The “Twin Epidemics” have the potential to devastate populations of the Western CIS. What scenarios could potentially change the course of the current public health crisis?

Mickey Rafa
EXECUTIVE SUMMARY

Since the collapse of the Soviet Union, Eastern Europe has been under the watchful eye of policy practitioners and social scientists from various countries and ideological allegiances. Some view the region for its essential geostrategic importance, while others see Eastern Europe as a social laboratory – a fascinating case study of varying degrees of political and economic liberalization.

While many were celebrating the honeymoon following the end of the Cold War, a troubling situation was unfolding in some former republics of the Soviet Union. The dramatic transition of social, economic and political systems brought both promises and problems throughout the region. Some countries on the eastern periphery saw prolonged and profound economic crises that caused millions of once-middle class individuals to slide into poverty.

While the economic climate captured the attention of most transition analysts, a disconcerting sub-plot was forming. During this period of dramatic change, the “twin epidemics” of HIV/AIDS and tuberculosis began to emerge in concentrated subpopulations, particularly among injecting drug users (IDUs). By the turn of the century, many analysts were predicting that new infection incidence rates in some Eastern European countries were the highest in the world. According to a UNAIDS report from 2009, Eastern Europe and Central Asia are the only regions in the world where HIV prevalence “clearly remains on the rise.” (Cohen, 2010: 160). To make matters worse, strains of multidrug-resistant and extensively drug-resistant tuberculosis (MDR-TB and XDR-TB) have been found, which has been the most lethal infectious disease among those infected with HIV.

The post-Soviet environment inherited a decaying health infrastructure that lacked the ability to respond to public health crises. These diseases pose a serious health threat for at risk populations throughout the region, and they could be particularly devastating in places with poor governing structures and healthcare systems. Data collection on the emerging epidemics and a public healthcare response has been inadequate, because the diseases emerged in concentrated sub-populations that are engaging in illegal behavior.
This study will focus on the countries of the Western Commonwealth of Independent States (Belarus, Moldova, Russia and Ukraine) and seek to forecast the potential future prevalence of HIV/AIDS in the region. This forecast will be conducted using UNAIDS Spectrum software to generate potential disease patterns to 2020.

I will begin with a survey of the social conditions that came to be during the transition period, along with a brief explanation of the research interest for this forecast. Then the domain knowledge of relevant forecasts will be outlined. What forecasting techniques have been employed, and are these tools suitable for the problem at hand? This section will serve as a research stepping-stone for the forecast. Following the assessment of existing literature on the subject, I will outline the methodology for the study and show how this framework will contribute to the existing domain knowledge.

The world in which we live is riddled with uncertainty, and it is for this reason that is critical to prepare for the future using different forecasting approaches. This report is an effort to expand our mental time horizon beyond the current, more immediate issues into a discussion about long term health possibilities for populations in the Western Commonwealth of Independent States.
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The Post-Soviet Transition Period

The demise of the Soviet Union led to one of the great transformations of the international system in history, from a world with two great powers to an unknown political landscape with the United States at the helm. But within countries of the former Soviet Union, ordinary citizens were also coping with dramatic change – an observation that is often overlooked by taking the global view. This massive political, economic and social dislocation was felt at every level of society.

For the countries in the Western CIS, the transition period was particularly punitive. Across the region, the volatile and uncertain economic environment led to high unemployment and rapidly declining living standards. This period was also characterized by a region-wide social transformation in which young adults were experimenting with newfound freedoms, engaging in risky behaviors and testing Soviet-era taboos. This fracturing socioeconomic environment coincided with the deterioration of the former healthcare structure.

Perhaps the most striking observation from this period is the decline in human development across the region during the post-Soviet period. Even as of 2007, no country in the region had returned to the HDI levels of 1990. The four former Soviet countries of this study saw a dramatic decline in life expectancy during the transition period; these states have all struggled to return to their 1990 levels.

![Life Expectancy in the Western CIS](source: IFs 6.54.

The experience of the Russian Federation is illustrative of the power of socioeconomic conditions on life expectancy. After the fall of the Soviet Union, Russia experienced the initial decline in life expectancy along with the other countries of the region. But the financial crisis that gripped Russia in the late 1990s was also reflected in a public health crisis.
Countries in this region were not quarantined from the Great Recession; in fact, the banking and finance industries were in some cases excessively exposed to capital flight from Western European investors. Similar to the first dislocation period experienced by countries throughout the region, the recent global recession will certainly have an adverse impact on human development.

