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Measurement and determinants of health poverty and richness: evidence from Portugal

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Abstract The analysis of health inequalities is a critical topic for health policy. With data for Portugal, we propose an algorithm to convert information provided by the official National Health Survey to EuroQol. Based on these data, we make two contributions. First, we extend measures and methods commonly applied in other fields of economic research in order to quantify the phenomena of health poverty, richness, and inequality. Second, using an ordered probit model, we evaluate the determinants of health inequalities in Portugal. The results show that there is a remarkable level of health inequality, with significant rates of poverty (11.64 %) and richness (22.64 %). The econometric study reveals that gender, age, education, region of residence, and eating habits are among the most critical determinant factors of health.

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1 Introduction

Health inequality has appeared more and more on the agenda of national and international organizations in recent years. OECD countries in general, and European regions in specific, have witnessed considerable gains in health, although important inequalities still exist. Moreover, the current world economic crisis has amplified the social and economic inequalities between and within countries, thereby giving high priority to further efforts to reduce them.

Reducing inequality in health is a goal in itself since "achieving the various specific global health and development targets without at the same time ensuring equitable distribution across populations is of limited value" (Blas and Kurup 2010, p. 4). Decreasing inequalities in health can thus be considered a matter of social justice (Jakab and Marmot 2012; Marmot et al. 2012). Eliminating these inequalities is a challenge to healthcare planners and policymakers. Their causes are complex and intertwined with several factors, including biological, behavioral, and socioeconomic factors (Målqvist et al. 2012). A more accurate knowledge of the causes of variations in health outcomes is a crucial step toward designing effective actions to reduce inequalities and, as a result, improve general community health (Dulin et al. 2012).

This paper contributes to the literature: (a) in the measurement of health poverty, richness, and inequality; and (b) in the empirical analysis of the under-explored Portuguese case, covering not only the quantification of the phenomena referred to in (a), but also the determinants of health inequality in Portugal.

Regarding the first contribution, the paper belongs to a well-established line of research that although concentrating preferentially on the measurement of income poverty and inequality (Cowell 2011), more recently also considers the evaluation of richness (Atkinson et al. 2011) and, simultaneously, has been expanding toward multidimensional analyses of these phenomena. In fact, economic literature has been recognizing that a correct evaluation of these concepts (poverty, richness, and inequality) cannot be achieved by considering only income (Ferreira 2011). The list of areas already covered is long, including education, time use, water, and nutrition, among others.

Obviously, given the importance of health for a multidimensional concept of well-being, these measures have also been applied taking health variables as the reference. The health economics literature has devoted a great deal of attention to the measurement of inequalities in health. Initial approaches to this issue applied indicators such as the Gini index or the Lorenz curve to health or healthcare measures (Chen 1976; Le Grand 1987) and evolved with proposals of bidimensional indicators of inequality such as the concentration index (Wagstaff et al. 1991; Kakwani et al. 1997). More recently, the theoretical discussion has been focusing on the development of inequality measures that are a better fit to ordinal health variables (Allison and Foster 2004;

Abul Naga and Yalcin 2008) and on cardinalization strategies of ordinal self-reported health measures to allow the use of the traditional inequality indicators (Van Doorslaer and Jones 2003). At the empirical level, researchers are doing their part by obtaining evidence for more countries, including developing countries (Wagstaff and Watanabe 2003) and making more international comparisons (Jürges 2010).

The present study follows this line of research taking as reference a summary measure of general health status instead of a specific and partial health indicator, as is commonly done (for exceptions, see Humphries and Van Doorslaer 2000; Van Doorslaer and Jones 2003; or Frick and Ziebarth 2013). This is accomplished through a process of conversion that makes the bridge between a national health survey and the well-known EuroQol (EQ-5D). Second, in addition to inequality, we incorporate poverty and richness in our analysis in order to gain a broader picture of the health distribution.

At the econometric level, we estimate an ordered probit model investigating what makes some people healthier than others. The fact that the analysis conducted herein is based upon individual data is an advantage compared to cross-country data. Indeed, national-level statistics often mask unfair disparities within and between population groups in terms of health outcomes (Blas and Kurup 2010).

Portugal is an interesting case study since it is one of the developed countries that, in the last decades, has made remarkable improvements in several key health indicators (e.g., mortality rates, life expectancy at birth, and vaccination) while simultaneously showing high levels of inequality (Van Doorslaer and Koolman 2004). Moreover, the country still has important inequalities at the individual and regional levels in variables that are critical to explain health outcomes (e.g., income *per capita* and education).

The remainder of the paper is structured as follows. Section 2 provides the background for the current study. Section 3 presents the health index that supports the empirical analysis we conduct. Section 4 discusses the measures of health poverty, richness, and inequality. Section 5 presents the econometric model and analyzes the estimation results. Section 6 explores an alternative econometric approach, exploiting the possibility of multilevel modeling. Section 7 discusses relevant policy implications of the study. Section 8 presents some final remarks.

2 Background

Portugal has experienced considerable progress in most health indicators since it became a constitutional democratic republic in 1974. For example, according to National Statistics (INE 2014), the infant mortality rate has fallen by over 7 % per year on average since 1970, dropping from 55.5 ‰ in 1970 to 3.4 ‰ in 2012 [Panel (a) in Fig. 1]. This allowed the country to move from the highest rate in Europe to among the lowest in the OECD today (OECD 2013). A similar improvement is seen with life expectancy at birth (64 years for males and 70.3 years for females in 1970; 76.8 years for males and 82.6 years for females in 2010). Panel (b) in Fig. 1 displays the evolution of this variable.

These improvements “reflect improved access to an expanding health care network, thanks to continued political commitment, and economic growth” (Barros et al. 2011, p.7).

