Statistical Data Analysis of Socio-Economic and Demographic Losses of Labor Resources in Ukraine

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ABSTRACT

Regarding the fact that life, in general, and public health, in particular, form the main values for the government and the individuals as well, the relevance of this study is indisputable. This article is aimed to statistical data analysis the losses in labor and life potentials of the Ukrainian population due to some negative socio-economic and demographic processes. The object of this study is represented by the demographic processes' impact on the national economy of Ukraine. Meanwhile, the subject of the paper is related to social, economic and demographic assessment of the losses in human resources in Ukraine associated with the catastrophic cancer mortality. The initial hypothesis of this study was that the interdependencies between the losses in labor potential, considering the premature mortality of Ukrainian working-aged population, and the Gross Domestic Product fluctuations were comparable with the corresponding relations in advanced economies. Regarding the losses in Gross Domestic Product, cancer-related issues are constantly urgent for both emerging and advanced economies. The problem is actualized due to the fact that cancer mortality primarily affects an economically active population, reduces the real Gross Domestic Product per capita growth rates and the quality of life. That fact is crucial for developing markets, namely Ukrainian. In this paper, the population's demographic and economic potentials were modeled in order to estimate the losses in life and labor potentials due to the certain reduction in life expectancy and increased cancer mortality. The observed cancer-related economic losses in Ukraine actualized the macroeconomic development programs aimed to counteract the main unfavorable consequences..

INTRODUCTION

Generally, human life is invaluable and priceless according to a plenty of philosophical, ideological, and humanitarian concepts (Marks, 1844). Nevertheless, economically, human life has its own value, considering its productive capability. In Ukraine, taking the modern conditions into account, the value of life is critically reduced by the negative socio-economic, political and catastrophic demographic trends as well. A huge number of philosophers described human life as the greatest value. That position was generalized by N. Berdiaev (1933), V. Kuvakyn (1998). In Ukraine, the tendencies associated with the decrease in the value of life are explicit. The evidences are represented by the rapid increase in criminogenic situation and the level of violence, crucially declined personal and social protection and justice, expanded unemployment and labor migration, internal political conflicts, decreased fertility and increased mortality, primarily in the working-aged male stratum. M. Minakov (2016) argues that the struggle for justice, liberal entrepreneurship, vitality and social equality and simultaneous counteracting corruption, violence, and excessive paternalism have become decisive for Ukraine. The aforementioned led to constant stress conditions, depression, deterioration of the standards of living. In particular, that fact increased the cancer incidence and mortality. According to N. Amelchenko (2013), in order to achieve social justice, the economic values – similar to those that are implemented in the European Union – should be formed in Ukraine.

In economic sociology, the concept of the human life value has been highlighted. Simmel concluded that money affected the human personal values. V. Hesner and R. Kramme (2002) pointed out that both human life and death could be evaluated, using economic indicators. E. Pylypenko and Y. Batalov (2013) shared the theoretical position of economical philosophers K. Marx (1844) that utility induced a person's social value. There are lots of approaches to the value of life estimation in economic theory. But, regarding the list of values, none of the above approaches can be considered as universal and indisputable. Those approaches traditionally include calculation of the production costs, healthcare and rehabilitation expanses, insurance payments, etc. In this particular article we propose to calculate and include into the analytical bases a special element related to the losses in Gross Domestic Product (GDP) associated with the premature cancer mortality. That element is regarded as the cost of the aggregated unproduced (over the active individual lifespan) value caused by the premature cancer mortality. In our investigation we took the WHO methodology into account. Thus, the limits for working-aged population were set from 15 to 64 years (Kozlovskyi et al., 2019).

It should be specifically mentioned that the problem of cancer-related morbidity and mortality is simultaneously medical, demographic and socio-economic. Leading to an increase in the population's absenteeism level and the crucial premature working-aged population mortality, it is also associated with a decrease in labor potential and forms a threat to the national economic security. According to the group of the WHO analytics (2018), cancer was the second cause of death in the world (every sixth death in the world was due to cancer). In 2018, about 10 million people died from cancer; the economic losses from cancer-related issues in the world in 2010 were equal to 1.16 trillion US\$. Ukraine is ranked second in Europe by the cancer-related deaths. The annually population losses caused by the cancer are estimated by 22 % of the total population. According to the WHO forecast, the situation is worsening: every second person after 2030 will be diagnosed with cancer. Regarding the alternative forecast, proposed by the political institutions, by 2050, the population of Ukraine will be reduced by 36 %. It also could be totally declined in 179 years due to the natural causes or in 90 years, taking the main migration trends into account. As on the 01.01.2019, the fact that there are about 1 million patients with cancer and its consequences, including about 6 thousand children, can be considered as a complicating factor. Moreover, about 150 thousand Ukrainians are annually diagnosed with cancer (420 people per day) and approximately 70 thousand people dies from it. Khmelnitsky region Health Center (2019) points out that about 10 % of cancer-causing factors are due to the genetic predisposition, while 90 % are related to carcinogenic environmental factors and the individual lifestyle. Therefore, cancer and the re-

spective economic reduction can be prevented. For example, adhering to the basic rules of the healthy lifestyle reduces the risk of cancer by 43 %. Hence, the main public governance task is to create the effective mechanisms to prevent cancer and to reduce the economic losses from premature death as well.

