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Monitoring and Assessment of Human Health and Medical Care in Ukraine

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Abstract.
The article an assessment of the integrated index of health and medical care of the population of the European Union and the population of other countries according to the UN (2019) and a description of the main factors that affect this indicator. Theoretical and practical analysis of the definition of the integrated index of health and medical care of doctors, nurses and beds of Ukraine in 2010, 2017 years. We have been developing a methodology for calculating the human health index (HDI) based on mortality, disability, and morbidity indicators for an objective assessment of the health status of the population of Ukraine.

Keywords: human development index, health care, health, doctors, paramedics.

Problem statement.

The Human Development Index (HDI) is a final indicator calculated annually for each country and conducted in an interstate comparison, which includes three main areas of human development: healthy life expectancy (longevity), literacy rate (number of years spent studying), the standard of living (purchasing power parity (PPS)), gross domestic product (GDP) per capita in US dollars). The best HDI should be closer to one and be high> 0.8, medium 0.5-0.8, and low <0.5. So it is better to compare this figure among all countries [9,14].

The HDI has been published in the UN Annual Report since 1990 and demonstrate how the health status of each country differs from other countries in the world depending on socio-economic development, level of vocational education and enrollment, mortality, and more. In 2010, the method of calculating the HDI was changed and updated to new requirements. Consequently, the duration of a healthy life began to be estimated by the number of years that a newborn can live in a given country, in terms of life expectancy, which will depend on the level and development of pharmacy. As for the level of literacy and level of education of young people in education, it depends on the number of years of study of the population aged 26 and older throughout their lives. The standard of living added: the level of inequality (infant mortality, quality of food), gender (birth rate, maternal mortality, adolescent births), as well as the number of harmful substances released into the air per capita and the population. in general. It is especially true today in Ukraine, as today the unsatisfactory environmental situation (water, air, soil) worsens the living conditions of the population of Ukraine in some industrial regions, as well as agricultural areas that use large amounts of pesticides to control pests, still at the same time, it is harmful to human health. Toxic pesticides accumulate in the human body, can be a risk of many acute and chronic diseases. According to statistics in Ukraine - 86% of deaths are chronic non-communicable diseases (CHD). According to the WHO, Ukraine ranked 103rd (2015) among 183 countries concerning average life expectancy (LLL). Compared to EU countries, the population of Ukraine lives ten years less [6,13].

According to UN statistics (2019), Ukraine ranked 88th among 189 countries in the HDI. For example, in Norway, where the HDI is highest at 0.954, life expectancy is over 82.3 years, and the country's average population is almost 18.1 years. However, in Ukraine, the lifetime is 72.0 years, and the average study rate is

15.1 years. HDI in Ukraine in 2019 reached - 0.750 with an average value in European countries - 0.757, but also lower than - 0.77, which was in Central Asia. In China, life expectancy exceeds all countries and is 84.7 years, and the lowest is in Fiji (322 islands of Melanesia) - 67.3 years [2,4,9].

In terms of standard of living (GDP) per capita, the highest rate in Norway is 68.1 US dollars, and in Ukraine, it is equal to 7.99, while it is at the same level as in the country of Jamaica (North American island nation), where the HDI is 0, 72 and, which is in 96th place and the standard of living is 7.93 US dollars per capita, and the lowest standard of living in Cuba is 7.8 US dollars, but the HDI - 0.78 is in 72nd place among 189 countries. Of all these indicators, Ukraine is in the worst position among 189 countries and European countries [2,9].

The purpose of the study. is to monitor and analyze the integrated health index in health care of the population of Ukraine in 2010 in full in the Autonomous Republic of Crimea, Sevastopol and Donetsk and Luhansk regions, as well as in 2017 without data in the Autonomous Republic of Crimea, Donetsk, and Luhansk regions. Assess the state of human health in the quality of medical care in Ukraine after the reform of medicine.

Materials and methods of research. The material of the study was the Demographic Yearbook "Population of Ukraine for 2010 and 2017", "Statistical Handbook of the Ministry of Health of Ukraine for 2010", Statistical Collection for 2017, Annual Report on Public Health, Sanitary and Epidemic Situation and results of the health care system of Ukraine for 2010 and 2017 The content analysis of domestic and foreign scientific sources, as well as biblio-semantic (for analysis of the use of legal regulation), theoretical (retrospective use of research data based on scientific literature, electronic resources) and analytical research methods were used.

Results / discussion.

The Human Development Index (HDI) in Ukraine during the years of independence increased by 6.3% from 0.705 to 0.750, but in the period from 1995-2015. the growth rate of the consolidated health budget expenditures to the runway of the total amount of outlay decreased by 25.0%, while in the European states, health expenditures increased to 10.04% (2014). Unfortunately, the incidence and prevalence of diseases in Ukraine increased with a catastrophic decrease in the number of doctors of all specialties by 18.1% (1990-2018) per 10 thousand population and nurses by 43.2% (1990-2018). g.) per 10 thousand population; the number of health care facilities decreased - by 56.4% and the number of hospital beds - by 56.9% (compared to 1990-2018 per 10 thousand population), but the material and technical base were not updated as it is carried out today during the pandemic COVID-19 [11,12].