The recession has increased the number of socially marginalized peoples in the Western CIS, which puts more people at risk of contracting deadly illnesses. In difficult economic times, governments are faced with tradeoffs in order to meet budget constraints, and oftentimes healthcare spending is put on the chopping block. In this way, a poor socioeconomic environment can be a distal driver for many systemic health related issues.

Although non-communicable diseases like heart diseases are today’s dominant drivers of premature death in the region, communicable diseases have explosive growth potential in the region that could command considerable policy attention to thwart wide scale epidemic. Due to the nature of communicable diseases and the early stage of the HIV epidemic in the western CIS, there is potential for the localized epidemic to dramatically increase in prevalence in the coming decades.

**Communicable Disease: HIV/AIDS**

The Western CIS was isolated from the initial outbreak of HIV in the 1980s, due to the harsh systems of social control in place and the restricted contact with foreigners. In a 1995 World Health Organization report, countries of Central and Eastern Europe accounted for only 1% of the reported cases of AIDS for the European region, while a group of 15 Western European countries claimed 92.8% of AIDS cases (Downs et al., 1997: 650). But 1995 marked the beginning of an epidemiological sea change in the evolution of the virus, when the first major outbreak of HIV was reported in the southern Ukrainian port cities of Odessa and Nikolayev among injecting drug users. Similar outbreaks among IDUs in Belarus, Moldova, the Russian exclave of Kaliningrad and parts of Russia proper followed in 1996 and 1997. By the turn of the
The Twin Epidemics

century the region held the grim title as one of the fastest growing HIV epidemics in the world behind Sub-Saharan Africa (United Nations Development Programme, 2004: 11). In fact, one out of every one hundred adults in Eastern Europe carries the HIV virus (UNDPa, 2004: 1).

![Communicable Diseases Distribution for Eastern Europe (Non-EU) in 2012](chart)

The outbreaks of HIV across region exhibit common epidemiological patterns, with the main cause of transmission being drug use with infected syringes. During the 1990s, Afghanistan became the world’s largest producer of opium, and new shipping routes had opened up through the once-Iron Curtain. This period coincided with the dramatic social change taking place in the former Soviet Union, and demand for illicit narcotics was on the rise. The infection rate was concentrated within the young males aged 15 to 24 of the populations, and the trend from Table 1 has persisted: the primary mode of HIV transmission in the region remains tainted needles from illicit drug use (UN, 2010: 66).

However, evidence suggests that transmission patterns are beginning to shift to sexual partners, primarily through heterosexual intercourse. In 2008, 42% of new HIV infections in Russia were women; this figure is up from 21% in 2000 (United Nations, 2010: 66). This has led to the growth of HIV prevalence in the general

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1 This is for the wider Eastern European region. Particularly, the Baltic States also struggle with high rates of HIV.
2 These figures reflect only reported cases. In reality, they may even be higher because the harsh criminalization of drugs among these countries prevents some of those infected from getting tested or receiving treatment. Source: HIV/AIDS in Eastern Europe.

<table>
<thead>
<tr>
<th>Country</th>
<th>Initial Years</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>76%</td>
<td>64%</td>
</tr>
<tr>
<td>Moldova</td>
<td>Unavailable</td>
<td>82%</td>
</tr>
<tr>
<td>Russia</td>
<td>90%</td>
<td>76%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>71%</td>
<td>54%</td>
</tr>
</tbody>
</table>

Figure 3. Communicable Disease Distribution. Source: IFs 6.54.
population, as it has spread through sexual partners of infected drug users. This suggests the potential for a much wider spread of the disease in the future as the transmission to the general public persists and the male to female ratio converges.

Russian and Ukrainian societies have been particularly decimated by the HIV epidemic. In just seven years since the initial outbreak of HIV in Russia, officially reported cases of HIV increased by a factor of fifty (International Labour Office, 2004: 2). In 2009, official registered cases of HIV in Russia totaled 529,828 (Bobylev et al., 2010: 82). It is widely agreed upon that official records do not reflect the complete gravity of the situation; some experts estimate that the true number of HIV cases could be as high as four times greater than official statistics (National Intelligence Council, 2002: 39). The World Health Organization estimates that the actual number of Russians infected with the virus to be 940,000, with their maximum approximation at 1,300,000 (Bobylev et al., 2010: 83).

A similar bleak story is unfolding in Ukraine; Russia and Ukraine together make up half of all cases of HIV in Europe (UN, 2010: 66). Since the start of the outbreak in 1995, 31,241 Ukrainians have been diagnosed with AIDS and nearly 18,000 have died (UNDPb, 2010: 77). The epidemic in Ukraine has entered a new phase: in 1999, an estimated 37% of people living with AIDS were women; by 2009 45% of those living with the disease were female. This suggests that the transition from primarily drug users to the general population is already underway (UNAIDSa, 2010: 38). In 2009, Ukraine reported its highest figure of new infections for the entire epidemic period at 19,840 (UNDPb, 2010: 77).

