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Cross-Country Evidence on the Social Determinants of the Post-Socialist Mortality Crisis in Europe:

A Review and Performance-Based Hierarchy of Variables

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ABSTRACT

An unprecedented mortality crisis befell the former socialist countries between 1989 and 1995, representing one of the greatest demographic shocks of the period after the Second World War. While it is likely that country-level variation in the post-socialist mortality crisis in Eastern Europe can be explained by a constellation of political and socio-economic factors, no comprehensive review of the existing scholarly attempts at explaining these factors exists. We review 39 cross-national multi-variable peer reviewed studies of social determinants of mortality in post-socialist Europe in order to assess the social factors behind the post-socialist mortality crisis, determine the gaps in the existing literature and to make suggestions for future research. We propose a novel methodology to determine the relative importance of variables based on the ratio of significant to insignificant findings for each variable. The literature identifies inequality, welfare payments, religious composition, democracy, economic performance, and unemployment as the leading factors that have a significant influence on mortality outcomes. Existing cross-country studies fail to establish a definitive connection between mortality and diets, drinking patterns, liberalisation, trust, health expenditure and war. We also point out that the level of analysis is not a neutral methodological choice but might influence the results themselves.

Keywords: Central and Eastern Europe, Mortality, Political Economy, Social determinants of Health, Capitalism

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INTRODUCTION

Throughout the decades following the Second World War life expectancy was improving almost everywhere around the globe due to developments in healthcare, the reduction of infectious diseases and improvements in infant mortality. Yet, as opposed to Western Europe, gains in longevity in socialist countries came to a halt around the end of the 1960s. Life expectancy began to stagnate and even decline over the next two decades. Making an already deteriorating health situation worse, an unprecedented mortality crisis befell the former socialist countries between 1989 and 1995 with the transition from socialism to capitalism[1]. The leading *direct* cause of death during the post-socialist mortality crisis was acute cardiovascular disease and alcohol poisoning. Russia and some other former members of the Soviet Union were affected the most (Billingsley, 2011). Thus, while in the 1970s Russia lagged behind western European countries by only 2-3 years in life expectancy, this gap has increased to 15–17 years for men by the early 2000s (Shkolnikov et al., 2004), with a total excess mortality reaching 3.26 million in 1990–1999 (UNICEF, 2001). The loss of healthy life expectancy had severe indirect costs as well. National income loss due to illness in Russia was estimated at 1.8–4.7 per cent of one year's GDP during the first half of the 1990s (Bloom & Malaney, 1998).

Bobak and Marmot (2009) differentiate between biomedical and sociological approaches to studying the causes of the post-socialist mortality crisis. Among the biomedical studies that focus on the proximate individual causes alcohol has received the most attention (Korotayev, 2008; Leon et al., 1997; McKee & Britton, 1998; Rehm et al., 2007). The relatively poor dietary patterns of Eastern Europeans compared to their Western European counterparts have been described as another potential factor causing excess mortality (Ginter, 1995; Stefler & Bobak, 2015). Some researchers have argued that hazardous drinking patterns and poor health lifestyles originate from the socialist times (Cockerham, 1997), claiming that irresponsible individual behaviour is a result of socialist ideology or the alleged culture of collectivism and patronising state (Cockerham et al., 2006; Piko, 2004).

However, the culturalist theory of inherited lifestyle in itself proved to be incapable of explaining sudden variations in mortality during the transition from socialism to capitalism. Most of the traditional risk factors that the theory was concerned with, such as diet and health behaviour, remained largely unchanged or even improved during the post-socialist transition. Therefore behavioural risk factors alone cannot explain the sudden increase in mortality during this period (Brainerd & Cutler, 2005: 123-124). Social and psychosocial factors accompanying the post-socialist transformation seem to be the major *distal* determinants of the post-socialist mortality crisis (Cornia & Paniccia, 1995; Kopp et al., 1998; Marmot & Bobak, 2000; Shapiro, 1995; Stone, 2000). Later, proponents of lifestyle theory also accepted the role of social change and stress in inducing unhealthy behaviour (Cockerham, 2013). Thus, there is a convergence towards emphasising distal social factors as crucial determinants of the post-socialist mortality crisis.

However, it is not clear what the importance of each potential distal social determinant is. The magnitude of the mortality crisis suggests that these social determinants go beyond absolute deprivation, encompassing broader segments of society through insecurity, stress, unemployment and inequality (Brainerd, 1998). Recessions and crises have been also convincingly linked to the loss of healthy lives (Stuckler, Basu, et al., 2009). However, there is no direct link between the level of economic production and mortality. Other large-scale factors mediate the health impact of macroeconomic cycles, like unemployment, inequality, the welfare state or economic uncertainty. Large-scale social phenomena are also influenced by economic policies, such as liberalisation and

privatisation, and these policies were also found to be leading to stress and higher levels of mortality (Brainerd, 2001; Stuckler, King, et al., 2009).

The level of analysis further complicates identifying the most important social determinants. In their programmatic paper Bobak and Marmot (1996) concluded that factors affecting the cross-national mortality gap between Eastern and Western European countries are similar to the factors behind domestic inequalities in mortality. However, we hypothesise that there is a significant difference in the determinants of within-country and cross-national variation in mortality. On their own, within-country studies are better at capturing the health effect of lower-level determinants of health, but cannot compare the differences at the level of nations. There are socioeconomic factors that influence society as a whole and lead to a general change in mortality levels. Universal welfare services, for example, are more difficult to measure in within-country studies, yet might be important explanatory factors in cross-national settings. Scholars are right to point out that macro-level studies might be prone to ecological fallacy. On the other hand, individual-level studies are often carried out in isolated individual countries and are unable to uncover the effect of large-scale social determinants of health and mortality (Stuckler, King, et al., 2009). Although most researchers agree on their importance, there remains a controversy surrounding the social determinants of the post-socialist mortality crisis. Yet, as of today there is no review that would integrate the cross-national empirical evidence to help identify the most important factors.

It is fundamental to assess the accumulated evidence on the post-socialist mortality crisis based on studies that allow researchers to investigate the health effect of large-scale social variables, i.e. cross-national empirical analyses. The aim of this paper is to review the cross-national empirical literature on the social determinants of mortality in post-socialist Eastern Europe to: a) determine the gaps in the existing research; and b) establish a list of the most important social variables leading to changes in mortality; and c) to analyse the performance of these variables based on their ability to significantly predict changes in mortality. We are not trying to refute any hypotheses, neither do we try to directly compare effect sizes of variables, these would be outside the scope of this paper. We aim to provide a systematic overview of the existing studies on the mortality crisis and establish a hierarchy of variables based on their performance to predict mortality in the existing literature.

The remainder of this paper is organised as follows: first, we provide a description of our methodology, including the selection criteria of the articles analysed. Second, we provide a concise review of the 39 articles included in our analysis specifying the methodology, the variables included and the findings of each article (see Table 1 of the online supplement for a full list of articles and their main characteristics). We also provide an analysis of the performance of the variables by ranking them based on the number and percentage of the studies that found them significant. We discuss the mechanisms and the various theories applied in the studies included in our review.

METHODS

A systematic review is a research approach to identify, evaluate and integrate the findings of a large number of existing studies that address a pre-defined research question in a transparent, systematic and replicable way (Centre for Reviews and Dissemination, 2008; Higgins & Green, 2011; Petticrew & Roberts, 2006). A systematic review is more than a narrative or traditional review that does not involve a systematic and replicable search strategy. This makes systematic reviews less prone to bias and more

