

Short Communication

PRESERVING THE ENVIRONMENT IN THE RESORT OF BANKYA

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The town of Bankya is a balneological resort (spa) situated in a picturesque valley 17 km west from Sofia. It is a place suitable for the treatment of cardiovascular diseases and certain functional diseases of the nervous system. As a national resort, it applies stricter environmental regulations for activities that might endanger the environment, including road transport. The aim of this study was to establish the health status of Bankya townspeople before the pending construction of a highway. The morbidity of the population of Bankya and neighbouring towns and villages was compared to that of the capital Sofia for the period between 1997 and 1999. The data were statistically processed using the non-parametric, chi-square analysis. The results showed similar morbidity in children from Bankya and neighbouring towns and villages, but it was significantly lower than in children from Sofia. The results for adults were also in favour of Bankya – lower morbidity than in the neighbouring towns and villages, and less than 50% of disease cases recorded for Sofia.

KEY WORDS: *air pollution, balneological resort, morbidity, road transport*

The town of Bankya is a balneological resort (spa) situated in a picturesque valley at 640 m above the sea level, 17 km west from Sofia. Its climate is temperate continental, with warm summers and moderately cold winters. The mean annual air temperature is 9.3 °C and the mean annual rainfall is about 670 mm. Western, north-western and partially south-western winds prevail, with mean annual velocity of 1.8–2 m/s. In bio-climatic respects, the resort can be defined as sparing to tonic. Its greatest treasure is mineral water – mildly mineralised, hypothermic, hydrocarbonate and sodium in contents.

These characteristics make Bankya a place suitable for treatment of cardiovascular diseases (hypertension, coronary heart disease, valvular defects, atherosclerosis, arteritis, thrombophlebitis, etc.) and certain functional diseases of the nervous

system (1). Its status of the national resort imposes stricter environmental regulations on industrial and other activities that might endanger the environment. This is particularly true for construction activities and road networking and transport. According to the national annual report of the Council of Ministers, in 1994 Bulgaria counted over 2.75 million vehicles. The number of automobiles exceeds 1.8 million, and, notwithstanding the drop in country's economy, their number increases 6.2% every year. Of all cars, only 20% are new and environmentally compliant. However, 46.3% of nitric oxides, 43.8% of carbon monoxide and 46.7% of carbon monoxide in the country originate from road vehicle exhausts (2). In 1999, road transport emissions were as follows: 52.6 thousand tonnes of nitric oxides (59.2 thousand tonnes in 1997), 238.1 thousand tonnes of carbon monoxide (195.6 thousand

tonnes in 1997), and 98.5 tonnes of lead aerosols (86.31 tonnes in 1997) (3,4). It is obvious that the contribution of road transport to atmospheric pollution of the country is substantial. This fact is to be included in all considerations related to the construction of new continental highways which will be passing through the country. One of these highways is "Lyulin", planned to run near the resort of Bankya. The aim of this study was to establish the baseline health profile of Bankya population before the highway is functional – for future reference.

SUBJECT AND METHODS

Population health was established through morbidity. Morbidity data for the period 1997–1999 were collected and analysed for the population of Bankya and neighbouring towns and villages of Malo Bouchino, Gorna Banya and Suhodol (21st Polyclinic), Filipovtzi (26th Polyclinic) and compared to the country's capital of Sofia. We selected those

classes of diseases which, according to literature, are most associated with road exhaust pollution. We obtained the data from the District Health Protection Centre in Sofia. Prevalence data for children (0–17 years of age) and incidence (number of morbid cases registered) data for the adults (>18 years of age) were collected from official records. The data were statistically processed using the non-parametric, chi-square analysis.

