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ORIGINAL ARTICLE

Health conditions in regions of Eastern and Western Europe

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Abstract
Objectives We report health conditions in the regions of the European Union (EU) from both objective and subjective perspectives and verify whether drawing conclusions regarding the health conditions in different countries without considering the countries' sub-national variability may lead to inaccurate results.
Methods To depict health conditions in the EU regions, two classification methods are used: (1) hierarchical clustering with Ward's method and squared Euclidean distance and (2) *k*-mean clustering. To illustrate the intra-country variability of health conditions, the coefficients of variation are computed.
Results Health conditions are considerably better in the western regions of the EU. Objective and subjective health measures do not always coincide. Extensive within-country differences in health conditions exist.
Conclusions The EU is clearly split into the EU-15 and Central and Eastern European countries; however, this division is observed with respect to objective health conditions only. Inclusion of self-perceived health status in the analysis measures considerably changes this picture.

Keywords Subjective health · Objective health · Regions · Eastern Europe · Western Europe · EU-SILC

Introduction

To ascertain the health status and health conditions of a population with individual-level data, two types of health measures can be applied: self-reported (self-perceived, subjective) and objective measures. The former generally manifests itself in survey questions and can be detected in individual opinions regarding health-related problems. Objective measures are captured by independent observers with a certain replicable methodology, and are generally recorded in registers (Murray and Chen 1992). Research results indicate that not only do objective measures generally capture the health concept differently, but more importantly, objective data also come from different data sources. However, it should be noted that the objective measures of health and biomarkers are increasingly included in surveys (Ambrasat et al. 2011). Examples of objective health measures and self-reported health indicators used in scientific research are presented in Table 1.

A great deal of literature is available on the advantages and limitations of objective and self-reported health measures. We try to gather them in concise way in Table 1.

The arguments for the use of both self-reported and objective indicators are consistent with the arguments raised in other fields in favour of such a combination (see, e.g. Bialowolski and Weziak-Bialowolska 2013). First, because objective and self-reported health indicators appear to play complementary roles, using both to assess the health conditions of populations or individuals appears to be a natural solution for obtaining a broader and more reliable picture. As shown by Leinonen et al. (2002), it may

This paper is based on data from Eurostat, EU statistics on income and living conditions. The responsibility for all conclusions drawn from the data lies entirely with the author.

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Table 1 Indicators of the objective and subjective health measures—examples, advantages and limitations

Health measures	Examples	Advantages and limitations
Objective health measures		
Medical parameters	Anthropometric parameters, serum parameters, electrocardiogram parameters (Perrig-Chiello et al. 1999; Johnston et al. 2009; Darko et al. 2012); measures of morbidity such as physiological and pathophysiological indicators; functional tests; and clinical diagnosis (Murray and Chen 1992)	Advantages Possibility to assess health in objective (perception free) way Limitations Difficulty of assessing the critical level pointing to the existence of phenomena of interest
Healthcare-related indicators	Healthcare use (Saevareid et al. 2007)	Different morbidity indicators may capture completely different aspects of diseases and health (Murray and Chen 1992)
Population-related health indicators	Life expectancy at birth and mortality rate (Bourne 2009)	Difficulty with interpretation of health conditions for groups with low mortality and morbidity (Allison and Foster 2004)
Indirect measures of health conditions	Handgrip strength (Ambrasat et al. 2011), body mass index and waist/hip ratio (Darko et al. 2012)	Lack of self-perceived opinion about the health conditions
Self-reported health indicators		
Single survey questions	On self-reported general health and satisfaction with it (Perrig-Chiello et al. 1999; Saevareid et al. 2007; Filipkowski et al. 2010; Ambrasat et al. 2011)	Advantages Possibility to assess self-perceived health conditions Limitations Suffer from a lack of reliability caused by (1) survey sampling, (2) question wording, (3) inaccurate participant memory, or (4) different formulations between people of self-reported opinions regarding morbidity (Bertrand and Mullainathan 2001; Prince et al. 2008; Johnston et al. 2009) Depend on social and cultural backgrounds, personal awareness and predispositions in the perception of illness, and inclination to pathological behaviours (Murray and Chen 1992)
	On morbidity: (1) illness/injury (Murray and Chen 1992; Baker et al. 2001; Bourne 2009; Darko et al. 2012), (2) chronic illness (Murray and Chen 1992; Baker et al. 2001; Johnston et al. 2009), (3) medication use (Filipkowski et al. 2010); (4) healthcare service use (Murray and Chen 1992)	
	On ability or disability/restriction to perform specific activities, functions, and tasks; restrictions on normal activities or on performing a specific task (Murray and Chen 1992; Baker et al. 2001)	
Scales constructed from survey questions	Of self-assessed physical and mental health (Ambrasat et al. 2011; Darko et al. 2012)	
	Of subjective health complaints (Saevareid et al. 2007; Filipkowski et al. 2010)	

occur that although in certain periods of life self-perceived health is relatively stable, objective health conditions worsen. Second, not only does self-reported health provide information regarding the importance and true burden of pain on an individual in the presence of an objectively identified disease but self-reported health is also an important predictor of both short-term prospective health status, especially of death among older adults, and the need for healthcare in the future (Schoenfeld et al. 1994; Rosen and Wu 2004; Schneider et al. 2004; Saevareid et al. 2007; Johnston et al. 2009).

