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Cultural values and population health: a quantitative analysis of variations in cultural values, health behaviours and health outcomes among 42 European countries



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ABSTRACT

Variations in 'culture' are often invoked to explain cross-national variations in health, but formal analyses of this relation are scarce. We studied the relation between three sets of cultural values and a wide range of health behaviours and health outcomes in Europe.

Cultural values were measured according to Inglehart's two, Hofstede's six, and Schwartz's seven dimensions. Data on individual and collective health behaviours (30 indicators of fertility-related behaviours, adult lifestyles, use of preventive services, prevention policies, health care policies, and environmental policies) and health outcomes (35 indicators of general health and of specific health problems relating to fertility, adult lifestyles, prevention, health care, and violence) in 42 European countries around the year 2010 were extracted from harmonized international data sources. Multivariate regression analysis was used to relate health behaviours to value orientations, controlling for socio-economic confounders.

In univariate analyses, all scales are related to health behaviours and most scales are related to health outcomes, but in multivariate analyses Inglehart's 'self-expression' (versus 'survival') scale has by far the largest number of statistically significant associations. Countries with higher scores on 'self-expression' have better outcomes on 16 out of 30 health behaviours and on 19 out of 35 health indicators, and variations on this scale explain up to 26% of the variance in these outcomes in Europe. In mediation analyses the associations between cultural values and health outcomes are partly explained by differences in health behaviours. Variations in cultural values also appear to account for some of the striking variations in health behaviours between neighbouring countries in Europe (Sweden and Denmark, the Netherlands and Belgium, the Czech Republic and Slovakia, and Estonia and Latvia).

This study is the first to provide systematic and coherent empirical evidence that differences between European countries in health behaviours and health outcomes may partly be determined by variations in culture. Paradoxically, a shift away from traditional 'survival' values seems to promote behaviours that increase longevity in high income countries.

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1. Introduction

1.1. Variations in health between European countries

Europe is a subcontinent of great diversity, not only in terms of language, religion and other aspects of culture, but also in terms of population health. At the start of the 21st century, life expectancy at birth in Europe is more unequal than it has been for decades (Mackenbach, 2013a), and enormous variations between countries have been documented on all available measures of population health, including mortality from specific conditions, incidence of

infectious diseases and cancer, and self-reported health and disability (Mackenbach, 2013b; Marmot et al., 2012; Mladovsky et al., 2009).

The main health divide within Europe is between East and West. Over the past decades, the countries of Western Europe have experienced sustained improvements in life expectancy, with a gradual convergence of all countries towards high values. By contrast, the countries in Central and Eastern Europe have experienced stagnation and sometimes even falls in life expectancy, both before and after the fall of the Soviet empire (Leon, 2011; McMichael et al., 2004). Although many specific health indicators also vary along an East–West axis, some other patterns can be noted as well, such as the low levels of mortality from ischaemic heart disease in Southern Europe (Mackenbach and McKee, 2013b).

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The explanation of these patterns of variation is undoubtedly complex, and is likely to include a wide range of factors. East–West patterns may be related to recent political history, when countries in Central and Eastern Europe lived for decades under autocratic, communist regimes (Mackenbach, 2013c, 2013a; McKee and Nolte, 2004). More specific explanations are likely to be involved as well, such as variations in economic conditions, health-related behaviours, access to health care, and effectiveness of health policies (Bobak et al., 2007; Mackenbach and McKee, 2013a; Nolte et al., 2004; Stuckler et al., 2009). However, the generic and long-standing character of these variations in health (life expectancy was already lower in Central & Eastern Europe before the second World War (Kirk, 1946; Mackenbach, 2013c)) suggests that there may also be some historically more persistent explanations, such as cultural differences.

1.2. Variations in culture between European countries

Despite a certain degree of cultural unity, however defined (Davies, 1996), and despite recent attempts at economic and political unification, Europe is a culturally diverse subcontinent. The concept of culture will be used here in its sociological definition of “the ways of thinking, the ways of acting, and the material objects that together shape a people's way of life” (Macicioni and Gerber, 2011). Variations within Europe have roughly been summarized as occurring along two ‘fault-lines’. The first separates East from West, e.g., Orthodox from Catholic Christianity, and late from early industrializing societies. The second ‘fault line’, equally fuzzy, divides South from North, e.g., Romance from Germanic languages, and Catholicism from Protestantism (Arts et al., 2003).

Variations in culture may have a profound impact on health, for example through variations in health-related behaviours (Payer, 1996). Individuals in different European societies differ in, among other things, their fertility patterns, lifestyles, and rates of participation in preventive programs, and some of these variations may well be due to variations in attitudes, norms or other elements of culture. The same applies to variations in what will be denoted here as “collective health behaviour”, in the form of national policies in the areas of prevention, health care, and the environment (Mackenbach, 2013b). However, although ‘culture’ is an implicit or explicit part of many theories of the determinants of health behaviour (Glanz et al., 2002), it is often treated as a background variable that eludes measurement, so that quantitative evidence of the impact of culture on between-country variations in health is extremely scarce.

One area of cross-cultural research where measurement issues have been tackled effectively, and where quantitative data on between-country variations in culture have become available, even abundantly, is that of cultural values. ‘Values’ are broad preferences concerning appropriate courses of action that the members of a society share, and that underlie their norms of behaviour in specific situations (Nolan and Lenski, 2004). Over the past decades, several approaches to operationalizing cultural values have evolved, each with its own theoretical rationale and its own set of survey-based indicators.

1.3. Cultural values and their measurement

One widely known approach has been developed by Ronald Inglehart, a political scientist from the United States who developed the theory of ‘post-materialism’ (Inglehart, 1977). In respondents’ answers to survey questions on their beliefs and attitudes, he discovered an intergenerational shift in the cultural values of the populations of advanced industrial societies, from religious to secular, and from survival-oriented to ‘well-being’ or ‘self-expression’-oriented

values (Inglehart, 1990). Inglehart has proposed to measure countries’ cultural value orientation with two indicators, each based on five survey questions, capturing a ‘traditional’ to ‘secular-rational’ and a ‘survival’ versus ‘well-being’ or ‘self-expression’ axis, respectively (Inglehart, 1997; Inglehart and Baker, 2000; Inglehart and Welzel, 2005). These two dimensions have since been confirmed, with small variations, in several other analyses (Hagenaars et al., 2003), and have allowed large-scale measurement of variations and changes in cultural values in many countries, particularly in the context of the World Values Study and the European Values Survey.

Another approach has been developed by Geert Hofstede, a Dutch sociologist who, on the basis of factor analysis of attitude surveys among employees of the IBM company in 50 countries, initially identified 4 dimensions of national cultures: ‘power distance’ (extent to which the less powerful accept that power is distributed unequally), ‘individualism’ (emphasis on personal achievements and individual rights), ‘uncertainty avoidance’ (tendency to cope with anxiety by minimizing uncertainty and ambiguity), and ‘masculinity’ (strict division of emotional roles between the genders and emphasis on competitiveness and power) (Hofstede, 1980, 2001). These results were later confirmed in other populations, but analyses of data from national values surveys have revealed two additional dimensions: ‘long-term orientation’ (importance attached to the future and emphasis on persistence and saving) (Hofstede, 2001; Minkov, 2007) and ‘indulgence’ (emphasis on gratification of natural human drives related to enjoying life) (Hofstede et al., 2010). The latter scale emerged from an analysis of Inglehart’s ‘self-expression’ dimension, which appeared to contain two different subdimensions, one corresponding to Hofstede’s ‘individualism’, the other to this newly coined ‘indulgence’ (Minkov, 2009). Important variations between countries, also within Europe, on Hofstede’s dimensions have been documented (Hofstede, 1980, 2001; Hofstede et al., 2010).

A third approach is that developed by Shalom Schwartz, an American-Israeli social psychologist. On the basis of a theory of basic human needs, and of surveys measuring the priority attached to items within each of these needs domains, he proposed seven cultural orientations. These are ‘affective autonomy’ (emphasis on the desirability of individuals independently pursuing pleasure and other positive experiences), ‘intellectual autonomy’ (desirability of individuals independently pursuing their own ideas), ‘embeddedness’ (or conservatism; importance of maintaining the social order), ‘egalitarianism’ (importance of transcending self-interest and promoting the welfare of others), ‘hierarchy’ (legitimacy of an unequal distribution of power and resources), ‘harmony’ (fitting harmoniously into the environment), and ‘mastery’ (getting ahead through active self-assertion) (Schwartz, 1994, 1999, 2006). Originally measured in relatively small and restricted samples, particularly students and teachers, questions capturing these dimensions are now also included in the European Social Survey (Davidov et al., 2008). Applications have documented important cross-national variations, also within Europe (Schwartz, 1999, 2006; Schwartz and Bardi, 1997).

Although these three approaches have different theoretical rationales, the dimensions overlap both conceptually and empirically (Gouveia and Ros, 2000; Inglehart and Oyserman, 2004; Schwartz, 2006). This also emerges from Fig. 1 which summarizes the geographical distribution of countries’ scores on these variables within Europe, on the basis of their associations with longitude and latitude. Some dimensions, such as Inglehart’s ‘self-expression’ and Schwartz’s ‘intellectual’ and ‘affective autonomy’ cluster closely together, all having higher values in the West, with Hofstede’s ‘individualism’ and ‘indulgence’ not far away.

