Original article

Socio-economic and environmental determinants of children's health in a big city (the case study of Lviv city, Ukraine)

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ABSTRACT

With the current economic and political instability in Ukraine, children's health is most certainly the best indicator of socio-economic development within the country and its different regions. This article analyses the socio-economic and environmental determinants of a child's health in a big city (using the example of Lviv, a city in Ukraine). The demographic indicators of the child population of the city of Lviv and the reasons for mortality were traced; the structure of children's diseases was analyzed; the factors affecting children's health potential (such as local budget expenditures on health care, the level of average nominal wages, the ecological situation in the region) were studied. Published and non-published statistical data from the Main Statistical Department of Lviv Region, Lviv City Council were used. Specific consumer behavior among randomly selected Lviv households with children aged between 0-14 years was studied by using a special survey. Research results show the links between socio-economic and ecological factors (local budget expenditures on health care, the level of average nominal wages, the ecological indices in the region), and child mortality. The limited capacity of parents to satisfy the basic needs of households and complete lack, or limitation, of time that parents spend with their children undoubtedly influences the potential of children's health in a destructive way.

KEY WORDS: child population, mortality, health status, Lviv

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1. Introduction

In terms of socio-political, socio-economic and ecological crises which emerged and deepened in Ukraine in the 90s of the XX century, the health of the nation significantly worsened. Areas, scope and inconsistencies in reforming different spheres of public life have led to a significant deterioration in the quality and standards of living of the population of Ukraine that can be clearly seen in the public health status of the population (PANTYLEJ, 2008; PANTYLEJ, 2014). Under the current economic and political instability in Ukraine, children's health is most certainly the best indicator of socio-economic development of the country and its different regions. Unfortunately, in recent

years in Ukraine in general and particularly in the city of Lviv, a sharp deterioration in the potential of children's health has been recognized (ARTEMENKO, 2014; PETROVSKA, 2013; PETROVSKA & PYLYPOVYČ, 2013). This situation is a consequence of the socio-economic reconstruction of society, poor living conditions of a significant group of the population, and unfavorable environmental conditions, which reduce the compensatory and adaptive capabilities of a child's body and its resistance to various harmful factors. In 2014, the share of the population of Ukraine with average equivalent incomes per month lower than the minimum level of subsistence was 12%. The part of the poorest population with incomes lower than \$2.5 per day remains considerable, as is the correlation between

the total income of the wealthiest and the poorest 10% of the population that amounted to 4.4 in 2014. The problem of poverty is strictly connected to the poverty of households which have children. Among the different types of households in Ukraine, the highest risk of poverty, according to both absolute and relative criteria, concerns those households with two or more children, with children under the age of 3, and households with children and unemployed adults.

The aims our paper are: to trace the demographic situation of the child population in Lviv; identify the causes of mortality; find out the state of children's health; analyze the structure of children's diseases; study the factors that affect their health potential (local budget expenditures on health care, the level of average nominal wages, the ecological situation in the region); discover the links between these factors and children's mortality; study (by using a special survey) the features of consumer behavior among randomly selected households with children aged 0-14 years in Lviv.

2. Study area

Lviv is the administrative, economic and cultural center of the Lviv region. The territory of the city is divided into 6 districts. The City Council also includes the town of Vynnyky, and the urban villages of Bryukhovychi and Rudno (Fig. 1). The territory of Lviv City Council is 171 km², while the territory of Lviv is 149 km² (0.8% of Lviv region).

On January 1, 2014, the population of Lviv City Council amounted to 758.4 thousand people, which is 30% of the population of the Lviv region. Among the most populated districts is Sykhivskyy district with 151.6 thousand people, and the least populated is Halytskyy with 56.7 thousand people (KILKIST' NASELENNJA, 2015). In terms of population size, Lviv is the 7th largest of the cities of Ukraine after Kyiv (2,868.7 million people), Kharkiv (1,451.1 million people), Odessa (1,017.0 million people), Dnipro (993.1 thousand people), Donetsk (949.8 thousand people) and Zaporizhzhya (766.3 thousand people). The dynamics of the population is shown in Fig. 2.

