CHSS
University of Kent

Centre for Health Services Studies

Current Population Health Needs and Their Regional Distribution in Ukraine

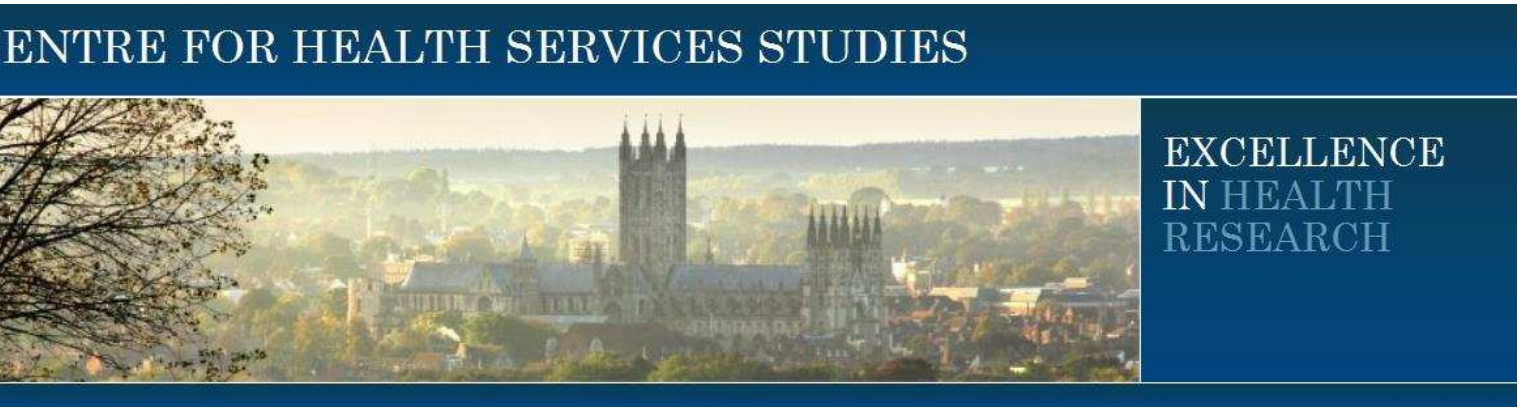
Authors

Olena Nizalova[§], Nataliia Shapoval*, Olga Nikolaieva*

[§] Centre for Health Services Studies
University of Kent

*** Kyiv Economics Institute**
Kyiv School of Economics

July 2017



Further copies can be obtained from:

Paula Loader, Librarian
Centre for Health Services Studies
George Allen Wing
University of Kent
Canterbury
Kent CT2 7NF

Tel. 01227 823940

http://www.kent.ac.uk/chss

@CHSS_Kent

Title

Current Population Health Needs and Their Regional Distribution in Ukraine

July 2017

Centre for Health Service Studies
University of Kent:

Olena Nizalova, Senior Research Fellow

Kyiv Economics Institute
Kyiv School of Economics:

Nataliia Shapoval, Research Associate

Olga Nikolaieva, Research Associate

Funded by:

Medical Research Council, Wellcome Trust, ESRC, UKAid
Project name: Feasibility Study "Effectiveness of public health system in combating severe population health crisis in Ukraine"

Place of work: Ukraine

Centre for Health Services Studies

CHSS is one of three research units of the University of Kent's School of Social Policy, Sociology and Social Research. Carrying out high quality health services research, with local, national and international professional partners, our goal is to improve the links between research, policy and practice.

The Centre draws together a wide range of research and disciplinary expertise, including health & social policy, public health & epidemiology, geriatric medicine, primary care, physiotherapy, statistical & information analysis and public engagement & involvement. CHSS supports research in the NHS in Kent and Surrey and has a programme of national and international health services research. While CHSS undertakes research in a wide range of health and health care topics, its main research programmes comprise-.

- Public health and public policy
- Integrated care
- Primary and community care
- Health psychology
- Health economics
- Palliative care

Researchers in the Centre attract funding of over £1.5 million per year from a diverse range of funders including the Department of Health, the European Commission, NHS Health Trusts, the ESRC and the MRC.

For further details about the work of the Centre or for more copies of the report please contact:

Kate Ludlow
Administrator
Centre for Health Services Studies
George Allen Wing
University of Kent
Canterbury
Kent CT2 7NF

Tel: 01227 824057

E-mail: k.ludlow@kent.ac.uk

www.kent.ac.uk/chss

Contents

Introduction

Ukraine is one of the five countries in the WHO European region with the lowest life expectancy (11 years less than in the EU) and more than 10 years' life expectancy gap between males and females (WHO 2012). The leading causes of mortality and morbidity include such conditions as CVD, stroke, COPD, cancers, HIV/AIDS. According to Ukraine's Statistical office, they cause approximately 72% of all deaths (World Bank 2009). These conditions are considered to be avoidable given the current state of medical knowledge and technology (Castelli and Nizalova 2011), but mainly require effective functioning of an integrated Public Health (PH) system, encompassing, among other things, disease prevention and health promotion.

This working paper describes briefly the situation in Ukraine in terms of population health over the past decade, starting from the analysis of the national level data on mortality and comparison of its levels and the last decade's dynamics to that in the UK, Estonia, and Russia. Further comparison is made between avoidable/non-avoidable mortality as a more appropriate measure of the effectiveness of the Public Health system. To complete the description of the situation with population health, we analyse the available information on morbidity across various conditions linked to high mortality.

Chapter 1: Mortality

Although Ukraine is geographically part of Europe, it is lagging far behind both Eastern and Western European countries, occupying second place in the world in terms of the number of deaths per thousand of population (15.72 in 2014)[1]: between South Africa (17.49) and Lesotho (14.91) while the EU average fluctuates around 10. In this section, we analyse position of Ukraine on mortality statistics as a final measure of population health, using Estonia, Russia, and the UK as comparison countries. Both Estonia and Russia share common institutional past with Ukraine and they were at the same levels in terms of mortality at the time of the Soviet Union breakout. Unlike Ukraine and Russia, Estonia is one of the three post-Soviet Baltic states which joined the EU and have shown remarkable convergence to the Western world on a number of outcomes, including health. The UK has been chosen for two reasons. First, it is one of the few developed economies with the healthcare system, which is free at the point of delivery, similar to the countries of the Former Soviet Union. Second, it has consistently been ranked among the top, and 1st in the most recent ranking, among the wealthiest countries in the world with the quality of care, access to care, and efficiency being the determining factors (Davis et al. 2014). We only focus on the most recent years available in the WHO Mortality Database (MDB)[2] starting from the period when all the considered country switch to reporting based on comparable ICD-10 coding.

Figure 1 below shows the dynamics of the crude death rate for men and women separately. As can be seen, from year 2004 Ukraine has shown more or less similar downward trend to the comparison countries, albeit at consistently higher level of mortality rates. The gap between male and female mortality is striking with the female mortality rate at the beginning of the considered period being equal to the male mortality rate at the end of the period. Only UK is showing more or less equal situation for men and women when examining the crude mortality rate.

---

[1] http://www.indexmundi.com/g/r.aspx?c=up&v=26

[2] Accessed at http://www.who.int/healthinfo/mortality_data/en/ on June 30, 2016. The analyses, interpretations and conclusions resulting from the use of the MDB are responsibility of the authors data and not the WHO, which is responsible only for the provision of the original information.

Being aware of the limitations of the comparisons based on the crude mortality rates due to the countries' differences in age and gender structure, the analysis which follows is making use of the age and gender standardization based on the European Standard Population (2013).

The comparison of crude deaths rates can actually be very misleading because of the differences in age distribution across countries, over time and between males and females. We apply the European Standard Population (ESP) 2013 developed by the Eurostat Taskforce (2013) to achieve proper comparison, using the template developed by the Office of National Statistics.[3] We also calculate the rates per 100,000 population to bring them in correspondence with the analysis that follows. Figure 2 illustrates the differences when weighted by the ESP 2013. As could be seen, the age standardised mortality rates are much higher for males than the crude mortality rates, while the difference is less dramatic for women. After standardization, there is virtually no difference in the mortality rates for women between Russia and Ukraine. However, the differences between Ukraine and the UK and Estonia have become greater. For example, in 2012, the last year when the data for all three countries is available, male mortality in Ukraine is 120% higher than that in the UK and 40% higher than in Estonia. For females, the difference is less dramatic with females likelihood of death in Ukraine being 68% higher than in the UK and 55% higher compared to Estonia. At the same time within country differences between males and females show a different pattern: the most striking difference in 2012 is observed in Estonia with males being 92% more likely to die than females, while the corresponding number is 73% for Ukraine and 32% for the UK.

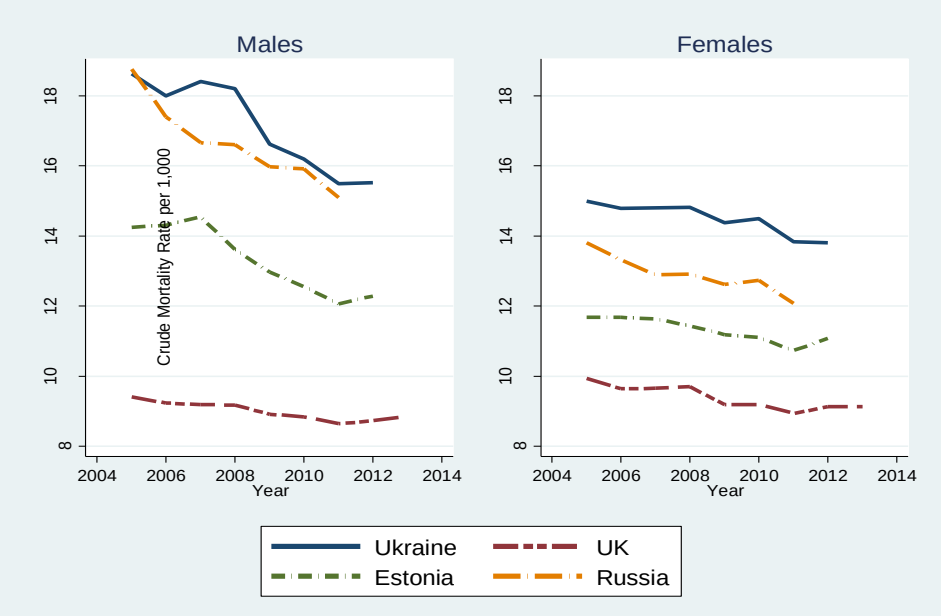


Figure 1 Crude Death Rate (per 1,000 population)

[3] Accessed online at http://www.ons.gov.uk/ons/guide-method/user-guidance/health-and-life-events/age-standardised-mortality-rate-calculation-template-2013.xls on June 30, 2016

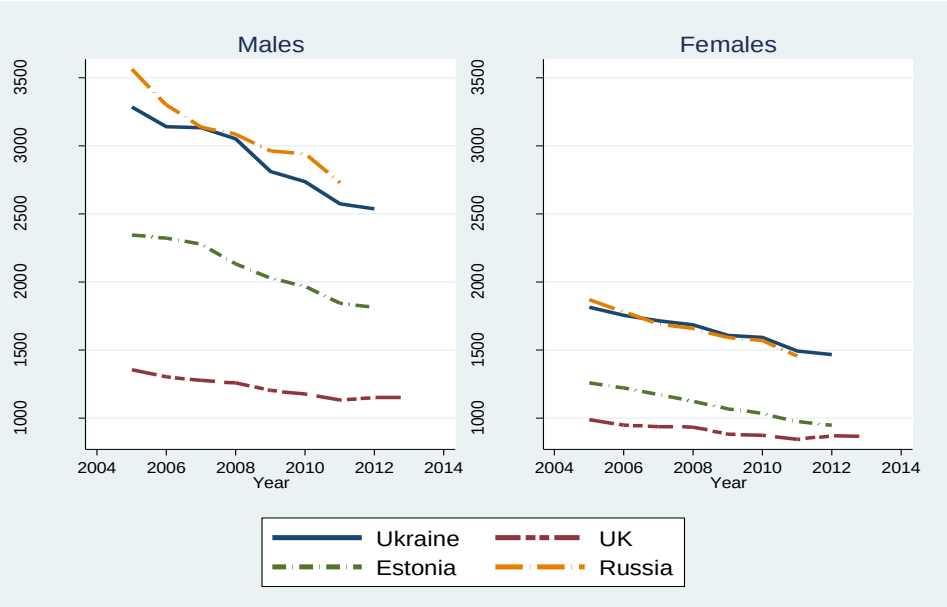


Figure 2 Age and Gender Standardized Mortality Rates (per 100,000 population)

There are a number of factors which can potentially explain such a difference in the age standardised mortality rates across countries, ranging from distant ones, such as macro-economic, ecological, socio-cultural, organization of health care system, to proximate such as health affecting behaviours, income, stressful events, hereditary risk factors, as well as the use of health care. Although ultimately any premature death can be considered as a failure of the Public Health system, it is instructive to start with the analysis of a number of causes which could have been avoided via proper and timely health care intervention or relevant public policy.

