between 1999 and 2010



Mortality from solid cancer

In 2010, a number of 94 deaths from solid cancers were reported for the Cernavoda area, resulting in a rate of 133.7⁰/₀₀₀₀ (in 2009, the mortality rate from solid cancers in Romania was of 220.7⁰/₀₀₀₀). The number of expected deaths was 189.5, and the ratio O/E was 49.6, i.e. less than half of the specific mortality for the entire country. Figure 2 shows the values of the specific mortality rates from solid cancers throughout the interval 1999 – 2010. Although the mortality rates for the entire country tend to increase, the rates for the Cernavoda area do not show the same trend.

Figure no. 2. Specific mortality from tumours in the Cernavoda area between 1999 and 2010

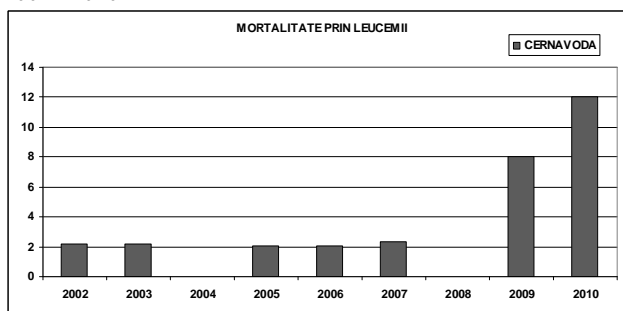


Mortality from leukaemia/lymphomas

With 9 deaths from leukaemia and lymphomas reported during the year 2010, the standardized mortality rate for the Cernavoda area was 12.02⁰/₀₀₀₀.

There are no data available for the specific mortalities from blood malignancies for the entire country, so we could not derive an expected number of deaths from these malignancies. We could only make some comparisons between the four studied areas.

Figure no. 3. Mortality from blood malignancies, 2002 - 2010

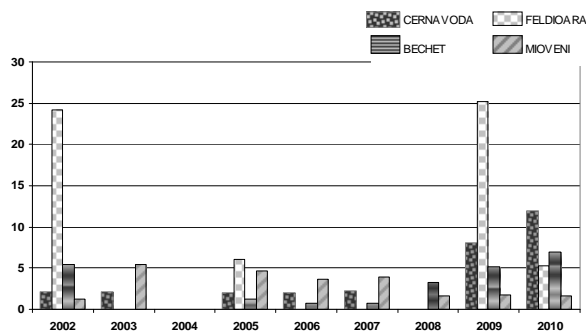


As shown in Figure no. 3, the mortality from blood malignancies has increased in 2009 and 2010. One of the

possible explanations could be the addition of data sources starting with 2008, when the data have begun to be collected additionally from the local oncology offices and the regional cancer registry. For the previous years, medical information was collected only from the general practitioners.

According to the reports for the year 2010, the leukaemia/lymphoma mortalities in the Cernavoda area were the highest among the four studied areas (see Figure no. 4).

Figure no. 4. Mortality from blood malignancies among four population groups living in the vicinity of nuclear facilities, 2002-2010

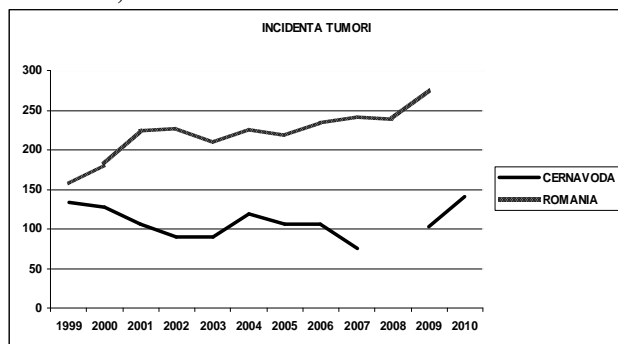


The incidence of solid cancer

During the year 2010, 105 new cases of solid cancer have been reported from the Cernavoda area, with an incidence rate of 140.58 ⁰/₀₀₀₀ (in 2009, the incidence rate of solid cancer for the entire country was 275.7 ⁰/₀₀₀₀). The expected number of new cancer cases was 236.7, and the ratio O/E for the new cases were 44.35.