On the other hand, many others have more distinct geographical patterns, implying that there may be scope for a comparative analysis of their impact on health behaviours. Several cultural values display either a clear North–South pattern (such as the ‘secular-rational’,

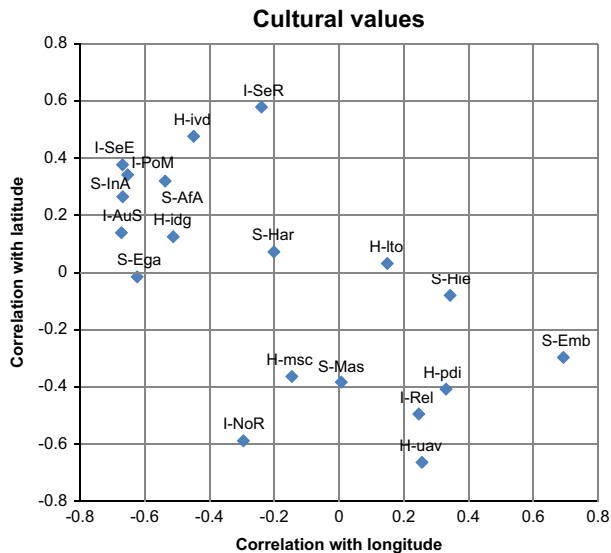


Fig. 1. Correlation between cultural values and geographical location of countries in Europe. Longitude (East–West position) and latitude (North–South position) of countries were based on the geographical coordinates of their capitals (source: Wikipedia). If a cultural value dimension has a positive correlation with longitude, scores are higher in countries with more Easterly positions. If a cultural dimension has a positive correlation with latitude, scores are higher in countries with more Northerly positions. Abbreviations: I-SeE = self-expression; I-SeR = secular-rational; I-PoM = post-materialism; I-Rel = religiosity; I-AuS = autonomy/socioliberalism; I-NoR = normative/religious; H-pdi = power distance; H-ivd = individualism; H-msc = masculinity; H-uav = uncertainty avoidance; H-Itto = longterm orientation; H-Idg = indulgence; S-AfA = affective autonomy; S-InA = intellectual autonomy; S-Emb = embeddedness; S-Ega = egalitarianism; S-Hie = hierarchy; S-Har = harmony; S-Mas = mastery.

‘normative/religious’, and ‘uncertainty avoidance’ scales), or a clear West–East pattern (such as ‘embeddedness’ and ‘egalitarianism’). Some other values escape a simple geographical pattern, as in the case of ‘masculinity’, ‘long-term orientation’, and ‘mastery’.

1.4. Hypotheses and study objectives

Empirical studies of the relation between cultural values and health-related variables are scarce, but national scores on ‘self-expression’ and related scales like ‘individualism’, ‘indulgence’ and ‘autonomy’ have on occasion been found to be associated with better self-assessed health, higher life expectancy, greater happiness, lower cause-specific mortality, extraversion, modern consumer behaviour, sports participation and other positive health outcomes (Hofstede et al., 2010; Hofstede and McCrae, 2004; Mackenbach and McKee, 2013a; Matsumoto and Fletcher, 1996; Minkov, 2009), perhaps through an effect on citizens’ tendency to invest in their personal well-being, or through an effect on levels of democracy, health care spending and other aspects of the functioning of public institutions (Hofstede et al., 2010; Inglehart and Welzel, 2005). We therefore expect higher average scores on these scales to be associated, over-all, with better health behaviours and better health outcomes.

We also expect average scores on the ‘secular-rational’ and ‘autonomy’ scales to be associated with better health behaviours and better health outcomes, through greater individual and collective reliance on modern scientific thought instead of tradition (and a reverse effect for ‘embeddedness’). On the other hand, ‘uncertainty avoidance’ and ‘power distance’ have previously been found to be associated with more unfavourable health outcomes, such as worse self-assessed health, higher rates of suicide, higher use of antibiotics, and less willingness to donate blood (Arrindell et al., 1997; de Kort et al., 2010; Deschepper et al., 2008; Hofstede et al., 2010), perhaps through higher levels of individual anxiety (in the case of ‘uncertainty avoidance’) or less effective functioning

of health care professionals and other public institutions (in the case of ‘power distance’) (Hofstede et al., 2010). The same may, by analogy, apply to the ‘hierarchy’ and ‘egalitarianism’ scales. For the other scales it is more difficult to derive testable predictions.

The main objective of the study reported in this paper then is to assess the explanatory power of these three sets of cultural values for variations between European countries in a wide range of health behaviours and health outcomes. We will also evaluate whether the associations of cultural values and health outcomes are mediated by variations in specific health behaviours.

Finally, after having determined the role of cultural values in the full range of countries with available data, we will further test their explanatory power by comparing the value orientations of neighbouring countries, which, despite being similar in many respects, including national income, have very different levels of health behaviour: Sweden and Denmark, the Netherlands and Belgium, the Czech Republic and Slovakia, and Estonia and Latvia (Mackenbach, 2013b; Mackenbach and McKee, 2013a).

2. Data and methods

2.1. Data (independent variables)

Data on Inglehart’s ‘self-expression’ and ‘secular-rational’ scales come from the 2006 or most recent waves of the World Values Study, and were extracted from the Quality of Government Dataset (Teorell et al., 2011) (<http://www.qog.pol.gu.se/data/>). We also used two alternative operationalizations. The first is a set of two indices calculated from respondent answers on World Values Study questions that predate the two dimensions currently in use, and that were designed to directly measure ‘post-materialism’ and ‘religiosity’, respectively. The second is a version developed by Hagenaars on the basis of a principal components analysis of 40 values-related indices from the European Value Surveys of 1999/2000. The first two components were labelled ‘autonomy/socioliberalism’ and ‘normative-religious’, and are conceptually similar to Inglehart’s ‘self-expression’ and (reversed) ‘secular-rational’ scales, respectively (Hagenaars et al., 2003).

Data on Hofstede’s value dimensions were collected in the International Business Machines (IBM) attitude surveys (held around 1970; first four dimensions) and in the World Values Survey (1990–2010; last two dimensions). We downloaded Hofstede’s set of authorized national values, partly based on more recent replications that showed stability over time in national rankings, from his website (<http://www.geerthofstede.nl/research-vsm>). Data on Schwartz’s cultural orientations were collected in surveys among students and teachers in urban areas of each country, and relate to various years between 1988 and 2007, centring around 1990, and kindly made available to us by Schwartz. Results for students and teachers were averaged, and have been shown to correlate well with estimates obtained in whole population samples through the European Social Survey (Schwartz, 2006).

Definitions and data sources for cultural values are given in Box 1, and country values are given in Web Appendix Table A1a. Correlations between value dimensions are given in Web Appendix Table A2.

We considered as potential confounders country characteristics that may have an independent effect on health behaviours or health outcomes, and may also affect cultural values. The main candidates for this are indicators of socioeconomic development such as national income and urbanization. These may affect health behaviours or health outcomes in various ways not involving value orientations, e.g. through access to consumer products like modern contraception, tobacco, or cars fitted with seat belts, or through access to public services like immunization programs, health care services, and sewage systems. At the same time,

Box 1—Definitions and sources of variables used in the analysis

(a) Cultural values					
<i>Cultural values</i>	<i>Description</i>	<i>Measurement units</i>	<i>Year</i>	<i>Data source</i>	<i>Reference</i>
<u>Inglehart</u>					
Self-expression	Adherence to self-expression instead of survival values	Principal components factor index, based on 5 variables	2006 or most recent	World Values Survey (through Quality of Government Dataset)	Inglehart & Baker 200
Secular-rational	Adherence to secular-rational instead of traditional values	Principal components factor index, based on 5 variables	2006 or most recent	World Values Survey (through Quality of Government Dataset)	Inglehart & Baker 200
Post-materialism	Number of postmaterialist items given priority	0-5 scale, based on 5 items	2006 or most recent	World Values Survey (through Quality of Government Dataset)	Inglehart
Religiosity	Adherence to religious beliefs and practices	0-100 scale, based on 6 variables	2006 or most recent	World Values Survey (through Quality of Government Dataset)	Inglehart & Norris 20
Autonomy/socioliberalism	Adherence to personal autonomy	Principal components factor index, based on 40 variables	1999/2000	European Values Study (through Loek Halman)	Hagenaars et al. 2003
Normative/religious	Adherence to strict moral standards	Principal components factor index, based on 40 variables	1999/2000	European Values Study (through Loek Halman)	Hagenaars et al. 2003
<u>Hofstede</u>					
Power distance	Extent to which the less powerful accept that power is distributed unequally	0-100 scale, based on weighted sum of scores on 3 items	1967-1973	IBM surveys (through Hofstede website)	Hofstede et al 2001
Individualism	Extent to which ties between individuals are loose (opposite of collectivism)	0-100 scale, based on factor scores derived from 14 items	1967-1973	IBM surveys (through Hofstede website)	Hofstede et al 2001
Masculinity	Extent to which emotional gender roles are clearly distinct (opposite of femininity)	0-100 scale, based on factor scores derived from 14 items	1967-1973	IBM surveys (through Hofstede website)	Hofstede et al 2001
Uncertainty avoidance	Extent to which people feel threatened by unknown situations	0-100 scale, based on weighted sum of scores on 3 items	1967-1973	IBM surveys (through Hofstede website)	Hofstede et al 2001
Longterm orientation	Extent to which pragmatic virtues oriented toward future rewards are fostered	0-100 scale, based on factor scores derived from 3 items	1990-2010	World Values Survey (through Hofstede website)	Hofstede et al 2010
Indulgence	Extent to which gratification of natural desires related to enjoying life is allowed (opposite of restraint)	0-100 scale, based on factor scores derived from 3 items	1990-2010	World Values Survey (through Hofstede website)	Hofstede et al 2010
<u>Schwartz</u>					
Affective autonomy	Emphasis on desirability of individuals independently pursuing pleasure	0-7 scale, based on 5 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2004
Intellectual autonomy	Emphasis on desirability of individuals independently pursuing their own ideas	0-7 scale, based on 4 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2005
Embeddedness	Emphasis on importance of maintaining the social order	0-7 scale, based on 14 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2006
Egalitarianism	Emphasis on importance of transcending self-interest and promoting the welfare of others	0-7 scale, based on 6 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2007
Hierarchy	Emphasis on legitimacy of an unequal distribution of power and resources	0-7 scale, based on 4 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2008
Harmony	Emphasis on importance of fitting harmoniously into the environment	0-7 scale, based on 4 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2009
Mastery	Emphasis on importance of getting ahead through active self-assertion	0-7 scale, based on 8 items, relative to mean score of country on all items	1988-2007	Schwartz Value survey among students and teachers	Schwartz 2010