In this paper, we seek to present health conditions in regions of the European Union (EU) with an emphasis on the comparison between Western and Eastern Europe. To this end, we first propose a set of measures of population health conditions using two perspectives: objective and self-perceived. Second, we determine the regions with highly favourable and extremely unfavourable health conditions. Of special interest are areas in which the two measures of health conditions are the opposite. Finally, we show that country-level health measures may lead to unjustified conclusions when compared with health conditions between regions of different countries.

The innovative points of our study are the following: To the best of our knowledge, this is the first approach to determine health conditions for sub-national European territorial units. Because the second level of the nomenclature of territorial units for statistics (NUTS 2) areas, being a part of a hierarchical system for dividing up the economic territory of the EU, is a key element of the EU's regional policy (Becker et al. 2010), we argue that research on the spatial distribution of health conditions among the sub-national populations is a necessity. In this study, the differences in health conditions are measured simultaneously from both

objective and self-reported perspectives using a set of indicators for each perspective.

In general, such an approach has been missing in previous analyses because they have focused mainly on relations between one self-reported and one objective measure of health and the analysis related to groups of people defined not by spatial location but by either demographic or socio-economic traits or according to the reported ailment. Examples of such analyses can be observed for older adults in Bound (1991), Cappeliez et al. (2004), Cho et al. (2011), Kalwij and Vermeulen (2008), Perrig-Chiello et al. (1999), Saevareid et al. (2007), and Schneider et al. (2004); for adults, in Darko et al. (2012) and Prince et al. (2008); for people suffering from chronic illness, in Arnold et al. (2005), Johnston et al. (2009), and Murberg et al. (1997); for married and divorced couples, in Colman et al. (2012); and for people with different labour market status, in Kalwij and Vermeulen (2008).

The remainder of the paper is organised as follows: in "Methods", we present the data sources with special emphasis on the indicators used. In "Results", we concisely present the methods adopted. We show the regions experiencing particular health conditions with respect to objective and subjective measures and present the analysis of within-country variability for each indicator separately and then collectively in the "Results" section. The final section concludes our study. Additional information on the analysed regions and on sub-national representation of the EU-SILC data is provided in the Supplementary Appendix.

Methods

Our goal was to preserve the dualistic nature of the concept of health and describe health at the sub-national level, optimally the NUTS 2 level. This need markedly influenced the choice of variables.

Data: objective health

Consistent with proposals of objective health measures presented in the literature, we decided to describe objective health with four indicators: (1) life expectancy at birth (LE), (2) infant mortality rate (IM), (3) potential years of life lost before age 70 (PYLL70) and (4) probability of not reaching age 65 (P65). All four indicators except LE are negatively oriented towards health conditions. We decided not to include objective data on morbidity mainly because there are no available objective data on morbidity that are both comparable across the EU countries and reported reliably at the sub-national level.

All indicators describing objective health dimensions were derived from the Eurostat and describe objective health conditions in 270 NUTS2 regions. To improve the reliability of indicators and to account for outliers, each indicator was averaged across three time points between 2007 and 2009.

Data: subjective health

To measure the health conditions from a subjective perspective, we used indicators describing general health conditions, morbidity operationalized as a long-standing illness and functional disability from three waves (2008–2010) of the European Union Survey on Income and Living Conditions (EU-SILC). Three indicators describing subjective or self-reported health conditions (all indicators related to health conditions that are available in the EU-SILC) were proportions of people (1) declaring to have good general health (GH), (2) reporting no long-standing illnesses (LSI), and (3) reporting no limitations in activities because of health issues (LA). For all indicators, higher values correspond to better self-reported health conditions.

To discern health conditions, we analysed 88 geographical units from different levels of NUTS classifications (more information on the issue is provided in the Supplementary Appendix).

Statistical methods

To depict health conditions in the EU regions, classification methods are used. Because final grouping may depend on the choice of the classification method and distance measure, two methods are used: (1) hierarchical clustering with Ward's method and squared Euclidean distance and (2) *k*-mean clustering.

To illustrate the within-country variability of the health conditions, first the coefficients of variation were computed. The computations for objective indicators are twofold: for all NUTS 2 and for "EU-SILC regions". Because the regions covered by the EU-SILC do not correspond directly to the NUTS 2 regions described by the objective health indicators, the latter were recomputed to enable comparisons of variability between objective and subjective indicators (labelled with "*"). Then, regional level estimates along with the country-level estimates are presented for objective indicators and for subjective indicators. All analyses are performed on standardised indicators using SPSS 18.

Results

Health conditions in Europe

To determine health conditions in Europe, we examined the interrelation between objective and subjective health

variables. To this end, two aforementioned classification methods were used. The results overlap in 91 % of cases (Table 2). The differences are noted for 8 of 88 analysed regions that belong to either group 1 or group 2 (BE3, CZ05, CZ07, ES12, ES41, ES52, ES61, and SE3—names of regions are presented in Table 2 and Supplementary Appendix), implying that it is not conclusive whether they are characterised by either good or bad subjective health conditions.