RESULTS AND DISCUSSION

Table 1 shows that the prevalence of diseases (classified according to the 9th edition of International Classification of Diseases) among children in Bankya (2790.42‰) was similar to that of neighbouring towns and villages and significantly smaller than in Sofia (3379.17‰). The results for adult population were also in favour of Bankya – lower morbidity than in the neighbouring towns and villages. These data suggest that Bankya population is reasonably healthy, that is,

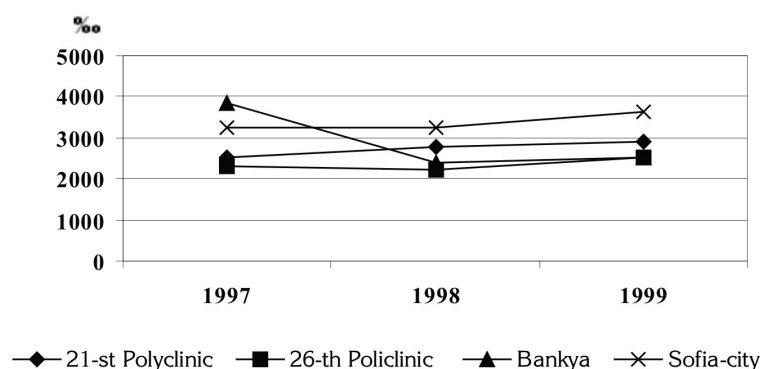


Figure 1 Prevalence of diseases among children (%) in 1997-99

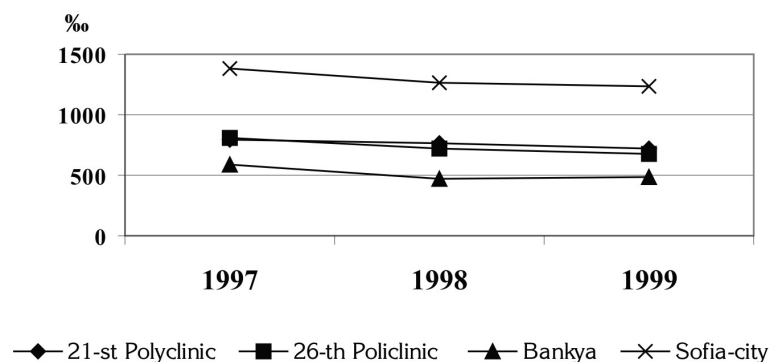


Figure 2 Prevalence of diseases among adults (%) in 1997-99

Table 1 Baseline morbidity data for Bankya, neighbouring area, and Sofia between 1997 and 1999

