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Health Status of Population Living in High Ecological Risk Areas in Poland
II. Specific Mortality Rates in the Period 1988-1993

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Abstract

The health status of the population living in high ecological risk areas in Poland is described at the level of specific mortality rates due to chosen diseases. The analysis of temporal trends over the period 1988-1993 is included. Specific mortality rates standardized according to 1991 demographic structures is compared between HERAs and areas outside HERAs. The study indicates higher mortality in the HERAs due to "civilization-related" diseases and diseases attributable to the environmental degradation.

Keywords: specific mortality rates, temporal trends, high ecological risk areas

Introduction

Issues of the adverse health effects of the exposure of the general population to hazardous substances present in the environment have become a sound social, economic, medical and political problem. Lack of sufficient, well-founded knowledge on the impact of environmental pollution on human health is one of the obstacles in making rational decisions and introducing preventative strategies.

In the multistage process aimed at assessing the adverse health effects of exposure to hazardous environmental factors, one of the principle steps is to define areas characterized by the highest health risks, potentially related to environmental exposure to hazardous factors by analyzing health status indicators.

The analysis of general negative health indicators (standardized mortality rate, infant mortality rate and low birth weight rate) in rural and urban regions inside and outside high ecological risk areas (HERAs) in Poland, presented in the previous paper [1], reveals spatial differences in the health status of the population, with overall worse indicators observed in populations inhabiting high ecological risk areas (for definition of the HERA see [1]).

The purpose of this article is to analyze spatial distribution and temporal trends of specific mortality rates due to major causes of disease (according to ICD, 9th Revision) in the rural and urban regions inside and outside high ecological risk areas in Poland in the period 1988-1992.

Material and Methods

Data used in the present study originate from the source records of births and deaths over the period 1988-1993, obtained from the Central Statistical Office. Specific mortality rates due to major causes of death were calculated with respect to the codes of International Classification of Diseases, Injuries and Causes of Death, 9th Revision and included the following groups:

I. Infectious and invasive diseases (001-139)
II. Neoplasms (140-239)
III. Disturbances in the endocrine system, nutritional status, metabolism and immunological system (240-279)
IV. Diseases of blood and haemopoietic organs (280-289)
V. Mental disorders (290-319)
VI. Diseases of the nervous system and sensory organs (320-389)
VII. Diseases of the circulatory system (390-459)
VIII. Diseases of the respiratory system (460-519)
IX. Diseases of the gastrointestinal system (520-579)
X. Diseases of the genitourinary system (580-629)
XI. Complications of pregnancy, labor and puerperium (630-676)
XII. Diseases of the skin and subcutaneous tissue (680-709)
XIII. Diseases of the musculoskeletal system and connective tissue (710-739)

XIV. Congenital developmental defects (740-759)
XV. Diseases of fetus and newborns occuring in the peripartum period (760-779)
XVI. Morbid signs, symptoms and unindentified states (780-799)
XVII. Injuries and poisonings (800-999)

Specific mortality rates were standardized [2] with respect to age and sex using the demographic structure of Poland as a standard. In order to assess the temporal trends of the above-mentioned indicators, linear regression analysis of respective time series has been performed. The results are quantified by means of a regression coefficient r and statical significance of the trend p (estimated by analysis of variance).

Results

Specific mortality rates due to major causes of death are listed in Table 1. They are calculated separately for urban and rural areas, both inside and outside HERAs. The table also includes temporal trends for each analyzed category.

Listed below are groups of diseases for which SMR in the urban and rural areas within HERAs were higher when compared with regions outside HERAs. For each group the temporal trend is analyzed.