The situation in Belarus in Moldova, while still very serious, is more contained. However, low overall prevalence rates can give policymakers a false sense of security; epidemics that are at once concentrated to specific demographic groups or regions can quickly spill over to the larger population (CSIS, 2002: 5). UNAIDS has estimated that 25,000 Belarusians are living with HIV, with 53% of infected people living in the southeast Gomel region (UNAIDSb, 2009: 1). Having a high concentration of HIV positive people within one region could eventually lead to a spike in prevalence rates in the future, as the risk pool for HIV contact spreads beyond intravenous drug users to the general population.

The incidence rate of HIV/AIDS in Moldova was reported at 19.4 cases per 100,000 people in 2008, marking a substantial increase from 4 cases per 100,000 in 2000 (Government of the Republic of Moldova, 2010: 10). There was a slight decline in the incidence rate in 2009, but it is difficult to know whether this marks a shift in the overall trend of the disease.

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**Figure 4. Causal Diagram of Mental Model for HIV Transmission in Urban Areas**

The incidence rate of HIV/AIDS in Moldova was reported at 19.4 cases per 100,000 people in 2008, marking a substantial increase from 4 cases per 100,000 in 2000 (Government of the Republic of Moldova, 2010: 10). There was a slight decline in the incidence rate in 2009, but it is difficult to know whether this marks a shift in the overall trend of the disease.
The currently understood “tipping point” for HIV is when the prevalence rate meets a 1% threshold. At this rate, it is believed that the virus is likely to crossover from concentrated risk groups like drug users or commercial sex workers into the general population (Sharp, 2007: 188). This is purely a rule of thumb for studying the epidemiology of the disease, and it can vary widely based on circumstances. For instance, looking at Belarus on the aggregate gives a misleading impression that the disease is less a problem than elsewhere in the region. But as mentioned above, the regional prevalence rate is highly concentrated, suggesting that the course of the disease could change quite rapidly.

Domain Knowledge for Forecasting HIV/AIDS Epidemics

Forecasts of the evolving HIV/AIDS epidemic are particularly challenging and vary considerably from study to study. Some forecasts have led to quite fatalist conclusions, while others appear far more conservative in their estimates about the ability of the disease to spread. As one Chief of the UNAIDS Humanitarian Unit has maintained, forecasts for the prevalence of HIV/AIDS are “highly speculative.” In the early 1990s, some had underestimated the spread of the disease in sub-Saharan Africa by over three times (CSIS, 2002: 4).

Some forecasts in the policy community have proven to be far too doomsday than reality has shown. Forecasts during the initial years of the epidemic were particularly grim. One such forecast projected HIV cases to eclipse 10 million in Russia by 2015 (Bobylev et al., 2010: 82). Some studies have opted for a far more qualitative approach to forecasting HIV/AIDS. For example, one study concluded that it is “likely” that Russian GDP growth will “see declines…or perhaps negative growth” within ten years (CSIS, 2002: 42).

A study by the National Intelligence Council in 2002 forecasted that HIV positive Russians would rise to between 5 to 8 million by 2010, with an upper bound adult prevalence rate of 11%
As it turned out, HIV cases have increased, but only to between 1 to 2 million. This study utilized opinions from experts and practitioners in the field to estimate infection rates (NIC, 2002: 6). The forecast was built upon the underlying assumption that the disease had not yet spread to the general population but was concentrated among intravenous drug users and prison inmates that were predominantly male (NIC, 2002: 11).

A publication in 2008 by The Population Council of the United Nations forecasted that HIV prevalence and incidence rates would decline across all regions over the next 30 years (Bongaarts, 2008). One of the foundational assumptions of this forecast was that the number of high-risk individuals would decline by 50% every 20 years. Due to the deep and prolonged nature of the recent global recession, many more people have been introduced to this high-risk pool than they had forecasted.

Scenario analysis has also been used to forecast potential futures of HIV/AIDS transmission in the region. The International Labour Office used scenario modeling to forecast the impact of HIV/AIDS in the Russian Federation. This model is unique, in that its 5 scenarios seek to forecast the impacts of the virus on pension solvency, healthcare costs, labor force participation, economic growth and life expectancy – all with embedded exogenous assumptions.

