An Analysis of Mortality Differentials across Europe

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Abstract

This paper investigates cross-national disparities in gender-specific life expectancy and infant mortality rates in Europe, looking specifically at differences across Western Europe, East Central Europe, and the former Soviet Union for the period of 1992-2008. We present three major findings. First, there are persistent differentials in population health status between Eastern and Western Europe, and the gap has grown over the past two decades. Importantly, there are substantial differences within the former communist countries in Eastern Europe. The health status of populations is significantly worse in the former Soviet Union than in East Central Europe. Second, mechanisms underlying mortality inequalities appear to differ by gender. Socioeconomic and behavioral factors explain regional variations in life expectancies of women, but large disparities remain for men. Third, we observe similar patterns of regional inequalities among infants, but cross-country differences are explained by socioeconomic conditions for both male and female infants. By focusing on heterogeneity within the former communist countries in Eastern Europe, this study provides a deeper understanding of the trends and mechanisms of differentials across European countries.

Introduction

The sharp political antagonisms once characteristic of the relationship between Eastern and Western Europe are now history. The Berlin Wall fell in November 1989, and the Soviet Union ceased to exist in December 1991. Countries in Eastern Europe underwent extraordinary political, economic, and social changes, and struggled to overcome their communist past. Eastern European countries have made remarkable progress, particularly in the political and economic spheres, over the last two decades. Ten countries (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) have joined the European Union (EU), and three more (Croatia, the Former Yugoslav Republic of Macedonia, and Montenegro) are doing so. Most of these countries, too, have established new economies, with predominantly private ownership.

While efforts toward greater European political and economic integration are in progress, there are severe social problems: as one important example, European countries are faced with substantial disparities in the health status of their populations. Early studies on this topic have traditionally focused on the difference between Eastern and Western Europe. People in the East live shorter lives (Bobak and Marmot 1996; Guo 1993; Meslé, Vallin, and Andreyev 2002), have poorer self-rated health status (Carlson 1998), suffer from a larger number of chronic conditions (Cockerham 1997), and spend more years in a poor health state (Andreev, McKee, and Shkolnikov 2003; Jagger et al. 2008) compared to those in the West. These research findings suggest large differentials in population health status between Eastern and Western Europe, the phenomenon known as the “East-West health divide” (Bobak and Marmot 1996; Marmot and Bobak 2000). More recently, researchers have begun to direct attention to inequalities within the former communist countries in the East. Life expectancy in East Central European countries has continued to increase since the early 1990s, whereas all the former Soviet republics have experienced wide fluctuations in life expectancy since the collapse of the Soviet Union in 1991 (Meslé 2004; Murphy 2011). Consequently, East Central Europe has started catching up with the West, while the former Soviet countries have continued to be left behind (Luy, Wegner, and Lutz 2011).

These observations point to inequalities in mortality and morbidity between Eastern and Western Europe as well as between East Central Europe and the former Soviet Union. However, prior research on the topic has left several important issues unaddressed. First, some previous work suffers from the limitation of employing a single cross-section of data (e.g., Andreev et al. 2003; Carlson 1998). As a result, we know relatively little about how patterns of regional inequalities in mortality outcomes have changed over the past two decades. Second, mechanisms underlying regional differentials remain to be explored. The East-West divide is due to lower levels of socioeconomic development, lack of an effective health care system, and unhealthy lifestyles in Eastern Europe (Bobak and Marmot 1996; Cockerham 2000; Cockerham, Snead, and DeWaal 2002; McKee and Nolte 2004; Velkova, van den Bosh, and Mackenbach 1997). It is, however, an open question as to the extent to which these socioeconomic and behavioral factors are related to disparities across Western Europe, Eastern Europe, and the former Soviet Union.

This paper examines mortality differentials across population groups in Europe, with a special focus on life expectancy at birth, life expectancy at age 65, and infant mortality rates, throughout the post-communist period. In particular, following Luy et al. (2011)'s work, we assess long-term trends in mortality differences across three country groups: Western Europe, East Central Europe, and the former Soviet Union. How do life expectancy at birth, life expectancy at age 65, and infant mortality rates differ across Western Europe, East Central Europe, and the former Soviet Union, during the period after communism's fall? How have these patterns of differences changed over the past two decades? What are the socioeconomic factors associated with regional differences in mortality? To answer these questions, we first summarize long-term mortality trends across Europe, with a special focus on factors related to mortality outcomes. Next, we describe the study sample and measures. We then present results based on ordinary least squares (OLS) regression analyses. Finally, we summarize the major study findings and suggest some directions for future research.

Theoretical Background

An Overview of Health and Mortality Trends in Europe

During the second half of the twentieth century, countries in Western and Eastern Europe underwent profound demographic transformations. By the middle of the past century, mortality rates in Western Europe were not very different from those in Eastern Europe. Demographic trends in these two blocs of countries, however, have dramatically diverged since the early 1960s (Guo 1993). 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 et al. 2002; Vallin and Meslé 2004). On the other hand, these favorable trends have not been shared by countries in the East. Cardiovascular disease has continued to be a major cause of death, and mortality rates remained high. The health status of the populations in Eastern Europe has lagged far behind from that in Western Europe throughout the second half of the twentieth century (Guo 1993; Meslé et al. 2002).

Other evidence indicates substantial disparities between the East and the West in terms of various health-related measures. Populations in Eastern Europe have higher rates of chronic diseases (Cockerham 1997) and worse self-rated health status (Carlson 1998), spend fewer years in a healthy state (Andreev et al. 2003; Jagger et al. 2008), and suffer from higher levels of psychological distress (Watson 1995) compared to those in Western Europe. These research findings offer strong evidence suggesting large differences in both mortality and morbidity between Eastern and Western Europe. The division of Europe into the West with the most favorable health outcomes and the East with the least favorable outcomes – the phenomenon known the "East-West health divide" – became a major characteristic of European demography at the end of the last century (Bobak and Marmot 1996; Marmot and Bobak 2000; Meslé et al. 2002).