falsifiable. Depending on the research question posed in the systematic review, statistical analyses may or may not be used to analyse the results of the selected studies (e.g. a meta-analysis involves a quantitative statistical evaluation of the findings of the literature). In this review we identify, evaluate and integrate studies that investigate the social determinants of the post-socialist mortality crisis in a cross-national setting. In our review we are focusing on a large set of independent variables (social determinants) in association with a set of dependent variables (measures of mortality) in a pre-defined geographic area (post-socialist countries in Eastern Europe) and time-frame (1991-2016). Because of the large variance in the types of variables it is not appropriate to carry out a regression analysis on the associations reported in the literature. Instead of a meta-analysis we present an integrated review of the performance of different groups of variables reported in the literature based on the number and proportion of studies that found those variables significant. We followed the requirements of a systematic review, but as our methodology to rank the performance of variables is not common in social epidemiology we decided not to call our article a systematic review. However, this does not undermine the systematic approach of this method.
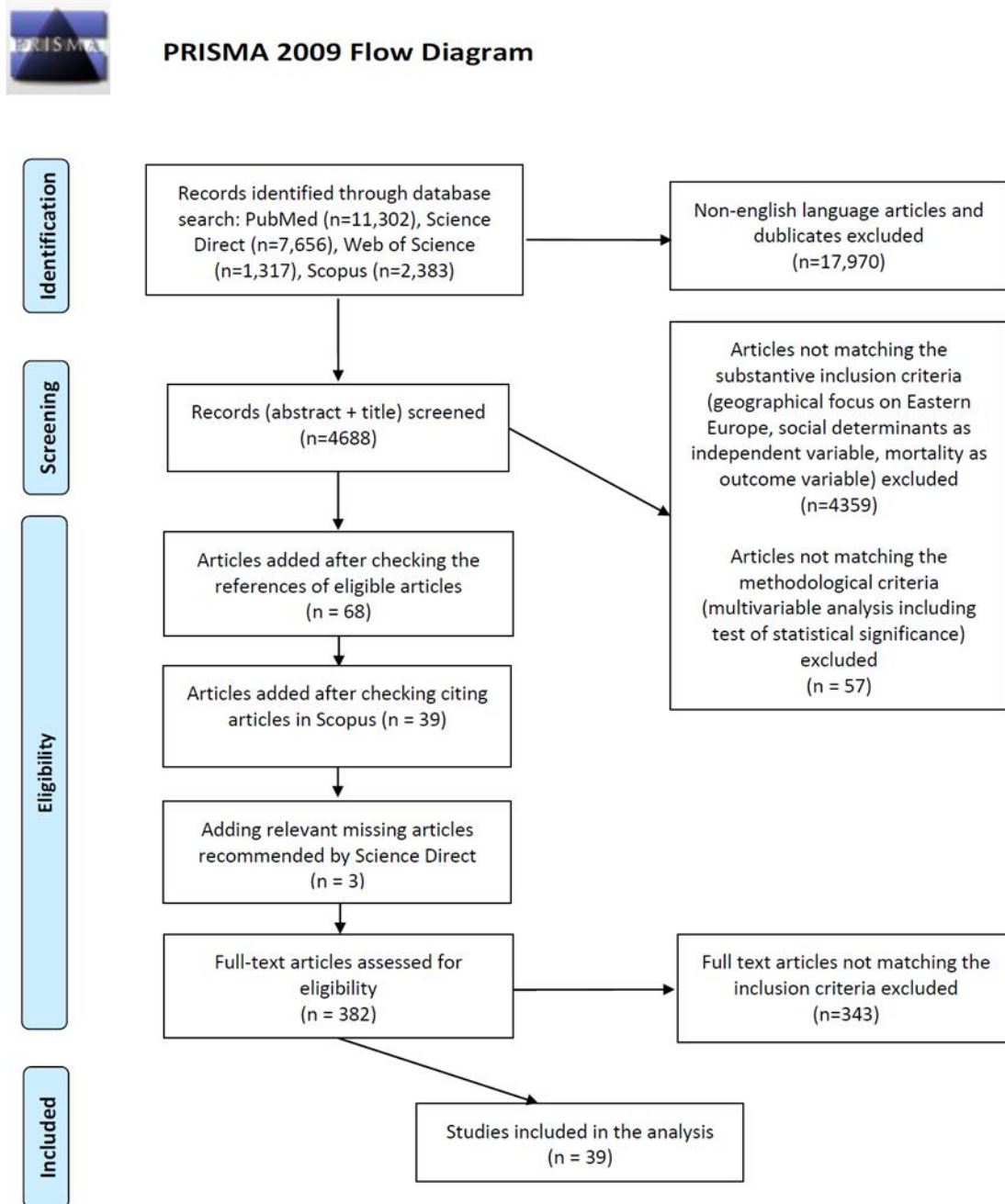
Data collection

We carried out a systematic keyword-based search in major medical and social science databases, including PubMed, Science Direct, Scopus, Sociological Abstracts and Web of Science as well as Google Scholar. We used the following key words: '*mortality', 'health',* and '*life expectancy'* in conjunction with geographic terms (e.g. Eastern Europe*; Russia*; Belarus*; Ukraine*; Hungary*), causal factors (e.g. social determinant*; social cause*; welfare state*; transition*; economic transformation*), and specific outcomes (e.g. suicide*). We did not use any Boolean operators that replace the original search terms with machine-stimulated approximation so as to avoid ambiguous search results.

The first keyword-based round of search returned 11,302 articles. First, we filtered out non-English language articles[2], and articles that were not published in social science, public health or epidemiology journals. Second, filtered the articles based on their titles and abstracts and filtered out studies that do not focus on Eastern Europe and do not include at least one socio-economic determinant of mortality. We used several substantive inclusion criteria to further reduce the number of studies. We only included studies analysing more than one Eastern European country as the focus of the paper is on the overarching cross-country factors explaining the regional mortality increase. In terms of the outcome variables, we included only those articles that operationalised some measure of mortality as a dependent variable, including articles focusing on natural-cause and external-cause mortality as well as suicides. We also included papers that use measures of age-specific and gender-specific mortality. In terms of the independent variables, we only included articles that explicitly focus on socio-demographic factors (gender, age, culture, socioeconomic status, occupation, and large-scale social and policy variables) of mortality, while purely biological studies were excluded from the analysis. By design, purely biological or medical articles lack focus on societal aspects, primarily focusing on individual-level variables. We also included studies that measure the impact of health behaviour (drinking, diet).

We also applied a number of methodological selection criteria. Only multivariable analyses that apply a statistical test of significance were included in the final database. Articles not published in peer reviewed journals, as well as dissertations and working papers were excluded because peer review is often accepted as the minimum guarantor of academic quality. Book chapters matching the inclusion criteria were rare; therefore, only one book (Marmot & Bobak, 2000) passed our selection criteria. We

only included articles that were published after 1991, the starting point of the liberalisation and privatisation policies in Russia – the largest post-socialist country. All together, we excluded 57 articles based on methodological reasons that provided either qualitative analysis or quantitative analysis based on one variable only without any test of significance.

Figure 1. PRISMA flow diagram

PRISMA 2009 Flow Diagram

Identification

Records identified through database search: PubMed (n=11,302), Science Direct (n=7,656), Web of Science (n=1,317), Scopus (n=2,383) → Non-english language articles and dublicates excluded (n=17,970)

Screening

Records (abstract + title) screened (n=4688) → Articles not matching the substantive inclusion criteria (geographical focus on Eastern Europe, social determinants as independent variable, mortality as outcome variable) excluded (n=4359)

Eligibility

Articles added after checking the references of eligible articles (n = 68)

Articles not matching the methodological criteria (multivariable analysis including test of statistical significance) excluded (n = 57)

Articles added after checking citing articles in Scopus (n = 39)

Adding relevant missing articles recommended by Science Direct (n = 3)

Full-text articles assessed for eligibility (n = 382) → Full text articles not matching the inclusion criteria excluded (n=343)

Included

Studies included in the analysis (n = 39)

After applying the substantive inclusion criteria, to increase the precision of our screening process we reviewed the bibliographies of the remaining articles and added further 68 relevant articles so identified. Further, we identified 20 articles with the highest number of citations and looked for articles in Scopus that cited any of them. This way we included further 39 articles the met our inclusion criteria. We added further 3 articles returned by our search in Science Direct. After several rounds of iterative search the full text of 382 articles was reviewed. Based on the full-text in-depth evaluation of the articles we excluded 343 articles that did not match our substantive or methodological inclusion criteria. This way we compiled a comprehensive list of 39 cross-national multi-variable peer reviewed articles investigating the social determinants of the post-socialist mortality crisis (see Table 1 of the online supplement for a detailed description). The first author performed the literature search to minimise the bias arising from several authors doing the search, evaluated and extended if necessary by the co-authors. The search and screening process started on 1 October 2015 and was closed on 31 January 2016.[3]

Data analysis: variable performance

Having reviewed each article, we extracted information on the independent variables, including the direction of the association and whether or not the variable was found to be significant. We accept the articles' definitions of significance, which vary from 0.001 to 0.05 on p values. To achieve the desired geographical and theoretical scope we analysed articles using different measures and causes of mortality with a great variety of independent variables. Methodologically, with multiple dependent and independent variables it is not viable to compare the statistical strength and significance of a single variable across different papers. Instead, we grouped the variables into sets to aid systematic comparison. We identified 20 sets of variables: alcohol consumption, regional country typologies, democracy, deprivation, drinking pattern, education, healthy diet, inequality, inflation, liberalisation, medical spending, national income, population health, privatisation, religious composition of society, social disintegration, social welfare, trust, unemployment, and war and armed conflict (see table 1 for the list of the indicators). There was a relatively large variance in the occurrence of variables, the variable group most often investigated was national income: all together 13 studies included some measure of it. Measures of personal income, social welfare and religious composition were each included in only two articles.