(b) Health behaviours
(a) Health behaviours

Health behaviours	Description	Measurement units	Year	Data source	Reference
Fertility-related behaviours					
Abortions	Abortions as a fraction of all live births	per 1000	2010 or latest	WHO Health for All Database 2013	n.a.
Teenage pregnancies	Births to mothers under 20 years of age, as a fraction of all live births	%	2010 or latest	WHO Health for All Database 2013	n.a.
Older mothers	Births to mothers 35 years or older, as a fraction of all live births	%	2010 or latest	WHO Health for All Database 2013	n.a.
Breast feeding	Infants breastfed at 6 months of age, as fraction of all infants	%	2010 or latest	WHO Health for All Database 2013	n.a.
Adult lifestyles					
Smoking (men)	Regular daily male smokers, age 15+, as fraction of all men	%	2010 or latest	WHO Health for All Database 2013	n.a.
Smoking (women)	Regular daily female smokers, age 15+, as fraction of all women	%	2010 or latest	WHO Health for All Database 2013	n.a.
Alcohol consumption	Sales of pure alcohol, per head of population age 15+	litres per capita	2009 or latest	WHO Health for All Database 2013	n.a.
Spirits consumption	Sales of spirits in pure alcohol, per head of population age 15+	litres per capita	2009 or latest	WHO Health for All Database 2013	n.a.
Obesity (men)	Body Mass Index 30 or higher among men, as fraction of all men	%	2008	WHO Global Health Observatory	n.a.
Obesity (women)	Body Mass Index 30 or higher among women, as fraction of all women	%	2008	WHO Global Health Observatory	n.a.
Use of preventive services					
Measles immunization	Children vaccinated against measles, as fraction of all children	%	2010 or latest	WHO Health for All Database 2013	n.a.
Haemophilus immunization	Infants vaccinated against invasive disease due to Haemophilus influenzae type b, as fraction of all infants	%	2010 or latest	WHO Health for All Database 2013	n.a.
Influenza vaccination	Elderly immunized against influenza, as fraction of all elderly	%	2010 or latest	VENICE and OECD Health Data 2012	OECD 2012
Breast cancer screening	Women in target group screened with mammography, as fraction of all women in target group	%	2010 or latest	OECD Health Data 2012	OECD 2012
Cervical cancer screening	Women in target group screened with pap smear, as fraction of all women in target group	%	2010 or latest	OECD Health Data 2012	OECD 2012
Seat belt wearing	Front seat vehicle occupants wearing seatbelts, as fraction of all front seat vehicle occupants	%	ca. 2007	European Status Report on Road Safety 2012	ESRS 2012
Prevention policies					
Tobacco policy	Tobacco control measures implemented, as fraction of all available measures	0-100 scale	2010	Tobacco Control Scale	Joossens & Raw 2011
Alcohol policy	Alcohol control measures implemented, weighted	0-40 scale	2004	Bridging the Gap Alcohol Control Scale	Karlsson & Osterberg
Child vaccination policy	Number of diseases against which children are routinely vaccinated	number of diseases (range: 9-12)	2010	EUVA database	n.a.
Cancer screening policy	Number of cancers for which persons in target group are screened, weighted for population-wide approach	0-9 scale	2007	International Agency for Research on Cancer	Von Karsa 2008
Child safety policy	Child safety measures implemented, weighted	0-60 scale	2010-11	Child Safety Alliance	Eurosafe 2012
Health care policies					
Health care expenditure	Total health expenditure as % of gross domestic product (GDP), WHO estimates	%	2010 or latest	WHO Health for All Database 2013	n.a.
Public expenditure	Public sector health expenditure as % of total health expenditure, WHO estimates	%	2010	WHO Health for All Database 2013	n.a.
Out-of-pocket expenditure	Private households' out-of-pocket payment on health as % of total health expenditure	%	2010	WHO Health for All Database 2013	n.a.
Caesarean sections	Caesarean sections, as fraction of all live births	per 1000	2009 or latest	WHO Health for All Database 2013	n.a.
Antibiotics consumption	Defined daily doses per capita per day	per 1000	2010 or latest	OECD Health Data 2012	OECD 2012
Environmental policies					
Sewage access	Fraction of rural population with access to sewage system or other hygienic means of sewage disposal	%	2010 or latest	WHO Health for All Database 2013	n.a.
Road safety management	Expert assessment of three phases of road safety management, in three classes	3-9 scale	ca. 2010	European Traffic Safety Council	ETSC 2012
Sulphur dioxide emissions	Sulphur dioxide emissions per capita per year	kg per capita per year	2000 or latest	WHO Health for All Database 2013	n.a.
Particulate matter concentrations	Average annual concentration of particulate matter <10 ⁶ µm (PM10) in the capital	*g/m ³	2009 or latest	WHO Health for All Database 2013	n.a.

(c) Health outcomes.
(b) Health outcomes

Health outcomes	Description	Measurement units	Year	Data source	Reference
General health indicators.					
Life expectancy, male	Life expectancy at birth, male	years	2011 or latest	WHO Health for All Database 2013	n.a.
Life expectancy, female	Life expectancy at birth, female	years	2011 or latest	WHO Health for All Database 2013	n.a.
Disability-adjusted life expectancy	Disability-adjusted life expectancy, (World Health Report), male	years	2011 or latest	WHO Health for All Database 2013	n.a.
Disability-adjusted life expectancy	Disability-adjusted life expectancy, (World Health Report), female	years	2011 or latest	WHO Health for All Database 2013	n.a.
SAH good, men	Fraction of male population self-assessing health as good	%	2011 or latest	WHO Health for All Database 2013	n.a.
SAH good, women	Fraction of female population self-assessing health as good	%	2011 or latest	WHO Health for All Database 2013	n.a.
Mother and child health outcomes					
Neonatal mortality	Deaths in first month of life, per 1000 live births	per 1000 livebirths	2011 or latest	WHO Health for All Database 2013	n.a.
Postneonatal mortality	Deaths in months 2–12 of life, per 1000 live births	per 1000 livebirths	2011 or latest	WHO Health for All Database 2013	n.a.
Maternal mortality	Deaths related to pregnancy, childbirth and puerperium, per 100000 live births	per 100000 livebirths	2011 or latest	WHO Health for All Database 2013	n.a.
Adult lifestyle related health outcomes					
Lung cancer incidence, men	Trachea, bronchus and lung cancer incidence, per 100000, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Lung cancer incidence, women	Trachea, bronchus and lung cancer incidence, per 100000, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Breast cancer incidence	Female breast cancer incidence, per 100000	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Cervix uteri cancer incidence	Cervix uteri cancer incidence, per 100000	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
IHD mortality, men	Standardized death rate, ischaemic heart disease, per 100000, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
IHD mortality, women	Standardized death rate, ischaemic heart disease, per 100000, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Liver cirrhosis mortality, men	Standardized death rate, chronic liver disease and cirrhosis, per 100000, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Liver cirrhosis mortality, women	Standardized death rate, chronic liver disease and cirrhosis, per 100000, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Preventive behaviour related health outcomes					
Measles incidence	Measles incidence, per 100000	per 100000 person-years	Average 2007–2011	WHO Health for All Database 2013	n.a.
Tuberculosis incidence	Estimated incidence of tuberculosis, per 100000	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Syphilis incidence	Syphilis incidence, per 100000	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
AIDS incidence	AIDS incidence, per 100000	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Breast cancer mortality, women	Standardized death rate, malignant neoplasm female breast	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Cervix cancer mortality, women	Standardized death rate, cancer of the cervix	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
MVTA mortality, men	Standardized death rate, motor vehicle traffic accidents, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
MVTA mortality, women	Standardized death rate, motor vehicle traffic accidents, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Health care related health outcomes					
Tuberculosis mortality, men	Standardized death rate, tuberculosis, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Tuberculosis mortality, women	Standardized death rate, tuberculosis, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Cerebrovascular mortality, men	Standardized death rate, cerebrovascular diseases, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Cerebrovascular mortality, women	Standardized death rate, cerebrovascular diseases, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Appendicitis mortality, men	Standardized death rate, appendicitis, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Appendicitis mortality, women	Standardized death rate, appendicitis, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Violence-related health outcomes					
Suicide, male	Standardized death rate, suicide and self-inflicted injury, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Suicide, female	Standardized death rate, suicide and self-inflicted injury, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Homicide, male	Standardized death rate, homicide and intentional injury, male	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.
Homicide, female	Standardized death rate, homicide and intentional injury, female	per 100000 person-years	2011 or latest	WHO Health for All Database 2013	n.a.

socioeconomic development also influences various cultural values (Hofstede et al., 2010; Inglehart, 1997; Inglehart and Baker, 2000; Minkov, 2011). According to Inglehart, socioeconomic development is associated with shifts away from absolute to “modern” norms and values (Inglehart and Baker, 2000), probably because “experiencing prosperity minimizes survival concerns, making social values associated with survival less important and allowing for increased focus on social values associated with self-expression and personal choice” (Inglehart and Oyserman, 2004). We will indicate socioeconomic development with Gross Domestic Product per capita and percentage population in urbanized areas.

We also considered to include various other confounders. As socioeconomic development goes hand in hand with increasing levels of education (Inglehart, 1997), and as education is known to strongly influence health-related behaviours at the individual level (Mackenbach et al., 2008), average levels of education could be confounders of the relation between cultural values and health behaviours. However, as between-country differences in levels of education could also be the result of differences in culture (Minkov, 2011), we will not control for education in the main analysis, but do this only in a sensitivity analyses to be reported in the Discussion section of this paper.