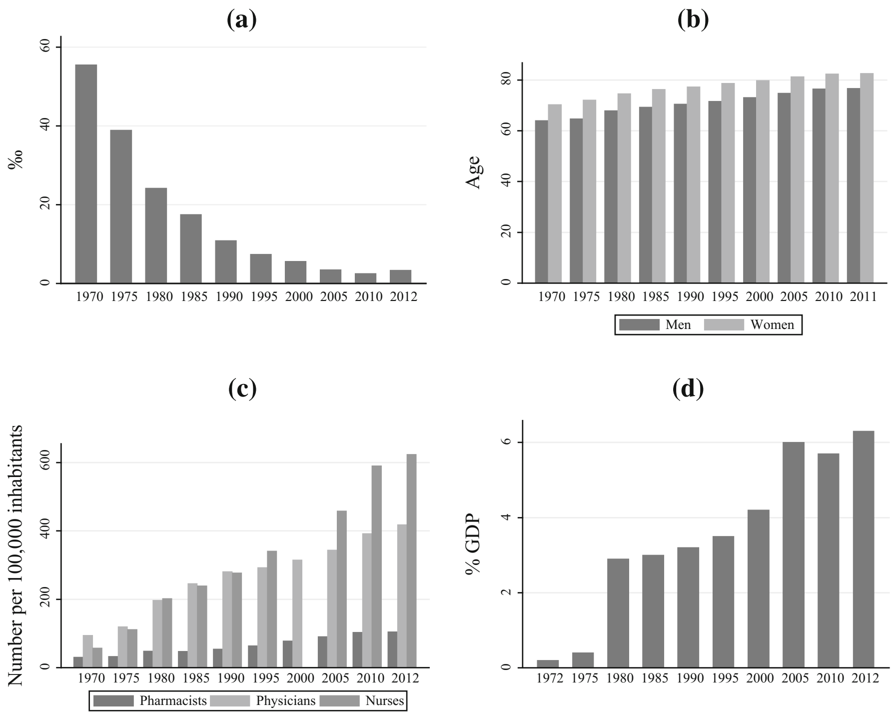


Fig. 1 Health indicators for Portugal (selected years). *Source*: National Statistics and PORDATA database. **a** Infant mortality rate. **b** Life expectancy at birth. **c** Number of physicians, nurses, and pharmacists per 100,000 inhabitants. **d** Government health expenditure as % of GDP

The Portuguese healthcare system is characterized by the coexistence of three systems: the National Health System (NHS), health subsystems for specific occupations or groups of employees (these can be found in the private and public sectors), and private voluntary health insurance. The NHS is a universal system, financed mainly through taxation, created in 1979 (following a trend observed in other Mediterranean countries—e.g., Greece, Spain, and Italy) with the objective of guaranteeing health protection to every citizen. The management responsibilities of the NHS were decentralized to the regional level during the 1990s. Concerning the health subsystems, many of them are in the public sector and target-specific groups: ADSE for civil servants (the largest subsystem, covering around 12 % of the Portuguese population); SSMJ for employees from the Ministry of Justice; ADFA, ADMA, and ADME for Air Force, Navy, and Army, respectively; SAD PSP for police officers and SAD GNR for National Republican Guards. In the private sector, the major subsystem is the one that targets those working in the banking or insurance sector (SAMS), covering 1 % of the population. Complementary, private health insurance covers between 10 and 20 % of the population.

Over the last decades, a substantial amount of financial resources (from the public and private sectors) have been dedicated to the healthcare system. This was crucial to its development. Between 1970 and 2012, the number of physicians, nurses, and pharmacists per 100,000 inhabitants increased considerably (see Panel (c) in Fig. 1). This trend was accompanied by: (i) a decrease in the overall number of hospitals (548 in 1975; 207 in 2012), due mainly to the reorganization of the network of public hospitals; and (ii) an increase in the number of primary health centers (206 in 1975; 387 in 2012).

Concerning the existence of a strong political commitment with this area, we see in Panel (d) of Fig. 1 that government health expenditure revealed a strong rising trend until 2005 and has remained relatively stable thereafter in approximately 6 % of the GDP (and 10 % of the total government expenditure).

Finally, the level of income *per capita* is one of the most important determinants of health. At constant prices of 2006, according to the PORDATA database, the average GDP *per capita* doubled between 1974 and 2012 (7332.9€ to 14,809.3€, respectively).

3 The health index

3.1 Data

This study is based on data for Portugal drawn from the National Health Survey (*Inquérito Nacional de Saúde*—INS) provided by National Statistics in cooperation with the Dr. Ricardo Jorge National Health Institute. We consider the last wave of the survey (2005–2006). INS contains a wide range of self-reported information on multiple health themes, namely: (a) health status, chronic diseases, and incapacities; (b) health care and prevention; (c) living styles; and (d) quality of life. This survey, conducted by the method of direct computer assisted interviews, is nationally representative of the households living in Continental Portugal and the islands (Madeira and Azores). For defining the sample, stratification was used at the level of NUTS III. In each household, information on every household member is obtained.

We use data from the first quarter (the only one that includes all the questions necessary for the construction of our health index), covering a representative sample of the Portuguese population with 6339 individuals ($i = 1, \ldots, 6339$).[1] Descriptive statistics of the sample are shown in Table 3, where we present the list of explanatory variables used in the econometric exercise.

3.2 Building the index

The analysis of health distributions starts with the need to measure individual health levels. Several strategies can be used to that end. The most frequent approach (to a great extent influenced by data availability restrictions) relies on self-assessed health measures in which individuals are asked to rate their health using a given scale. The main problem with this type of variable is related to inaccuracies stemming from reporting heterogeneity. As mentioned by Pfarr et al. (2012, p. 1), "given an identical understanding of health-related questions and response style, self-assessed health would

[1] The survey includes groups of questions that were applied in all the quarters as well as some others that were answered only in a specific quarter.

reflect (unobservable) true health which would make it a valid indicator. However, varying reporting behavior leads to discrepancies between self-assessed health and the underlying true health. This may result in systematic differences in stated health across population subgroups, even if the underlying true health status is identical". Other approaches include vignette-based health measures (e.g., an assessment method in which individuals are asked to rate their health and other hypothetical cases on the same response scale), medical healthcare measures (e.g., doctor visits, days in hospital), objective measures (e.g., grip strength, body mass index), and quasi-objective measures (e.g., SF-12, EQ-5D).

It is especially appealing to measure health status through the use of multi-attribute surveys that allow gathering information on a number of health dimensions into an index representing the individual's (self-reported) overall health condition. EQ-5D is one of the most well-known multi-attribute surveys. The survey defines health in terms of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. For each dimension, there are three possible responses (1, 2, 3) reflecting increasing levels of severity: no problems, some or moderate problems, and extreme problems. The combination of the answers leads to a 5-digit number describing the respondent's general health status. Each of these codes expresses a given health status (e.g., code 11111 represents full health). A total number of 243 situations are possible.

The EQ-5D index score from each individual $i\,(H_i)$ is computed through an algorithm that deducts from the maximum value of that index (score equal to 1.0) predetermined coefficients for each response different from 1 on any dimension and also two constant values—one when there exists at least one response different from 1 and another one if any dimension has a level 3 problem. More specifically, health utilities derived from the UK value set were used (Dolan 1997), which means that H_i varies between -0.594 and 1. The health index of a given individual i will be designated as HI_i and results from the normalization, through the min–max method, of HI_i to the 0–1 range:

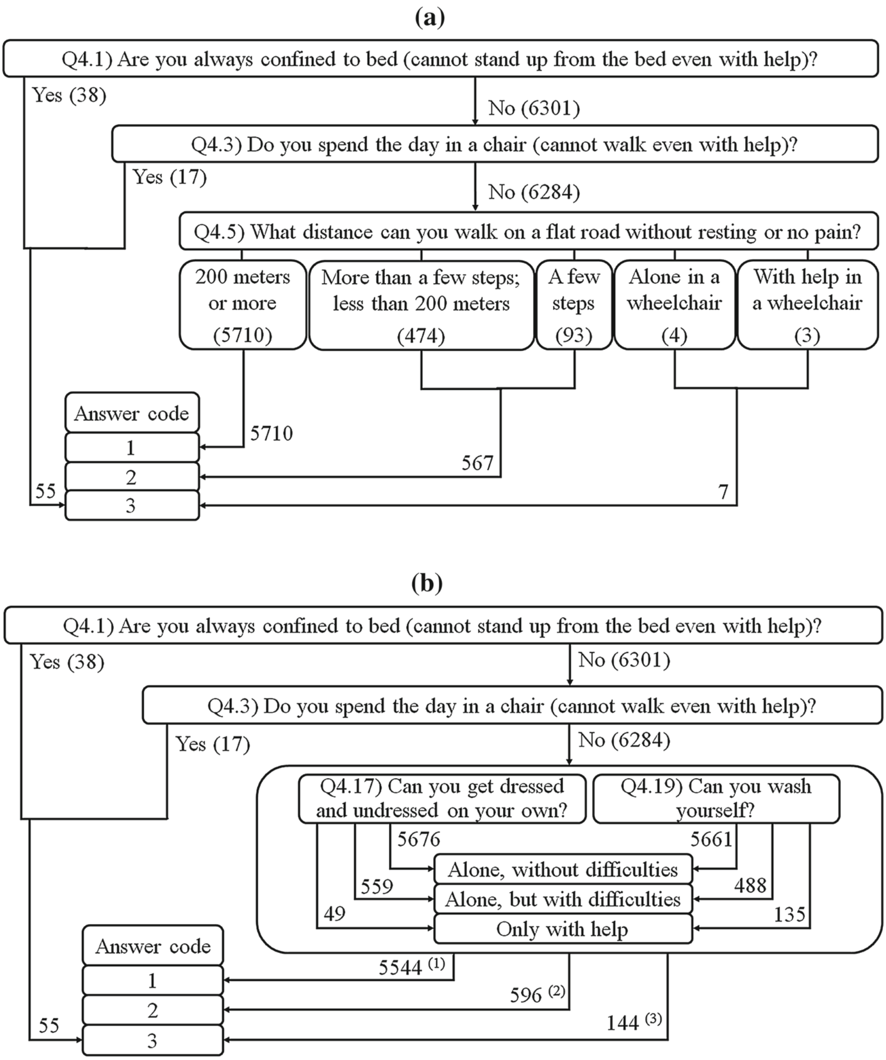
$$\mathrm{HI}_i = \frac{H_i - H^{\mathrm{Min}}}{H^{\mathrm{Max}} - H^{\mathrm{Min}}} \tag{1}$$

in which H^{Max} and H^{Min} correspond to the maximum and minimum values assumed by H_i, respectively.

Obtaining a summary measure of health status such as that provided by EQ-5D (or other similar indexes) from national surveys, such as INS, is difficult (or in some cases virtually impossible) as they do not include the necessary questions. Fortunately, INS has information that allows inferring the answer that each respondent would give to a particular EQ-5D question. However, the process is neither easy nor immediate and demands a complex conversion process which we propose in this study. Below, we present a description of our strategy, which is complemented with several flowcharts (Panels (a) to (e) in Fig. 2).[2] In each of them, the number of respondents that select each possible answer is reported.

[2] The original number of the questions from INS are also reported in the flowcharts.

Mobility [Panel (a) in Fig. 2]: individuals who indicated that they could walk 200 m or more on a flat road without resting or experiencing pain were classified with level 1 ("I have no problems in walking about"). In turn, those who reported being able to walk either a few steps or up to 200 m were classified with level 2 ("I have some problems in walking about"). Finally, level 3 ("I am confined to bed") was assigned to respondents who fulfilled one of the following conditions: (a) confined to bed; (b) though not confined to bed, spends the day on a chair, i.e., cannot walk even with help;



(1) "Alone, without difficulties" in all the answers; (2) Other cases; (3) At least one answer "Only with help".

Fig. 2 Flowcharts for EQ-5D dimensions. **a** Dimension "Mobility". **b** Dimension "Self-care". **c** Dimension "Usual activities". **d** Dimension "Pain/Discomfort". **e** Dimension"Anxiety/Depression"