To compare the performance of each set of variables we calculated the ratio of significant to insignificant findings for each variable. We measured the performance of each set of variables by calculating the percentage of the studies that found the variable significant among those studies that included that particular variable. Although this is not common in epidemiology, ranking variables by their performance to significantly predict the outcome variable is an accepted methodology in economics, as evidenced by reviews focusing on financial crises and other instances of socio-economic shocks (Frankel & Saravelos, 2012; Kaminsky et al., 1998). This approach is useful to reducing a large number of potentially relevant variables to a smaller set that can be further investigated to analyse the size and strength of the association. Adopting this approach to social determinants of mortality research enables not only a structured overview of existing evidence, but also a systematic understanding of the best performing variables. In this case, due to the large variance in the occurrence of different variables comparing their performance solely by measuring what percentage of studies found them significant would be insufficient. Therefore we used the significant to insignificant ratio taking the number of studies that contained a measure of the variable also into consideration. Studies that used multiple models and multiple measures of the same theoretical concept were treated as

separate instances of measurement and hence appear in the summary table as separate studies. This explains why the overall number of studies in the table is higher than the actual number of studies included in the review. By including these multiple variables we avoid an unnecessary loss of information.

RESULTS

Characteristics of studies

Figure 2. The temporal distribution of studies included
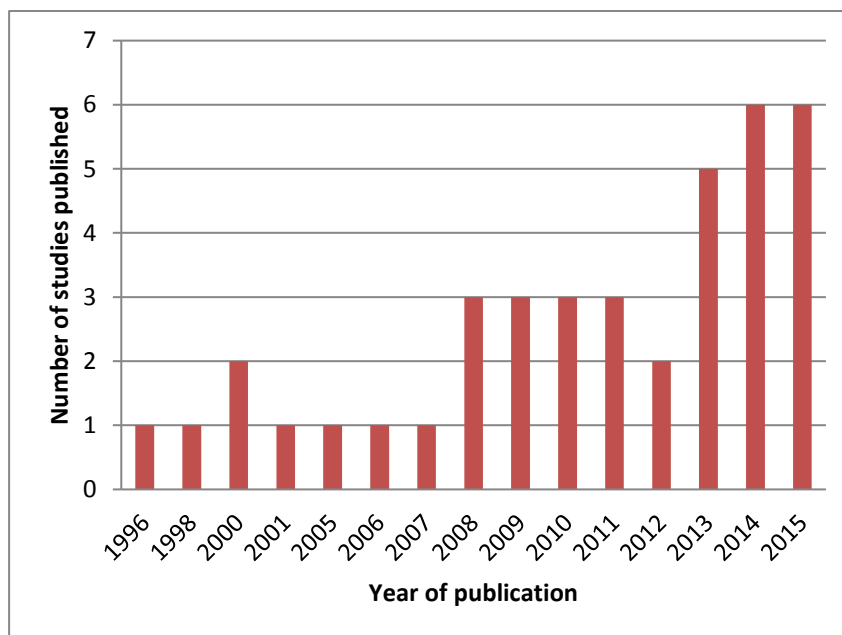
We found 22 studies relying on a cross sectional regression analysis, 10 studies based on prospective cohorts estimating Cox hazard ratios and 7 studies used time series techniques. Most of the studies used multiple measures of mortality by age, gender and causes of death. The temporal distribution of the studies is skewed towards the present, with an increasing number of studies published over time, as portrayed in Figure 1. Half of the studies were published after 2012. This trend might reflect the increasing empirical sophistication of social science and mortality research, the increasing availability of data for empirical mortality research, as well as growing interest in the health outcomes of economic crises.

Table S1 of the supplement gives an overview of the final set of the 39 studies including a brief summary of their findings. The majority of the studies included multiple control variables beyond the main independent variable, with a few exceptions. Studies investigating the mortality effect of alcohol consumption and dietary habits tend to include fewer control variables. However, existing studies on the mortality crisis relying on individual level data cannot explain both societal and individual causes, which does not make them useful for explaining the mechanisms linking macro-social phenomena to mortality.

Performance of variables

Table 1 provides an overview of the performance of the most important sets of variables to significantly predict mortality. The dependent variable always stands for some measure of mortality. In the case of multiple dependent variables within a single study we took working age male all-cause or CVD mortality as reference. The sign of the effect was indicated with – or +. In the case of conflicting definitions (e.g. employment level versus unemployment level) vectors were converted for comparability. In the case of the example the variable set was named unemployment which means the sign of the relationship between employment and mortality was changed, indicated with *-1 in the first column of the table. +/- indicates a single study with multiple models and multiple signs. Significance means p<0.05; in case of Cox regressions that report confidence intervals, significance indicates that the confidence interval does not contain 1.

Since only a limited number of studies is available, it is important to look at the significant to insignificant ratio as an alternative assessment strategy. Measuring the performance of variables by the number of studies that found them significant we can conclude that economic performance was perceived to be the most important social determinant of mortality by most researchers. 16 studies found economic performance to be a significant predictor of mortality, against three studies that did not. Economic performance is followed by democracy, economic deprivation and social disintegration with 7 studies providing an evidence of a significant relationship each. In the case of democracy it is important to point out that the effect of democratisation on mortality appears to be somewhat ambiguous with 5 studies finding a negative, 2 studies a positive and 1 study a mixed effect. A more detailed analysis of the process of democratisation is necessary to understand the mechanisms linking democratic transition to mortality. This is further discussed in the next section.

The third most important social determinant as perceived by researchers (by the number of significant findings) is alcohol consumption (6 studies). However, there were 3 studies that did not find alcohol consumption to be significantly related to mortality. Unemployment (5:1), inequalities (4:0) and rapid privatisation (4:1) also appear to be important social determinants of the post-socialist mortality crisis based on the absolute number of studies that found them significant. There were five studies emphasising significance of education, but the relatively high number of studies failing to establish a significant relationship between education and mortality casts some doubt on the importance of education in explaining *cross-national* inequalities in mortality.

Table 1. Performance ranking of social determinants of mortality variables

Variable	Direction	Sig.: insig.	Performance
Economic Inequality (Gini coefficient, labour market inequality)	4+	4:0	100%
Social welfare (spending per capita, participation in IMF lending*-1)	2-	2:0	100%
Religious composition (proportion of Muslims*-1, proportion of Catholics)	2+	2:0	100%
Democracy (Freedom House freedom score, Heritage Foundation freedom rating, Polity 2, change in current democracy)	5- 2+ 1+/-	7:1	88%
Economic performance (Decline in GDP*-1, Economic stress index*-1, GNP per capita; GDP per capita, industrial production);	18- 1+	16:3	84%
Unemployment (growth, per population, employment*-1)	6+	5:1	83%
Privatisation (change in private sector share of employment; mass privatisation dummy, EBRD privatisation index)	4+ 1-	4:1	80%
Material Deprivation (personal income*-1, minimum wage*-1, deprivation index, labour market poverty, bad housing conditions, bad neighbourhood conditions, household amenities*-1, food expenditure*-1)	9+	7:2	78%
Social disintegration (crime rate, divorce rate, male suicide rate, industry/services sector employment, urbanisation, perceived control*-1, female labour force participation)	8+ 1~ 1-	7:3	70%
Alcohol consumption (heavy drinking: > 60g/day)	8+ 1-	6:3	67%
Inflation (log, rate)	3+	2:1	67%
Country type (member of the SU, independence, regional transition type)	1+ 1- 1+/-	2:1	67%
Education (level of education, share higher education, occupational class)	7- 1~	5:3	63%
Liberalisation (de Melo liberalisation index, Foreign exchange rate and trade liberalisation, Price liberalisation, freedom of the world index, EBRD transition indicator)	4+ 2- 1+/-	4:3	57%
Population health (Old age, life expectancy, fertility, birth rate, maternal mortality rate*-1, dependency ratio)	4+ 2- 1~	4:3	57%
Healthy diet (fruit and vegetable cons., protein cons., energy availability, Mediterranean diet score, healthy diet score, antioxidant cons.)	5- 2+ 1~	4:4	50%
War, armed conflict	2- 2+*	2:2	50%
Healthcare spending and infrastructure (public or private, in % total expenditure, in % of GDP, in purchasing power parity, number of doctors, number of hospital beds)	7- 1+	3:5	38%
Drinking pattern (drinking pattern score, binge drinking, frequency of drinking)	4+ 1~ 1+/-	2:4	33%
Trust (trust, belonging, voluntary work, confidence, concern, helping)	5- 1+	2:4	33%

DISCUSSION

Over the last two decades, researchers across different disciplines have been trying to understand the underlying causes of the post-socialist mortality crisis. The age distribution of mortality as well as the stability of neoplasm-related deaths in comparison to a sharp increase in heart disease largely precludes the possibility that the post-socialist mortality crisis would be a statistical artefact (Leon et al., 1997). Similarly, the detrimental environmental legacy of socialist industrialisation has been blamed for excess mortality (Feshbach & Friendly, 1993; Little, 1998). However, environment-related health actually improved from the end of the 1980s following the industrial collapse (Nell & Stewart, 1994: 17). As a result, environmental factors explain at most 3 per cent of post-socialist mortality (Bobak & Feachem, 1995).