Fig. 1. Subdivisions of the Lviv city region

Fig. 2. Dynamics of the population of the Lviv city between 2004-2014
(source: own elaboration based on Statystyčnyj ščoričnyk Lvivs'koji oblasti...2016)

The decrease in the population of Lviv could be explained by the following reasons: the poor economic situation in the country, high demographic burden of the population by post-productive population, high migration outflow of the population and low number of children in the family (1-2 children per family).

3. Materials and methods

While conducting research, published and non-published statistical data from the Main Statistical Department of Lviv Region, Lviv Regional Informational-Analytical Public Health Center were used. The features of the consumer behavior of households in Lviv were investigated by using a questionnaire survey. The respondents were asked (based on self-assessment) to identify the consumer behavior, which is most common in their household. The questionnaire included 30 questions. Four hundred and twenty respondents were interviewed in 2014 in all the administrative districts of Lviv (a representative selection of the sample). The processing of the questionnaires was conducted using the software package "PSQ". PSQ is a software used in sociological research at the Institute of Sociology of the National Academy of Science in Ukraine.

4. Results

The most important indicators of child potential and child health are: birth rate, infant and child mortality rates, level and structure of child morbidity and the disability rate among children.

The birth rate in Lviv city was 10.8 % in 2014. In comparison, in the Lviv region it was 11.9%, and in Kyiv city – 11.2%. Compared with the birth rate in 2004, it has increased by 13% (Fig. 3). According to the evaluation criteria of basic demographics, fertility is "low" (less than 15 per 1,000 population) (SOCIALNI INDYKATORY, 2015; STATYSTYČNYJ ŠČORIČNYK LVIVS'KOJI OBLASTI, 2016). The mortality rate was 11.1% (compared with Ukraine – 14.5, in Lviv region – 2.3, in Kyiv city – 10.4%). Among the causes of death in 2014 the following diseases prevail: cardiovascular diseases (63.8%), tumours (16.6 %), external causes (5.1%) (digestive, respiratory and certain infectious and parasitic diseases). The infant mortality in Ukraine is not only much higher than in developed countries, but, has also risen in recent years. However, it is not typical for Lviv, where a tendency of reducing children's mortality under 1 year of age was traced: in 2012 it was 9.1%, while in 2014 it was 8.4%. The mortality of children under 1 year of age was mainly due to conditions arising during the perinatal period and congenital malformations, deformations, and chromosomal anomalies. While analyzing the indices of mortality rate of the child population between the ages 0-14 in the city of Lviv, one should observe the similar tendency of reducing child mortality as is the case of child mortality under 1 year of age.

In the structure of morbidity of the child population under the age of 14 in Lviv city, the following diseases are predominant: respiratory diseases – 59.8%, diseases of the eye and adnexa – 84.2%, and endocrine system diseases – 4.2% (FONDOVI MATERIALY UPRAVLINNJJA OCHORONY ZDOROV'JA, 2014).

Fig. 3. Natural movement of the population in Lviv city in 2004-2014
(source: own elaboration based on Statystychny ščoričnyk Lvivs'koji oblasti...2016)

Disability is an important indicator of the children's health along with morbidity, physical development, and medical and demographic criteria. The reasons for the child disability are fundamentally different from those of adults. The current level of medicine can save the lives of prematurely born children, children injured in childbirth and those with congenital malformations, which later become the main contingent of a child's disability. The leading causes that determine disability in a child are the severity of disease, the nature of the disease, lack of medical rehabilitation, and the early age of disease. The difference between morbidity and disability is that disability reflects not only health, but also gives an idea of the required amount of state social protection for people with complications of chronic diseases, traumas and congenital defects. In Lviv city in 2014, there were 45.2 thousand people with disabilities, including disabled children up to 18 years of age - 0.1 thousand (0.2%) were recorded.

Among the most important factors that determine health and socio-demographic situation is the national income, produced per capita and wages. In 2013, the gross regional product per capita in the Lviv region amounted to 24,937 UAH. For comparison, in Ukraine it was UAH 33,473. The revenue in Lviv in 2014 amounted to 3,087.5 million UAH (4,111 UAH per person), while expenditures were 3,057.9 million UAH (4,072 USD

per person). Of these, education accounted for 25.6%, health 15.1%, and social protection and social security 25.0%. The level of wages in Ukraine in 2014 amounted to UAH 3,195 (for comparison, in Lviv region it was 2,961, while in Ukraine – 3,480 UAH) (SOCIALNI INDYKATORY, 2015).