In medical statistics, the individual health index has existed for a long time, and the indicators that have developing reflect different health conditions of the population. In different comparison groups, it can be high, the mortality rate with low disability or morbidity, and vice versa, mortality can be low, and disability or morbidity is high, which creates biased conclusions about the health status of the population being compared.

We have developed a methodology for calculating the human health index (HHI) based on mortality, disability, and morbidity indicators for an objective assessment of the health for 2010 and 2017. in the context of all regions of Ukraine.

HHI is a prototype created by analogy with the method of calculating the human development index (HDI) [3,9].

For each health indicator, individual indices have been calculating according to the following formula:

$$Iind = \frac{\text{Actual value P} - \text{minimum value } P_1}{\text{Maximum value } P_2 - \text{minimum value } P_1} \quad (1)$$

where P – actual health indicator; P_1 i P_2 – fixed minimum and maximum health indicators.

At our initiative, based on these individual indices (indicators) of health, a generalized (integrated) index of human health have been calculating, assigning to each of the measures a coefficient of weight (significance, price) of individual indicators in assessing the health of the population. Since death causes irreversible damage to health, we gave unreal value to the mortality rate - 0.5; disability rate - 0.3, and morbidity rate - 0.2, and in total these, ratios should not exceed 1.

Determination of the proposed weighted index of human health is carried out according to the formula:

$$HHI_{wi} = \sqrt{C_c I_c^{\,2} + C_i I_i^{\,2} + C_3 I_3^{\,2}}, \quad (2)$$

where HHI_{wi} – the human health index is weighted;

C_c C_i C_3 – the coefficient of the weight of health indicators;

I_c I_i I_3 – individual indices of health indicators.

Table 1 provides data for the calculation of complex HHI in terms of regions of Ukraine in 2010, and Table 2 provides data for 2017 [1,5,7,8].

Table 1: The results of the calculation of the human health index in Ukraine in terms of individual regions of Ukraine, 2010

№	Regions	Primary morbidity		Mortality		Primary disability		Weighted human health index HHI_{wi}
		Indicator, ‰	Index I_3	Indicator, ‰	Index I_c	Indicator, ‰	Index I_i	
1		2	3	4	5	6	7	8
1	Autonomous Republic of Crimea	545	0,193	145	0,329	45	0,500	0,369
2	Vinnytsia	865	0,964	161	0,524	54	0,800	0,718
3	Volyn	775	0,747	139	0,244	46	0,533	0,565
4	Dnipropetrovsk	821	0,858	163	0,549	42	0,400	0,588
5	Donetsk	635	0,410	166	0,585	45	0,500	0,529
6	Zhytomyr	643	0,429	166	0,585	51	0,700	0,596
7	Zakarpattia	673	0,501	120	0,024	45	0,500	0,354
8	Zaporizhzhia	582	0,282	158	0,488	48	0,600	0,493
9	Ivano-Frankivsk	862	0,957	127	0,110	42	0,400	0,487
10	Kyiv	719	0,612	165	0,573	45	0,500	0,560
11	Kirovohrad	567	0,246	174	0,683	45	0,500	0,566
12	Luhansk	563	0,236	169	0,622	45	0,500	0,529
13	Lviv	841	0,906	128	0,112	53	0,767	0,590
14	Mykolaiv	570	0,253	158	0,488	51	0,700	0,528
15	Odesa	705	0,578	151	0,402	49	0,633	0,517
16	Poltava	587	0,294	179	0,695	47	0,567	0,596
17	Rivne	785	0,771	130	0,146	49	0,633	0,500
18	Sumy	511	0,111	173	0,671	39	0,300	0,505
19	Ternopil	661	0,472	144	0,317	46	0,533	0,424
20	Kharkiv	841	0,906	152	0,415	38	0,267	0,521
21	Kherson	639	0,419	151	0,402	42	0,400	0,405
22	Khmelnytsk	666	0,484	157	0,476	51	0,700	0,554
23	Cherkasy	788	0,778	169	0,622	53	0,767	0,701
24	Chernivts	763	0,573	130	0,146	45	0,500	0,389
25	Chernihiv	735	0,651	196	0,951	56	0,867	0,873
Fixed indicators:								
Minimal		465	-	118	-	30	-	-
Maximum		880	-	200	-	60	-	-
Their difference		415	-	82	-	30	-	-
Weight factor (C)		0,2	-	0,5	-	0,3	-	-

Table 2: The results of the calculation of the human health index in Ukraine in terms of 22 regions of Ukraine, except for the Autonomous Republic of Crimea, Donetsk, Luhansk regions, 2017

№	Regions	Primary morbidity, ‰		Mortality, ‰		Primary disability, ‰		Weighted human health
		Indicator	Index	Indicator,	Index	Indicat-	Index	

