Illegal Drug Use, Crime, and Population Health in Post-Socialist Russia, 2001-2008

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Abstract

Using the Russian 2001–2008 panel data and controlling for vodka sales, poverty, and industrialization, this study shows that changes in population health are significantly explained by the hepatitis rate as a proxy measure of intravenous drug use and practices. Results may imply that drug trade-related crime compared to the intravenous drug use is more likely to be connected with homicide. Living along the Central Asian border costs both men and women two years of expected life and increases instances of homicidal violence by 14 per 100,000 of population, compared to the rest of the country. Results surprisingly show that in contrast to the rest of the country, an increase in registration of drug crime was associated with improvement of population health in the border regions. Finally, our findings confirm the Muslim health advantage, which is more pronounced during the peak of the Russian mortality crisis, especially among men.

1. Introduction

The demise of the Soviet Union, having lost the lion's share of its legitimate power after 1989, left the Russian borders open to competition from globalized violence, illegal drug trade and consumption (UNODCCP; Russian Ministry of the Interior Affairs; Paoli 2002; Atlani et al. 2000). Loose border control has fostered drug trafficking to Russia from Afghanistan through the former Soviet republics in Central Asia. In 2003, the United Nations Office for Drug Control and Crime Prevention (UNODCCP)

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estimated that about $4 billion (USD) was generated from drug trafficking in countries neighboring Afghanistan. Among these countries, the Central Asian states that were part of the USSR before it's disintegration in 1991[3], generated the largest profits: $2.2 billion, compared to $1.3 billion in Iran and $400 million in Pakistan. As pointed out by Paoli (2002, p. 22), what makes the Russian case of illegal drug use and related crime so astounding is the rapid and abrupt expansion of drug abuse during the period from 1990 to 2000. Based on official statistics from the Russian Ministry of Health prevalence rate for drug abuse, i.e. the number of new and pre-existing registered drug abuse cases, increased from 19.1 per 100, 000 in 1990 to 44 per 100,000 in 1995, expanded by almost tenfold in 2000 to 187 per 100,000, and reached 241 registered drug users per 100,000 in 2008 (GosKomStat, National Statistical Committee, www.gks.ru[4]). This dramatic increase by a factor of 12.6 of hospitalized drug users between 1990 and 2008 is presumably driven by two causes, an actual increase of drug users as well as improvements in the reported cases in official statistics.

As a comparison with the United States, the admission episodes increased from 243 drug abuse patients per 100,000 in 1992 to 281, 319, and 342 patients per 100,000 population in 1995, 2000, and 2007 respectively (USA, Substance Abuse and Mental Health Services Administration, Treatment Episode Data Set). On the other hand, prevalence for alcohol substance abuse in Russia indicates a declining trend, the number of new and pre-existing registered patients with alcoholism and alcoholic psychosis was 1,630 per 100,000 population in 1995, declined to 1,519 patients per 100,000 population in 2000, and 1,459 per 100,000 in 2008 (GosKomStat, National Statistical Committee).

The Russian Ministry of Health collects statistics on admitted drug users from the Alcohol and Drug Treatment Services System, which includes inpatient departments, day hospitals, dispensaries, rehabilitation centers, and toxicological laboratories. Dispensaries consist of

[3] The Central Asian states include Kazakhstan (bordering Russia), Uzbekistan, Kyrgyzstan, Turkmenistan and Tajikistan.
[4] http://www.gks.ru/bgd/regl/B01_34/IssWWW.exe/Stg/d010/i010960r.htm

anonymous help rooms, offices for substance abuse counselors, adolescent rooms, intoxication assessment offices, and methodic departments (Russian Ministry of Health, National Research Center on Addiction[5]). Based on the UNODCCP regional report (2008, p.10), the majority of patients in Russia were registered for opiate consumption, a subset of opioids derived from the opium poppy plant including opium, morphine, and heroin. For example, eighty-nine percent of registered drug users were opiate drug users, six percent cannabis, one percent stimulant, and six percent polydrugs users. The distribution by drug type among registered drug users has not changed over the period from 2001 to 2008, ranging from ninety percent opiate users in 2001 to eighty-eight percent in 2008 (National Research Center on Addiction). Furthermore, although the unfavorable trend in drug abuse is probably captured correctly, the actual reported numbers are very likely underestimated since governmental statistics report only officially registered drug patients.

The Ministry of Internal Affairs (MVD) data indirectly shows the rapid expansion of the Russian drug market after the fall of the Soviet Union. The rise of heroin seizures has been grown from almost non-existent until the beginning of the 1990s (Paoli 2002) to 50,900 kilograms in 1993 and 442,900 kilograms in 1998 (Global Illicit Drug Trends 2000[6]). Heroin seizures continued to increase rapidly to 3,897,000 kilograms in 2004 and reached 4,676,000 kilograms in 2005. After 2005 heroin seizures plummeted almost twice lower and increased again reaching 3,442,762 kilograms in 2008 (World Drug Report 2011). Furthermore, epidemiologists have also reported a drastic increase in injecting drug use and concomitant epidemic spread of blood-borne infections such as hepatitis C and B and HIV/AIDS among injection drug users (IDUs) following

[5] Council of Europe, Pompidou Group, Conference on Guidelines and Recommendations in Drug Treatment, Nicosia, Cyprus on 11-13 May 2009
http://www.coe.int/t/dg3/pompidou/Source/Files/Nicosie_Mai09/Presentations/StanislavMokhnachev.pdf
[6] http://www.unodc.org/pdf/report_2000-09-21_1.pdf

the Afghan-Russian war and the fall of the USSR in certain regions of Russia such as St. Petrsburg, Samara, and Nizhniy Novgorod (Paintsil et al. 2009; Rhodes et al. 2005, 2006; Shustov et al. 2005).

