Inequalities in Healthy Life Expectancy in Eastern Europe

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Scholars have long been interested in social factors that affect population health. The classic work of Durkheim (1951[1897]) first demonstrated the potential influence of social structure on health, with his work focused on suicide rates in Western Europe. According to Durkheim, deviance prevails when society's capacity to integrate and regulate the behaviors of its members is reduced during times of rapid social change, a state known as anomie, but destructive behaviors should decline once the social system adapts to the new order.

Succeeding theorists have elaborated on the ways in which social structure influences individual behavior. Merton (1938, 1968), for instance, argued that deviance increases when there is a discrepancy between culturally defined goals and socially structured means to achieve those goals. As long as there is equal emphasis on ends and means, the stability of a social system is maintained. However, when there is unbalanced emphasis on these two components (e.g., the social structure emphasizes goals, but fails to provide effective regulations or the means to achieve these objectives), "the integration of society becomes tenuous and anomie ensues" (Merton 1938, p. 674). While Durkheim suggested that anomie results from the disappearance of an old system, for Merton the malfunction of an existing social structure causes deviant acts, such as fraud, crime, and corruption. Thus, in Merton's perspective, the disruptive effects of social anomie can be long-lasting in the face of social dysfunction (Sztompka 2000).

The countries of Eastern Europe offer an excellent opportunity to examine the relationship between social structure and population health. The deterioration of population health was one of several alarming trends accompanying the collapse of communism after 1989 (Cornia and Paniccia 1995, 2000). Geographically, the high death rates were concentrated in the former Soviet Union (Brainerd 2001). In Russia, for example, life expectancy at birth dropped by 6.0 years for men and 5.2 years for women between 1990 and 1994, the largest decline in the global north outside of wartime (World

Bank 2000). While all the former Soviet republics exhibited large declines in life expectancy in the early 1990s, the downturn was relatively minor in East Central Europe. This core difference in mortality outcomes between East Central Europe and the former Soviet Union has become a major topic in European demography (Luy, Wegner, and Lutz 2011; Meslé 2004).

Although scholarly interest in demographic trends in Eastern Europe has increased, existing research shares several weaknesses. First, previous studies are limited by their exclusive focus on mortality outcomes. For decades, population health was largely measured in terms of the expected length of life, but more recently there has been rising interest in measures looking beyond mortality to overall health status, called health expectancy (Robine et al. 2003). A fuller understanding of demographic trends in Eastern Europe requires a shift in the focus of research from quantity of life to health-related quality of life. Second, prior research is narrow in scope. Although the idea of health expectancy is becoming popular in European demography, few researchers have calculated health expectancy for Eastern Europe. Consequently, it is an open question whether health-related quality-of-life measures differ as starkly as mortality outcomes between East Central Europe and the former Soviet Union. The third limitation concerns factors related to population health. Substantial evidence indicates the strong influence of structural characteristics on health at the population level (Beckfield and Krieger 2009; Franco, Álvarez-Dardet, and Ruiz 2004; Mackenbach 2013; Ruger 2003, 2005), but no study has yet examined the relationship between political, economic, and social factors and health in Eastern Europe. This is a critical shortcoming, since some former communist countries continue to show signs of social instability, characterized by corruption, restrictions on individual freedom, and violence.

The purpose of this study is twofold. First, I document differences in overall population health, measured by healthy life expectancy (HLE), in 23 Eastern European countries. I pay particular attention to differentials between East Central Europe and the former Soviet Union. Second, drawing on Merton's theory of social dysfunction, I estimate the association between population health and various social factors in these countries. This article improves upon previous assessments of demographic trends in Eastern Europe in three ways. First, I shift the focus from mortality measures to overall population health status. Specifically, I estimate the average duration of life people can expect to spend in good health between ages 20 and 74 (i.e., partial HLE). An age-specific form of health expectancy allows me to assess the health status of economically and socially active population groups. Second, I examine data for a large number of countries. Using the best available cross-sectional data for 23 Eastern European countries, I produce a comparative assessment of the distribution of health expectancy in this geographic area. Finally, I identify the structural correlates of HLE. I extend the work of Jagger et al. (2008) by incorporating political, economic, and social conditions specific to Eastern European countries and analyzing their relationship to health expectancy.

Health status of populations in Eastern Europe

Reductions in infant and child mortality, the eradication of infectious diseases, and advances in the treatment of cardiovascular disease since the 1970s have led to large increases in life expectancy in Western Europe (Meslé, Vallin, and Andreyev 2002; Vallin and Meslé 2004). In Eastern Europe, by contrast, cardiovascular disease continues to be a major cause of death, and mortality rates have remained high. It is widely recognized that populations in the East live shorter average lives (Bobak and Marmot 1996; Meslé, Vallin, and Andreyev 2002), suffer from a larger number of chronic conditions (Marmot and Bobak 2000), and have worse self-rated health status (Carlson 1998) compared to those in the West.

Although European countries have long been faced with substantial disparities in the health status of their populations, regional differentials have grown since the early 1990s. The post-1989 collapse of communist regimes was accompanied by a sharp rise in mortality rates in many parts of Eastern Europe. Working-age individuals, particularly men, were hit hard by the mortality crisis of the 1990s, and high violent deaths rates, specifically those due to accidents and suicide, characterized their mortality profile (Brainerd and Cutler 2005; Cockerham 1999; Vallin and Meslé 2004). Increased premature mortality was concentrated in the western part of the former Soviet Union, including the Baltic states, Belarus, Russia, and Ukraine, which Brainerd (2001) referred to as a "mortality belt." On the other hand, in some countries in East Central Europe, the downturn in longevity during the 1990s was relatively minor and was soon followed by substantial increases. Health gains in East Central Europe primarily resulted from reductions in cardiovascular disease and from dietary improvements (Meslé 2004; Rychtarikova 2004). Close examination of post-communist mortality trends reveals emerging heterogeneity in mortality outcomes within the former communist bloc in the East (Luy, Wegner, and Lutz 2011; Meslé 2004).