1. LITERATURE REVIEW

Vojtko et al. (2009) stated that the economic costs of medical care provision for the cancer patients were about 1 billion UAH or 16.7 % of the total health-care expenses. The vast majority of the aforementioned expenditures were associated with the financial assistance and support services for the people with disabilities, premature mortality of the patients, absenteeism, the payments to the family-members of the cancer patients, etc. R. Shevchenko (2019) proved that that in Russia the annually loses due to premature deaths from cancer and its consequences were about 8.1 billion US$, while the overall economic costs, including treatment, exceed 20.0 billion US$ (more than 1.0 % of GDP). In addition, according to the numerous estimates, the premature deaths from cancer losses in advanced countries were comparable and estimated by 0.1–0.5 % of GDP.

E. Libanova (2007) approximately assessed the socio-economic losses due to the high cancer-related morbidity and mortality in the working-aged population stratum in Ukraine. In 2006, the total economic losses due to premature mortality at the age of 25–64 years amounted to 72.3 billion UAH or 13.28 % of GDP. N. Rynhach (2016) calculated the GDP-gap due to premature death in Ukraine, which was amounted to 12 billion US$. If the population from 15 to 59 years was considered, the respective losses amounted to 10 billion US$ or 6.7 % of the Ukrainian nominal GDP (Government service of statistics of Ukraine, 2017). N. Rynhach (2016) showed that due to the cancer-related premature mortality in Ukraine the annual potential life losses were equal to 4 million years, while the GDP losses amounted to 90.0 billion UAH.

In the USA and the other advanced countries, the indicator of Years of Potential Life Lost (YPLL) is used. It is represented in the national (e. g., National Center for Health Statistics, NCHS) and international databases. That statics enables to calculate YPLL results for the population up to 65 years. N. Rynhach (2016) highlighted YPLL for the selected US states. The Figure 1 represents YPLL for Utah.
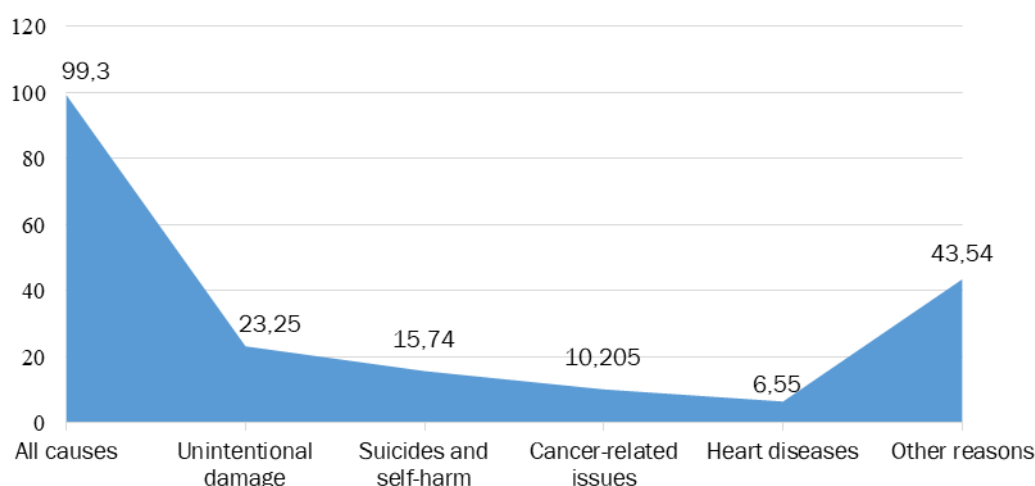

Figure 1. Years of Potential Life Lost in 2015 in Utah (USA), per 100,000 population (both genders)

Source: N. Rynhach and L. Luschyk (2018)

According to Figure 1, the largest YPLL in Utah (USA) were caused by: unintentional damage – 23.25 cases per 100 thousand population; suicide and self-harm – 15.74 cases per 100 thousand population; cancer-related issues – 10.205 cases per 100 thousand population. In fact, one in ten Utah working-aged residents annually dies. That situation leads to significant potential losses essential to the families, the state, the whole society, and the US economy as well. A huge number of domestic scholars (Libanova, 2007; Stetsenko, 2001; Pyrozhkov, 2008; Makarova, 2004; Rynhach, 2016) provided the methodologies for the estimation of Ukrainian losses in labor potential, applying some potential demographics' methods, building mortality tables, determining the duration of the working-aged population economically active life-span, the costs of their production and consumption, etc.

2. PROBLEM STATEMENT AND HYPOTHESES OF RESEARCH

2.1 Research objectives

The main objective of this research is to calculate and to model the demographic and economic potential of the population on the basis of life potential, taking the population's participation in public production into account. The losses caused by cancer-related premature mortality and the related issues both in the man-years and in terms of value. The main estimation criteria, regarding the age characteristics of the working-aged population stratum, for the losses caused by cancer-related premature mortality and the related issues include:

− years of potential life lost as a result of premature death (losses in life potential due to premature death);
− years of active life lost (losses in labor potential) – denoted by the number of man-years of lost public production as a result of premature death;
− the losses due to premature mortality in terms of value.