While the relationship between alcohol consumption and population health in Russia has been extensively studied and scholars agree that alcohol abuse is crucial to explaining mortality fluctuations in the former Soviet Union (Leon et al. 2007; McKee, Shkolnikov and Leon 2001; Chenet et al. 1998; Bobak et. Al 1999; Zaridze et. al 2009; Bhattacharya, Gathmann, and Miller 2012), surprisingly few studies have investigated the linkage between the expansion of drug crime, injecting drug abuse and the deterioration of population health. Moreover, alcohol and illegal drug abuse are often linked and prevalent in the same groups under risk, i.e. prime-age men and women. To mention just some of the existing studies, in Leon's et al. case-control study (2007) conducted in Izhevsk city between 2003 and 2005, for instance, fifty-one percent of deceased cases (based on household informants) and thirteen percent of controls (randomly selected from the city population and frequency matched to deceased cases by age) were classed as problem drinkers. Adjusted for smoking and education, forty-three percent of mortality was attributable to hazardous drinking. Examining Moscow city death certificates in the years 1993-1995, Chenet et al. (1998) found a significant increase in death from alcohol poisoning, accidents, and violence and cardiovascular diseases on Saturdays, Sundays, and Mondays, especially for sudden death. McKee et al. (2001) pointed out that volatile fluctuations in mortality in the 1990s were mainly due to changes in causes such as road-traffic accidents and stomach cancer, associated with alcohol abuse. One of the limitations of these and other studies investigating the determinants of the mortality patterns in Russia after 1989 is that the types of deaths associated with alcohol consumption that fluctuated most during the transition may also be associated with illicit drug abuse and violence. Generally, existing studies did not address changing (or

diversifying) substance abuse behavior among prime-age men and women living through Russia's boom of illegal drug markets, specifically the rapid diffusion of Afghani heroin and substantial upsurge in injecting drug use.

Using fixed and random-effects models for 2001-2008 panel data and controlling for important determinants of population health in Russia such as vodka consumption (Pridemore 2002; Bhattacharya, Gathmann, and Miller 2012), poverty (Brainerd and Cutler 2005), and level of economic development and industrialization (Walberg et al. 1998), this study investigates the association between the expansion of drug crime, injecting drug use and the deterioration of population health during Putin's first presidency and sets forth the following hypotheses.

a) First, injecting drug consumption and trade, measured by hepatitis rate and drug-related crime, are important determinants of population health, measured by life expectancy at birth, working-age mortality, and homicide rates.

b) Second, we hypothesize to observe higher rates of homicide and working-age mortality, and lower life expectancy closer to the vast Eurasian border, where multiple national and international crime organizations compete for the drug trade, territories, and potential or active drug consumers (UNODCCP; Paoli 2002).

c) We also hypothesize that we will observe a strong male-female difference in working age mortality related to drug abuse and related crime with men experiencing significantly higher death rates, since, since prime-aged men represent the major demographic that engages in illegal drug consumption, trade, and violence (Volkov 2002; Paoli 2002).

The topic we investigate in this paper is of a particular public health relevance since there is a widespread recognition among the Member States of the UN that illegal drugs, drug abuse together with organized crime jeopardize the achievement of the Millennium Development Goals (World Drug Report 2011). Findings from the 2010 Global Burden of Disease Study showed that

illicit drug dependence is an important contributor to the global burden of disease, accounting for 200 million disability-ajusted life years (DALYs), with the highest burden in the wealthiest parts of the world such as USA, UK, Russia, and Australia. Injecting drug use as a blood-borne risk factor for HIV accounted for 2 • 1 million DALYs and as a blood-borne risk factor for hepatitis C accounted for 502,000 DALYs (Degenhardt et al. 2013).

The consequences of illegal drug abuse and organized drug-related trade crime go beyond the individual user and affect their families and larger communities. For instance, children of drug users are of greater risk to adopt riskier behaviors and to use drugs themselves. Illicit drug use is shown to contribute to the rapid spread of infectious diseases like HIV and hepatitis (Atlani et al. 2000; Shepard, Finelli, and Alter 2005; Houdt et al. 2009; Hagan et al. 2011; Kaushik et al. 2001; Paintsil et al. 2009). According to the UNODCCP Global Illicit Drug Trends Report (2000), the diffusion of drug injecting to an increasing number of countries, where previously the behavior was often unknown, and the accompanying risk of HIV and hepatitis infection remain a serious global concern. In the 1990s, the world's steepest HIV and HCV curve was recorded in the newly independent states of the former Soviet Union. IDUs are primarily accounting for the majority of new infections and drug injecting appears to have diffused across many parts of the Russian Federation. Drug trafficking, linking supply and demand, fuels a global criminal enterprise that poses a growing challenge to stability and security in strong and weak states. Specifically, drug markets and drug abuse patterns tend to be circumfluent and change rapidly, and social research and global policy must adapt in order to respond to new global challenges (UNODCCP 2000).

2. Analytical Approach and Description of Data

2.1 Analytical approach

Although the negative effects of drug use on individual health are well known, measuring the impact at the population level is more challenging because of the difficulty of obtaining accurate reports on the level and trends over time. Illegal drug use is known to be seriously underreported in official statistics worldwide (Degenhardt et al. 2013; UNODCCP Global Illicit Drug Trends Report, 2000). Instead of relying on considerably inaccurate reports, we use the hepatitis rate (all hepatitis types combined) per 100,000 population, which is equivalent to the prevalence of hepatitis reported by region, as a proxy measure of intravenous drug abuse in Russia. The National Statistical Committee of Russia receives the data on the registered hepatitis patients in regional clinics from the Ministry of Health. Epidemiological research has shown a high prevalence of hepatitis viruses among injecting drug users (Houdt et al. 2009; Hagan et al. 2011; Kaushik et al. 2001; Paintsil et al. 2009). The prevalence of hepatitis C virus (HCV) among intravenous drug users (IDUs), in the range of 50-90 percent for the high-income countries, exceeds that of human immunodeficiency virus (HIV) (Hagan H. et al. 2001). In the middle-income countries, such as Vietnam, scholars reported an association between intravenously sharing drugs (specifically, through frontloading) and higher rates of bloodborne viral infections of HIV, HBV, and HCV, with the prevalence rate of 42.4, 80.9, and 74.1 respectively (Quan et al. 2009).Although HCV is not efficiently transmitted sexually, the HCV incidence is associated with the sharing of injection paraphernalia (needles), frequency and years of drug use, hepatitis B virus (HBV) coinfection and alternate injecting practices, such as drawing blood into the syringe prior to injection (Kaushik et al. 2011). Houdt et al. (2007, 2009) documented sporadic spillover of the HBV infection from the drug users to the general population via drug-injecting commercial sex workers and the reverse spillover from the general population to the IDUs, via the heterosexual clients of drug-injecting commercial sex workers. In a study focused on the epidemiology of HCV among IDUs in St Petersburg in 2005, Paintsil et al. (2009) emphasized that the HCV prevalence

was higher than any of the previous estimations for the former Soviet Union, ranking the highest among IDUs worldwide with a seroprevalence rate of 94.6 percent (366 of 387). In St Petersburg, investigated behavior among IDUs was common to IDU populations in other countries, such as the sharing of injection paraphernalia and social injecting practices that put IDUs at soaring risk of HCV infection. 57 percent of the injectors reported having non-IDU sex partners, contributing to the HCV spillover to the general population via unsafe sex (Paintsil et al. 2009). Studies suggested that the HCV prevalence among 1700 IDUs in Russia was 81 percent of 1700 IDUs (Volkova et al. 1999) and 54 percent among the surveyed 543 users in Pskov city (Sivatcheva 1999); 65 percent of 335 users studied in Nizhniy Novgorod (Moshkovich 2000); 87 percent of 411 users investigated in Togliatti (Rhodes et al. 2005); and 54 percent of 488 users studied in Barnaul (Maksimova et al. 2005).