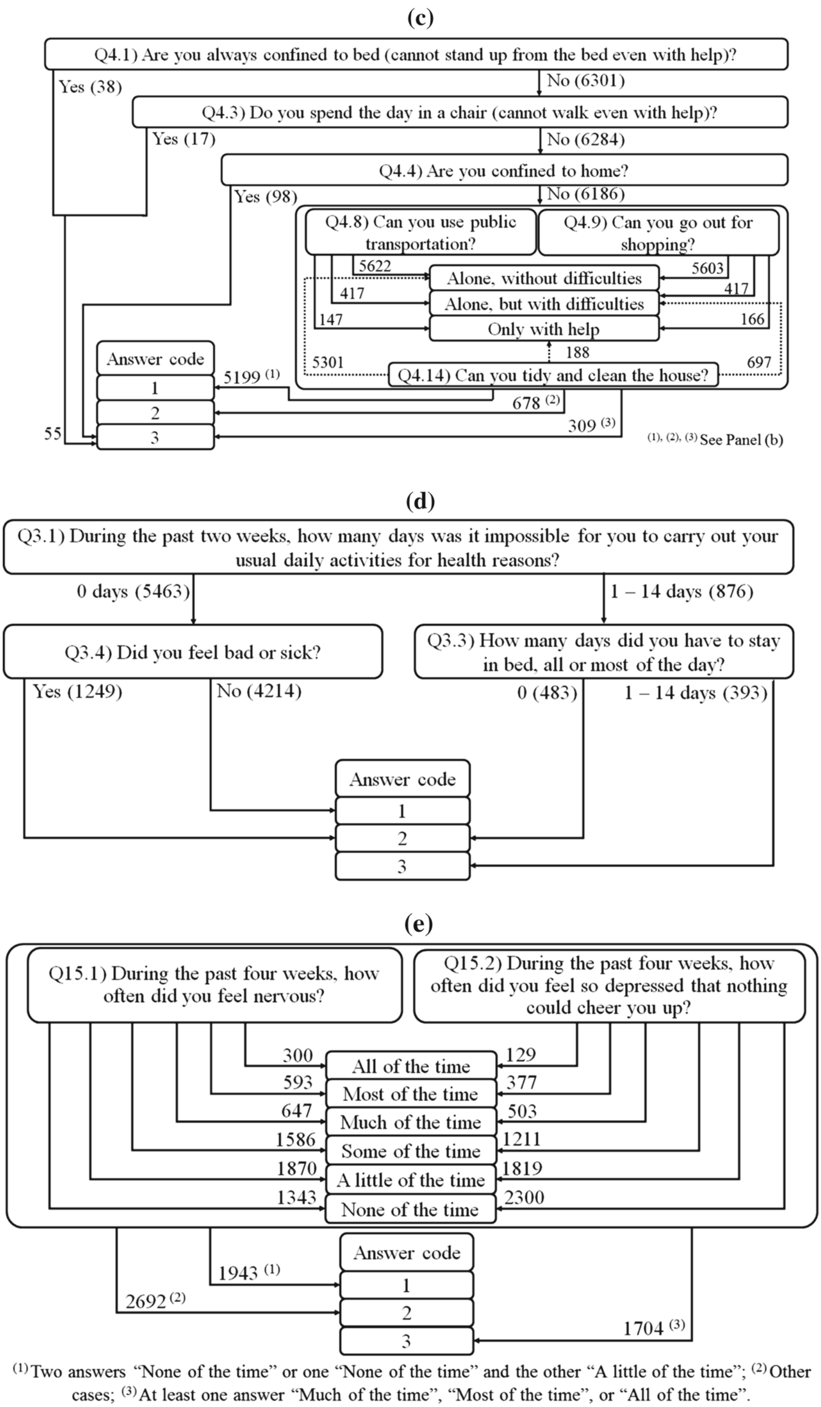


Fig. 2 continued

(c) although in neither of the previous situations [(a) and (b)], has mobility only in a wheelchair (with or without help).

Self-care (Panel (b) in Fig. 2): two questions were asked to those stating not being confined to bed and also not spending the day in a chair: (a) "can you get dressed and undressed on your own?" and (b) "can you wash yourself?". An answer "alone without difficulties" to both questions was coded as 1 ("I have no problems with self-care"). The severest level in this dimension (level 3: "I am unable to wash or dress myself") was attributed to respondents who: (a) are confined to bed; (b) though not confined to bed, spend the day in a chair; or (c) answer "only with help" to at least one of the above questions. The remaining cases were considered to be in an intermediate situation (level 2: "I have some problems washing or dressing myself").

Usual Activities (Panel (c) in Fig. 2): the conversion process of this health dimension is the most complex. Individuals who were not confined to home answered the following questions: (a) "can you use public transportation?"; (b) "can you go out for shopping?"; (c) "can you tidy and clean the house?". If those three activities were said to be accomplished without difficulty, level 1 ("I have no problems with performing my usual activities") was assigned. Level 3 ("I am unable to perform my usual activities") was attributed to four situations: (a) confined to bed; (b) though not confined to bed, spend the day in a chair; (c) although in neither of the previous situations ((a) and (b)), are confined to home; and (d) although in none of the previous situations ((a), (b), and (c)), answer "only with help" to at least one of the above questions. Level 2 ("I have some problems with performing my usual activities") was assumed in the remaining situations.

Pain/Discomfort (Panel (d) in Fig. 2): respondents who reported not having stopped their usual daily activities for health reasons in the last 2 weeks and not feeling bad or ill in the same time period were classified has having no pain or discomfort (level 1: "I have no pain or discomfort"). The lowest level of health in terms of pain/discomfort (level 3: "I have extreme pain or discomfort") was attributed when in some days of the last 2 weeks, usual daily activities were not done because of a health problem and the respondent was kept in bed the entire day or most of it. The intermediate level for this health dimension (level 2: "I have moderate pain or discomfort") corresponds to the following two situations: (a) in at least 1 day of the last 2 weeks, usual things were not done because of a health problem, but the respondent was not kept in bed on those days; (b) even though the respondent did not stop doing usual things for health reasons in the last 2 weeks, he/she felt bad or ill in part of that time period.

Anxiety/Depression (Panel (e) in Fig. 2): this dimension was captured through two questions: (a) "during the past 4 weeks, how often did you feel nervous?"; (b) "during the past 4 weeks, how often did you feel so depressed that nothing could cheer you up?". To each of these questions, there are six possible answers: all of the time, most of the time, much of the time, some of the time, a little of the time, and none of the time. The reclassification into the three EQ-5D answers was done in the following way: (a) level 3 ("I am extremely anxious or depressed") to respondents who gave at least one answer "much of the time" or more; (b) level 1 ("I am not anxious or depressed") to those who answered both questions "none of the time" or one "none of the time" and the other "a little of the time"; (c) level 2 ("I am moderately anxious or depressed") for the remainder.

Table 1 Proportion of respondents with differing levels of problem for EuroQol dimensions (%)

Health dimensions (EQ-5D)	Answer levels	Overall sample	Health state		
			Poor	Middle class	Rich
Mobility	1	90.08	46.61	94.36	100
	2	8.94	44.99	5.64	0
	3	0.98	8.40	0	0
Self-care	1	87.46	34.42	92.53	100
	2	9.40	42.14	6.84	0
	3	3.14	23.44	0.63	0
Usual activities	1	82.02	26.42	86.22	98.40
	2	11.80	37.53	10.75	1.60
	3	6.18	36.05	3.03	0
Pain/discomfort	1	66.48	13.28	64.35	100
	2	27.32	41.33	34.25	0
	3	6.20	45.39	1.40	0
Anxiety/depression	1	30.65	4.47	11.40	100
	2	42.47	27.37	59.77	0
	3	26.88	68.16	28.83	0

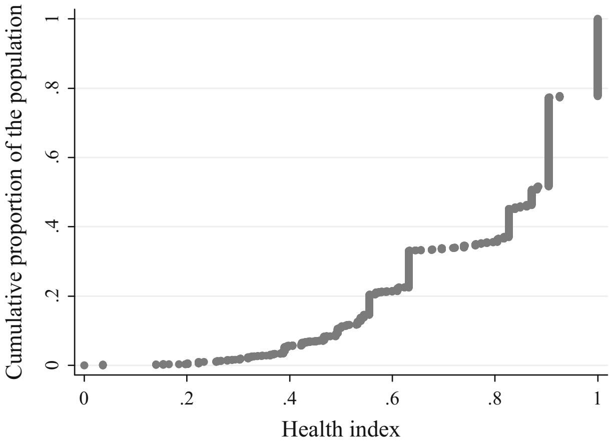


Fig. 3 Empirical distribution function of the health index

The column "overall sample" in Table 1 shows the distribution of individuals across the three possible answers for each of the five EuroQol dimensions.

From this evidence, it is clear that anxiety/depression and pain/discomfort are the two dimensions in which the self-rated health levels are the poorest, while the best results concern mobility. In this last case, for example, only 9.92 % of the individuals report the existence of problems. The cumulative distribution function for the health index is drawn in Fig. 3.

The expected inverted L-shape of the empirical distribution function is found in our sample (Tubeuf and Perronnin 2008; Jones et al. 2013). This shape reflects that there is a long left-hand tail which represents relatively few individuals in very bad health and many people concentrated in the right-hand tail.

4 Poverty, richness, and inequality in health

Having taken the steps to build the health index, HI_i, we now quantify health inequality, poverty, and richness. For measuring inequality, two commonly used indicators in the literature on income inequality are applied: the $P90/P10$ index and the Gini index. The P90/P10 index is the ratio of the 90th and 10th percentile of the distribution. The Gini index (G) can be obtained as follows:

$$G = \frac{2}{\overline{\mathrm{HI}}} \mathrm{cov}\left(\mathrm{HI}_i, R_i^{\mathrm{HI}}\right) \tag{2}$$

where $\overline{\mathrm{HI}}$ is the average of the health index and R_i^{HI} is the fractional health rank of individual i. This index ranges between 0 (complete equality) and 1 (all the population's health concentrated in only one individual).