Avoidable mortality: causes of deaths that are considered amenable to both medical intervention and health policy.

Treatable causes or medical care indicators (MCI): causes of deaths amenable to medical intervention only.

Preventable causes or health policy indicators (HPI): causes of death that are amenable to health policy only.

Rutstein's et al. (1976) original list of untimely diseases, disability and death has been revised several times to take into account advances in medical care as well as to incorporate changes made to the coding of causes of deaths (ICD codes) (Charlton et al. 1983, Holland 1986, Nolte and McKee 2004). The concept was later broadened to include causes preventable not only via medical intervention but also via public policies (Page et al. 2006).

The concept of avoidable mortality refers, therefore, to all those deaths that, given current medical knowledge and technology, could be avoided by the healthcare system through either prevention and/or treatment. The remainder of deaths include those which cannot be avoided, either by the terminal nature of the disease for which there is no known cure, or due to very old age, or due to an accident for which no policy could be devised.

Avoidable mortality indicator (AM) is constructed from the WHO Mortality database death counts from specific causes per 100 thousand population. We combine the list of causes from Nolte and McKee (2004) and Page et al. (2006) (See Table A.1 in Castelli and Nizalova (2011)).

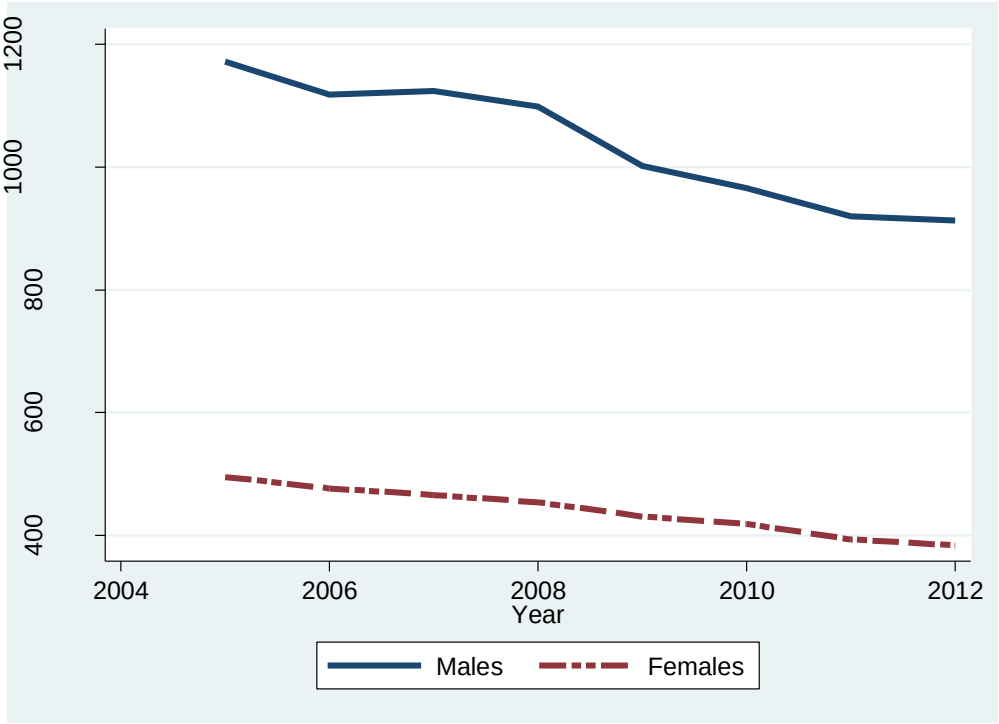


Figure 3 Avoidable Mortality in Ukraine per 100,000 population

Figure 3 shows age and gender standardised avoidable mortality rates over the considered period. As could be seen deaths which can be avoided are much smaller than the total mortality shown in Figure 2. Several observations are worth mentioning with respect to these graphs. First of all, in spite all the difficulties which the country has been experiencing, there is a clear downward trend in avoidable mortality. Second, the decline in sharper for males than for females. Finally, the gender gap in avoidable mortality in 2012 is much larger than that in total mortality: avoidable mortality is 137% for men than for women while the difference in total mortality is only 73%. This points to a significant difference in effectiveness of existing healthcare system and public health policies in improving health of men when compared to women.

To put things into perspective it is instructive to compare the ratio of avoidable mortality rates to total mortality rates in dynamics and to those in the United Kingdom, as a country which is regarded as having one of the best healthcare systems in the world. As is evident from Figure 4, Ukraine lags far behind in terms of the share of deaths due to avoidable causes in total mortality both for males and females. The share of

avoidable deaths for males in Ukraine has been quite stable, showing a slight decrease in Russia and Estonia and a significant decrease in the UK. This resulted in an increasing gap between the countries: the share of avoidable deaths among all death amounted to 33.3% among males in Ukraine while only to 15.9% in the UK (the respective numbers for females are 23% and 11%).

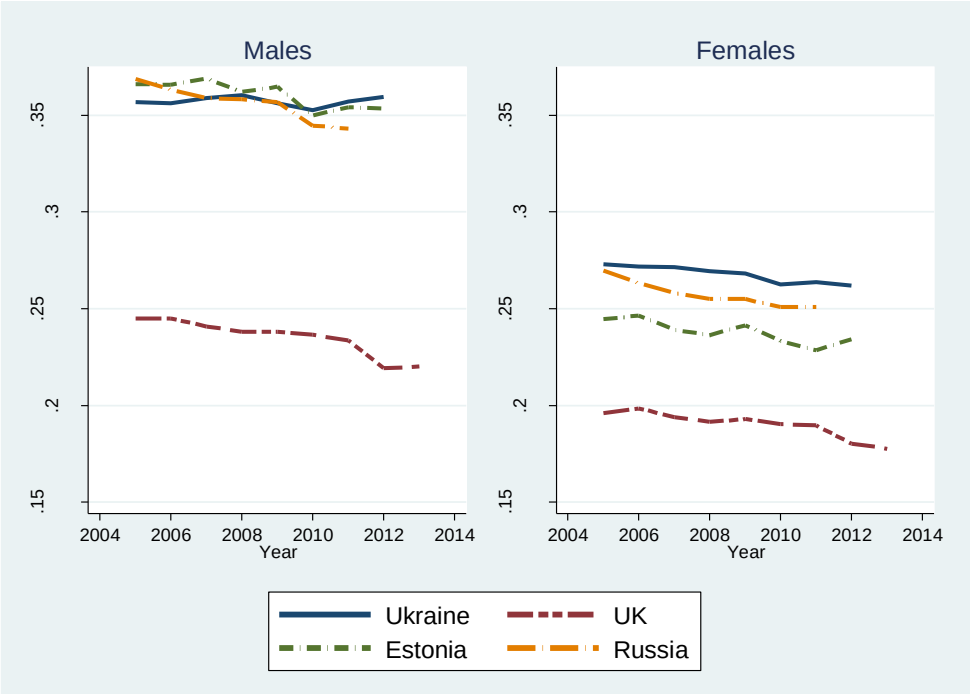


Figure 4 Share of avoidable mortality in total mortality.

In terms of the mortality breakdown by cause, diseases of the circulatory system are leading the chart. In this perspective, Ukraine shows a similar trend to the developed countries (see Table 1). Overall, the diseases in this category account for 67% of all deaths. Neoplasms (mainly malignant neoplasms) are on the second place among the causes of mortality, leading to 13% of deaths. External causes refer to 6.3%, diseases of the digestive system cause 4% of deaths, and diseases of the respiratory system constitute 2.3%. Certain infectious and parasitic diseases are on the sixth place by causes of death. This refers to the Tuberculosis and the HIV infection. Although, the TB and the HIV death rates decreased somewhat in recent years, these epidemics still are of major concern. To summarize, the overall distribution of deaths shows a great burden of non-communicable diseases (NCDs), as in the developed countries, but also a continued concern with some of the communicable diseases, which are mostly common in the developing countries, such as tuberculosis.

Table 1: Crude mortality rates by cause of death in 2014 (per 100,000)

Causes of death	2014	% of total
All causes	1470.4	100.0%
Diseases of the circulatory system	989.8	67.3%
Neoplasms	195.1	13.3%
Diseases of the digestive system	58.7	4.0%
Diseases of the respiratory system	34.4	2.3%
Certain infectious and parasitic diseases , incl.	25.5	1.7%
Tuberculosis	12.2	0.8%
HIV	10.2	0.7%
Diseases of the nervous system	13.7	0.9%
Endocrine, nutritional and metabolic diseases	5.2	0.4%
Diseases of the genitourinary system	6.3	0.4%
Certain conditions originating in the perinatal period	4.6	0.3%
Mental and behavioural disorders	3.7	0.3%
Congenital malformations, deformations and chromosomal abnormalities	3.5	0.2%
Diseases of the skin and subcutaneous tissue	1.2	0.1%
Diseases of the musculoskeletal system and connective tissue	1.2	0.1%
Pregnancy, childbirth and the puerperium	0.2	0.0%
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	0.6	0.0%
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	33.5	2.3%
External causes	93.3	6.3%

Source: UISS, 2016.

Chapter 2: Morbidity

The most frequent diseases among adult population are respiratory diseases (44% in total incidence), diseases of circulatory system (6.9%), urogenital diseases (6.6%), injury, poisoning and certain other consequences of external causes (6.3%), skin and subcutaneous tissue (5.8%) etc. (SSSU 2016). In the following, we focus on the diseases, which are the main causes of mortality and constitute main health issues.

Diseases of the circulatory system

Diseases of the circulatory system are the most widespread among non-infection diseases in the country. The prevalence rate constituted 52,957 cases per 100,000 people in 2015 and the rate increased 2.7 times since 1991 (UISS under the Ministry of Health, 2016). The latter can be also explained by better diagnostics and higher completeness of exposure. Over the last 10 years the dynamics is more positive, the incidence rate decreased from 5179 in 2005 to 4979 in 2013 and 4321 in 2015[4] (SSSU, 2016). According to the WHO'sEuropean Health for All Database (HFA-DB, 2016) age-standardized death rate amounted to 674 cases per 100,000 people in 2014, which is more than 3 times higher compared to the EU average of 192. The

[4] The improvement in the incidence and prevalence dynamics in 2014-2015 should be treated with caution due to the lack of information from temporarily occupied territories of Ukraine

most widespread conditions by incidence rate are hypertensive diseases (39%), ischaemic heart diseases(27%), and cerebrovascular diseases (17%) (UISS, 2016).

Cancer

The estimated age-standardised (European) incidence rate from all sites but non-melanoma skin cancer was 260.4 per 100,000 in 2012, compared to the EU average of 378.5 (Ferlay at al., 2013), though the difference is unlikely to mean more favorable situation, but being mostly an indication of poor diagnostics. The ratio of mortality to incidence based on age-standardized data of International Agency for Research on Cancer amounted to 61% for Ukraine and only 48% for the EU. One of the reasons for that is the late diagnosis. Only 54% of all cancer cases are diagnosed at the 1-2 stage in Ukraine (NCRU, 2016). Over 20% of female breast cancer and 58-60% of ovarian cancer cases are diagnosed at advanced stages. The corresponding EU or US numbers are 5-7% (UISS, 2016). In most recent 2014-2015 years the dynamics is more positive. Still, the risk of having cancer during a lifetime is 28% for men and 18% for women (UISS, 2016). The most frequent for males are cases of trachea, bronchus and lungs (16%), colorectal (12%) skin (10%) and prostate cancer (10%), while breast (20%), skin (13%), colorectal (12%), uterine (9%) and cervical (6%) malignant neoplasms are most widespread for females.

The cancer incidence rates for children aged 0-17 are much lower compared to the adult population and constitute 15.6 cases per 100,000 in 2014 according to the National Cancer Registry of Ukraine. However, these incidence rates are increasing. For instance, the correspondent rate in 2007 constituted 12.7. The most frequent are leucosis, lymphoma, and malignant neoplasm of other and unspecified parts of nervous system.