2.2 Purpose of the study

This paper is aimed to statistical data analysis and to evaluate the losses in labor and life potential of the Ukrainian population caused by the main negative social, economic and demographic processes.

2.3 The research hypothesis

Hypothetically, an average Ukrainian is considered to be working-aged until he reaches the age of 65 years, while in advanced countries the respective limit is denoted by 70 years or even more. The question under study is: "What are the losses in life and labor potentials (in man-years and the terms of value) caused by the premature cancer-related mortality of the working-aged population (aged 15–64)?" The data on the periods after 2017 is partly unavailable. Thus, 2017 was considered as the basis of our research. In the study we assumed that GDP should be adjusted for the shadow economy index. Consumption was accepted at the level of 75.0 %, while the shares of production and consumption in each age range were distributed similar to the survey data of O. Makarova (2004). In order to estimate the losses in labor potential we accepted the limiting age of 65 years. When GDP per capita was calculated, we regarded the working-aged population in the age range of 15–64 years.

3. METHODOLOGY

The calculation algorithm was based on the application of the potential demographics method, allowing to estimate the losses in labor and life potentials of the Ukrainian population caused by the cancer-related issues. The most important indicator in our calculations was the average life expectancy (mortality table). At the first stage of investigation, the annual economic value of an average person life expectancy in the age range from 0 to 100+ was determined (Kozlovskyi, 2010). We calculated a set of indicators, in particular: the production distribution between different age strata and its total value; the average economic value of each expected year of life per person; the total consumption, regarding the population structure; the average consumption of each expected year of life per person; the difference between production and consumption of each expected year of life.

Similar to S. Stetsenko (2005), *potential demographics method* was applied to estimate the demographic losses in:

− the total population's over 15 years old (when people usually start their working activity) life potential:

$$L_{life\_p} = d_i \cdot e_{life},\qquad(1)$$

where L_{life_p} – the losses in life potential of a particular age stratum;
d_i – the quantity of the deceased at the age of i individuals;
e_l – life expectancy at the age of i.

− the losses in labor potential due to the premature mortality (in man-years) were calculated as the difference between the actual age at the time of death and the maximum working age (that was equal to 65 years):

$$L_{labor\_p} = d_i \cdot e_{labor},\qquad(2)$$

where L_{labor_p} – the losses in labor potential of a particular age stratum;
d_i – the quantity of the deceased at the age of i individuals;
e_{labor} – labor life expectancy at the age of i (before reaching 65 years).

While calculating the losses in life and labor potentials, we applied the GDP per capita indicator, calculated as the ratio of the actual GDP (taking the shadow economy into account) to the size of the working-aged population stratum (aged 15-64).

Data collection. In the course of our study, in order to estimate both socio-economic and demographic losses in human resources due to the high level of cancer-related morbidity and mortality the official data of the State Statistics Service of Ukraine on 2017 were used. In particular, the forms "Distribution of deaths by sex and occupational groups" and "Distribution of deaths by sex, age and causes of death" (according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems – ICD–10) were involved as well as the statistical tables on life expectancy, GDP, population size and division by detailed occupation and age. The data provided by the Ministry of Economic Development, Trade and Agriculture (Kozlovskyi et al., 2017) of Ukraine (2019) on the size of the shadow economy was used in order to estimate GDP per capita.

4. STATISTICAL DATA ANALYSIS

4.1 Reliability and validity

Aiming to achieve high reliability and validity of the research, in the calculations we applied a probability statistical model. That model described the extinction process of some theoretical gen-

eration with fixed initial numbers and was based on the official statistics and calculations of the mortality table and the average life expectancy. The mortality process was characterized accurate and adequate.

4.2 Data analysis and results

According to the initial hypothesis, all the appropriate production and consumption calculations for the each year of the expected life were performed. Those calculations are presented in Table 1. While the indicators were calculated, nominal GDP was adjusted, taking the level of the shadow economy in 2017 into account. The respected shadow economy was amounted to 3908885.42 million UAH (while GDP in 2017 was equal to 2983882 million UAH) due to the data of the State Statistics Service of Ukraine (2019). According to the expert estimations of the Ministry of Economic Development, Trade and Agriculture of Ukraine (2019) in 2017, the level of the shadow economy equaled to 31 % of GDP. The main task of the above calculations was to determine the specific age when the population began to consume significantly more than produce; the economic value of the premature cancer-related mortality of the working-aged population was taken into account as well. Table 1 proved that the population of Ukraine began to consume more than produce at the age of 45–49 years. The authors made similar calculations for 2006. The empirical data proved that the analyzed age interval had shifted over the past 10 years from the range of 50–54 years (Koziuk and Dluhopolskyi, 2018). That fact poses enormous threats to the Ukrainian economy sustainability in the future. That was due to the negative demographic trends, represented by the decrease in the total population and its economically active stratum with the simultaneous increase in the share of elderly population, dangerous migration processes, and a number of phenomena in the Ukrainian economy.