| Description of diseases | ICD* class | Children 0–17 years | | Adults 18+ years | |
|--|----------------|------------------------|----------|---------------------|----------|
| | | ‰ | P** | ‰ | P** |
| All classes | 001–999 | | | | |
| 21 st Polyclinic | | 2752.68 | <0.00001 | 758.14 | <0.00001 |
| Bankya | | 2790.42 | <0.00001 | 509.99 | <0.00001 |
| 26 th Polyclinic | | 2349.53 | <0.00001 | 735.77 | <0.00001 |
| Sofia | | 3379.17 | | 1291.90 | |
| Neoplasms | 140–239 | | | | |
| 21 st Polyclinic | | 2.50 | 0.00151 | 5.17 | <0.00001 |
| Bankya | | 0.48 | 0.01321 | 6.79 | <0.00001 |
| 26 th Polyclinic | | 2.92 | 0.01107 | 10.90 | <0.00001 |
| Sofia | | 4.24 | | 15.06 | |
| Endocrine, Nutritional and Metabolic Diseases, and Immunity Disorders | 240–279 | | | | |
| 21 st Polyclinic | | 0.94 | <0.00001 | 14.37 | <0.00001 |
| Bankya | | 0.00 | 0.00002 | 3.75 | <0.00001 |
| 26 th Polyclinic | | 2.61 | <0.00001 | 5.82 | <0.00001 |
| Sofia | | 9.35 | | 24.51 | |
| Diseases of the Nervous System and Sense Organs | 320–389 | | | | |
| 21 st Polyclinic | | 213.53 | <0.00001 | 137.97 | <0.00001 |
| Bankya | | 152.31 | <0.00001 | 115.66 | <0.00001 |
| 26 th Polyclinic | | 122.89 | <0.00001 | 117.45 | <0.00001 |
| Sofia | | 258.21 | | 230.08 | |
| Diseases of the Circulatory System | 390–450 | | | | |
| 21 st Polyclinic | | 22.17 | 0.00021 | 88.11 | <0.00001 |
| Bankya | | 2.86 | <0.00001 | 38.53 | <0.00001 |
| 26 th Polyclinic | | 11.23 | <0.00001 | 58.67 | <0.00001 |
| Sofia | | 17.90 | | 161.07 | |
| Diseases of the Respiratory System | 460–519 | | | | |
| 21 st Polyclinic | | 1946.47 | <0.00001 | 237.76 | <0.00001 |
| Bankya | | 2211.65 | 0.93351 | 150.74 | <0.00001 |
| 26 th Polyclinic | | 1768.28 | <0.00001 | 261.48 | <0.00001 |
| Sofia | | 2206.17 | | 314.34 | |
| Diseases of the Digestive System | 520–579 | | | | |
| 21 st Polyclinic | | 36.84 | <0.00001 | 33.69 | <0.00001 |
| Bankya | | 122.16 | 0.02553 | 13.03 | <0.00001 |
| 26 th Polyclinic | | 40.59 | <0.00001 | 35.30 | <0.00001 |
| Sofia | | 105.23 | | 55.10 | |
| Diseases of the Skin and Subcutaneous Tissue | 680–709 | | | | |
| 21 st Polyclinic | | 151.19 | <0.00001 | 64.68 | <0.00001 |
| Bankya | | 103.13 | <0.00001 | 13.14 | <0.00001 |
| 26 th Polyclinic | | 90.86 | <0.00001 | 37.45 | <0.00001 |
| Sofia | | 208.20 | | 90.39 | |
| Congenital Anomalies | 740–759 | | | | |
| 21 st Polyclinic | | 0.29 | 0.00086 | 0.10 | 0.00221 |
| Bankya | | 0.95 | 0.89950 | 0.00 | 0.15673 |
| 26 th Polyclinic | | 0.47 | 0.00308 | 0.13 | 0.01869 |
| Sofia | | 1.29 | | 0.33 | |
| Injury and Poisoning | 800–999 | | | | |
| 21 st Polyclinic | | 107.91 | <0.00001 | 40.31 | <0.00001 |
| Bankya | | 68.06 | <0.00001 | 55.90 | <0.00001 |
| 26 th Polyclinic | | 110.46 | <0.00001 | 49.51 | <0.00001 |
| Sofia | | 138.75 | | 84.34 | |

*ICD – International Classification of Diseases, 9th edition. **P value is calculated toward Sofia

healthier than the population of the capital. However, we noticed an increasing trend in prevalence among children toward the end of the follow-up period (Figure 1). Unlike other locations, Bankya showed a substantial initial drop from 1997 to 1998, and only then did follow an increase in prevalence in 1999. The incidence in adults shows a slight decrease in all locations, with the lowest incidence in Bankya (Figure 2).

Analysing morbidity, we found that it was significantly lower in Bankya than in Sofia for all classes of diseases according to the International Classification of Diseases (ICD), with the exception of respiratory diseases in the children of Bankya (ICD class 460–519), but the difference was not statistically significant ($P=0.93351$).

Morbidity data were the most favourable in adult population of Bankya. We believe this finding is very important, because intensified road transport, after the “Lyulin” highway is completed, is likely to increase atmospheric pollution and, consequently the incidence of respiratory diseases which are a good indicator of air pollution (5–9). A number of studies revealed a positive correlation between air pollution and the incidence of cardiovascular diseases (10,11). The levels of carbon monoxide, whose basic source is internal combustion engine, are particularly important, since this pollutant impairs the transport of oxygen to the body tissues and more specifically to the myocardium (12).