Diabetes mellitus

The global diabetes mellitus prevalence rate is rising. The main dangers of this disease are serious complications, which include cardiovascular diseases, kidney, foot and eye complications, etc. Dynamics of this indicator in Ukraine is in line with the global patterns. So far, diabetes mellitus prevalence rate is 43% lower compared to the EU average: 2.89% in Ukraine compared to 3.76% for the European region and 5.09% for the EU in 2012(HFA-DB, 2016). The International Diabetes Federation estimates that there is a significant underdiagnosis in this regard. Age-adjusted prevalence at age 20-79 is 6.5% for Ukraine compared to 7.3% for Europe on average[5]. Despite relatively lower incidence rates, the numbers are growing. In 2013 the incidence rate was 60% higher than 10 years before that.

Infectious diseases

HIV

The HIV incidence rate is among the highest in the European region and an increase in incidence rates is even more alarming. The HIV incidence rate, which is drastically higher compared to the EU average (36.88 vs. 5.85 per 100,000 in 2014), increased by 230% since 2000 (HFA-DB, 2016). Even more striking is the progress of HIV infection into AIDS. The AIDS incidence rates constituted 22.98 compared to 0.8 in EU, which is an indication of an ineffective HIV treatment. The estimated prevalence rate among people aged 15 and above amounted to 0.58% at the beginning of 2015 (UNAIDS, UCDC, 2015). A large share of all HIV cases remains undetected in Ukraine. According to the UNAIDS/ UCDC report (2015), only 60% of estimated HIV

[5] International Diabetes Federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation, 2015. Accessed online at http://www.diabetesatlas.org/ on November 26, 2016

cases were registered. Regarding transmission mechanisms, there is a tendency towards an increase in the share of heterosexual contacts in newly registered cases. In 2015, 71% of newly registered cases were transmitted through heterosexual contacts and 26% through injecting drug use. The number of children born from infected mothers constituted 2,958 in 2015, which is almost 19% of total registered cases. The majority of these children will lose HIV maternal antibodies after 18 months and will not be infected by the HIV. The frequency rate of mother-to-child transmission of the HIV reduced from 27,8% in 2001 to 3,35% in 2014 (UCDC, 2016a).

Tuberculosis

According to the WHO definition, Ukraine has tuberculosis epidemics with a registered prevalence rate of 90 per 100,000 (UISS, 2016) and estimated prevalence rate of 114 in 2014 (HFA-DB, 2016). The growth in the TB incidence stopped in 2004 and incidence rates started to decline since 2007. Despite improved dynamics, Ukraine is far from combating the disease. The first issue is the expansion of multidrug-resistant tuberculosis due to insufficient treatment of the disease in previous years. According to 2014 data Ukraine was among the top-5 countries with multidrug-resistant tuberculosis (Global tuberculosis report, 2016). Another pertinent issue is the TB and HIV co-infection. The incidence rate of the TB and HIV co-infection is 13.0 per 100,000 which is 18% of all TB cases (UISS, 2016).

Maternal health

Though maternal death rate decreased from 30 per 100,000 in 1991 to 14.81 in 2014 (HFA-DB, 2016), there is no stable downward trend. For instance, before falling to 14.81 in 2014, the rate decreased to 13 in 2004 and then went up to 25 in 2009. Compared to the EU average, maternal death rate in Ukraine is three times higher. Perinatal death rate constituted 8.6 in Ukraine compared to 6.09 in the EU on average in 2014 and neonatal death amounted to 3.4 and 2.52 respectively. Despite the overall negative situation, several improvements had taken place. The implementation of the evidence-based medicine and clinical pathways allowed decreasing the number of obstructed labour from 63% in 2004 to 32% in 2015 (UISS, 2016). However, the rate of Caesarean sections increased from 16.0% in 2010 to 18.5% in 2015, while, according to the WHO Statement on Caesarean Section Rates (WHO, HRP, 2015), the “caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates” (p. 4). At the same time, the Ukrainian figures are substantially lower compared to the EU average of 27.4% (HFA-DB, 2016). Historically, the number of abortions had been higher than the number of live births since Soviet times in Ukraine. The situation reversed in 2001 and the rate of abortions decreased further to 25.66 per 100 live births in 2015 (UISS, 2016). The ratio of safe to unsafe abortions improved from 3.5 in 2011 to 5.9 in 2015.

Children health

Infant mortality rates are lower compared to most of the CIS countries, but still are twice as high as the average EU rate: 7.85 compared to 3.69 per 1000 live birth in 2014 (HFA-DB, 2016). The probability of dying before age 5 is more than twice higher as well: 7.85 vs. 3.69 per 1000 live birth.

As for general incidence rates, the most frequent diseases were respiratory system diseases (69% in total incidence), skin and subcutaneous tissues diseases (4.9%), certain infectious and parasitic diseases (3.7%), injury, poisoning and certain other consequences of external causes (3.6%), digestive system diseases (3.4%), etc. (SSSU, 2016).

Immunization is one of the most problematic issues since the immunization coverage ratio in Ukraine is among the lowest in the world. Only 45% of newborns were vaccinated against tuberculosis in 2015, only 42% of children of the first year of life were vaccinated against diphtheria and tetanus, 43% against

whooping cough, 68% against poliomyelitis, 42% against hepatitis B (SSSU, 2016). As a result of the low immunization coverage rates, two cases of vaccine-derived polio were registered in 2015, both in non-vaccinated children. The main reasons for low immunization coverage are related to the shortages in the supply of vaccines and distrust towards vaccinations among the population.

Chapter 2: Spatial Inequalities in Health

The analysis of both country level mortality and morbidity data has shown some positive trends towards improvement of population health. Although the speed of this improvement has been quite slow to allow for a meaningful convergence with the Western countries. A significant health inequality between men and women has been detected and this sub-section takes the analysis further by exploring the spatial aspects of the data, analysing it by geographic location and the degree of rurality. Here we rely on a database of mortality and morbidity collected from the Oblast Centres of Medical Statistics. The quality and scope of the data will be discussed later in Chapter 7.

Ukraine is divided into 27 territorial entities: 24 oblasts, one Autonomous Republic of Crimea, and 2 cities with special status (Kyiv and Sebastopol). Each oblast is subdivided into rayons and cities (settlements with more than 10,000 inhabitants). The smallest feasible level of spatial disaggregation in the health related data is at the rayon level. While the country level data allows us to see the overall status in the country, the rayon-level data provides an opportunity to investigate whether there is a significant variation in the indicators and, consequently, if there is any specific group which may be considered vulnerable and would require more attention in the programmes/project design and evaluation. Since the start of the Russian annexation of Crimea and invasion to Donetsk and Luhansk oblasts, the data from these regions is not being collected and therefore they are excluded from the analysis in the report. Table 2**Error! Reference source not found.** uses the data for the first and the last available years – 2008 and 2015 – to analyse both the geographic variation and the time dynamics.

Analysing first the total mortality, we see that it has somewhat improved over time. Yet, there is still a significant variation across rayons – the standard deviation is larger than 10% of the magnitude of the mean total mortality. The lowest observed levels of mortality at the end of the period are still higher than the EU average of 10 per 1,000 (or 1,000 per 100,000), while the maximum is more than twice higher than that number. There is an even larger variation in the avoidable mortality – with the standard deviation constituting more than 20% of the mean value, both in 2008 and 2015.

The right panel of the table allows the analysis by gender. As can be seen, total mortality among men is 75% larger than that for women in 2008 and 68% larger in 2015, with a significant spatial variation. The situation is much worse in what concerns avoidable mortality – with men having 185% higher indicator than the one for women in 2008 and 173% higher in 2015. This evidence clearly shows that men are more vulnerable in terms of mortality than women. And the answer lies not only in the socio-economic and environmental factors, but also in the healthcare and public health system, as the gender inequality in avoidable mortality is striking and requires further investigation on how to improve the reach of males by the existing system.

Table 2: Total and Avoidable Mortality based on the rayon level data (per 100,000)

		Total population		Men		Women	
		Total mortality	Avoidable mortality	Total mortality	Avoidable mortality	Total mortality	Avoidable mortality
		(1)	(2)	(3)	(4)	(5)	(6)
2008	mean	2061.7	702.4	2772.1***	1096***	1581.6***	385.2***
	sd	(241.0)	(147.3)	(384.5)	(228.4)	(197.2)	(99.5)
	median	2061.8	694.4	2759.9	1087.6	1578.8	373.8
	min	1400.8	356.6	1667.7	558.1	1009.3	138.1
	max	3167.7	1538.2	4709.5	2276.6	2378.3	950.1
	obs.	564	564	564	564	564	564
2015	mean	1888.9	550.8	2511.2***	850.3***	1488.8***	311.1***
	sd	(211.3)	(111.2)	(338.1)	(176.5)	(172.1)	(77.5)
	median	1888.6	546.9	2490.7	839.5	1479.4	305.6
	min	1170.0	275.7	1325.3	387.6	911.3	159.7
	max	2695.8	924.4	3670.0	1506.7	2422.5	752.3
	obs.	563	563	563	563	563	563

Note: All mortality rates are age and gender standardised based on the ESP 2013. Stars indicate statistically significant differences between men and women in each year: *** 1%, ** 5%, * 10%.

Table 3 adds another dimension to the analysis distinguishing between rural and urban rayons. Cities of oblast subordination were considered as urban territories. Other rayons were considered rural. So, effectively, rural rayons have either no cities or small urban-type settlements.

As expected, mortality in rural areas is larger than that in urban areas for both men and women. Moreover, the gender inequality in mortality within rural areas is much more pronounced than within urban areas. Columns (3) and (6) show the relative size of total mortality among men when compared to women in the same areas. In 2008, this meant that mortality among men in urban areas was 69.27% higher than among women. Over the 8 years of considered period it does show a decline by 3.6 percentage points, but this decline is minuscular compared to the size of inequality. In rural areas the inequality is larger, but it has also shown a similar size of decline over the considered period.

The next table (see Table 4) repeats the analysis in terms of avoidable mortality. In line with the earlier observation, the gender inequality in avoidable mortality is much larger than in total mortality. And, although it does exhibit a downward trend, the rate of decline in inequality is slightly larger in urban areas than it is in rural. So, overall, the analysis of total and avoidable mortality along gender and rurality dimensions show that men in rural areas represent the most vulnerable group of population, followed by men in urban areas, and women in rural areas.

Table 3: Gender and Rural/Urban dimensions of Total Mortality (per 100,000)

		Urban			Rural		
		Men	Women	Male mortality relative to female	Men	Women	Male mortality relative to female
		(1)	(2)	(3)	(4)	(5)	(6)
2008	mean	2576.3	1522.0	169.27%	2827.3	1598.5	176.87%
	sd	(450.2)	(202.7)		(344.8)	(192.6)	
	median	2522.2	1510.5		2806.1	1593.2	
	min	1667.7	1009.3		2022.2	1116.8	
	max	4709.5	2053.5		4393.6	2378.3	
	obs.	124	124		440	440	
2015	mean	2308.4	1392.9	165.73%	2567.9	1515.6	169.43%
	sd	(416.0)	(195.0)		(288.9)	(155.0)	
	median	2291.0	1388.9		2544.9	1505.0	
	min	1325.3	911.3		1890.2	964.7	
	max	3670.0	1980.5		3433.6	2422.5	
	obs.	123	123		440	440	

Note: All mortality rates are age and gender standardised based on the ESP 2013.

Table 4: Gender and Rural/Urban dimensions of Avoidable Mortality (per 100,000)

		Urban			Rural		
		Men	Women	Male mortality relative to female	Men	Women	Male mortality relative to female
		(1)	(2)	(3)	(4)	(5)	(6)
2008	mean	945.9	337.2	280.52%	1138.3	398.7	285.55%
	sd	(177.0)	(78.9)		(223.6)	(100.6)	
	median	937.3	335.0		1124.2	385.2	
	min	558.1	138.1		587.8	208.0	
	max	1495.6	616.6		2276.6	950.1	
	obs.	124	124		440	440	
2015	mean	728.0	271.1	268.54%	884.4	322.3	274.40%
	sd	(162.5)	(61.2)		(164.9)	(77.9)	
	median	717.5	263.1		869.7	320.2	
	min	387.6	163.4		514.8	159.7	
	max	1442.7	522.9		1506.7	752.3	
	obs.	123	123		440	440	

Note: All mortality rates are age and gender standardised based on the ESP 2013.