Our indirect approach assumes that the hepatitis rate is a reliable indicator of illegal drug use in the population of interest. Related indirect estimation approaches have been widely used and for instance have been recently applied to estimate the impact of smoking on mortality, where lung cancer mortality is used as a proxy for smoking (Preston et al. 2010, Peto et al. 1992, Martikainen et al. 2013). The Ministry of Health data on hepatitis is based on the recorded number of cases per year, discovered (or taken to dispensary care) during patients' visits to clinics or during their prophylactic examination. The prevalence of hepatitis infection is calculated as ratio of number of registered patients to the average annual number of resident population per 100,000 population. The number of hepatitis patients includes both new cases, patients with the diagnosis set for the first time, and old cases, patients with the diagnosis registered in prior years (National Statistical Committee).

Although our indirect measure of illegal drug use is vastly more reliable than reports on drug use per se, we are also aware of the fact that hepatitis rate is estimated on the basis of medical

cases that have been officially registered and reported in regional clinics. For example, in 2003 in Barnaul, a Western Siberian city, 173 (or 75 percent) of 231 surveyed IDUs did not know about their HCV-positive status, while engaging in high risk social injecting practices (Maximova et al. 2005). As a result the prevalence of hepatitis infections is likely to be underestimated as well. Thus in addition, we assume that misreporting of hepatitis is constant over time and region, and although the levels of hepatitis infections are underestimated, the data employed in this analysis reflect correct trends over time. Hence, if we control for fixed-effects over time, we are able to estimate the impact of drug use as measured by hepatitis rate on population health.

We used a fixed-effect regression model specified as following:

$Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + \gamma_t + \varepsilon_i,$

where *i* represented the region and *t* represented the year ranging from 2001 to 2008. X_{ij} terms were defined by independent variables for region *i* at time *t*, and the intercept β_1, was a fixed parameter. The term α_i represents all regional characteristics, which have been stable over time and γ_t are time dummies for the years 2001 to 2008. We estimate models with 5 different dependent variables Y_{it}: life expectancy at birth for men (Model 1) or women (Model 2), working-age mortality per 100,000 population for men (Model 3) or women (Model 4) and homicide rate per 100,000 in Russia (Model 5). The fixed effects analysis allowed us to have a separate intercept for each cross-sectional unit. To further support our choice of the fixed-effects estimates, we conducted the Hausman test and the results indicated the preference of the fixed-effects models over the random-effects analysis (Wooldridge, 2009). Fixed-effects models have several advantages over random-effects models. For instance, they allow us to control for differences in regional characteristics that importantly relate to health and mortality outcomes, such as availability of health care facilities, differences in quality of health care, differences in low

enforcement against drug users, public perception of drug users and discrimination against them, and others.

2.2 Data

The analysis employed a panel dataset of Russian regions (Slav *oblasts/krays* and non-Slav republics/*okrugs*) for the period 2001 to 2008 that was obtained from Goskomstat, the Russian National Statistical Committee (www.gks.ru). The dataset consists of 57 Slav regions (oblasts and krays, but for simplicity we call both regional categories oblasts), including two cities Moscow and St. Petersburg, and 21 non-Slav regions (republics and okrugs, but for simplicity we call both republics). The analysis includes 78 regional units, eight years, and 624 observations. The republics of Chechnya and Ingushetiya were excluded from the dataset due to war-related missing data.

To explore the determinants of mortality in post-socialist Russia, we used three types of dependent variables: life expectancy at birth, death rate per 100,000 population at working ages 15 to 65 inclusively, and homicide rate per 100,000 population. We also stratified the analysis by sex to explore differences in the associations by sex because the latter is of a particular relevance since previous research (Shkolnikov et al.1998; Becker and Henley 1998; Cockerham 1999) demonstrated that Russian prime-age men were the major demographic to account for the rapid mortality crisis in the 1990s.

Finally, we considered the analysis of homicide as a dependent variable and examined the conditions that influenced the variation in violence across the regions. The homicide data by gender was not available, therefore, the analysis of homicide was not stratified by gender. The National Statistical Committee receives the data on crime from the Ministry of the Interior.

Recorded crime signifies an officially registered socially dangerous act defined by the criminal law of Russia (Ministry of the Interiior; www.mvd.ru). The recorded number of crimes from homicide includes both homicide and homicide attempts calculated as rate per 100,000 population by region. However, it should be admitted that the quality of Russian homicide data lags behind the international standards; criminologists considered the Russian mortality from homicide to be a better quality measurement compared to the Russian homicide crime data (Pridemore, 2003; Chervyakov et al. 2002). However, Russian homicide mortality is also a subject of mis- and underreporting, and Gavrilova et al. (2008) correctly stated that increasing number of socially marginalized people and inadequate investigation of their death contributed to misclassification of mortality from injuries of undetermined intent as mortality from ill-defined conditions.

Our analysis includes a host of independent variables: hepatitis rate per 100,000 population, registered drug-related crime per 100,000 population, indicator (a dummy variable) if a region is located along the Central Asian border regions, an interaction between the Central Asian border regions and registered drug-related crime, percent of Muslim population per region, vodka sale (deciliters per person), percent of urban population, and percent of population living below poverty rate.

The recorded drug-related crime was calculated as a rate per 100,000 population. Table 1 shows the top fifteen regions with a drug-related crime above the national average in 2001 and 2008. The table clearly demonstrates that the regions with the highest rates of drug-related crime were adjacent or close to the Central Asian border in 2001 and 2008 since these regions served as the main drug-traffic channels from Tadjikistan and Kazakhstan to Russia and the rest of Europe. The Trans-Siberian railroad and motorway, attractive routes for the drug traffickers, connect the largest cities along the border. The border-adjacent regional centers serve not only as destinations,

but also as major rail and motorway transshipment points to other destinations in Russia and Europe (UNODCCP, Illicit Drug Trends in the Russian Federation, 2008).