The groups were assessed with respect to the average level of each objective and subjective indicator and the results are presented in Fig. 1. Group 1 comprises regions

Table 2 European Union regions according to objective and subjective health measures—classification results based on the European Union Survey on Income and Living Conditions indicators (2008–2010) and indicators provided by the Eurostat (2007–2009)

		Objective health	
		Bad	Good
Subjective health	Bad	Group 4 – CZ04-Severozapad, CZ08-Moravskoslezsko, – Estonia – HU1-Kozep-Magyarorszag, HU2-Dunantul, HU3-Alfold Es Eszak, – Lithuania, – Latvia, – PL1-Region Centralny, PL2-Region Południowy, PL3-Region Wschodni, PL4-Region Polnocno-Zachodni, PL5-Region Poludniowo-Zachodni, PL6-Region Polnocny, – Slovakia (n = 15)	Group 1 – AT1-Ostosterreich, AT2-Sudosterreich, AT3-Westosterreich, – Germany, – ES11-Galicia, ES43-Extremadura, – FI13-Itä-Suomi, FI18-Etelä-Suomi, FI19-Länsi-Suomi, FI1A-Pohjois-Suomi, – FR2-Bassin Parisien, FR3-Nord-Pas-de-Calais, FR4-Est, FR5-Ouest, FR6-Sud-Ouest, FR7-Centre-Est, FR8-Mediterranee, – the Netherlands, – Portugal, – Slovenia (n = 20)
	Good	Group 3 – BG3-Severna i Iztochna Bulgaria, BG4-Yugozapadna i Yuzhna Centralna Bulgaria, – RO11-Nord-Vest, RO12-Centrum, RO21-Nord-Est, RO22-Sud-Est, RO31-Sud-Muntenia, RO32-Bucuresti-Ilfov, RO41-Sud-Vest Oltenia, RO42-Vest (n = 10)	– BE3-Région Wallonne, – CZ05-Severovýchod, CZ07-Střední Morava, – ES12-Principado de Asturias, ES41-Castilla y León, ES52-Comunidad Valenciana, ES61-Andalucía, SE3-Norra Sverige (n = 8) Group 2 – BE1-Région de Bruxelles-Capitale, BE2-Vlaams Gewest, – Cyprus, – CZ01-Praha, CZ02-Střední Čechy, CZ03-Jihozápad, CZ06-Jihovýchod, – Denmark, – ES13-Cantabria, ES21-País Vasco, ES22-Comunidad Foral de NavarraES23-La Rioja, ES24-Aragón, ES30-Comunidad de Madrid, ES42-Castilla-La Mancha, ES51-Cataluña, ES53-Illes Balears, ES62-Región de Murcia, ES70-Canarias, – FR1-Île de France, – GR1-Voreia Ellada, GR2-Kentriki Ellada, GR3-Attiki, GR4-Nisia Aigaiou, Kriti, – Ireland, – ITC-Nord-Ovest, ITD-Nord-Est, ITE-Centro, ITF-Sud, ITG-Isole, – Luxembourg, – Malta, – SE1-Östra Sverige, SE2-Södra Sverige, – the United Kingdom (n = 35)

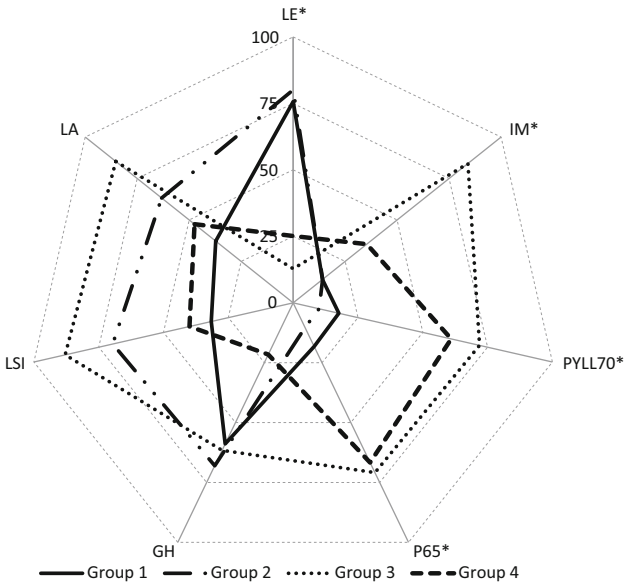

Fig. 1 Group characteristics according to objective (based on the indicators provided by the Eurostat, 2007–2009) and subjective health indicators (derived from the European Union Survey on Income and Living Conditions 2008–2010); means normalised by min–max method; *GH* percentage of people declaring to have good general health, *LSI* percentage of people reporting no long-standing illnesses, *LA* percentage of people reporting no limitations in activities because of health issues, *LE** life expectancy at birth, *IM** infant mortality rate, *PYLL70** potential years of life lost before age 70, *P65** probability of not reaching age 65

that have very good position with regard to all objective health indicators but the worst position with regard to two of the three subjective health indicators (LA and LSI) and moderate position related to the remaining indicator (GH). Group 2 is similar to group 1 with respect to objective health situations but differs in subjective situations. To this group belong regions in which the health situation is perceived as very good with the highest percentage of people claiming to be in at least good health and the second highest percentage of people without LSI or who do not feel limited in everyday activity because of health problems. Group 3 is unusual. It comprises regions performing worst in all objective health measures and best in two of the three subjective health measures (LA and LSI) and very well in the remaining subjective measure (GH). Regions belonging to group 4 are characterised by relatively poor performance in three of the four objective health indicators (LE*, PYF*, P65*) and moderate performance in the remaining indicator (IM*). This unfavourable situation coincides with poor measurements in all self-perceived measures. Namely, this group comprises the lowest share of people claiming at least good health. This group is second lowest in the number of people without long-standing illness and who are not limited in activity because of health conditions.