Using a different approach to the measurement of inequality, the concentration index—which is "the most popular health inequality indicator" (Frick and Ziebarth 2013, p. 432)—attends to the socioeconomic status of the individuals. In contrast to the Gini index, which ranks individuals according to their health levels, the concentration index (CI) uses a welfare indicator (e.g., social class, wealth, income, consumption, or educational attainment) as ranking variable.[3] CI can be calculated as follows (Wagstaff et al. 1991):

$$\mathrm{CI} = \frac{2}{\overline{\mathrm{HI}}} \mathrm{cov}\left(\mathrm{HI}_i, R_i^{y}\right) \tag{3}$$

where R_i^y is the fractional rank of an individual in the sample distribution of a welfare indicator. CI varies between -1 (when all the population's health is concentrated in the most disadvantaged person) and 1 (when all the population's health is concentrated in the least disadvantaged person). CI is always smaller than G except when there is a perfect correlation between the health and the socio-economic ranking. For a visual analysis of health inequality, we can draw Lorenz and concentration curves associated with the Gini and concentration indexes, respectively.

Regarding poverty and richness, we first need to define poverty and richness lines. A health poverty line separates the poor from the non-poor, while a health richness line sets the limit above which individuals are classified as rich. The main methodological option here is between absolute or relative poverty/richness lines. In the first case, the thresholds are defined without reference to the pattern prevailing in society. In the second case, that reference is taken into account and thus the health poverty and

[3] For an overview of the most recent contributions regarding measurement of inequality and inequity in health and health care, see Van Ourti et al. (2014).

richness lines correspond to a given percentage of the average or median level of health in society. Following the most common option, we adopt a relative poverty line (α) defining as poor an individual with a health index below 60 % of the median of HI_i. The richness line (γ) is obtained in a symmetric way, a rich individual being one with a value for HI_i above that threshold. Summarizing, individuals are classified into one of three possible health states (y_i):

$$y_i = \begin{cases} 1 \text{ if } \mathrm{HI}_i < \alpha \text{ (poor)} \\ 2 \text{ if } \alpha \leq \mathrm{HI}_i \leq \gamma \text{ (middle class)} \\ 3 \text{ if } \mathrm{HI}_i > \gamma \text{ (rich)} \end{cases} \tag{4}$$

The next step is the selection of the indicators for measuring poverty and richness. The literature usually takes into account three fundamental dimensions—incidence, intensity, and severity (Cowell 2011). The present study adopts a similar perspective.

The incidence of health poverty is measured through the headcount ratio (H_p), representing the proportion of the total number of poor (P) in total population (N):

$$H_p = \frac{P}{N} \times 100 \tag{5}$$

The greatest weakness of H_p is the fact that it is only an accounting of the poor, with no sensibility to the heterogeneity among the poor. Evaluating the intensity of health poverty overcomes this limitation. To that end, the poverty gap (PG) measures the mean deviation from the health poverty line for the poor individuals, being obtained as follows:

$$PG = \alpha - \overline{\mathrm{HI}}_p \tag{6}$$

where $\overline{\mathrm{HI}}_p$ is the average value of the health index among the poor.

Finally, the evaluation of health poverty severity takes into account the inequality among the poor. This can be done through the use of the Gini index applied exclusively to the health poor population (G_p). Alternatively, we can consider a new poverty threshold reflecting a greater degree of privation in terms of health. With reference to this line of extreme poverty (θ), we can quantify, in a similar vein, the incidence and intensity of severe health poverty (H_p^+ and PG^+, respectively). For that, we define the extreme poverty line at 60 % of the poverty line (i.e., 36 % of the median).

Regarding the evaluation of health richness, we can conceive, with the appropriate adaptations, indicators similar to those used in the analysis of poverty to measure the corresponding richness dimensions: incidence (H_r), intensity (RG), and depth (G_r, H_r^+, and RG^+).[4] The indicators H_r^+ and RG^+ are defined using an extreme richness line (φ). Table 2 reports the results.

Analyzing health inequality in 11 European countries (not including Portugal) and the US, Jürges (2010) identifies a geographical pattern: Mediterranean countries (France, Spain, Italy, Greece) exhibit the highest inequality levels while the lowest values are registered by the Nordic countries (Sweden, Denmark) and Western European

[4] Depth instead of severity is used merely for terminological reasons.

Table 2 Health poverty and richness indicators for Portugal

Dimensions	Indicators	Value	Relevant thresholds
Health inequality	G	0.1395	
	CI		
	Education	0.0739	
	Household income	0.0491	
	$P90/P10$	2.60	
Health poverty	H_p	11.64 %	$\alpha = 0.5232$
	PG	0.1398	$\theta = 0.3139$
	H_p^+	1.94 %	
	PG^+	0.089	
	G_p	0.1293	
Health richness	H_r	22.64 %	$\gamma = 0.9232$
	RG	0.0756	$\varphi = 0.9359$
	H_r^+	22.27 %	
	RG^+	0.046	
	G_r	0.0012	

countries (Switzerland, Germany, Austria, Netherlands). Confirming earlier evidence, our results point to a value for the Gini index higher than those obtained by Jürges (2010) for all the countries considered in his study. Additionally, considering the $P90/P10$ index, we find that the average health level of the 10 % richest individuals is 2.6 times higher than that of the 10 % poorest.

To obtain the concentration index, we consider two different ranking variables: one related to education and the other to net monthly household income. To calculate the education-related measure of health inequality, we use the ISCED-97 classification of the highest degree completed by the individual: no education, ISCED 0 (pre-primary education), ISCED 1 (primary education), ISCED 2 (lower secondary education), ISCED 3 (upper secondary education), ISCED 4 (post-secondary education), and ISCED 5 and ISCED 6 (first and second stages of tertiary education). In the survey, there is a question about the net monthly household income in which ten income groups are presented to the respondent. This allows us to obtain an income-related measure of health inequality. For a graphic perception of inequalities in health, we also present the Lorenz curve and two concentration curves (Fig. 4).

Once more, the results reached in this study are above the corresponding evidence obtained by Jürges (2010) for a group of 12 developed countries.

Focusing on the distribution of the individuals in accordance with their health state, we conclude that 11.64 % are poor, among which only a small fraction face a situation of extreme poverty (corresponding to 1.94 % of the total population). On the other hand, 22.64 % of the individuals exhibit a health richness condition, with most of them being extremely rich in health (22.27 % of the total population). The remaining 65.72 % of the respondents are classified as belonging to an intermediate situation in terms of health.