While inequalities between Eastern and Western Europe have been well studied, a growing body of research implies an emerging heterogeneity within the former communist bloc in the East (Luy et al. 2011; Meslé 2004; Vallin and Meslé 2004). It is widely recognized that the breakup of the communist regimes

has had devastating health consequences to populations in Eastern Europe (Kennedy, Kawachi, and Brainerd 1998), but a close examination of mortality trends reveals differentials between as well as within countries. On the one hand, all the former Soviet republics exhibited sharp decreases in life expectancy at birth during the first half of the 1990s. This high toll of premature mortality was concentrated in the western part of the former Soviet Union, namely the Baltic states, Belarus, Russia, and Ukraine. Mortality due to cardiovascular disease and external causes remained high, and populations in the former Soviet states experienced wide fluctuations in life expectancy throughout the 1990s (Cockerham 1997; Meslé 2004; Murphy 2011). In Russia, for example, life expectancy at birth decreased by 6.03 years for men and 3.16 years for women between 1991 and 1994 (Human Mortality Database 2013). On the other hand, in some countries in East Central Europe, the downturn in longevity during the 1990s was minor, and was soon followed by substantial improvements. The Czech Republic and Slovenia experienced the largest gains in life expectancy at birth during the last decade of the past century, followed by Poland, Slovakia, Hungary, and Croatia (Luy et al. 2011). Health gains in East Central Europe were primarily due to reductions in cardiovascular disease and dietary improvements (Cornia and Paniccia 2000; Rychtarikova 2004). Given the diverging trends across Eastern Europe, researchers now argue that the health situation on the European continent can be best understood by a trisection approach: Western Europe with the most favorable health outcomes, the former Soviet Union with the least favorable conditions, and East Central Europe in the middle (Luy et al. 2011).

Potential Explanations for European Mortality Differentials

Several explanations have been put forward for inequalities in mortality across European countries. First, socioeconomic conditions are responsible for health disparities. Cross-national research suggests that a nation's wealth, often measured by GDP per capita, is an important predictor of the average health status of populations. Ram (2006) finds that higher levels of per person GDP are related to increases in life expectancy at birth and reductions in infant mortality rates across 108 countries in the world. Also, Olsen and Dahl (2007) demonstrate that GDP per-capita is predictive of better self-rated health for men and women in 21 European countries. The level of socioeconomic development appears to have an important bearing on mortality differences. Economic development levels are lower in Eastern Europe than in Western Europe: GDP per capita is much lower, and so are major industrial and agricultural output levels (EBRD 1999). In fact, the impact of macroeconomic indicators, namely GDP per capita, on health largely depend on the level of a nation's wealth (Wilkinson 1992).

Second, Eastern and Western European countries have different social welfare systems. Welfare states seek to reduce inequality and poverty in society, and countries with governments more committed to social welfare provide individuals with various social services, including a comprehensive health care system, pensions, and disability benefits (Navarro and Shi 2001). The percentage of public expenditures spent on health care in relation to total GDP is often used as an indicator to measure a nation's social welfare characteristics, and it exhibits significant associations with life expectancy as well as infant mortality rates (Wilkinson and Pickett 2006). In fact, deficiencies in health care services play a major role in explaining higher mortality rates in the East than in the West. The Soviet system sought to achieve universal and free access to basic medical services in all parts of the Soviet Union, but this goal was never achieved (Balabanova et al. 2004). The Soviet economy was largely focused on the arms race and space competitions, which resulted in the lack of financial resources necessary to create efficient health care systems (Meslé 2004). Further, the quality of health care has largely deteriorated with the demise of the old system (McKee and Nolte 2004). Death rates from conditions amenable to medical intervention are considerably higher in Eastern Europe than in Western Europe (Nolte, McKee, and Scholz 2004; Velkova et al. 1997).

Finally, researchers often consider negative health lifestyles, more prevalent among populations in the East than in the West, as a major contributor to their poorer health status (Cockerham 2000; Cockerham et al. 2002). The most commonly-cited negative health behaviors include alcohol consumption, smoking, and a lack of physical exercise, and these practices deteriorate physical health status (Himes 2011). Evidence for

widespread health-damaging lifestyles in Eastern Europe is compelling. Most alcohol in Eastern Europe is consumed in a specific form of spirits, vodka (Khaltourina and Korotayev 2008), and some countries, such as Estonia, Moldova, and Russia, have the highest levels of spirits consumption in the world (WHO 2011a). The rate of death due to alcohol-related causes, such as heart stroke and liver cirrhosis, is much higher in Eastern Europe than in Western Europe (WHO 2011a). Furthermore, continued political, economic, and social instability throughout the 1990s produced enormous stress and induced health-damaging behaviors among citizens (Cockerham 1997; Murphy 2011; Watson 1995). In Abbott and Wallace (2007)'s qualitative study of post-communist Russia and Ukraine, the majority of respondents turned to alcohol consumption and cigarette smoking to cope with daily stress engendered by acute political, economic, and social changes in the early 1990s.

Taken together, socioeconomic conditions, social welfare characteristics, and health behaviors appear to play an important role in accounting for the health divide between Eastern and Western Europe. Moreover, these socioeconomic and behavioral factors might have contributed to the widening of the pre-existing East-West gap during the period following the collapse of communism through devastating socioeconomic crises, the deterioration of health care system, and unhealthy lifestyles.

Conceptual Framework and Hypotheses

Scholarly interest in European mortality inequalities has increased over time, and the literature has grown large. However, previous studies share several weaknesses. The first limitation of earlier studies has to do with the scope of research. Some previous work suffers from the limitation of employing only a single cross-section data. Carlson (1998) finds significant differences in self-rated health status between Eastern and Western Europe, but results are based on cross-sectional data from the 1990-1991 World Values Survey (WVS). Analysis by Eikemo et al. (2008) uses two waves of the European Social Survey (ESS), but the research period is restricted to 2002 and 2004. Thus, due to the narrow scope of research, previous studies tell us little about long-term trends in health disparities across Europe. In fact, preliminary evidence suggests that the socioeconomic circumstances in Eastern Europe have gradually improved over time. Eastern Europe is now considered one of the world's fastest growing regions, with continued economic growth driven by domestic consumption, investment, and export (EBRD 2011). Improvements in overall socioeconomic conditions might have important implications for the health status of populations. In Eastern Germany, for example, advances in medical care and changes in people's diet thanks to greater availability of imported foods led to substantial progress in life expectancy at birth after reunification in 1989 (Nolte and McKee 2004). Adeyi et al. (1997) indeed maintain that Eastern Europe would eventually close the gap with Western Europe in health through the transition to a market economy and adaptation of democratic governments. These observations raise the possibility that the picture of inequalities might have changed over the past two decades, as a result of the progress in the political, economic, and social reform process.