There are two particularly distinctive scenarios in the analysis by the International Labour Office: 1.) a scenario that shifts HIV transmission to older age cohorts, thereby simulating a shift from drug use to greater sexual transmission, and 2.) a scenario that represents the impact of HIV saturation among intravenous drug users. In even their worst case scenario, the ILO projected HIV cases to peak by 2008, while the population and GDP of Russia would decline from 2-5% by 2050 (ILO, 2004: 14).

The World Health Organization utilized scenario analysis to forecast global disease and morbidity burden. The three scenarios in this model use a baseline, pessimistic, and optimistic format that uses parameter changes that are unique to each cause of morbidity or mortality. The HIV/AIDS component of the forecast focused on access to anti-retroviral drugs, with the optimistic scenario achieving 80% coverage. This scenario projects a decline in HIV/AIDS deaths by nearly 3 million people worldwide by 2030 (Mathers & Loncar, 2006: 8).

<table>
<thead>
<tr>
<th><strong>Table 3. Forecasts of Russian HIV epidemic v. Actuality</strong></th>
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<tbody>
<tr>
<td><strong>Bobylev</strong></td>
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<td><strong>National Intelligence Council</strong></td>
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<td><strong>International Labour Organization</strong></td>
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<tr>
<td><strong>How the epidemic has actually unfolded</strong></td>
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</table>
The wide range of forecasts showcases the unique challenge for forecasters of the epidemic in the Western CIS. One of the main obstacles to conducting a meaningful forecast is the hidden, almost incalculable nature of IDUs driving the spread of the disease. Concentrated epidemics are best understood when the subpopulations are well-known and measured. It is also difficult to forecast the spillover point from a concentrated to a generalized epidemic, without a grasp of the “bridge population” that connects risk from subpopulations to the general population (i.e., sexual partners of IDUs). These challenges will inform the forecast methodology later in this study.

**Communicable Disease: Tuberculosis (TB)**

The tuberculosis epidemic began in the region in tandem with the HIV outbreak in the 1990s, amidst a political and socioeconomic environment in upheaval. Tuberculosis has also had a devastating impact on health in the region due to its cofactor relationship with HIV; contracting HIV increases one’s susceptibility to the more “active, contagious form of TB.” (NIC, 2002: 12) The parallel epidemic of HIV/AIDS in the Western CIS has left populations more vulnerable to contracting more deadly forms of TB. In fact, tuberculosis is the primary cause of death among those that have contracted HIV/AIDS, which lends credence to the troubling parallel relationship between the two diseases (Sekhri, 2006: 43).

Much like the aforementioned HIV epidemic, Russia leads the region in the dubious category of tuberculosis. But that has not followed historic the historic epidemiological path of the disease. After World War II, tuberculosis declined in Russia for a half century. It was not until the 1990s that a resurgence of TB was underway, as incidence and death rates from tuberculosis more than doubled (Bobylev et al., 2010: 82). Today, 35% of all new incidences of TB in the entire world are found in Russia (Bobylev et al., 2010: 86). Using 1991 as the baseline year, incidence of TB was 2.4 times higher in 2009. Tuberculosis is now recognized as the most lethal infectious disease in Russia – responsible for 5-6% of the total deaths in recent years of the 25 to 44 year old age bracket. Russia owns the highest fatality rate from tuberculosis in Europe at 16-18 deaths per 100,000 people (Bobylev et al., 2010: 86-87).

The prevalence of multi-drug resistant tuberculosis (MDR-TB) is responsible for much of Russia’s problems with combating the disease. This more devastating mutation of the disease is caused by two factors present in Russia: 1.) HIV positive patients are more susceptible to this more resilient, lethal form, and 2.) Drug resistant forms come into being because TB patients do not complete full treatment regiments (Sekhri, 44). The World Health Organization has estimated that Russia is among the top ten countries in terms of incidence and prevalence of MDR-TB. Currently, drug-resistant strains account for 10% of TB cases, and this figure is on the rise (Bobylev et al., 2010: 86-87).

Ukraine’s tuberculosis epidemic began to unfold in 1995, as the opportunistic infection exploited the parallel HIV outbreak. Incidence rates of tuberculosis grew uninterrupted from 1995 to 2005. The current epidemiological situation in Ukraine is dismal – over 30,000 new cases of TB are reported every year (UNDP, 2010: 79). TB mortality estimates vary, but the UNDP claims
that death totals eclipse 10,000 each year in Ukraine. Tuberculosis claims more adult lives than any infectious disease (UNDPb, 2010: 80).