Some variables appear in the cross-country literature as robustly significant predictors of the post-socialist mortality crisis. Most notably, various measures of economic performance (see table 1 for the full list of variables constituting the measure) have been found significant throughout a number of studies. The sign of the relationship appears to be very clear with 18 out of 19 studies identifying a positive health effect of economic performance and negative health effect of crises and recessions. The only study that found a positive relationship between economic performance and mortality used industrial production as a proxy of industrial emissions (Cornia & Paniccià, 1996: 123-6). The theoretical consideration was that industrial emissions are strongly correlated with respiratory diseases and emissions are a result of industrial production, therefore the effect of environmental pollution on health could be measured by the proxy of industrial production. Cornia and Paniccià found a positive relationship between industrial production and mortality, however, the relationship was not significant. Thus we can safely conclude that the relationship between economic performance and mortality is negative and significant, and the relationship between crises, recessions and mortality is positive and significant.

Inequality, social welfare payments, religious composition, democracy, economic performance, unemployment, privatisation (rapid economic reform policies), material deprivation and social disintegration are particularly relevant social factors identified by the cross-country literature that significantly influenced mortality outcomes in post-socialist countries. At least 70 per cent of the studies that included a measure of these variables found them significantly related to mortality. All of the studies that included a measure of inequality, social welfare, and religious composition found them significant, yielding a 100 per cent performance. At least 80 per cent of the studies found democracy, economic performance, unemployment and privatisation to be significantly correlated with mortality in post-socialist countries. The existing cross-country research failed to establish a definitive result regarding the mortality effect of diets, drinking pattern, liberalisation, trust, medical spending and armed conflict in explaining variations during the post-socialist mortality crisis. Less than 60 per cent of the studies investigating these variables found them significant. The ambiguities in the direction of the effect, with studies both finding positive and negative correlation among these variables and mortality also indicate that these factors might be less relevant in explaining the post-socialist mortality crisis based on the existing cross-country research.

Measures of economic performance and crises are also clearly linked to another set of robustly significant variables that measure the impact of unemployment on mortality. Five out of six cross-country studies found employment status to be significantly associated with post-socialist mortality. Economic downturn and rapid change often wreak havoc in the labour market. This has been shown to be particularly relevant in explaining individual health outcomes. For example, the increase in

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mortality in Russia was strongly associated with labour market upheaval, the regions that dismissed the highest number of employees saw the steepest increase in mortality (Cornia & Paniccià, 1996; Walberg et al., 1998). Large-scale social changes and individual mortality outcomes are linked through the mechanism of stress driven by rapid change, unemployment and loss of status (Cornia & Paniccià, 2000). Rapid large-scale social change increases inequality which has also been shown to lead to higher rates of mortality (Marmot & Bobak, 2005). In times of crises resulting in loss of productivity and employment, public social protection might act as a buffer against increasing mortality (Bambra & Eikemo, 2009). In our review on the social determinants of mortality in Hungary we found that these within-country studies also report economic performance as a major and significant determinant of the post-socialist mortality crisis (Scheiring, Irdam, et al., 2018). However, due to study design these articles often use individual measures such as unemployment or available income, and thus are less equipped to capture national-level political economic processes.

The question of what is more important, public welfare or sufficient health care spending, merits special attention. Several researchers have argued that the collapse of the socialist health care system might be an important contributing factor to the post-socialist mortality crisis (Budhdeo et al., 2015; Ellman, 1994; Velkova et al., 1997). Changes in the source of financing, a shift from public to private funding, the types and sources of care could significantly influence health, but these qualitative aspects of healthcare systems were not investigated in the articles we reviewed. Cross-country studies that found a significant role of quantitative dimensions of healthcare, such as healthcare spending and infrastructure, report that they were negatively associated with mortality, suggesting that more health care spending could avert mortality. Yet, the large number of insignificant findings (five out of eight) casts doubt on the importance of healthcare expenditure in preventing the post-socialist mortality crisis specifically. Existing literature suggests that there appears to be a weak link at best between healthcare spending and infrastructure and the mortality levels of the early transition years (King et al., 2009). Marmot and Bobak (2000: 133) estimate that deaths amenable to health care explain maximum 10 to 20 percent of excess mortality. The improvement in child mortality (largely dependent on the healthcare infrastructure) also shows that the relationship between healthcare and mortality is ambiguous (Adeyi et al., 1997). In contrast to healthcare spending and infrastructure, social welfare spending seems to be better at protecting people from the health effects of financial crises (Stuckler et al., 2010). Each additional $100 increase in social welfare spending has been associated with a 1.19 per cent drop in all-cause mortality, this reduction is seven-fold greater when compared to a reduction in mortality as a result of GDP growth by each $100.

Political economists and sociologists of mortality have been discussing what has better outcomes on health: shock therapy or gradual transitions. Advocates of rapid reforms, like Sachs (1996) or Shapiro (1995) suggested that countries with radical privatisation policies would have better mortality outcomes, yet empirical research has cast doubt on this (Brainerd, 1998; Brainerd & Cutler, 2005; Hertzman & Siddiqi, 2000; Irdam et al., 2015; Mackenbach et al., 2013; Minagawa, 2013). Stuckler, King and McKee (2009) investigated the health effect of mass privatisation (a policy of rapid privatisation involving privatisation through vouchers) and found that it significantly contributed to the loss of life expectancy in post-socialist countries during the early transition years. It was also found that stabilisation packages, such as IMF programs, if carried out without adequate attention to the maintenance of vital public services, might also have detrimental mortality effects (Stuckler et al., 2008). Out of the five cross-country studies we found and included in our review four demonstrated that rapid privatisation is significantly and positively associated with mortality with the only exception of Gerry (2012). Gerry argues that the cross-national nature of the article by Stuckler et al. results in

ecological fallacy, i.e. fail to establish an individual level linkage between mass privatisation and mortality. The debate attracted a lot of attention in media (see for example Earle & Gehlbach, 2010; Gerry et al., 2010a; Gerry et al., 2010b; King et al., 2006; Sachs, 2009a, b). The critics emphasise the risks of ecological fallacy and confounding by other factors that over time correlated with mass privatisation, suggesting that alternative analyses could yield different results. This is indeed a limitation of cross-country approaches. However, using multi-level data on settlements and individuals we have confirmed that privatisation was associated with higher mortality among men is Russia (Azarova et al., 2017), and among women in Hungary (Scheiring, Stefler, et al., 2018).

The ambiguous findings regarding the health effect of democratisation appear to be also related to the question of shock therapy. Seven out of the eight cross-country studies found democracy to be significantly associated with mortality, yet the sign of the relationship was not clear. For example the study by Mackenbach et al. (2013) found that in the 1960-1990 period current democracy was strongly associated with higher life expectancy, yet between 1987-2008 current democracy was associated with lower, and cumulative democracy with higher life expectancy. The authors conclude in line with Stuckler, King, et al. (2009) that democratisation in Central and Eastern Europe was part of a complete system change which caused major societal disruptions therefore short term rapid changes might have had a negative effect on life expectancy. These findings would merit special attention as in the long run high rates of mortality, as a sign of the ambiguous performance of liberal reforms during the post-socialist transition, could be associated with the declining quality of democracy in some Eastern European countries (Scheiring, 2018). Finally, the effect of various liberalisation measures is less clear than that of privatisation, with 57 percent of cross-country studies finding a significant relationship, four with a positive sign, two negative and one study finding both positive and negative effects. In line with the speed-dependent impact of democratisation on mortality, Minagawa (2013) found that during the first period of transition liberalisation actually first caused an increase and then a decrease in suicide rates.