While the negative health consequences of communism's fall have been well reported, preliminary evidence suggests that there have been improvements in population health in recent years. Countries in East Central Europe have continued to catch up with the West in life expectancy at birth since the end of the past century (Luy, Wegner, and Lutz 2011). Although all of the former Soviet republics registered decreases in longevity during the 1990s, many of them have recorded falling mortality rates since the early 2000s. According to the World Health Organization, the average length of life in the Commonwealth of Independent States increased by 3.2 years for men between 2000 and 2010 and by 2.1 years for women.[1]

Evidence suggesting recent improved longevity in the former communist countries is encouraging, but long life does not always mean healthy life: people can experience longer expected life but worsening health (Crimmins, Saito, and Ingegneri 1989, 1997). The need for research focusing on both

mortality and morbidity led to the development of the concept of health expectancy (Sanders 1964). This indicator combines health prevalence data with mortality data and decomposes life expectancy after a given age into various health states (Robine et al. 2003). Focusing on the length of life spent without disability, known as healthy life years (HLY), Jagger et al. (2008) showed that, in 2005, the average number of HLY at age 50 was higher for the 15 EU member states in the West (17.8 years for men and 18.3 years for women) than for the ten newly joined countries in the East (14.5 years for men and 16.7 years for women). Another cross-national study by Andreev, McKee, and Shkolnikov (2003) reported wide variation in the average number of years spent in good health at age 20 between Eastern and Western Europe, amounting a Western advantage of 8.5 years for men and 9.2 years for women. These findings strongly suggest the existence of large differentials in health-related quality of life between East and West.

Structural correlates of population health

The health status of populations reflects features of the social structures in which people live (Hertzman, Frank, and Evans 1994). Many studies, for example, find that the level of social and economic development, as measured by GDP per capita and social welfare expenditures, is related to the production and distribution of health at the population level (for a comprehensive review, see Wilkinson 1992). Recent scholarship, however, argues that economic and social welfare factors alone cannot explain health patterns at the population level (see Beckfield and Krieger 2009). A more complete analysis should consider additional structural factors, including established political and social arrangements—for example, governance and social values.

Democratic and effective governance requires an open and competitive political process, as well as governments that privilege the well-being of the many. On average during the second half of the twentieth century, countries with permanent democratic institutions experienced a 5.4-year increase in life expectancy at birth and reductions in infant deaths of 17.4 per 1,000 live births (Besley and Kudamatsu 2006). In contrast, authoritarian regimes provide benefits for few at the expense of the many, thereby leading to closed politics and widespread corruption (Lake and Baum 2001; Sen 1999). There is a negative relationship between the prevalence of corruption and population health (Azfar 2005; Vian 2008). A cross-national study by Gupta, Davoodi, and Tingson (2000), for example, found that a higher level of corruption was associated with higher rates of infant and child mortality and of low-birthweight babies in 128 countries.

Among the political and social factors associated with population health, corruption may be especially pertinent in the case of Eastern Europe. According to Stiglitz (2003), the former Soviet Union is one of the most corrupt

regions in the world. The abrupt departure from communism opened opportunities for large-scale corruption, and corrupt practices were manifested in every sphere of society (Sajó 2003). Corruption likewise extends to the health sector, where it is likely to have a direct influence on population health. Informal payments to public health care providers are widespread in Eastern Europe, as documented in Lewis's (2007) comparative study on health system governance.

Social values are also likely to be strongly related to the health status of populations. Democratic principles increase public accountability, as the existence of opposition groups and free journalism forces the government to respond to public needs (Franco, Álvarez-Dardet, and Ruiz 2004; Lake and Baum 2001). Societal freedom, including freely available information and freedom of assembly, association, and expression, constitutes one of the major components of democracy (Lijphart 2011). The presence of freedom in society is positively linked to health and longevity. Using the global freedom ratings published by Freedom House, Álvarez-Dardet and Franco-Giraldo (2006) reported strong correlations between lack of societal freedom and life expectancy (Pearson's correlation $r = -.629$), infant mortality rates ($r = .760$), and maternal mortality rates ($r = .555$) across 23 countries in Eastern Europe. These significant associations persist even after adjusting for factors reflecting the level of national wealth.

Three hypotheses

Drawing on Durkheim's theory, many studies substantiate the short-term destructive influences of the collapse of communism on population well-being in Eastern Europe (e.g., King, Hamm, and Stuckler 2009; Stuckler, King, and McKee 2009). Analysis based on Merton's theory, however, is surprisingly rare. Merton's theoretical model bears particular importance in the Eastern European context, since it implies that anomic conditions might prevail over a long period of time in the face of the malfunction of the existing social structure (Sztompka 2000). Although more than 20 years have passed since the collapse of the communist regimes, Eastern European countries, particularly the former Soviet states, continue to exhibit signs of social disorder, characterized by mass governmental corruption and constriction of the democratic space. Moreover, some of these countries abound with crime and violence, which, according to Merton, constitute major features of structural disorganization. Therefore, Eastern European countries provide the opportunity to empirically test Merton's theory of structural dysfunction by examining population health differentials in the region.