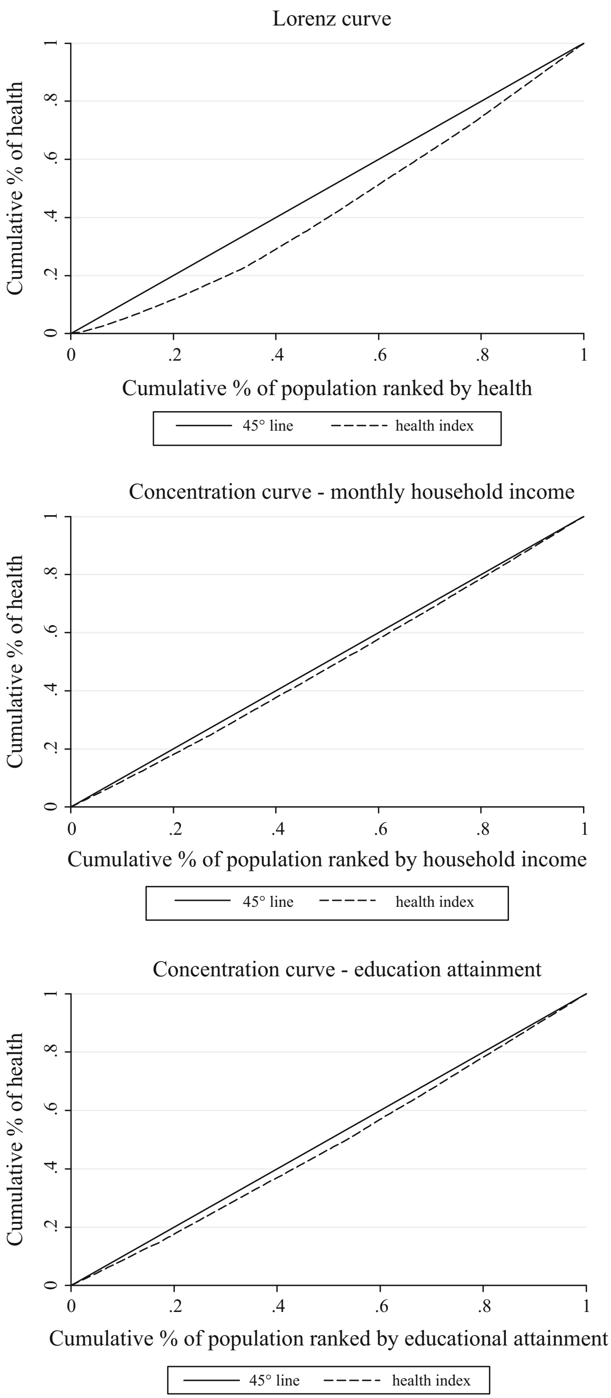


Fig. 4 Lorenz and concentration curves of the health index

Regarding poverty intensity, the average deviation of the poor from the poverty line is equal to 0.1398. When taking into account a severe poverty line, the average intensity of extreme poverty in health is obviously lower (0.089). Concerning richness, on average, an individual classified as rich presents a health level that exceeds by 0.0756 the richness line. In turn, the health surplus of the extremely rich above the extreme richness line is 0.046.

Finally, the health inequality level among the poor and the rich population is 0.1293 and 0.0012, respectively. Thus, we find an expressive level of poverty inequality, reflecting poverty severity.

Let us now return to Table 1. The evidence in the last three columns makes clear the existence of a considerable gap between the poor and the remaining groups in all the EuroQol dimensions. In fact, considering the poor population, we see that 8.4 % have severe mobility problems, while the corresponding level 3 responses for the remaining dimensions are 23.44 % (self-care), 36.05 % (usual activities), 45.39 % (pain/discomfort), and 68.16 % (anxiety/depression). These results compare with very low values for middle class and rich groups, the only exception being the 28.83 % found for middle class in the anxiety/depression dimension.

5 Econometric model and estimation results

Complementing the above descriptive analysis, we now investigate the most important determinant factors of the individual health state (y_i). Since health state is an ordered categorical variable, the ordered probit model is a commonly used framework. This model is based on a latent measure of health (y_i^*)—a continuous and unobserved variable—which can be defined as a linear function of the observed explanatory variables (X) and a random error term (ε) normally distributed with zero mean and unit variance:

$$y_i^* = \beta' X_i + \varepsilon_i \tag{7}$$

The value observed in y_i is determined by the value of y_i^*:

$$y_{\mathrm{i}} = \begin{cases} 1 \text{ if } & -\infty \leq y_i^* \leq \mu_1 \\ 2 \text{ if } & \mu_1 < y_i^* \leq \mu_2 \\ 3 \text{ if } & \mu_2 < y_i^* \leq \infty \end{cases} \tag{8}$$

where μ_1 and μ_2 represent thresholds to be estimated.

The probabilities associated with the possible values assumed by y_i are:

$$\begin{cases} Pr\,(y_{\mathrm{i}} = 1) = \Pr\left(y_{\mathrm{i}}^* \leq \mu_1\right) = \Pr\left(\beta' X_i + \varepsilon_i \leq \mu_i\right) = \Phi\left(\mu_1 - \beta' X_i\right) \\ Pr\,(y_{\mathrm{i}} = 2) = Pr\left(\mu_1 < y_{\mathrm{i}}^* \leq \mu_2\right) = \Pr\left(\beta' X_i + \varepsilon_i \leq \mu_2\right) - \Pr\left(\beta' X_i + \varepsilon_i \leq \mu_1\right) \\ \qquad\qquad\quad = \Phi\left(\mu_2 - \beta' X_i\right) - \Phi\left(\mu_1 - \beta' X_i\right) \\ Pr\,(y_{\mathrm{i}} = 3) = \Pr\left(y_{\mathrm{i}}^* > \mu_2\right) = \Pr\left(\beta' X_i + \varepsilon_i > \mu_2\right) = 1 - \Phi\left(\mu_2 - \beta' X_i\right) \end{cases} \tag{9}$$

in which Φ is the standard normal cumulative distribution function (for more information on this model, see Greene 2011).

The vector of explanatory variables (X) includes three groups of factors that, according to the literature, are likely to affect an individual's health: (a) biological factors—gender and age; (b) socioeconomic factors—marital status, nationality, education, labor market state, region of residence, net monthly income of the household, and the health system/subsystem; and (c) behavioral factors—weight, drinking, smoking, and eating habits. In Table 3, the explanatory variables are defined in detail.[5]

Due to missing data concerning the explanatory variables, the sample used in the estimation drops to 6244 individuals. The parameters of the ordered probit model were estimated by the method of maximum likelihood. The changes in the probability levels of the dependent variable are also estimated, providing an interpretation of the impact of the independent variables (Table 4). These are measured relative to a reference case in which all the dummy variables are set equal to 0. This allows us to interpret changes in the probability of the health states for a change in a given parameter, relative to the reference case. Since all the independent variables are dummy variables, the marginal effects correspond to a discrete change from 0 to 1 in the dummy variable. In this baseline scenario, the estimated probabilities of being poor, middle class, and rich are 19.46, 71.18 and 9.36 %, respectively.