The specific mortality rate due to *neoplasms* in 1988-1993 decreased in urban areas both inside and outside HERAs ($r = -0.98$, $p < 0.001$ and $r = -0.96$, $p < 0.02$, respectively). In rural areas inside and outside HERAs, standardized mortality due to *neoplasms* did not reveal any significant trend. Specific mortality rate due to *disfunctions of the endocrine sysytem, nutritional status, metabolism and immunological system* significantly decreased in the urban areas of HERAs ($r = -0.97$, $p < 0.001$) and rural areas outside HERAs ($r = -0.96$, $p < 0.006$). For *diseases of circulatory system*, SMR showed a decreasing trend in the urban areas of HERAs ($r = -0.97$, $p < 0.002$) and in urban areas and rural areas outside HERAs ($r = -0.93$, $p < 0.007$ and $r = -0.91$, $p < 0.008$ respectively). A decreasing trend in the SMR due to *diseases of the gastrointestinal tract* was observed in urban areas of HERAs ($r = -0.98$, $p < 0.005$) and outside HERAs ($r = -0.89$, $p < 0.01$). An analogous trend was seen in SMR due to *genitourinary diseases* ($r = -0.98$, $p < 0.002$ for HERA's urban areas, and $r = -0.98$, $p < 0.003$ in the urban areas outside HERAs). No significant tendency could be observed in SMR due to *complications of pregnancy, labor and puerperium* inside and outside HERAs. An increasing trend was noticed in SMR from *diseases of the fetus and newborns* occuring in the peripartum period for urban areas inside and outside HERAs ($r = 0.90$, $p < 0.01$ and $r = 0.96$, $p < 0.002$, respectively). A significant increase was also observed in the rural areas outside HERAs ($r = 0.96$, $p < 0.002$). Within urban and rural areas inside HERAs a decrease in SMR due to *injuries and poisonings* was observed ($r = -0.94$, $p < 0.004$ and $r = -0.88$, $p < 0.02$, respectively), whereas no significant trend was observed outside HERAs.

Groups of diseases are enumerated below, for which higher SMRs are observed in urban areas inside HERAs compared to the urban areas outside HERAs, and lower SMRs are observed in rural areas of HERAs compared to respective units outside HERAs. The temporal trend is also presented.

SMR for *infectious and invasive diseases* revealed a significant decrease in urban areas outside HERAs ($r = -0.97$, $p < 0.001$). In urban areas inside and outside HERAs a decrease in SMR due to *diseases of the respiratory system* was noticed ($r = -0.93$, $p < 0.006$ and $r = -0.84$, $p < 0.03$, respectively), with no significant trend in villages in both areas. Neither inside nor outside HERAs was there a significant tendency in SMR due to *diseases of skin and subcutaneous tissue*. SMR due to *congenital malformations* does not reveal any significant trend in the urban and rural areas inside HERAs, whereas an increasing tendency was seen in the urban areas and rural areas outside HERAs ($r = 0.89$, $p < 0.01$ and $r = 0.97$, $p < 0.001$, respectively).

Diseases for which SMRs were higher in the urban and rural areas outside HERAs compared to the urban and rural areas within HERAs are listed below. SMR due to *symptoms and morbid signs and undefined states* revealed significant decrease in rural HERA areas ($r = -0.86$, $p < 0.03$) and in urban and rural areas outside HERAs ($r = -0.93$, $p < 0.006$ and $r = -0.99$, $p < 0.0005$, respectively). A marked decrease in SMR due to *diseases of blood and the hemopoietic system* was observed in the urban areas of HERAs ($r = -0.95$, $p < 0.004$). The same holds for SMR due to *diseases of the nervous sytem and sensory organs* ($r = -0.98$, $p < 0.0007$). In the case of *diseases of musculoskeletal system and connective tissue* SMR, decreased significantly in urban areas outside HERAs ($r = -0.91$, $p < 0.01$).

The results of other studies, undertaken to assess the impact of environmental pollution on human health [3, 4], suggest deterioration of the health status of populations living in environmentally-degraded areas. However, differences in applied methodologies, quality and quantity of available data, and first of all the complexity of addressed issues make interpretation of the results difficult, limit comparability of the studies, and affect the value of final conclusions.

Discussion and Conclusions

Comparison of SMR due to major groups of diseases between administrative units inside and outside HERAs reveals the existence of territorial differences in standardized specific mortality rates (SMRs) attributable to various groups of diseases. This is supported by other authors [3, 4]. Within HERAs, higher SMRs are observed (compared to areas outside HERAs) due to neoplasms; disturbances in the endocrine system, nutritional status, metabolism and immunological system; diseases of circulatory, gastrointestinal and genitourinary systems; complications of pregnancy, labor, and puerperium; morbid status of fetus and newborns occuring in peripuerpal period; and injuries and poisonings.