Table 1. Economic value of the one year of the average person's life expectancy[1]

Age	Population, persons	Life expectancy, years	Share of production, corresponding with each age, %	Value of production corresponding with each age, mln. UAH	Total production, mln. UAH	Average value of production corresponding with the subsequent year of expected life, mln. UAH	Average value of production corresponding with the subsequent year of a person's expected life, UAH.	Share of age-specific consumption, %	Consumption corresponding with a certain age, mln. UAH	Total consumption, mln. UAH.	Average consumption corresponding with the subsequent year of expected life, mln. UAH.	Average consumption corresponding with the subsequent year of a person's expected life, UAH	Difference between the value of production and consumption corresponding with the subsequent year of expected life, mln. UAH.
0	394 626	71.98	0.00	0.00	3908963.60	54306.25	137614.47	1.62	47493.91	2931664.07	40728.87	103208.79	34405.68
1–4	1 829 449	71.52	0.00	0.00	3908963.60	54655.53	29875.41	1.62	47493.91	2884170.16	40326.76	22043.12	7832.29
5–9	2 334 380	67.62	0.00	0.00	3908963.60	57807.80	24763.66	4.483	131429.13	2836676.25	41950.26	17970.62	6793.04
10–14	1 977 081	62.68	0.00	0.00	3908963.60	62363.81	31543.38	5.674	166345.95	2705247.12	43159.65	21829.99	9713.39
15–19	1 881 631	57.75	2.111	82516.57	3826447.03	66258.82	35213.51	6.853	200910.96	2538901.18	43963.66	23364.65	11848.85
20–24	2 451 572	52.89	10.329	403748.78	3422698.25	64713.52	26396.75	8.205	240547.85	2337990.22	44204.77	18031.19	8365.55

25–29	3 212 459	48.10	12.497	488493.41	2934204.84	61002.18	18989.25	9.471	277663.46	2097442.37	43605.87	13573.99	5415.26
30–34	3 619 265	43.42	12.854	502448.13	2431756.71	56005.45	15474.26	9.5	278513.66	1819778.91	41911.08	11580.00	3894.26
35–39	3 186 012	38.87	12.682	495724.85	1936031.86	49807.87	15633.30	9.5	278513.66	1541265.26	39651.79	12445.59	3187.71
40–44	3 062 265	34.51	12.583	491855.05	1444176.81	41848.07	13665.72	9	263855.04	1262751.60	36590.89	11948.96	1716.76
45–49	**2 840 642**	**30.28**	**12.283**	**480128.40**	**964048.41**	**31837.79**	**11207.96**	**8**	**234537.82**	**998896.56**	**32988.66**	**11613.10**	**-405.14**
50–54	2 925 578	26.19	11.356	443893.03	520155.38	19860.84	6788.69	6.929	203139.07	764358.74	29185.14	9975.85	-3187.16
55–59	3 154 026	22.28	9.43	368607.90	151547.49	6801.95	2156.59	5.437	159397.76	561219.68	25189.39	7986.43	-5829.83
60–64	2 678 385	18.58	2.819	110191.48	41356.01	2225.83	831.04	4.301	126093.39	401821.91	21626.58	8074.49	-7243.45
65–69	2 269 745	15.16	1.02	39870.63	1485.38	97.98	43.17	4	117268.91	275728.52	18187.90	8013.19	-7970.02
70–74	1 299 459	12.03	0.037	1446.29	39.09	3.25	2.50	2.96	86778.99	158459.61	13172.04	10136.56	-10134.05
70–74	1 299 459	12.03	0.037	1446.29	39.09	3.25	2.50	2.96	86778.99	158459.61	13172.04	10136.56	-10134.05
75–79	1 751 144	9.21	0.001	39.09	0.00	0.00	0.00	1.534	44972.63	71680.62	7782.91	4444.47	-4444.47
80+	1 547 186	6.80	0.00	0.00	0.00	0.00	0.00	0.92	26971.85	26707.99	3927.65	2538.57	-2538.57

Note: [1] data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions.

Source: the authors' own calculations.

Using Table 1 and Table 2, considering the data on the cancer-related deaths distribution in 2017, we can determine the economic losses due to the premature death for each age stratum. Thus, Table 2 shows that the losses in production caused by all types of cancer in the age range of 15–19 years amounted to 142.35 million UAH. Considering the causes of death in the working-aged population stratum, mouth, pharynx & larynx cancers (COO–C14) was associated with the production losses amounted to 2.03 million UAH; the other types of cancer (C17, C23–24, …, D00–D48) were associated with the production losses amounted to 65.07 million UAH.