Table 1
The top 15 regions with the highest drug-related crime rate per 100,000 population in 2001 and 2008, difference compared to national average (NAD), and border proximity

Regions	2001	NAD	2008	NAD	Border
National Average	117		156		
Evreyskaya A. Oblast	450	333	317	161	Adjacent
Primorskiy Kray	277	160	277	121	Adjacent
Habarovskiy Kray	264	147	195	39	Adjacent
Astrakhanskaya Oblast	250	133	192	36	Adjacent
Amurskiy Oblast	236	119	283	127	Adjacent
Novosibirskaya Oblast	208	91	253	97	Adjacent
Tumenskaya Oblast	205	88	245	89	Adjacent
Tomskaya Oblast	198	81	169	13	Close
Komi Republic	197	80	112	-44	Far
Krasnodarskiy Kray	197	80	185	29	Adjacent
Republic of Tyva	196	79	369	213	Adjacent
Magadanskaya Oblast	152	35	322	166	Adjacent
Krasnoyarskiy Kray	171	54	315	159	Close
Samarskaya Oblast	164	47	272	116	Adjacent
Republic of Buryatiya	126	9	249	93	Adjacent

We also explored how the spread of illegal drug abuse and trade impacts on population health compared to alcohol consumption that has been shown to be one of the main risk factors for the negative health trends in Russia. Scholars agree that alcohol abuse is crucial to explaining mortality fluctuations in the former Soviet Union and during the post-Soviet time, and that specifically the Russian mortality crisis in the post-Soviet era was not related to poor medical care, environmental pollution, hospital infections, or genetics but unprecedented alcohol abuse (Cockerham 1999). Evidence suggests that hazardous alcohol consumption is related to almost one-third of all Russian deaths (Nemtsov, 2002) and one-half of premature deaths among working-age Russian men (Leon 2007). Risky drinking habits are reflected in alcohol-related causes of death, alcohol abuse-related violence (Pridemore, 2006), and overall deaths (Leon,

2007). In our analysis, we used regional vodka sale (thousand deciliters of vodka per 1000 population) as a crude measure of regional alcohol consumption.

Because of the religious restrictions impacting on life style including nutritional and alcohol consumption patterns among Muslim communities, we controlled for the regional percent of Muslims. Specifically, Kohler and Preston (2011) investigated ethnic/religious mortality differentials in post-communist Bulgaria and found that for working-age men, Muslim mortality is substantially lower than that of non-Muslims when socio-economic differences are controlled. In addition, suicide mortality is lower for Muslims than for Christian groups of the same ethnicity. An analysis of causes of death suggests that lower consumption of alcohol may contribute to this 'Muslim paradox', in which Muslims have lower mortality, despite being poorer than the other groups (Kohler and Preston, 2011). In addition, Bougdaeva (2010) demonstrated that in the ethno-territorial federative system of Russia, membership in the Muslim ethno-religious communities rather than in autonomous republics is found to be significant in resistance to cumulative death crisis during a period of dramatic societal changes. Moreover, Fish (2011) showed that the proportion of the country that is made up of Muslims is a good predictor of the murder rate, with a larger Muslim population associated with fewer homicides.

To estimate the regional concentration of Muslims, we used the regional data from the last Soviet census in 1989 and the two post-Soviet censuses from 2002 and 2010; we linearly interpolated percent of Muslims between 2001 and 2008.

Since one of the main possible confounders in the study of violence and population death is socioeconomic development, we added percent of population living below poverty level and percent of urban population. Contrary to the impoverishment theories, studies showed that wealthy urban regions with the most rapid economic transition experienced the greatest declines in

mortality in post-Soviet Russia (Walberg et al. 1998). Summary statistics of all variables for the years 2001, 2004 and 2008 are shown in Table 2.

Table 2. Descriptive statistics, 2001-2008

Variables	2001 Mean (SD)	2004 Mean (SD)	2008 Mean (SD)
Dependent Variables			
Men's Life Expectancy	58.66 (2.36)	57.95 (3.07)	60.88 (2.71)
Women's Life Expectancy	71.92 (2.00)	71.42 (2.57)	73.43 (2.22)
Men's Working-Age Death rate per 100,000 population	11.89 (2.12)	13.58 (3.00)	11.65 (2.38)
Women's Working-Age Death rate per 100,000 population	3.26 (0.86)	3.66 (1.11)	3.09 (0.88)
Homicide per 100,000 population	0.24 (0.11)	0.24 (0.12)	0.16 (0.09)
Independent Variables			
Hepatitis Rate per 100,000 population	140.55 (71.36)	111.05 (72.98)	71.71 (44.33)
Drug Crime per 100,000 population	117.22 (72.12)	97.41 (51.04)	156.41 (65.85)
Vodka Sale (*Deciliters* of hard liquor per person yearly)	1.42 (0.50)	1.45 (0.58)	1.27 (0.54)
% Muslims	7.97 (16.89) Min=0.38 Max=96.35	7.94 (17.02) Min=0.33 Max=96.65	7.73 (17.12) Min=0.18 Max=96.15
% Urban	69.48 (12.62)	69.28 (12.39)	69.33 (12.48)
% Below Poverty	32.47 (9.55)	25.04 (8.00)	16.53 (5.12)

Source: Goskomstat - National Statistical Bureau

Between 2001 and 2004 male and female life expectancy at birth declined slightly. In contrast, in 2008 male life expectancy at birth was about 3 years higher compared to 2004, while for women there was not change within this period. Similar trends are observed for working-age mortality: the death rate for working ages 15-65 per 100,000 population increased slightly for men between 2001 and 2004, and improved in 2008. For women, working-age mortality did not change between 2001 and 2004, but the death rate improved to 3.09 per 100,000 population in 2008. Homicide rate was also stable at 0.24 per 100,000 population during the first 2 periods, but

improved substantially by 2008. A more detailed review of our data by year showed that a rapid improvement in population health occurred between 2005 and 2007 and it slowed down after 2007. Hepatitis rate per 100,000 population changed substantially during the period of observation and in 2008 declined to half of the rate observed in 2001, the first year of our analysis. Similarly, hepatitis rate rapidly declined from 2004 to 2006 and worsened after 2006.