Another important indicator is the financial situation of households. The financial behavior of households is affected by two main factors, which can be grouped into economic and social issues. Economic factors deal with the macro-economic situation in the country in general and the real income of the household, in particular. Social issues deal with the social status of household members, the specifics of the relationship between the subjects and the objects of financial behavior, confidence in the public authorities and financial market institutions, and established household traditions of consumption and savings, etc.

According to the State Statistics Service of Ukraine, the average size of households in the Lviv region is 3.02 persons. The results of our study showed that household expenditure is quite different depending on the level of education. For example, only 6.25% of respondents with higher education can afford expenditures in the region of 10 thousand UAH for one household. Expenditure between 2 to 5 thousand UAH is the most characteristic of respondents with advanced degrees. Respondents with secondary education had an expenditure up

to 2 thousand UAH. It should be noted that the level of expenditure depends on wages, which increase relative to education level.

The number of children in each household also has a significant impact on consumer behavior.

The acquisition of expensive goods and savings for profit are not inherent in families with 4 or more children. Households without children (24.3%) can afford to purchase expensive goods (Fig. 4).

Fig. 4. The financial behavior of the households depending on the number of children, 2014
(source: own elaboration based on the survey)

Among respondents, women were most inclined to pay for food and housing and communal services (59.5% of the respondents). Males dominated (40.9%) in the purchase of tobacco products, alcoholic beverages, medicines and furniture, as well as paying for eating out, leisure services and sports. Another interesting point was the distribution of savings according to the sex of respondents. More than 50% of women (63.6%) are more economical than men. Men (64.2%) can save only 20-30% of their funds.

The analysis of money saving helps to understand the nature of financial behavior. The analysis particularly, how people govern their savings. Savings can just lie still or can create additional income through interest on deposits or rises in the cost of precious metals. One hundred percent of respondents with a higher education keep their money in foreign currency. For respondents with an academic degree (9.1%), the best way is to keep their savings in gold. Those interviewed with a vocational education do not consider gold and currency for saving money at all. For this

group (31%), the best example of savings is in a moneybox.

Consumer income can be considered as a basic element which influences his/her everyday behavior and creates opportunities to enjoy the benefits of civilization to meet their own needs. Often employee income depends on the level of his/her education. Revenue from ownership as a basic income is most characteristic for people with a higher education (78.6%). Respondents with an incomplete higher education (42.9%) consider their main type of income to be social assistance. For people with secondary education, entrepreneurial income is not considered as an income, while the main income support is from alimony (50%) (Fig. 5).

Scholarship is a basic income for those aged between 20-29 years (31.9%), while entrepreneurial income is prevalent in the age group 30-39 years (29.3%). For those aged 15-19 and 40-49 years (50%), the main type of income is alimony. People aged 60 and over (50%) see their main income in property, which can be exploited for money apart from state benefits (pensions) (Fig. 6).

Fig. 5. Household income compared to education, 2014 (source: own elaboration based on survey)

Fig. 6. Household income of different ages of the population, 2014 (source: own elaboration based on survey)

It was found that household consumer behavior depends on sex, age, presence of children in the family and education. The households in the research which had children couldn't afford expensive goods nor have savings for profit.

Another important factor in children's health in Lviv city is the environmental situation in the region. Among the vital environmental factors air, water and soil are distinguished. The problem of air pollution is quite palpable within the densely

populated, industrialized regions, which includes the city of Lviv. In 2014, the city emitted 39.4 tons of pollutants into the air, of which 35.3 tons were produced by motor vehicles (89.5%). Stationary pollution sources in 2014 produced 9.5 tons of pollutants per 1 km², 2.1 kg per one person (for comparison, in Lviv region, it was 4.6 tons and 39.5 kg, respectively). Among stationary pollution sources, the highest percentage is accounted for by thermal power complexes