SMR due to infectious and invasive diseases, congenital malformations, diseases of the respiratory system and diseases of skin and subcutaneous tissue are higher in urban areas inside HERAs than in urban areas outside HERAs, and lower in the rural areas of HERAs (when compared with respective units outside HERAs). In the regions outside HERAs, both in the urban and rural areas, higher SMR, when compared with respective units within HERAs are noticed because of diseases of blood and hemopoietic system, mental disturbances, diseases of nervous system

Table 1. Specific mortality rates in and outside HERAs during the period 1988-1992 (standardized according to age and sex).

Cause of death	Years	HERAs			Outside HERAs		
		Urban	Rural	Total	Urban	Rural	Total
1	2	3	4	5	6	7	8
Infectious and invasive diseases	1988	98.13	89.05	92.71	103.34	100.07	103.44
	1989	102.17	98.03	97.23	99.01	99.85	101.59
	1990	102.44	105.36	101.02	97.53	99.59	99.62
	1991	102.99	95.35	98.96	95.06	100.40	99.40
	1992	107.70	98.54	105.74	88.44	99.42	94.76
Neoplasm	1988	107.43	106.50	112.28	98.04	98.64	95.93
	1989	106.34	112.29	112.85	95.75	98.14	94.30
	1990	102.98	105.85	109.23	95.29	98.99	94.43
	1991	99.82	105.35	106.27	94.89	98.73	94.17
	1992	98.51	106.18	105.49	91.24	97.42	91.69
Disturbances in the endocrine system...	1988	112.09	103.16	124.51	93.92	99.64	90.48
	1989	109.04	114.56	121.93	93.24	98.00	90.01
	1990	108.12	118.46	120.32	90.31	97.12	88.93
	1991	103.95	116.55	116.58	91.03	96.67	88.97
	1992	96.39	109.02	107.66	93.53	95.96	90.29
Diseases of blood and haemopoietic organs	1988	103.03	60.53	103.87	101.35	105.14	99.76
	1989	102.38	92.02	103.61	99.27	100.58	98.63
	1990	99.93	128.46	110.58	98.84	95.82	94.08
	1991	92.04	76.53	96.29	102.86	102.29	99.37
	1992	90.56	98.02	92.89	99.61	97.88	97.87
Mental disorders	1988	82.46	105.23	91.04	121.69	99.40	106.59
	1989	99.24	109.14	110.52	102.35	98.80	95.21
	1990	89.18	95.06	95.55	109.10	100.40	101.53
	1991	84.94	82.74	95.07	110.31	101.64	100.22
	1992	84.51	86.51	92.79	106.36	99.67	98.69
Diseases of the nervous system and sensory organs	1988	103.55	102.74	101.14	99.73	98.24	100.03
	1989	99.94	90.43	96.40	101.50	100.96	102.26
	1990	95.72	103.67	95.99	103.22	99.63	101.79
	1991	90.70	93.44	90.82	105.14	100.45	102.88
	1992	85.51	92.00	85.54	106.58	100.62	104.15
Diseases of the circulatory system	1988	105.06	101.67	105.53	101.06	100.58	100.27
	1989	104.52	108.69	106.95	97.74	99.00	97.63
	1990	101.31	100.35	102.65	96.95	99.36	97.66
	1991	97.85	98.94	99.63	97.52	99.24	97.79
	1992	97.77	98.59	99.64	93.17	97.53	94.94
Diseasesof the respiratory system	1988	108.96	100.26	99.81	96.65	99.89	102.17
	1989	104.83	101.47	96.82	97.34	99.73	102.24
	1990	105.62	91.78	95.89	93.22	100.79	101.14
	1991	102.44	93.86	94.77	93.60	100.34	100.47
	1992	97.42	90.62	90.86	94.12	99.59	99.84