Figure 5 allows us to document any existing patterns in terms of geographic variation across the larger regions of Ukraine. The maps use the same ranges of indicators to allow for both spatial and time

comparisons. It is evident that at the beginning of the period there is a regional pattern in terms of both total and avoidable mortality with the highest values observed in the northern parts of Ukraine, in the oblasts bordering Russian Federation, and also the South-North cluster in the East connecting Odesa and Kharkiv regions. In 2015 the situation has changed, leaving only few rayons in the same highest range within the same larger regions of the country. The lowest mortality cluster is observed in the Western part of the country. More detail analysis by gender shows that this is driven by lowest female mortality in the West (detailed maps are presented in the Appendix).

In contrast to mortality, documenting spatial patterns in disease burden is much more difficult for several reasons. First, any comprehensive measure of the number of morbidities per rayon would be meaningless, as it would combine diseases, which are very different by nature. Second, the administrative data on diseases includes a large number of indicators and would require a specialised inquiry on the appropriateness of any specific indicator, which is beyond the scope of this project. Finally, within this project our goal was to scope the data and, therefore, we have had only limited capacity to bring all the collected data into a format suitable for statistical analysis. Thus, in this Chapter we have chosen to show several selective indicators referring only to two non-communicable conditions – diabetes and heart diseases. The data on mortality in the tables and figures, which follow, is referring to the mortality in hospitals and is derived from Form 20 which each hospital fills in. As a result, this may be different from the data in the mortality register analysed earlier in this sub-section.

All health facilities managed by the Ministry of Health, submit medical statics Form 20, called “Report of the healthcare facility”, to the State Statistics Committee once a year through a chain of aggregation points. First, central hospitals of the respective administrative units (either cities or rajons) collect the data from the lower level facilities and submit it to oblast health departments. Than the Form is being aggregated by the Ministry of Health and passed further. This Form contains 76 separate tables with statistics on all the specialized departments/cabinets of health facilities. Tables of the Form primarily quantify the services that were provided by facility and respective health statistics. For further analysis, we work with the Table 3220 “Composition of in-patient patients, the timing and outcome of treatment (quantity)”.

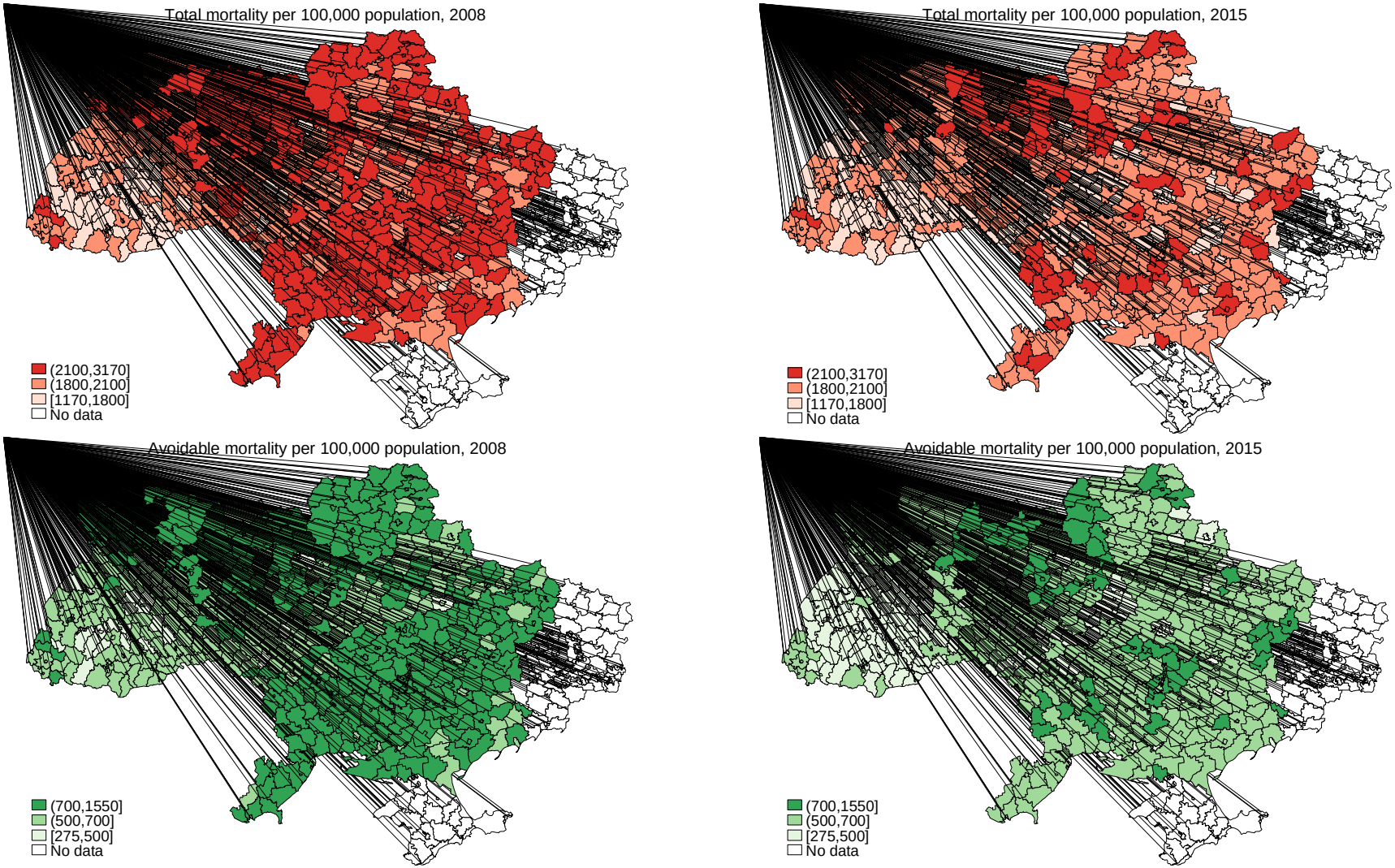


Figure 5: Spatial variation in total and avoidable mortality in 2008 and 2015.

Table 3220 of the Form 20 basically contains 3 indicators distributed by 3 age-groups (Table 5). This data is available for 19 major disease classes according to the International Statistical Classification of Diseases and Related Health Problems.

Table 5: Structure of the medical statistics Form 20, Table 3220.

Age-groups	Indicators	Disease classes
1. 18 and older 2. 0-17 years 3. Less than one year	1. Number of discharged patients 2. Number of bed-days spent by discharged patients 3. Number of deaths	1. Certain infectious or parasitic diseases 2. Neoplasms 3. Diseases of the blood or blood-forming organs 4. Diseases of the immune system, 05 Endocrine, nutritional or metabolic diseases 5. Mental or behavioural disorders 6. Diseases of the nervous system 7. Diseases of the eye or ocular adnexa 8. Diseases of the ear or mastoid process 9. Diseases of the circulatory system 10. Diseases of the respiratory system 11. Diseases of the digestive system 12. Diseases of the skin 13. Diseases of the musculoskeletal system or connective tissue 14. Diseases of the genitourinary system 15. Pregnancy, childbirth or the puerperium 16. Certain conditions originating in the perinatal or neonatal period 17. Developmental anomalies 18. Symptoms, signs or clinical findings, not elsewhere classified 19. Injury, poisoning or certain other consequences of external causes

In further analysis we use the data for the following disease classes: **(i) Diabetes** (subsection of the Endocrine, nutritional or metabolic diseases), and (ii) aggregated number **for Diseases of circulatory system**, including Acute rheumatic fever, Chronic rheumatic heart diseases, Hypertensive diseases, Ischaemic heart disease (including stenocardia, myocardial infarction and other forms of acute ischemic heart disease), Cerebrovascular diseases (including intracranial hemorrhage, brain infarction, stroke unspecified, cerebral infarction).

As Figure 6 shows, the number of patients with diabetes discharged from hospitals has been increasing from year 2008 till 2013, showing a small decrease afterwards. The dynamics of the number of bed-days almost exactly repeats the one on the number of discharged patients, most likely reflecting the standard length of the treatment. What is worrying is the dynamics in the number of deaths, which has shown a considerable increase over the period from 2010 to 2012. However, a decline was documented from year 2013 to 2014.

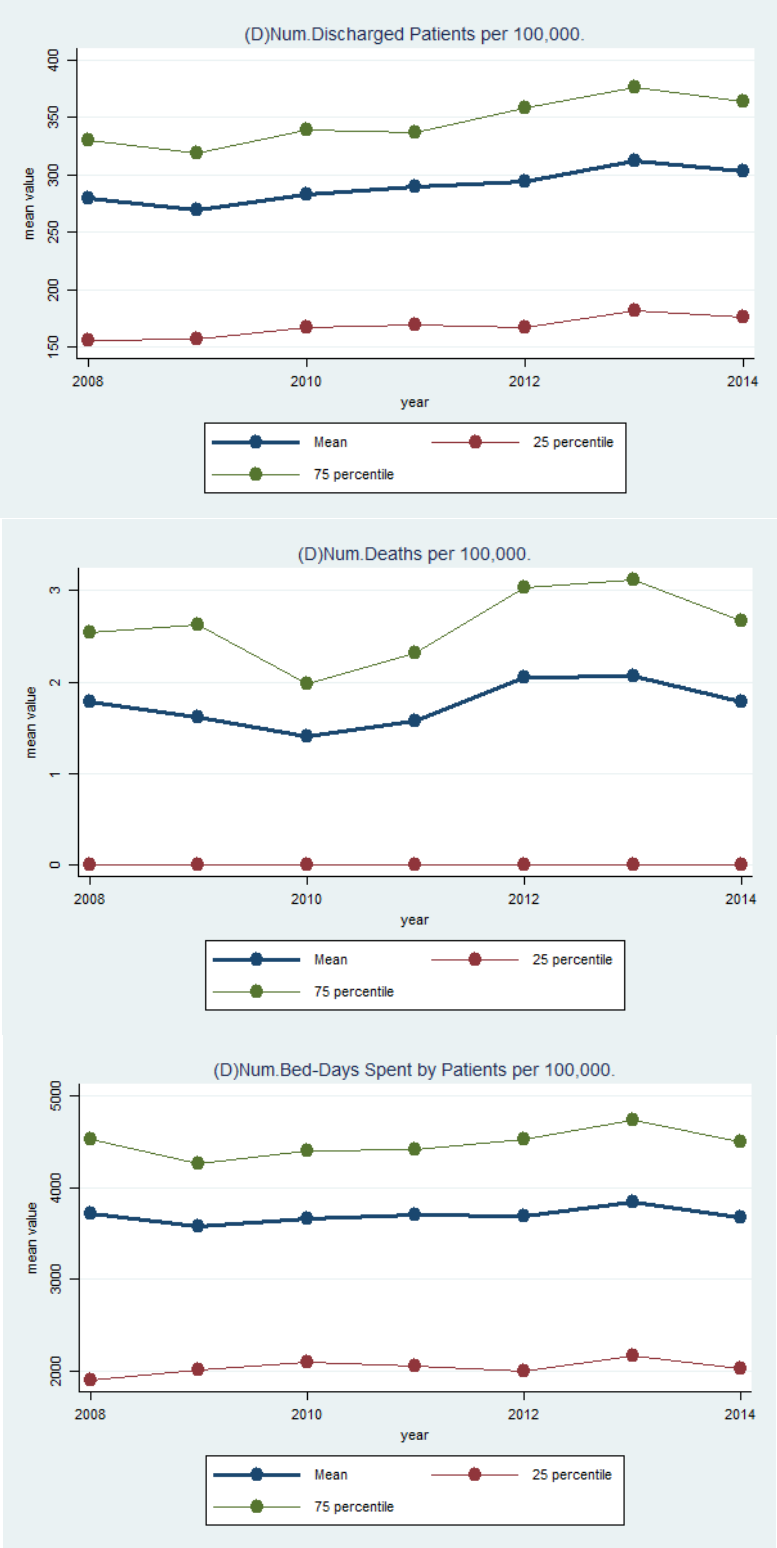


Figure 6: Number of patients, bed-days spent at hospital and deaths related to diabetes.

Figure 7 shows similar indicators for heart disease. As could be seen, the number of patients discharged from hospitals remained relatively stable over the considered period. However, the lengths of their stay seem to have been decreasing, while at the same time the death from the condition have been on the rise.