Religion, e.g. protestant versus catholic affiliation, has previously been shown to be related with various health outcomes and health behaviours (Mackenbach, 2007), perhaps because of the ‘protestant work ethic’ and the associated tendency to refrain from luxury and indulgence (Weber, 1920 (2002)). Religious heritage is also associated with cultural values, e.g. Inglehart’s value dimensions (Inglehart and Baker, 2000). However, because it is unclear whether religion has an impact on behaviour or health that is independent from the effect of cultural values (Minkov, 2011), we will refrain from controlling for religion in our main analysis, and do this only in a sensitivity analysis to be reported in the Discussion. Religious heritage will be indicated by the proportion of the population by religious affiliation in 1980, classified in four categories (protestant, catholic, muslim, and other (mainly orthodox)). Data on religious affiliation were extracted from the Quality of Government Dataset (Teorell et al., 2011) (<http://www.qog.pol.gu.se/data/>).

2.2. Data (dependent variables)

We distinguish six groups of indicators of health behaviour, some of which can be seen as the aggregate of individual behaviours, whereas others measure health policy, which can be seen as a form of collective behaviour: fertility-related behaviours (mainly individual), adult lifestyles (mainly individual), use of preventive services (mainly individual), prevention policies (mainly collective), health care policies (mainly collective), and environmental policies (mainly collective). Please note that our term ‘collective health behaviour’ should not be confused with Frohlich et al.’s notion of ‘collective health lifestyles’, which is defined by these authors as “an expression of a shared way of relating and acting in a given environment” and emphasizes the fact that seemingly ‘individual’ health behaviours are strongly determined by the social context (Frohlich et al., 2001). Our term ‘collective health behaviour’ instead refers to the way national populations and their representatives and institutions work together to achieve common health objectives.

For each area we identified between 4 and 6 indicators, and extracted data from harmonized international data sources. The main data source was the WHO Health for All Database 2013 (<http://data.euro.who.int/hfad/>), accessed 23 July 2013). Additional data sources include OECD Health Data 2012 and various

compilations of data on specific health behaviours. We only included data that were available for at least 25 countries.

Definitions and data sources for health behaviours are given in Box 1. Country values for health behaviours are given in Web Appendix Table A1b.

We collected data on six groups of health outcomes: general health indicators (life expectancy, disability-adjusted life expectancy, and self-assessed health), fertility-related health outcomes (neonatal, postneonatal and maternal mortality), adult lifestyle-related health outcomes (incidence of lung, breast and cervical cancer, mortality from ischaemic heart disease and liver cirrhosis), preventive behaviour-related health outcomes (incidence of measles, tuberculosis, syphilis, and AIDS, mortality from breast and cervical cancer and motor vehicle accidents), health care related health outcomes (mortality from tuberculosis, cerebrovascular disease, and appendicitis), and health outcomes related to violence (suicide and homicide). The full rationale for studying these health outcomes can be found elsewhere (Mackenbach and McKee, 2013b).

All health outcomes data were extracted from the WHO Health for All Database 2013 (<http://data.euro.who.int/hfad/>), accessed 23 July 2013). For this analysis we have used an expanded and updated dataset as compared to the dataset used in a previous comparative analysis (Mackenbach and McKee, 2013a, 2013b). Definitions and data sources for health outcomes are given in Box 1, and country data given in Web Appendix Table A1c.

2.3. Analysis

In the absence of individual level data, all analyses will be conducted at the aggregate (country) level. To explore associations between values and health behaviours or health outcomes we computed simple Pearson correlations. To study these associations while controlling for confounders we performed a series of multi-variable linear least-squares regression analyses with countries’ health behaviours and health outcomes as the dependent variable, and their cultural values, Gross Domestic Product per capita and percentage population in urbanized areas as independent variables. To study the mediating role of health behaviours in the relation between cultural values and health outcomes we added the latter to the regression models with health outcomes as dependent variables, and assessed whether the regression coefficients for cultural values were attenuated.

3. Results

3.1. Health behaviours

Large variations in aggregate individual as well as collective health behaviours are found between European countries. Fig. 2a summarizes the geographical distribution of health behaviours in Europe; for full details see Web Appendix Table A1b. There are no individual health behaviours with strong North–South gradients, as shown by the rather low correlations with latitude. There are, however, several with strong East–West gradients, as shown by positive or negative correlations with longitude: teenage pregnancy and smoking among men are more common in the East, and influenza vaccination, older mothers, and smoking among women are clearly more common in the West.

On the other hand, some of the collective health behaviours do have clear North–South gradients: for example, there are stronger alcohol policies in the North, and higher levels of air pollution by particulate matter in the South. Health care expenditure, public health care expenditure and caesarean sections are higher in the West, and out-of-pocket health care expenditure is clearly higher in the East.

In a first exploration of the association between cultural values and health behaviours we calculated simple correlations, and an overview of the results is presented in Table 1, while the full results are given in Web Appendix Table A3. The largest numbers of notable ($r = < .-4$ or $> = 0.4$) or moderately strong ($r = < .-6$ or $> = 0.6$) correlations are found with Inglehart's 'self-expression' scale and its variants, 'post-materialism' and 'autonomy/socioliberalism'. The 'secular-rational' dimension is much less important, as are its variants, 'religiosity' and 'normative/religious'.

Several of Schwartz's cultural orientations, particularly 'embedd- edness', 'affective autonomy', 'intellectual autonomy', and 'egalitarian- ism', also have a substantial number of notable or moderately strong correlations with health behaviours. Hofstede's value dimensions, however, are clearly less often correlated with individual or collective health behaviours, with the exception of 'indulgence', the scale that is conceptually and empirically closest to Inglehart's 'self-expression'.

In a second step we regressed all health behaviours on a selection of cultural values, controlling for national income and

