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# Health consequences of the war in Eastern Ukraine: comparing 2015-16 to 2012-13

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## Abstract

Previous literature identifies significant negative consequences of violent conflict on population health. Using a unique data set of 36,024 district level observations for main disease groups spanning 2012-2016, we test whether this finding carries over to a military conflict in Eastern Ukraine before the full-scale Russian invasion on February 24<sup>th</sup>, 2022. The difference-in-difference methodology used in this paper shows no statistically significant effect on population health in war-affected regions of Donbas for the majority of disease classes, including those identified in the previous literature. These insignificant results are surprising because they contradict substantial recent evidence on the negative socio-economic effect of the conflict in Donbas on happiness, political participation, and employment.

JEL classification: I15, D74

Keywords: Violent conflict, Population health, Donbas

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## 1. Introduction

Since February 24<sup>th</sup>, 2022, Ukrainian heroic resistance to the unprovoked and brutal full-scale Russian aggression has become in the focus of the global attention. Many observers forget, however, that this military conflict has been ongoing with a varying level of intensity since February 2014 when Russia started the military operation to annex Ukrainian Autonomous Republic of Crimea. There exists considerable literature on the devastating effects of violent conflict on residents, refugees, and migrants from conflict-affected areas. Three major streams of research can be identified. First, conflicts are associated with the reemergence of infectious diseases such as tuberculosis, polio, and measles (Ozaras et al., 2016; Akil and Ahmad, 2016) and even cholera (Blackburn, Lenze, and Casey 2020). Second, conflicts lead to worsening mental health as manifested by posttraumatic stress disorder (PTSD), depression, somatization disorder (Dietrich et al., 2019; Londoño, Romero, and Casas, 2012). Third, wars may

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contribute to certain chronic non-communicable diseases such as cardiovascular diseases (Poole, 2012; Jawad et al., 2019) and cancer (Jawad et al., 2020). In this paper, we test whether the results of previous studies carry over to Ukraine, which has suffered from a major violent conflict since 2014 focusing on the earlier period of the Russian aggression up until 2016.

Despite the major economic downturn and certain social unrest, the Ukrainian transition to the market economy and democracy was mostly peaceful from 1991 until 2013. However, in the Fall of 2013, a fully armed confrontation between protesters and then-President Viktor Yanukovich began over the Ukraine–EU Association Agreement. After the tragic days in February of 2014, when dozens of Euromaidan protesters and police officers were killed, Yanukovich fled to Russia, Crimea was annexed by Russia, and violent conflict started in the Eastern regions of Donetsk and Luhansk.

In order to evaluate the effect of conflict on population health, we construct a unique dataset for 474 districts in Ukraine, including 39 districts in conflict-affected areas of Donetsk and Luhansk regions under governmental control. The dataset includes medical statistics on the number of reported cases for all disease categories over 2012–2016. The difference-in-difference approach is then applied to each disease category with additional district characteristics. Surprisingly enough, we do not detect a robust effect of conflict on population health, which makes an important contribution to the literature because it contradicts many previous findings, including other negative consequences of Donbas conflict.

The rest of the paper is organized as follows. First, we discuss the violent conflict in Ukraine and also previous literature on the effects of wars on population health. Then we provide information on the data collection (which took us more than one year) and the details of the difference-in-difference methodology. Finally, we present and discuss our findings, and the last section concludes.

## **2. Violent conflict in Ukraine**

Ukraine has peacefully survived the collapse of the Soviet Union, unlike former republics of Moldova, Armenia, Azerbaijan, Georgia, Tajikistan, Uzbekistan, Kyrgyzstan, and Russia, where in the late 1980s and early 1990s there were military conflicts of different levels of aggression. Despite several episodes of heightened social

confrontation, the largest of which were student movements and miners' strikes of the early 1990s and the Orange Revolution of 2004, Ukraine enjoyed a peaceful political process until 2013. The main issues that led to social protests were the economic instability and the choice of political orientation.

The choice of political orientation was the main cause of the protests that began in the Fall of 2013 and grew into a fully armed confrontation between protesters and then-President Viktor Yanukovich. While Viktor Yanukovich has been negotiating the Ukraine–EU Association Agreement for a long time, he refused to sign it due to pressure from the Russian Federation. Further efforts to suppress protests in Kyiv using special police units, the Security Service of Ukraine (SBU) and informal paramilitary groups have led to an escalation of conflict and Yanukovich's ousting (Shveda and Park, 2016).

In February 2014, Viktor Yanukovich fled to Russia, leaving Ukraine in a political crisis and uncertainty over the central government. The situation was used by the Russian Federation, which launched a military operation to capture the Autonomous Republic of Crimea on February 20, 2014 (Kurkov, 2014). This operation included taking over administrative buildings (Supreme Council of Crimea) and critical transport facilities (airports in Simferopol and Belbek, a seaport of Feodosia) as well as blocking Ukrainian military units (Carbonnel, Prentice, 2014). On March 15, 2014, a so-called "referendum" was held on the entry of the Crimea and the city of Sevastopol into the Russian Federation, which was implemented on March 18 ('Crimea referendum: Voters 'back Russia union' ', 2014). The occupation of Crimea was accompanied by the murder of two Ukrainian soldiers and the systematic persecution of the pro-Ukrainian inhabitants of the Crimean peninsula, many of whom migrated to the continental part of Ukraine.

The events related to the occupation of Crimea have influenced the situation in several regions in the south and east of Ukraine. The population of these regions has traditionally been the electoral base of Viktor Yanukovich's party and was considered to be dominated by supporters of cooperation with Russia. In March 2014, attempts to seize administrative premises began. Initially, these attempts were not successful (D'agata, 2014), but after the occupation of Crimea, the situation in the east escalated.

In early April 2014, pro-Russian militants occupied the SBU premises in Luhansk, regional state administrations in Donetsk and Kharkiv.

The violent conflict in Eastern Ukraine started after capturing several cities in the Donetsk region (Sloviansk, Kramatorsk, Lyman and Sviatogirsk) by the pro-Russian sabotage groups ('Another government building in eastern Ukraine attacked by pro-Russia militants', 2014). These armed formations began active combat operations, launching attacks on Ukrainian troops, police, the SBU and local residents. In May, clashes took place in all major towns of Donetsk and Luhansk regions. The most active confrontations occurred in the area of Sloviansk, Mariupol, Pokrovsk and Volnovakha of Donetsk region, as well as in Lugansk and Rubizhne of Lugansk region.