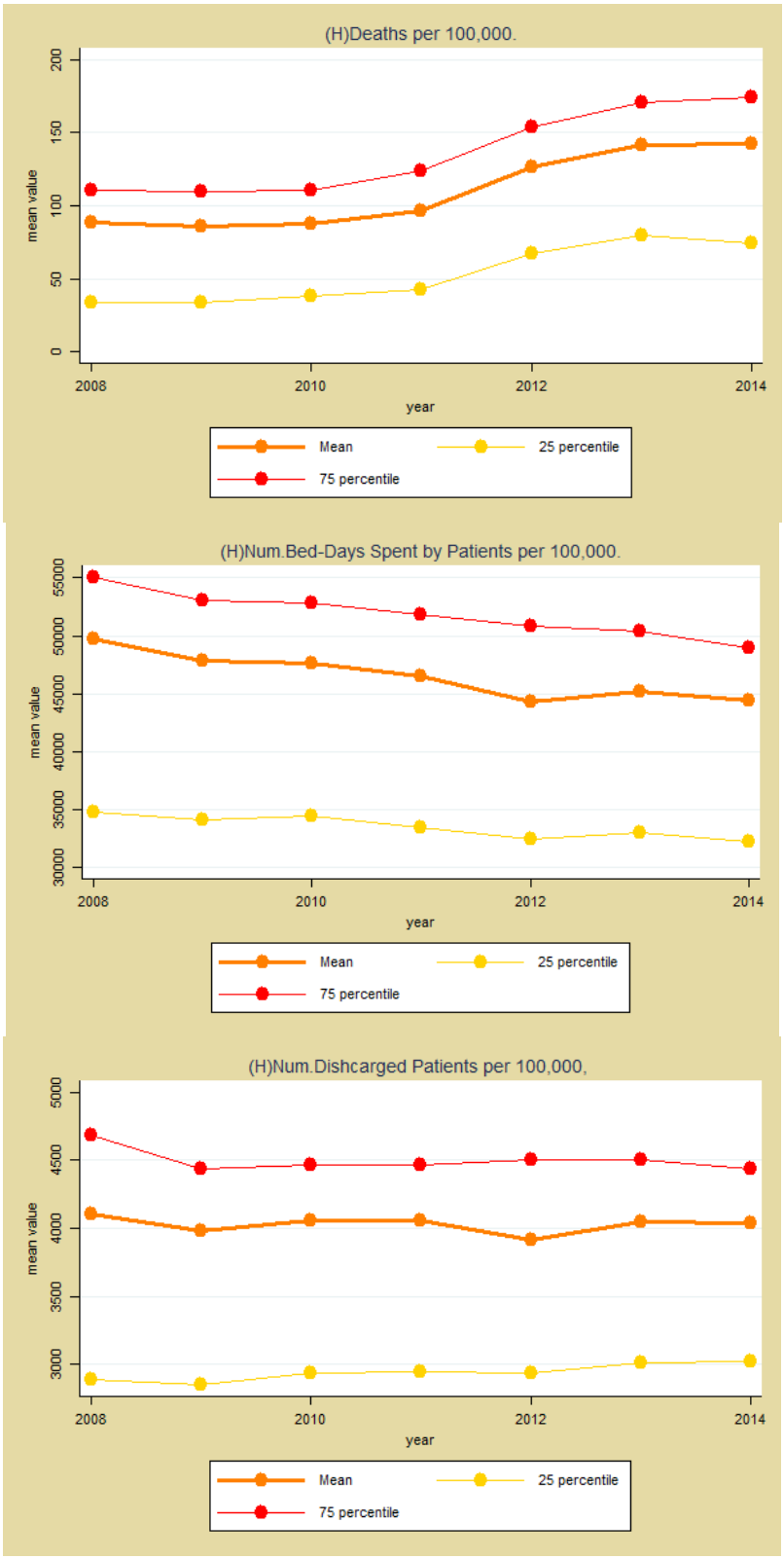


Figure 7: Number of patients, bed-days spent at hospital and deaths related to heart disease.

Figures Figure 8 and Figure 9 show the spatial distribution of the diabetes and heart disease at the beginning and the end of the period.

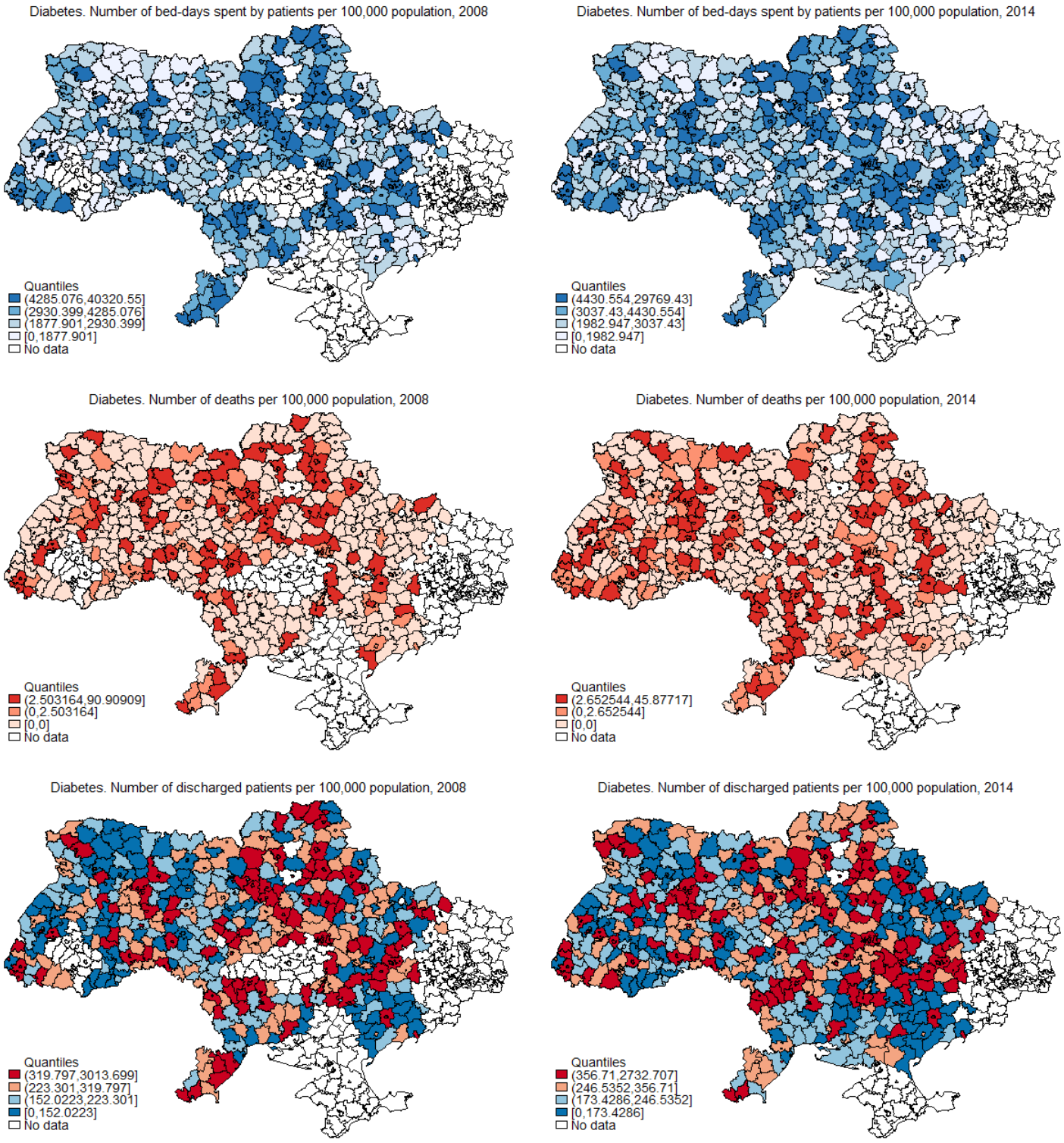


Figure 8. Spatial distribution of number of patients, bed-days spent at hospital and deaths related to diabetes in 2008 and 2014.

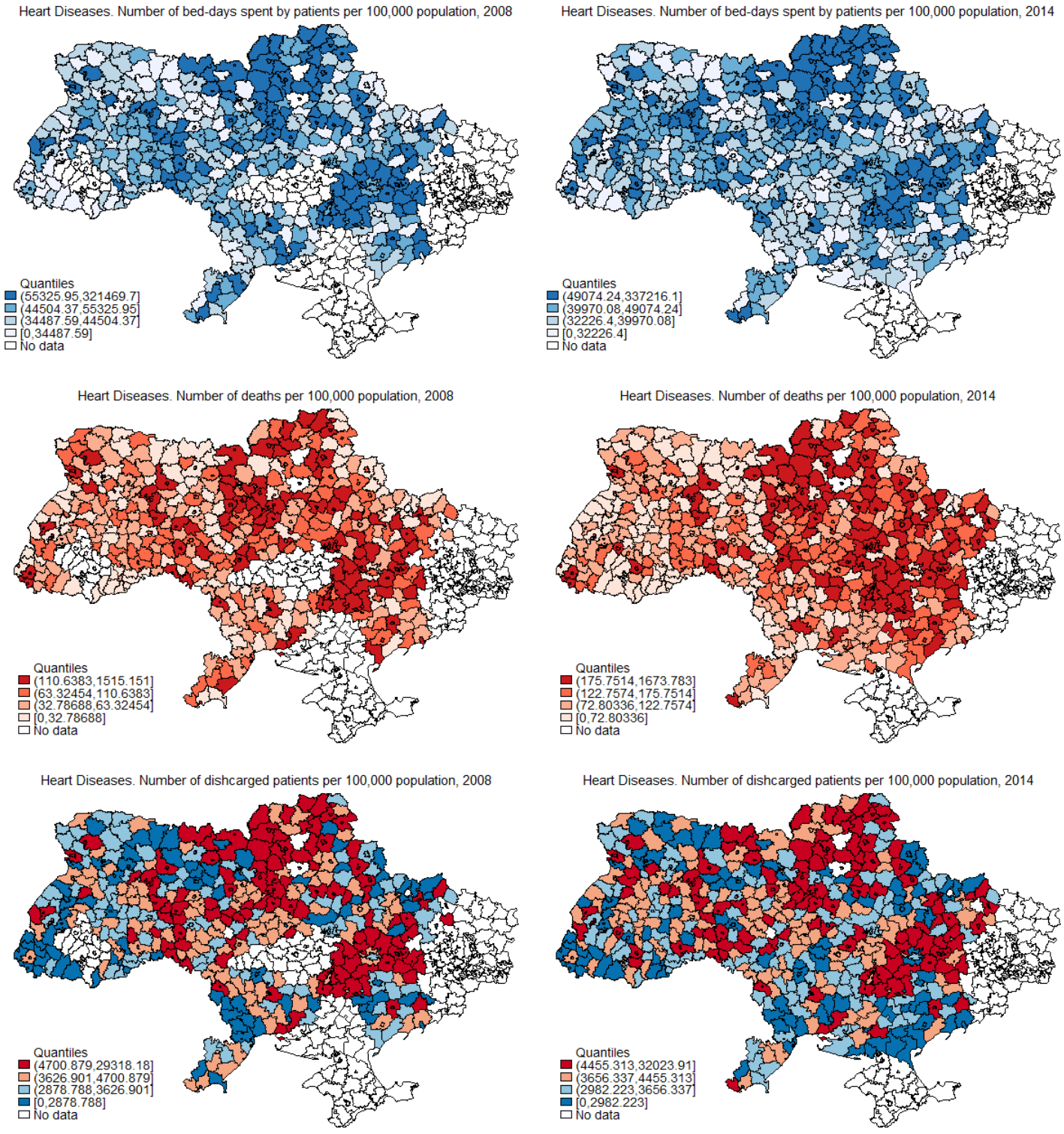


Figure 9. Spatial distribution of number of patients, bed-days spent at hospital and deaths related to heart diseases in 2008 and 2014.

Most of the indicators for both classes of diseases do not reveal clear regional patterns. However, some regional effects are noticeable. For example, the number of discharged patients and the number of bed-days spent by the discharged patients with heart disease show distinct regional effects for Kyiv, Chernihiv and Dnipropetrovsk oblasts. Similarly, the Right Bank of the Dnipro River and Western part of Ukraine show lower rates for both disease classes. Generally, all the maps show significant within and between oblasts

variation. Standard deviation is quite significant for all the indicators. The maximum values differ from the averages approximately by 10 times (Table 6).