(40%), which is a nationwide trend (<http://city-adm.lviv.ua/portal/for-citizen/ecology>). In 2014, the Lviv sanitary and hygienic laboratory selected 4,691 samples, of which 838 samples (18%) exceeded the MAC¹. Stationary emission sources accounted for 24.0% in Shevchenkivskyy district, 23.5% – in Zaliznychnyy, 19.7% – in Halytskyy, 16.6% Lychakivskyy, 16.2% – in Frankivskyy (DOVKILLJA, 2015). Exceeding the average dust concentration (1.23 MAC), nitrogen dioxide (1.18 MAC) and formaldehyde (1.3 MAC) in the air is connected with the emissions from mobile sources. The share of samples exceeding MAC reached 37% (the highest rate in the Lviv region). The most polluted are the city centre (Halytskyy district, intersection I. Franka – K. Levyts'koho – Kn. Romana and I. Franka – Sq. Soborna – Vynnychenka), northern (Shevchenkivskyy district, streets Chornovola – Pid Dubom) and southern (Sykhivskyy district, intersection Stryyska – Naukova – Khutorivka) parts of the city. These areas have the most intense vehicular traffic, as confirmed by our research, because they are the main entrance to the city from the highway Kyiv-Chop. Overall, at the intersections of the city there is a dangerous degree of pollution, where the multiplicity of excess MAV² mixture of substances varies between 1.16-1.94 (FONDOVI MATERIALY LVIVS'KOJI MIS'KOJI RADY, 2014).

Water quality is another crucial factor for child health. The water hardness, high iron content in the water, the great length of pipelines and their poor state (14.77% of water produced is not reaching the city), and the fact that water is taken from different water intakes, which in turn affects the water quality are among the factors that affected water quality in Lviv.

Tap water does not meet city standards for physical and chemical parameters, such as physiological standards and the usefulness of the mineral composition of drinking water, which includes calcium, magnesium, total alkalinity, potassium, sodium and salinity (www.lvivvodokanal.com.ua). The highest levels of exceedance of standards are traced in Lychakivskyy, Sykhivskyy and Shevchenkivskyy districts. Closest to the standards are the indicators in Frankivskyy district. According to the "Geotechnical Institute" research laboratory the worst quality water is from the eastern and north-eastern parts of the city, in the north-western and western parts, tap water has a slightly better quality, and the best water quality is found in the territory south of the city center

between the streets of Kulparkivska and Zelena, Luganska and Stryyska.

The studies of soil within the buffer zones and places of waste accumulation of Lviv enterprises suggest that pollutants are mainly from waste storage (landfills, sludge sites) and industrial waste, which, in turn, cause diseases within the population. The problem which worries the city is the change in the morphological structure of the municipal solid waste landfill. In particular, the use of packaging and semi-finished products in the daily life of most people has increased. This has led to an increase in the content of plastics and polymers, textiles and wood residues in solid waste. For comparison, in 2004, the main component of solid waste was food waste (40%), while in 2014 this share accounted only for 26%. In 2004, plastic and PET accounted for 3%, and in 2014 – for 13 %, due to a change in living standards. In the morphological part of industrial solid waste, the reduction of construction waste from 25% in 2004 to 19% in 2014 was found (ZVITNI MATERIALY, 2004; PRO PROGRAMU POVODŽENNJA, 2014).

The analysis of children's health in Lviv was based on the correlation model, which showed a probability of change which depended on the intensity of the environmental situation. After analyzing the prevalence of diseases in children up to 14 years of age, there were a number of contributing factors. The contributory factors included: emissions of pollutants into the atmosphere, the volume of return water discharges, and waste volumes in the designated areas. As a result, the following peculiarities were observed: an connection is found between the amount of return water discharges and diseases of the digestive system (correlation coefficient 0.452) and between the amount of harmful emissions into the atmosphere from stationary sources (0.302); a significantly lower link is found between the amount of harmful emissions into the atmosphere from all sources of pollution and the prevalence of respiratory diseases (0.214), between the amount of return water discharges and diseases of the endocrine system (0.207), and between the amount of harmful emissions into the atmosphere from mobile sources (0.184); a weak link exists between the amount of return water discharges and diseases of the genito-urinary system – 0.062, and between the amount of waste in designated areas and diseases of the circulatory system (correlation coefficient 0.025) (Fig. 7).

¹ MAC – maximum allowable concentration;

² MAV – maximum allowable value.