		, ‰	I_3	‰	I_c	or, ‰	I_i	index HHI_{wi}
1		2	3	4	5	6	7	8
1	Autonomous Republic of Crimea	-	-	-	-	-	-	-
2	Vinnytsia	651	0,377	241	0,705	50	0,500	0,593
3	Volyn	685	0,46	135	0,175	41	0,275	0,284
4	Dnipropetrovsk	891	0,977	165	0,325	38	0,200	0,506
5	Donetsk	-	-	-	-	-	-	-
6	Zhytomyr	641	0,352	200	0,500	43	0,325	0,426
7	Zakarpattia	588	0,220	150	0,250	39	0,225	0,237
8	Zaporizhzhia	587	0,217	277	0,885	50	0,500	0,690
9	Ivano-Frankivsk	848	0,870	173	0,365	42	0,300	0,495
10	Kyiv	769	0,672	274	0,890	45	0,375	0,727
11	Kirovohrad	641	0,352	156	0,280	42	0,300	0,302
12	Luhansk	-	-	-	-	-	-	-
13	Lviv	770	0,675	128	0,140	62	0,800	0,541
14	Mykolaiv	663	0,407	170	0,350	44	0,350	0,362
15	Odesa	682	0,455	141	0,205	42	0,300	0,299
16	Poltava	547	0,117	234	0,670	46	0,400	0,525
17	Rivne	753	0,632	147	0,235	41	0,275	0,361
18	Sumy	532	0,080	176	0,380	37	0,175	0,287
19	Ternopil	687	0,467	148	0,240	42	0,300	0,315
20	Kharkiv	664	0,410	157	0,285	36	0,150	0,285
21	Kherson	541	0,102	159	0,295	37	0,175	0,340
22	Khmelnytsk	639	0,347	196	0,480	49	0,475	0,455
23	Cherkasy	651	0,377	200	0,500	35	0,125	0,398
24	Chernivts	633	0,332	112	0,060	39	0,225	0,198
25	Chernihiv	730	0,575	189	0,445	45	0,375	0,455
Fixed indicators:								
Minimal		500	-	100	-	30	-	-
Maximum		900	-	300	-	70	-	-
Their difference		400	-	200	-	40	-	-
Weight factor (C)		0,2	-	0,5	-	0,3	-	-

From Table №1 in 2010 in terms of all regions of Ukraine HHI has been the worst in the Vinnytsia region - 0.718 and in 2017 - 0.593, but for seven years we see an improvement due to a decrease in enterprises that

were negative environmental and economic factors in the region. At the same time, the best indicator of ILS in 2010 has been registering in the Zakarpattia region - 0.354 and 2017 - 0.237, and it tends to improve. From Table №2 for 2017, the generalized weighted index of human health has been different in individual oblasts without the Autonomous Republic of Crimea, Donetsk, and Luhansk oblasts. Thus, it is the smallest registered in the Chernivtsi region - 0.198 and 2010 - 0.389, but in seven years it has been doubling. We note the largest ILS in the Kyiv region - 0.727 and 2010 - 0.560. It should be borne in mind that the lower the human health index, the better the level of health of the population, and the higher it is, the worse the health should be considered as we see in the Kyiv region.

But the question arises as to which indicators should be considered low, medium, and high. We solved this question using the sigma method of evaluation. It has been knowing that within $X \pm 1\delta$ lies 68% of the frequencies, which are considered average values. Values smaller than $X-1\delta$ are considered low and values greater than $X + 1\delta$ are considered high values [3].

Calculating the average value of the index according to the table №3 and №4 its δ, which were - 0.408 and 0.147, we obtain that the average values of the index have been in the range of 0.408 ± 0.147, ie from 0.261 (2010 - 0.424) to 0.555 (2010 - 0.650). Values below 0.261 are considered low, and a value greater than 0.555 has been observing as high human health indices.

From Tables №3 and №4, we grouped the regions of Ukraine into oblasts with good ILS, which was less than 0.261 (2010 - 0.424), satisfactory ILS from 0.262 to 0.555 (2010 - 0.425-0.650) and unsatisfactory HHI greater than 0.555 (2010 - more than 0.650) health status, respectively.

In Tables №3 and №4, we disaggregate data on the proportion of the population aged 65 and over as one of the main risk factors for health and data on the level of medical care provided to the citizen by groups of regions. But these factors are given as an example per capita medical professional can, at its discretion, on this principle to study other factors that may affect the ILS in their region.

Table 3: Distribution of oblasts of Ukraine according to the state of health of the population and the size of ILS and data on the share of the elderly and the level of provision of medical care to the population, 2010 (per 100 thousand population)

Level of health and area	Human health index	Percentage of the total population of persons aged 65 and older	Security of the population		
			Doctors, per 100 thousand population	Paramedics, per 100 thousand population	Beds, on 100 thousand population
1	2	3	4	5	6
I. **Good health (0,424 i <)**					
1. Autonomous Republic of Crimea	0,369	24,5	52,3	102,9	88,0
2. Zakarpattia	0,354	19,1	42,0	92,2	80,7
3. Ternopil	0,424	23,8	52,1	112,4	91,1
4. Kherson	0,405	23,8	35,7	95,5	102,2
5. Chernivtsi	0,389	22,1	62,0	105,4	89,5
Total	1,941	113,3	244,1	508,4	451,5
In average	0,388	22,7	48,8	101,7	90,3
II. Satisfactory health (0,425-0,650)					
1. Donetsk	0,529	27,0	44,7	94,0	87,1
2. Zaporizhzhia	0,493	25,8	47,9	100,6	92,8
3. Ivano-Frankivsk	0,487	21,8	59,5	109,9	90,6
4. Luhansk	0,529	26,6	43,8	98,9	105,3