According to government figures in the Republic of Moldova, newly diagnosed cases of TB rose 43% from 2000 to 2004 (GRM, 2010: 75). Within recent years there has been a marked rise in multi-drug resistant TB in Moldova; official government records claim that 43% of the total patients now have the more resilient form of the infection, which is a 6% increase since 2008 (GRM, 2010: 80).

<table>
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<th>Table 4. Tuberculosis Indicators(^3)</th>
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<tr>
<td><strong>Country</strong></td>
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<tr>
<td>Belarus</td>
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<td>Moldova</td>
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<td>Russia</td>
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<td>Ukraine</td>
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Although the epidemiological environment in Belarus is considerably better than other countries in the region, tuberculosis incidence rates have been on the rise (although not continuously) since independence from the Soviet Union: 29.8 in 1990, to 51.7 in 2003, to 70 in 2010. While Belarus appears to be more in control than any other country in the study, multi-drug resistant


\(^4\) This figure excludes HIV positive patients.
TB is more prevalent than in any other state in the region (UNDPc, 2005: 39). This poses particularly challenging demands of a public health system and authoritarian regime that is relatively closed to external aid.

**Box 1. Proximate Drivers of the Twin Epidemics.**

1. **Injecting drug users.** IDUs are responsible for the outbreak of HIV in the region. This pattern has persisted for over 15 years. Recent epidemiological studies seem to suggest that this paradigm is shifting, though, as the disease spreads through sexual partners into the general population.
2. **Risky sexual behavior.** This driver is very difficult to quantify in its entirety. Data on condom usage is available, but this will not capture all risky sexual behaviors, such as the size of the commercial sex work industry.
3. **Population density.** People living in densely populated areas are more likely to come in contact with people living with HIV/AIDS. Additionally, the spread of these diseases has been concentrated to highly populated areas, because intravenous drug use is more prevalent in cities.
4. **HIV/AIDS (as a driver of TB).** People living with HIV/AIDS are far more susceptible to contracting tuberculosis, because it is an opportunistic infection that capitalizes on weak immune systems.
5. **Prevalence of MDR-TB.** Increased prevalence of MDR-TB throughout the region means that more healthy people are coming into contact with contagious TB patients that are not responding to typical treatment regimens.
6. **Access to Anti-retroviral medication (ARVs).** Access to ARVs is far from universal. These medications stave off the worst of immune system deterioration, which can influence whether patients contract opportunistic infections like tuberculosis.

**Domain Knowledge for Forecasting Tuberculosis**

Forecasts of the tuberculosis epidemic pose many challenges similar to HIV forecasting. Tuberculosis is generally confined at the outset to concentrated risk groups with poor standards of living. It is nearly impossible to forecast when the epidemic will become more generalized and at what prevalence rate it will peak. Furthermore, these issues are influenced by government spending on health initiatives and a plethora of distal socioeconomic drivers.

If the time horizon is within reasonable distance (which is completely subjective), simple extrapolation methods may be appropriate for forecasting TB. The 2010 national report for Ukraine on the Millennium Development Goals forecast the incidence rate for tuberculosis over a five year time frame; the results of this method showed a decline in overall morbidity and mortality rates over the five year timeline (UNDPb, 2010: 80).
There are substantial risks that must be accepted to utilize simple extrapolation for epidemics. Had this method been used before TB reached epidemic status in 1995, the forecast would have fallen drastically short of reality. And this can have real world implications – forecasts can prepare policy practitioners and determine spending priorities. An epidemiological forecast that falls way below the mark could force leaders into an uninformed response to outbreaks.

The Forecast Working Group from the Center for Global Development worked primarily with forecasting future world markets of HIV/AIDS, tuberculosis and malaria medications. This perspective still attempts to forecast disease burden, but with additional supply and demand forces of disease treatments. Projections from The Forecast Working Group use a “wisdom of the crowd” method that encourages dialogue from field experts to project the future market for treatments (Sekhri, 2006: 5). This group relies heavily on qualitative forecasting from authorities in the field and calls for “voluntary integration” of quantitative methods in areas where appropriate data is available (Sekhri, 2006: 23). Although this group encourages diverse forecasting techniques that may introduce creativity into the discussion, it seems that this perspective glosses over the proximal and distal drivers of each disease’s epidemic.

The Global Burden of Disease study by Mathers and Loncar (2006) constructed scenarios of distal drivers of several kinds of diseases. This forecast used three main distal drivers: GDP per capital, average number of years of schooling, and time as a proxy for the impact of technological change on health outcomes. The study exogenously put parameters into the forecast based on relevant drivers specific to the disease.

Forecasts of tuberculosis and HIV/AIDS should go hand in hand, given the characteristics of the parallel epidemics and the cofactor relationship between the diseases. Because HIV is a proximal driver, particularly for MDR-TB, forecasting models for TB must integrate HIV into the conceptual and concrete models.