The majority of the biomedical theories of mortality emphasise individual health choices. Yet, in our sample of cross-national studies, only half of the studies that included a measure of diet found it to be significant. This is in line with the hypothesis that individual dietary choices *in themselves* are insufficient in explaining the sudden increase in mortality during the transition. Although several studies were able to attribute increased risk of mortality in the region to poor diets to (Connor et al., 2004; Stefler et al., 2017), the general dietary pattern has been stable or even improved during the post-socialist transition (Brainerd & Cutler, 2005: 123-4). It thus appears that the culturalist theory of inherited lifestyle has its strength in explaining long-term differences in mortality trends across countries, but is less suited to explaining sudden variations. It has been shown that increases in death rates went far beyond historical trends during the early years of the transition (Cornia, 2000). None of the traditional risk factors (including obesity, cholesterol, smoking, high blood pressure) changed enough to explain the dramatic increase in cardiovascular mortality (Brainerd & Cutler, 2005: 115-8). This underpins the need for explanations that can account for social embeddedness of health lifestyles (Cockerham, 2005).

Alcohol has often been identified as a major factor behind mortality by within-country studies (Leon et al., 1997; McKee & Chenet, 1995; Scheiring, Irdam, et al., 2018). Our review in contrast is less conclusive about the importance of drinking in cross-country setting. Six out of the nine studies included in our review that measure the effect of alcohol on mortality establish a significant positive relationship between mortality and alcoholism measured by high amounts of alcohol consumed regularly. This means that in our hierarchy, alcoholism is only the tenth strongest performing variable

in international comparisons. Drinking patterns seem to be even less robust when predicting mortality in international comparisons, with only two out of six studies included finding a significant relationship between drinking patterns and mortality. This is a striking difference to within-country studies that clearly show the importance of alcohol consumption and drinking patterns as direct causes of mortality. This divergence from within-country studies could be explained by two factors: a) Cross national analyses often compare different types of alcohol consumed within the same category. Comparing relatively light alcoholic beverages with strong spirits is problematic when assessing the effect of drinking on health and mortality. b) The impact of large-scale social factors that cannot be measured by within-country studies crowds out some of the effect of alcohol, suggesting that alcohol is a *mediating* factor between large-scale social variables and mortality. Yet, within-country studies might be less able to capture these distant, upscale factors that influence individual-level alcohol consumption patterns. It has been shown that detrimental health behaviour, such as alcoholism, especially among working class males, is often caused by structural factors. For example, the shock of the abrupt and severe economic transition resulted in increased alcohol intake in working class men (McKee & Shkolnikov, 2001; Shkolnikov et al., 1998; Watson, 1995; Weidner, 2002). Further multi-level studies are needed to elucidate the interrelatedness of large-scale social and individual level factors.

Finally, the Durkheimian concept of social disintegration also appears to be perceived as an important social determinant of the post-socialist mortality crisis in the literature. Seven out of ten cross-country studies found various measures of social disintegration such as crime, divorce or loss of control over one's life to be significantly and positively associated with mortality. Social disintegration has been often characterised as a situation where people do not have the necessary resources to achieve desirable goals. Durkheim associated this with the sense of not having control and linked this to economic and psychosocial stress. Social disintegration is a key category in Durkheim's social theory (Berkman et al., 2000): rapid social change, urbanisation, changes in the sectorial composition of labour (industrialisation in the nineteenth, deindustrialisation at the end of the twentieth century), rapid changes in female labour force participation are hypothesised to lead to a breakdown in the normative social regulation, which in turn results in an increase in crime rates, divorces and suicides. Direct evidence linking psychological stress with health and mortality is limited but existing studies seem to establish a similar trend. Perceived control and weak sense of mastery (Appels et al., 1996; Bobak et al., 1998; Bobak et al., 2000; Gilmore et al., 2002; Lundberg et al., 2007), work stress as measured by effort-reward imbalance (Pikhart et al., 2001), economic pressures on families and especially male manual workers' reactions to uncertainties (Carlson & Vägero, 1998; Watson, 2006), job strain and poor coping skills in the face of elevated levels of psychological stress (Kristenson et al., 1998) have all been linked to health deterioration in post-socialist countries. A large number of within-country studies found measures of social integration to be a significant predictor of mortality (see our review, Scheiring, Irdam, et al., 2018).

Education, which is again a crucial determinant of within-country inequalities in mortality, appears also to be less important in explaining mortality differences cross-nationally. Russia is a case in point. The national average level of education in Russia surpasses that of many other post-socialist countries, yet Russia has seen the steepest increase in mortality in the region during the 1990s. Although education is significantly correlated with within-country mortality in Russia, there are other large-scale social factors that could be more important when comparing mortality in Russia to other countries. This indicates the importance of uncovering the mechanisms through which education prevents mortality – whether this is through generally healthier life-styles of people with higher levels of education, which can be explained by better health awareness, or through more investment in preventive healthcare

among the better educated. It would be important to understand how education can be used by policy-makers for decreasing mortality inequalities both in times of economic stability and during economic crises.

CONCLUSIONS

We have provided an integrated review of quantitative cross-national multivariable empirical evidence on the social determinants of mortality in post-socialist Europe. Inequality, social welfare, religious composition, democracy, economic performance and unemployment are among the most important sociological factors analysed by the existing cross-country literature that were significantly associated with mortality in post-socialist countries. Economic performance appears to be the most robust significant factor behind the loss of life expectancy during the transition. Measures of economic performance and crises are also clearly linked to another set of highly significant variables that measure the impact of unemployment on mortality. Rapid large-scale social change increases inequality which has also been shown to lead to higher rates of mortality. In the majority of within-country studies, alcohol is considered a major factor behind the post-socialist mortality crisis. However, the cross-country evidence investigated in this study is less conclusive about the role of alcohol, which might be explained by the ability of cross-country studies to better ingrate macro-level determinants into their models.

There appears to be a weak link at best between diet, healthcare spending and infrastructure and the mortality crisis of the transition period in the cross-national literature we investigated. In contrast to healthcare spending, social welfare spending seems to be more important to protect people from the health effects of financial crises. However, the qualitative dimensions of healthcare, such as the privatisation of healthcare finance, were beyond the scope of this review, although these factors could significantly influence health. Four out of five studies found rapid privatisation to be significantly and positively related to mortality. The impact of democratisation on mortality also seems to interact with shock therapy economic policies which caused major societal disruptions. Studies included in the review found that democratisation in the short term had a negative effect on life expectancy. The cross-country literature also established a strong effect of social disintegration like crime, divorce or loss of control over one's life and work on mortality. Social disintegration, conceptualised as strain, the lack of personal resources to control challenging situations, which has also been linked to stress, was one of the main, though difficult to measure, determinants of the post-socialist mortality crisis.

Due to the small number of studies conclusions regarding the performance of each variable as well as the sign and the direction of causality should be made with caution. Further research is needed to elucidate the most important social determinants of the post-socialist mortality crisis. We have not differentiated the studies by the type of the outcome variable, i.e. causes of mortality. However, there might be significant differences between mortality due to suicide, accidents, liver diseases, cancer or diseases of the circulatory system. Reviews in the future could pay special attention to separating studies not only by subsets of the explanatory factors but also by causes of mortality. The relatively small number of cross-national studies might be offset by including within-country studies in the review process. However, the very high number of single country analyses makes such a review significantly more complex. We also included some of the single country studies and some of the non-multivariable analyses into our discussion section but a more systematic review of the within-country

evidence would allow for more robust conclusions. Although we did not include qualitative analysis of health and mortality, we believe that future research could uncover the deeper mechanisms linking large-scale social factors to individual health outcomes through qualitative analyses.

Testing the effect sizes of the variables we identified as important is outside the scope of this article. We can only infer to the perceived importance of each group of variable in the literature. The strength of our approach is to point out the performance of variables measured as their ability to significantly predict mortality. This can serve as a guide for future empirical research. Our approach also allowed us to integrate the results of a heterogeneous set of analyses that employ different variables to measure similar underlying concepts. This is useful in establishing what concepts are worth investigating more to establish the strength or the size of the effect. Future systematic reviews could concentrate on a subset of the variable groups we identified and analyse their effect on mortality in more detail. Our approach also allowed us to point out how methodological choices might lead to substantive differences in the results. Within-country studies tend to focus on more direct, behavioural causes, whereas cross-country analyses appear to be better equipped to grasp the influence of distal macro-social determinants of mortality. Some of the direct causes identified by within-country analyses could appear as mediating factors in cross-country research designs.