5. Mykolaiv	0,528	24,2	36,8	85,3	85,9
6. Odesa	0,517	23,6	49,0	94,4	94,1
7. Rivne	0,500	19,9	41,6	115,7	91,3
8. Sumy	0,505	26,8	39,6	109,7	96,7
9. Kharkiv	0,499	25,4	58,0	96,4	92,0
10. Volyn	0,565	20,8	38,7	109,1	83,3
11. Dnipropetrovsk	0,588	25,2	49,2	96,6	106,0
12. Zhytomyr	0,596	25,0	38,9	112,1	79,6
13. Kyiv	0,560	24,6	42,2	93,6	87,8
14. Kirovohrad	0,566	26,8	36,2	106,0	97,5
15. Lviv	0,590	22,4	59,5	112,8	97,9
16. Poltava	0,596	26,8	48,9	102,5	90,6
17. Khmelnytsk	0,554	25,7	42,3	107,2	92,8
Total	9,192	418,4	776,8	1744,8	1570,9
In average	0,541	24,6	45,7	102,6	92,4
III. Notsatisfactory health (ІЛІЗ >0,650)					
1. Vinnytsia	0,718	26,3	49,5	107,7	87,8
2. Cherkasy	0,701	27,4	39,0	105,5	89,3
3. Chernihiv	0,873	29,1	37,3	112,4	115,5
Total	2,292	82,8	125,8	326,0	292,6
In average	0,764	27,6	41,1	108,7	97,5
Reliability factor F	53,2	4,97	0,70	1,01	0,73
p	<0,01	<0,05	>0,05	>0,05	>0,05

Table 4: Distribution of oblasts of Ukraine according to the state of health of the population and the size of ILS and data on the fate of the elderly and the level of provision of medical care to the population, except for the Autonomous Republic of Crimea, Donetsk, Luhansk oblasts, 2017 (per 100 thousand population)

Level of health and area	Human health index	Percentage of the total population of persons aged 65 and older	Security of the population		
			Doctors, per 100 thousand population	Paramedics, per 100 thousand population	Beds, on 100 thousand population
1	2	3	4	5	6
I. **Good health (ІЛІЗ <0,261)**					
1. Zakarpattia	0,237	11,6	38,8	82,5	67,8
2. Kherson	0,234	15,4	36,0	84,7	76,4
3. Chernivtsi	0,198	14,0	60,1	98,7	73,2
Total	0,669	41	1349	2659	2174
In average	0,223	13,7	45,0	88,6	72,5
II**. Satisfactory health (0,262-0,555)**					
1. Volyn	0,284	12,9	38,3	100,1	70,1
2. Dnipropetrovsk	0,506	16,5	47,2	87,1	87,5
3. Zhytomyr	0,426	16,2	37,9	103,1	68,6
4. Ivano-Frankivsk	0,495	14,0	61,3	105,7	76,7

5. Kirovohrad	0,302	17,7	35,4	95,2	85,0
6. Lviv	0,541	14,5	55,5	101,2	83,0
7. Mykolaiv	0,362	15,8	33,9	75,9	70,6
8. Odesa	0,299	15,2	47,1	83,5	77,9
9. Poltava	0,525	17,5	48,7	95,5	79,2
10. Rivne	0,361	12,4	41,5	104,4	73,8
11. Sumy	0,287	17,5	40,8	104,2	82,0
12. Ternopil	0,315	15,4	52,7	102,9	83,2
13. Kharkiv	0,285	16,4	57,3	87,0	83,7
14. Khmelnytsk	0,455	16,7	36,0	95,9	78,7
15. Cherkasy	0,398	18,3	38,6	97,2	80,7
16. Chernivtsi	0,455	19,2	60,1	104,2	93,3
Total	6,296	256,2	732,3	1542,6	1274,0
In average	0,393	16,0	45,8	96,4	79,6
III. Notsatisfactory health (IJI3> 0,555)					
1. Vinnytsia	0,593	17,3	49,1	97,3	69,0
2. Zaporizhzhia	0,690	16,9	49,1	90,2	83,6
3. Kyiv	0,727	15,3	41,7	83,9	72,5
Total	2,01	49,5	139,9	271,4	225,1
In average	0,670	16,5	46,6	90,5	75,0
Reliability factor F	21,97	2,78	0,02	1,40	1,96
p	<0,01	0,05<p<0,1	>0,05	>0,05	>0,05

As can be seen from Table №3, the lowest human health index in 2010 has been observing in the group of oblasts with good population health, which averaged 0.388 (in 2017 - 0.223). In the group of areas with adequate health, it reaches - 0.541 (in 2017 - 0.393), and in the group with unsatisfactory health - 0.764 (in 2017 - 0.670). It means that in this category, the state of health of the population is approximately 41.2% worse than in the group of oblasts with adequate health and almost two times worse than in the group of oblasts with good health as in the Autonomous Republic of Crimea, Transcarpathian, Ternopil, Kherson, and Chernivtsi. Compared to 2017, oblasts with an adequate human health index have not changed, except for Ternopil oblast, which moved to the group with good health - 0.315. Vinnytsia region is persistently in the group with unsatisfactory health both in 2010 and in 2017 as one of the agricultural territories of Ukraine. In the group of areas with satisfactory health, the level of health of the citizen is 39.4% worse than in the group of areas with good health. This difference is statistically significant at the level of 99% confidence and more ($F = 53.2$; $p < 0.01$).