It can be noted that the prevailing number of regions can be described as having favourable health conditions measured in objective terms (20 + 8 + 35). However, these are exclusively regions of Western and Southern European countries. This group includes only two regions of the Central and Eastern European countries (CEE)—the Czech Republic and Slovenia. All other CEE countries are characterised by relatively worse objective health conditions.

Regions experiencing good objective health conditions differ with regard to subjective measures. Poor subjective health conditions coexist with good objective health in Germany, the Netherlands, Portugal, Slovenia, all Austrian, all Finish, nearly all French (apart from Ile de France-FR10) and two Spanish regions.

In Cyprus, Denmark, Ireland, Luxembourg, Malta, the United Kingdom, all Italian, all Greek, a prevailing number of Spanish, four of eight Czech, two of three Belgian, one French, and two of three Swedish regions, people are healthy according to both subjective and objective measures.

Definitely the worst health conditions are experienced by people living in the CEE countries. Estonia, Lithuania, Latvia, Slovakia, all Polish, all Hungarian and two of eight Czech regions not only report being in disadvantaged health conditions but are also unhealthy according to objective measurements. Notably, people living in Romanian and Bulgarian regions declared themselves to be in general good health; although the levels of objective health recorded there are the lowest in the entire EU.

Within-country variability of health measures

The analysis of the regional variability of each indicator (Table 3) shows that changing the NUTS level from NUTS 1 (columns 5–8) to NUTS 2 (columns 1–4) increases variations, which shows that regions are more diversified than macro-regions or countries. The variability differs between indicators. Among objective indicators (columns 1–4 and 5–8), the most differentiated is the IM rate, and the most homogeneous is LE at birth. Comparing objective (columns 5–8) and subjective health indicators (columns 9–11), it is noticeable that objective measures have higher variations than the subjective measures. The conclusion from the above analysis is that regardless of the spatial location of the region, considerable within-country differences are indicated if only sub-national levels are available.

To better illustrate the issue, the regional variability of each indicator is presented in Figs. 2, 3, 4, 5 for objective indicators and Figs. 6, 7, 8 for subjective indicators. Countries are sorted starting with the best performer. For each country, all available NUTS estimates related to an indicator of interest are presented and compared with the country-level estimate. It is seen that relying only on countrywide estimates may be

Table 3 Coefficients of variation (%) for the European Union countries based on the European Union Survey on Income and Living Conditions indicators (2008–2010) and indicators provided by the Eurostat (2007–2009)

Country	LE (1)	IM (2)	PYLL (3)	P65 (4)	LE* (5)	IM* (6)	PYLL70* (7)	P65* (8)	GH (9)	LSI (10)	LA (11)
Austria	0.89	33.51	9.04	9.01	0.84	34.62	8.85	8.66	1.13	2.91	3.86
Belgium	1.60	33.21	17.54	17.69	1.52	6.51	14.54	15.80	3.78	2.54	4.19
Bulgaria	0.83	23.13	6.19	3.86	1.10	24.29	7.60	4.42	1.74	2.45	2.58
Cyprus	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Czech Republic	1.34	27.20	11.76	10.75	1.34	27.20	11.76	10.75	2.72	2.89	3.89
Germany	0.89	20.75	8.75	8.91	–	–	–	–	–	–	–
Denmark	0.64	9.65	5.66	5.54	–	–	–	–	–	–	–
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	1.22	25.84	11.47	10.94	0.97	17.73	7.71	8.26	1.77	3.76	4.90
Finland	1.38	30.77	18.34	19.36	0.70	8.15	6.82	6.36	0.85	3.62	4.39
France	1.48	48.70	15.93	11.82	1.58	9.05	12.03	14.31	1.10	3.61	3.78
Greece	0.93	37.70	9.88	7.60	0.58	18.75	4.86	3.36	1.42	1.37	1.28
Hungary	1.29	24.89	9.35	7.44	1.54	19.28	10.65	8.46	2.56	6.31	6.25
Ireland	0.18	3.82	1.72	2.97	–	–	–	–	–	–	–
Italy	0.76	26.23	8.45	7.76	0.69	18.76	7.00	5.82	2.35	1.61	2.02
Lithuania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Latvia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Malta	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	0.46	15.98	3.60	3.03	–	–	–	–	–	–	–
Poland	1.11	12.02	9.49	8.89	0.40	9.72	3.92	4.05	1.37	1.40	1.99
Portugal	2.42	15.98	16.65	19.27	–	–	–	–	–	–	–
Romania	0.95	15.46	7.25	4.70	0.95	15.46	7.25	4.70	1.53	2.39	2.84
Sweden	0.57	19.90	4.63	4.32	0.58	4.91	5.05	3.77	0.18	2.15	1.76
Slovenia	1.99	33.94	15.71	15.85	–	–	–	–	–	–	–
Slovakia	1.47	49.56	13.25	10.03	–	–	–	–	–	–	–
United Kingdom	1.59	17.17	13.74	14.04	–	–	–	–	–	–	–

