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Environmental Risks Perception – A Study of the awareness of families to threats in areas with increased health disorders in children

Grzegorz Dziubanek[1], Ewa Marchwińska-Wyrwał[1], Agata Piekut[1], Ilona Hajok[1], Teresa Bilewicz-Wyrozumska[2], Bernadeta Kuraszewska[3]

[1] *Department of Environmental Health, Faculty of Public Health, Medical University of Silesia, Katowice, Poland*
[2] *Department of Epidemiology, Faculty of Public Health, Medical University of Silesia, Katowice, Poland*
[3] *Medical University of Silesia, Katowice, Poland*

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Abstract

Introduction: Children are at greater risk than adults to experience adverse effects from environmental agents. Significant neurological damage to children can occur even at very low levels of exposure. Reliable protection of children living in areas with high environmental hazards is not possible without their parent's' understanding of where, how and why children's exposures occur.

Objectives: The aim of the presented study was to indicate families' awareness of environmental risks with increased health disorders in children in the chosen area of the Silesian Province.

Materials and Methods: Rates of development disorders in general, including physical and psychomotor development disorders, in a population of children from the study area were estimated. A questionnaire was used in order to explore through a door-to-door survey the perceptions of environmental risk in a population of 2,491 residents.

Results: The presented study shows that the parents' awareness of environmental health risks is not satisfactory. The majority expressed an opinion that the outdoor environment exerts a major influence upon the state of health, but less than 1% of the parents were aware of the indoor environmental risk.

Conclusion: The most effective way to prevent children's exposure is to teach the community to identify environmental threats and educate them on how to their protect children. The appropriate policies and programmes should be developed and implemented as this seems to be the most effective and cheapest way to prevent children's exposure to environmental risks.

Key words

environmental risk perception, environmental threats, children' health disorders, Silesian Province, air pollution

INTRODUCTION

Air pollution, both indoors and outdoors, is a major environmental health problem affecting everyone in developed and developing countries alike. It has been reported that over 40% of the global burden of disease attributed to environmental factors affects children under five years of age, though that group accounts for only ~10% of the world population [1]. Children are very susceptible to health injury resulting from exposures to chemical toxicants in the environment because of their biological vulnerability and the patterns of exposure [2]. Recent research has indicated that significant neurologic damage to children occurs even at very low levels of exposure to lead and PCBs [3, 4, 5, 6, 7, 8]. Preventing these levels of exposure in young children will require controlling a significant and persistent cause of lead poisoning. Consistent results have been reported of the association between exposure to background levels of PCBs/dioxins, especially trans-placental PCBs, and defective neurodevelopment of infants in the USA and Europe [9, 10].

Address for correspondence: Grzegorz Dziubanek, Department of Environmental Health, Faculty of Public Health, Medical University of Silesia, Piekarska 18, 41-902 Bytom, Poland
e-mail: gdziubanek@sum.edu.pl

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The case study area chosen by us for EU Project (Dabrowa Gornicza – DG) is located in the Silesian Province. This is an area of the greatest exposure in Poland to heavy metals and other pollutants, such as dioxins and PCBs. This is mainly due to the high emission in the past of cadmium and lead compounds from the plants of non-ferrous metals, which has led to a high contamination of the agricultural land and locally grown food. During the last decade, the average content of cadmium in suspended dust was 6.4 ng/m^3, and ranged from 1.4–4.64 mg/m^2/year in falling dust [11, 12]. The content of cadmium in soil ranges from 3–15 mg/kg [13]. The average lead concentration in suspended dust within the 15-year period of 1989–2003 was 144.2 ng/m^3 [11, 12]. The concentration of lead in soil of the examined area exceeded by 3 – 4 times the permissible concentration established by the FAO/WHO [14]. Exposure to lead causes various adverse health effects, including impaired intelligence quotient and neurobehavioral disorders, such as hyperactivity, apathy, etc., and mostly observed in children, as well as disorders of the nervous, immune, cardiovascular and reproductive systems, anaemia, and impaired kidney function [14, 15]. The average benzo [a] pyrene (BaP) concentration in DG in 1989–2003 was 32.87 ng/m^3 [11, 12]. Perera et al. (2006) suggested that environmental PAHs at levels recently encountered in the air of New York City might adversely affect children's cognitive development at 3 years of age, with implications for

school performance [16]. In the majority of the countries, the concentrations of PCB's and dioxins are not monitored. An unpublished study by the authors shows that the concentration of dioxins, furans and PCBs in the study area, especially in the city district of DG – Losien, was 2–3 times higher than in other parts of the province. This is probably due to the operation in the region of an incinerator for toxic waste with a capacity of 20,000 tons per year. Limited information is available on the dose-response function of PCBs and dioxins with respect to human health. A review of studies in Europe and the USA found that a TCDD-related lowering of thyroid production in the mother may be responsible for some of the negative effects on the foetus. Reported effects were brain development defects and deficits in IQ and behaviour, temporary liver enlargement, temporary bone marrow effects, and persistently decreased lung function [17].