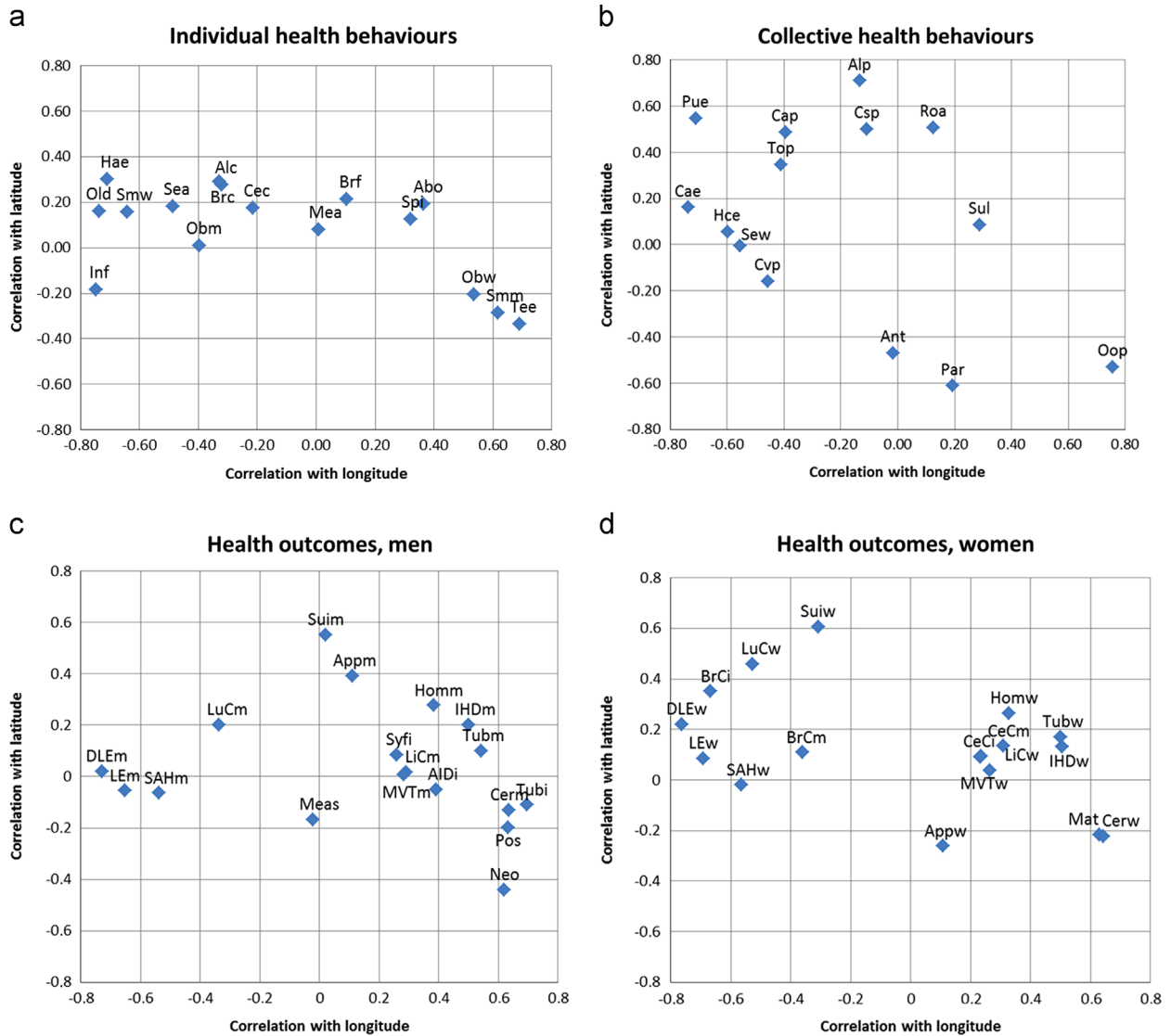


Fig. 2. Correlation between health behaviours, health outcomes and geographical location of countries in Europe. Longitude (East–West position) and latitude (North–South position) of countries were based on the geographical coordinates of their capitals (source: Wikipedia). If a health behaviour or health outcome has a positive correlation with longitude, rates or scores are higher in countries with more Easterly positions. If a health behaviour or health outcome has a positive correlation with latitude, rates or scores are higher in countries with more Northerly positions. (a) Individual health behaviours. Abbreviations: Abo=abortions; Tee=teenage pregnancies; Old=older mothers; Brf=breast feeding; Smm=smoking (men); Smw=smoking (women); Alc=alcohol; Spi=spirits; Obm=obesity (men); Obw=obesity (women); Mea=measles immunization; Hae=haemophilus immunization; Inf=influenza vaccination; Brc=breast cancer screening participation; Cec=cervical cancer screening participation; Sea=seat belt wearing. (b) Collective health behaviours. Abbreviations: Top=tobacco policy; Alp=alcohol policy; Cvp=child vaccination policy; Cap=cancer screening policy; Csp=child safety policy; Hce=health care expenditure; Pue=public health care expenditure; Oop=out-of-pocket expenditure; Cae=caesarean sections; Ant=antibiotics consumption; Sew=sewage access; Roa=road safety management; Sul=sulphur dioxide emissions; Par=particulate matter concentrations. (c) Health outcomes, men. Abbreviations: LEm=life expectancy men, DLEm=disability-free life expectancy men, SAHm=self-assessed health men, Neo=neonatal mortality, Postneonatal mortality, LuCm=lung cancer incidence men, IHDm=ischaeamic heart disease mortality men, LiCm=liver cirrhosis mortality men, Meas=measles incidence, Tubi=tuberculosis incidence, Syfi=syphilis incidence, AIDi=AIDS incidence, MVTm= motor vehicle traffic accident mortality men, Tubm=tuberculosis mortality men, Cerw=cerebrovascular disease mortality men, Appm=appendicitis mortality men, Suim=suicide men, Homm=homicide men. (d) Health outcomes, women. Abbreviations: LEw=life expectancy women, DLEw=disability-free life expectancy women, SAHw=self-assessed health women, Mat=maternal mortality, LuCw=lung cancer incidence women, BrCi=breast cancer incidence, CeCi=cervical cancer incidence, IHDw=ischaeamic heart disease mortality women, LiCw=liver cirrhosis mortality women, BrCm=breast cancer mortality, CeCm=cervical cancer mortality; MVTw= motor vehicle traffic accident mortality women, Tubw=tuberculosis mortality women, Cerw=cerebrovascular disease mortality women, Appw=appendicitis mortality women, Suiw=suicide women, Homw=homicide women.

urbanization. We limited these regression analyses to two variables out of each set, and selected the variables with the largest number of correlations, and/or those for which we had a specific expectation to test. From the set of value dimensions related to Inglehart's work we selected the two dimensions that are currently most in use ('self-expression' and 'secular-rational'), from Hofstede's value dimensions we selected 'power distance' and 'uncertainty avoidance' (and left out 'indulgence', because of its similarity with 'self-expression'), and from Schwartz's cultural orientations we selected 'embeddedness' and 'egalitarianism'. An overview of the results is presented in Table 2a, while full results can be found in Web Appendix Table A4a.

After controlling for national income and urbanization, 'self-expression' clearly comes out as the cultural value dimension with the largest number of statistically significant associations. Countries with higher scores on this dimension have more favourable outcomes for 15 out of 30 health behaviours, and more unfavourable for only 1 (i.e., older mothers). Favourable outcomes are found for both individual and collective health behaviours. None of the other value dimensions comes even close. 'Uncertainty avoidance' has 6 statistically significant associations (countries with higher scores on this value have worse health behaviours), and both 'embeddedness' and 'egalitarianism' have 6 as well (countries with higher scores on the first have mostly worse, while countries with higher scores on the latter have mostly better health behaviours).

Table 2a also shows the percentage additional variance explained by cultural values, on top of the variance explained by national income. Across all 30 health behaviours, 'embeddedness' and 'egalitarianism' on average explain a larger part of the variance, 14 and 15% respectively, than the other value dimensions in the table.

For a few health behaviours we could test whether the 'self-expression' scale affects individual health behaviours directly, or through collective health policies aimed at those behaviours: smoking and tobacco control, alcohol sales and alcohol control,

and breast and cervical cancer screening participation and cancer screening policies. Results of this mediation analysis are presented in Web Appendix Table A6. In two of the four comparisons (alcohol sales and breast cancer screening participation), controlling for health policies attenuates the regression coefficient for 'self-expression', suggesting that part of the latter's effect on individual health behaviours is indeed mediated by health policy.

We finally look at the possible role of variations in cultural values in explaining some of the striking differences in health behaviour between neighbouring European countries. Denmark's levels of individual and collective health behaviour are often considerably less favourable than Sweden's, and the same applies to Belgium as compared to the Netherlands, Slovakia as compared to the Czech Republic, and Latvia as compared to Estonia (Table 3). In all these cases the two neighbouring countries have similar levels of national income; the exception is Estonia, which has a higher national income than Latvia.

In the case of Denmark and Sweden, there is a clear difference on both the 'self-expression' and 'secular-rational' scales: Sweden has more 'modern' orientations on both. In view of the independent associations between these cultural values and many health behaviours (Table 2a), this may (partly) explain Denmark's higher rates of caesarean sections and male smoking, as well as its lower rates of measles immunization, cervical cancer screening participation, and alcohol policy. In the case of Belgium and the Netherlands, the main differences in cultural values are on the 'power distance' and 'uncertainty avoidance' scales: Belgians score much higher on both scales, which may (partly) explain Belgium's lower breast cancer screening participation, higher rates of antibiotics consumption, and lower level of road safety management (Table 2a). Similarly, the differences in health behaviour between the Czech Republic and Slovakia may be related to the more 'modern' value orientation of the Czech population, as seen for the 'self-expression', 'secular-rational', 'embeddedness' and 'power distance' scales. Estonians' more favourable health behaviour as

Table 1
Correlations between cultural values and health-related variables.

	Health behaviours			Health outcomes		
	# Correlations			# Correlations		
	Total	$r < = -0.4$ or $> = 0.4$	$r < = -0.6$ or $> = 0.6$	Total	$r < = -0.4$ or $> = 0.4$	$r < = -0.6$ or $> = 0.6$
<i>Inglehart</i>						
Self-expression	30	21	7	35	26	12
Secular-rational	30	6	0	35	3	0
Post-materialism	30	23	11	35	21	9
Religiosity	30	2	1	35	3	0
Autonomy/socioliberalism	30	18	9	35	27	23
Normative/religious	30	3	0	35	7	0
<i>Hofstede</i>						
Power distance	30	15	1	35	20	5
Individualism	30	11	1	35	10	2
Masculinity	30	2	0	35	0	0
Uncertainty avoidance	30	10	2	35	4	0
Longterm orientation	30	2	0	35	11	0
Indulgence	30	16	5	35	25	14
<i>Schwartz</i>						
Affective autonomy	30	18	3	35	13	2
Intellectual autonomy	30	16	4	35	19	4
Embeddedness	30	19	7	35	21	8
Egalitarianism	30	16	6	35	24	11
Hierarchy	30	6	0	35	14	0
Harmony	30	2	0	35	5	0
Mastery	30	3	0	35	0	0

Correlations $r < = -.4$, or $> = .4$ correspond to $p < .03$ if 30 observations and to $p < .02$ if 35 observations. Correlations $r < = -.6$, or $> = .6$ correspond to $p < .001$ if 30 observations and to $p < .001$ if 35 observations.

Table 2

Summary of associations between cultural values and health behaviours (regression analysis controlling for GDP and urbanization).