The presidential elections in Ukraine on May 25, 2014, eliminated political uncertainty at the central level, which positively affected the effectiveness of the Ukrainian law enforcement agencies. Ukrainian troops recaptured Mariupol and the area around Lyman on June 13-14 and June 19 accordingly ('Ukraine crisis: Kiev forces win back Mariupol', 2014). By July 5, Sloviansk-Kramatorsk agglomeration (Kramatorsk, Druzhkovka, and Kostyantynivka) was liberated ('Ukraine crisis: Donetsk rebels in mass withdrawal', 2014). By the end of July, the Ukrainian army's attacks cut the occupied territories into isolated parts, making it impossible for them to endure long-term resistance.

However, at the end of Summer 2014, the Ukrainian army suffered a sudden defeat in Ilovaik, eventually leading to the "Minsk-1" ceasefire agreement signed in September 2014 (Coupe and Obrizan, 2016a). In the winter of 2015, the last two major military operations took place – the battles at Debaltseve bridgehead (Luhn A., Grytsenko O, 2015) and Donetsk airport ('Russia-backed separatists seize Donetsk airport in Ukraine', 2015). In February 2015, the "Minsk-2" complex of measures for the implementation of the Minsk Agreements was signed ('Ukraine crisis: Leaders agree peace roadmap', 2015). The signing of Minsk-2 put the conflict into a state of positional confrontation for a few years with constant exacerbations in the form of artillery and rifle shootings, e.g., in Marinka (summer 2015), in Svitlodarsk (summer-winter 2016), and in Avdiivka (winter 2017).

Things have drastically changed after the unprovoked full-scale Russian invasion on February 24<sup>th</sup>, 2022, with thousands killed, millions of Ukrainians turning into

refugees and internally displaced people, massive attacks on critical infrastructure and no sight of a quick ending of the conflict. In this paper we look at the earlier stages of the conflict which in 2015-16 mostly affected Donetsk and Luhansk regions.

### **3. Literature review: Armed conflicts and health**

Armed conflicts are strongly associated with a dramatic devastating impact on public health (Roy and Ray, 2018). The health impact of violent conflict manifests through various direct and indirect channels. Direct channels are apparent and include killed and traumatized people. However, armed conflicts have more complex and long-term health consequences.

The collapse of economy and infrastructure (Imai and Weinstein, 2000), unemployment (Vakhitova and Iavorskyi, 2020), forced external and internal displacement (Kondylis, 2010), food shortages, lack of medicines, and living in unsanitary and overcrowded refugee camps (Van Berlaer et al., 2016) put tremendous pressure on conflict survivors. Such pressure leads to starvation, the spread of infectious diseases, mental disorders, and the exacerbation of chronic diseases.

Previous literature on the effect of violent conflict on population health mostly focuses on infectious diseases and mental health. In particular, conflicts often lead to the reemergence of infectious diseases such as tuberculosis, polio, and measles. In the case of tuberculosis, for example, this may happen because of a significant delay in the diagnosis both for patients from conflict-affected zones and from non-conflict zones (Gele and Bjune, 2010). The incidence and prevalence ratios for populations experiencing displacement, armed conflict, or natural disaster compared to reference populations were two or higher in 11 of 15 studies (Kimbrough et al., 2012). The primary reasons for the rapid transmission of tuberculosis among refugees are crowded and unsanitary living conditions and inadequate screening (Ozaras et al., 2016).

Violent conflicts have also resulted in the reemergence of polio in countries that were polio-free for decades and may contribute to the spread of the virus to neighboring countries (Akil and Ahmad, 2016). Akil and Ahmad (2016) find a relationship between poliomyelitis outbreaks and conflicts in Afghanistan, Cameroon, Equatorial Guinea, Ethiopia, Iraq, Kenya, Nigeria, Pakistan, Somalia, and Syria. Polio-endemic countries may also spread the virus to neighboring countries through the

movement of displaced populations that may lack the proper vaccinations and health care.

Blackburn, Lenze, and Casey (2020) study the relationship between conflict and the cholera epidemic in Yemen in 2016. The destruction of hospitals and drinking water systems is linked to the most severe cholera outbreak in the last years (and probably centuries), with more than 1 million cases and more than 2000 deaths (Blackburn, Lenze, and Casey, 2020).

Sexual violence inevitable in armed conflicts can contribute to the spread of HIV/AIDS (Betsi et al., 2006; Iqbal and Zorn, 2010). Betsi et al. (2006) find that armed conflict in Côte d'Ivoire led to a decrease in the number of health personnel and functioning health facilities, lack of essential drugs, and a lower number of sold condoms. Iqbal and Zorn (2010) find a strong positive relationship between HIV/AIDS prevalence and both international and domestic conflicts.

The growing body of literature focuses on the mental trauma of posttraumatic stress disorder (PTSD), depression, psychosis, etc. Dietrich et al. (2019) use data on the screening for posttraumatic stress disorder in young adult refugees from Syria and Iraq. The higher intensity of conflict exposure is associated with PTSD severity, with a prevalence of 8% (Dietrich et al., 2019). Exposure to war trauma events was strongly associated with PTSD in the conflict-affected districts of northern Uganda (Mugisha et al., 2015).

Londoño, Romero, and Casas (2012) compare two communities in Colombia: directly impacted by conflict and unaffected. There is a statistically significant association between exposure to armed conflict and the presence of mental illnesses, such as depression, somatization disorder, and alcohol abuse (Londoño, Romero, and Casas, 2012). Nidzvetska et al. (2017) conduct a series of semi-structured in-depth interviews to assess barriers to healthcare access and the overall health of mothers and young children displaced by the conflict in Ukraine. The interviewees report that their mental rather than physical health is affected by the conflict (Nidzvetska et al., 2017).

Relatively few papers focus on the effect of violent conflict on chronic non-communicable diseases such as cardiovascular diseases (Poole, 2012; Jawad et al., 2019) and cancer (Jawad et al., 2020). Armed conflicts from 1960 to 2000 are found to increase cardiovascular disease mortality rates in 134 countries (Poole, 2012). A

systematic review of 65 studies reveals that armed conflicts are positively associated with coronary heart disease, cerebrovascular and endocrine diseases (Jawad et al., 2019). There is also some evidence that armed conflict is associated with increases in the incidence and mortality of nonspecific cancers, breast cancer, and cervical cancer (Jawad et al., 2020). Hence, the literature review suggests that violent conflicts may increase the number of reported cases for many diseases, including infectious, sexually transmitted, mental, and certain non-communicable diseases.

Before completing the literature review it is worth noting that the intensity of the conflict in Eastern Donbas during the period under study may look relatively low compared to other conflicts, such as in Syria. In 2014, when Russia annexed Crimea and started para-military operations in Eastern Donbas, the civilian death toll in Ukraine was 2,084<sup>1</sup> compared to 18,038 civilian deaths in Syria the same year.<sup>2</sup> This observation may partially explain mostly insignificant effect of the war on public health in Ukraine that we find in this paper. However, the results are very much likely to change when the data become available for 2022 – the year of full-scale Russian invasion.