In contrast to Bobak and Marmot (1996) our review underpinned the argument that there are differences between the factors affecting mortality inequalities domestically and cross-nationally. The ambiguous role of education in explaining cross-national variation is a case in point. Education has often been pointed out as the most important social determinant in individual level studies, but cross-national studies emphasise the role of other large-scale social factors that are harder to measure at the individual level. The level of analysis is not a neutral methodological choice but might influence the results themselves. To understand these differences researchers should follow methodologies that can link contextual-level variation to individual outcomes. Multi-level research is the best – although the costliest – way to address this challenge. Our review has identified several multi-level studies as the best examples.

Our results underpin the inadequacy of proximal factors alone in explaining the unprecedented mortality crisis across Eastern Europe during the transition from socialism to capitalism. There is also a growing recognition of the importance of the sociological determinants of these proximate causes as demonstrated for example by the WHO's programme on the social determinants of health (WHO, 2014). Yet, the scientific knowledge on the social determinants, especially on the health implications of the broader political and economic context and social change is less developed. This uneven development of health research calls for an increased attention by sociologists, political scientists and political economist advancing the sociology of health and illness (White, 2009).

Our review has established a systematic list and a hierarchy of performance of the most important sociological variables associated with mortality increase in Eastern Europe. Our study has revealed the centrality of socio-economic factors in understanding cross-national variance in life expectancy without which temporal, social and regional variations in mortality cannot be fully understood. Our analysis also revealed that sociological approaches to mortality need to adapt analytical strategies (e.g. multi-level analysis) that can capture the health impact of large-scale social factors often neglected by within-country public health studies. The fields of sociology and political economy of health represent vital extensions of the biomedical and public health scholarship that could significantly expand our knowledge of the determinants of mortality.

NOTES

[1] Including countries of Eastern Europe and Former Yugoslavia.

[2] We only included articles in English to ensure that the findings can be verified and our approach can be replicated by all readers of this journal.

[3] There are several articles that were published as online first when we finished searching, and were later assigned a volume, issue and year by the journal. In these cases we use the updated publication year and volume in our references, which might result in publication dates that go beyond the search period. In Figure 2 we used the original online first publication date.

SUPPLEMENT

Table S1. Studies and their main characteristics

Article	Data Collection	Analysis	Dependent Variables	Independent Variables	Results
Álvarez-Dardet and Franco-Giraldo (2006)	Data on democracy from Freedom House; data on mortality from World Development Report (ca 2000) Gini coefficient from the World Bank (ca 2000)	Cross-country linear regression for 23 post-communist countries in 2000	Life expectancy, infant mortality, maternal mortality (2000)	Freedom House freedom ratings (1990-2000); Gini coefficient, GNP per capita	Correlation of the democratic deficit with life expectancy, infant mortality and maternal mortality.
Arinaminpathy and Dye (2010)	National data for incidence of new TB cases (of all forms) and deaths from TB in Central and Eastern Europe (1980-2007) from World Health Organization Global TB database Mortality rates are unweighted sums over all age groups. Population data from the United Nations Statistics Division As a measure of macro-economic conditions - World Bank estimates for GDP *per capita*, also available from UNSD, expressed as purchasing power parity (PPP) in international dollars and the IMF data	Cross-country linear regression for different periods for 26 Central and Eastern European countries, from 1980 to 2007	Incidence of new TB cases; deaths attributed to TB	GDP per Capita (PPP); GDP loss	Strong, linear relationship between economic losses in a major recession and TB impact.
Billingsley (2011)	The Russian Generations and Gender Survey data of a nationally representative sample of 18-79 year olds that was conducted in 2004. The supplementary Education and Employment Survey data of	Random effects cross-country panel regression for 19 post-communist countries, 1990–2003	All-cause mortality rates, deaths due to circulatory diseases, external causes (including accidents and homicide), and suicide by	Inflation, employment growth, wage growth, GDP, and the transition type (regional country	All results for men in the 40–59 and 60 years or older age groups were significant even after adjusting the model for dummy variables (e.g. basic

	a GGS subsample of 18-55 year olds in 2005. A retrospective survey was given to this subsample, which collected detailed life histories of all education and employment activity since January of the year the respondent turned 17		different age groups and gender	typology)) to which a country belongs	geographical divisions). GDP and inflation had the most consistent effects.
Bobak et al. (2016)	Original data from the prospective cohort study based on the Health Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE) project	Cox regression estimating hazard ratios (HR) based on a prospective cohort study involving 36,106 men and women aged 45–69 years	All-cause mortality, cause-specific mortality	Average daily alcohol intake, drinking frequency, drinking pattern; location, age, education; current economic activity, marital status, household asset index, subjective hardship score, smoking status	Abstainers had 30–50 per cent increased mortality risk compared to light-to-moderate drinkers. Mortality was associated with high average alcohol intake but not binge drinking, except for alcohol-related deaths in men.
Brainerd (1998)	A series of monthly cross-section household surveys conducted by the All-Russian Center for Public Opinion Research VCIOM in 1991, 1993, and 1994 on adult population of Russia aged 16+; each monthly survey comprises 3,000-4,000 randomly selected individuals in one-third of Russia's 88 regions	Cross-country linear regression for 22 transition economies, 1989-94	Male standard death rate	Reform category, liberalization, date of stabilization, country dummies, GDP, crime, expenditure on food, NR of doctors, private sector share of employment, unemployment, inflation, alcohol, share of ethnic Russians	Degree of economic reforms is correlated with mortality levels; positive and significant correlation between the increase in private sector share. Stress created by the reforms in many countries is an important factor in the mortality crisis.
Brainerd (2001)	Suicide rates and life expectancy: WHO Health for All database (June 2000); GNP per capita: World Bank (2000) World Development Indicators; employment, population, divorce rates, crime rates: Social Statistics of the Countries of the Commonwealth of Independent States (1999) and national statistical yearbooks; alcohol consumption: WHO Health for All	Fixed effects cross-country regressions using data for 22 transition economies for the 1988 -1998 period	Death rate from suicide	GNP per capita, employment, divorce, alcohol consumption, crime, life expectancy at age 65, measure of time horizons	Male suicide rates are highly sensitive to the state of the macro-economy. The steep and prolonged declines in GDP in the western countries of the former Soviet Union caused the suicide epidemic.

	database and national statistical yearbooks				
Brainerd and Cutler (2005)	Mortality data: WHO Mortality database; national statistical yearbooks Economic and social variables: WHO Health for All Database (2004); World Development Indicators (2003) Panel data: Russian Longitudinal Monitoring Survey (RLMS)	Cross-country regression for 23 transition economies of the former Soviet bloc for 2004	Log change in mortality rates, change in the mortality rate from external causes, change in the mortality rate due to cardiovascular disease for men aged 25-64,	Efficacy of the medical system, alcohol consumption, fruit and vegetable consumption, stress	Up to 25 per cent increase in mortality in Russia is due to increased alcohol use, while other 25 per cent of the mortality increase results from the stress of transition (countries where expectations got worse had increases in mortality; changes in the minimum wage are negatively and significantly related to changes in mortality).
Budhdeo et al. (2015)	Socioeconomic data (1995-2010): World Bank's Development Indicators and Global Development Finance 2013 Government debt as a percentage of GDP: IMF Historical Public Debt Database Mortality data: Institute for Health Metrics and Evaluation	Fixed effects multivariate cross-country regression for the 27 countries of the EU in 1995–2010	Neonatal mortality, post-neonatal mortality, one to five years of age mortality, under five years of age mortality, adult male mortality, adult female mortality	Government spending on health care	A 1 per cent decrease in government healthcare spending was associated with significant increase in all mortality metrics, the relationship is particularly strong for adult male mortality.
Bye (2008)	Annual statistics on homicide rates and per capita alcohol consumption: Belarus (1970-2004), Bulgaria (1964-2003), former Czechoslovakia (1953-1989), Hungary (1961-2002), Poland (1959-2002), and Russia (1959-1998) from WHO statistics Annual sales statistics in litres of pure alcohol per inhabitant aged 15+ were used as a proxy for alcohol consumption: WHO, Brewers Association of Canada, and World Drink Trends	Linear and semi-logarithmic time-series regressions for six countries in different periods	Homicide rates	Annual sales statistics in litres of pure alcohol per inhabitant; hazardous drinking pattern score.	Annual changes in alcohol consumption are positively associated with homicide rates. The estimates were stronger in countries with a more detrimental drinking pattern.