We observed substantial fluctuations over time in our second dependent variable drug crime that decreased from 117.22 per 100,000 in 2001 to 97.41 in 2004, but dramatically raised by 2008 to 156.41 per 100,000 in 2008.Vodka sales were stable between 2001 and 2004, but rapidly declined in 2005-2006 and continue to decline to 1.27 deciliter per person in 2008, which is mostly a result from more restrictive alcohol policy to control the production and sale of ethanol introduced in 2005 by the Putin's administration. The observed changes in alcohol consumption, drug crime and population health are coinciding with Putin's sustained campaign to revitalize the Commonwealth of Independent States (CIS) and to prevent narcotics trafficking and trade in the region.

The CIS members developed the capacity to mobilize large multinational military formations to defend against transnational threats such as drug trafficking, arms smuggling, and terrorism. For example, the CIS members established battalions based in Kazakhstan, Kyrgyzstan, Russia, and Tajikistan, engaging in major exercises in Central Asia such as "Frontier 2004" in August 2004 and "Frontier 2005" in April 2005, which involved approximately 3,000 troops. Since 2003, the intelligence, law-enforcement, and defense agencies of the member states have jointly conducted annual "Kanal" ("Channel") operations to intercept drug shipments from Afghanistan through the region's porous borders. Furthermore, the CIS has established a working group on Afghanistan to strengthen that country's law enforcement and counter-narcotics efforts (Richard Weitz, 2006).

There is a substantial variation in the population composition across the Russian regions ranging from 0.38-0.18% of Muslims in the Central Federal District to regions in the North-Caucasus Federal District, where the population is almost entirely Muslim such as in the Republic of Dagestan (96%), the Republic of Ingushetia (98.7%), the Republic of Kabardino-Balkaria (72%), and the Republic of Karachay-Cherkessia (65 %)). In addition, the majority of the population in the regions lived in urban areas (about 70% in all years reported in Table 2). The percent of the population living in poverty declined over time from an average of 32% in 2001, to 25% in 2004 and about 17% in 2008. This trend is consistent with studies highlighting Putin's "growth decade" in 1999-2008 before the global financial crisis, when Russia was one of the fastest growing economies in the world at an average rate of seven percent per year with the growth benefits trickling down to all strata of Russian society (Guriev and Tsyvinski; Guriev and Zhuravskaya 2009, Gorodnichenko et al. 2010).

3. Results

Table 3. Results from fixed-effects regression with cluster robust standard errors predicting life expectancy for men (LEM) and women (LEW), working-age mortality per 100,000 population for men (WAMM) and women (WAMW), and homicide per 100,000 population in Russia, 2001-2008

Fixed-Effects	Model 1 LEM	Model 2 LEW	Model 3 WAMM	Model 4 WAMW	Model 5 Homicide
Hepatitis Rate	-0.004**	-0.005*	0.448**	0.160*	0.004
Drug Crime	-0.005~	-0.004~	0.322	0.105	0.009~
Central Asian Border Regions*Drug Crime	0.005~	0.007*	-0.461	-0.275~	-0.029~
% Muslims	0.326	-0.022	-36.818~	2.774	1.097~
Vodka Sales	-0.371*	-0.302*	16.747	8.104	0.553
% Urban	-0.052~	-0.029	0.355	0.703	0.019
% Below Poverty	-0.006	-0.004	-0.565	-0.183	0.041
2001	Reference	Reference	Reference	Reference	Reference
2002	-0.363***	-0.294***	126.739***	31.612***	-0.711~
2003	-1.330***	-1.066***	198.437***	53.248***	-0.914~
2004	-1.107***	-0.773***	200.427***	51.424***	-0.084

2005	-1.320***	-0.900***	275.349***	65.751***	0.143
2006	0.212	-0.058	124.206***	28.931***	-1.973*
2007	1.455***	0.842***	3.752	0.326	-6.185***
2008	1.931***	1.174***	-13.041	-6.604	-7.789***
2002*Muslims	0.001	0.004	-2.071***	-0.773***	0.009
2003*Muslims	0.019***	0.012***	-2.759***	-0.950***	0.014
2004*Muslims	0.023***	0.011**	-2.781***	-1.007***	-0.004
2005*Muslims	0.024***	0.019***	-3.229***	-1.286***	-0.021
2006*Muslims	0.012*	0.007	-1.527**	-0.743***	-0.003
2007*Muslims	0.008	0.003	-0.568	-0.352*	0.041*
2008*Muslims	0.010	0.004	-0.665	-0.365*	0.038
Constant	61.343***	75.491***	1371.546***	226.40***	11.754
Within R-sq	0.75	0.67	0.65	0.57	0.59

Random-Effects	Model 1 LEM	Model 2 LEW	Model 3 WAMM	Model 4 WAMW	Model 5 Homicide
Hepatitis Rate	-0.005**	-0.005*	0.493**	0.169*	0.005
Drug Crime	-0.005~	-0.004~	0.278	0.101	0.010*
Central Asian Border	-1.822*	-2.113*	26.357	78.414	13.810*
Central Asian Border Regions*Drug Crime	0.004	0.005~	-0.383	-0.235~	-0.026~
% Muslims	0.071***	-0.045***	-7.540***	-1.940***	-0.155***
Vodka Sales	-0.439*	-0.366*	20.438	9.337	0.632
% Urban	-0.019	-0.005	-0.193	0.346	0.002
% Below Poverty	-0.015	-0.012	-0.289	-0.029	0.066
2001	Reference	Reference	Reference	Reference	Reference
2002	-0.358***	-0.299***	125.986***	31.838***	-0.663~
2003	-1.380***	-1.106***	200.969***	53.948***	-0.825~
2004	-1.190***	-0.834***	205.773***	52.458***	0.029
2005	-1.449***	-0.977***	285.328***	66.989***	0.220
2006	0.014	-0.168	140.002***	30.686***	-1.923~
2007	1.226***	0.727**	21.348	1.870	-6.201***
2008	1.682***	1.059***	5.858	-5.338	-7.864***
2002*Muslims	0.002	0.003	-2.205***	-0.752***	-0.003
2003*Muslims	0.020***	0.011**	-2.912***	-0.911***	0.023
2004*Muslims	0.024***	0.010*	-2.968***	-0.956***	0.009
2005*Muslims	0.025***	0.018***	-3.448***	-1.222***	-0.007
2006*Muslims	0.013*	0.005	-1.797***	-0.668***	0.014
2007*Muslims	0.009	0.000	-0.876	-0.267	0.061**
2008*Muslims	0.011	0.002	-1.021*	-0.271	0.060**
Constant	61.933***	74.219***	1151.994***	262.370***	18.903***
Between R-sq	0.40	0.36	0.39	0.32	0.27