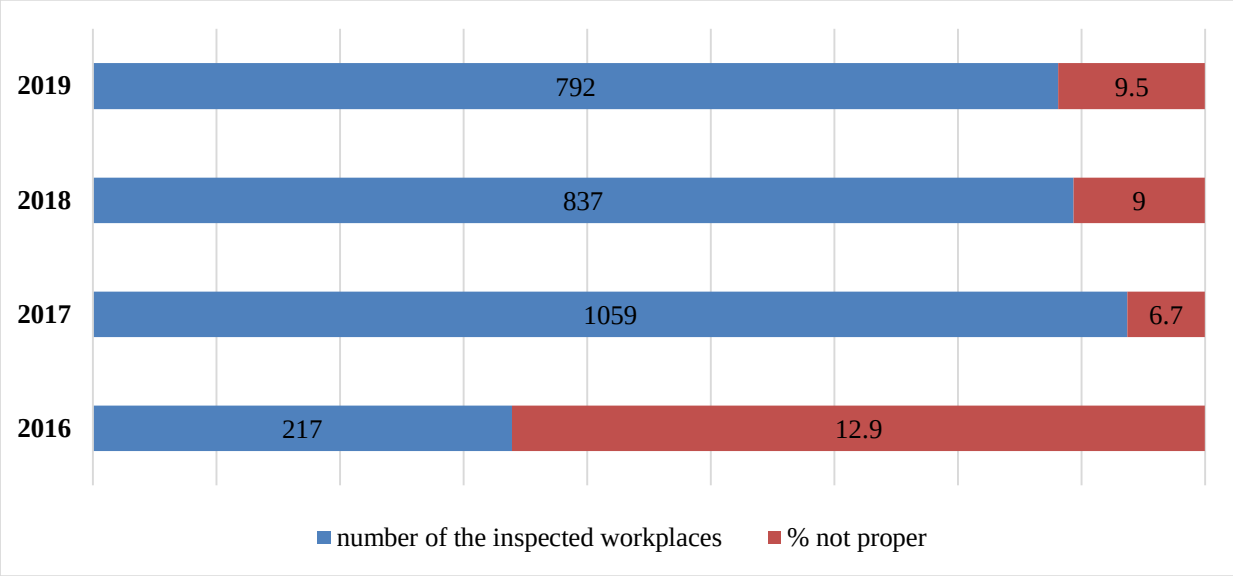
The data for 2017 from Table №4 are as follows: the lowest human health index has been observing in the group of oblasts with good population health, which averages 0.223. In the group of areas with good health, it reaches - 0.393, and in the group with unsatisfactory health - 0.670. It means that in this classification the state of health of the population is 70.0% worse than in the group of oblasts with good health and three times worse than in the group of oblasts with good health. In the group of oblasts with satisfactory health, the level of health of the population is 76.0% worse than in the group of oblasts: Zakarpattia, Kherson, Chernivtsi with good health. This difference is statistically significant at the level of 99% confidence and more ($F = 21.97$; $p < 0.01$).

From Tables №3 and №4, we observe a decrease in the number of doctors, nurses, and a reduction in hospital beds in 7 years. Thus, in the group of oblasts with good ILS in 2010, the number of doctors per 100,000 population decreased from 48.8 to 45.0; nurses from 101.7 to 88.6 per 100 thousand population and reduction of beds from 90.3 to 72.5 per 100 thousand citizens.

The internal hospital environment of health care facilities should be aiming at ensuring the optimal individual psychological condition of patients and the relevant parameters and its sanitary and hygienic characteristics. They must be in line with the latest technologies for the provision of modern qualified

medical care using a biopsychosocial approach, which will facilitate the transition to European standards [10]. Unfortunately, during the analysis in all treatment and prevention facilities for 2016-2019. Vinnytsia region microclimate parameters according to LTO 3.36.042-99 "Sanitary norms of the microclimate of industrial premises" were as follows (Fig. 1).

Fig.1: **Indicators of meteorological factors in treatment and prevention facilities of Vinnytsia region,%**



The largest share of non-compliant measurements we observed in 2016 - 12.9%, and 2017-2019. indicators have decreased due to the constant moratorium on inspections.

Changes in the parameters of the microclimate and air environment, for which the medical staff of health care facilities is responsible, have a great influence on the sanitary-hygienic and anti-epidemic regime of medical and preventive health care institutions. Creating sanitary and hygienic conditions in hospitals is the main factor in preventing nosocomial infections, optimizing the hospital environment, improving conditions in the medical work of medical staff, as well as rapid recovery of patients [10].