Carlson and Hoffmann (2011)	Mortality data: Human Mortality Database Other data: International Labour Organization Yearbooks and ILO web pages, Eurostat web pages, U.N. Statistical Yearbooks	Fixed-effects panel regression for countries at Europe's periphery between 1960 and 2005	Death rates for men in the working ages	Socialist/market capitalist dichotomy; shares of primary, secondary and tertiary sectors in employment	Forced rapid expansion of heavy industry and restrictions on the service sector lead to male workers leaving agriculture. The magnitude of structural labour force changes across countries correlates with death rates. No control variables.
Cornia and Paniccià (1996)	Data from Council of Europe (1993), TRANSMONEE Database, National Statistics	Pooled cross-country time-series regression for 13 Eastern European countries for 1989-94	Male mortality, crude death rate	Economic stress index (average real wage index, employment rate, inflation rate), index of real health expenditure, industrial production	None of the traditional risk factors (environmental degradation, smoking, diet, and alcohol consumption) explains the recent increase in mortality. The Economic Stress Indicator (as well as the health expenditure index) is positively correlated with mortality.
Ferrario et al. (2014)	Data from the MORGAM Project (http://www.thl.fi/morgam), pooling a number of population-based cohorts from several European countries	Regression based risk analysis for 68 455 40–64-year-old men and women from 47 prospective population-based cohorts including 3 Eastern European countries	CVD mortality	SCORE index, education	Even after adjusting for the score index that combines traditional CVD risk factors educational class remained a strong and statistically significant predictor of CVD mortality.
Gerry (2012)	Data from UNICEF monitoring transition in central and eastern Europe database	Cross country panel regression for 24 countries for the period 1989-2002	Mortality	Mass privatization, GDP per capita, price liberalization, foreign exchange rate, democracy, war, dependency ratio, higher education, urban percentage	Rapid mass privatisation is not a „crucial determinant" of male mortality fluctuations in the post-communist world once dynamic features are considered through accounting for the lag variables.
Huisman and Oldehinkel (2009)	Standardised Mortality Rates: World Health Information database	Spearman rank correlations for 35 developed countries, including 16 former	Self-inflicted injury and violence-related	Income inequality, GDP per capita, trust, belonging, voluntary	In former communist countries, income inequality is correlated with violence-related, but not

	Income inequality: the United Nations Development Report Social values: printed summary measures of the European or World Values Survey for 2000	communist countries around 2000	Mortality	work, confidence, concern, helping	natural deaths. Only in former communist countries did adjusting for the level of preparedness to help others (as a measure for social capital) reduce the associations.
King et al. (2009)	A panel using the January 2005 mortality data from the WHO Mortality Database and the January 2006 European Health for All Mortality Database Economic and social variables: the World Bank's World Development Indicators (2005), the European Bank for Reconstruction and Development's (EBRD) Transition Report (2003), the TransMONEE database (2003), and the World Bank/EBRD Business Environment and Enterprise Performance Survey (1999)	Fixed effects cross country panel regression involving 26 transition countries	Life expectancy, male life expectancy, suicide mortality, ischaemic heart disease, alcohol related mortality	Mass privatization, GDP per capita, liberalization, political freedom, education, dependency ratio, urbanization, alcohol, protein- fruit- and vegetable availability, medical infrastructure	Mass privatization is significantly related to mortality accounting for 0.86-5.14 years. The combined effect of liberalization and mass privatization strongly reduces life expectancy by 2.8 years. Political freedom increases life expectancy, urbanization decreases it.
Kölves et al. (2013)	European Mortality Database WHO (2010a) Data on doctors: European Health for All Database (WHO, 2010) Gini, female labour force participation: world bank (2010) Divorce: UN Statistics division	Cross-sectional time-series and panel data fixed-effects regression for 13 countries of the former Soviet bloc between 1990 and 2008	Gender-specific age-adjusted suicide rates	Unemployment, GDP, divorce rate, birth rate, the Gini index, female labour force participation, alcohol consumption, general practitioners per 100,000 people	Suicide was related to socioeconomic disruptions, GDP per capita and unemployment. Male suicide rates were not associated with alcohol consumption. Gini index had a significant effect on female suicide only. There was a negative link between the number of GPs per 100,000 people and male suicide.
Lachenmeier et al. (2014)	All data from: Global Information System on Alcohol and Health (GISAH) of the World Health Organization	Cross country linear regression globally where data was available including post-communist countries in 2005	Liver cirrhosis age-standardized mortality rate .	Levels of unrecorded and total consumption, prevalence of heavy drinking	Unrecorded alcohol consumption causes liver cirrhosis mortality rates, but the effect disappears when the data are adjusted for the

					prevalence of heavy episodic drinking.
Landberg (2008)	WHO Mortality Database General population surveys from several countries	Cross country time series analysis for 7 former communist countries for the post-war period	Annual suicide mortality rates	Per capita alcohol consumption	The effects on the overall population were largest in the spirits countries, and were somewhat smaller in the non-spirits countries. The estimates for males were larger than for females.
Landberg (2010)	Mesle et al. 2003 dataset GDR data: Federal Statistics Institute of Germany Belarus data: Ministry of Statistics of Belarus Poland suicide data: Central Statistics Office of Poland	Auto regressive integrated moving average time-series modelling for 6 Eastern European countries during the post-war period	Injury mortality rates	Per capita alcohol consumption	The results suggest that changes in per capita consumption have an impact on injury mortality in these countries, but the strength of the association tends to be stronger in countries where intoxication-oriented drinking is more common.
Mackenbach et al. (2013)	Quality of Government dataset Life expectancy at birth, by gender, for the period 1960e2008 from the Human Lifetable Database Mortality: International Mortality Database of the National Center for Health Statistics of the Centers for Disease Control & World Health Organization Health for All Database	Pooled cross-sectional time-series regression with country-fixed effects for the periods 1960-1990 and 1987-2008	Life expectancy at birth, age-standardized total and cause-specific mortality rates	Current democracy, cumulative democracy (both measured by the Polity 2 index), GDP, education, independence, armed conflict	In the period 1960-1990 current democracy was more strongly associated with higher life expectancy than cumulative democracy. In the period 1987-2008 however, current democracy was associated with lower and cumulative democracy with higher life expectancy, particularly among men.
Mackenbach and Looman (2013)	Data on national income per head of population were extracted from a dataset originally compiled by Maddison Life expectancy: Human Lifetable Database & WHO Health for All; United Nations Demographic Yearbook Historical	Cross country linear regression for 25 European countries including in the period 1955–1989	All-cause mortality	Cause-specific mortality, democracy (polity 2 index), GDP per capita in PPP	After 1960, dispersion in all-cause mortality in Europe as a whole increased. Divergence in Central and Eastern Europe is explained from stagnating trends in average income and an increasing mortality

	Supplement, 1948-1997; Mesle Vallin Database				disadvantage due to democratic deficit.
Makinen (2000)	Suicide data: WHO, WHO yearbooks (World Health Statistics Annual), Health For All. These were completed by data from the pioneering works of VaÈrnik, Wasserman and others	Cross-country linear regression for 27 post-communist countries for 1985, 1989 and 1993	Rate of certain suicide types	Changes in per capita alcohol consumption, economic situation, the level of general pathogenic social stress, democratic change, and societal (dis)organization	No relation with suicide. The correlation between homicide and suicide, significantly positive in the total material declined between 1984 and 1989 to reappear in 1994. Alcohol consumption is only significant for Hungary, East Germany and Croatia.
Marí-Dell'Olmo et al. (2015)	Original data from a cross-sectional ecological study as part of the INEQ-CITIES project	Hierarchical Bayesian spatial model based on a cross-sectional study involving 15 European cities including 3 Central Eastern European	Cause-specific mortality by gender	Independent: socioeconomic deprivation index	Socioeconomic inequalities for most causes of mortality studied, although these inequalities differed markedly between cities, being more pronounced in Northern and Central-Eastern Europe.
Marmot and Bobak (2000)	WHO Health for All	Cross country linear regression for 7 post-communist countries	All-cause mortality	Perceived control	Perceived control was strongly correlated with all-cause mortality.
Minagawa (2013)	Human Mortality Database and WHO European Values Study	Cross country regression linear regression for 28 former communist countries in Eastern Europe from 1989 to 2006	Suicide rates by gender	EBRD transition indicators, GDP growth rate, inflation rate, unemployment rate, conflict dummy, percentage of Muslims and Catholics, membership in the Soviet Union.	Higher levels of structural change lead to increases in suicide death rates during the first five years of the transition. Yet continued reforms were associated with reductions in suicide in more recent years. The shock therapy had negative consequences on population health.
Muntaner et al. (2012)	International Labour Organization's (ILO) Key Indicators of Labour Markets (KILM) database	Cross-country correlation between labour market types and health outcomes for 113 countries including	Adult mortality, healthy life expectancy, infant mortality, maternal mortality, and years of life	Labour market inequality, labour market poverty.	Labour market poverty and population health is significantly correlated in low- and middle-income countries.