	Better=	Self-expression Direction	Secular-rational Direction	Power distance Direction	Uncertainty avoidance Direction	Embeddedness Direction	Egalitarianism Direction
(a) Health behaviours							
Abortions	Less	Better	Worse	Worse	Better	Worse	Better
Teenage pregnancies	Less	Better	Better	Worse	Worse	Worse	Better
Older mothers	Less	Worse	Better	Better	Better	Better	Worse
Breast feeding	More	Worse	Better	Worse	Worse	Worse	Worse
Smoking (men)	Less	Better	Better	Worse	Worse	Worse	Better
Smoking (women)	Less	Worse	Worse	Better	Worse	Better	Better
Alcohol consumption	Less	Better	Worse	Worse	Worse	Better	Better
Spirits consumption	Less	Better	Worse	Worse	Better	Worse	Better
Obesity (men)	Less	Better	Better	Worse	Worse	Worse	Better
Obesity (women)	Less	Better	Better	Worse	Worse	Worse	Better
Measles immunization	More	Better	Better	Better	Better	Worse	Better
Haemophilus immunization	More	Better	Better	Better	Worse	Worse	Better
Influenza vaccination	More	Better	Worse	Better	Better	Worse	Better
Breast cancer screening	More	Better	Better	Worse	Worse	Better	Better
Cervical cancer screening	More	Better	Better	Better	Worse	Worse	Worse
Seat belt wearing	More	Better	Worse	Worse	Worse	Worse	Better
Tobacco policy	More	Better	Worse	Worse	Worse	Better	Worse
Alcohol policy	More	Better	Better	Worse	Worse	Better	Worse
Child vaccination policy	More	Better	Better	Worse	Better	Worse	Better
Cancer screening policy	More	Better	Better	Worse	Worse	Better	Worse
Child safety policy	More	Better	Better	Worse	Worse	Better	Worse
Health care expenditure	More	Better	Better	Worse	Worse	Worse	Better
Public expenditure	More	Better	Better	Worse	Worse	Worse	Worse
Out-of-pocket expenditure	Less	Better	Better	Worse	Worse	Worse	Worse
Caesarean sections	Less	Better	Better	Worse	Worse	Better	Worse
Antibiotics consumption	Less	Worse	Better	Worse	Worse	Worse	Worse
Sewage access	More	Better	Better	Worse	Worse	Worse	Better
Road safety management	More	Better	Better	Worse	Worse	Worse	Worse
Sulphur dioxide emissions	Less	Better	Better	Worse	Worse	Worse	Better
Particulate matter concentrations	Less	Better	Better	Worse	Worse	Better	Worse
Number of behaviours		30	30	30	30	30	30
Number "better"		15	5	0	0	2	4
Number "worse"		1	0	4	6	4	2
Average additional R-squared ^a		0.10	0.06	0.07	0.07	0.14	0.15
Minimum additional R-squared ^a		0.00	0.00	0.00	0.00	0.00	0.00
Maximum additional R-squared ^a		0.26	0.25	0.33	0.34	0.44	0.43
(b) Health outcomes							
Life expectancy at birth, male	More	Better	Worse	Worse	Better	Worse	Better
Life expectancy at birth, female	More	Better	Worse	Worse	Better	Worse	Better
Disability-adjusted life expectancy, male	More	Better	Worse	Worse	Better	Worse	Better
Disability-adjusted life expectancy, female	More	Better	Worse	Worse	Better	Worse	Better
SAH good, men	More	Better	Worse	Worse	Better	Worse	Better
SAH good, women	More	Better	Worse	Worse	Better	Worse	Better
Neonatal mortality	Less	Better	Better	Worse	Better	Worse	Worse
Postneonatal mortality	Less	Better	Better	Worse	Better	Worse	Better
Maternal mortality	Less	Better	Better	Worse	Better	Worse	Worse
Lung cancer incidence, men	Less	Better	Worse	Better	Better	Better	Better
Lung cancer incidence, women	Less	Worse	Worse	Better	Worse	Better	Better
Breast cancer incidence	Less	Worse	Worse	Better	Worse	Better	Worse
Cervix uteri cancer incidence	Less	Better	Worse	Worse	Better	Worse	Better
IHD mortality, men	Less	Better	Worse	Worse	Better	Worse	Better
IHD mortality, women	Less	Better	Worse	Worse	Better	Worse	Better
Liver cirrhosis mortality, men	Less	Better	Worse	Worse	Better	Better	Better
Liver cirrhosis mortality, women	Less	Better	Worse	Worse	Better	Better	Better
Measles incidence	Less	Better	Worse	Worse	Better	Worse	Better
Tuberculosis incidence	Less	Better	Better	Worse	Better	Worse	Better
Syphilis incidence	Less	Better	Worse	Worse	Better	Worse	Better
AIDS incidence	Less	Better	Better	Better	Better	Worse	Better
Breast cancer mortality, women	Less	Better	Worse	Worse	Worse	Better	Better
Cervix cancer mortality, women	Less	Better	Worse	Worse	Better	Better	Better
MVTA mortality, men	Less	Better	Worse	Worse	Better	Worse	Better
MVTA mortality, women	Less	Better	Worse	Worse	Better	Worse	Better
Tuberculosis mortality, men	Less	Better	Worse	Worse	Better	Worse	Better

Table 2 (continued)

	Better is:	Self-expression Direction	Secular-rational Direction	Power distance Direction	Uncertainty avoidance Direction	Embeddedness Direction	Egalitarianism Direction
Tuberculosis mortality, women	Less	Better	Worse	Worse	Better	Worse	Better
Cerebrovascular mortality, men	Less	Better	Worse	Worse	Better	Worse	Better
Cerebrovascular mortality, women	Less	Better	Worse	Worse	Better	Worse	Better
Appendicitis mortality, men	Less	Better	Worse	Worse	Worse	Worse	Better
Appendicitis mortality, women	Less	Better	Better	Worse	Worse	Worse	Better
Suicide male	Less	Better	Worse	Better	Better	Better	Better
Suicide, female	Less	Worse	Worse	Better	Better	Better	Better
Homicide, male	Less	Better	Worse	Worse	Better	Worse	Better
Homicide, female	Less	Better	Worse	Worse	Better	Worse	Better
Number of health outcomes		35	35	35	35	35	35
Number "better"		19	1	1	19	1	12
Number "worse"		2	1	4	2	2	0
Average additional R-squared ^a		0.09	0.03	0.05	0.12	0.10	0.13
Minimum additional R-squared ^a		0.00	0.00	0.00	0.00	0.00	0.00
Maximum additional R-squared ^a		0.21	0.12	0.24	0.27	0.37	0.33

"better" = statistically significantly ($p.05$) better outcome at higher scores on cultural value.

"worse" = statistically significantly ($p.05$) worse outcome at higher scores on cultural value.

^a When added to a model already containing GDP and urbanization.

compared to Latvia may be related to the first country's better scores on the 'secular-rational' and 'egalitarianism' scales.

3.2. Health outcomes

We summarize the geographical distribution of health outcomes in Europe, using their correlations with geographical longitude and latitude, in Fig. 2b. In order to increase legibility, we have created separate figures for men (also including neonatal and postneonatal mortality and incidence of various infectious diseases that are not differentiated by sex) and for women. Among men, the general health indicators have a very strong East–West gradient, with higher values in the West for all three indicators: life expectancy, disability-free life expectancy, and self-assessed health. A few specific health indicators follow a similar but reverse gradient, with higher values in the East, without much of a North–South gradient: tuberculosis incidence, cerebrovascular disease mortality, postneonatal mortality. By contrast, suicide follows a North–South gradient, with higher values in the North.

Among women, the geographical patterns are largely similar. Life expectancy, disability-free life expectancy, and self-assessed health have higher values in the West, and so has breast cancer incidence. Maternal and cerebrovascular disease mortality have higher values in the East, and suicide has higher values in the North. Low correlations with both longitude and latitude are found for measles and syphilis incidence, and for motor vehicle traffic accident mortality.

In a first exploration of the association between cultural values and health outcomes we have calculated simple correlations, and an overview of the results is presented in Table 1b. The full results are given in Web Appendix Table A3. The largest numbers of notable ($r = < .-4$ or $> = 0.4$) or moderately strong ($r = < .-6$ or $> = 0.6$) correlations are found with Inglehart's 'self-expression' and its variants, 'post-materialism' and 'autonomy/socioliberal', and with Hofstede's 'indulgence'. The 'secular-rational' dimension is much less important, as are its variants, 'religiosity' and 'normative/religious'.

Among Hofstede's value dimensions, apart from 'indulgence', 'power distance' is the most often correlated with health outcomes. Several of Schwartz's cultural orientations, particularly 'embeddedness' and 'egalitarianism', also have a substantial number of notable or moderately strong correlations with health behaviours.

In a second step we regressed all health outcomes on a selection of cultural values, controlling for national income and urbanization. We limited these regression analyses to two variables out of each set of cultural values, and selected the variables with the largest number of correlations. From the set of value dimensions related to Inglehart's work we selected the two dimensions that are currently most in use ('self-expression' and 'secular-rational'), from Hofstede's value dimensions we selected 'power distance' and 'indulgence', and from Schwartz's cultural orientations we selected 'embeddedness' and 'egalitarianism'. An overview of the results is presented in Table 2b. Full results can be found in Web Appendix Table A4b.

After controlling for national income and urbanization, 'self-expression' and 'indulgence' clearly come out as the cultural value dimensions with the largest number of statistically significant ($p < 0.05$) associations. Countries with higher scores on these dimensions have more favourable outcomes for 19 out of 35 indicators, spanning the whole range of indicators included in the analysis, and more unfavourable for only 2 (i.e., incidence among women of lung and breast cancer). The patterns are remarkably similar between these two dimensions; it is only for female suicide that the direction of the associations is different, but both are non-significant. None of the other value dimensions comes even close to these two, with the exception of 'egalitarianism' which has 12 statistically significant associations. Countries with higher scores on this value have better health outcomes in almost all areas.

Table 2b also shows the percentage additional variance explained by the cultural variables, on top of the variance explained by national income. Across health outcomes, 'self-expression', 'indulgence', 'embeddedness' and 'egalitarianism' all explain around 10% of variance.

We finally look at the results of a mediation analysis in which we assess whether, as we expect, the association between cultural values and health outcomes are based on their role in promoting better or worse health behaviours. We do this for 'self-expression', and for all outcomes for which relevant data on health behaviours are available (Table 4). For example, to assess whether the association between 'self-expression' and neonatal mortality is explained by health behaviours, we draw on previous results for teenage pregnancies and older mothers, both of which are strongly related to 'self-expression' (Table 2a) and are known to affect neonatal mortality. When we add these two possible mediators to a regression equation already containing 'self-expression', GDP

Table 3

Comparison of cultural values of neighbouring countries with different health behaviours.

	Self-express.	Secular-rational	Embed-dedness	Egalit-arianism	Power distance	Uncert-ainty av.	Smoking (m)	Measles immun.	Cervical screen.	Alcohol policy	Child safety	Cesar. sections
Sweden	1.37	1.47	3.12	4.90	31	29	13	97	78	36	41	167
Denmark	0.92	1.17	3.19	5.03	18	23	20	85	66	17	32	214
	Self-express.	Secular-rational	Embed-dedness	Egalit-arianism	Power distance	Uncert-ainty av.	Influenza vaccin.	Breast screen.	Seat belt	OOP expend.	Antibiot. consum.	Road safety
Netherlands	0.73	0.66	3.19	5.03	38	53	81	82	94	5	10	7
Belgium	0.73	0.52	3.25	5.20	65	94	65	73	79	20	28	3
	Self-express.	Secular-rational	Embed-dedness	Egalit-arianism	Power distance	Uncert-ainty av.	Teenage pregn.	Breast screen.	Child safety	Public expend.	OOP expend.	Antibiot. consum.
Czech Republic	0.45	0.97	3.59	4.45	57	74	3	50	44	84	15	19
Slovakia	0.15	0.32	3.82	4.58	104	51	7	16	27	66	31	25
	Self-express.	Secular-rational	Embed-dedness	Egalit-arianism	Power distance	Uncert-ainty av.	Smoking (m)	Measles immun.	Breast screen.	Seat belt	Sewage access	SO ₂
Estonia	−0.39	0.77	3.81	4.58	40	60	37	95	62	90	94	42
Latvia	−0.61	0.47	3.83	4.32	44	63	47	90	42	77	71	66

Denmark, Belgium, Slovakia, Latvia more than half standard deviation less favourable than Sweden, Netherlands, Czech Republic, Estonia
For explanation of variables, see Box 1. OOP=out-of-pocket

Note: For each pair of countries, the six health behaviours that differ most between them have been selected for presentation in this table.