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*Figure 7. Causal Diagram of Mental Model for HIV/AIDS and TB Transmission in the Western CIS.*
Methodology

Forecasts for generalized epidemics benefit from far more certainties about the disease path than concentrated epidemics that remain in subpopulations. In generalized epidemics, forecasts typically rely on data collected from women at antenatal clinics. The logic behind collecting data in this fashion is sound for generalized epidemics, because the male to female ratio is more or less in balance (UNAIDS/WHO, 2004: 7).

Uncertainties are far more challenging in forecasts of concentrated epidemics, because the trajectory of the disease is still unknown. In all countries in the region, UNAIDS still classifies the HIV epidemic as concentrated. Typically, this designation is for countries below the 1% prevalence threshold, but UNAIDS has recognized that in Ukraine and Russia the disease has remained within high-risk subpopulations (UNAIDS, 2009: 7). For a concentrated epidemic like the one in this study, data from antenatal clinics would not reflect the true nature of the disease. If prevalence rates are far higher in males that use intravenous drugs, relying on female clinic data would underrepresent the actual epidemic.

UNAIDS Spectrum is a software package designed to model HIV/AIDS epidemics. This program distinguishes between generalized and concentrated epidemics in its forecasting tools, so it is uniquely fit for forecasting the course of the epidemic in the Western CIS, which has been particularly concentrated among a sub-population. Nationwide surveys are commonly used to forecast HIV/AIDS and TB epidemics in other parts of the world. Unfortunately, data for the epidemics in the Western CIS is not comprehensive or consistent.

The Workbook module within Spectrum is designed to overcome data shortfalls, to allow forecasting in areas with poor data collection. Data on IDUs is sparse, and it is known to be significantly underreported when it is measured. By designating that the epidemic is concentrated in injecting drug users, I can produce a forecast that is based on the assumptions built into Spectrum for that particular type of sub-epidemic.5

Spectrum generates curves for concentrated epidemics if at least three values for drug use prevalence are provided. Due to the difficulty of measuring the IDU subpopulation, statistics were gathered from a few different sources. To simplify the data collection process, I used statistics of opiate users to represent the IDU group as a whole, because heroin accounts for an overwhelming majority of intravenous drug use. Country-specific drug prevalence statistics were taken from the annual World Drug Report from United Nations Office on Drugs and Crime. In instances where a confidence interval is given to estimate the range of IDU prevalence from the general population, I use the mean value to construct the forecast. In some cases, only one estimate is provided for a country from a given year, so I used just that number for the population input into Spectrum.

Table 5. Prevalence of Injected Drug Use Among the General Population

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<tbody>
<tr>
<td>Belarus</td>
<td>.08</td>
<td>.07</td>
<td>.1</td>
<td>.4</td>
<td>.5</td>
<td>.08</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>Moldova</td>
<td>.04</td>
<td>.07</td>
<td>.1</td>
<td>.3</td>
<td>.1</td>
<td>.12</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>2.1</td>
<td>2.0</td>
<td>1.6</td>
<td>1.64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ukraine</td>
<td>.3</td>
<td>.8</td>
<td>.9</td>
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</tbody>
</table>

For input statistics on HIV prevalence within the IDU subpopulation, two sources were used. The European Monitoring Centre for Drugs and Drug Addiction provided estimates of HIV prevalence within IDUs for Belarus and Moldova. For estimates within Russia, studies have found that HIV prevalence among the IDU risk group ranges from 12% to 56%, so I took the mean of the two prevalence estimates (Luo and Cofrancesco, 2006: 935). Because statistics on prevalence rates among IDUs are unavailable for Ukraine, I used the regional average to generate the HIV forecast.

Finally, Spectrum has a turnover function that represents the amount of time that an individual stays in a given subpopulation. This function captures the change in risk behaviors for individuals over time. When a person exits the IDU subpopulation, their risk of contracting HIV diminishes significantly. A study of the Russian IDU risk group found that the duration an individual remains a drug user is a median of eight years, and this figure will be used for all countries in the region (Niccolai et al., 2009: 136).

Statistics of HIV prevalence in the general population were taken from the World Development Indicators. Boxes 2 and 3 represent possible scenario descriptions for the upper and lower bounds of this forecast.

Table 6. HIV Prevalence Among IDUs

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>16.7%</td>
</tr>
<tr>
<td>Moldova</td>
<td>21%</td>
</tr>
<tr>
<td>Russia</td>
<td>12% - 56%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Box 2. Scenario: Disease Spiral (Upper Bound).