Fig. 7. Relationship between children's diseases and pollutants in the atmosphere, and volume of return water and waste in designated areas in the city of Lviv, 2014 (source: own elaboration)

The level of favorable living conditions in the population of Lviv city was determined by comparison to the average living conditions in Ukraine (Table 1). The indicators of living standards in the city were taken as: average monthly wages, the level of urbanization, the volume of sold services

per capita, total living space per person and the number of physicians per 10,000 inhabitants. These figures suggest that the city of Lviv is densely populated, as evidenced by the values for total living space per person. In addition, Lviv city boasts the highest average monthly wage compared to

average wages, and possesses a high purchasing power. The total index of living is calculated as the arithmetic mean of normalized indices.

When assessing the standard of living, it is important to consider the positive performance indicators and negative performance indicators (ŠTOKALO, 2009). To analyze the living standards in the city, the method of assessing the level and

quality of life of S. Kushnarev was used. Based on this technique, all parameters are considered as equivalent. For the assessment, three groups of indicators of living standards (particularly economic, social and environmental ones) were selected. As a result of the integrated assessment of these indicators, the data were obtained, which are presented in Table 2.

Table 1. Basic indicators of living standards in Lviv compared with averages in Ukraine (source: own elaboration)

Administrative units	Indexes					
	Average salary	Level of urbanization	Volume of services sold per capita	Total living space per person	Number of doctors per 10,000 inhabitants	Total figure
Lviv	1.33	1.45	2.32	0.78	1.10	1.40
Average in the region	1.24	0.88	1.21	0.91	0.50	0.95
National average	1	1	1	1	1	1

Table 2. Evaluation of living degree in Lviv (source: own elaboration)

Evaluation of living degree in terms of stimulants								
Administrative unit	Average monthly salary	Birth rate	Housing supply	Provision of medical staff	Availability of hospital beds	Library fund	Nearby cinemas	Places in clubs
Lviv	1.33	0.91	0.81	1.10	1.95	1.70	0.50	0.10
Average in the region	1.24	1.04	0.91	0.50	1.16	1.08	0.40	1.00
National average	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Evaluation of living degree in term of destimulants								
Administrative unit	Mortality rate	Unemployment rate	Incidence of alcoholism	Incidence of drug abuse	Emissions of hazardous substances into the atmosphere from stationary and mobile sources	Integral assessment		
Lviv	0.72	0.39	1.10	0.86	23.05	2.66		
Average in the region	0.85	0.94	0.93	0.53	1.04	0.89		
National average	1.00	1.00	1.00	1.00	1.00	1.00		

Among the partial indicators, the supply of hospital beds (1.95) and medical staff (1.10) to the population of Lviv should be emphasized, which helps to lower the mortality rate compared to the average mortality rate (0.72) in the country. Among other important elements of the standard of living one should mention the numbers of cinemas and club places, and the library fund. Cinema places are half and place in clubs are one

tenth of the national; averages, which has caused additional proposals from entertainment service providers (bowling, quest-room, 3,4-D technology). The library fund in Lviv is significantly higher than the average in Ukraine. The city's annually conducted Book Forum and other similar measures provide an indicator of 1.7. Although the unemployment rate is 2.5 times lower in Lviv than in Ukraine, and the average salary in Lviv is

higher than the average one, the population is characterized by a high incidence rate of alcoholism (1.10) and high enough rate of drug abuse (0.86). The city's urban transport system is causing an extremely high rate of harmful emissions into the atmosphere (23.05). From the analysis of the integrated indicators of Lviv living standards (Table 2), one should conclude that a typical indicator level/value is 2.66, which is higher than the national average.

5. Conclusions

The health and demographic potential of the child population and socio-economic and environmental determinants of its development in the city of Lviv were analyzed, in the light of statistical indicators and the use of a sociological questionnaire survey. The results of both studies indicate a potential crisis within the child population caused by a health and demographic crisis (depopulation and increase in the incidence and prevalence of diseases amongst children). An attempt to understand the links between factors affecting children's health potential (local budget expenditures on health care, the level of average nominal wages, the environmental situation in the region) and morbidity of children did not bring the expected results. This reflects the more complicated and sometimes elusive statistical links between factors and potential of children's health. The limited capacity of parents in satisfying the basic needs of households and complete lack, or limitation, of time that parents spend with children undoubtedly influences the potential of children's health in a destructive way.

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