Table 4
Results of mediation analysis for 'self-expression' and health outcomes.

	Controlled for							
	GDP/urb			GDP/urb/behavioural mediators				Behavioural mediators
	Observations	R-squared	Coefficient	P-value	R-squared	Coefficient	P-value	
Life expectancy (m)	39	0.63	5.315	0.000	0.79	0.878	0.539	Smoking (m), alcohol, spirits
Life expectancy (w)	39	0.63	2.607	0.002	0.71	1.543	0.074	Smoking (w), alcohol, spirits
Neonatal mortality	39	0.45	-1.225	0.025	0.73	0.174	0.705	Teenage pregnancy, older mothers
Postneonatal mortality	39	0.47	-0.844	0.030	0.58	-0.176	0.676	Teenage pregnancy, older mothers
Maternal mortality	36	0.33	-5.703	0.061	0.49	-2.244	0.439	Teenage pregnancy, older mothers
Lung cancer incidence (m)	37	0.12	-3.980	0.692	0.16	-12.530	0.324	Smoking (m)
Lung cancer incidence (w)	37	0.37	13.476	0.051	0.48	11.981	0.060	Smoking (w)
Breast cancer incidence	37	0.72	28.682	0.011	0.75	18.907	0.104	Older mothers
IHD mortality (m)	39	0.34	-123.100	0.034	0.41	-62.795	0.369	Smoking (m), obesity (m)
IHD mortality (w)	39	0.34	-58.331	0.081	0.46	-30.020	0.383	Smoking (w), obesity (w)
Liver cirrhosis (m)	39	0.27	-9.420	0.198	0.63	-5.820	0.323	Alcohol, spirits
Liver cirrhosis (w)	39	0.16	-4.546	0.328	0.61	-2.172	0.547	Alcohol, spirits
Measles incidence	37	0.03	-0.858	0.853	0.04	-0.925	0.843	Measles immunization
Breast cancer mortality	25	0.44	-3.233	0.025	0.44	-3.134	0.043	Breast cancer screening
Cervical cancer mortality	24	0.84	-0.920	0.241	0.89	-1.287	0.067	Cervical cancer screening
MVTA mortality (m)	28	0.45	-4.086	0.137	0.60	-3.840	0.112	Seat belt wearing
MVTA mortality (w)	28	0.39	-1.515	0.088	0.55	-1.437	0.067	Seat belt wearing
Tuberculosis mortality (m)	40	0.71	-0.193	0.914	0.76	1.623	0.462	Health care exp., public exp., OOP exp.
Tuberculosis mortality (w)	39	0.57	0.180	0.695	0.64	0.569	0.285	Health care exp., public exp., OOP exp.
Cerebrovascular mortality (m)	40	0.65	-59.663	0.001	0.70	-42.351	0.044	Health care exp., public exp., OOP exp.
Cerebrovascular mortality (w)	40	0.63	-36.656	0.004	0.68	-24.792	0.112	Health care exp., public exp., OOP exp.
Appendicitis mortality (m)	35	0.16	-0.100	0.297	0.20	-0.047	0.694	Health care exp., public exp., OOP exp.
Appendicitis mortality (w)	35	0.30	-0.069	0.083	0.31	-0.055	0.320	Health care exp., public exp., OOP exp.

Breast cancer mortality, cervical cancer mortality, and tuberculosis mortality controlled for incidence.

Bold=statistically significant ($p < 0.05$).

GDP=Gross Domestic Product. Urb=urbanization. OOP=Out-of-pocket.

and urbanization, the original effect (coefficient -1.225 , $p=0.025$) is substantially attenuated (new coefficient 0.174 , $p=0.705$), confirming a possible role of these health behaviours in explaining the association between 'self-expression' and neonatal mortality.

Clear indications of a mediating role of relevant health behaviours are also seen for male and female life expectancy (smoking, alcohol, spirits consumption), postneonatal mortality (teenage pregnancy, older mothers), breast cancer incidence (older mothers), male ischaemic heart disease mortality (smoking, obesity), and cerebrovascular disease mortality (health care, public and out-of-pocket expenditure).

In the case of mortality from three conditions we were able to take into account the incidence of these conditions, in order to obtain a sharper picture of the mechanisms involved. Breast cancer mortality is not associated with 'self-expression' in an analysis only controlling for GDP and urbanization (Table 2b). However, when we add breast cancer incidence to the regression, an association emerges (Table 4), suggesting that mortality-given-incidence is lower in countries with higher scores on 'self-expression'. However, when we then add breast cancer screening participation as well, no attenuation can be observed, so that it is unlikely that the effect of 'self-expression' is mediated by this particular aspect of behaviour. The other two conditions for which incidence could be controlled are cervical cancer and tuberculosis mortality, but in neither of these cases is attenuation of the effect of 'self-expression' seen when relevant behavioural variables are included.

4. Discussion

4.1. Summary of main findings

In univariate analyses, all scales are related to aggregate individual and collective health behaviours and most scales are

related to health outcomes, but in multivariate analyses Inglehart's 'self-expression' (versus 'survival') scale has by far the largest number of statistically significant associations. Countries with higher scores on 'self-expression' have better outcomes on 16 out of 30 health behaviours and on 19 out of 35 health indicators, and variations on this scale explain up to 26% of the variance in these outcomes in Europe. In mediation analyses the associations between cultural values and health outcomes are partly explained by differences in health behaviours. Variations in cultural values also appear to account for some of the striking variations in health behaviour between neighbouring countries in Europe (Sweden and Denmark, the Netherlands and Belgium, the Czech Republic and Slovakia, and Estonia and Latvia).

4.2. Limitations

A major strength of this paper is that we have used an eclectic approach to the measurement of values, and have included measures from three major strands of comparative values research. However, although Inglehart, Hofstede and Schwartz are among the most highly cited social scientists of all time, their approaches have also attracted criticism. For example, Inglehart's measures have been criticized for their theoretical rationale (Abramson, 2011) as well as for being heterogeneous collections of items (Haller, 2002). While some of this criticism may be justified, the fact that we find similar associations for conceptually similar dimensions originating in different comparative values traditions (e.g., 'self-expression' and 'indulgence') strengthens confidence in our findings.

A potential problem of Inglehart's measure of 'self-expression', and of Hofstede's measure of 'indulgence', is that they are derived from a set of World Values Study items that includes 'life satisfaction', a measure of happiness. This would raise obvious issues of circularity if one would use countries' scores on 'self-expression' or

'indulgence' as predictors of their average levels of happiness. If a person's happiness also affects the perception of his or her health, the resulting reporting bias will produce spurious associations between 'self-expression' or 'indulgence' and levels of self-assessed health, as we found in our analysis, and others have found in other datasets (Inglehart and Baker, 2000). However, as most of the dependent variables included in our analysis are not self-reported, or, if they are, less dependent on respondents' perceptions, this problem is largely irrelevant for our study.

Another strength of our paper is that it covers a large number of European countries, capturing a wide range of variation in cultural values. As in all cross-cultural studies, this comes at the expense of having to rely on large data-bases, which tend to be filled with administrative data of sometimes questionable validity. The main threat to the validity of our results is that countries' value orientations are associated with the quality of their health behaviour or health outcomes data. For example, countries with a higher score on 'self-expression' appear to attach more importance to monitoring health data, as can be seen from Web Appendix Tables A1b and A1c. If higher levels of 'self-expression' or 'indulgence' would also go together with higher quality of health behaviour or health outcome data, the effect on our results could go two ways: better recording of 'good' health behaviours or health outcomes would give a positive bias, but better recording of 'bad' behaviours or outcomes would give a negative bias.

Despite remarkable efforts to establish regular value surveys in many countries, some of the data on value orientations used in our analysis are quite old (Box 1). This will be problematic if value orientations, and their variations between countries, have changed over time. Trend data are scarce, but studies have shown that value orientations are rather stable on a time-scale of a few decades, and even if they change, countries' relative positions tend to remain the same (Dekker et al., 2007; Inglehart, 2008).

Another limitation is that our analysis has controlled for a few possible confounders only, i.e., national income and urbanization. Both countries' cultural values and health behaviours and outcomes are the result of long social, economic and epidemiological histories, but unfortunately quantitative data on confounders arising from these histories is extremely scarce. We considered to include education but did not, because we are uncertain about the causal connections between values, education, and health behaviours. In order to check the robustness of our findings, we performed additional analyses for 'self-expression' with controls for education. Neither of these controls changed the results in any way, mainly because countries' average levels of education are not related to health behaviours or health outcomes (results not shown).

We also had doubts about the potential confounding role of religious variables, because it is unclear how religion relates to values and health behaviours or health outcomes. Does a country's religious heritage affect its value orientation, or did a country's value orientation in the past affect its choice of religion (Minkov, 2011)? In the latter case, controlling for religion will result in an over-adjustment of the association between values and health behaviours.