I explore the role of a number of political, economic, and social factors in the distribution of health-related quality of life across Eastern Europe and test the following three hypotheses in the process:

First, I expect to find variations in the health status of populations, measured by healthy life expectancy, across Eastern Europe. In line with research on variations in mortality (Luy, Wegner, and Lutz 2011), I hypothesize that populations in East Central Europe spend more years in a healthy state than those in the former Soviet Union.

Second, building on Merton's theory, I hypothesize that factors representing social disorder, such as corruption, crime, and violence, are inversely associated with healthy life expectancy in Eastern Europe.

Third, I hypothesize that the associations between structural factors and healthy life expectancy will remain strong even when other key determinants of population health are adjusted for. Statistically, this implies that controlling for macro-level economic factors does little to affect the main associations between political and social factors and healthy life expectancy.

Data and methods

Data

Computing health expectancy based on the Sullivan (1971) method requires two pieces of information: age-specific mortality and the age-specific proportions of the population in different health states.

Mortality data. Data on age-specific mortality come from life tables published by the Human Mortality Database (HMD) or the World Health Organization. In cases where multiple data sources are available, I use information from the HMD, which contains annual life tables. The WHO, on the other hand, published life tables for member states in 1990, 2000, and 2009. Because the data on self-rated health refer to 2008 (from the European Values Study [EVS], as discussed below), I use 2009 life tables in cases where I rely on life tables from the WHO. Note that there is a one-year discrepancy between data on health status (from EVS) and life tables (from the WHO).

Health data. I rely solely on the European Values Study for the prevalence of age-specific self-rated health in each country. This cross-national survey contains information on basic human values and beliefs of individuals throughout Europe. The EVS was conducted in four waves: 1981, 1990, 1999, and 2008. I use the latest wave from 2008, because most of the former communist countries participated in the survey only during this wave. The 2008 survey covers 47 countries, including the 23 Eastern European countries examined here (see Table 1). The five Central Asian countries did not participate in the survey, thus the "former Soviet Union" in the current study refers to the Slavic (Belarus, Russia, and Ukraine), Baltic (Estonia, Latvia, and Lithuania), and Caucasus (Armenia, Azerbaijan, and Georgia) countries as well as Moldova. The sample is restricted to men and women aged 20 to 74.

TABLE 1 List of countries, number of observations in European Values Study (EVS), and data sources for life tables

Region and country	No. of observations in EVS			Life-table data source
	Total	Men	Women	
East Central Europe				
Albania	1,419	710	709	WHO 2009
Bosnia and Herzegovina	1,471	665	806	WHO 2009
Bulgaria	1,462	616	846	HMD 2008
Croatia	1,421	575	846	WHO 2009
Czech Republic	1,697	757	940	HMD 2008
Hungary	1,446	684	762	HMD 2008
Macedonia	1,462	829	633	WHO 2009
Montenegro	1,458	652	806	WHO 2009
Poland	1,417	626	791	HMD 2008
Romania	1,451	636	815	WHO 2009
Serbia	1,471	684	787	WHO 2009
Slovakia	1,482	592	890	HMD 2008
Slovenia	1,342	614	728	HMD 2008
Former Soviet Union				
Armenia	1,395	600	795	WHO 2009
Azerbaijan	1,431	726	705	WHO 2009
Belarus	1,411	574	837	HMD 2008
Estonia	1,467	511	956	HMD 2008
Georgia	1,448	533	915	WHO 2009
Latvia	1,439	533	906	HMD 2008
Lithuania	1,409	632	777	HMD 2008
Moldova	1,493	677	816	WHO 2009
Russia	1,435	477	958	HMD 2008
Ukraine	1,455	546	909	HMD 2008

NOTE: WHO = World Health Organization; HMD = Human Mortality Database.

After deleting those with missing values on either age or self-rated health, the sample sizes range from 1,342 (Slovenia) to 1,697 (the Czech Republic).[2]

Measures

Healthy life expectancy (HLE). I estimate the number of years of life between ages 20 and 74 in which people can expect to live in a healthy state (i.e., partial HLE). Data on HLE are publicly available, such as those published by the Global Burden of Disease (GBD) study (Salomon et al. 2012). While GBD estimates are measured at birth, the present study uses EVS data and examines health-related quality of life among men and women aged 20–74. An age-restricted measure of health expectancy has advantages for assessing the health status of adult populations. Without an upper age limit, health ex-

pectancy measures might be inaccurate, because observed death rates among the elderly tend to be unreliable (McGehee 2011). HLE measured at birth might also be influenced by higher death rates among infants and children. Finally, investigating the health of adults is especially important in the Eastern European context, since working-age people in the region experienced large increases in premature mortality in the early 1990s (Cockerham 1999).

The EVS includes a single item on physical health. Respondents were asked about their general health condition: "All in all, how would you describe your state of health these days?" There are five response categories: "very poor," "poor," "fair," "good," and "very good." Combining the response categories of "good" and "very good," I calculate the number of years in which people can expect to live in good health. Information on health states is stratified by sex and five-year age intervals in accordance with life tables. According to the Sullivan (1971) method, HLE at age x (HLE_x) is defined by:

$$HLE_x = \frac{1}{\ell_x} \sum_{a=0}^{\omega} L_a(\pi_a)$$

where ℓ_x is the number of survivors at age x, L_a is the person-years lived for each age interval, and π_a is the prevalence of good health for the age interval (for details on the method, see Jagger et al. 2007).