The second weakness of previous studies concerns mechanisms associated with inequalities. The East-West health divide is a result of complex interactions among a number of factors, including lower levels of socioeconomic development, a lack of effective health care system, and negative health lifestyles in the East (Bobak and Marmot 1996; Cockerham 2000; Cockerham et al. 2002; McKee and Nolte 2004; Velkova et al. 1997). Prior research, however, often employs a dichotomous approach of "East versus West," and thus neglects emerging differences between East Central Europe and the former Soviet Union (Bobak and Marmot 1996; Marmot and Bobak 2000; Meslé et al. 2002). As a consequence, it remains an open question as to whether and to what extent the pre-existing explanations for the East-West divide are associated with inequalities across the three country groups of Western Europe, Eastern Europe, and the former Soviet Union. In particular, emerging mortality differences across Eastern Europe stress separating East Central Europe from the former Soviet Union, instead of combining them into a large bloc of the "East."

The aim of this study is to summarize mortality trends across Western Europe, East Central Europe, and the former Soviet Union throughout the post-communist period. We focus on two mortality indicators for which European countries exhibit substantial differences: life expectancy (at birth and at age 65) and

infant mortality rates. Rather than just focus on adult health status, we also pay attention to infant death rates. Since the life chances of infants are highly sensitive to broad socioeconomic conditions such as income levels, innovations in medical technology, and access to health services (Gortmaker and Wise 1997), infant death rates provide a valuable test case for addressing the influence of socioeconomic conditions on health. This work departs from prior research in the following three ways: (1) by directing attention to differences between East Central Europe and the former Soviet Union; (2) by focusing on long-term trends in mortality differentials across Western Europe, East Central Europe, and former Soviet Union; and (3) by investigating potential mechanisms underlying mortality differences across these three country groups.

The theoretical framework described above suggests the following hypotheses.

Hypothesis 1: We expect to observe differentials in life expectancy when comparing Western Europe, East Central Europe, and the former Soviet Union during the period after communism's fall. Specifically, guided by the trisection approach (Luy et al. 2011), we hypothesize that life expectancy at different ages is distributed in a graded fashion across three country groups: Western Europe has the best outcomes, followed by East Central Europe, and then the former Soviet republics.

Hypothesis 2: In line with Adeyi et al. (1997)'s work, we hypothesize that the size of mortality differentials becomes smaller in more recent years due to improvements in socioeconomic conditions in Eastern Europe.

Hypothesis 3: We hypothesize that regional variations in mortality indicators become smaller when socioeconomic and behavioral factors are accounted for. Statistically, this implies that controlling for GDP per capita, health care expenditures, and spirits consumption should render the differences insignificant, or reduce them to marginal significance.

Hypothesis 4: We expect to observe differences in infant mortality rates across the three country groups. Also, following Gortmaker and Wise (1997)'s argument, we hypothesize that disparities in infant death rates are strongly influenced by macroeconomic and health infrastructure differences among countries.

Methods

Data

The main source of information for this study is the WHO European Health for All Database (HFA-DB) (WHO 2011b). The HFA-DB is a collection of major health statistics, including socio-demographic information, health care utilization, and lifestyles, for the 53 WHO member states in the European region. Turkey and Israel were excluded from the current analysis due to their geographic locations. Because of the limited availability of data, Andorra, Cyprus, Monaco, and San Marino were also excluded. After these exclusions, the final sample size is 47. Also, note that Bosnia Herzegovina was excluded from the life expectancy at age 65 and infant mortality analyses due to data availability. Since our interests fall in emerging differentials in population health between East Central Europe and the former Soviet Union, we restrict our data to the period following the dismantling of communism. We collect information of interest for 1992, 1996, 2000, 2004, and 2008. Instead of pooling all the years, we use five sets of cross-sectional data and analyze each time point separately. This strategy allows us to not only capture the magnitude of health disparities during each stage of the transition process, but also address changes in inequality patterns over time. We found that the results remained almost unchanged using other time-points.

Measures

There are two dependent variables. First, we focus on gender-specific life expectancy at birth (e0) and at age 65 (e65). Life expectancy at birth is the average length of life for infants given current age-specific death rates, and life expectancy at 65 refers to the expected duration of life at age 65 based on current age-specific mortality rates (Preston, Heuveline, and Guillot 2001). Second, we use infant mortality rates, which is the number of deaths of children less than one year of age per 1,000 live births in that year. This measure is logged, due to a skewed distribution. I maintain the original metrics of other dependent variables.

Guided by the trisection approach (Luy et al. 2011), we use the following three country groups as the focal independent variable: (1) Western Europe (Austria, Belgium, Denmark, Finland, France, Ger-

many, Greece, Iceland, Ireland, Italy, Luxemburg, Malta, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom); (2) East Central Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Hungary, the Former Yugoslav Republic of Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia, and Slovenia); (3) and the former Soviet Union (Armenia, Azerbaijan, Belarus, Estonia, Georgia, Latvia, Lithuania, Kazakhstan, Kyrgyz, the Republic of Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan). Western Europe serves as the reference category in the regression analyses.