The share of people aged 65 and older in the group of oblasts with good health in 2017 was - 13.7 (for 2010 - 22.7), in the group of oblasts with satisfactory health - 16.0 (for 2010 - with 24.6), and with unsatisfactory health - 16.5 (for 2010 - 27.6). This difference is statistically significant at the level of 90-95% significance ($F = 2.78$; $0.05 < p < 0.1$) ($F = 4.97$; $0.05 < p < 0.1$ in 2010, respectively) .

At the same time, the indicators of the provision of the population of the above-mentioned groups of oblasts with doctors, paramedics, and beds did not differ statistically ($p > 0.05$). That is, all three groups of oblasts mentioned above had approximately the same level of medical care.

The above tables show that in areas where the health of the population is unsatisfactory, the largest proportion of the population is aged 65 and over, which is the most significant risk factor for health. Thus, the calculations showed that the integrated ILS significantly depends on people aged 65 years and older among the population, and the determined correlation coefficient reaches - 0.829 (in 2010 - 0.629) at $p < 0.01$. It means that this risk factor, according to the coefficient of determination ($d = r2x\ 100$), by 68.5% (in 2010 - 39.6%) causes a deterioration in public health in recent years.

All over the world, medicine aims to determine the degree of public health disorders and to eliminate the adverse effects of risk factors on public health. But for example, the COVID-19 pandemic, which is an uncontrolled risk factor and the effectiveness of health care in Ukraine, is not achieving the expected results due to incomplete health care reform. In Ukraine, there is no clear system for the electronic collection of information, as is the case in today's European countries during the COVID-19 pandemic for rapid response, risk identification, and other ways to overcome the effects of the pandemic. [11,12].

The proposed method of determining ILS, in our opinion, will allow at different hierarchical levels to assess the general health of the population of certain areas of the country and the rapid response of health care in these regions. It is necessary for the development of plans, measures to improve and enhance the health of both the areas and Ukraine as a whole.

Thus, we propose to calculate a comprehensive index of the provision of the citizens with medical care based on data, on the supplying of the population with hospitals, paramedics, and hospital beds. These data in terms of individual regions of Ukraine as of 2010, 2017 are given in tables №5 and №6, respectively.
To provide an overall assessment of the level of health care, we propose forming a general index of health care. Since in one area there may be a large number of doctors and a small number of nurses or beds, in another area, on the contrary, a large number of beds and a small number of nurses and doctors, we proposed assigning each indicator a weighting factor - importance their effects on the recovery of patients. The highest weight ratio has been giving to hospitals - 0.5, nurses - 0.3, and hospital beds - 0.2.

Individual and integrated indices of medical care have been calculating according to the above formulas: separate according to formula (I), and weighted (integrated) index - according to formula (2). The results of the calculation for them presenting in tables №5 and №6 (for 2010, 2017) [1,5,7,8].

Table 5: The results of the calculation of the complex weighted index of medical care of the population of Ukraine in 2010 in terms of regions

№	Regions	Security of the population, $\%_{0000}$						The index of medical care is weighted
		Doctors		Paramedics		Beds		
		Indica-Tor	I_{doc}	Indica-tor	I_{pm}	Indica-tor	I_b	
1		2	3	4	5	6	7	8
1	Autonomous Republic of Crimea	532	0,673	1029	0,538	880	0,287	0,574
2	Vinnytsia	495	0,587	1077	0,675	872	0,282	0,570
3	Volyn	387	0,257	1091	0,775	833	0,168	0,438
4	Dnipropetrovsk	492	0,578	966	0,359	1060	0,745	0,563
5	Donetsk	447	0,440	940	0,285	871	0,265	0,368
6	Zhytomyr	389	0,263	1121	0,801	796	0,740	0,580
7	Zakarpattia	420	0,358	922	0,234	807	0,102	0,287
8	Zaporizhzhia	479	0,538	1006	0,473	928	0,440	0,495
9	Ivano-Frankivsk	595	0,893	1099	0,738	906	0,357	0,766
10	Kyiv	422	0,364	936	0,273	878	0,282	0,323
11	Kirovohrad	362	0,180	1060	0,627	975	0,529	0,436
12	Luhansk	438	0,413	988	0,424	1053	0,728	0,495
13	Lviv	595	0,893	1122	0,823	979	0,539	0,812
14	Mykolaiv	368	0,199	853	0,037	859	0,234	0,176
15	Odesa	490	0,572	944	0,296	941	0,443	0,479
16	Poltava	489	0,569	1025	0,527	906	0,354	0,520
17	Rivne	416	0,345	1157	0,903	913	0,371	0,576
18	Sumy	396	0,284	1097	0,732	967	0,509	0,503
19	Ternopil	521	0,667	1124	0,809	911	0,366	0,667
20	Kharkiv	580	0,749	964	0,353	920	0,389	0,590
21	Kherson	357	0,165	955	0,328	1022	0,649	0,361
22	Khmelnytsk	423	0,367	1072	0,661	928	0,410	0,482
23	Cherkasy	390	0,266	1055	0,612	893	0,321	0,410
24	Chernivts	620	0,969	1054	0,610	895	0,326	0,776
25	Chernihiv	373	0,214	1128	0,823	1158	0,987	0,649
Fixed indicators:								
Minimal		303	-	840	-	767	-	-
Maximum		630	-	1191	-	1160	-	-