	World Health Organization's Statistical Information System (WHOSIS)	15 post-communist countries	lost to communicable and non-communicable diseases		The association between labour market inequality and health indicators is significant only in low-income countries.
Puddu et al. (2011)	Original data from a survey and a follow up	Prospective cohort study of 6,554 men aged 40-59 around 1960 in Northern, Southern and Eastern European areas of the seven countries	Mortality risk	A series of traditional risk factors, socio-economic status	In a pooled model besides traditional risk factors socio-economic status was also significantly associated with mortality.
Ramstedt (2007)	WHO Mortality Data Base Annual per capital alcohol consumption: WHO, World Drink Trends and Brewers Association of Canada; data from Treml and Nemtsov for Russia	Cross country time–series analysis nine eastern European countries	Liver cirrhosis mortality	Per capita alcohol consumption	Cirrhosis mortality rates were related significantly to population drinking in eight of nine eastern European countries and both relative and absolute alcohol effects laid within the range of previous western European estimates. No control variables.
Sengoelge et al. (2013)	WHO Mortality Database The European Statistical Office Eurostat and the European Union Income, Social Inclusion and Living Conditions Database (EU SILC)	Cross country linear regression for 26 European countries for 2006	Child mortality	Gross domestic product (GDP), income inequality, housing and neighbourhood conditions.	Country-level income inequality and GDP is associated with child mortality for all outcomes. Housing strain, but not neighbourhood strain affects all child mortality outcomes.
Stefler et al. (2017)	Original data from the prospective cohort study based on the Health Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE) project	Cox regression estimating proportional hazard ratios in a prospective cohort study based on a total of 19,333 male and female participants in 3 post-communist countries	All-cause mortality	Mediterranean diet-score, age, sex, cohort, education, household amenities score, marital status, smoking, physical activity, total energy intake, vitamin supplement intake.	One standard deviation (SD) increase in the MDS (equivalent to 2.2 point increase in the score) is inversely associated with death from all causes (HR, 95 per cent CI 0.93, 0.88–0.98) and CVD (0.90, 0.81–0.99) even after multivariable adjustment.
Stefler et al. (2014)	Original data from the prospective cohort study based on the Health Alcohol and	Cox regression estimating proportional hazard ratios	All-cause and cause-specific mortality	Healthy diet indicator (HDI), age, sex, cohort,	After adjusting for covariates, HDI was inversely associated

	Psychosocial Factors in Eastern Europe (HAPIEE) project	in a prospective cohort study based on a total of 18 559 adult participants in 3 post-communist countries		education, household amenities score, marital status, smoking, physical activity, total energy intake, vitamin supplement intake.	with cardiovascular disease (CVD) and coronary heart disease (CHD) mortality, but not with other cause-specific and all-cause mortality in the pooled sample.
Stefler et al. (2016)	Original data from the prospective cohort study based on the Health Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE) project	Cox regression estimating proportional hazard ratios in a prospective cohort study based on a total of 19,333 male and female participants in 3 post-communist countries	All-cause and cause-specific mortality	Fruit and vegetable intake, age, sex, cohort, education, household amenities score, marital status, smoking, physical activity, total energy intake, vitamin supplement intake.	After multivariable adjustment, significant inverse association is seen between cohort-specific quartiles of F&V intake and stroke mortality. Total mortality has interaction (p ¼ 0.008) between food and vegetable intake and smoking.
Stepaniak et al. (2015)	Original data from the prospective cohort study based on the Health Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE) project	Cox regression estimating proportional hazard ratios in a prospective cohort study based on a total of 28,945 men and women aged 45–69 in 3 post-communist countries	All-cause, cardiovascular (CVD) disease and cancer mortality	Vitamin C, Vitamin E and beta-carotene consumption, age, sex, education, smoking, alcohol consumption, health status	In multivariable-adjusted analyses, there were no clear inverse associations between antioxidant vitamin intakes and mortality, although in some groups, several hazard ratios (HRs) were significant. No strong, dose–response evidence for protective effects of antioxidant vitamin intake.
Stuckler et al. (2010)	OECD Social Expenditure Data, 2008 WHO European health for all database	Fixed effects cross-country regression for 15 European Union countries including 4 post-communist countries for 1980-2005	Standardized all-cause mortality	Social welfare spending, GDP per capita, health care spending	Social welfare spending is associated with mortality. Each additional $100 increase in social welfare spending has been associated with a 1.19 per cent drop in all-cause mortality. Seven-fold greater reduction in mortality due to welfare spending compared to GDP.
Stuckler et al. (2008)	Health outcomes data: WHO WHO Global Tuberculosis Database	Fixed effects, pooled OLS and random effects cross-country panel regression	Tuberculosis incidence, prevalence, and mortality	Participation in an IMF program, GDP; democratization, military	Participating in an IMF program was associated with increased tuberculosis incidence,

	HIV and AIDS prevalence data were obtained from the WHO/UNAIDS Global HIV database IMF data were from the World Bank World Development Indicators (WDI) WHO European Health For All Database 2007; WDI, and UNICEF TransMONEE database	for 21 post-communist countries		or ethnic conflict, urbanization, dependency ratios, education	prevalence, and mortality rates by 13.9, 13.2, and 16.6 per cents, respectively. Each additional year of participation in an IMF program was associated with increased tuberculosis mortality rates by 4.1 per cent.
Stuckler, King, et al. (2009)	Data from UNICEF monitoring transition in central and eastern Europe database	Cross-country panel regression for 25 post-communist countries for the period 1989-2002	Age-standardised mortality rates in working-age men.	Mass privatization, liberalisation, GDP, initial country conditions, democratization, inflation, military or ethnic conflict, urbanization, dependency ratios, education	Mass privatisation programmes were associated with an increase in short-term adult male mortality rates of 12.8 per cent, with similar results for the alternative privatisation indices from the European Bank for Reconstruction and Development.
Vandenheede et al. (2014)	Original data from the prospective cohort study based on the Health Alcohol and Psychosocial Factors in Eastern Europe (HAPIEE) project	Cox regression estimating proportional hazard ratios in Prospective population-based cohort involving 35 992 persons aged 45–69 in 4 post-communist countries	All-cause mortality	Socioeconomic position (education, difficulty buying food and household amenities)	Mortality inequalities by the three socioeconomic position indicators were observed in all samples. The magnitude of inequalities varied according to gender, country and SEP measure.
Vikhireva, Broda, et al. (2014)	Data from two international multi-centre studies – WHO MONICA (MONItoring of trends and determinants in CArdiovascular disease) Project; HAPIEE (Health, Alcohol, and Psychosocial factors In Eastern Europe) study	Cross-sectional regression based on two prospective cohort studies in 4 Eastern European Countries involving 14,696 + 19,900 participants	CVD mortality	SCORE index (traditional risk factors), level of education	The high-risk SCORE at baseline strongly and significantly predicted fatal CVD both before and after adjustment for education and marital status. After controlling for SCORE, lower education and non-married status were associated with CVD mortality.

| Vikhireva, Kubinova, et al. (2014) | HAPIEE (Health, Alcohol, and Psychosocial factors In Eastern Europe) study

Mortality data: national (the Czech Republic) and local (Poland and Russia) registers | Cox regression based on a prospective cohort study in 4 Eastern European Countries involving 8927 persons | CVD mortality | SCORE index (traditional risk factors), level of hazardous drinking | After controlling for the high-risk SCORE, binge drinking and problem drinking were inconsistently associated with fatal CVD. Extending the high-risk SCORE by hazardous drinking failed to improve prognostic performance. |

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