To examine the extent to which socioeconomic and behavioral factors are linked to regional inequalities, we include the following factors into the analysis. First, GDP per capita provides information about the level of economic development. GDP per-capita has been used as a summary index of business, commercial, and government activities (Granados 2008), and it is strongly associated with life expectancy at birth and infant mortality rates (Ram 2006; Wilkinson 1992, 1997). We use purchasing power parity (PPP)-adjusted GDP per capita that allows for better international comparisons (Firebaugh 2000). We divide the GDP data by 1,000 and use a logarithmic transformation to better linearize the relationship of this variable with the dependent variables. Although previous studies suggest income inequality, often measured by Gini coefficients, as a key determinant of mortality (Beckfield 2004; Ram 2006), due to data constraints, the present study focuses on GDP per capita an indicator of a nation's socioeconomic development. Second, we include health care expenditures as the percentage of total GDP into the models as a key indicator of welfare-regime characteristics. We use the strategy of grand-mean centering for GDP per capita and health care expenditures (Singer and Willett 2005). Finally, we focus on the level of alcohol consumption to account for the prevalence of negative health lifestyles. In particular, given a high prevalence of hard liquor consumption in Eastern Europe (WHO 2011a), we look at the level of spirits consumed per capita. Due to large differences in terms of the levels of alcohol consumption between Western and Eastern Europe, we include a dichotomous measure of heavy alcohol consumption: high spirits consumption is coded 1 if a country's level of spirits consumption exceeds the third quartile threshold of spirits consumption (75%), and 0 otherwise. We found that the impact of alcohol consumption becomes more evident in a dichotomous measure than in a continuous fashion.

Analytical Design

We use ordinary least-squares (OLS) regression to assess how life expectancy and infant mortality rates differ across Western Europe, East Central Europe, and the former Soviet Union between 1992 and 2008. There are three analytical steps. We first compare absolute differences in terms of longevity and infant mortality rates across three country groups in 1992, 1996, 2000, 2004, and 2008. Here, the values represent the average of each country group. We then perform an equality test for the coefficients of East Central Europe and the former Soviet Union. In other words, we test the following hypotheses:

$$H_0: \beta_i \text{ East Central Europe} = \beta_i \text{ the former Soviet Union}$$
$$H_1: \beta_i \text{ East Central Europe} \neq \beta_i \text{ the former Soviet Union}$$

where β refers to the coefficient for each country group in the i^{th} year. If we detect statistically significant differences, this indicates heterogeneity in mortality outcomes between East Central Europe and the former Soviet Union, thereby lending support for Luy et al. (2011)'s trisection approach. Finally, we employ multivariate OLS regression models. We include only country groups in model 1, and then adjust for GDP per capita, health care expenditures, and spirits consumption levels in model 2. There are two models in the infant mortality analyses: the baseline model that includes country groups (model 1) and a full model that adjust for GDP per-capita and health care expenditures (model 2). Here we only control for socioeconomic variables, based on the assumption that the survival of infants is, unlike their adult counterparts, not influenced by their own behavioral factors. All of the analyses are stratified by gender.

We handle missing data with a mean substitution approach. There is no significant difference between the imputed and non-imputed results. The distribution of dependent variables is almost symmetric, except for infant mortality rates, as noted earlier. We find linear relationships between dependent and control variables,

and there is no sign of multicollinearity between control variables. All analyses are conducted in Stata11.0 (StataCorp 2009).

Results

Descriptive Statistics

Table 1 presents the variables used in the analysis. The distribution of gender-specific life expectancy at birth shows that men and women in Western Europe enjoy the longest lives on average. Those in the former Soviet Union, on the other hand, have the lowest life expectancy at birth. Moreover, the life expectancy of the people in the former Soviet states remained almost unchanged between 1992 and 2008 (a .77-year increase among men and a .41-year increase among women), while it continued to improve in Western Europe (a 4.42-year increase among men and a 3.14-year increase among women) as well as in East Central Europe (a 3.68-year increase among men and a 2.45-year increase among women). We find similar regional gradients in terms of life expectancy at 65 and infant death rates. Socioeconomic indicators are also distributed in a graded fashion across the three blocs: Western Europe has the highest levels of GDP per capita and heath care expenditures, followed by East Central Europe, and then the former Soviet Union. Consistent with prior research on unhealthy lifestyles prevalent among populations in Eastern Europe (Cockerham 2000; Cockerham et al. 2002), spirits consumption is considerably higher in the East than in the West.

Results from Multivariate Analyses

Tables 2, 3, and 4 present the main results. Esti-

Table 1. Description of Variables Used in the Analysis, 47 European Countries, 1992-2008

	1992		
	Western Europe (n=19)	East Central Europe (n=13)	Former Soviet Union (n=15)
Life expectancy at birth			
- Male	73.62 (1.35)	68.21 (1.74)	64.42 (1.57)
- Female	79.93 (1.27)	75.83 (1.66)	73.42 (1.88)
Life expectancy at 65[1]			
- Male	15.03 (.87)	13.18 (.90)	12.89 (.94)
- Female	18.81 (1.05)	16.45 (1.35)	16.16 (.80)
Infant mortality[2]			
- Male	7.85 (1.77)	18.03 (8.45)	27.59 (12.24)
- Female	6.04 (1.23)	14.49 (7.51)	21.30 (9.68)
GDP per capita[3]	25.77 (7.48)	7.47 (3.59)	4.45 (2.82)
Health care expenditures[4]	8.01 (1.29)	6.75 (2.00)	5.67 (1.40)
Spirits consumption[5]	0	6 (46.15)	5 (33.33)
	1996		
Life expectancy at birth			
- Male	74.49 (1.31)	69.38 (2.14)	63.61 (2.56)
- Female	80.67 (1.20)	76.71 (2.12)	72.70 (2.31)
Life expectancy at 65			
- Male	15.41 (.80)	13.16 (.78)	12.35 (1.11)
- Female	19.26 (1.00)	16.73 (1.87)	15.64 (1.25)
Infant mortality			
- Male	5.89 (1.35)	13.52 (5.66)	23.51 (12.11)
- Female	5.09 (2.02)	11.35 (5.25)	18.89 (9.61)
GDP per capita	27.65 (7.82)	8.44 (4.30)	3.92 (2.56)
Health care expenditures	8.11 (1.31)	6.88 (1.94)	5.82 (1.56)
Spirits consumption	0	6 (46.15)	5 (33.33)

Table 1, cont.