The difference	327	-	351	-	393	-	-
Coefficient C	0,5	-	0,3	-	0,2	-	-

Table 6: The results of the calculation of the comprehensive weighted index of medical care of the population of Ukraine in 2017 in terms of 22 regions of Ukraine, except the Autonomous Republic of Crimea, Donetsk, Luhansk regions

№	Regions	Security of the population, $\%_{0000}$						The index of medical care is weighted
		Doctors		Paramedics		Beds		
		Indica-tor	I_{doc}	Indica-tor	I_{pm}	Indica-tor	I_b	
1		2	3	4	5	6	7	8
1	Autonomous Republic of Crimea	-	-	-	-	-	-	-
2	Vinnytsia	491	0,477	973	0,682	690	0,225	0,513
3	Volyn	383	0,207	1001	0,752	701	0,252	0,451
4	Dnipropetrovsk	472	0,430	871	0,427	875	0,687	0,491
5	Donetsk	-	-	-	-	-	-	-
6	Zhytomyr	379	0,197	1031	0,827	686	0,215	0,483
7	Zakarpattia	388	0,220	825	0,312	678	0,199	0,247
8	Zaporizhzhia	491	0,477	902	0,505	836	0,590	0,510
9	Ivano-Frankivsk	613	0,782	1057	0,892	767	0,417	0,761
10	Kyiv	417	0,292	839	0,347	725	0,312	0,313
11	Kirovohrad	354	0,135	952	0,630	850	0,625	0,454
12	Luhansk	-	-	-	-	-	-	-
13	Lviv	555	0,637	1012	0,780	830	0,575	0,672
14	Mykolaiv	339	0,097	759	0,147	706	0,265	0,159
15	Odesa	471	0,427	835	0,337	779	0,447	0,406
16	Poltava	487	0,467	955	0,637	792	0,480	0,526
17	Rivne	415	0,287	1044	0,860	738	0,345	0,536
18	Sumy	408	0,270	1042	0,855	820	0,550	0,562
19	Ternopil	527	0,567	1029	0,822	832	0,580	0,656
20	Kharkiv	573	0,682	870	0,425	837	0,592	0,876
21	Kherson	360	0,150	847	0,367	764	0,410	0,292
22	Khmelnytsk	439	0,347	959	0,647	787	0,467	0,479
23	Cherkasy	386	0,215	972	0,680	807	0,517	0,464
24	Chernivts	601	0,752	987	0,717	732	0,330	0,677
25	Chernihiv	370	0,175	1042	0,855	933	0,832	0,611
Fixed indicators:								
Minimal		300	-	700	-	600	-	-
Maximum		700	-	1100	-	1000	-	-
The difference		400	-	400	-	400	-	-
Coefficient C		0,5	-	0,3	-	0,2	-	-

In contrast to ILS, the higher it is, the worse the health of the population, the higher the index of health care, the higher it is, the higher the health care and the lower it is, the lower the health care of the population.

From tables №5 and №6 (2010, 2017, respectively), we have been noting that out of 22 oblasts 82% for seven years there is a decrease in the index of medical care and the lowest weighted indices of medical care for 2010 have been observing in Mykolayiv, Zakarpattia and Kyiv oblasts and the largest - in Lviv, Chernivtsi, and Ivano-Frankivsk oblasts, which means that in the first group of oblasts the level of health care is the lowest, and in the second - the highest, and in 2017 the lowest weighted indices of health care have been observing in Mykolaiv, Zakarpattia and Kherson oblasts, and the highest - in Kharkiv, Ivano-Frankivsk, Chernivtsi regions, which means that in the first group of areas the level of medical care is the lowest, and in the second - the highest.

To determine the level of health care for people with different health status, as shown in tables №3-№6, our index of health care has been distributing in the same groups of areas for which the integrated index of human health. This distribution is presented in tables №7 and №8, respectively.

Table 7: Distribution of regions of Ukraine by the state of health of the population and the size of the human health index and by these groups of regions of the index of medical care of the population, 2010

Level of health and area	Human Health Index (HHI)	Medical index providing the population (MIPP)
1	2	3
I. Good health		
1. Autonomous Republic of Crimea	0,369	0,574
2. Zakarpattia	0,354	0,287
3. Ternopil	0,424	0,667
4. Kherson	0,405	0,361
5. Chernivtsi	0,389	0,776
Total	1,941	2,665
In average	0,388	0,533
II. Satisfactory health		
1. Donetsk	0,529	0,368
2. Zaporizhzhia	0,493	0,495
3. Ivano-Frankivsk	0,487	0,766
4. Luhansk	0,529	0,495
5. Mykolaiv	0,528	0,176
6. Odesa	0,517	0,479
7. Rivne	0,500	0,576
8. Sumy	0,501	0,503
9. Kharkiv	0,499	0,590
10. Volyn	0,565	0,438
11. Dnipropetrovsk	0,588	0,563
12. Zhytomyr	0,596	0,580
13. Kyiv	0,560	0,323
14. Kirovohrad	0,566	0,436
15. Lviv	0,590	0,812
16. Poltava	0,596	0,520
17. Khmelnytsk	0,554	0,482
Total	9,192	8,602
In average	0,541	0,506
III. Notsatisfactory health		
1. Vinnytsia	0,718	0,570
2. Cherkasy	0,701	0,410
3. Chernihiv	0,873	0,649