1	2	3	4	5	6	7	8
Diseases of the gastrointestinal system	1988	111.16	106.30	121.50	94.15	99.07	91.53
	1989	106.76	111.90	118.57	95.31	98.21	91.54
	1990	106.45	114.49	117.83	92.18	97.76	90.32
	1991	102.16	99.81	113.98	93.26	99.19	90.52
	1992	100.68	104.06	113.05	90.00	97.41	88.13
Diseases of the genitourinary system	1988	104.73	103.28	106.44	100.91	99.55	99.22
	1989	103.51	107.31	106.21	98.49	98.74	97.65
	1990	101.79	99.73	103.15	96.50	99.73	97.53
	1991	99.07	96.21	101.09	96.42	99.77	97.11
	1992	96.10	101.64	99.26	93.80	97.74	94.86
Complications of pregnancy, labor and puerperium	1988	109.84	54.55	98.60	90.48	105.89	99.92
	1989	135.62	56.32	113.51	66.71	106.06	91.95
	1990	116.80	152.12	114.21	85.23	91.59	92.16
	1991	102.42	156.34	111.31	98.36	91.60	94.42
	1992	82.96	225.60	102.25	118.37	81.25	101.17
Diseases of the skin and subcutaneous tissue	1988	109.96	65.99	101.77	94.51	105.08	101.15
	1989	101.55	82.23	116.15	100.33	88.70	92.71
	1990	94.51	83.56	93.65	103.08	101.83	101.95
	1991	92.05	86.58	89.76	102.25	101.11	102.48
	1992	107.60	126.40	115.86	85.11	95.95	88.51
Diseases of the musculoskeletal system and connective tissue	1988	76.00	91.25	70.64	128.74	101.17	117.06
	1989	89.61	99.83	85.84	112.21	100.11	108.15
	1990	75.36	89.02	71.15	122.58	101.31	113.99
	1991	85.49	83.57	79.90	110.04	101.31	107.88
	1992	88.33	97.54	84.67	100.63	97.91	101.77
Congenital developmental defects	1988	94.30	83.15	89.96	96.31	97.91	98.31
	1989	103.13	98.30	101.29	96.28	99.63	98.63
	1990	108.18	86.42	101.24	98.42	103.76	102.79
	1991	97.26	80.79	91.65	109.40	103.15	106.87
	1992	107.58	91.62	103.06	110.58	107.17	109.29
Diseases of fetus and newborns occuring in the peripartum period	1988	99.85	99.10	101.78	90.44	95.41	92.40
	1989	109.93	113.76	112.91	90.46	97.52	93.56
	1990	109.66	96.29	106.65	98.09	102.65	100.96
	1991	108.76	94.52	104.90	100.97	101.07	101.52
	1992	114.78	112.28	114.57	108.60	105.50	106.67
Morbid signs, symptoms and unidentified states	1988	97.94	87.95	88.37	108.43	103.77	109.36
	1989	92.49	85.27	83.56	109.30	102.55	109.02
	1990	92.59	87.38	85.15	105.14	100.55	105.70
	1991	95.94	89.47	90.33	99.11	99.60	101.77
	1992	90.94	90.84	87.38	99.70	97.35	100.34
Injuries and poisonings	1988	104.29	105.57	100.81	99.62	98.41	100.85
	1989	105.45	111.35	104.00	96.11	98.08	98.38
	1990	103.09	103.35	100.39	95.98	99.41	99.24
	1991	99.38	98.01	96.84	96.99	99.74	99.70
	1992	97.48	98.32	95.45	95.43	98.83	98.43

and sensory organs, diseases of musculoskeletal system and connective tissue, and symptoms, morbid signs and undefined states. Also, higher mortality due to so-called complications occur there. Most of these causes of death are somehow associated with environmental conditions.

Results of this study indicate higher mortality due to diseases often attributable to degradation of the environment, and the group of so-called civilization-related diseases, i.e. neoplasms, diseases of the circulatory system, complications of pregnancy, labor and puerperium in regions of HERAs. Interpretation of the above-presented results must be very cautious in order to avoid oversimplification of the problem. It must be remembered that the health status of the population depends on many factors, including development of health care services, socio-economical status, level of education, demographic structure of the population, etc., with the quality of the general environment being one of them. Moreover, the relationship between environment and health is extremly complex in its nature. We must bear in mind that relationships between the state of the environment and health are extremely complex. On one hand, observed health effects result from the action of many substances occuring in various concentrations; moreover, the final effect can be substantially modified due to interactions between compounds. On the other hand, there are significant qualitative differences in activities of hazardous substances. Adverse health effects resulting from environmental exposure to pollutants can occur with a delay, often years after exposure took place. Higher mortality due to these causes suggests the impact of environmental pollution. However, interpretation of the results cannot be straightforward. Observed indicators cannot be attributed merely to environmental factors. Health status is a very complex phenomenon, depending on a number of (endo- and exogeneous) factors. In light of the deteriorating health status of the population living in HERAs, further detailed studies of the problem are required.

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