	2000		
Life expectancy at birth			
- Male	75.62 (1.16)	70.05 (1.65)	64.82 (3.64)
- Female	81.34 (1.12)	76.79 (1.63)	73.44 (2.99)
Life expectancy at 65			
- Male	16.10 (.80)	13.29 (.83)	12.61 (1.19)
- Female	19.75 (.96)	16.51 (1.18)	15.76 (1.23)
Infant mortality			
- Male	5.16 (.96)	10.96 (4.29)	18.77 (10.65)
- Female	4.06 (1.03)	8.88 (3.52)	15.90 (9.98)
GDP per capita	31.97 (9.55)	9.59 (4.84)	4.68 (3.13)
Health care expenditures	8.27 (1.35)	7.17 (1.42)	5.54 (.97)
Spirits consumption	0	6 (46.15)	7 (46.67)
	2004		
Life expectancy at birth			
- Male	76.95 (1.17)	71.15 (1.76)	65.39 (3.83)
- Female	82.26 (1.01)	77.73 (1.73)	74.11 (2.55)
Life expectancy at 65			
- Male	16.94 (.63)	13.87 (.66)	12.68 (1.13)
- Female	20.43 (.91)	17.11 (1.23)	16.01 (1.25)
Infant mortality			
- Male	4.39 (.89)	8.83 (4.26)	18.05 (13.22)
- Female	3.69 (.60)	7.28 (3.03)	14.65 (10.59)
GDP per capita	33.95 (10.39)	10.93 (5.79)	6.30 (4.31)
Health care expenditures	9.26 (1.08)	7.60 (1.31)	5.57 (1.38)
Spirits consumption	0	4 (30.77)	8 (53.33)
	2008		
Life expectancy at birth			
- Male	78.04 (1.08)	71.89 (1.75)	65.19 (2.76)
- Female	83.07 (.95)	78.28 (2.29)	73.83 (3.58)
Life expectancy at 65			
- Male	17.66 (.82)	14.45 (.88)	12.84 (.98)
- Female	20.94 (.95)	17.84 (1.41)	16.41 (1.50)
Infant mortality			
- Male	4.22 (1.74)	9.04 (5.14)	18.77 (14.06)
- Female	3.33 (1.08)	7.33 (4.74)	14.85 (11.39)
GDP per capita	37.77 (14.47)	13.90 (7.03)	8.76 (5.66)
Health care expenditures	9.40 (1.15)	7.67 (1.50)	5.77 (2.16)
Spirits consumption	0	5 (38.46)	7 (46.67)

Note: Columns contain means for continuous variables (standard errors in parentheses) and absolute numbers for categorical variables (percentages in parentheses).
1. N is 46, excluding Bosnia Herzegovina.
2. Infant deaths per 1,000 live birth. N is 46, excluding Bosnia Herzegovina.
3. ln (GDP per capita in PPP/1,000)
4. Total health care expenditures as percentage of GDP
5. Sprits consumption exceeds the third quartile (=1)

Source: Data on life expectancy at birth, at age 65, infant mortality, health care expenditures, and spirits consumption comes from the WHO European Health for All Database (HFA-DB, WHO 2011b). Information on GDP per capita is from the Penn World Table 7.0 (Heston et al. 2011).

mation is based on the OLS regression procedure, using life expectancy at birth (Table 2), life expectancy at age 65 (Table 3), and logged infant mortality rates (Table 4) as the dependent variable.

We first focus on life expectancy at birth. Model 1 in Table 2 presents crude differences in gender-specific life expectancy at birth across Western Europe (referent), East Central Europe, and the former Soviet Union. Three points are worth emphasizing. First, in line with earlier studies on the topic, there is a large divide in terms of life expectancy at birth between the East and the West throughout the post-communist period. Men and women in East Central Europe and the former Soviet Union consistently exhibit shorter life expectancy at birth compared to their Western European counterparts. For instance, in 1992, the average male life expectancy at birth in East Central Europe was 5.41 years shorter compared to that in Western Europe, and the difference between the former Soviet Union and Western Europe was 9.20 years. All the results are significant at the .001 level for men and women throughout the analyses. Second, we find evidence to support the trisection approach. Life expectancy at birth is considerably shorter in the former Soviet Union than in East Central Europe. Results from an equality test indicate significant differences in effect sizes between these two country groups for both genders throughout the study period. These results provide clear support for Hypothesis 1. Third, there is limited evidence to suggest convergence in mortality differentials. The magnitude of the East-West divide has in fact increased over time for both men and women. Between 1992 and 2008, the disadvantage in life expectancy at birth for East Central Europe relative to Western Europe increased by .74 years among men (from 5.41 to 6.15) and by .68 years among women (from 4.10 to 4.79). During the same period, the difference between Western Europe and the former Soviet Union grew by 3.65 years among men (from 9.20 to 12.85) and by 2.73 years among women (from 6.51 to 9.24). Overall, the gap between the East and the West not only exists, but also has grown large over the past two decades. These results run directly counter to Hypothesis 2.

Next, we examine factors related to inequalities in mortality outcomes. Model 2 adjusts for GDP per capita, the percentage of health care expenditures in relation to total GDP, and the level of spirits consumption. Even after controlling for these socioeconomic and behavioral factors, the gap in life expectancy at birth between Eastern and Western Europe remains large and persistent among men. Statistical controls for these variables somewhat attenuate differences in male life expectancy at birth. The largest change in the effect of living in Eastern Europe comes after adjusting for all the variables in 2008, with 40% ((6.15-3.69)/6.15=.40) in East Central Europe and 31% ((12.85-8.82)/12.85=.31) in the former Soviet Union. Despite these changes, the differences by country group remain statistically significant at the .01 level. Taken together, with the addition of socioeconomic and behavioral factors, the East-West gap in male life expectancy at birth slightly decreases; however, large disparities still remain.

Then, what about women? Do theoretically important variables have limited explanatory power in their case as well? The results show that mechanisms associated with mortality inequalities considerably differ by gender. Among women, statistical controls for GDP per capita, health care expenditures, and spirits consumption significantly reduce the size of the East-West divide in longevity. The difference between Western Europe and East Central Europe disappears as early as 1996, net of all controls. All the initially significant associations between country groups and female life expectancy at birth (recognized in model 1) are rendered insignificant in 2008, even when comparing the former Soviet Union to Western Europe. These results stand in stark contrast to the analysis of male life expectancy at birth, in which regional disparities remain large even net of all controls.