Table 2. Calculation of production and consumption losses due to premature mortality from different types of cancer and its consequences (population ages 15–64)[1]

	Causes of death, including:								
	006 Chapter II: Neoplasms COO–D48			In particular: 007 Malignant neoplasms of lip, oral cavity and pharynx C00–C14			Other types of cancer (C17, C23–24, …, D00–D48)		
Age	number of death, persons	production losses due to premature death, mln. UAH	consump-tion losses due to premature death, mln. UAH	number of death, persons	production losses due to premature death, mln. UAH	consumption losses due to premature death, mln. UAH	number of death, persons	production losses due to premature death, mln. UAH	consumption losses due to premature death, mln. UAH
15–19	70	142.35	94.45	1	2.03	1.35	32	65.07	43.18
20–24	163	227.57	155.45	4	5.58	3.81	58	80.98	55.31
25–29	286	261.23	186.73	4	3.65	2.61	81	73.98	52.89
30–34	569	382.31	286.10	17	11.42	8.55	151	101.46	75.92
35–39	1 074	652.63	519.56	31	18.84	15.00	184	111.81	89.01
40–44	1 928	909.25	795.03	135	63.67	55.67	289	136.29	119.17
45–49	3 173	1076.84	1115.77	275	93.33	96.70	428	145.25	150.50

50–54	5 667	1007.57	1480.60	465	82.68	121.49	752	133.70	196.47
55–59	9 903	475.83	1762.12	657	31.57	116.90	1 352	64.96	240.57
60–64	12 110	186.99	1816.79	672	10.38	100.82	1 548	23.90	232.24

Note: [1] data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions.

Source: the authors' own calculations.

In Table 3 the estimations of the production losses and due to the premature mortality of the population aged 15-64 from cancer and its consequences were summarized. The production losses due to premature death of 34943 working-aged individuals (population ages 15–64) amounted to 5323 million UAH, while consumption losses amounted to 8213 million UAH (see Table 3). The observed fact led to an excess of consumption over production due to premature cancer-related mortality, which amounted to 2890 million UAH.

Table 3. Estimation of generalized production losses due to cancer mortality and its consequences (population ages 15–64)[1]

Causes of death	Number of death, persons	Production losses due to premature death, mln. UAH	Consumption losses due to premature death, mln. UAH	The difference between production and consumption losses due to premature death, mln. UAH
Neoplasms (total), including:	34943	5323	8213	**-2890.00**
Malignant neoplasms of lip, oral cavity and pharynx	2261	323.15	522.90	**-199.75**
Malignant neoplasms of esophagus	920	97.96	192.96	**-95.00**
Malignant neoplasms of stomach	2837	405.32	651.00	**-245.68**
Malignant neoplasms of intestine	3573	415.83	764.96	**-349.13**
Malignant neoplasms of liver and intrahepatic bile ducts	834	116.97	190.83	**-73.86**
Malignant neoplasms of pancreas	1871	222.31	404.25	**-181.94**
Malignant neoplasms of larynx	799	91.21	171.06	**-79.85**
Malignant neoplasms of trachea, bronchus and lungs	5599	567.34	1153.52	**-586.18**
Melanoma and other malignant neoplasms of skin	573	131.84	159.46	**-27.62**
Malignant neoplasms of breast	3126	499.43	749.33	**-249.90**
Malignant neoplasms of cervix uteri	2132	459.80	578.16	**-118.36**
Malignant neoplasms of ovary	1213	208.63	299.61	**-90.98**
Malignant neoplasms of prostate	709	41.23	127.20	**-85.97**
Malignant neoplasms of bladder	519	44.09	101.61	**-57.52**
Malignant neoplasms of brain	1286	335.10	380.80	**-45.70**
Non-Hodgkin's lymphoma	585	157.29	175.59	**-18.30**
Multiple myeloma	268	25.76	54.52	**-28.76**
Leukemia	963	241.88	279.57	**-37.69**
Other causes	4875	937.41	1255.27	**-317.86**

Note: [1] data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions.
Source: the authors' own calculations.

Figure 2 represents the difference between production and consumption losses due to premature death.

The losses in life potential of the working-aged population (ages 15–64) due to cancer and its consequences, considering the types of cancer (Khmelnytsk regional center of health, 2019), were calculated in man-years (see Table 4).
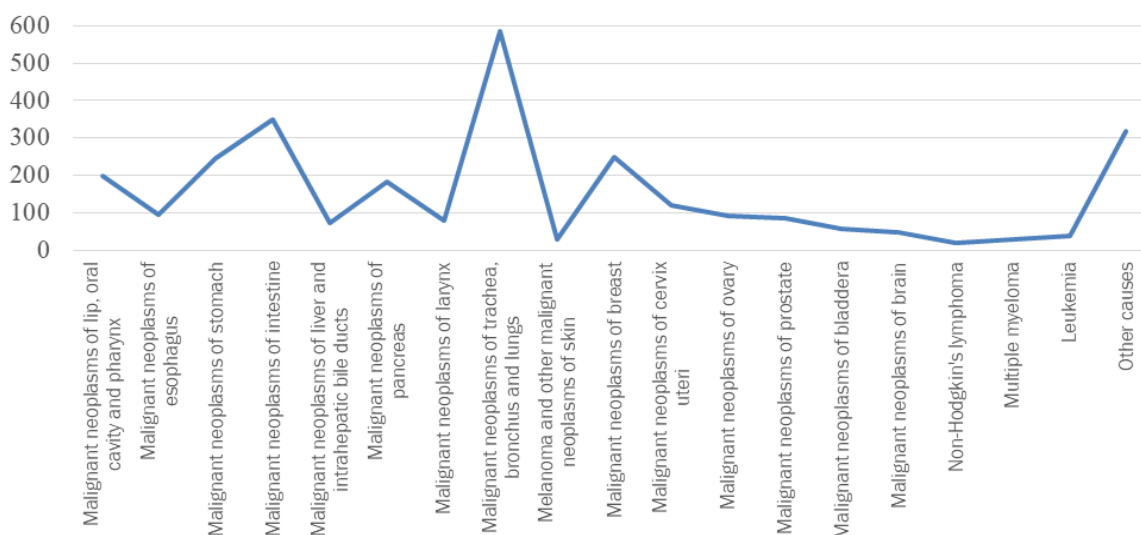

Figure 2. Difference between production and consumption losses due to premature death, mln. UAH

Source: the authors' own calculations.