DG, together with seven other big cities in the region, were classified by Wcislo et al. (2002) as cities with high environmental hazards which may cause visible threats to public health [18]. In comparison with other parts of Poland, the region is characterized by a higher incidence of many diseases [19]. Statistical analysis of the data showed that in the population of children a significant increase has been indicated in disorders of the neurological and urinary systems, especially in DG (Tab. 1). This is probably due to the long-term environmental impact of a big steel mill, the above-mentioned toxic waste incinerator (working capacity of 20,000 ton waste/year) located within the city district of Losien, and a non-ferrous metals plant also located in close proximity.

The most effective way to reduce children's risks of contamination by chemicals is to prevent their exposure. According to Barrett (2009), reliable protection of the children living in areas with high environmental hazards is not possible without their parent's' understanding of where, how and why children's exposures occur [20].

Objectives. The aim of the presented study was to indicate the families' awareness of environmental threats in an area where the number of health disorders in children exposed to heavy metals and other pollutants as PCBs and Dioxins, are higher than in other cities of the Silesian Province.

MATERIAL AND METHODS

The research was based on a questionnaire developed within an EU Project for use in the case study area (DG). Perceptions of environmental risk were explored through a door-to-door survey of 2,491residents. The interviews were conducted by trained public health students. One adult from each of the participating households was interviewed. The study questionnaire included questions regarding knowledge and evaluation of environmental and health risks, the attitude of the population towards environmental and other health-related issues, as well as personal health practices. Additionally, 372 questionnaires were analyzed, which concerned the state of health of the children. Parents were questioned about their opinions on the state of the environment in the place they live, the factors that exert the greatest impact on health, and the interrelation between the environment and the state of health of their children. The parents also responded to the question of which sources of information about environmental risks they considered the most reliable and convincing.

Estimated rates of development disorders in general, including physical and psychomotor development disorders, annotated in 2005 in a population of children under 18 years of age (Tab. 1), was verified in 2008 and 2011 (Tab. 2). For the population of children from the Losien district, which was researched within the framework of the DROPS project (DROPS – Development of Macro and Sectoral Economic Models Aiming to Evaluate the Role of Public Health Externalities on Society), was conducted in a retrospective study, using the MZ-11 reports prepared by an out-patient clinic working in the primary health care sector and located in the district of Losień. Data was obtained from them on the number of diagnosed developmental disorders, including physical and psychomotor development disorders in children up to age 18, who are under the care of a primary care physician (family doctor). The received data for the years 2008 and 2011 were standardized (Tab. 2).

Table 1. Diseases in the population of children between 0–18-years-old, treated by a family doctor. Cases per 10,000 people (2004-2005, retrospective study).

Disorder according to the ICD–10	Cases per 10,000 children in the cities from the same district					
	Bytom	Katowice	Dąbrowa Górnicza	Tychy	Sosnowiec	Zabrze
Urinary system diseases[a]	38	54	**227**	87	62	47
Psychomotor development disorders (R62.0)[b]	13	16	**66**	11	15	30
Physical development disorders (R62.8)[c]	46	18	**61**	11	15	32

[a](N00-N23) – according to the International Statistical Classification of Diseases and Related Health Problems (ICD-10), includes:
– glomerular diseases (N00-N008)
– renal tubule-interstitial diseases (N10-N16)
– renal failure (N17-N19)
– urolithiasis (N20-N23)
[b] (R62.0) Delayed attainment of expected physiological developmental stage – late talker, walker.
[c] (R62.8) Failure to: gain weight, thrive, infantilism NOS, lack of growth, physical retardation.

Table 2. Estimated rates of development disorders in a population of children under 18 years of age (retrospective study).

Cases per 10,000 children between 0–18-years-old	Opole Province		Wielkopolska Province		Silesian Province					
							Dabrowa Górnicza		Losien	
	2008	2010	2008	2010	2008	2011	2008	2011	2008	2011
R62 – Development disorders (general)	98.3	87.4	71.7	43	111.2	109.7	213.5	158	186	256.5
R62.8 – Physical development disorders	57	48.9	42.7	22.8	66.5	60.2	110.3	84.4	93	-
R62.0 – Psychomotor development disorders	34.9	33.4	24.1	15.5	36.1	31.8	87.7	55.4	93	-

RESULTS

The amount of disease in a population of children in Silesia Province differs depending on the city. Studies have shown that estimated rates of development disorders in general and physical and psychomotor development disorders in a population of children under 18 years of age are much higher in the area of research than in other parts of the Province (Tab.1). The highest estimated rates of development disorders in the population of children have been recorded in DG, where the toxic waste incinerator is located (Losien). The area is characterized by high concentrations of PCBs and Dioxins in the air which, together with heavy metals present in all elements of the environment, are probably responsible for these high concentrations. The question arises: to what extent are the parents aware of environmental threats?