GH percentage of people declaring to have good general health, *LSI* percentage of people reporting no long-standing illnesses, *LA* percentage of people reporting no limitations in activities because of health issues, *LE* life expectancy at birth, *IM* infant mortality rate, *PYLL70* potential years of life lost before age 70, *P65* probability of not reaching age 65

* Coefficients of variation computed for the regions present in the European Union Survey on Income and Living Conditions, called "EU-SILC regions"

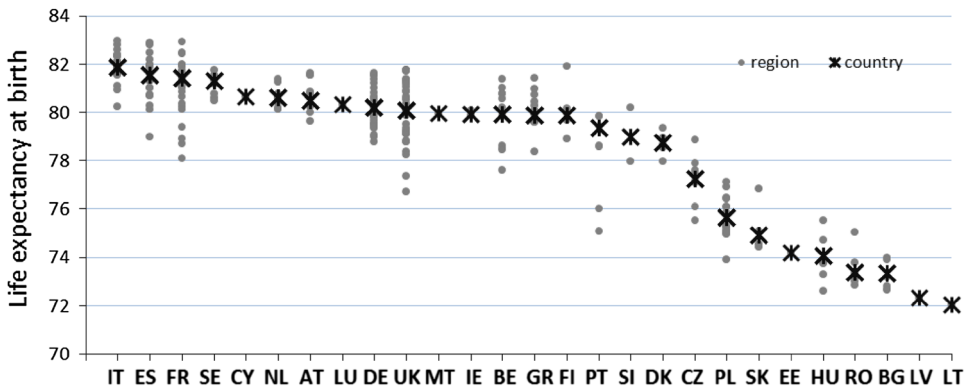

Fig. 2 Life expectancy at birth in the European Union countries

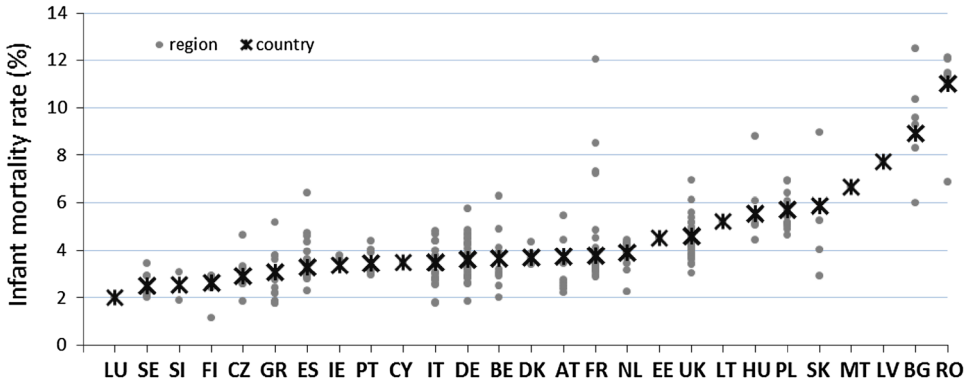

Fig. 3 Infant mortality rate in the European Union countries

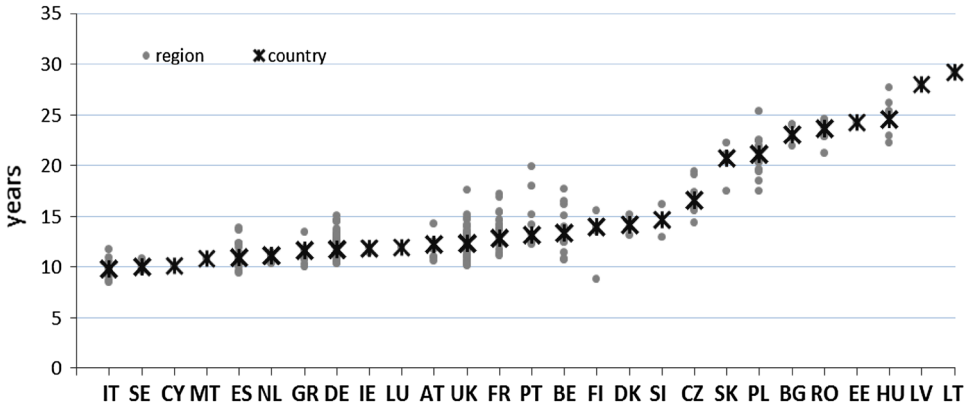

Fig. 4 Potential life years lost before 70 in the European Union countries

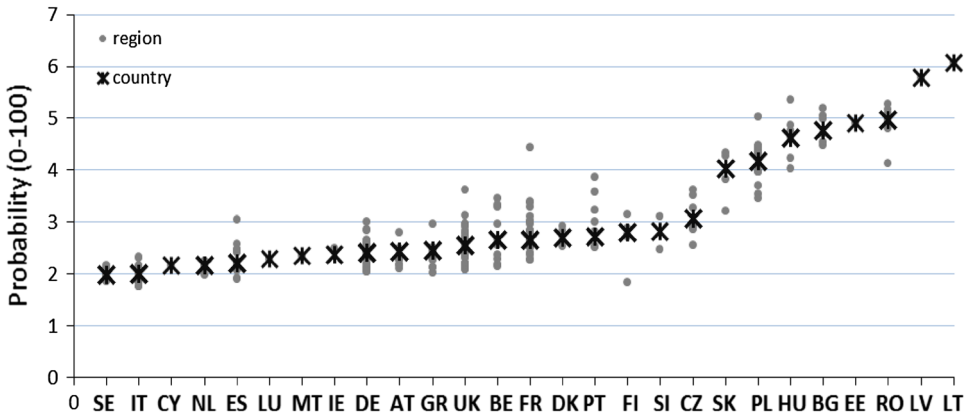