Table 4. Losses in life potential of the working-aged population (ages 15–64) due to cancer and its consequences, considering the types of cancer[1]

Causes of death	Number of death, persons	Losses in life potential of the working-aged population, man-year
Neoplasms (total), including:	34943	849547.62
Malignant neoplasms of lip, oral cavity and pharynx	2261	54692.74
Malignant neoplasms of esophagus	920	21117.04
Malignant neoplasms of stomach	2837	68286.17
Malignant neoplasms of intestine	3573	82549.39
Malignant neoplasms of liver and intrahepatic bile ducts	834	19955.45
Malignant neoplasms of pancreas	1871	43641.62
Malignant neoplasms of larynx	799	18549.19
Malignant neoplasms of trachea, bronchus and lungs	5599	127126.72
Melanoma and other malignant neoplasms of skin	573	15393.83
Malignant neoplasms of breast	3126	77288.00
Malignant neoplasms of cervix uteri	2132	56561.29
Malignant neoplasms of ovary	1213	30341.31
Malignant neoplasms of prostate	709	14867.60
Malignant neoplasms of bladder	519	11479.20
Malignant neoplasms of brain	1286	35454.62
Non-Hodgkin's lymphoma	585	16215.26
Multiple myeloma	268	6023.25
Leukemia	963	25972.21
Other causes	4875	124032.73

Note: [1] data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions.

Source: the authors' own calculations.

The losses in life potential of the working-aged population a represented below (see Figure 3).

Figure 3. Losses in life potential of the working-aged population, man-year

Source: the authors' own calculations

Regarding the actual causes of the premature cancer-related mortality of the working-aged population, the greatest losses in life potential were due to malignant neoplasms of: trachea, bronchus and lungs – 127126.72 man-years, intestine – 82549.39 man-years, breast – 77288.00 man-years. The economic losses in labor potential due the premature cancer-related mortality of the population aged 15–64 years are summarized in Table 5.

Table 5. Economic losses in labor potential due the premature cancer-related mortality of the population aged 15–64

Age	Losses in labor potential, man-year	Losses in labor potential, mln. UAH
15–19	3360.00	452.71
20–24	7009.00	944.35
25–29	10868.00	1464.29
30–34	18777.00	2529.90
35–39	30072.00	4051.73
40–44	44344.00	5974.65
45–49	57114.00	7695.21
50–54	73671.00	9926.00
55–59	79224.00	10674.18
60–64	36330.00	4894.89
Total	**360769.00**	**48607.91**

Source: the authors' own calculations.

Graphically the main results of the study in terms of time (Figure 4) and in the monetary expression (Figure 5) are illustrated below.
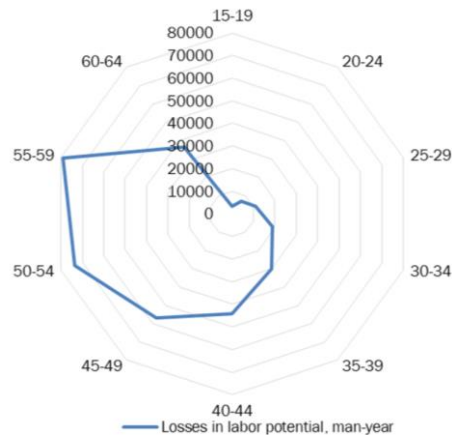

Figure 4. Losses in labor potential in terms of time, man-year
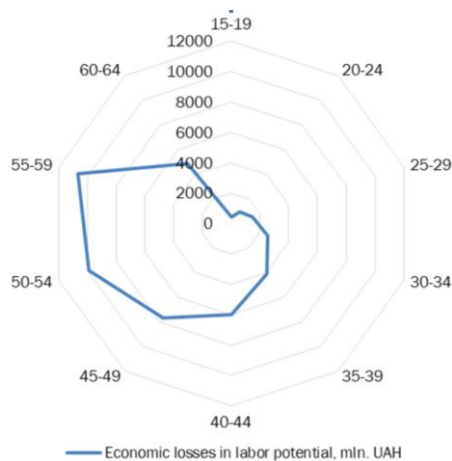
Source: the authors' own calculations.

Figure 5. Economic losses in labor potential, mln. UAH

Source: the authors' own calculations.