#### **4. Data and methods**

The Ukrainian public health statistics system consists of regional centers of medical statistics supervised by the Ministry of Health (MOH). These centers are coordinating activities of public health institutions on the collection, processing, and analysis of statistical information. Formally, medical statistics reports are prepared and submitted to regional centers of medical statistics by healthcare facilities: municipal or rural hospitals, primary healthcare centers, specialized clinics etc. These data have been used in the previous literature (Nizalova and Vyshnya, 2010).

To collect data for this project, we requested statistics by mail from each of the regional centers of medical statistics, and 20 regions (or Oblasts in Ukrainian) out of 25 and the City of Kyiv responded.<sup>3</sup> Due to area-specific issues, data on conflict-affected regions were collected directly from local public healthcare facilities. In some cases,

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<sup>1</sup> United Nations Human Rights (2022a)

<sup>2</sup> The Syrian Observatory for Human Rights (2020)

<sup>3</sup> The excluded regions are Autonomous Republic of Crimea, Chernivtsi, Kherson, Kropyvnytskyi (former Kirovohrad) and Mykolaiv. Since the regions are located in different parts of Ukraine it is reasonable to assume that the data are missing at random and should not affect our results.

information was directly obtained from hospitals. The information on new cases was collected from Form #12, which classifies cases according to the 10th revision of the International Classification of Diseases (ICD-10). Format of documents differed substantially and included documents in MS Word, PDF, MS Excel, and various database formats. Although the formats of submitted documents represented certain challenge for data processing, all hospitals used the same Form # 12 and followed the same reporting procedure given a highly centralized system of health care in Ukraine.

In addition, we collected information from the Ukrainian statistical authority UkrStat on population, the share of the rural population, average wage, and capital investment per capita, which are available at the district (rayon) level. We converted nominal wage and investment to real wage and investment in prices of 2012 using the consumer price index. Besides, we collected information on gross regional product per capita, unemployment, and a number of firms (as a proxy for the level of economic development). However, these data are only available at a regional (oblast) level and not the district level. We decided not to include these variables into our preferred specification because of measurement issues. In particular, the data for Donetsk and Luhansk regions for 2015-2016 will only include districts controlled by the Ukrainian government because of a lack of official statistics.

To study the effect of violent conflict on population health, we apply difference-in-difference methodology to each group of diseases

$$Cases_{i,year} = \alpha + \beta \cdot X_{i,year} + \gamma \cdot D_{2015/16} + \delta \cdot Donbas + \eta \cdot D_{2015/16} \cdot Donbas + \varepsilon_{i,year},$$

where  $Cases_{i,year}$  is the number of new cases reported per 1,000 people and  $X_{i,year}$  is the vector of socio-demographic and economic variables in district  $i$  in a given  $year$ . Our data set includes two peaceful years of 2012 and 2013 and two years when the conflict was ongoing – 2015 and 2016. We excluded 2014 because the conflict started in the spring, and we will not be able to identify which cases happened before and which during the conflict. As such, the set of difference-in-difference coefficients includes an indicator  $D_{2015/16}$  for years 2015 and 2016 when the conflict was ongoing, an indicator  $Donbas$  for Donetsk and Luhansk oblasts where the conflict took place (with data being



available only for government-controlled territories) and, finally, the interaction term between the two.

## **5. Results**

The final balanced sample includes 474 districts observed over 2012-2013 and 2015-2016 years, of which 39 (or 8.23%) are conflict-affected districts of Donbas. Table 1 shows the distribution of new cases classified according to the 10th revision of the International Classification of Diseases (ICD-10). The new cases are reported per 1,000 residents separately for regions not affected by conflict and Donbas for 2012-2013 and 2015-2016. The table also reports the change in the number of cases after the conflict start relative to cases in 2012-2013.

Respiratory diseases are the most frequent and represent 43 to 49% of all new cases because they include seasonal influenza and other common health conditions. Regions of Ukraine not affected by the conflict demonstrate a stable number of new cases in the category “All diseases.” However, there is a certain variation in the composition of cases. Two categories with significant decline include “Pregnancies and childbirth” (14% fewer cases in 2015-2016 compared to 2013-2014) and “Mental disorders” (11% decrease). At the same time, there are 7% more cases of respiratory diseases, and 5% of cases unclassified in other groups. However, most of these categories (except for respiratory diseases) have just a few cases, so that even a small change in the number of cases leads to large percentage changes.

Table 1. New cases per 1,000 residents tabulated by diseases and years

New cases per 1,000 residents	Not affected by conflict				Change after 2014	Donbas				Change after 2014
	2012	2013	2015	2016		2012	2013	2015	2016	
All diseases	643.71	650.03	642.63	656.47	1.00	522.66	511.33	535.97	629.27	1.13
Infectious and parasitic diseases	20.30	20.09	18.68	18.75	0.93	21.54	22.40	20.12	21.48	0.95
Cancer	8.04	8.64	8.23	8.25	0.99	7.58	7.56	7.33	7.87	1.00
Blood and hematopoietic diseases	5.90	5.70	5.32	5.19	0.91	2.85	2.82	3.56	4.27	1.38
Nutrition and metabolic disorders	11.59	11.77	10.84	10.34	0.91	7.81	8.48	6.74	8.11	0.91
Mental disorders	3.75	3.98	3.52	3.40	0.89	3.24	3.09	2.76	2.78	0.88
Nervous system diseases	17.09	17.04	16.98	16.77	0.99	6.73	7.21	7.43	8.24	1.12
Eye diseases	33.68	33.73	33.21	33.01	0.98	22.49	23.14	24.07	23.71	1.05
Ear diseases	21.67	21.92	21.87	22.19	1.01	18.35	18.10	18.89	19.80	1.06
Circulatory system diseases	50.09	49.09	45.22	44.46	0.90	38.38	42.72	46.65	49.08	1.18
Respiratory diseases	280.78	287.64	294.47	312.06	1.07	226.73	219.18	241.45	307.38	1.23
Digestive diseases	29.09	28.17	28.17	27.60	0.97	18.63	20.22	19.14	21.10	1.04
Skin diseases	35.64	35.77	34.93	34.71	0.98	26.97	29.35	26.71	28.11	0.97
Musculoskeletal system diseases	30.01	29.98	29.15	29.10	0.97	20.81	22.09	23.32	27.11	1.18
Genitourinary system diseases	38.28	38.59	37.71	36.96	0.97	29.80	31.32	33.65	41.04	1.22
Pregnancy and childbirth	10.91	11.40	9.89	9.25	0.86	8.97	8.41	6.85	6.78	0.78
Chromosomal disorders	1.02	1.00	1.01	0.97	0.98	0.66	0.71	0.72	0.83	1.13
Unclassified in other groups	1.02	1.02	1.05	1.09	1.05	0.31	0.31	0.63	0.48	1.78
External causes	43.31	43.09	41.07	41.17	0.95	43.67	42.72	44.79	49.91	1.10

Notes: "Increase after 2014" is computed as ratio  $(2016+2015)/(2012+2013)$ . Donbas includes districts of Donetsk and Luhansk regions under control of Ukrainian government.