Table 3 contains the results of life expectancy at age 65. We find similar patterns of regional disparities among older men and women. There are significant differences between Eastern and Western Europe as well as between East Central Europe and the former Soviet Union (model 1). Results in model 1 remain significant at the .001 level for both genders throughout the post-communist period. Further, consistent with the life expectancy at birth analysis, mechanisms underlying inequalities vary by gender. On the one hand, regional disparities in male life expectancy at 65 remain unaffected between 1992 and 2008, even when socioeconomic and behavioral factors are accounted for (model 2). On the other hand, initially significant differences in female life expectancy at 65 go away as

Table 2. Life Expectancy at Birth Regressed on Country Groups and Socioeconomic and Behavioral Factors, 47 European Countries, 1992-2008

	1992		1996		2000		2004		2008	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
(1) Male										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	-5.41***	-5.75***	-5.11***	-5.36***	-5.56***	-4.57***	-5.78***	-5.25***	-6.15***	-3.69**
Former Soviet Union	-9.20***	-9.97***	-10.88***	-11.69***	-10.79***	-9.71***	-11.56***	-10.25***	-12.85***	-8.82***
GDP per capita	—	.81	—	.96	—	.74	—	.61	—	1.00*
Health care expenditures	—	.14	—	.39**	—	.67**	—	.29	—	.44**
Spirits consumption	—	-1.23**	—	-1.61**	—	-1.79**	—	-2.67**	—	-1.63**
Constant	73.62****	74.26***	74.49***	75.07***	75.62***	75.60***	76.95***	77.06***	78.04***	76.49***
Adjusted R-squared	.87	.89	.85	.87	.79	.83	.80	.84	.89	.90
(2) Female										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	-4.10***	-2.95***	-3.96***	-1.90	-4.56***	-2.40*	-4.53***	-1.97*	-4.79***	-.47
Former Soviet Union	-6.51***	-4.22***	-7.97***	-4.42**	-7.90***	-3.74**	-8.15***	-3.68**	-9.24***	-1.91
GDP per capita	—	.86**	—	1.08**	—	1.34**	—	1.30**	—	2.97***
Health care expenditures	—	.23*	—	.30**	—	.45*	—	.43*	—	.65***
Spirits consumption	—	-.19	—	-.69	—	-.13	—	-.35	—	-.07
Constant	79.93***	78.95***	80.67***	79.23***	81.34***	79.44***	82.26***	80.19***	83.07***	79.55***
Adjusted R-squared	.76	.82	.77	.82	.74	.77	.79	.81	.73	.86

Note: * p<.05　** p<.01　*** p<.001 (n=47)

Table 3. Life Expectancy at Age 65 Regressed on Country Groups and Socioeconomic and Behavioral Factors, 46 European Countries, 1992-2008

	1992		1996		2000		2004		2008	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
(1) Male										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	-1.85***	-2.41***	-2.25***	-2.32***	-2.81***	-2.14**	-3.07***	-2.44***	-3.21***	-2.22***
Former Soviet Union	-2.14***	-3.13***	-3.06***	-3.41***	-3.49***	-2.40**	-4.26***	-3.00***	-4.82***	-3.25***
GDP per capita	—	.67	—	.36	—	.06	—	.14	—	.48*
Health care expenditures	—	.07	—	.12	—	.19*	—	.09	—	.08
Spirits consumption	—	-.43	—	-.48	—	-.94**	—	-1.27***	—	-1.07**
Constant	15.03***	15.62***	15.41***	15.66***	16.10***	15.82***	16.94***	16.67***	17.66***	17.14***
Adjusted R-squared	.57	.62	.69	.72	.74	.78	.84	.88	.85	.87
(2) Female										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	-2.36***	-2.18**	-2.53***	-1.51*	-3.24***	-.90	-3.30***	-1.02	-3.10***	-.95
Former Soviet Union	-2.64***	-2.39**	-3.62***	-2.11*	-3.98***	-.98	-4.39***	-.69	-4.53***	-.97
GDP per capita	—	.08	—	.37	—	1.15***	—	1.29***	—	1.44***
Health care expenditures	—	.09	—	.21*	—	.31**	—	.28**	—	.22**
Spirits consumption	—	-.15	—	-.69	—	-.70	—	-.64	—	-.76
Constant	18.81***	18.71***	19.26***	18.65***	19.75***	18.60***	20.40***	18.73***	20.94***	19.39***
Adjusted R-squared	.57	.60	.58	.60	.73	.82	.76	.83	.71	.79

Note: * p<.05　** p<.01　*** p<.001 (n=46)