5. DISCUSSION

5.1 Key findings and results

In this paper, the attempt to justify the enormous losses in life and labor potentials for an individual, the family, the state and entire society due to the catastrophic depreciation in the value of life, associated with the exogenous causes, in particular cancer-related issues, was made. The observed situation significantly reduced the individual value of life and eliminated effect of investment in human capital in Ukraine. In our opinion, that was primarily due to the negative economic trends in Ukraine, such as a rapid decline in the quality of life and deep crisis in socio-economic, demographic, political and other processes. A crucial disregard in social and economic justice in Ukraine is interconnected with the high cancer morbidity and mortality from cancer. It was proved that in 90 % of cases cancer was caused by the life-stile, society and the political environment.

It was found out that the losses in labor potential of Ukrainian population (aged 15–64) due to the cancer-related premature mortality equaled to 360.8 thousand man-years or 48607.91 million UAH (1.24% of Ukrainian GDP). In general, according to various estimates of a huge number of domestic and foreign scholars (Libanova, 2007; Stetsenko, 2001; Pyrozhkov, 2008; Makarova, 2004; Rynhach, 2016), the above economic losses amounted to 0.1–0.5 % of GDP. The observed fact was confirmed by our calculations and also gave the reason to conclude that the real losses were essentially higher.

In addition, the other results can be obtained if we change the initial hypothesis. If the limit of working-age was shifted from 65 to 70 years, the cancer-related losses in labor potential would be equal to 535.5 thousand man-years or 72147.99 million UAH (1.85% of GDP). Those conclusions were made ignoring the costs of treatment, surgery, rehabilitation, medical care, social welfare benefits, absenteeism, the relatives expenses associated with the care for the sick, the cost of burial, etc. Thus, in that case, the cancer-related economic losses in Ukraine amounted to 200 % of the respective indicator in a huge number of advanced and emerging countries.

5.2 Prospects for further research

The study results' relevance is justified by the fact that the person represents the highest social value and enormous wealth of the nation. The latter is rapidly decreasing; there is a risk of unmanaged processes in our country. Due to the enormous amount of demographic and socio-economic losses in labor resources, active, young, and promising people are condemned to death of the aforementioned fatal illness instead of full realization of their immanent working potential. The disclosed situation and a crucial lack of public resources for prevention and effective cancer treatment exacerbated the other problems in the country. It undermined the confidence in social justice and the constitutional right to get qualified medical care.

Considering the availability of complete statistical information, the further research should be associated with socio-economic and demographic estimations of the labor losses due to cancer mortality and related issues, e. g., the morbidity-related losses; losses for the family as a whole and regarding dependents; consumption losses; investment losses of society for the human, social, intellectual, innovative, cultural and other types of capital's formation.

CONCLUSION

The study's results are summarized in the next statements:

- it is advisable to use the potential demographics method to statistical data analysis the socio-economic and demographic losses in labor resources in Ukraine;
- using the statistical analysis methods, it was revealed that there was an imbalance between the production and consumption losses in the age ranged of 45–49 years. The tendency of the above indicator to the deterioration over the past ten years proved that an average citizen started to consume more than produce ten years earlier (regarding the advanced economies);
- the developed probability statistical model allowed to establish that premature retirement limits of Ukrainian labor potential, occurred because of the high morbidity and mortality levels. It was proved that the greatest imbalance between production and consumption losses was recorded due to the above reason;
- based on the statistical data analysis, it was determined that the losses in life potential from the cancer-related issues in the population stratum aged 15–64 years amounted to 0.85 million man-years; due to the disposal of labor resources, the loss in labor potential amounted to 0.361 million man-years (which was amounted to 48.6 billion UAH);

− the hypothesis that economic losses due to a high incidence of such exogenous causes as neo-plasms equaled to 1.24 % of GDP, while in the advanced countries the respective expenses were ranged from 0.1 to 0.5 % of GDP;

− the projected losses in Ukrainian economy due to premature losses in labor potential were amounted to 0.54 million man-years and 0.721 billion UAH, which equaled to 1.85 % of GDP;

− based on the statistical data analysis it was proved that, at the present stage of the Ukrainian economy's development, it would be necessary to take immediate and productive measures aimed to create an effective organizational and economic mechanism of the human capital self-preservation.

REFERENCES

Amelchenko, N. (2013), *Review. Values of incorporated Europe*, https://parlament.org.ua/upload/docs/European_Values.pdf

Berdiaev, N. A. (1933), "About social philosophy of personality", *Novyj Hrad*, Vol. 7, pp. 44-60.

Government service of statistics of Ukraine. A gross domestic product is for 2017, http://www.ukrstat. gov.ua/ (In Ukrainian).

Governmental portal. The level of shadow economy in Ukraine in 2017 diminished on 4 percent points, avaible at: https://www.kmu.gov.ua/ua/news/riven-tinovoyi-ekonomiki-v-ukrayini-v-2017-roci-zmenshivsya-na-4-vidsotkovi-punkti-minekonomrozvitku (in Ukrainian).

Government service of statistics of Ukraine. Statistical annual of Ukraine is for 2017, https:// ukr-stat. org/uk/druk/ publicat/kat_u/2018/zb/11/zb_seu2017_u.pdf (in Ukrainian).