The situation in the conflict-affected districts of Donbas is more volatile with an increase in the number of cases from 523 in 2012 to 629 in 2016 (20.27% growth in the number of cases or 13% average growth from 2012-2013 to 2015-2016). It may be tempting to attribute this increase only to the results of violent conflict, but there are only 39 included districts in Donbas, making statistics quite volatile because of a small sample. Besides, there could be many changes in the underlying sample characteristics. Hence, we will next proceed to descriptive statistics and regression analyses.

Table 2 shows descriptive statistics by year for districts not affected by conflict and for Donbas. 20% of districts not affected by conflict are in three regions bordering Donbas – Kharkiv, Dnipropetrovsk, and Zaporizhzhia. These regions can be quite different from the rest of Ukraine because they share the industrial heritage of Eastern Ukraine.

Districts in Donbas, which remain under governmental control, have a lower share of the rural population (34.522-35.710%) than the rest of Ukraine (73.106-73.911%). Real wage in 2015-16 decreased by 22% in Donbas compared to only 18% drop in the rest of Ukraine compared to 2012-13. But even in 2016 the average real wage in Donbas was higher by 17% compared to the areas not affected by the conflict. On the other hand, real per capita investment in Donbas, which was 2.4 times higher in

2012 than in the rest of Ukraine in 2016, dropped to only 68.45% of the average investment in areas not affected by conflict. The total decline in real per capita investment for 2015-16 compared to 2012-13 reached an enormous 79% for Donbas compared to a relatively modest 23% in the rest of Ukraine.

Table 2. Descriptive statistics for explanatory variables by year

Mean (std dev) for Variables	Not affected by conflict				Change after 2014	Donbas				Change after 2014
	2012	2013	2015	2016		2012	2013	2015	2016	
Oblast bordering	0.200	0.200	0.200	0.200		0.000	0.000	0.000	0.000	
Donbas	(0.400)	(0.400)	(0.400)	(0.400)		-	-	-	-	
Kyiv	0.002	0.002	0.002	0.002		0.000	0.000	0.000	0.000	
	(0.048)	(0.048)	(0.048)	(0.048)		-	-	-	-	
City > 500 thousand	0.016	0.016	0.016	0.016		0.000	0.000	0.000	0.000	
	(0.126)	(0.126)	(0.126)	(0.126)		-	-	-	-	
Population, in 1,000	73.911	73.853	73.413	73.106	0.99	65.074	64.615	63.023	62.410	0.97
	(176.858)	(178.193)	(179.659)	(180.100)		(79.906)	(79.498)	(78.495)	(77.852)	
Share of rural population, %	55.115	55.004	54.997	55.097	1.00	34.574	34.522	35.754	35.710	1.03
	(27.557)	(27.545)	(27.484)	(27.503)		(33.586)	(33.551)	(34.660)	(34.629)	
Real Monthly Average Wage, in UAH	2363.351	2557.584	1952.958	2088.443	0.82	2923.821	3119.231	2290.068	2451.472	0.78
	(608.646)	(669.801)	(524.067)	(567.021)		(912.922)	(965.476)	(554.858)	(540.154)	
Real Capital Investment per capita, in UAH	260.320	237.082	172.082	212.904	0.77	623.939	603.168	106.133	145.732	0.21
	(339.356)	(315.254)	(223.705)	(276.302)		(550.473)	(470.914)	(95.160)	(128.394)	
Observations	435	435	435	435		39	39	39	39	

Notes: "Change after 2014" is computed as ratio (2016+2015)/(2012+2013). Real wages and capital investment are expressed in 2012 UAH. Donbas includes districts of Donetsk and Luhansk regions under control of Ukrainian government.

Table 3 presents the result of the estimation of difference-in-difference indicators for 19 groups of diseases in ICD-10. Full models are available in Table A1 in the Online Appendix. The first interesting observation is that Donbas districts under governmental control actually had fewer new cases per 1,000 reported before the conflict started. The coefficient on the indicator for Donbas is always negative and significant at 5% or 1%. Similarly, there are fewer cases per capita for bordering Oblasts (regions) with negative and statistically significant indicators for about half of disease classes. Once again, this may indicate certain common features in industrialized regions of Eastern Ukraine.

Table 3. Difference-in-difference estimation results - the effect of conflict on population health

New cases per 1,000 people	Infectious and parasitic diseases			Cancer	Blood and hematopoietic diseases	Nutrition and metabolic disorders	Mental disorders	Nervous system diseases
	All diseases							
Intercept	482.487*** (71.567)	17.338*** (3.277)	9.046*** (1.450)	3.627*** (0.876)	9.485*** (1.436)	4.804*** (0.498)	13.426*** (2.420)	
Post War Years 2015/16	25.504*** (8.884)	-0.353 (0.485)	0.024 (0.205)	-0.552*** (0.141)	-1.090*** (0.248)	-0.451*** (0.163)	-0.213 (0.377)	
Donbas	-172.302*** (23.361)	-1.195 (1.848)	-1.121 (1.057)	-2.228*** (0.399)	-3.137*** (0.698)	-1.204*** (0.352)	-10.950*** (1.497)	
Years 2015/16*Donbas	92.457 (122.894)	0.730 (2.310)	0.319 (1.764)	1.456 (1.054)	0.089 (1.319)	0.298 (0.378)	2.942** (1.446)	
Oblast bordering Donbas	-38.299* (23.145)	0.067 (1.271)	2.918*** (0.994)	-0.861** (0.407)	-2.686*** (0.535)	-1.191*** (0.217)	-3.738*** (1.142)	
Adjusted R-squared	0.044	0.136	0.060	0.120	0.082	0.023	0.121	
New cases per 1,000 people	Eye diseases	Ear diseases	Circulatory system diseases	Respiratory diseases	Digestive diseases	Skin diseases	Musculo skeletal system	
Intercept	27.614*** (5.116)	18.514*** (3.950)	36.752*** (5.836)	173.965*** (38.904)	20.108*** (3.297)	31.227*** (5.070)	24.524*** (4.443)	
Post War Years 2015/16	0.361 (0.853)	0.673 (0.572)	-4.134*** (0.933)	34.179*** (4.817)	-0.605 (0.504)	0.428 (0.742)	-0.031 (0.651)	
Donbas	-11.788*** (2.715)	-3.957** (1.929)	-8.462*** (3.062)	-86.044*** (13.669)	-8.600*** (1.767)	-10.257*** (2.828)	-10.349*** (2.231)	
Years 2015/16*Donbas	1.636 (3.728)	1.04 (3.606)	13.797* (7.570)	50.864 (68.112)	1.997 (2.532)	-0.573 (4.165)	6.363 (6.323)	
Oblast bordering Donbas	-0.506 (2.126)	1.625 (1.730)	-2.134 (2.140)	-22.470* (11.627)	-4.677*** (1.414)	-4.164* (2.159)	0.786 (1.886)	
Adjusted R-squared	0.039	0.045	0.049	0.043	0.109	0.063	0.034	
New cases per 1,000 people	Genitourinary system diseases	Pregnancy and childbirth	Chromosomal disorders	Unclassified in other groups	External causes			
Intercept	38.876*** (6.679)	10.729*** (2.217)	0.803*** (0.175)	-0.064 (0.411)	39.983*** (7.239)			
Post War Years 2015/16	-0.956 (0.910)	-1.400*** (0.397)	0.006 (0.033)	0.204*** (0.071)	-0.355 (0.969)			
Donbas	-8.128** (3.170)	-3.780*** (1.177)	-0.288*** (0.068)	-1.346*** (0.350)	-7.195** (3.274)			
Years 2015/16*Donbas	8.351 (8.764)	0.030 (0.879)	0.073 (0.130)	0.802* (0.478)	10.132 (13.535)			
Oblast bordering Donbas	4.585* (2.529)	-3.240*** (0.821)	0.268*** (0.083)	-1.123*** (0.201)	-1.643 (2.285)			
Adjusted R-squared	0.043	0.051	0.062	0.092	0.045			