One could argue both ways, as illustrated by the comparison of Estonia and Latvia. Although both countries are now largely secularized, they both have a strong religious heritage, which in the case of Estonia is mainly Protestant, in the case of Latvia mainly Roman-catholic. These differences have deep historical roots: in the 16th and 17th centuries, Estonians lived under Swedish rule, while many Latvians lived under Polish-Lithuanian rule (Kasekamp, 2010). The Swedish rulers were Lutherans, and the Polish rulers were Roman-catholics, and these 'exogenous' influences may explain why Estonia became Protestant and Latvia remained largely Roman-catholic. As Protestants, the Swedes also

fostered education (Becker and Woessmann, 2009), and made Estonia a more literate society, and the combined effects of centuries of Protestantism and literacy may well explain Estonians' higher scores on the 'secular-rational' scale, as well as some of their better health behaviours, as compared to Latvians.

While this line of reasoning would lead to the conclusion that religion confounds the comparison of Estonians and Latvians, other comparisons do not necessarily suffer from the same problem. Why were the Swedes Protestants, and the Poles Roman-catholics? This difference is unlikely to be completely 'exogenous', and may well reflect cultural differences between these two peoples, that are still reflected in their value orientations (Minkov, 2011). Because of these uncertainties we conducted another sensitivity analysis for 'self-expression', in which we introduced controls for religion Web Appendix (Table A5a). Nine out of the 16 statistically significant associations with health behaviours found in Table 2a 'survive' this additional control with minimal attenuation, suggesting that religion is not a main confounder. Substantial attenuation is found, however, for smoking (men), breast cancer screening participation, alcohol policy, cancer screening policy, and road traffic safety management, suggesting that depending on one's theoretical perspective religious heritage (in this case: a protestant heritage) may provide an alternative explanation for favourable health behaviours in Europe.

Also, with this additional control, 10 out of the 21 statistically significant associations with health outcomes found in Table 2b are still statistically significant ($p < 0.05$), but in the majority of cases there is more than 10% attenuation of the regression coefficient, supporting a possible role of religion as a confounder, depending on one's theoretical position Web Appendix (Table A5b). A closer look at these changes shows substantial attenuation ($> 50\%$) for neonatal and postneonatal mortality, female lung and breast cancer incidence, and motor vehicle traffic accident mortality. In almost all of these cases, it is the 'other (mainly orthodox)' religious denomination that replaces 'self-expression' as a determinant of population health. Thus, in a multivariate analysis, controlling for national income, urbanization and 'self-expression', countries with a larger population share of Eastern orthodox Christians have higher postneonatal and motor vehicle accident mortality, and lower lung and breast cancer incidence.

In the absence of studies that have tried to identify the specific effects of Eastern orthodox Christianity on health and its determinants, we are uncertain whether this is a causal effect, or represents another background factor common to countries that have historically been attached to the Eastern orthodox church. Intriguingly, the Eastern orthodox church has also been associated with delayed democratization, due to its traditionally strong connections with the state in Eastern Europe (Huntington, 1991), suggesting that a lack of institutional effectiveness may be involved in the explanation of its association with postneonatal and motor vehicle accident mortality. In any case, even if one accepts an independent role of religious heritage as an explanation for variations in population health, there is still room for a substantial impact of cultural values as well.

A methodological issue that needs to be taken into account is that all analyses were conducted at the aggregate level, and do not necessarily have any interpretation at the individual level. For example, when we find that countries with higher average scores on the 'self-expression' scale have a lower smoking prevalence (Table 2a) and a higher life expectancy (Table 2b), this does not imply that individuals within these countries who have a higher score on 'self-expression' smoke less or live longer. This is due to the problem of the 'ecological fallacy' (Piantadosi et al., 1988; Robinson, 1950): theoretically, the observed aggregate level effect could be due to less smoking or higher life expectancy among individuals with low scores on 'self-expression' who live in countries with high average scores of 'self-expression'. In the

absence of individual level data, and without doing the multilevel analyses that the combination of individual and aggregate level data would permit, conclusions will have to be phrased exclusively at the aggregate (i.e., country) level.

Finally, causal inference is hampered by the possibility of reverse causality: good health outcomes may promote modern value orientations, instead of the other way around. For example, it has been argued that a high prevalence of infectious diseases leads to an emphasis on collectivism instead of individualism (Fincher et al., 2008), and that a history of high exposure to disease produces 'tight' cultures with strong social norms (Gelfand et al., 2011). Similarly, setbacks in life expectancy in the former Soviet Union may have contributed to the popular dissatisfaction that provided a fertile ground for autocratic setbacks in countries like Russia and Belarus (Grigoriev et al., 2010).

In our study of health behaviours such reverse effects are less likely, but in the analysis of health outcomes there could indeed be some reverse causality, if only because higher life expectancy will naturally diminish the need to focus on 'survival' values, and give more room for an orientation on 'well-being' and 'self-expression'. Unfortunately, the number of countries for which trends in value orientations can be determined is too small to permit a longitudinal analysis of changes in values against changes in life expectancy and vice versa, so we will remain uncertain about how strong such reverse effects are likely to be.

4.3. Interpretation

Our most notable finding is that Inglehart's 'self-expression' scale has statistically independent associations with 15 out of 30 health behaviours, and with 19 out of 35 health outcomes, and that the overwhelming majority of these imply that countries with higher scores on 'self-expression' have better health behaviours or health outcomes. The associations found are in accordance with the expectations set out in the Introduction, as well as some previous studies (Arrindell et al., 1997; Matsumoto and Fletcher, 1996), and although causality is difficult to establish they suggest that this cultural value orientation reflects a generalized tendency towards individual and collective investments in health.

The 'self-expression' scale has previously been associated with positive outcomes in many other spheres of life, which has been interpreted as the result of a general shift in cultural orientations in response to improvements in socioeconomic conditions. In modern high-income societies an emphasis on economic security and economic growth is giving way to an increased emphasis on quality of life (Inglehart, 1997). This may have a direct effect on individual health behaviour, or may foster collective interventions to improve health. 'Self-expression' is associated with greater gender equality (Inglehart et al., 2002), which may explain some of our findings on fertility-related behaviour (Table 2a). But it is also associated with public support for environmental protection (Inglehart, 1995), which may explain our findings on air pollution. An effect on public policies is further suggested by its association with democracy (Inglehart and Welzel, 2009), and by the fact that democracy tends to go together with health policies that are in the interest of the majority of the population (Mackenbach, 2013b; Mackenbach et al., 2013b).

Associations with other cultural value scales are also in broad agreement with our expectations. For example, our study confirms previously reported associations between 'power distance' and 'uncertainty avoidance' and antibiotics use (Table 2a), which can perhaps be ascribed to the more open communication between patients and doctors in countries with lower 'power distance' (Deschepper et al., 2008; Meeuwesen et al., 2009), and the greater acceptance of a 'watchful waiting' approach in countries with less 'uncertainty avoidance' (Deschepper et al., 2008).

Our pair-wise comparison of neighbouring countries with different levels of health behaviour, which have often puzzled health researchers, illustrated the possible role of cultural variations in the explanation of these differences. The differences between Denmark and Sweden, both at the level of individual behaviour and health policy, have often been noted (Vallgarda, 2007, 2011), but never satisfactorily explained. Our results suggest that the Danes' greater emphasis on personal responsibility for health behaviours, and the Swedes' greater reliance on public policies to improve health, has complex cultural origins. Danes are less 'modern' than Swedes on Inglehart's two value scales, but even more 'modern' on Hofstede's 'power distance', for which they have Europe's second lowest score. Perhaps the latter accounts for their greater resistance to authority and state intervention (Vallgarda, 2007, 2011).

National cultures are likely to have deep and interesting historical roots. Socioeconomic modernization, as postulated in Inglehart's theory (Inglehart, 1997), is just one of the influences, and our own analysis shows that there are important variations in cultural values between countries even after controlling for national income and urbanization. Differences between European countries in 'power distance', which vary along a North–South axis (Fig. 1), have speculatively been ascribed to whether or not countries have been part of the Roman empire, which had a highly centralized power structure. Perhaps this ultimately derives from differences in subsistence patterns: in the North, nature is less abundant, and agriculture has historically been less productive, giving less opportunity for building strongly hierarchical societies (Hofstede et al., 2010). Similarly, more 'indulgent' societies do not have long traditions of intensive agriculture that stretch into the present, and may therefore have developed a greater sense of freedom and happiness (Hofstede et al., 2010). On a shorter time-scale, the lack of enthusiasm for 'egalitarianism' in Central & Eastern Europe may be a product of decades under communism (Schwartz and Bardi, 1997).

These deep historical roots also suggest that national differences in cultural values will not disappear soon, and that convergence is unlikely in the short term. Although some degree of convergence appears to be occurring within Western Europe (Inglehart, 2008), in Europe as a whole convergence of value orientations over the last decades has been limited (Dekker et al., 2007; Hofstede et al., 2010), suggesting substantial barriers to future convergence of population health within Europe.

Although the value orientations captured by Inglehart's, Hofstede's, and Schwartz's scales appear to be predictive of countries' health outcomes, there may be other aspects of national cultures that are also worthy of further investigation. Other values than those included in these three sets could be important, as suggested by Minkov who has proposed a 'hypometropia' versus 'prudence' scale to explain variations in homicide (and adolescent fertility) (Minkov, 2011). In addition to values, specific attitudes, beliefs and norms may play a role as well, for example in explaining the striking variations in dietary patterns (Keys et al., 1986; Trichopoulou et al., 2002; Verbeke et al., 2010) or patterns of alcohol consumption (Anderson and Baumberg, 2006; Popova et al., 2007; Rehm et al., 2003) in Europe. Further study of these other aspects of culture, however, requires development of quantitative measures of attitudes, beliefs and norms that can be compared across countries.

5. Conclusions

This study is the first to provide systematic and coherent empirical evidence that differences between European countries in health behaviours and health outcomes may partly be determined by variations in culture. Paradoxically, a shift away from

traditional 'survival' values seems to promote behaviours that increase longevity in high income countries.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.healthplace.2014.04.004>.

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