Government service of statistics of Ukraine. Distribution of the dead for the article, by the age-related groups and reasons of death, http://database.ukrcensus.gov.ua/ Mult/Dialog/varval.asp?ma=000_0308&path=../Database/Population/03/02/&lang=1 (in Ukrainian).

Hesner, V., Kramme, R. (2002), *Aspects of money culture. New works on «Philosophy of money» of George Zymmelia*, Edyts'on, Mahdeburh.

Koziuk, V., Dluhopolskyi, O. (2018), "Resource curse: The role of weak institutions and cronysec-tors", *Ideology and Politics Journal*, Vol. 1, No. 9. pp. 68-104.

Kozlovskyi, S., Khadzhynov, I., Lavrov, R., Skydan, O., Ivanyuta, N., Varshavska, N. (2019), "Eco-nomic-mathematical modeling and forecasting of competitiveness level of agricultural sector of Ukraine by means of theory of fuzzy sets under conditions of integration into European mar-ket", *International Journal of Recent Technology and Engineering*, Vol. 8, pp. 5316-5323. http://dx.doi.org/10.35940/ijrte.D7541.118419

Kozlovskyi, S. V. (2010), "Economic policy as a basic element for the mechanism of managing de-velopment factors in contemporary economic systems", *Actual Problems of Economics*, Vol. 1(103), pp. 13-20.

Kozlovskyi, S., Khadzhynov, I., Vlasenko, I., Marynchak, L. (2017), "Managing the sustainability of economic system as the basis of investment development in Ukraine", *Investment Manage-ment and Financial Innovations*, Vol. 14(4), pp. 50-59. https://doi.org/10.21511/ im-fi.14(4).2017.06

Kuvakyn, V.A. (1998), *Your paradise and hell: Humaneness and inhumanity of man* (*Philosophy, psychology and thinking style*), Aletejia, Moskow.

Khmelnytsk regional center of health. on February, 4, 2019 is the World day of fight against a chasse, avaible at: https://www.adm-km.gov.ua/?p=51452 (In Ukrainian).

Libanova, E.M. (2007), *Death rate of population of Ukraine in capable of working age*, In-t dem-ohrafii ta sotsialnykh doslidzhen NAN Ukrainy, Kyiv (in Ukrainian).

Marks, K. (1844), *Economic-philosophical manuscripts,* http://www.souz.info/library/marx/1844works.htm

Makarova, O.V. (2004), *Government social programs: theoretical aspects, methodology of devel-opment and estimation*, In-t demohrafii ta sotsialnykh doslidzhen NAN Ukrainy, Kyiv.

Minakov, M. (2016), Post-soviet social experiments: Ukraine and her neighbours in 1990 and at the beginning of 2000th, avaible at: https://www.lvivcenter.org /uk/chronicle/news/2159-16-12-03-mykhailo-minakov-lecture, Accessed: 2016, in Ukrainian.

Pylypenko, E.V., Batalov, Y.V. (2013), *An evolution of concept is «riches»: from Aristotle to the economy of knowledge*, available at: https://cyberleninka.ru/article/ n/evolyutsiya-ponyatiya-bogatstvo-ot-aristotelya-do-ekonomiki-znaniy (In Russian).

Pyrozhkov, S.I. (2008), *Demographic and labour potential*, Chosen scientific works, Kyivskyj natsionalnyj torhovelno-ekonomichnyj universytet, Kyiv (in Ukrainian).

Rynhach, N.O. (2016), "An economic equivalent of losses is through a premature death rate in Ukraine", *Demography and Social Economy*, Vol. 2, pp. 39-49 (in Ukrainian).

Rynhach, N.A., Luschyk, L. V. (2018), "Regional features of losses of years of potential life through a premature death rate from principal reasons in Ukraine", *Demography and social economy*, Vol. 3, pp. 39-55 (in Ukrainian).

Shevchenko, R.(2019), *Experts estimate the economic losses of Russia from a chasse in 20 milliards of dollars*, https://medvestnik.ru/ content/news/Eksperty-ocenivaut-ekonomicheskie-poteri-Rossii-ot-raka-v-20-mlrd-dollarov.html (In Russian).

Stetsenko, V.S. (2001), *A demographic crisis is in Ukraine. Research problems, sources, constituents, directions of counteraction*, In-t ekonomiky NAN Ukrainy, Kyiv.

Stetsenko, S.H. (2005), *Demographic statistics : is a textbook*, Vyscha shkola, Kyiv.

The economic effect of chasse is considerable, and he increases. A general annual economic damage from a chasse in 2010 is estimated approximately in a 1,16 trillion of dollars of the USA, https://www.who.int/ru/news-room/fact-sheets/detail/cancer

Ukraine on the second place in Europe after the amount of deaths from a chasse, https:// 24tv.ua/health/ukrayina_na_drugomu_mistsi_u_yevropi_za_kilkistyu_smertey_vid_raku__vooz_n980342

Vojtko, O.V., Omelchuk, S.T., Ostapchuk, Y.M. (2009), "Influence of separate anthropogenic factors on morbidity of population of Ukraine on a cancer lungs", *Oncology*, Vol. 4, pp. 257-262. http://dspace.nbuv.gov.ua/handle/ 123456789/19751 (in Ukrainian).