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit. All models control for Kyiv dummy, cities with population of 500 thousand or more, population in thousands, share of rural population in %, real monthly average wage in UAH and real capital investment per capita in UAH. There are 1,896 observations in each model.

What is surprising, however, is a lack of statistically significant effects of the conflict on the population health. The coefficients for infectious diseases, mental disorders, and chronic conditions identified in the literature review are statistically insignificant. We have tried different specifications: with only the set of the difference-in-difference indicators; with additional explanatory variables measured at the regional

level; with a total count of new cases instead of per capita numbers; with a total number of cases instead of new cases only. In all these specifications (available upon request), the coefficients for infectious diseases, mental disorders, and chronic conditions remain insignificant.

There are only three disease classes out of 19 that demonstrate a marginally significant positive effect of conflict on the number of new cases. Districts in Donbas under governmental control report 2.942 more cases of nervous system diseases per 1,000 people (significant at 5%), 13.797 more cases of circulatory system diseases, and 0.802 more new cases of diseases unclassified in other groups (both significant at 10%). What is interesting is that these coefficients also remain marginally significant in many of the alternative model specification listed above. These results are somewhat unexpected and warrant further discussion but first let us first discuss a few additional robustness checks applied to the main model specification with the number of new cases per 1,000 people.<sup>4</sup>

In order to check the difference between years which may be related to conflict intensity and population adjustment we consider the separate difference-in-difference estimates for 2015 and 2016 in Table A2 in the Online Appendix. The results remain very similar to the main model specification in Table 3. In particular, there is a statistically significant increase in the number of cases for nervous system diseases - by 2.421 in 2015 (significant at 10% level) and by 3.478 in 2016 (significant at 5% level) and circulatory system diseases by 12.223 in 2015 (significant at 10% level) and by 15.425 in 2016 (significant at 10% level). The increase in the number of cases for diseases unclassified in other groups remains significant at 10% only in 2015 but the magnitude of the coefficients in both years (0.901 and 0,706) is in the ballpark of the coefficient in the main model (0.802).

We argued that regions bordering Donbas – Kharkiv, Dnipro, and Zaporizhzhia - can be quite different from the rest of Ukraine because they share the industrial heritage of Eastern Ukraine. It would be then natural to see how the results will change if we limit the control group to just three bordering regions rather than entire Ukraine except

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<sup>4</sup> When we consider the insignificant coefficients in Table 3 for Donbas in 2015/2016, it is only one case when the coefficient is negative, and the magnitude of the coefficients is not that small in many cases. As such, there is some evidence of worsening health in Donbas after the conflict start, although the data do not allow to precisely estimate the effects. We would like to thank an anonymous referee for this insightful observation.

for Donbas. Table A3 in the Online Appendix shows that the majority of difference-in-difference coefficients remain insignificant except for the number of circulatory system diseases which is higher by 22.661 (significant at 1%).

Our main model in Table 3 includes covariates such as investments and wages as controls but these may also be affected by the conflict, hence, leading to the underestimation of the impact of the conflict. What if we only include the set of difference-in-difference indicators and the intercept? Table A4 in the Online Appendix shows that the majority of difference-in-difference coefficients remain insignificant in this case as well except for the number of circulatory system diseases which is higher by 12.067 (significant at 10%). Hence, the statistically insignificant effect of the conflict on the population health remains robust for the majority of disease classes in many alternative specifications.

## 6. Discussion and Conclusions

Despite the fact that economists typically do not appreciate insignificant results, our findings contribute to the existing literature and call for further investigation. First of all, these results contradict previous literature on the adverse socio-economic effects of conflict in Donbas, including the reduced level of happiness (Coupe and Obrizan, 2016a), lower level of political participation (Coupe and Obrizan, 2016b), and lower chance of employment for heads of internally-displaced households two years after resettlement (Vakhitova and Iavorskyi, 2020).

One concern may be about data quality, but these data have been used in previously published studies (Nizalova and Vyshnya, 2010). It is possible that some of the medical records do not fully reflect the actual burden of the disease, for example, due to “ghost patients” who were never diagnosed with a disease but were entered into the records to cover up for personnel absenteeism, theft of medications or other illegal activities. For example, in 3.110% of observations the number of disease cases could be 0 in one year and non-zero in other years which can potentially (but not necessarily) point to some data misreporting. However, the results do not change substantially when we exclude such cases. Some important reforms (such as introduction of adequate compensation for medical personnel and electronic records) are underway in Ukraine which should improve the quality of medical statistics for future studies.

Another problem is that population statistics used to compute cases per 1,000 residents may fail to reflect the actual level of internal and external migration. By the end of 2015 there were 321 thousand refugees to other countries from Ukraine and 1 million 600 thousand internally displaced people in Ukraine (United Nations High Commissioner for Refugees (UNHCR) 2017). However, a very similar picture obtains in terms of the number of insignificant coefficients when we use the total and not per capita number of new cases.

Yet another potential reason for such unexpected results is an increased reliance on self-care and traditional healers in Ukraine, with formal medical care only serving as a last resort (Rechel and McKee, 2009). If this is the case, then the governmental medical statistics (even if properly collected) will fail to capture the increased number of new cases in conflict-affected areas simply because residents do not apply for formal medical help. One possible channel through which this can affect our difference-in-difference estimates is higher probability of reliance on self-care by internally displaced persons (IDPs) who may have fewer financial resources to apply to formal medical facilities. Since the share of IDPs is higher in Donbas compared to other regions of Ukraine this will potentially lead to underestimation of the effect of the conflict on medical outcomes.