Structural indicators. To test the hypothesized relationships between social structure and health, I focus on several political, economic, and social conditions. Transparency International evaluates the levels of public perception of corruption in a country's public sector and has published the Corruption Perceptions Index (CPI) since 1995. This indicator aims to increase public awareness of the issue of corruption and to encourage governments and international organizations to design anti-corruption measures (Lancaster and Montinola 2001). The index, ranging from 1 (highly corrupt) to 10 (very clean), is regarded as one of the most reliable cross-national measures of corruption (You and Khagram 2005).[3]

Next, to test the health effects of freedom, I examine economic freedom, societal freedom, and freedom of the press. The Heritage Foundation, in partnership with the *Wall Street Journal*, annually publishes the economic freedom index, using a scale from 0 (minimum freedom) to 100 (maximum freedom). This indicator captures various institutional aspects influencing economic activities, based on rule of law, limited government, regulatory efficiency, and open markets (de Haan and Sturm 2003). The index has a negative association with life expectancy and child mortality rates (Stroup 2007). In addition to economic freedom, I focus on the level of freedom in society. Freedom House has published an evaluation of freedom in society since 1973. The measurement assesses political rights and civil liberties, extending from 1 (free) to 7 (not free). Although debate continues over the subjectivity of the index (Cheibub, Gandhi, and Vreeland 2010; Munck and Verkuilen 2002),

it has been widely used to estimate the relationship between freedom and population health (e.g., Álvarez-Dardet and Franco-Giraldo 2006; Franco, Álvarez-Dardet, and Ruiz 2004; Klomp and de Haan 2009; Pillai and Gupta 2006). Freedom of the press is measured through Freedom House's press freedom score, which annually ranks countries from 0 (best) to 100 (worst), according to laws and regulations that influence the flow of information in print, broadcast, and internet-based media.

Finally, I include the number of terrorist attacks and prison population rates to account for the associations between violence and crime and population health. The Global Terrorism Database contains an annual record of the number of terrorist events, such as kidnappings, bombings, and assassinations, around the world between 1970 and 2011. Prison population rates per 100,000 for each national population from the World Prison Population List Eighth Edition (Walmsley 2008) are used in lieu of country-specific crime rates.

To control for the influences of economic development levels on population health, I add two control variables: per-person GDP (divided by 1,000 and logged) and the percentage of health care expenditures in total GDP.[4] The information about GDP comes from the Penn World Table (Heston, Summers, and Aten 2011), and data on health care expenditures are taken from the WHO European Health for All Database (HFA-DB). Table 2 summarizes the variables used in the analysis.

TABLE 2 Description of structural indicators used in the analyses

	Measurement and description of variables	Source (URL)
Corruption Perceptions Index[a]	1–10; the higher, the more corrupt	Transparency International (www.transparency.org)
Economic freedom[a]	0–100; the higher, the less free	Heritage Foundation (www.heritage.org)
Freedom in society	1–7; the higher, the less free	Freedom House (www.freedomhouse.org)
Freedom of the press	0–100; the higher, the less free	Freedom House (www.freedomhouse.org)
Terrorist attacks	Number of terrorist attacks in a given year	Global Terrorism Database (www.start.umd.edu/gtd)
Prison population rates	Prison population per 100,000 national population	International Center for Prison Studies (www.prisonstudies.org)
GDP per capita, international purchasing power parity dollars	Divided by 1,000 and logged	Penn World Table (pwt.econ.upenn.edu)
Percent of total health care expenditure in GDP	0–100	WHO European Health for All Database (data.euro.who.int/hfadb)

[a]Reverse-coded from the original metrics such that higher values reflect higher levels of corruption and constraints on economic activity.

Analytical design

The analysis has three parts. The first presents the estimates of partial HLE between ages 20 and 74 for 23 Eastern European countries in 2008.[5] The second compares the mean values of sex-specific partial HLE in East Central Europe and the former Soviet Union, thereby testing my first hypothesis. The third investigates structural factors related to partial HLE. I conduct generalized least-squares (GLS) regression analyses.[6] There are two statistical models:

$$\text{Model 1: } y_i = \alpha + \beta_{1k} \times x_{ik} + \varepsilon_i$$

$$\text{Model 2: } y_i = \alpha + \beta_{1k} \times x_{ik} + \beta_2 \times \text{GDP per capita}_i + \beta_3 \times \text{Share of health care expenditures}_i + \varepsilon_i$$

where y_i is partial HLE for the ith country in 2008, x_{ik} is the structural factor k (with main effect β_1), and ε_i is an error term. Model 1 addresses my second hypothesis. I fit each structural indicator separately and test bivariate relationships between each variable and partial HLE. In model 2, I use multivariate regression analysis. I add GDP per capita and the percentage of health care expenditures in total GDP as controls and assess how the effects of each independent variable change after adjustment for these two variables. Thus, model 2 tests my third hypothesis.[7]

Results

Estimates of partial healthy life expectancy

The results show a wide gap in population health status across Eastern European countries (Table 3 and Figure 1). The differences in partial HLE amounted to 21.6 years for men (ranging from 35.6 years in Macedonia to 14.0 years in Russia) and 21.9 years for women (from 34.4 years in the Czech Republic to 12.5 years in Russia). For instance, in 2008, men in Macedonia could expect to live 72 percent of their lives between ages 20 and 74 in a healthy state. For women in the Czech Republic, the result was 66 percent. In stark contrast, men and women living in the former Soviet republics had much poorer outcomes. The most notable example is Russia, where all the results are the worst among the ten former Soviet states for both sexes. In 2008, Russian men spent 14.0 years in good health, which is equal to 34 percent of their expected duration of life between ages 20 and 74. Women spent only 12.5 years, 25 percent of their adult lives, in good health. Among the ten former Soviet states, men in Lithuania and women in Azerbaijan spent the largest proportion of their lives—58 percent in both cases—in good health.