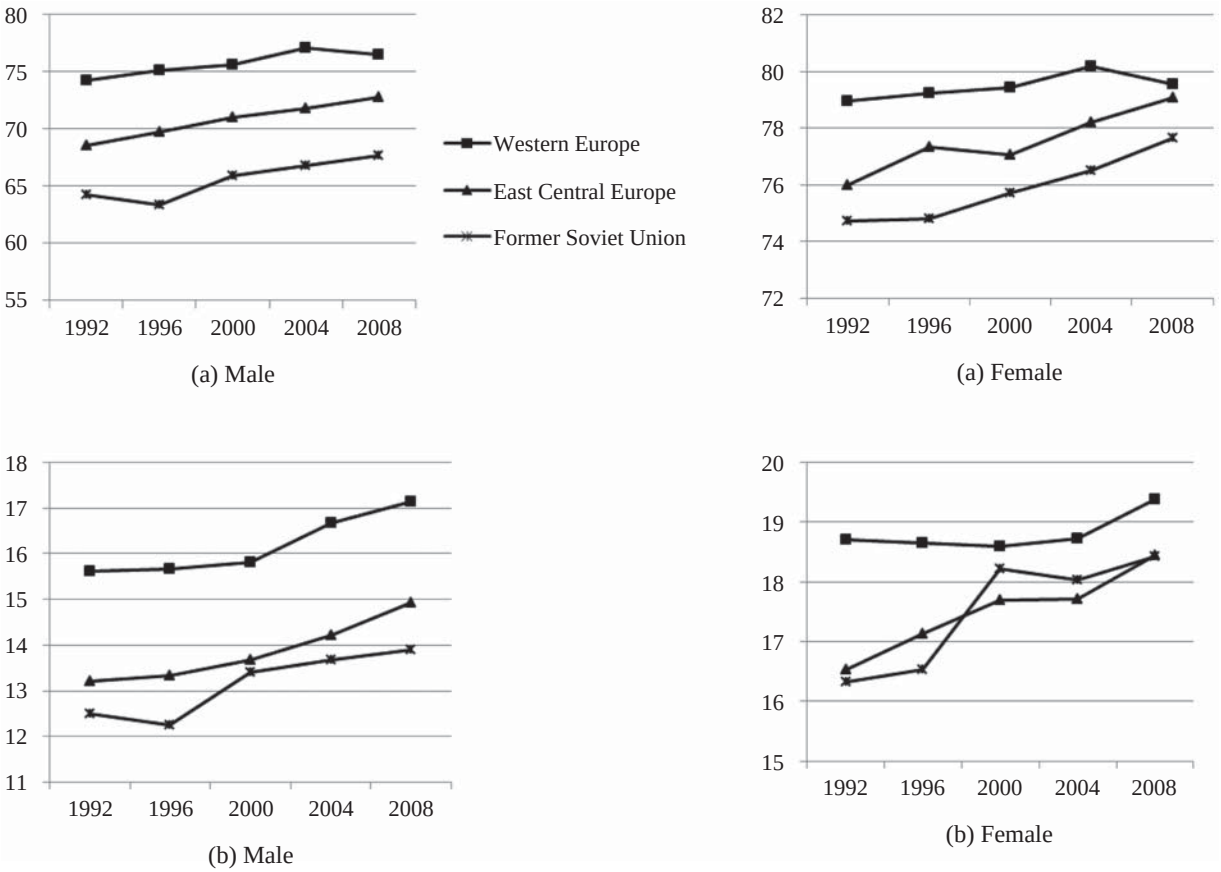

Figure 1. Predicted Average Life Expectancy at Different Ages by Country Group, 1992-2008. (a) Life Expectancy at Birth; (b) Life Expectancy at Age 65

Table 4. Logged Infant Mortality Rates Regressed on Country Groups and Socioeconomic Factors, 46 European Countries, 1992-2008

	1992		1996		2000		2004		2008	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
(1) Male										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	.77***	.24	.77***	.10	.70***	.02	.62***	-.25	.68***	-.28
Former Soviet Union	1.17***	.31	1.30***	.12	1.20***	-.10	1.25***	-.25	1.31***	-.31
GDP per capita	—	-.33***	—	-.45***	—	-.52***	—	-.56***	—	-.76***
Health care expenditures	—	-.10***	—	-.10***	—	-.04**	—	-.12***	—	-.09**
Constant	2.04***	2.47***	1.75***	2.32***	1.62***	2.21***	1.46***	2.18***	1.38***	2.16***
Adjusted R-squared	.70	.82	.70	.88	.68	.87	.60	.82	.50	.87
(2) Female										
Western Europe	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
East Central Europe	.80***	.24	.74***	.01	.75***	.03	.62***	-.15	.65***	-.32
Former Soviet Union	1.17***	.26	1.26***	-.05	1.27***	-.03	1.21***	-.13	1.29***	-.39
GDP per capita	—	-.35***	—	-.49***	—	-.49***	—	-.48***	—	-.76***
Health care expenditures	—	-.10***	—	-.11***	—	-.09**	—	-.12**	—	-.10**
Constant	1.78***	2.24***	1.58***	2.20***	1.36***	1.98***	1.29***	1.94***	1.15***	1.95***
Adjusted R-squared	.67	.82	.63	.85	.63	.80	.63	.82	.48	.79

Note: * p<.05 ** p<.01 *** p<.001 (n=46)

early as 2000.

Using the intercepts and coefficients in model 2 in Tables 2 and 3, we calculate predicted average life expectancy at birth and at age 65 for Western Europe, East Central Europe, and the former Soviet Union. Figure 1 illustrates clear gender differences in the post-communist life expectancy trajectory. Net of GDP, health care expenditures, and the level of spirits consumption, regional disparities in female life expectancy become smaller over a 16-year period, whereas inequalities remain large in the male population. Overall, we find partial support for Hypothesis 3.

Finally, we examine how infant death rates vary across Europe (Table 4). There are three important findings. First, infant mortality rates are significantly higher in the East than in the West throughout the post-communist period (model 1). Second, we find sizable differences in infant mortality rates between East Central Europe and the former Soviet Union. Infant death rates remain higher in the former Soviet Union than in East Central Europe, and the difference is significant at the .001 level. Third, controlling for GDP per capita and health care expenditures reduces regional differences in infant mortality rates to insignificance (model 2). Originally significant differences in infant death rates disappear with the adjustment for socioeconomic variables as early as 1992, and results are identical for both male and female infants. These results indicate that infant death rates are closely associated with socioeconomic development levels, offering support for Hypothesis 4.

Discussion and Conclusions

In the current study, we use cross-national data for 1992, 1996, 2000, 2004, and 2008 to analyze trends in health disparities across Western Europe, East Central Europe, and the former Soviet Union. There are four major findings. First, we find support for the traditional East-West health divide thesis (Bobak and Marmot 1996; Marmot and Bobak 2000). Gender-specific life expectancy at different ages is shorter in Eastern Europe than in Western Europe throughout the post-communist transition period. Importantly, we find evidence suggesting another health divide on the European continent. Life expectancy is significantly shorter in the former Soviet Union than in East Central Europe. Therefore, these results confirm the presence of inequalities across Eastern Europe, providing support for Hypothesis 1.

Second, the magnitude of the East-West divide has grown larger over time. It has been suggested that the progress in the post-communist political, economic, and social transformation process would eventually contribute to the narrowing of the East-West gap in population health (Adeyi et al. 1997). The present findings, however, demonstrate that the magnitude of inequalities has indeed grown large since the fall of communism. These results run counter to Hypothesis 2.

Third, mechanisms linking country-level factors to mortality outcomes differ by gender. While socioeconomic and behavioral factors are strongly related to cross-national differentials in female life expectancy, differences in male life expectancy remain unchanged even after adjusting for all the theoretically important variables. These results imply that the existing explanations for European mortality differences, measured by GDP per-capita, the percentage of health care expenditures in total GDP, and spirits consumption, have limited power in explaining regional variations in adult men's mortality outcomes. Overall, we find support for Hypothesis 3 only for women.