Fig. 5 Probability of not reaching the age of 65 in the European Union countries

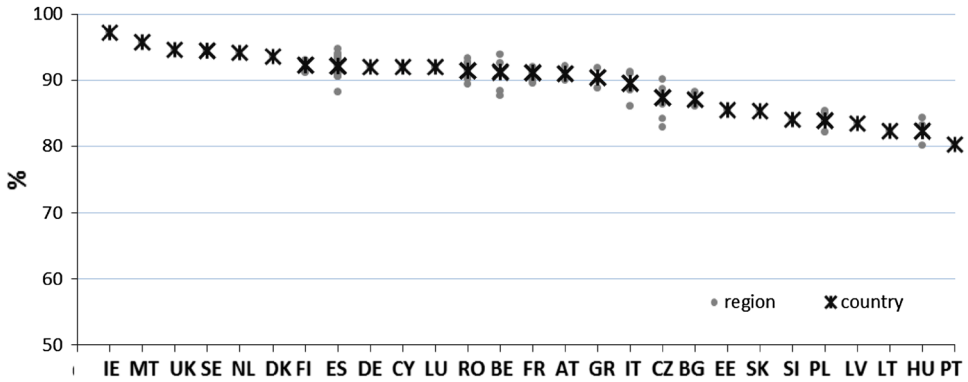

Fig. 6 Percentage of people declaring to have good general health in the European Union countries

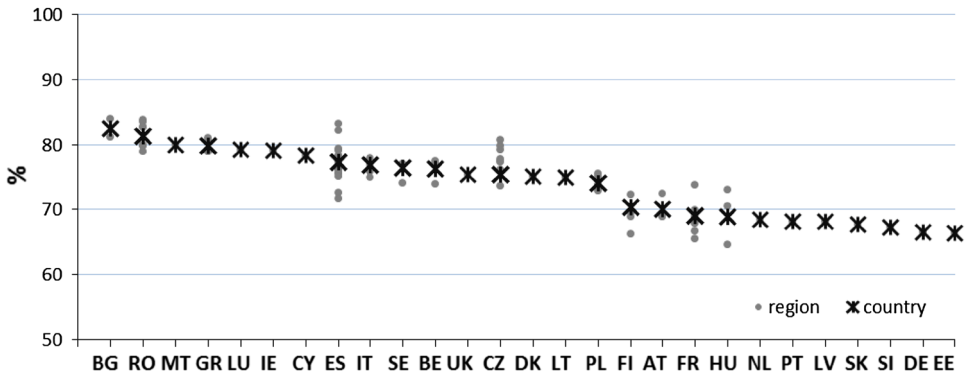

Fig. 7 Percentage of people reporting no long-standing illnesses in the European Union countries

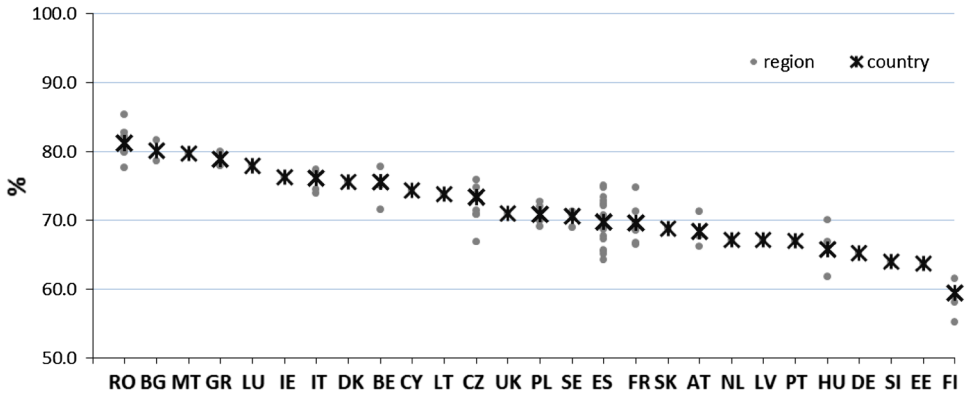

Fig. 8 Percentage of people reporting no limitations in activities in the European Union countries* *AT* Austria, *BE* Belgium, *BG* Bulgaria, *CY* Cyprus, *CZ* the Czech Republic, *DE* Germany, *DK* Denmark, *EE* Estonia, *ES* Spain, *FI* Finland, *FR* France, *GR* Greece, *IE* Ireland, *HU* Hungary, *IT* Italy, *LT* Lithuania, *LU* Luxembourg, *LV* Latvia, *MT* Malta, *NL* the Netherlands, *PL* Poland, *PT* Portugal, *RO* Romania, *SE* Sweden, *SI* Slovenia, *SK* Slovakia, *UK* the United Kingdom