Table 6: Summary statistics for heart diseases and diabetes indicators measures per 100 000 population. Country level, 2014

Statistics	Diabetes			Heart Diseases		
	Num. of bed-days spent by discharged patients	Num. of deaths	Num. of discharged patients	Num. of bed-days spent by discharged patients	Num. of deaths	Num. of discharged patients
Mean	3,617.1	1.8	298.9	44,243.6	142.6	4,029.2
Standard Deviation	2,756.5	3.5	225.6	22,823.4	120.4	2,061.4
Median	3,037.4	0	246.5	39,970.1	122.8	3,656.3
Min	0	0	0	0	0	0
Max	29,769.4	45.9	2,732.7	337,216.1	1,673.8	32,023.9
N	506	500	506	508	508	508

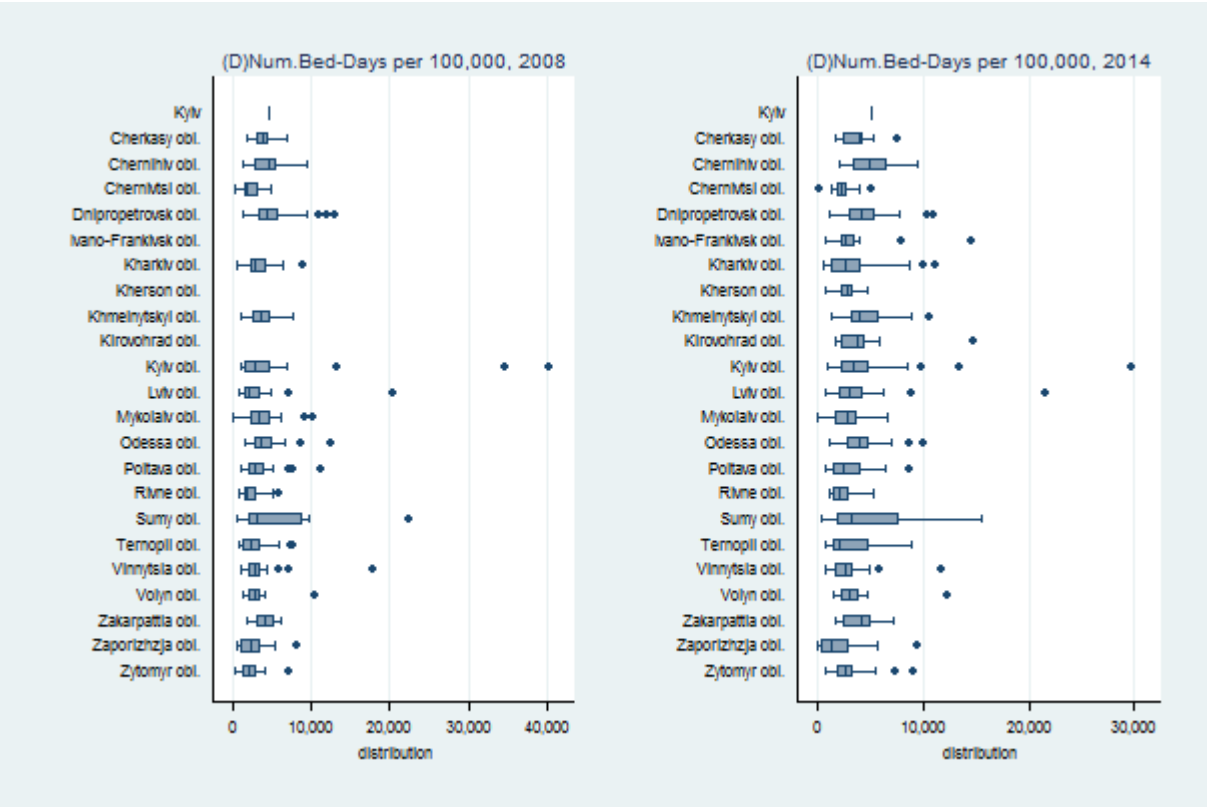
The variation in indicators also differs across regions. Box plots[6] for the number of bed-days spent by patients diagnosed with diabetes or heart disease (Figure 10) shed more light on the nature of high maximum values. Dots in the box plots show rayons and cities which stand out with very high values of indicators. When working with the data, in fact, we could not drop this values considering them outliers: administrative units with these high values of indicators have been following the same track during the whole period from 2008 to 2014. Although we don't have enough evidence to explain these abnormalities, one of the factors likely contributing to this is location of large specialized hospitals in these cities/rayons. (Appendix: Figure 14, Figure 15) shows box plots for the rest of the indicators, the situation is consistent across indicators, years and oblasts.

Average administrative unit has 26% - 126% absolute deviation from the average value for the oblast where it is located (Table 7).

Table 7: Average absolute deviation from the oblast mean value. 2014

Diabetes			Heart Diseases		
Num. of bed-days spent by discharged patients	Num. of deaths	Num. of discharged patients	Num. of bed-days spent by discharged patients	Num. of deaths	Num. of discharged patients
46 %	126 %	45 %	26 %	44 %	26 %

[6] Box plot (boxplot, box-and-whiskers plot) is standardized way of displaying the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum.



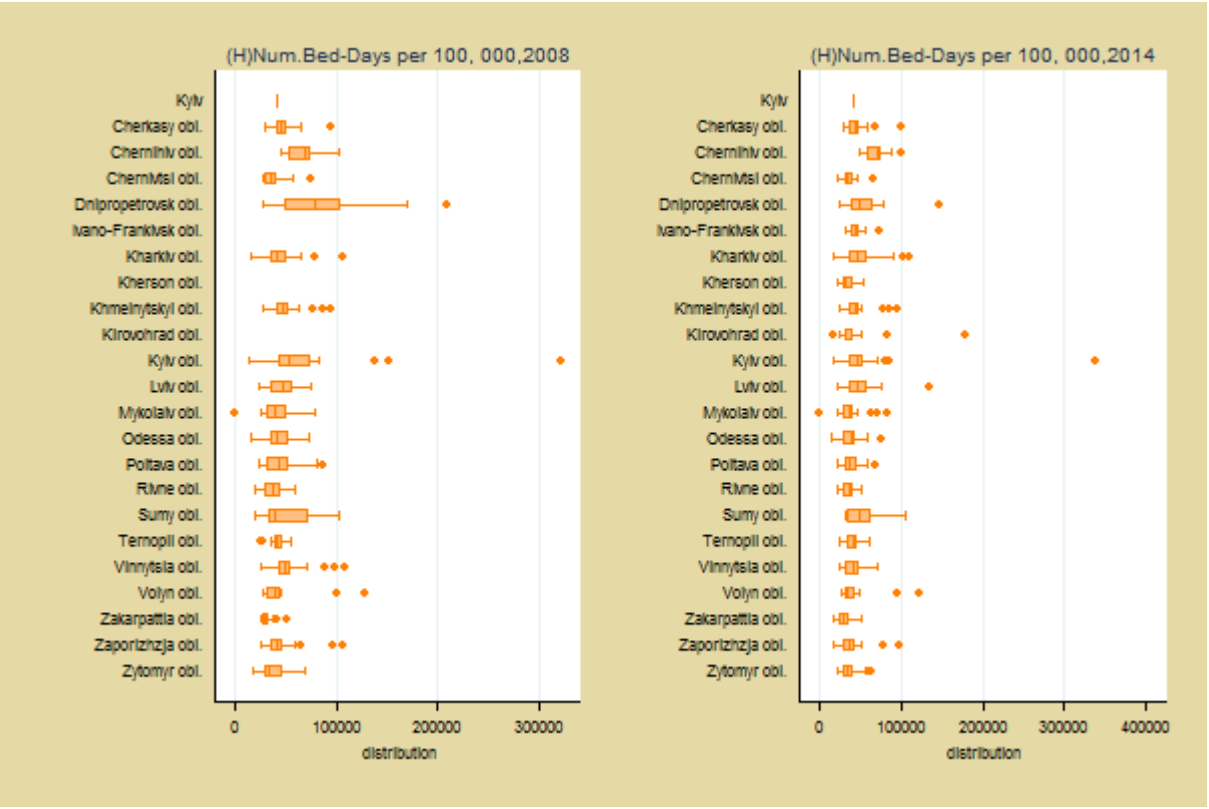


Figure 10. Box plots of number of bed-days spent at hospital related to diabetes and heart diseases in 2008 and 2014.

Conclusions

The aim of the chapter was to describe patterns of the population health in Ukraine over the past decade. Country level analysis for mortality and morbidity showed some improvement over the recent years. However, compared with other countries the speed of this improvement has been quite slow to allow for a meaningful convergence with the developed countries, with the age standardised mortality rate remaining about twice higher than in the UK, and about 50% higher than in Estonia. The difference between male and female mortality continues to be large. In 2012, the age-standardized death rate for males in Ukraine was 120% higher than in the UK. At the same time, this difference for females was less dramatic –68%. Apart from the total mortality rate, we have also analysed avoidable mortality, i.e. causes of deaths, which are considered amenable to medical intervention and health policy. This analysis revealed patterns similar to those in total mortality. In spite of a downward trend, which reflects further developments in medical technologies and their increasing availability, the gender gap is even more pronounced in avoidable mortality. Moreover, among the countries compared in the analysis, Ukraine has the highest share of avoidable mortality to total mortality among females, with that among males being on par with Estonia and Russia, but much higher than that in the UK.

The main causes of death in Ukraine are the diseases of the circulatory system (67% of all deaths) and neoplasms (13%), while HIV and TB are the main causes of concern among infectious diseases. The diseases of the circulatory system are the most widespread among NCDs in the country. As for the neoplasms, the incidence rate is lower in Ukraine than in the EU, which is mostly likely due to a poor diagnostics rather than more favourable situation. The HIV incidence rate is among the highest in the European region and continue to increase. The TB incidence rates have declined since 2007, though the expansion of the multidrug-resistant tuberculosis remains a concern. Regarding the childhood health, low levels of immunisation coverage induced by the distrust of population towards vaccination and shortages of the supply of vaccines in previous years raises more and more concerns regarding the future situation with some of the previously eradicated infections, such as mumps, rubella, polio, etc.

In order to investigate the spatial inequalities in health in more detail, we have utilised the rayon-level data, which is a smallest feasible level of spatial disaggregation in the health statistics. The mortality analysis at rayon level confirms our conclusions at the country level. We admit the improvement in total and avoidable mortality, though we observe larger variation between rayons – more that 10% from the mean. The variation in avoidable mortality is even greater – up to 20% of the mean. We also confirm gender inequality. The differences in total and avoidable mortality rates between males and females at rayon level tend to decrease. However, the magnitude of the decrease is tiny compared to the level of the difference. As for the urban-rural divide, mortality rates in rural areas are larger than that in the urban areas for both men and women. Overall, the analysis of total and avoidable mortality along gender and rurality dimensions show that men in rural areas represent the most vulnerable group of population, followed by men in urban areas, and women in rural areas.

The disease burden analysis at rayon level has been performed for two classes of diseases: diabetes and cardiovascular diseases. For them, we analysed the number of bed-days spent by discharged patients, the number of discharged patients and the number of deaths (the latter refer to death which happened in the hospital). For these diseases, we do not see a stable downward trend in death rates. In contrast, the death rate for diabetes increased in 2008-2013 and slightly diminished in 2014, while the death rate from cardiovascular diseases has been on the rise during the whole 2008-2014 period. As for the variation across rayons, we observe a significant variation within and between regions. For most of the indicators, regional

effects are hard to distinguish with few exceptions: lower rates for both classes of diseases in the Western part of Ukraine and higher rates for heart diseases for Kyiv, Chernihiv and Dnipropetrovsk oblasts.

References

Bray F, Ren JS, Masuyer E, Ferlay J. 2013. Estimates of global cancer prevalence for 27 sites in the adult population in 2008. Int J Cancer. 2013 Mar 1;132(5):1133-45. doi: 10.1002/ijc.27711. Epub 2012 Jul 26.

Castelli, A., Nizalova, O. 2011. *Avoidable mortality: what it means and how it is measured*. York, UK: Centre for Health Economics, University of York. Working Papers 063cherp.

Charlton, J. R. H., Hartley, R., Silver, R., & Holland, W. 1983. Geographical variation in mortality from conditions amenable to medical intervention in England and Wales. *Lancet*, 321(8326) : 691-696

Davis K., Stremikis K., Schoen C., and D. Squires, *Mirror, Mirror on the Wall, 2014 Update: How the U.S. Health Care System Compares Internationally,* The Commonwealth Fund, June 2014.

European Health for All Database (HFA-DB). 2016. WHO Regional Office for Europe, Copenhagen, Denmark. Accessed online at http://data.euro.who.int/hfadb/ on November 26, 2016

Eurostat Taskforce. 2013. Revision of the European Standard Population. Accessed online at http://ec.europa.eu/eurostat/documents/3859598/5926869/KS-RA-13-028-EN.PDF/e713fa79-1add-44e8-b23d-5e8fa09b3f8f on December 12th, 2016.