Finally, we observe East-West differentials among infants. Infant mortality rates are considerably higher in Eastern Europe than in Western Europe, and there are large inequalities in infant mortality rates within the former communist countries in Eastern Europe as well. Here, it is important to note that differences in infant mortality rates are strongly related to socioeconomic factors. Statistical controls for GDP per capita and health care expenditures reduce differences in infant death rates to insignificance for male and female infants. These findings lend support for Hypothesis 3.

One of the central findings of this research is substantial disparities in mortality outcomes within the former communist bloc in the East. Consistent with the trisection approach (Luy et al. 2011), we find significant disparities in life expectancy and infant death rates between East Central Europe and the former Soviet Union throughout the post-communist period. Sociological theories of health and illness posit that the social circumstances in which people are embedded play a major role in the production and distribution of health (Hertzman, Frank, and Evans 1994). The social contexts of East Central Europe and

the former Soviet Union are indeed largely different. While the Soviet Union was established at the beginning of the twentieth century through the Russian Revolution, Soviet-type communism was exported to East Central Europe only after World War II. Anti-Soviet culture tended to be strong in the satellite states, and people's social networks remained active even in communist times (Ekiert 1991; Ekiert and Kubik 1999). According to Szelenyi (1988), the strength of various social movements was the key to the "silent revolution from below" during the 1980s, such as the Solidarity movement in Poland. In contrast, the communist party maintained an overwhelming presence in every sphere of society in the Soviet Union (Henry 2006). Even after the demise of the Soviet system, civil society remains distinctively weak in this part of the globe (Howard 2002, 2003; Salmenniemi 2005). The dominance of the communist party and its instructions into every aspect of social life not only prevented the emergence of a vibrant civil society, but also fostered a high degree of institutional distrust among citizens in the former Soviet states (Stickley et al. 2009).

Distinct social circumstances in East Central Europe and the former Soviet Union might be related to the health status of these populations. Social cohesion has increasingly come to be recognized as an important determinant of health. People living in societies characterized by strong social networks and high levels of institutional trust tend to be healthier compared to those living in disorganized societies (Kawachi, Subramanian, and Kim 2008). Social cohesion is related to population health status in Eastern Europe as well. Kennedy and his colleagues (1998) find that lower levels of social cohesion, such as trust in local government and active civil engagement, are associated with higher levels of overall mortality and cause-specific death rates in contemporary Russia. Also, Nolte and McKee (2004) document how active social involvement buffers the negative impact of socioeconomic inequality on health in Eastern and Western Germany. These research findings imply that a high degree of social cohesion and social integration might have mitigated the adverse effects of post-communist political, social, and economic changes in East Central Europe. On the other hand, populations in the former Soviet republics were directly hit by socioeconomic crises when the state apparatus itself disappeared. According to Subramanian and Kawachi (2004), the impact of social inequality on health becomes most salient after a 15-year time lag. From this standpoint, the observed gap in population health status between East Central Europe and the former Soviet Union might reflect long-lasting consequences of the communist past.

Another important finding of this research is substantial differences in mortality patterns by gender. A sociological consideration can offer some purchase on pronounced gender differences. Communist party ideology encouraged women's participation in the labor force, and gender inequality in the labor market was consequently smaller in Eastern Europe than in capitalist societies (Ashwin and Lytkina 2004; Trappe and Rosefielde 1998). However, occupational segregation remained high. Men were primarily directed toward industrial occupations with higher prestige, while women's jobs were limited to the service sector, the so-called "non-productive branches" from the communist-party perspective (van der Lippe and Fodor 1998). Women's lower labor market positions relative to men in fact offered protection against the shocks of the post-communist crises. The service sector continued to expand through structural reforms, but traditionally male-dominant heavy industries quickly diminished in size. Thus, while women maintained their employment patterns even after the demise of the old economic system, men inevitably experienced falling real wages, employment difficulties, and the loss of status of chief breadwinner (Brainerd 2001; Kiblitskaya 2000; Watson 1995). Sociological research finds that disruptions of established roles and statuses in later life serve as a particularly powerful stressor (Pearlin et al. 2005), and the high toll of premature mortality in post-communist Eastern Europe was indeed concentrated among men with limited resources: blue-collar workers (Carlson and Hoffmann 2011), the unmarried (Watson 1995), and the less educated (Shkolnikov et al. 2006). Taken together, the diverging social experiences of men and women during and after the communist period may partly explain pronounced gender differences in mortality outcomes. This argument is further supported by the findings from the infant mortality analyses, in which mechanisms related to differentials are identical for male and female babies.

The strengths of this research include the use of three country groups, a close examination of long-

term trends in a variety of mortality outcomes, and the exploration of mechanisms related to regional differentials in mortality. Nonetheless, this study has several limitations. For instance, the factors associated with population health are crude. Environmental pollution has been implicated as an important contributor to the poor health of people in Eastern Europe. Air pollution is related to increases in adult and infant mortality rates in East Germany (Ebelt et al. 2001), Poland (Krzyzanowski and Wojtyniak 1992), and the Czech Republic (Bobak and Leon 1992). The present analysis, however, only includes GDP per capita, health care expenditures, and spirits consumption due to data availability. Also, this study focuses only on the aggregate level and uses countries as the unit of analysis, thereby excluding individual-level determinants of health. Future research would benefit from multilevel models that permit a simultaneous analysis of the effects of aggregate and individual-level factors on health outcomes. In addition, this research treats all countries equally, and thus it does not take into account differences across observations. Cross-national social surveys provide numerical weights to account for variations in the size of observations, whereas the present study uses country-specific information taken from publicly available data sources, making it impossible to assign weights to each observation. Finally, this work does not attempt to establish causality. The present findings instead demonstrate associations between a range of macro-level factors and mortality outcomes across European countries. For example, we find that GDP per capita is strongly associated with female life expectancy, but scholars argue that the impact of this variable is influenced by the levels of a nation's wealth (Wilkinson 1992). Thus, readers should be reminded that this work only indicates factors related to the health of populations in 47 countries during the study period.

This study's results, together with its strengths and weaknesses, make important contributions to the existing literature on the topic. Focusing on a variety of health-related measures, the present findings imply that observed mortality differentials might reflect the long-lasting impacts of the historical, cultural, and socioeconomic environments in which these countries are embedded.

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