In this scenario, the epidemic has crossed over from concentrated subpopulations to the general public. Prevalence among drug users remains high, but bridge populations have linked high risk groups to the general population. Public health officials are witnessing a rise in prevalence rates at antenatal clinics. With more of the general public now exposed to a greater risk of infection, health systems throughout the region struggle to meet the growing demand for care.
Box 3. Scenario: Defeating the Disease (Lower Bound).

In this scenario, public health policies have responded to the rising threat of the epidemics. Public spending on disease prevention has increased, despite fiscal constraints placed on governments by the economic climate. Education initiatives have increased public awareness of what drives transmission and informed people about how to protect their health. Needle exchange programs have been implemented throughout the region to address the main driver of intravenous drug use with tainted syringes.

These scenarios are meant to illustrate a range of possible futures for the Western CIS. In a forecast with so much inherent uncertainty, this serves the purpose of generating a range of potential outcomes for the epidemiology of the disease. This forecast is an attempt to include recent data on the driving subpopulation of the HIV epidemic in the Western CIS.

Results

Due to the differing scales of the epidemic in Belarus and Moldova compared to Russia and Ukraine, the results will group the countries accordingly. First, I will outline the epidemic curves that forecast HIV prevalence rates.

The epidemics have historically been more contained in Belarus and the Republic of Moldova, and this forecast shows the likelihood of the epidemic remaining largely within the IDU subpopulation.

![HIV Prevalence Forecasts for Belarus and Moldova.](image-url)
HIV prevalence rate in Ukraine has remained steady at 1.1% since 2003. This forecast illustrates the possibility that the epidemic has peaked in Ukraine and prevalence will begin a downward trend. However, the upper bound forecast shows the potential for the epidemic to generalize by 2020. The mean prevalence rate of this forecast would be a continuation of the current prevalence rate, which is around 1.1% of the total adult population.

I put the least amount of stock in the upper bound of the Russian forecast. The high prevalence among IDUs is potentially driving these results, but the prevalence in this subpopulation is not the same across all of Russia. For instance, one study has found that HIV prevalence rate among drug users in St. Petersburg is 30%, but this is likely much higher than most rural areas (Kozlov et al., 2006: 902). By using the mean prevalence rate for IDUs (34%) across the entire country, this forecast misses the significant regional variation in Russia. However, the mean prevalence forecast seems reasonable given the historic trajectory of the HIV epidemic in Russia.

Spectrum’s AIM package allows forecasters to use the generated prevalence curves to translate into useful population data for HIV statistics. Below are forecasts of the number of new HIV infections on an annual basis, as well as a forecast of the total number of adults infected by HIV in the respective countries.
Figure 11. New HIV Infections Forecast.

New HIV infections (15-49)

<table>
<thead>
<tr>
<th>Year</th>
<th>Belarus2020</th>
<th>Moldova2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.42</td>
<td>1.42</td>
</tr>
<tr>
<td>2011</td>
<td>1.46</td>
<td>1.51</td>
</tr>
<tr>
<td>2012</td>
<td>1.51</td>
<td>1.60</td>
</tr>
<tr>
<td>2013</td>
<td>1.56</td>
<td>1.70</td>
</tr>
<tr>
<td>2014</td>
<td>1.61</td>
<td>1.81</td>
</tr>
<tr>
<td>2015</td>
<td>1.68</td>
<td>1.92</td>
</tr>
<tr>
<td>2016</td>
<td>1.76</td>
<td>2.06</td>
</tr>
<tr>
<td>2017</td>
<td>1.90</td>
<td>2.24</td>
</tr>
<tr>
<td>2018</td>
<td>2.06</td>
<td>2.45</td>
</tr>
<tr>
<td>2019</td>
<td>2.24</td>
<td>2.68</td>
</tr>
<tr>
<td>2020</td>
<td>2.42</td>
<td>2.92</td>
</tr>
</tbody>
</table>

Figure 12. Adult HIV Population Forecast.