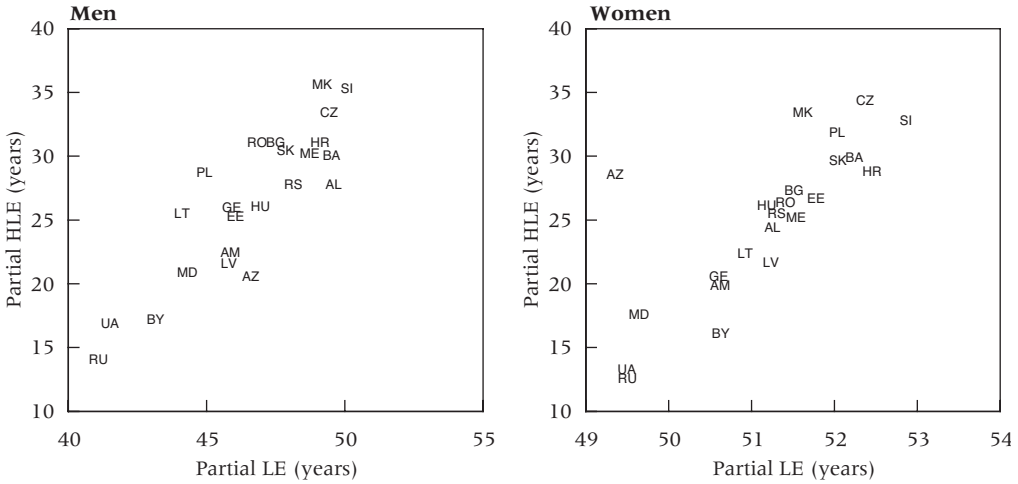
TABLE 3 Partial healthy life expectancy (HLE) between ages 20 and 74 and proportion of life spent in good health, by sex, 23 Eastern European countries, 2008

Region and country	Men		Women	
	HLE 20–74	Proportion	HLE 20–74	Proportion
East Central Europe				
Albania	27.7	0.56	24.4	0.48
Bosnia and Herzegovina	30.1	0.61	29.8	0.57
Bulgaria	31.0	0.65	27.3	0.53
Croatia	30.6	0.62	28.8	0.55
Czech Republic	33.4	0.68	**34.4**	**0.66**
Hungary	26.0	0.55	26.0	0.51
Macedonia	**35.6**	**0.72**	33.4	0.65
Montenegro	30.4	0.62	25.2	0.49
Poland	28.7	0.61	31.9	0.61
Romania	30.9	0.66	26.2	0.51
Serbia	27.7	0.58	25.7	0.50
Slovakia	30.4	0.64	29.7	0.57
Slovenia	35.2	**0.72**	32.7	0.62
Average	30.6	0.63	28.9	0.56
Former Soviet Union				
Armenia	22.4	0.49	20.0	0.40
Azerbaijan	20.6	0.44	28.6	0.58
Belarus	17.2	0.40	16.1	0.32
Estonia	25.5	0.55	26.7	0.52
Georgia	25.8	0.56	20.3	0.40
Latvia	22.0	0.48	21.6	0.42
Lithuania	25.5	0.58	22.3	0.44
Moldova	20.9	0.47	17.6	0.35
Russia	**14.0**	**0.34**	**12.5**	**0.25**
Ukraine	16.8	0.41	13.3	0.27
Average	21.1	0.47	19.9	0.39

NOTE: Highest and lowest levels in bold.

On the basis of the results in Table 3, I compare mean values for partial HLE between East Central Europe and the former Soviet Union. There are statistically significant differences in partial HLE between the two country groups ($p<.001$). In 2008, men in East Central Europe spent 30.6 years in a healthy state between ages 20 and 74, whereas those in the former Soviet states spent only 21.1 years, on average, in good health. Women showed a similar pattern of regional differences. These differences suggest that men and women in East Central Europe enjoy considerably healthier lives than those in the former Soviet states. Taken together, these findings reveal large

FIGURE 1 Relationship between partial life expectancy (LE) and partial healthy life expectancy (HLE) between ages 20 and 74, by sex, 23 Eastern European countries, 2008



NOTE: AL = Albania; AM = Armenia; AZ = Azerbaijan; BY = Belarus; BA = Bosnia and Herzegovina; BG = Bulgaria; HR = Croatia; CZ = Czech Republic; EE = Estonia; GE = Georgia; HU = Hungary; LV = Latvia; LT = Lithuania; MK = Macedonia; MD = Moldova; ME = Montenegro; PL = Poland; RO = Romania; RU = Russia; RS = Serbia; SK = Slovakia; SI = Slovenia; UA = Ukraine

disparities in partial HLE between East Central Europe and the former Soviet Union, lending support for my first hypothesis.