As shown in the last columns of Table 4, the probability of poverty is 44.07 % lower for men than for women, while the probability of richness is 83.50 % greater for men. This is consistent with the so-called "iceberg of morbidity" argument according to which, due to social and biological factors, despite women's greater longevity they experience higher rates of morbidity and psychological distress (Bird and Rieker 1999). Concerning age, the evidence makes it clear that it is one of the most important determinants of health state. A negative influence of this variable on the health state is a consensual and well-documented outcome (e.g., Albert and Davia 2011). Moreover, the impact is monotonic, with a more remarkable impact in the two highest categories, showing that individuals aged 75 or more (AGE 75–84 and AGE $>$84) reveal, on average, a much poorer health condition. The probability of being poor in health is 48.51 and 50.21 %, respectively, in these categories, which compares with a probability of 19.46 % in the reference scenario.

The second group of determinants relates to *socioeconomic aspects*. Despite the evidence suggesting the importance of marital status, this factor does not reveal statistical significance in the Portuguese case. The same conclusion is true for nationality. The evidence in Table 4 indicates that natives and immigrants have similar probabilities associated with all the health states. The comparison between health levels of these two groups is a complex issue. At the arrival, depending on the destination and origin country being analyzed, it is possible to find a positive as well as a negative gap between these two groups. Over time, there are factors that can influence either

[5] There is some degree of correlation between the explanatory variables. Concerning collinearity we used the VIF instrument (Variation Inflation Factor) which calculates the impact upon the variance of the one variable resulting from the correlations between the other regressors. It is usually mentioned in the literature that there is evidence of collinearity when the value that indicates the highest VIF is greater than 5. Our values are below this limit.

Table 3 Variable definitions, descriptive statistics, and estimation results (ordered probit model)

Variable type	Variable title	Definition	Mean	SD	*Coef.*	*z statistic*
Dependent var.	HI	Three categories: poor (1), middle class (2), and rich (3)	2.11	0.57		
Biological factors	Male	1 if male, 0 otherwise	0.42	0.49	0.372***	(10.41)
	Age 16–24	1 if aged 16–24, 0 otherwise	0.09	0.28	Ref.	
	Age 25–39	1 if aged 25–39, 0 otherwise	0.20	0.40	−0.145**	(−2.09)
	Age 40–54	1 if aged 40–54, 0 otherwise	0.25	0.43	−0.311***	(−4.48)
	Age 55–64	1 if aged 55–64, 0 otherwise	0.18	0.38	−0.429***	(−5.91)
	Age 65–74	1 if aged 65–74, 0 otherwise	0.17	0.38	−0.464***	(−5.75)
	Age 75–84	1 if aged 75–84, 0 otherwise	0.09	0.29	−0.824***	(−9.12)
	Age >84	1 if aged over 84, 0 otherwise	0.01	0.12	−0.866***	(−5.80)
Socioecon. factors	Single	1 if not married, 0 otherwise	0.30	0.46	0.015	(0.39)
	Migrant	1 if migrant, 0 otherwise	0.02	0.14	0.019	(0.18)
	Noeduc	1 if has no education, 0 otherwise	0.17	0.38	Ref.	
	Primary	1 if highest educational level is primary education, 0 otherwise	0.63	0.48	0.190***	(3.91)
	Second	1 if highest educational level is secondary education, 0 otherwise	0.11	0.32	0.258***	(3.63)
	Trtiary	1 if highest educational level is tertiary education, 0 otherwise	0.08	0.28	0.338***	(4.22)
	Worker	1 if working, 0 otherwise	0.50	0.50	Ref.	
	Unemp	1 if unemployed, 0 otherwise	0.05	0.21	−0.194***	(−2.63)
	Retired	1 if retired, 0 otherwise	0.27	0.44	−0.277***	(−5.20)
	Iactive	1 if another inactive, 0 otherwise	0.19	0.39	−0.151***	(−3.21)
	Norte	1 if lives in Norte, 0 otherwise	0.16	0.37	Ref.	
	Centro	1 if lives in Centro, 0 otherwise	0.14	0.35	0.105*	(1.88)
	Lisboa	1 if lives in Lisboa, 0 otherwise	0.15	0.36	0.169***	(3.04)
	Alentejo	1 if lives in Alentejo, 0 otherwise	0.15	0.35	0.390***	(6.97)
	Algarve	1 if lives in Algarve, 0 otherwise	0.15	0.36	0.416***	(7.46)
	Azores	1 if lives in Azores, 0 otherwise	0.16	0.37	0.406***	(5.32)
	Madeira	1 if lives in Madeira, 0 otherwise	0.09	0.29	0.988***	(10.68)
	Income 1	1 if household net monthly income is 0€–351€, 0 otherwise	0.14	0.35	Ref.	
	Income 2	1 if household net monthly income is 351€–1200€, 0 otherwise	0.58	0.49	0.064	(1.33)
	Income 3	1 if household net monthly income is above 1200€, 0 otherwise	0.28	0.44	0.154***	(2.64)
	NHS	1 if uses the National Health System, 0 otherwise	0.63	0.48	Ref.	

Table 3 continued

Variable type	Variable title	Definition	Mean	S.D.	*Coef.*	*z statistic*
	RHS	1 if uses the Regional Health System, 0 otherwise	0.18	0.39	−0.308***	(−3.96)
	ADSE	1 if uses the Health Subsystem for Civil Servants, 0 otherwise	0.12	0.33	−0.090	(−1.59)
	OSYS	1 if uses other health subsystem, 0 otherwise	0.06	0.06	0.073	(1.08)
Behavior factors	Weight	1 if BMI is below 16 or above 30, 0 otherwise	0.18	0.38	−0.116***	(−2.87)
	Alcohol	1 if drinks alcoholic beverages, 0 otherwise	0.46	0.50	0.172***	(4.95)
	Smoking	1 if smokes (daily), 0 otherwise	0.17	0.37	0.029	(0.66)
	Food 1	1 if eats <4 food groups (daily), 0 otherwise	0.10	0.30	Ref.	
	Food 2	1 if eats between 5 and 7 food groups (daily), 0 otherwise	0.64	0.48	0.220***	(4.16)
	Food 3	1 if eats more than 7 food groups (daily), 0 otherwise	0.27	0.44	0.262***	(4.49)
	Ancillary parameters					
	μ_1				−0.861***	(−7.72)
	μ_2				1.319***	(11.78)
	Number of observations				6244	
	Log likelihood				−4,877.93	
	Pseudo R-squared				0.0938	

Note: *, **, *** Significant at 10 5 and 1 %, respectively

positively or negatively the health state of immigrants (Antecol and Bedard 2006). On the positive side, the integration process is expected to increase income levels and to provide access to better healthcare services and a more developed socio-economic context. Nevertheless, immigrants are a vulnerable group because of their immigration status, socioeconomic background, integration in the labor market, lower access to health care, and marginalization (Derose et al. 2007). In addition, the access to improved health care may reveal previously unknown pre-existing health conditions (McDonald and Kennedy 2004). Our results suggest that these opposing arguments tend to cancel out.