During the entire monitoring interval, (1999-2010), the incidence rates of solid malignancies in the studied area were much lower than the corresponding incidence rates for the entire country. The upward trend shown during the last two years follows the national and global increase tendency in the frequency of cancer incidence (see Figure no. 5).

Figure no. 5. The incidence rates of solid cancer in Cernavoda, 1999-2010



The incidence of blood malignancies

A number of 5 new cases of leukaemia and lymphoma were recorded during the year 2010, i.e. an incidence rate of 7.64 ⁰/₀₀₀₀

The highest incidence rate of blood malignancies was recorded during the year 2009. In 2010, the incidence rate decreased to the value that was recorded for the year 2000 (see Figure no. 6).

As compared to the other monitored areas, even the highest value for Cernavoda was much lower than the values computed for the Feldioara area, or for Bechet area (Figure no. 7).

Figure no. 6. The incidence rates for blood malignancies, Cernavoda, 1999-2010

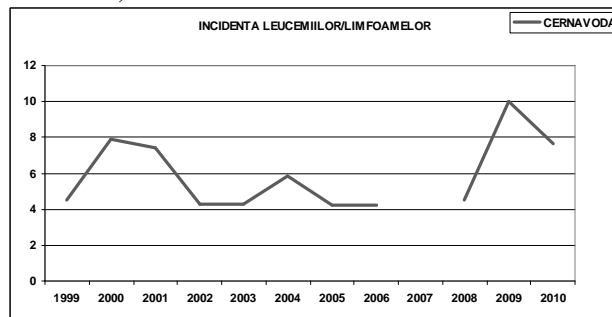
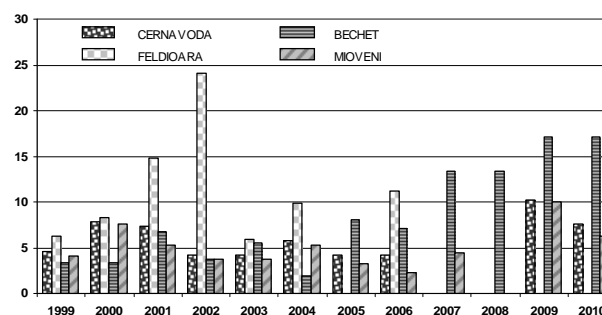


Figure no. 7. The incidence rates of blood malignancies in the four population groups living in the vicinity of nuclear facilities, 1999-2010



DISCUSSIONS

The data on which the computations are based were collected and reported by the Laboratories of Radiation Hygiene of the Directorates of Public Health in the districts that include nuclear facilities. The information is collected from the general practitioners, and from the county oncology offices and the regional cancer registries.

The pooled data are recorded on overall records. The new cases of malignant diseases are recorded individually, on standard records.

This report presents an analysis of the results we achieved during the 12 years of monitoring the health status of populations residing in the vicinity of nuclear facilities. During the first few years of this interval, the reported numbers largely varied from one year to the other. As the methodology has improved, the variations were smaller. In 2008, the methodology was changed once more, to include the oncology offices and the regional cancer registries, as data sources. For the following three years, the monitored indicators have reached values that followed the national trend.

CONCLUSIONS

Among the population in the Cernavoda area, the overall mortality shows values that are constantly lower than the values for the entire country. The specific mortality from solid cancers shows values that are approximately half the values for the entire country, during the entire interval 1999-2010. The mortality from blood malignancies in Cernavoda cannot be compared to the corresponding rates for the entire country: such data are not available in the statistic yearbooks. In 2009 and 2010, the Cernavoda area showed an important increase in mortality from leukaemia and lymphomas, with the highest values among the four monitored population groups. The incidence of solid cancer showed values lower than the corresponding rates for the entire country, while the time

tendency of these values followed the national tendency, during the entire time interval. The incidence rate of blood malignancies had the highest value in 2009, and decreased in 2010. However, the highest value in 2009 was lower than the incidence rate recorded for the Bechet area.

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