Structural correlates of HLE in Eastern Europe

The values of the structural indicators used in the analysis vary by country, but the former Soviet republics tend to fare worse than countries in East Central Europe (Table 4). In 2008, public sectors in the former Soviet states were more corrupt, and citizens experienced greater restrictions on freedom and higher levels of crime and violence. For example, the average number of terrorist attacks in the former Soviet Union (20.8) was ten times higher than the average in East Central Europe (2.1), with by far the largest number of terrorist incidents in Russia (170). The only exception is economic freedom, where the former Soviet Union had a more favorable level than East Central Europe. This is because the Baltic states enjoyed very high levels of economic freedom in 2008. Without the Baltics, the levels of restrictions on economic activities were higher in the former Soviet Union (43.1) than in East Central Europe (39.5).

To what extent are these indicators related to partial HLE among men and women in Eastern Europe? I first test bivariate associations between each independent variable and partial HLE in model 1. Here, each variable was included singly. Results from model 1 shown in Table 5 demonstrate that all

TABLE 4 Descriptive statistics of structural indicators for 23 Eastern European countries, 2008

Region and country	Corruption Perceptions Index (1–10)	Economic freedom (0–100)	Freedom in society (1–7)	Freedom of the press (0-100)	Terrorist attacks (count)	Prison population rates (per 100,000)	GDP per capita (international PPP dollars)	Percent of total health care expenditure in GDP
East Central Europe								
Albania	6.6	37.7	3	50	0	159	6,478	6.9
Bosnia and Herzegovina	6.8	46.2	3.5	45	4	133	6,839	10.3
Bulgaria	6.4	36.3	1.5	33	2	134	11,192	7.3
Croatia	5.6	45.9	2	36	2	93	15,985	7.8
Czech Republic	4.8	31.9	1	18	3	182	24,062	6.8
Hungary	4.9	32.4	1	21	2	149	17,621	7.4
Macedonia	6.4	39.8	3	47	9	107	7,704	7.0
Montenegro	6.6	41.8	3	38	0	108	7,443	9.5
Poland	5.4	39.8	1	24	0	221	16,036	6.6
Romania	6.2	38.3	2	44	2	124	10,235	4.7
Serbia	6.6	43.4	2.5	39	3	122	8,728	9.8
Slovakia	5	40.1	1	22	0	148	20,753	7.8
Slovenia	3.3	39.8	1	23	0	65	27,600	7.8
Average	5.7	39.5	2.0	33.9	2.1	134.2	13,898	7.7
Former Soviet Union								
Armenia	7.1	30.2	4.5	66	0	109	5,741	3.8
Azerbaijan	8.1	44.7	5.5	77	2	229	8,689	3.6
Belarus	8	54.7	6.5	91	1	468	12,308	6.5
Estonia	3.4	22.1	1	16	1	259	18,288	5.9
Georgia	6.1	30.8	4	60	32	415	5,211	8.7
Latvia	5	31.7	1.5	22	1	288	15,175	6.5
Lithuania	5.4	29.1	1	18	0	234	16,218	6.2
Moldova	7.1	42.2	3.5	66	0	227	2,562	10.7
Russia	7.9	50.3	5.5	78	170	629	15,317	5.2
Ukraine	7.5	49.1	2.5	53	1	323	7,364	6.8
Average	6.6	38.5	3.6	54.7	20.8	318.1	10,687	6.4

SOURCE: As in Table 2.

TABLE 5 Results of generalized least-squares (GLS) regression analyses assessing associations between partial healthy life expectancy (HLE) between ages 20 and 74 and structural indicators, by sex, 23 Eastern European countries, 2008

	Model 1		Model 2	
	Male	Female	Male	Female
Corruption Perceptions Index (the higher, the more corrupt)	–2.7	–3.1	–2.0	–2.8
Economic freedom (the higher, the less free)[a]	–2.6	–2.5	–3.0	–2.8
Freedom in society (the higher, the less free)	–2.2	–2.4	–2.0	–2.0
Freedom of the press (the higher, the less free)[a]	–1.7	–1.9	–1.2	–1.8
Terrorist attacks (exceed the 75th percentile = 1)	–8.0	–7.0	–9.1	–7.8
Prison population rates (per 100,000 national population)[a]	–3.5	–3.2	–3.3	–3.1

[a]These variables were changed to the 0–10 scale in regression models.
NOTE: All coefficients significant at p<.001 (n=23). Model 1 estimates bivariate relationships between partial HLE and each structural indicator. Model 2 adjusts for GDP per capita and health care expenditures as controls. The full results of model 2 are available upon request.

of the structural indicators are strongly associated with partial HLE for both men and women across 23 Eastern European countries. The coefficients of these independent variables are consistently negative, indicating that they are inversely associated with the number of years spent in good health between ages 20 and 74. For example, a one-unit increase in the Corruption Perceptions Index is related to a 2.7-year decrease in partial HLE among men and a 3.1-year decrease among women. The other independent variables exhibit similar patterns. The lack of economic, societal, and press freedoms are inversely associated with the number of years spent in good health, and higher levels of violence and crime are associated with lower levels of partial HLE among men and women in Eastern Europe. These results support my second hypothesis.

Finally, I adjust for GDP per capita and the percentage of GDP spent on health care while examining the relationship between each structural indicator and partial HLE in model 2. Prior research documented the significant relationship between structural indicators and population health, net of the level of economic development (Álvarez-Dardet and Franco-Giraldo 2006; Besley and Kudamatsu 2006; Franco, Álvarez-Dardet, and Ruiz 2004). As is evident in model 2 in Table 5, per-person GDP and health care expenditures have limited effects on the associations between the structural indicators and partial HLE among men and women in these 23 countries. The size of the coefficients undergoes little change even after controlling for GDP per

capita and health care expenditures. Widespread corruption, restrictions on economic, societal, and press freedoms, and the prevalence of violence are associated with lower levels of partial HLE, net of economic development factors. Taken as a whole, these results illustrate strong links between the political, economic, and social factors and partial HLE—links that appear to operate independently from macro-level social and economic determinants of health. These findings offer clear support for my third hypothesis.