HIV population (15-49)

<table>
<thead>
<tr>
<th>Year</th>
<th>Belarus2020</th>
<th>Moldova2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>11.39</td>
<td>9.26</td>
</tr>
<tr>
<td>2011</td>
<td>11.97</td>
<td>9.98</td>
</tr>
<tr>
<td>2012</td>
<td>12.58</td>
<td>10.75</td>
</tr>
<tr>
<td>2013</td>
<td>13.20</td>
<td>11.57</td>
</tr>
<tr>
<td>2014</td>
<td>13.83</td>
<td>12.43</td>
</tr>
<tr>
<td>2015</td>
<td>14.47</td>
<td>13.34</td>
</tr>
<tr>
<td>2016</td>
<td>15.15</td>
<td>14.31</td>
</tr>
<tr>
<td>2017</td>
<td>15.86</td>
<td>15.35</td>
</tr>
<tr>
<td>2018</td>
<td>16.60</td>
<td>16.48</td>
</tr>
<tr>
<td>2019</td>
<td>17.41</td>
<td>17.71</td>
</tr>
<tr>
<td>2020</td>
<td>18.29</td>
<td>19.05</td>
</tr>
</tbody>
</table>

HIV population (15-49)

<table>
<thead>
<tr>
<th>Year</th>
<th>Russia2020</th>
<th>Ukraine2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>737.26</td>
<td>454.50</td>
</tr>
<tr>
<td>2011</td>
<td>752.08</td>
<td>467.49</td>
</tr>
<tr>
<td>2012</td>
<td>787.92</td>
<td>499.98</td>
</tr>
<tr>
<td>2013</td>
<td>787.92</td>
<td>531.85</td>
</tr>
<tr>
<td>2014</td>
<td>804.01</td>
<td>562.93</td>
</tr>
<tr>
<td>2015</td>
<td>824.35</td>
<td>595.01</td>
</tr>
<tr>
<td>2016</td>
<td>842.36</td>
<td>621.83</td>
</tr>
<tr>
<td>2017</td>
<td>885.64</td>
<td>648.94</td>
</tr>
<tr>
<td>2018</td>
<td>863.51</td>
<td>675.88</td>
</tr>
<tr>
<td>2019</td>
<td>886.97</td>
<td>696.37</td>
</tr>
<tr>
<td>2020</td>
<td>867.06</td>
<td>716.12</td>
</tr>
</tbody>
</table>
There are some interesting takeaways from this forecast for policymakers and healthcare practitioners in the region. The most striking finding is that the HIV prevalence rate in Ukraine is forecast to nearly double, reaching 3.66% in 2020. If this were to happen, it would certainly classify the epidemic as generalized. This would lead to a serious strain on the Ukrainian healthcare system, if efforts are not made in the near term to stem this outbreak.

The epidemic is also forecast to worsen considerably in Moldova by 2020, even surpassing the prevalence rate found in Russia. Prevalence rate is calculated as a percentage of population totals, and Moldova is only a tiny fraction of Russia. In absolute totals, Russia’s epidemic is on a much higher magnitude. Nonetheless, this finding suggests that Moldova will need to appropriate significantly higher public funds to address the HIV epidemic.

Conclusion

This forecast is an attempt to add to the domain knowledge in the field with one critical distinction. Previous forecasts have not focused on the driving subpopulation for the region – injecting drug users. Some effort has been made in recent years to quantify the IDU group in the Western CIS, but forecasts to date have not made use of these studies.

That being said, this research focus poses some challenges and absolutely has its limits. Constructing a forecast on the IDU subpopulation is difficult, because the size and behavior of this group is not well known and varies from region to region within each country. Despite these limitations, I believe this forecast is an attempt to address what I believe is the critical shortfall among other regional HIV forecasts. This must be treated as a concentrated epidemic, and I believe that UNAIDS has made a step in the right direction by continuing to categorize Russia and Ukraine as concentrated epidemics despite crossing the 1% threshold. This forecast follows that conceptual foundation, but attempts to go further by gathering data on drug users throughout the region to constitute this forecast. Box 3 outlines some limitations that I see to this study, as well as areas for further research.
I believe that the upper bound forecasts from this report are unlikely. Fatalist forecasts have been wrong to date, and I do not feel that they are any more likely in the coming years. Prevalence rates north of 10% or 10 million HIV positives in the region seems to be too detached from the epidemiological development of the disease in the region.

But my sense is that the epidemics are not leveling off. The rising prevalence of HIV in females may be a weak signal that the epidemic could be in the process of entering a new phase. If bridge populations are beginning to link high risk IDU groups with lower risk individuals in the population, it could signal an initial transition from a concentrated to a generalized epidemic.

It would be a tragic mistake for policymakers to ignore the HIV epidemic because it has remained concentrated for nearly two decades. This forecast indicates that new HIV infections will continue to rise annually up to 2020 in all countries of the Western CIS. It is imperative that governments prepare for a scenario in which the epidemic does become generalized, to avoid an inadequate response and wide scale human suffering.
The Twin Epidemics

Bibliography


Sharp, Shombi. *The Economic Impact of HIV and AIDS in Russia: Current Trends and*
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References

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