Notes: significance levels are: ***≤0.001; **≤0.01; *≤0.05; ~≤0.10; N of observations=624; N of regions=78

In Table 3 we reported results from fixed-effects regression models with cluster-robust standard errors predicting life expectancy at birth (Model 1 and 2) and working-age mortality (Models 3 and 4) for men and women separately between 2001 and 2008, while holding other covariates constant and allowing the year-interaction effect with the regional proportion of Muslims. First, holding other factors constant, life expectancy significantly worsened from its level in the reference year 2001 from 2002 until 2005 for men and women, with the sharpest decline in life expectancy in 2003. In 2003, adjusting for other factors, life expectancy at birth for both men and women decreased by one year, whereas after 2006, life expectancy significantly improved for both genders as compared to its level in 2001.

Similar patterns are observed for working age mortality (15-65 years old) for both sexes: the coefficients in Models 3 and 4 show an increase in the death rate from 2001 to 2006 for both men and women, with the sharpest increase observed in 2005. On average, adjusting for other factors and allowing the interaction term, about two hundred seventy-five more working-age men per 100,000 population and approximately sixty-six more working-age women per 100,000 population died as compared to its level in 2001. The magnitude of volatile change in death was more pronounced among working-age men than women.

Finally, we examined the time trend of homicide for both sexes combined, while adjusting for other factors and allowing the year-interaction effect with percent of Muslims. Controlling for other factors, homicide did not show any significant changes until 2006 as compared to its reference level in 2001. After 2007 however, the homicide rate significantly decreased by six people per 100,000 population in 2007 and almost eight people per 100,000 population in 2008, as compared to its reference level in 2001.

In models 1 and 2, we presented fixed-effects estimates of the association between the regional rate of hepatitis and life expectancy for men's and women's population groups. Holding other factors constant, the hepatitis rate was strongly (at the 0.01 level) and negatively associated with men's and women's life expectancy at birth; one hepatitis patient increase per 100,000 population resulted in a decline of 0.004 years of life expectancy. Compared with hepatitis and other covariates, the coefficients for vodka sale showed the largest magnitude effects on life expectancy for both men and women. If other factors remained constant, one additional deciliter of vodka sold per person annually was associated with a 0.4-year decline in life expectancy for men and with a 0.3-year decline in life expectancy for women (at the 0.05 significance level).

Adjusting for covariates, drug-related crime per 100,000 population had a similar magnitude, but a borderline negative effect (at the 0.10 level) on life expectancy. Holding other factors constant, one drug-related crime increase per 100,000 population resulted in a decline of 0.005 and 0.004 years of life expectancy for men and women respectively. The results also showed a significant positive association between the drug-related crime in the border regions and life expectancy among men and women, when other factors were controlled. In contrast to the rest of the country, every additional registration of drug-related crime per 100,000 population was associated with an increase of 0.01 years of life expectancy for men and women in regions along the vast border.

In models 3 and 4, we analyzed the association between the regional rate of hepatitis for men's and women's working-age mortality. Holding other factors constant, the hepatitis rate was significantly at the 0.05 level and positively associated with men's and women's working-age death; one hepatitis patient increase per 100,000 population resulted in a 0.5 increase in death for working-age men and a 0.2 increase in death for working-age women per 100,000 population. Results showed that determinants of working-age mortality varied by gender. First, the association

between the drug-related crime in the border regions and working-age mortality among men was insignificant. However, the fixed-effects model showed a significant and negative association between the drug-related crime in the border regions and women's working-age mortality. In contrast to the rest of the country, increased registration of drug crime was associated with regional decrease of women's working-age mortality along the border, when other factors remained constant.

In the final model 5, we showed results from region and year fixed-effects regression predicting homicide per 100,000 population in Russia between 2001 and 2008. The impact of the regional rate of hepatitis and alcohol consumption on homicide rendered insignificant. Holding other factors constant, drug-related crime was significantly at the 0.10-level and positively associated with homicide rates, as each additional registered drug-related crime per 100,000 population was associated with a 0.01 per 100,000 increase in homicide. On the other hand, results showed a significant (at the 0.10 level) and negative association between the drug-related crime in the border regions and homicide rates. In contrast to the rest of the country, increased registration of drug crime was associated with a decline of homicide rates along the border, as each additional registered drug-related crime per 100,000 population was associated with a 0.03 per 100,000 decrease in homicide, when covariates were adjusted in the model.

The final part of the analysis sought to determine the association between the regional concentration of Muslims and population health. Predicting men's working age mortality, Models 3 and 4 showed large negative effects of the association with percent of Muslims in the region. According to results, in the reference year 2001, each additional percent of Muslim population in the region was associated with a decline of 37 men's deaths per 100,000 population at the 0.10 level, if covariates remained constant. When we adjusted for other factors, one percent increase in concentration of Muslims was associated with a decrease of 39 men's deaths per 100,000

population at the 0.001 level in 2002-2005, and 38 men's deaths per 100,000 population at the 0.01 level in 2006. The association between percent of Muslims and working-age mortality strikingly differ by gender, suggesting an increase of 3 women's deaths as opposed to a decline of 37 men's deaths per 100,000 population with each additional percent of Muslims, when adjusting for other factors in the reference year 2001. If covariates remained constant, one percent increase in concentration of Muslims was associated with an increase of 2 women's deaths per 100,000 population at the 0.001 level in 2002-2006 and at the 0.05 level in 2007-2008.

The results for the association between percent of Muslims and life expectancy are consistent with the results for the association between percent of Muslims and working-age mortality, implying a positive relationship between percent of Muslims and men's life expectancy and a negative relationship between percent of Muslims and women's life expectancy, when adjusted for other factors. Despite the negative association between working-age men's mortality and concentration of Muslims, the relationship between percent of Muslims and homicide showed the opposite effect. In the reference year 2001, each additional percent of Muslims was associated with an increase of one homicide per 100,000 population at the 0.10 level, when adjusted for other factors. The effect of percent of Muslims was the same in every year as it was in 2001, except for 2007 when it was 0.041 larger as compared to the reference year.