misleading when properly assessing the relative standing of a region with respect to health conditions, which can be illustrated with the following examples:

- Regarding LE at birth (Fig. 2) and considering the range France and the United Kingdom (UK) are the two most diversified countries in this respect. The difference between the best performers (French FR10-Ile de France and British UKJ1-Berkshire, Buckinghamshire and Oxfordshire) and the worst performers (French FR93-Guyane and British UKM3-Southwestern Scotland) amounts to 4.83 and 5.07 years, respectively. Thus, even considering the least volatile indicator, there are differences between regions of one country that hinder replication of country rankings with sub-national administrative entities.
- Analysing IM and again considering the range show (Fig. 3) France to be the most diversified country in this respect. Specifically, the French region FR93-Guyane, the Bulgarian BG34-Yugoiztochen and two Romanian (RO21-Nord-Est, RO22-Sud-Est) regions are among the worst performers whereas other regions from these countries are in the middle of the rankings.
- Regarding PYLL70 (Fig. 4) and P65 (Fig. 5), the highest sub-national volatility is observed in the middle of the country rankings. This phenomenon is observable for British, French, Portuguese, Belgian and Polish regions, implying that ignoring country perspective may affect the rankings considerably. For example, the Finish region FI20-Aland, in terms of both PYLL70 and P65 indicators, may attain one of the top positions when examined separately. Identical reasoning applies to the Spanish region ES30-Comunidad de Madrid.

Discussion

Our findings clearly demonstrate that the EU is split into the EU-15 and the CEE countries with respect to health

conditions but only when considering objective measures. Inclusion of measures of self-perceived health status considerably enriches this picture. We showed that the best health conditions with regard to both objective and subjective measures occur in Cyprus, Denmark, Ireland, Luxembourg, Malta, the United Kingdom, in all Italian and Greek regions, in northeastern Spanish regions, the French capital region, the Belgian capital region and Wallonia and the southern section of the Czech Republic. The worst health conditions are in Estonia, Lithuania, Latvia, Slovakia, all Polish, all Hungarian and two of eight Czech regions. The most interesting cases are, however, those with opposite conclusions in the area of subjective and objective health measures. Romanian and Bulgarian populations, although objective measures indicate unfavourable health conditions, report satisfactory health conditions. On the other hand, regions of Germany, the Netherlands, Portugal, all Austrian, all Finish, nearly all French regions (apart from the capital region), regions in Western Spain, and Slovenia experience good objective health conditions but report weak subjective measures. It is worth noting that Slovenia is the only CEE country with good objective health conditions, which implies that it managed to maintain positive facets of the 'old' health system during the political and economic transition in the 1990s and combine them with modern approaches to the public health (Allutis et al. 2013). However, it should be also noted that Slovenia at the date of accession to the EU (i.e. 2004) was the most developed country out of the CEE countries with GDP per capita exceeding average for the new member states by around 50 %.

With regard to the inconsistent results with respect to objective and subjective health measures, the explanation for such seemingly peculiar behaviour may be related to the (1) latent and multi-facet nature of the self-reported health measures [including understanding of the concept of perceived health, process of health assessment (Jylhä 2009) and health ideals related to the awareness issues (Graham 2008; Filipkowski et al. 2010)], (2) frequency of use of health service (Murray and Chen 1992) related to service provision, (3) level of health literacy (WHO 2013), (4) and delay-of-death effects (Gruenberg 2005) but only in the case of regions objectively in good health conditions but subjectively not.

There is a long-standing debate on the understanding of the perceived health measures, especially of the self-rated health question (see Fayers and Sprangers 2002; Huisman and Deeg 2010; Jylhä 2009, among others). Although there is a widespread agreement that the measures provide useful information on overall assessment of individual health status, there are still concerns about the understanding of this concept and the process of health assessment. As noticed by Jylhä (2009), the concept of health has not any universally agreed conceptual and operational definition. Therefore, its understanding in terms of definition and components differ among individuals depending on the contextual frameworks. These frameworks include the cultural and historical background of an individual, but also his/her social characteristics such as social class or standard of living, among others. Although both issues relate to the concept of the measurement invariance (Vandenberg and Lance 2000), the former seem to change the interpretations and conclusions drawn from the health assessment process (Jylhä 2009), the latter are likely to influence the likelihood of different objective health conditions being used as a basis for self-ratings (Manderbacka et al. 1999).