Discussion and conclusions

Two major findings are apparent. First, substantial disparities in partial healthy life expectancy between ages 20 and 74 exist between East Central Europe and the former Soviet Union. In 2008, differences in partial HLE, on average, amounted to almost ten years for both sexes. Hence, men and women in East Central Europe not only live longer, but also spend many more years in good health than those in the former Soviet Union. Using the concept of health expectancy, the current findings demonstrate differentials in terms of health-related quality of life within the former communist countries. A full understanding of population health status in this region requires extending traditional mortality indicators to incorporate health-related quality-of-life measures.

Second, structural factors are strongly related to the average number of years spent in good health in Eastern European countries. Guided by Merton's work, I hypothesized that factors representing social dysfunction might produce negative consequences for population well-being. Focusing on the prevalence of corruption, the levels of economic, societal, and press freedoms, and violence, I found strong negative associations between these structural indicators and partial HLE in 23 countries in 2008. Men and women living in countries where corruption is widespread, freedom is curtailed, and violence is prevalent spend fewer years on average in good health. Significant associations remain, even when macro-level determinants of health, namely GDP per capita and health care expenditures, are accounted for.

Although this study did not aim to establish the causal processes through which health inequalities are generated, potential pathways linking societal conditions to health deserve comment. It is well documented that social structure is linked to health by influencing access to resources (e.g., medical care, health-related information, and social support) and determining degree of exposure to risks (e.g., environmental hazards, stress, and lifestyles) (House 2002; Link and Phelan 1995; Link et al. 2008; Phelan et al. 2004; Phelan and Link 2005). From this standpoint, the dysfunction of the social structure is likely to influence health by restricting access to health-related resources. I noted a negative relationship between the Corruption Perceptions Index and partial HLE across Eastern Europe, augmenting prior

research that demonstrated the negative consequences of corruption on the well-being of citizens (Azfar 2005; Gupta, Davoodi, and Tingson 2002; Lewis 2007). Widespread corruption increases the operating cost of government, lowers revenue, and reduces resources for the provision of social services (Azfar and Gurgur 2008). In the health sector, shortages in revenue lead to inadequate salaries, crumbling infrastructure, and shortages of drugs and equipment. At the individual level, when access to care is structurally constrained, patients resort to informal methods, such as exploiting social connections or making informal payments to care providers (Balabanova et al. 2004; Vian 2008), while persons deprived of such means may receive no care.

Another pathway connecting social structure to health is through exposure to health-related risk factors. The structural contexts in which people live shape stressor types and determine the degree of stress manifestations (Pearlin 1989). The detrimental health effects of economic strain can be caused at the national level, and this study finds evidence of a strong association between the absence of economic freedom and lower healthy life expectancy. Economic hardships, in turn, might be linked to poor health by inducing negative health behaviors, such as excessive alcohol intake. Alcohol was one of the most significant risk factors for increased premature mortality from heart disease and suicide in Eastern Europe immediately after the fall of communism (Bobrova et al. 2010; Leon, Shkolnikov, and McKee 2009; Leon and Chenet 1997; Murphy 2011; Nicholson et al. 2005). The structuralist approach to population health suggests that unequal distribution of resources—wealth, power, and coping tools—might be important to understanding the link between social structure and health.

Several other limitations in addition to the lack of causality analysis should be noted. First, the computation of partial healthy life expectancy in this study is based on a subjective measure. Self-rated health is strongly related to subsequent mortality risk (Idler and Angel 1990; Idler and Benyamini 1997), but it might be subject to reporting bias (Salomon, Tandon, and Murray 2004). Reports on self-rated health are influenced by age, sex, and information available to a respondent at the time of evaluation, such as knowledge and experience of specific diseases (Idler et al. 2004). Further, cross-national comparisons of self-rated health might be influenced by cultural and linguistic variations in the interpretation of health-related questions (Verropoulou 2009).

Second, the European Values Study includes only non-institutionalized persons. Although some studies incorporate data on institutionalized persons from separate sources (e.g., Crimmins, Saito, and Ingegneri 1989, 1997), the lack of data makes it difficult to determine the percentage of the institutionalized population for the 23 Eastern European countries considered here. While institutionalized persons are small in number, they nevertheless may affect

overall computations of healthy life expectancy. Consequently, calculations of partial HLE in this study are likely to be overestimated, since they are based on the assumptions that institutionalized and non-institutionalized individuals have identical distributions of self-rated health.

Third, the present study is based on cross-sectional data from 2008. Structural factors cannot be assumed to immediately influence the health status of populations (Beckfield and Krieger 2009). To address this issue of time-lagged influence, I conducted supplemental analysis using structural indicators from 2004 as independent variables. The results are almost identical to those presented here: all structural indicators taken from 2004 were inversely associated with partial HLE measured in 2008 for both sexes ($p<.001$).

Other limitations involve data quality. Since statistical systems are poorly developed in Eastern Europe (Luy, Wegner, and Lutz 2011), the present study uses publicly available data taken from the WHO and HMD (for life tables) and EVS (for self-rated health). Therefore, one should note that my estimates of partial HLE are based on a mix of sources. Also, this study consistently includes the Baltic states in the former Soviet Union, because evidence indicates that EU membership has not yet contributed to the narrowing of the gap in life expectancy between Eastern and Western Europe (Mackenbach 2013). Other methods of constructing country groups may produce different conclusions, based on political or cultural affiliation, and this is an important subject for future study.