The corresponding analysis using the random-effects regression models tells a similar story with consistent significant results. In addition, a study of the RE models highlights a stronger beneficial impact of concentration of Muslims on working-age mortality for both men and women. However, the results show that higher concentration of Muslims reveal the beneficial effects on life expectancy for men and the deleterious effects on life expectancy for women. Results may suggest that the effects of the buffering role of Muslim culture on health are differed by age and gender and they are more pronounced among working-age men in the midst of mortality crisis.

In contrast to the deleterious effects of Muslim concentration on homicide in the fixed-effects regression analysis, the random-effects analysis shows the favorable effects of Muslim concentration on homicide. The RE results may indicate that the Muslim regions with a larger population of Muslims experience advantageous health/homicide outcomes, whereas the FE results may imply that the Russian regions with an increasing percent of Muslims encounter tension and violence based on ethno-religious characteristics. Results also infer that living along the Central Asian border costs both men and women two years of expected life and increases instances of homicidal violence by 14 per 100,000 of population, compared to the rest of the country. Similar to the FE results, increased registration of drug crime along the border was associated with regional improvement in homicidal violence and population health, particularly among women.

Discussion

Past research has shown that during their painful socio-economic transition, post-socialist Russian regions experienced a sudden expansion of the illegal drug trade and illegal drug consumption (UNODCCP; Ministry of the Interior Affairs; Paoli 2002). Despite the urgency to address this socially critical development, the effects of illegal drug abuse on population health have been understudied empirically. Using longitudinal panel data by region for the period 2001-2008 and fixed-effects regression models, we investigated the relationship between illegal drug use, crime prevalence and population health in Russia during Putin's first presidency.

Comparing homicide crime data from the Ministry of the Interior and homicide mortality data from the vital statistics, Pridemore (2003) concluded that both systems under-report and

should be used with caution. In our study we considered this limitation and analyzed population health using life expectancy and working-age mortality, in addition to homicide crime. Population health in terms of life expectancy, working-age mortality, and homicide showed signs of improvement by 2005-2006 as compared to reference levels in 2001. According to Shkolnikov et al. (2013), in the working-age age group, lower external cause mortality, especially homicide, made the biggest contribution to improved population health and the increase in life expectancy may be attributable to measures that were launched after 2005 to control the production and sale of ethanol, as well as to prevent and treat socially significant diseases.

Our study supports the following conclusions. First, the hepatitis rate, as a crude measure of intravenous drug use and practices, explained the population health variation among men and women within Russian regions. The hepatitis rate was negatively associated with life expectancy for men (at the 0.01 level) and women (at the 0.05 level) and positively associated with mortality for working-age men (at the 0.01 level) and working-age women (at the 0.05 level). The association between the hepatitis rate and homicide was insignificant; however, the association between drug-related crime and homicide was significant (at the 0.10 level). These results may imply that pathways between intravenous drug use, illegal drug related crime, and homicidal violence are different. For example, drug traffickers may compete for the drug trade, territories, and consumers and are more likely to be connected with homicidal violence. On the other hand, intravenous drug users seem to spend their intensely self-destructive lives focusing primarily on their own negative health behaviors, which result in poorer indicators of life expectancy and working-age mortality.

Second, the analysis of factors associated with life expectancy suggests the importance of both the hepatitis rate and vodka sales in explaining the life expectancy variation for men and women within regions. Contrastingly, the analysis of factors associated with working-age

mortality highlights the significant effect of the hepatitis rate and the insignificant effect of vodka consumption. Results of this analysis may imply that it is important to distinguish the impact of practices on health outcomes not only among intravenous drug consumers and traffickers, but also among intravenous drug users and legal alcohol consumers. Both legal and illegal substance abuse bring harm to overall population life expectancy. However, the intensity of injecting drug use has more immediate life-threating effects during the prime working age, compared to the life long-term harmful effects of vodka consumption.

Third, population health along the Central Asian border deserves particular attention since the demise of the Soviet Union and the rapid expansion of illegal drug trade from Afghanistan. Living along the Central Asian border costs both men and women two years of expected life and increases instances of homicidal violence by 14 per 100,000 of population, compared to the rest of the country. Unexpectedly, results of the analysis demonstrate that in contrast to the rest of the country, every additional registration of drug-related crime per 100,000 population was associated with an increase of men's and women's life expectancy, a decrease of women's working-age mortality, and a decline of homicide rates in the border regions. One explanation may be that the improvement of population health in these regions is attributable to the effective policies that were focused on control and punishment of the illegal drug crime in the most problematic regions along the vast Eurasian border. An alternative explanation may be that the law enforcement system punishes the messengers, but not the larger multilateral institution that is also responsible for this trade. This institution facilitates the coherent underground economy infrastructure in the drug trading ports along the Central Asian border, contributing to the improvement of homicidal violence and overall population health.

Fourth, our findings confirm the Muslim mortality advantage, specifically in terms of working-age death and life expectancy for both men and women. Interestingly, in the first decade

of this century the Muslim mortality advantage is more pronounced during the peak of the mortality crisis. These results support past research on Muslim distinctiveness (Steven Fish, 2011; Redmond and Spooner, 2009; Kohler et al. 2011; Bougdaeva, 2010) and may imply that Muslims' special emphasis on shared values and strong community have a positive effect on population behavior and health outcomes. However, despite the Muslim health advantage, there is no significant negative association between higher concentrations of Muslims and homicide. In fact, we found a positive relationship between these factors and a significant increase of the effect of percent of Muslims on homicide in 2007 compared to the reference year in 2001. These findings are notable, since the evidence may to point to the increasing ethno-religious tension in post-Soviet Russia.

Future research on the relationship between illegal drug crime, abuse, and population health can be improved by employing a pooled cross-section time series data that captures the time series from the collapse of the Soviet Union to the most recent years. Future studies also need to consider how to overcome the research limitations related to the lack of direct measures of intravenous drug abuse, the Muslim migration, and ethno-religious crime and homicide. Scholarship on population health can be enriched by extending the regions of observation across the Eurasian regions and capturing drug trafficking to Russia from Afghanistan through the former Soviet republics in Central Asia.

References

Andreev, E., Dobrovolskaya, V., & Shaburov, K. (1992). Etnicheskaya differentsiatsiaya smertnosti. Ethnic differentiation of mortality. *Sotsiologitchskiye Issledovaniya,* 7, 43-49.