Ferlay J, Steliarova-Foucher E, Lortet-Tieulent J, Rosso S, Coebergh JWW, Comber H, Forman D, Bray F. 2013. Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012. Eur J Cancer. 2013 Apr;49(6):1374-403. doi: 10.1016/j.ejca.2012.12.027.

Global Tuberculosis Report. 2016. WHO, Geneva 2016. Accessed online at http://apps.who.int/iris/bitstream/10665/250441/1/9789241565394-eng.pdf?ua=1 on November 26, 2016

Holland W. (1986). The 'avoidable death' guide to Europe. *Health Policy* 6 115-117.

International Diabetes Federation. 2015. *IDF Diabetes Atlas, 7th edn.,* Brussels, Belgium: International Diabetes Federation. Accessed online at http://www.diabetesatlas.org/ on November 26, 2016

Joint United Nations Programme on HIV and AIDS (UNAIDS), Ukrainian Center for Socially Dangerous Disease Control (UCDC) under the Ministry of Health of Ukraine. 2015. *Ukraine harmonized aids response progress report. Reporting period: January, 2012 –December 2014*. (in Ukrainian). Kyiv, Ukraine. Accessed online at http://www.unaids.org/sites/default/files/country/documents/UKR_narrative_report_2015.pdf on November 26, 2016

National Cancer Registry of Ukraine (NCRU), Ed. Shchepotin I. B. 2009. *Cancer in Ukraine, 2007-2008*. (in Ukrainian). Bulletin, 10, Kyiv, Ukraine. Accessed online at http://www.ncru.inf.ua/publications/BULL_10/index.htm on November 26, 2016

National Cancer Registry of Ukraine(NCRU), Ed. Kolesnik O.O. .2016. Cancer in Ukraine, 2014-2015. Bulletin vol.17, Kyiv, Ukraine Accessed online at http://www.ncru.inf.ua/publications/BULL_17/index_e.htm on November 26, 2016

Nolte E, McKee CM. (2004). *Does health care save lives? Avoidable mortality revisited*. London, The Nuffield Trust.

Page, A., Tobias, M., et al. 2006. *Australian and New Zealand atlas of avoidable mortality*. Adelaide, PHIDU, University of Adelaide

Rutstein, D.D., Berenberg, W., et al. 1976. Measuring the quality of medical care. *New England Journal of Medicine* 294(11): 582-588.

State Statistics Service of Ukraine (SSSU). 2016. *Health care and morbidity in Ukraine in 2015*. (in Ukrainian). Statistical bulletin. Kyiv, Ukraine. Accessed online at https://ukrstat.org/uk/druk/publicat/kat_u/2016/bl/06/bl_zoz_15pdf.zip on November 26, 2016

Ukrainian Center for Socially Dangerous Disease Control (UCDC) under the Ministry of Health of Ukraine. 2016a. Mother-to-child transmission rate: statistical data. (in Ukrainian). Kyiv, Ukraine Accessed online at http://ucdc.gov.ua/uploads/documents/ab1ccb/c32bee5867544ab4939bc92dbec36e95.pdf on November 26, 2016

Ukrainian Center for Socially Dangerous Disease Control (UCDC) under the Ministry of Health of Ukraine. 2016b. Update on officially registered cases of HIV infection, AIDS, and the number of AIDS-related deaths for December 2015. (in Ukrainian). Kyiv, Ukraine. Accessed online at http://ucdc.gov.ua/uploads/documents/83da57/c0bb032ecc34c6dfcba359b3c1456929.pdf on November 26, 2016

Ukrainian Institute of Strategic Studies (UISS) under the Ministry of Health of Ukraine, Ed. Shafranskyi V. V. 2016. *Annual report on health status of the population, sanitary and epidemiological situation, and the performance of the healthcare system of Ukraine in 2015*. (in Ukrainian). Kyiv, Ukraine Accessed online at http://www.uiph.kiev.ua/dawnload/Vidavnictvo/Shchorichna%20dopovid/%D0%A9%D0%BE%D1%80%D1%96%D1%87%D0%BD%D0%B0%20%D0%B4%D0%BE%D0%BF%D0%BE%D0%B2%D1%96%D0%B4%D1%8C.2016.pdf on November 26, 2016

United Nations Population Fund. 2009. A Review of Progress in Maternal Health in Eastern Europe and Central Asia - New York, New York: UNFPA Accessed online at http://www.unfpa.org/sites/default/files/pub-pdf/maternal_health.pdf on November 26, 2016

World Bank. 2009. An avoidable tragedy : combating Ukraine's health crisis - lessons from Europe. Health and demography. Washington, DC: World Bank.

World Health Organization (WHO). 2012. *The European health report 2012: Charting the way to well-being*. Accessed online at http://www.euro.who.int/__data/assets/pdf_file/0004/197113/EHR2012-Eng.pdf on December 28th, 2016.

World Health Organization (WHO), Human Reproduction Programme. 2015. WHO statement on caesarean section Rates. WHO/RHR/15.02. Accessed online at http://apps.who.int/iris/bitstream/10665/161442/1/WHO_RHR_15.02_eng.pdf?ua=1 on November 26, 2016

World Health Organization, United Nations Children's Fund. 2016. Progress and Challenges with Achieving Universal Immunization Coverage: 2015 Estimates of Immunization Coverage WHO/UNICEF Estimates of National Immunization Coverage (Data as of July 2016). Accessed online at http://www.who.int/immunization/monitoring_surveillance/who-immuniz-2015.pdf?ua=1 on November 26, 2016