A related concern is that many transition countries in Eastern Europe including Ukraine have been characterized by overutilization of services under the Semashko system of healthcare (Obrizan, 2019) compared to countries in other parts of the world that have also been affected by military conflicts. Then, the increase in the number of new cases of the same magnitude but relative to a higher base utilization may be less likely to transform into a statistically significant effect in Ukraine. For example, during the active phase of the conflict some patients may reduce the number of unnecessary “just in case” visits to the clinic which will counterbalance the increase in the new visits which are truly necessary.

Finally, what could have looked like relatively low-intensity conflict during the study period in 2014-2016, with mostly insignificant effects on public health, has changed completely after the full-scale Russian invasion on February 24<sup>th</sup>, 2022. The official death toll of 5,996 killed civilians<sup>5</sup> over the 8 months of the full-scale Russian

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<sup>5</sup> United Nations Human Rights (2022b)

invasion is already almost twice the number of 3,404 civilians killed<sup>6</sup> over the 8 years of the conflict taking place mostly in Donbas in 2014-2021. However, the official statistics may significantly underestimate the real number of casualties due to difficulties with accessing the data from occupied territories. In just one city of Mariupol there could be at least 22,000 killed<sup>7</sup> according to Ukrainian government officials. Unfortunately, it is very likely that the negative public health effects of the war will be identified for many more diseases once the data become available for 2022.

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<sup>6</sup> United Nations Human Rights (2022a)

<sup>7</sup> Vandoorne, Bell (2022)



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## Appendix

Table A1. Difference-in-difference estimation results - the effect of conflict on population health

New cases per 1,000 people	All diseases	Infectious and parasitic diseases	Cancer	Blood and hematopoietic diseases	Nutrition and metabolic disorders	Mental disorders	Nervous system diseases
Intercept	482.487*** (71.567)	17.338*** (3.277)	9.046*** (1.450)	3.627*** (0.876)	9.485*** (1.436)	4.804*** (0.498)	13.426*** (2.420)
Post War Years 2015/16	25.504*** (8.884)	-0.353 (0.485)	0.024 (0.205)	-0.552*** (0.141)	-1.090*** (0.248)	-0.451*** (0.163)	-0.213 (0.377)
Donbas	-172.302*** (23.361)	-1.195 (1.848)	-1.121 (1.057)	-2.228*** (0.399)	-3.137*** (0.698)	-1.204*** (0.352)	-10.950*** (1.497)
Years 2015/16*Donbas	92.457 (122.894)	0.730 (2.310)	0.319 (1.764)	1.456 (1.054)	0.089 (1.319)	0.298 (0.378)	2.942** (1.446)
Oblast bordering Donbas	-38.299* (23.145)	0.067 (1.271)	2.918*** (0.994)	-0.861** (0.407)	-2.686*** (0.535)	-1.191*** (0.217)	-3.738*** (1.142)
Kyiv	-832.845** (357.725)	-45.105*** (16.406)	2.294 (7.997)	-7.317** (3.608)	-18.649*** (7.196)	3.400 (3.353)	-43.056*** (12.589)
City > 500 thousand	-179.924 (125.874)	-7.349 (7.058)	1.877 (3.311)	-1.979 (1.463)	-7.400*** (2.815)	1.671 (1.440)	-10.162** (5.089)
Population, in 1,000	0.417** (0.166)	0.017** (0.008)	-0.001 (0.004)	0.003 (0.002)	0.009*** (0.003)	-0.002 (0.002)	0.022*** (0.006)
Share of rural population, %	0.415 (0.616)	-0.081*** (0.025)	-0.036* (0.019)	0.041*** (0.007)	0.040*** (0.011)	-0.006 (0.004)	0.064*** (0.021)
Real Monthly Average Wage, in UAH	0.045*** (0.015)	0.003*** (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)
Real Capital Investment per capita, in UAH	0.046 (0.031)	-0.001 (0.001)	0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)	0.001 (0.000)	0.005** (0.002)
Observations	1896	1896	1896	1896	1896	1896	1896
Adjusted R-squared	0.044	0.136	0.060	0.120	0.082	0.023	0.121

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit.

Table A1 continued. Difference-in-difference estimation results - the effect of conflict on population health

New cases per 1,000 people	Eye diseases	Ear diseases	Circulatory system diseases	Respiratory diseases	Digestive diseases	Skin diseases	Musculo skeletal system diseases
Intercept	27.614*** (5.116)	18.514*** (3.950)	36.752*** (5.836)	173.965*** (38.904)	20.108*** (3.297)	31.227*** (5.070)	24.524*** (4.443)
Post War Years 2015/16	0.361 (0.853)	0.673 (0.572)	-4.134*** (0.933)	34.179*** (4.817)	-0.605 (0.504)	0.428 (0.742)	-0.031 (0.651)
Donbas	-11.788*** (2.715)	-3.957** (1.929)	-8.462*** (3.062)	-86.044*** (13.669)	-8.600*** (1.767)	-10.257*** (2.828)	-10.349*** (2.231)
Years 2015/16*Donbas	1.636 (3.728)	1.04 (3.606)	13.797* (7.570)	50.864 (68.112)	1.997 (2.532)	-0.573 (4.165)	6.363 (6.323)
Oblast bordering Donbas	-0.506 (2.126)	1.625 (1.730)	-2.134 (2.140)	-22.470* (11.627)	-4.677*** (1.414)	-4.164* (2.159)	0.786 (1.886)
Kyiv	-33.829 (21.396)	-43.874** (18.721)	-80.725*** (21.204)	-356.310* (208.668)	-88.205*** (18.127)	-43.051 (26.536)	-44.125 (29.112)
City > 500 thousand	1.866 (9.899)	-2.050 (7.210)	-12.923 (11.258)	-102.777 (69.494)	-28.042*** (8.615)	-5.478 (14.758)	5.149 (11.842)
Population, in 1,000	0.012 (0.010)	0.019** (0.009)	0.036*** (0.011)	0.189* (0.097)	0.044*** (0.009)	0.016 (0.014)	0.015 (0.013)
Share of rural population, %	-0.001 (0.039)	-0.014 (0.030)	0.145*** (0.042)	0.385 (0.337)	0.115*** (0.025)	-0.059 (0.040)	-0.004 (0.039)
Real Monthly Average Wage, in UAH	0.002* (0.001)	0.001 (0.001)	0.001 (0.002)	0.030*** (0.008)	0.000 (0.001)	0.003** (0.001)	0.001 (0.001)
Real Capital Investment per capita, in UAH	-0.001 (0.003)	-0.000 (0.002)	0.004 (0.004)	0.028 (0.019)	0.001 (0.002)	-0.004 (0.003)	0.003 (0.003)
Observations	1896	1896	1896	1896	1896	1896	1896
Adjusted R-squared	0.039	0.045	0.049	0.043	0.109	0.063	0.034

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit.