Atlani, L., Carael, M., Brunet, J., Frasca, T., Chaila, N. (2000). Social change and HIV in the

former USSR: the making of a new epidemic. *Soc Sci Med*., 50,1547–1556.

Becker, C., & Hemley, D. (1998). Demographic change in the former Soviet Union during the transition period. *World Development,* 26 (11), 1957-1975.

Bobak, Martin, Martin McKee, Richard Rose, and Michael Marmot. (1999). Alcohol consumption in a national sample of the Russian population. *Addiction*, 94, 857-866.

Bougdaeva, S. (2010). The Russian puzzle: mortality and ethnicity in a changing society, 1994–2004. *Communist and Post-Communist Studies*, 43 (3), 325-333.

Chervyakov, V.V., Shkolnikov, V.M., Pridemore, W.A., McKee, M. (2002). The changing nature of murder in Russia. *Soc Sci Med*., 10,1713–1724.

Cockerham, W. (1999). *Health and Social Change in Russia and Eastern Europe.* London and New York: Routledge.

Degenhardt, L., Whiteford, H.A., Ferrari, A. J., Charlson, F.J., Hall, W.D., & Vos, T. (2013). Global burden of disease attributable to illicit drug use and dependence: findings from the Global Burden of Disease Study 2010. *Lancet*, 382 (9904), 1564-1574.

Fish, M.S. (2010). *Are Muslims Distinctive? A Look at the Evidence*. Oxford University Press.

Gavrilova, N.S., Semyonova, V.G., Dubrovina, E, Evdokushkina, G.N., Ivanova, A.E., & Gavrilov, L. (2008). Russian mortality crisis and the quality of vital statistics. *Popul Res Policy Rev,* 27: 551-74.

Hagan, H, Thiede, H, Weiss, NS, Hopkins, SG, Duchin, JS, Alexander, ER. (2001). Sharing of drug preparation equipment as a risk factor for hepatitis C. *Am J Public Health*, 91, 42-46.

Kaushik, K., Kapila, K., & Praharaj, A.K. (2011). Shooting up: the interface of microbial infections and drug abuse. *Journal of Medical Microbiology*, 60: 408–422

Kohler, I. & Preston, S. (2011). Ethnic and religious differentials in Bulgarian mortality,

1993-98. *Population Studies: A Journal of Demography*, 65: 91-113.

Leon, DA, Saburova, L, & Tomkins, S. (2007). Hazardous alcohol drinking and premature mortality in Russia: a population based case-control study. *Lancet*, 369:2001–9.

Moskovich, G.F., Pikovskaia, E.D., Fedotova, N.V., Shilov, D.V., Kuznetsov, A.V., Moiseev, A.P. (2000). The prevention of HIV infection and other blood-contact diseases among intravenous narcotic users in Nizhniy Novgorod within the framework of the Harm Reduction program. *Zh Mikrobiol Epidemiol Immunobiol,* 4, 78-82.

Nemtsov, AV. (2002). Alcohol-related human losses in Russia in the 1980s and 1990s. *Addiction*, 97, 1413–25.

Paintsil, E., Verevochkin, S., Dukhovlinova, E., Niccolai, L., Barbour, R., White, E., Toussova, O., Alexander, L., Kozlov, A., & Heimer, R. (2009). Hepatitis C Virus infection among drug injectors in St. Petersburg, Russia: social and molecular epidemiology of an endemic infection. *Addiction*, 104 (11), 1881-1890.

Paoli, L. (2002). The Development of an Illegal Market. Drug Consumption and Trade in Post-Soviet Russia. *The British Journal of Criminology*, 42 (1), 21-39.

Pridemore, W.A. (2003). Measuring homicide in Russia: a comparison of estimates from the crime and vital statistics reporting systems. *Soc Sci Med*, 57 (8), 1343-54.

Pridemore, W.A. (2006). Vodka and Violence: Alcohol Consumption and Homicide Rates in Russia. *Am. J. Public Health*, 92, 1921-1930.

Redmond, G. & Spooner, C. (2009). Alcohol and other drug related deaths among young people in CIS countries: Proximal and distal causes and implications for policy. *International Journal of Drug Policy*, 20: 38-47.

Rhodes, T, Platt, L, Judd, A, Mikhailova, LA Sarang, A, Wallis, N, Alpatova, T, Hickman, M, Parry JV. (2005). Hepatitis C virus infection, HIV co-infection, and associated risk

among injecting drug users in Togliatti, Russia. *Int. J. STD AIDS*,16(11), 749-54.

Shkolnikov, V.M., Cornia, G.A., Leon, D.A., Meslé, F. (1998). Causes of the russian mortality crisis: Evidence and interpretations. *World Development*, 26 (6), 1995-2011.

Shkolnikov, V., McKee, M., and Leon, D.A. (2001). Changes in life expectancy in Russia in the mid-1990s. The Lancet 357 (9260): 917-921.

Shkolnikov, V.M., Andreev, E.M., McKee, M., Leon, D.A. (2013). Components and possible determinants of the decrease in Russian mortality in 2004-2010. *Demographic Research*, 28 (32), 917-950.

van Houdt, R., Sonder, G. J., Dukers, N. H. T. M., Bovee, L. P. M. J., van den Hoek, A., Coutinho, R. A., & Bruisten, S. M. (2007). *Impact of a targeted hepatitis B vaccination program in Amsterdam, The Netherlands.* Vaccine, 25*,* 2698*–2705.*

van Houdt, R., van den Berg, C. H., Stolte, I. G., Bruisten, S. M., Dukers, N. H., Bakker, M., Wolthers, K. C., Prins, M., & Coutinho, R. A. (2009). Two decades of hepatitis B infections among drug users in Amsterdam: are they still a high-risk group? *J Med Virol,* 81, 1163*–1169.*

Volkov, V. (2002). *Violent Entrepreneurs: The Use of Force in the Making of Russian Capitalism*. Cornell University Press.

Volkova, G., Kutasova, T., Kryga, L., Ostrovsky, D., Boshanov, A., Ivanov, I. (1999). Study of HIV-infection, hepatitis B and C among drug addicts as a means to improve epidemiological surveillance. *Proceedings of Project Participants: Current Problems of HIV and AIDS, Saint Petersburg, Canadian-Russian AIDS Project,* 1, 32–34.

Wooldridge, J.M. (2002). *Econometric Analysis of Cross Section and Panel Data.* Cambridge, Massachusetts and London, England: the MIT Press.