The questionnaire study showed that awareness of the risks in the adult population is unsatisfactory. More than 72% of the investigated parents in the examined area classified the state of the environment as less than good (36.7%– satisfactory and 35.6% -bad). Almost 66% of the respondents expressed an opinion that the outdoor environment exerted a major influence upon the state of health state, but the indoor environment was regarded as the least important (0.75%). One in three responded that the polluted air and the bad quality of drinking water posed the greatest risks to health. Lifestyle factors were considered important by 26.4% of the responders. Thus, surprisingly, only two parents were aware of the indoor environmental risk.

DISCUSSION

More than 99% of investigated parents saw no risk in their children's indoor environment. Indoor pollution contribute considerably to overall human exposure since indoor concentrations of respirable particulates, nitrogen dioxide, carbon monoxide, VOCs, formaldehyde and radon are often higher than outdoor concentrations. In developed countries, people spend abound 90% of their time in indoor environments, and from that about 66% is spent in homes [21]. Indoor pollution has been ranked by the US Environmental Protection Agency (EPA), Science Advisory Board and the Centers for Disease Control and Prevention as a high environmental risk [22]. Therefore, indoor air pollution could be a greater health hazard than outdoor air pollution. The possible components include tobacco smoke, the products of cooking, cleaning materials, insecticide sprays, volatile organic compounds (VOCs), phthalates and contaminants, such as nitrogen dioxide from space heaters and poorly ventilated furnaces [23]. Poor indoor air quality at home may lead to the development of symptoms and diseases, such as allergies, asthma, infection, hypersensitivity pneumonitis, inhalation fevers, mucosal irritation, central nervous system effects, psychological effects (including depression), dermatitis, and even some forms of cancer [24, 25, 26, 27, 28, 29, 30, 31].

In a polluted environment, foetuses, infants, and young children are the most susceptible [32], and the association of tobacco smoke and environmental lead exposure with conduct disorder (CD) has been reported [33]. Braun at. al. (2008) suggested that prenatal tobacco exposure and environmental lead exposure contributed substantially to CD in children in the USA [33]. The latest research indicates that lead exposure in school-age children may be more strongly related to cognitive and behavioural development than exposures during earlier childhood [34, 35]. The results of these studies indicated that efforts to reduce lead exposure should continue as children progress to school age. The number of children in the USA with learning and developmental disabilities has been increasing over the past decade, reaching nearly one in six by 2008 [36]. Children are particularly vulnerable to indoor air pollutants because they inhale relatively high volumes of air per unit body weight, and play on the floor where contaminant levels tend to be particularly high due to resuspension. The immaturity of organ systems and metabolic functions adds to the vulnerability of young children. Furthermore, children have little control over their own environment. The poor housing conditions of those from disadvantaged backgrounds may expose them to the pollutant hazards of dampness, degradation of building materials and lack of ventilation [23]. The value of environmental measurements, such as surface and toy wipes, and indoor air or house dust samples, requires further investigation [37].

The majority of respondents (55%) believed that the environmental pollution might cause serious disorders and even pre-term mortality. However, most of them did not associate the environmental hazards in the place where they live with the state of health f their children, since they assessed it as good (53.76%) or very good (37.63%). Only three people (0.1%) assessed the health state of their children as bad. Obviously, subjective reporting of health status does not necessarily reflect the true health status. Only 15% of respondents connected the respiratory system diseases, allergies and headaches in their children with environmental hazards. The presented study shows that the parents' awareness of the environmental health risks is not satisfactory. Unfortunately, according to Norton et al. (2003), parents should be the most effective teachers of health habits at home when prompted by health educators. Besides, improvement of the parent-child communication processes may also reduce individual risk factors [38]. Parents should be properly educated about environmental risks and the health effects. The education may be achieved by the mass media and medical doctors. However, it seems that the position of doctors is underestimated nowadays. Only 18.55% of parents considered a family doctor as an appropriate source of health risk information, which might result from the poor communication between doctors and patients. As stated by Galvez et al. (2007), pediatric children's health care providers should be prepared to address the health risks of environmental exposures [39]. Several factors may influence the effectiveness of communications, such as: whether the individual providing the information is considered a reliable source, the familiarity of the physician and parents with these issues, and the limited research specifically assessing risk of exposure in childhood. The Internet can also provide a wealth of information related to the effects of environmental exposures on children's health [40]. As the study indicates, the media is by far the most common source of environmental risk information (62.14% of respondents). Hence, communicating the environmental hazards and health effects through the mass media seems to be the most effective method.

CONCLUSIONS

The presented study shows that it is necessary to teach parents and the community to identify environmental threats, educate them about the special vulnerability of children, and show them how to protect their children by adopting practices that will reduce risks of exposure. The evolution of environmental risk perception and the increase in education about environmental risks towards doctors who are the important sources of knowledge for the public would be beneficial. Public perceptions of risk are important because they influence policy, although some perceptions may result in poor policy. The need to educate the media is evident; thus, educating the media about environmental policy and environmental risk may well be the most effective means of improving the public's awareness and understanding of these issues. It is hoped that the presented study will provide a better understanding of the environmental concerns and risk perception in families. The appropriate policies and programmes should be developed and implemented as they seems to be the most effective and cheapest ways to prevent children's exposure to environmental risks.

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