Appendix

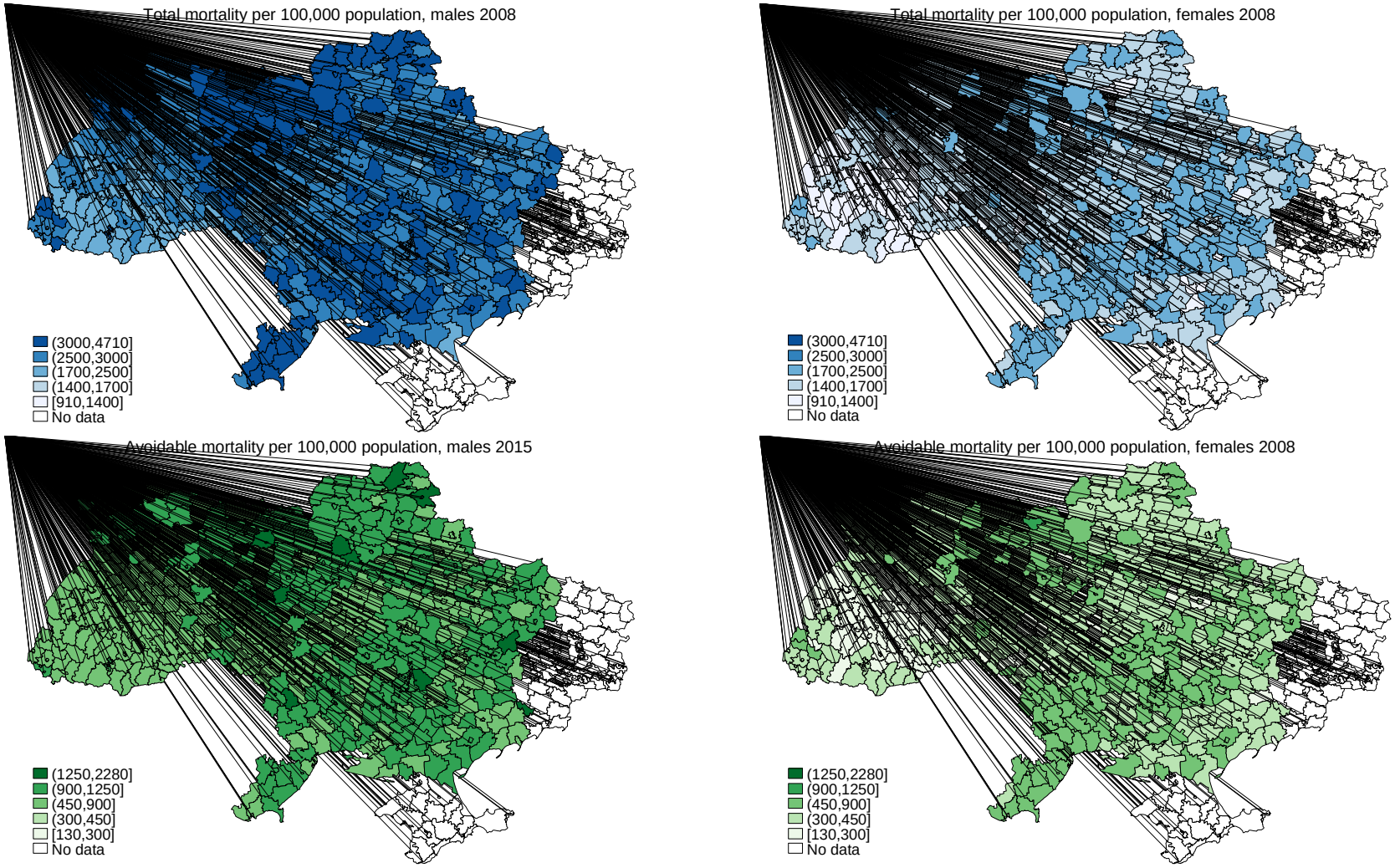


Figure 11: Spatial distribution of total and avoidable mortality by gender, 2008

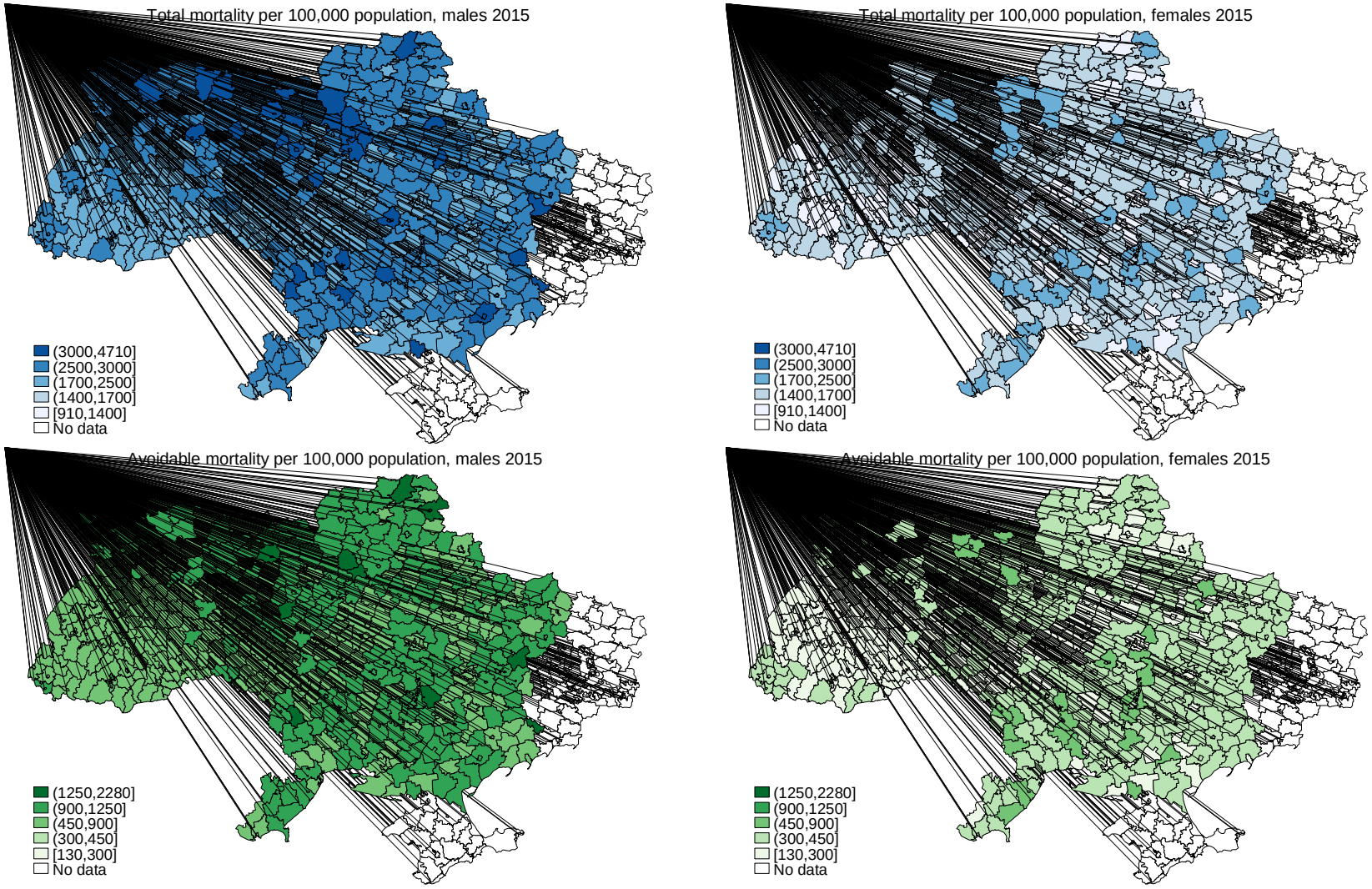


Figure 12: Spatial distribution of total and avoidable mortality by gender, 2015

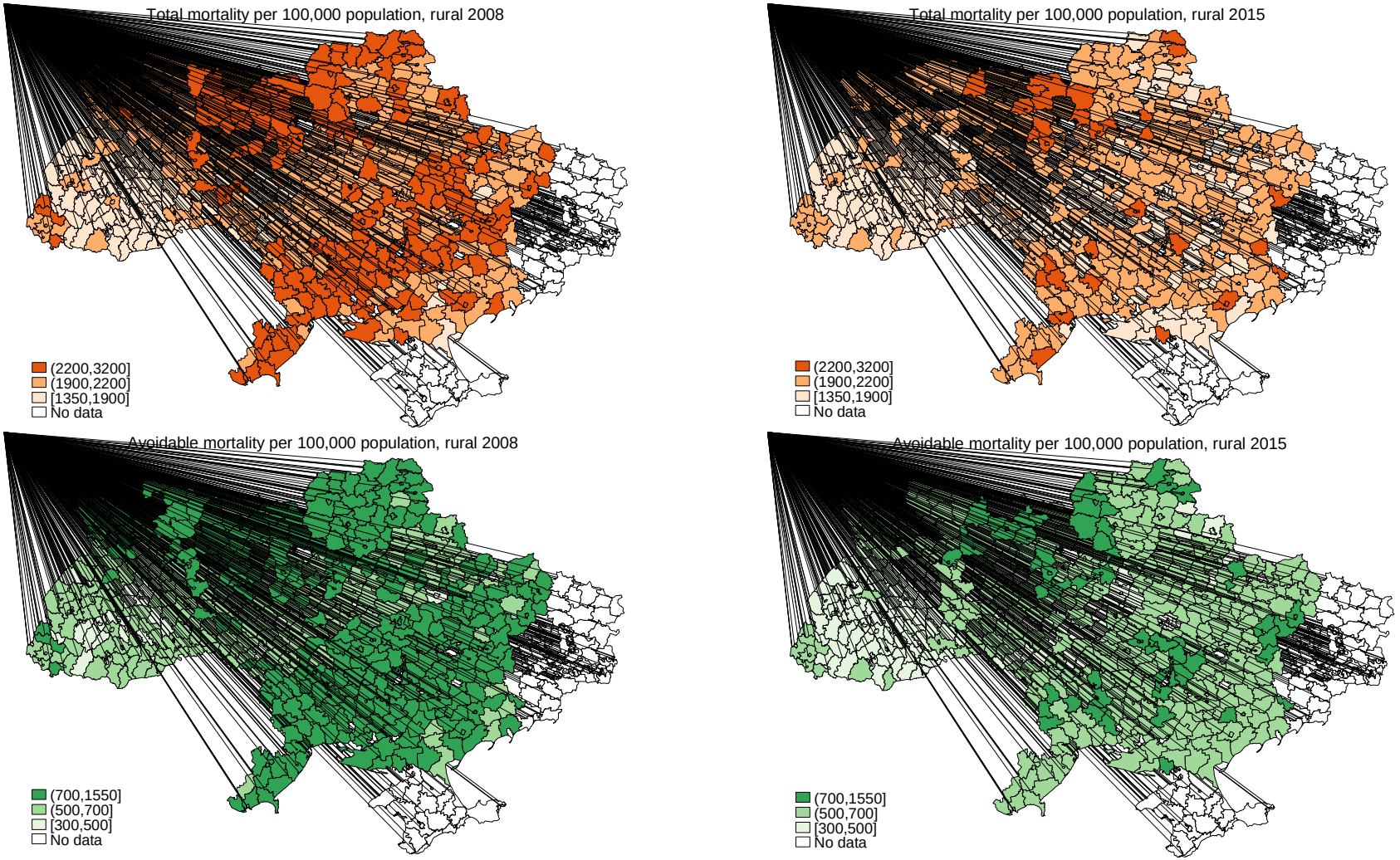


Figure 13: Spatial distribution of total and avoidable mortality in rural areas

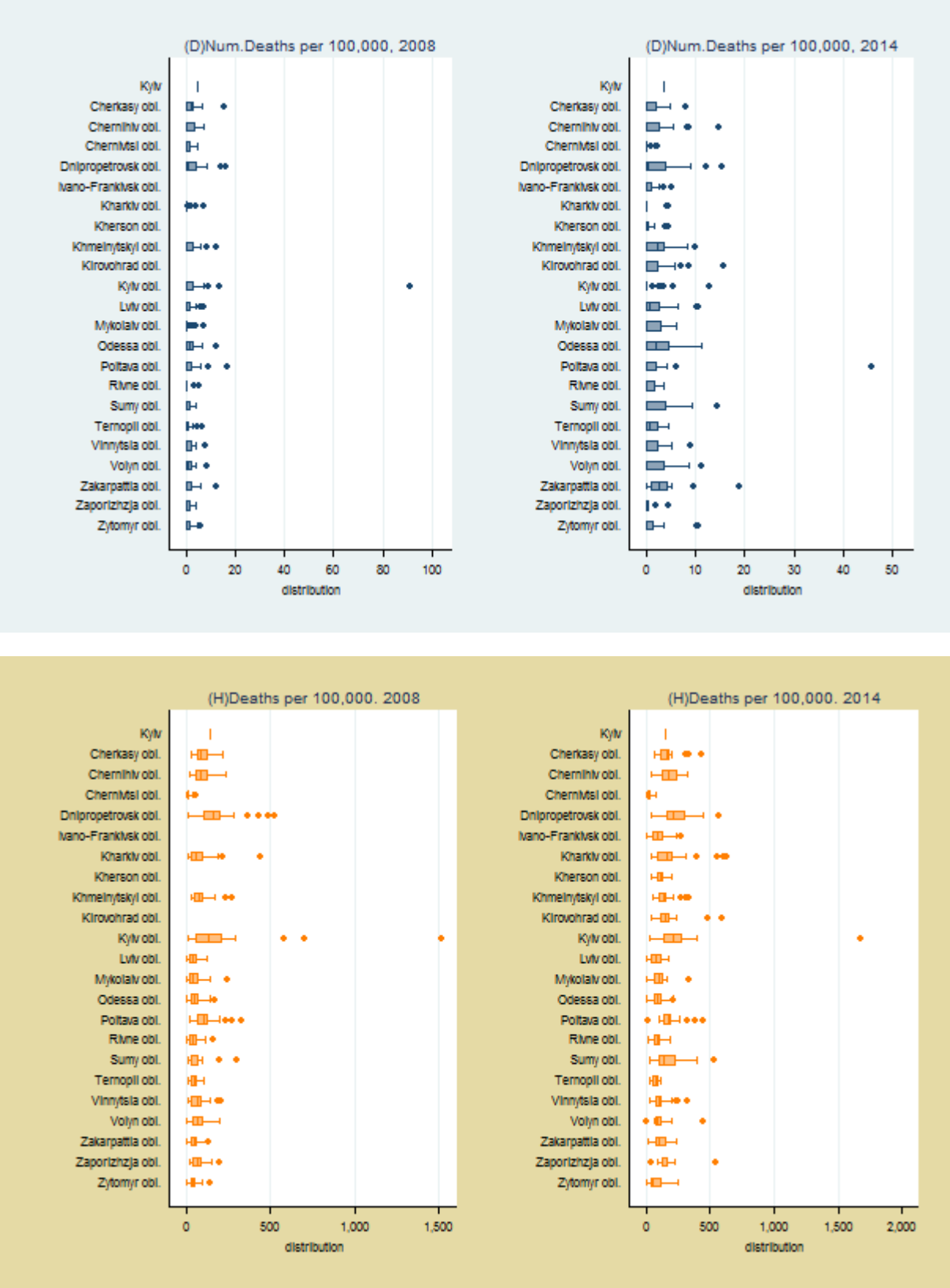


Figure 14. Box plots of number of deaths related to diabetes and heart diseases in 2008 and 2014.

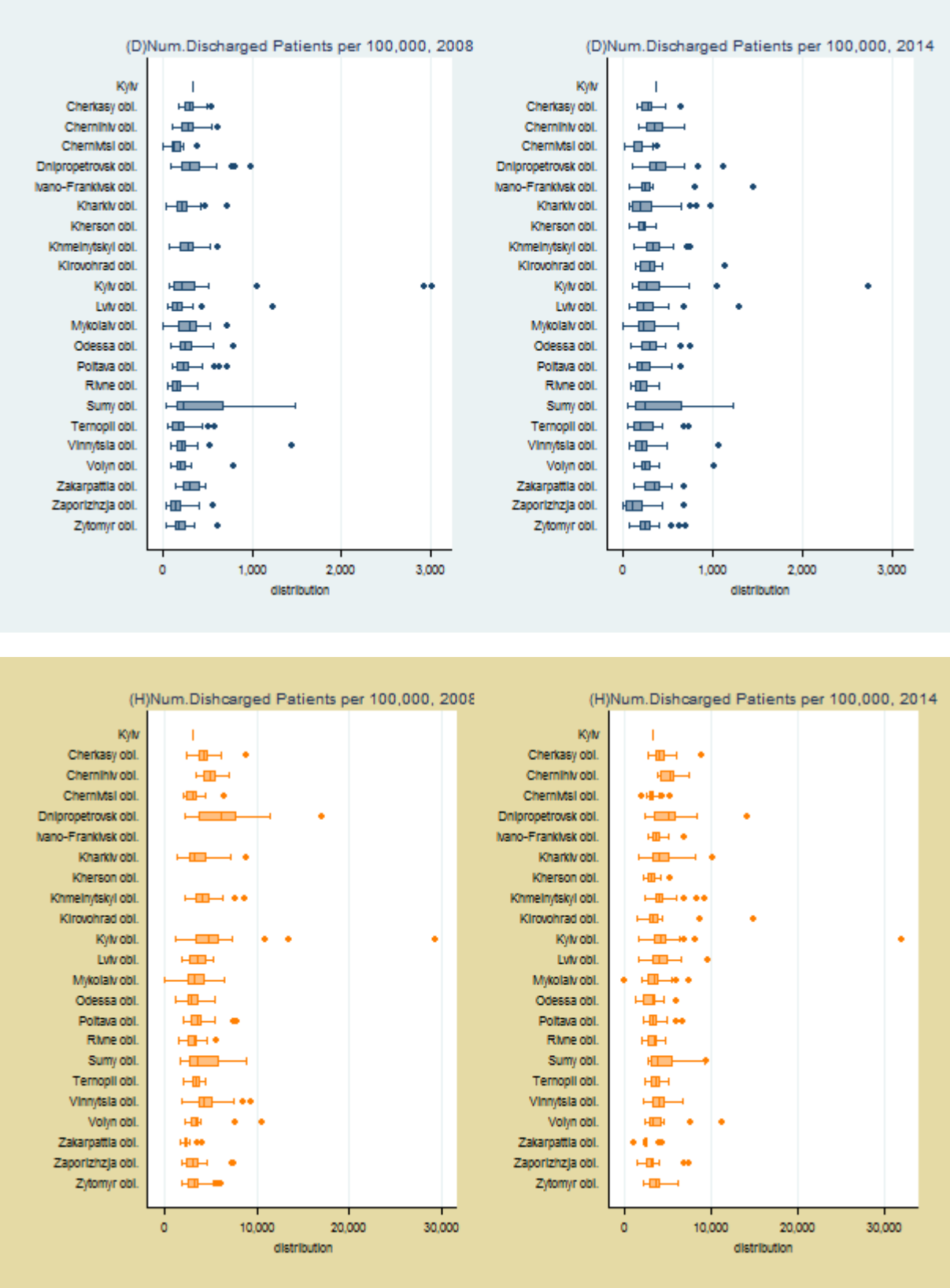


Figure 15. Box plots of number of discharged patients with the diagnosis related to diabetes and heart diseases in 2008 and 2014.