Table A1 continued. Difference-in-difference estimation results - the effect of conflict on population health

New cases per 1,000 people	Genitourinary system diseases	Pregnancy and childbirth	Chromosomal disorders	Unclassified in other groups	External causes
Intercept	38.876*** (6.679)	10.729*** (2.217)	0.803*** (0.175)	-0.064 (0.411)	39.983*** (7.239)
Post War Years 2015/16	-0.956 (0.910)	-1.400*** (0.397)	0.006 (0.033)	0.204*** (0.071)	-0.355 (0.969)
Donbas	-8.128** (3.170)	-3.780*** (1.177)	-0.288*** (0.068)	-1.346*** (0.350)	-7.195** (3.274)
Years 2015/16*Donbas	8.351 (8.764)	0.030 (0.879)	0.073 (0.130)	0.802* (0.478)	10.132 (13.535)
Oblast bordering Donbas	4.585* (2.529)	-3.240*** (0.821)	0.268*** (0.083)	-1.123*** (0.201)	-1.643 (2.285)
Kyiv	-10.034 (35.387)	-30.983** (11.986)	-0.773 (0.800)	-2.403 (2.215)	9.124 (33.882)
City > 500 thousand	17.712 (16.020)	-6.011 (6.067)	-0.827** (0.325)	-0.607 (0.769)	-23.209 (15.072)
Population, in 1,000	0.008 (0.016)	0.013** (0.006)	0.001** (0.000)	0.001 (0.001)	0.014 (0.017)
Share of rural population, %	-0.053 (0.054)	-0.012 (0.016)	-0.001 (0.001)	0.009*** (0.003)	-0.114* (0.062)
Real Monthly Average Wage, in UAH	0.000 (0.002)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.003* (0.002)
Real Capital Investment per capita, in UAH	0.001 (0.003)	0.000 (0.001)	-0.000 (0.000)	0.001* (0.001)	0.007** (0.003)
Observations	1896	1896	1896	1896	1896
Adjusted R-squared	0.043	0.051	0.062	0.092	0.045

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit.

Table A2. Difference-in-difference estimation results - separate effects for 2015 and 2016

New cases per 1,000 people	Infectious and parasitic diseases		Cancer	Blood and hematopoietic diseases	Nutrition and metabolic disorders	Mental disorders	Nervous system diseases
	All diseases						
Intercept	484.765*** (71.493)	17.316*** (3.300)	9.050*** (1.446)	3.620*** (0.880)	9.431*** (1.450)	4.785*** (0.501)	13.389*** (2.422)
Year 2015	22.139** (10.893)	-0.228 (0.549)	0.033 (0.259)	-0.490*** (0.170)	-0.837*** (0.311)	-0.387** (0.171)	-0.051 (0.434)
Year 2016	28.157*** (7.840)	-0.471 (0.465)	0.014 (0.181)	-0.612*** (0.132)	-1.327*** (0.219)	-0.509*** (0.159)	-0.363 (0.370)
Donbas	-171.726*** (23.324)	-1.201 (1.850)	-1.120 (1.062)	-2.230*** (0.399)	-3.152*** (0.697)	-1.209*** (0.353)	-10.960*** (1.503)
Years 2015*Donbas	52.753 (96.829)	0.129 (2.358)	0.067 (1.770)	1.032 (0.747)	-0.839 (0.968)	0.232 (0.369)	2.421* (1.315)
Years 2016*Donbas	131.297 (149.188)	1.340 (2.344)	0.569 (1.781)	1.883 (1.391)	1.040 (1.704)	0.372 (0.428)	3.478** (1.607)
Adjusted	0.044	0.135	0.059	0.120	0.082	0.022	0.121
New cases per 1,000 people	Eye diseases	Ear diseases	Circulatory system diseases	Respiratory diseases	Digestive diseases	Skin diseases	Musculo skeletal system diseases
Intercept	27.531*** (5.152)	18.558*** (3.980)	36.624*** (5.886)	176.856*** (38.689)	20.041*** (3.323)	31.161*** (5.096)	24.520*** (4.444)
Year 2015	0.609 (0.977)	0.567 (0.678)	-3.592*** (1.095)	27.488*** (5.821)	-0.278 (0.595)	0.703 (0.817)	0.157 (0.738)
Year 2016	0.139 (0.790)	0.765 (0.518)	-4.637*** (0.880)	39.970*** (4.297)	-0.911* (0.471)	0.174 (0.718)	-0.219 (0.620)
Donbas	-11.810*** (2.720)	-3.946** (1.932)	-8.496*** (3.069)	-85.299*** (13.616)	-8.618*** (1.770)	-10.275*** (2.833)	-10.351*** (2.235)
Years 2015*Donbas	1.760 (3.267)	0.740 (3.652)	12.223* (7.162)	26.434 (50.777)	0.735 (2.425)	-1.315 (3.894)	4.463 (5.036)
Years 2016*Donbas	1.547 (4.299)	1.323 (3.607)	15.425* (8.061)	74.155 (85.595)	3.289 (2.813)	0.197 (4.485)	8.266 (7.638)
Adjusted R-squared	0.038	0.044	0.049	0.045	0.108	0.062	0.034
New cases per 1,000 people	Genitourinary system diseases	Pregnancy and childbirth	Chromosomal disorders	Unclassified in other groups	External causes		
Intercept	38.868*** (6.674)	10.616*** (2.240)	0.799*** (0.176)	-0.074 (0.416)	39.961*** (7.248)		
Year 2015	-0.555 (1.018)	-1.025** (0.459)	0.027 (0.036)	0.225*** (0.086)	-0.056 (1.122)		
Year 2016	-1.355 (0.868)	-1.740*** (0.357)	-0.013 (0.033)	0.185*** (0.062)	-0.647 (0.885)		
Donbas	-8.132** (3.169)	-3.810*** (1.181)	-0.290*** (0.068)	-1.349*** (0.351)	-7.202** (3.278)		
Years 2015*Donbas	4.291 (5.826)	-0.233 (0.872)	-0.002 (0.100)	0.901* (0.501)	7.661 (11.469)		
Years 2016*Donbas	12.421 (11.797)	0.340 (0.934)	0.150 (0.167)	0.706 (0.460)	12.615 (15.627)		
Adjusted R-squared	0.043	0.051	0.062	0.092	0.044		

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit. All models control for Kyiv dummy, cities with population of 500 thousand or more, population in thousands, share of rural population in %, real monthly average wage in UAH and real capital investment per capita in UAH. There are 1,896 observations in each model.