Therefore, the differences between objective and subjective measures, which we recorded for the populations mentioned above, may, first, reflect the real differences in the objective measures that are not included in the analysis but taken into account by the subjective measures. Second, they may correspond to differences in levels of knowledge about one's own health or, third, differences in the evaluation process. The last option includes the way of use of: (1) answer scale to a survey question (e.g. predisposition to choose extreme answer categories), (2) information about health ideals and morbidity occurrences in a given society constituting reference bases for the assessment, and (3) willingness to report positive or negative pictures of an individual himself.

Unfortunately, knowledge about differences in the health assessment process and the process of answering to specific health-related survey question (but also in general to a survey question) between populations of different cultural and historical background are limited. It is mainly because these factors are difficult to be measured in the quantitative studies. What we propose for the future, based on the results from this study, is a consultation with culture studies experts and/or linguists to examine potential sources of divergence occurring not only for national populations but also for national sub-populations (i.e. particular French and Spanish regions) in Europe.

Regarding mostly the Western European regions that experience good objective health conditions but report weak subjective measures, it is first worth noting that frequency of use of health service has increased more rapidly in the EU-15 than in the CEE. It results in better health provision and is likely to increase knowledge of health processes and health ideals. This, in turn, may increase community and individual health standards but at the same time is likely to increase perception of morbidity. Higher standards with respect to the health ideals, as pointed by Graham (2008), are likely to stimulate demand and expectations for health care, resulting in the phenomenon of the healthy and unhappy Europeans and the happy peasant. Additionally, as noted by Filipkowski et al.

(2010), "increased familiarity with health care may skew one's perception of illness, e.g. medical student syndrome, which may occur in regions with intensive health promotion policy". Furthermore, as Filipkowski et al. (2010) claim, those who care more about health consequences of modern living (e.g. air pollution, food additives, chemicals in household products) tend to complain more often for symptoms and report poorer health. Thus, in countries where health literacy competencies are higher, people not only adopt healthier lifestyles but also demand stronger their rights as patients (WHO 2013). It is likely that one of such examples is the Netherlands (with the highest percentage −71 %—of people having sufficient or excellent health literacy competencies) being one of the countries scoring well in terms of objective measures and not so well according to the subjective ones.

Second, during the recent period of economic slowdown, some countries belonging to the group reduced expenses on health promotion or disease prevention justifying it by high and still growing LE of populations. Since these decisions and situations were present in the public debate, they might have influenced population discontent causing a rise in unfulfilled expectations, especially in contrast to the previous health care conditions.

Finally, it has been acknowledged that in low-mortality countries the LE of individuals with chronic diseases has increased more than that of the rest of the population. Those people, despite living longer, are more prone to report unsatisfactory health conditions because of higher aspiration level or higher expectations concerning one's health status (Jylhä 2009).

Declared good general health conditions combined with the lowest levels of objective health measures present in Romanian and Bulgarian regions are in line with the conclusions formulated by Murray and Chen (1992) and Sen (2002). They claim that for some reason poorer people in developing countries report morbidity less readily or less often, whatever their objective health status may be. However, their positive self-rated health does not have to be an indicator of good physical health, as noted by Jylhä (2009). As Romania and Bulgaria are the poorest countries among the EU countries, this reasoning seems to fit also in this case. A person living in a community with many diseases and a poor healthcare system may be inclined to underestimate her/his own health condition, taking as normal symptoms that are clinically preventable and/or treatable (Sen 2002; Jylhä 2009). This in turn may result in lower expectations for good health care and lower demand for treatment due to insufficient awareness (Graham 2008).

Furthermore, weak health literacy competencies result in poorer health, less healthy choices and behaviours, and less participation in health-promoting and disease detection activities, among others (WHO 2013). All the above-mentioned neglects impede improvements in objective measures of health but are rather indifferent to the subjective measures of health. Bulgaria is the worst performer with respect to the health literacy, with 62 % people with inadequate or problematic level of health literacy (HLS-EU Consortium 2012). Unfortunately, Romania did not participate in the survey; therefore, no conclusions in this respect can be drawn. However, taking into regard that lower health literacy is more prevalent in low-income population groups and among cultures in transition, we may expect that the level of health literacy is not very high there.

The second finding of the article, which should be subject to discussion, is the presence of considerable within-country differences between regions with respect to health situations. Although the research based on subnational data is scarce, our arguments are supported by analyses of the standardised mortality ratios by Brennan and Clare (1980) and Mays and Chinn (1989) and also of the morbidity indicators by Brennan and Clare (1980), i.e. objective health measures. They show for the regional and district levels in the United Kingdom that the level of the phenomena measured differs considerably. Our results go even further. The most striking result is the case of the Czech Republic with regions belonging to different groups with respect to both objective and subjective measures. Relying only on countrywide estimates may, thus, be misleading when applied to assessment of the relative standing of a region with respect to health conditions. This, in turn, may lead to incorrectly formulated policy targets in the field of public health.

Our research adds to the existing literature by combining dimensions of subjective and objective health measures on the regional level. However, it has also one major limitation. Our calculations of subjective health measures were based on data from a survey representative at the country level. To overcome this issue, we verified the usefulness of data in regional analysis but the application of techniques like the small area estimation technique may be considered for further research.

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