Total	2,292	1,629
In average	0,764	0,543
Reliability factor F	53,2	0,10
p	<0,01	>0,05

Table 8: Distribution of regions of Ukraine by the state of health of the population and the size of the human health index by 22 groups of areas of the index of medical support of the citizens, except the Autonomous Republic of Crimea, Donetsk, Luhansk regions, 2017

Level of health and area	Human Health Index (HHI)	Medical index providing the population (MIPP)
1	2	3
I. Good health		
1. Zakarpattia	0,237	0,247
2. Kherson	0,234	0,92
3. Chernivtsi	0,198	0,677
Total	0,669	1,216
In average	0,223	0,405
II. Satisfactory health		
1. Volyn	0,284	0,451
2. Dnipropetrovsk	0,506	0,491
3. Zhytomyr	0,426	0,483
4. Ivano-Frankivsk	0,495	0,761
5. Kirovohrad	0,302	0,454
6. Lviv	0,541	0,672
7. Mykolaiv	0,362	0,159
8. Odesa	0,299	0,406
9. Poltava	0,525	0,526
10. Rivne	0,361	0,536
11. Sumy	0,287	0,562
12. Ternopil	0,315	0,656
13. Kharkiv	0,285	0,876
14. Khmelnytsk	0,455	0,479
15. Cherkasy	0,398	0,464
16. Chernihiv	0,455	0,611
Total	6,296	8,587
In average	0,393	0,537
III. Notsatisfactory health		
1. Vinnytsia	0,593	0,513
2. Zaporizhzhia	0,690	0,510
3. Kyiv	0,727	0,313
Total	2,01	1,336
In average	0,670	0,445
Reliability factor F	21,97	1,08
p	<0,01	>0,05

To determine the level of health care for people with different health conditions, as shown in Tables 9 and 10 (in 2010, 2017, respectively), the declared index of health care is distributed in the same groups of areas in which the HHI has been spreading.

Table 9: Distribution of regions of Ukraine by the state of health of the citizen and the value of the human health index by these groups of areas of the index of medical care, 2010

№	Health level	Number of areas	Average values	
			Human health index	Index of the medical provision of the population
1		2	3	4
1	Good health	5	0,388	0,533
2	Satisfactory health	17	0,541	0,506
3	Nonsatisfactory health	3	0,764	0,543
	Criterion F	-	53,2	0,10
	p	-	<0,01	>0,05

Table 10: Distribution of regions of Ukraine according to the state of health of the population and the size of the human health index in 22 areas of the index of medical care, except for the Autonomous Republic of Crimea, Donetsk, Luhansk regions, 2017

№	Health level	Number of areas	Average values	
			Human health index	Index of the medical provision of the population
1		2	3	4
1	Good health	3	0,228	0,405
2	Satisfactory health	16	0,393	0,537
3	Nonsatisfactory health	3	0,670	0,445
	Criterion F	-	21,97	1,08
	p	-	<0,01	>0,05

As can be seen from tables №9 and №10, the average group values of the index of health care were as follows: in the group of regions with good health it was - 0.405 (in 2010 - 0.533), with good health - 0.537 (for 2010 - 0,506), with unsatisfactory health - 0,445 (2010 - 0,543). Analysis of variance showed that these values do not differ significantly between 2017 ($F = 1.08$; $p > 0.05$) and 2010 ($F = 0.10$; $p > 0.05$), respectively. It means that all population groups in areas with different levels of health have approximately the same level of medical care in its complex. The integrated index of medical care of the population repeats the results of the analysis of medical care of the population by its types. Thus, the proposed index of health care adequately reflects the reality of our data.

Conclusions.

Thus, the proposed integrated indices of human health and health care, which adequately reflect reality and are easy to apply, can be recommended for the realization of medical statistics. They can be used to compare the generalized levels of health of the citizen and its health care in terms of individual areas of Ukraine to develop plans, measures to improve and enhance the health of both their region and Ukraine as a whole.

To create appropriate in-hospital, sanitary and hygienic, psychological conditions for strengthening and speedy recovery of Ukrainian patients in health care facilities, we consider it necessary to implement European requirements for standardization of design of these facilities in Ukraine and develop amendments to the State Construction Standards Health ”on the construction of a new type of hospitals for the accessibility of the population of Ukraine and the improvement of the quality of medical care, and not only the reduction of medical staff and beds.

Future volume. It is one of the steps to improve the quality of medical services to the population of Ukraine. With the help of the Human Health Index, it is possible to assess the health of the citizen and its health care in the context of individual regions of Ukraine to develop plans, measures to improve and enhance the health of both their areas and Ukraine.

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