Table A3. Difference-in-difference estimation results - Donbas versus Kharkiv, Dnipro, and Zaporizhzhia (base category)

New cases per 1,000 people	Infectious and parasitic diseases		Cancer	Blood and hematopoietic diseases	Nutrition and metabolic disorders	Mental disorders	Nervous system diseases
	All diseases						
Intercept	430.423** (175.241)	15.682** (6.858)	12.639*** (4.641)	2.184 (1.675)	7.586*** (2.222)	3.340*** (0.667)	14.131*** (3.484)
Post War Years 2015/16	38.781* (20.917)	0.702 (1.211)	0.396 (0.656)	-0.218 (0.324)	-0.569 (0.430)	-0.437*** (0.118)	-1.527** (0.625)
Donbas	-130.000*** (32.992)	-1.263 (2.118)	-5.057* (2.873)	-1.747*** (0.575)	-1.265* (0.648)	0.359 (0.266)	-7.737*** (1.085)
Years 2015/16*Donbas	85.689 (124.099)	-0.182 (2.564)	1.425 (2.506)	2.119* (1.086)	1.080 (1.365)	-0.308 (0.356)	2.212 (1.418)
Adjusted R-squared	0.027	0.152	0.035	0.085	0.027	0.019	0.176
New cases per 1,000 people	Eye diseases	Ear diseases	Circulatory system diseases	Respiratory diseases	Digestive diseases	Skin diseases	Musculo skeletal system diseases
Intercept	34.242*** (10.481)	20.313** (9.019)	25.283** (12.638)	141.367 (92.424)	17.408*** (6.307)	30.053*** (9.865)	19.395** (9.607)
Post War Years 2015/16	0.595 (2.183)	0.626 (1.533)	-6.595*** (2.035)	45.732*** (11.381)	0.430 (1.027)	-0.019 (1.555)	2.255 (1.634)
Donbas	-14.756*** (3.516)	-6.623*** (2.242)	-12.315*** (3.199)	-45.978** (18.557)	-5.853*** (1.882)	-8.700*** (3.140)	-12.007*** (2.973)
Years 2015/16*Donbas	4.823 (4.132)	1.463 (3.737)	22.661*** (7.704)	32.766 (68.120)	4.425 (2.682)	0.887 (4.508)	7.593 (6.486)
Adjusted R-squared	0.122	0.055	0.092	0.025	0.094	0.148	0.076
New cases per 1,000 people	Genitourinary system diseases	Pregnancy and childbirth	Chromosomal disorders	Unclassified in other groups	External causes		
Intercept	36.716** (14.875)	11.514*** (2.335)	1.126*** (0.386)	0.023 (0.465)	33.914* (17.609)		
Post War Years 2015/16	0.279 (2.384)	-2.060*** (0.461)	0.067 (0.096)	0.030 (0.060)	-0.430 (2.262)		
Donbas	-11.495*** (3.242)	0.522 (0.964)	-0.611*** (0.120)	-0.048 (0.155)	-3.228 (3.716)		
Years 2015/16*Donbas	5.909 (9.066)	-0.821 (0.818)	0.117 (0.168)	0.369 (0.371)	6.934 (13.633)		
Adjusted R-squared	0.061	0.081	0.093	0.005	0.002		

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit. All models control for cities with population of 500 thousand or more, population in thousands, share of rural population in %, real monthly average wage in UAH and real capital investment per capita in UAH. There are 504 observations in each model.



Table A4. Difference-in-difference estimation results - no other covariates included

New cases per 1,000 people	Infectious and parasitic diseases		Cancer	Blood and hematopoietic diseases	Nutrition and metabolic disorders	Mental disorders	Nervous system diseases
	All diseases						
Intercept	646.870*** (8.886)	20.193*** (0.515)	8.343*** (0.288)	5.800*** (0.176)	11.678*** (0.323)	3.868*** (0.163)	17.062*** (0.467)
Post War Years 2015/16	2.679 (4.649)	-1.476*** (0.303)	-0.107 (0.107)	-0.542*** (0.095)	-1.087*** (0.188)	-0.407*** (0.141)	-0.191 (0.297)
Donbas	-129.875*** (19.189)	1.774 (2.100)	-0.774 (0.622)	-2.963*** (0.282)	-3.531*** (0.578)	-0.703** (0.277)	-10.091*** (0.646)
Years 2015/16*Donbas	62.943 (115.694)	0.310 (2.004)	0.140 (1.525)	1.620 (1.028)	0.367 (1.257)	0.012 (0.331)	1.059 (1.213)
Adjusted R-squared	0.014	0.005	-0.001	0.028	0.025	0.005	0.063
New cases per 1,000 people	Eye diseases	Ear diseases	Circulatory system diseases	Respiratory diseases	Digestive diseases	Skin diseases	Musculo skeletal system diseases
Intercept	33.704*** (0.790)	21.794*** (0.533)	49.587*** (0.873)	284.208*** (4.811)	28.630*** (0.605)	35.706*** (0.816)	29.992*** (0.697)
Post War Years 2015/16	-0.595 (0.545)	0.235 (0.315)	-4.751*** (0.649)	19.059*** (2.492)	-0.745** (0.340)	-0.889** (0.413)	-0.871** (0.398)
Donbas	-10.888*** (2.209)	-3.569** (1.800)	-9.039*** (2.365)	-61.254*** (9.847)	-9.206*** (1.384)	-7.546*** (2.697)	-8.543*** (1.749)
Years 2015/16*Donbas	1.668 (3.197)	0.885 (3.280)	12.067* (7.308)	32.405 (64.380)	1.442 (2.498)	0.139 (3.583)	4.636 (5.861)
Adjusted R-squared	0.024	0.003	0.016	0.015	0.030	0.012	0.011
New cases per 1,000 people	Genitourinary system diseases	Pregnancy and childbirth	Chromosomal disorders	Unclassified in other groups	External causes		
Intercept	38.433*** (0.904)	11.155*** (0.406)	1.009*** (0.031)	1.019*** (0.088)	43.197*** (0.886)		
Post War Years 2015/16	-1.098** (0.522)	-1.585*** (0.243)	-0.018 (0.024)	0.051 (0.034)	-2.077*** (0.446)		
Donbas	-7.872*** (2.932)	-2.466*** (0.855)	-0.324*** (0.062)	-0.707*** (0.105)	-0.001 (2.982)		
Years 2015/16*Donbas	7.880 (8.017)	-0.288 (0.650)	0.107 (0.114)	0.193 (0.365)	6.230 (12.508)		
Adjusted R-squared	0.004	0.016	0.011	0.007	0.002		

Notes: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors in parentheses. Estimated by OLS with robust standard errors clustered at the level of administrative unit. There are 1,896 observations in each model.