To recapitulate, populations in the former Soviet states have borne greater burdens than those in East Central Europe in health-related quality of life, and political, economic, and social conditions appear to have an important bearing on their health disadvantages. The corruption among government officials, pervasive state control over the economy, and lack of freedom for journalists may not instantly result in increases in mortality rates, but exposure to the unfavorable political, economic, and social environments might produce negative health consequences to citizens. While the implementation of public health programs or technological developments against specific diseases contribute to improvements in population health status, efforts toward the consolidation of democratic governments, liberalization of domestic markets, and tightening security control over territories may also help to achieve health gains among populations in this part of the world.

Appendix

TABLE A1 Expected partial life expectancy between ages 20 and 74, by sex, 23 Eastern European countries, 2008

Region and country	Men	Women
East Central Europe		
Albania	**49.6**	51.3
Bosnia and Herzegovina	49.5	52.2
Bulgaria	47.4	51.5
Croatia	49.1	52.5
Czech Republic	49.4	52.4
Hungary	46.9	51.3
Macedonia	49.2	51.6
Montenegro	48.7	51.5
Poland	47.2	52.0
Romania	47.2	51.4
Serbia	48.1	51.3
Slovakia	47.8	52.0
Slovenia	49.0	**52.9**
Former Soviet Union		
Armenia	45.8	50.6
Azerbaijan	46.6	49.7
Belarus	43.1	50.6
Estonia	46.0	51.8
Georgia	45.9	50.6
Latvia	45.8	51.2
Lithuania	44.1	50.9
Moldova	44.3	49.6
Russia	**41.1**	**49.5**
Ukraine	41.5	**49.5**

NOTE: Highest and lowest levels in bold.

TABLE A2 Details about variables, model specification, and influential data points

Variables	Note on variables	Model specification	Influential points	
			Male	Female
Corruption	continuous; centered	linear	Estonia, Russia	Azerbaijan, Estonia, Russia
Economic freedom	continuous; centered	quadratic	Belarus, Russia	Russia
Societal freedom	continuous; centered	linear	Russia	Azerbaijan, Russia
Press freedom	continuous; centered	linear	Russia	Azerbaijan, Russia
Terrorist attacks	binary (exceeds the third quartile = 1)	dummy variable	—	—
Prison population rates	continuous; centered	linear	Georgia	—

Notes

Support for this research was provided by Waseda University (Waseda University Grant for Special Research Projects 2013A-981) and Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research 25293121). I thank Robert A. Hummer, Daniel A. Powers, and Yasuhiko Saito for their helpful comments on an earlier version of this article.

1 The Commonwealth of Independent States was created in December 1991 as a regional organization of the former Soviet republics. Official member states include Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Uzbekistan. Turkmenistan and Ukraine are unofficial members.

2 The level of missing data is low for each country included in my analysis. Sex is complete for 23 countries, although age and self-rated health tend more frequently to have missing values. Croatia has the highest level of missing values, but data are missing for less than 3 percent of that country's sample. According to the EVS study team, response rates for the 2008 wave ranged from 35 percent in Russia to 88 percent in Albania (GESIS 2010). Since the response rate for Russia was low, I conducted supplemental analysis excluding that country from regression analyses. Given that the results were almost the same with or without Russia, I included the country in the model and thereby kept the sample size larger.

3 Indicators of corruption and economic freedom were reverse-coded to ensure that higher scores reflect higher levels of corruption and more constraints on economic activity. Because the relationship between partial HLE and economic freedom was not linear, I used a quadratic specification for this predictor, and included a lower-order linear term in regression models. Measures of societal freedom and freedom of the press measures were kept in the original metrics, such that higher scores represent lower levels of freedom. Since observations for the number of terrorist attacks were not evenly distributed across countries, I created a binary variable coded 1 if the number of terrorist events in 2008 exceeded the third quartile (75 percent), and 0 otherwise (only Georgia and Russia were coded 1). All the variables were re-centered before analysis (Singer and Willet 2003).

4 Since education and income inequality have been used as indicators reflecting national wealth (Beckfield 2004; Klomp and de Haan 2009; Lake and Baum 2001; Ram 2006; Wilkinson 1992), I conducted additional analyses with adjustment for education (gross enrollment ratio in secondary school) and income inequality (the Gini index). These variables were only weakly associated with partial HLE for men and women in Eastern Europe, according to 2008 data. Importantly, associations between structural indicators and partial HLE remain almost unchanged even after controlling for these variables. Therefore, I report the results based on the models that control only for GDP per capita and health care expenditures (model 2 in Table 5).

5 I also estimated the expected duration of life between ages 20 and 74 for each country. The results are presented in Appendix Table A1.

6 Ordinary least-squares (OLS) models assume homoscedasticity, but the country-specific partial HLEs (y) in the present study have a different degree of precision (e.g., smaller or larger variances), which needs to be accounted for when estimating the slope. This can be achieved with GLS regression models.

7 Before conducting regression analyses, I checked the relations between partial HLE and each structural indicator and identified several influential observations that combine large residuals and high leverage (Fox 2008). Given that influential points can have a strong influence on the slope, I estimated regression models that account for influential observations. I found no major differences in the findings when comparing the results with and without adjustment for influential observations. Therefore, I report the findings based on the models that do not control for influential data points. Appendix Table A2 summarizes the details of the variables, model specifications, and influential observations for each predictor.

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