As we expected the morbidity data for the diseases of the circulatory system (ICD class 390–450), were lower in Bankya, which confirms the beneficent effect of the spa in the treatment of cardiovascular diseases and in prophylaxis of their sequelae. A number of specialized publications point out that vehicle exhausts released in the atmosphere contain great quantities of different chemical compounds which are the products of complete or incomplete fuel combustion. These include carbon dioxide, nitric dioxide, sulphur dioxide, polycyclic aromatic hydrocarbons, soot, petrol vapours, lead and cadmium aerosols, as well as secondary photochemical pollutants. The qualitative and quantitative composition of exhaust gases depends on a number of factors: type and quality of fuel (petrol, diesel, gas), engine, and operating conditions (13–16). Emissions from road traffic have a combined, complex, cumulative and remote harmful effect on organism. Thus, carbon monoxide increases the toxicity of mixed vapours, gases and aerosols which cause irritation of the

centre of breathing and hypoxia. The effects of toxic substances and noise may be additive. About 65% of Europeans exposed to noise from road vehicles experience disturbances in sleep (17). Symptoms of the nervous system associated with noise are irritability, neurosis, difficulties in concentration, low work capacity and fatigue (18,19). Even at admissible levels (5, 7, 20–22), road transport pollution may increase respiratory, cardiovascular and neurological morbidity, increase the risk of cancer, and affect the immune reaction. Table 1 shows that the baseline health of Bankya population is favourable with respect to the diseases of the nervous system and sense organs (ICD class 320–389) and to neoplasms (ICD class 140–239). Higher morbidity in the population from the area of the 21st Polyclinic requires further investigation. We believe that the frequency of congenital anomalies (ICD class 740–759) is too small for proper interpretation of Bankya results in children with respect to Sofia and the neighbouring area.

Beside pollution, intensified road traffic is expected to increase the number of road accidents, which in turn will lead to an increase in the frequency of injuries (ICD class 800–999). Table 1 shows that injuries and poisoning in Bankya are significantly less frequent than in Sofia.

The data analysed in this study suggest that the baseline morbidity of Bankya population (that is, before the construction of the “Lyulin” highway, which is pending) is significantly lower than the morbidity of Sofia population, and is more similar in nature to that of the neighbouring towns and villages.

It is very important that the “Lyulin” highway project should include all necessary technological, engineering, sanitary, and organizational precautions to preserve the nature of the resort and the health of its population. Once the highway is operational, it is imperative to have systemic control of the atmospheric and noise pollution of the town of Bankya.

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Sažetak

OČUVANJE OKOLIŠA U PODRUČJU GRADA BANKYJE

Grad Bankya nalazi se u kupališnome području smještenom u slikovitoj dolini 17 km zapadno od Sofije. To je mjesto pogodno za liječenje kardiovaskularnih bolesti i nekih funkcionalnih poremećaja živčanog sustava. Budući da se radi o zaštićenome području, ekološki zahtjevi za razvoj proizvodnje koja bi mogla ugroziti okoliš su stroži, a to se odnosi i na povećanje cestovnog prometa. Cilj je ovog istraživanja bio ispitati zdravstveno stanje stanovništva grada Bankyje prije izgradnje autoceste Lyulin. U razdoblju od 1997. do 1999. godine analizirano je poboljšanje stanovnika grada Bankyje i okolnih gradova i sela i uspoređeno s poboljšanjem stanovnika Sofije. Dobiveni rezultati statistički su obrađeni neparametrijskom analizom – kriterij χ^2 . Nađeno je da je poboljšanje djece u gradu Bankyji slično kao u susjednim gradovima i selima, no da je značajno niže negoli u Sofiji (3379, 17%). Rezultati istraživanja u odrasloj populaciji govore u prilog nižem poboljšavanju u gradu Bankyji u usporedbi sa susjednim gradovima i selima. Štoviše, u usporedbi sa Sofijom poboljšanje je bilo dva puta manje.

KLJUČNE RIJEČI: *cestovni promet, ljekovito kupalište, morbiditet, onečišćenje zraka*

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