Education emerges as a critical variable to explain health condition, with monotonic influence and the expected sign. This link operates through three main channels (Cutler and Lleras-Muney 2010; Park and Kang 2008). First, education increases the capacity to access and interpret information, leading to better health decisions. Second,

Table 4 Marginal effects of the health states

Variables	Marginal effects						Change relative to the reference case (%)		
	Poor		Middle class		Rich		Poor	Middle class	Rich
Biological factors									
Male	−0.086	(−6.88)	0.008	(0.39)	0.078	(6.26)	−44.07	1.07	83.50
Age 25–39	0.042	(2.16)	−0.020	(−2.04)	−0.022	(−1.88)	21.79	−2.86	−23.50
Age 40–54	0.097	(4.73)	−0.054	(−3.80)	−0.042	(−3.34)	49.60	−7.65	−44.91
Age 55–64	0.138	(6.15)	−0.085	(−4.60)	−0.053	(−3.96)	71.02	−11.92	−57.00
Age 65–74	0.151	(5.89)	−0.095	(−4.53)	−0.056	(−3.97)	77.65	−13.31	−60.16
Age 75–84	0.291	(9.25)	−0.213	(−6.98)	−0.078	(−4.77)	149.34	−29.93	−82.84
Age >84	0.307	(5.41)	−0.228	(−4.32)	−0.079	(−4.65)	158.03	−32.07	−84.58
Socioeconomic factors									
Single	−0.004	(−0.39)	0.002	(0.37)	0.003	(0.40)	−2.12	0.22	2.72
Migrant	−0.005	(−0.18)	0.002	(0.18)	0.003	(0.17)	−2.69	0.28	3.46
Primary	−0.048	(−3.50)	0.012	(1.18)	0.036	(3.68)	−24.61	1.70	38.22
Second	−0.063	(−3.42)	0.012	(0.93)	0.051	(3.29)	−32.36	1.72	54.16
Tertiary	−0.079	(−4.05)	0.010	(0.56)	0.070	(3.54)	−40.76	1.35	74.44
Unemp	0.058	(2.47)	−0.029	(−1.84)	−0.028	(−2.62)	29.69	−4.12	−30.40
Retired	0.085	(4.63)	−0.047	(−2.83)	−0.038	(−4.23)	43.69	−6.55	−40.97
Inactive	0.044	(3.18)	−0.021	(−2.32)	−0.023	(−2.80)	22.78	−3.02	−24.41
Centro	−0.028	(−1.85)	0.009	(1.26)	0.019	(1.82)	−14.19	1.24	20.08
Lisboa	−0.043	(−2.95)	0.012	(1.26)	0.031	(2.77)	−22.13	1.63	33.60
Alentejo	−0.089	(−5.56)	0.006	(0.32)	0.083	(5.29)	−45.78	0.88	88.45
Algarve	−0.094	(−5.81)	0.004	(0.19)	0.090	(5.46)	−48.19	0.58	95.75
Azores	−0.092	(−4.93)	0.005	(0.24)	0.087	(4.12)	−47.27	0.70	92.92
Madeira	−0.162	(−6.68)	−0.114	(−2.25)	0.277	(7.03)	−83.43	−16.06	295.58
Income 2	−0.017	(−1.29)	0.006	(1.01)	0.011	(1.35)	−8.85	0.84	11.99
Income 3	−0.040	(−2.52)	0.011	(1.25)	0.028	(2.53)	−20.33	1.56	30.36
RHS	0.095	(3.48)	−0.054	(−2.35)	−0.042	(−3.85)	49.02	−7.54	−44.53
ADSE	0.026	(1.51)	−0.012	(−1.20)	−0.014	(−1.64)	13.19	−1.62	−15.10
OSYS	−0.019	(−1.11)	0.007	(1.09)	0.013	(1.01)	−9.94	0.93	13.58
Behavior factors									
Weight	0.034	(2.71)	−0.016	(−1.87)	−0.018	(−2.75)	17.28	−2.19	−19.22
Alcohol	−0.044	(−4.51)	0.012	(1.29)	0.032	(4.00)	−22.50	1.64	34.28
Smoking	−0.008	(−0.67)	0.003	(0.66)	0.005	(0.65)	−4.07	0.42	5.30
Food 2	−0.055	(−3.67)	0.012	(1.07)	0.042	(3.91)	−28.17	1.75	45.25
Food 3	−0.064	(−3.98)	0.012	(0.91)	0.052	(4.03)	−32.86	1.71	55.26

Note: *z*-statistics are reported in parentheses it improves the chances of obtaining jobs with safer working conditions and higher wages, thereby supporting healthier lifestyles. Third, more education allows access to more sophisticated social contexts, in which the propensity toward more healthy behaviors is greater. The individuals with the highest level of education considered in this study (TERTIARY) benefit from a reduction in the likelihood of poverty of 40.76 % and an increase of 74.44 % in the probability of being rich when compared with the reference case.

Focusing now on the labor market state of the individual, we find that, in comparison with individuals currently employed, retired individuals have a higher probability of poverty and a lower probability of richness. The results for unemployed individuals follow a similar qualitative pattern but the quantitative influence is lower in this case, with an increase of 29.69 % in the probability of poverty and a reduction of 30.40 % in the probability of richness, while similar effects for the case of retirees are 43.69 and 40.97 %, respectively. As suggested by Benoit et al. (2009) and Albert and Davia (2011), employment influences health through income, thereby increasing the capacity to purchase health-enhancing resources.

An interesting conclusion emerging from the results presented in Tables 3 and 4 is the existence of spatial differences in terms of health. This conclusion is not surprising since regional inequality is a fundamental characteristic of the Portuguese economy (Hoeller et al. 2012). There are several aspects related to residence area that can affect health: degree of urbanization, neighborhoods, socioeconomic factors predominantly represented in the area of residence, among other constraints that affect the access to healthcare services, infrastructures, and the environment itself (Bernard et al. 2007; Franzini and Giannoni 2010). More specifically, our results allow us to conclude that this variable is one of the most important determinants of health inequality. In fact, an individual living in Madeira, Algarve, Azores, and Alentejo has a much lower likelihood of health poverty and higher of richness.

In line with the nearly consensual perspective of a vast number of studies (e.g., Karlsson et al. 2010; Karlsdotter et al. 2012), the positive association between income and health is confirmed in our model. Individuals belonging to high-income households show a probability of health poverty of 15.50 % which is 20.33 % lower than in the reference case.

Let us consider finally the behavior determinants of health. An inappropriate weight increases the probability of being poor in health by 17.28 % and reduces the probability of richness by 19.22 %. The evidence suggests that poor diet (low diversity of food groups) also has a negative impact on health status.

The results regarding drinking show that it reduces the probability of being poor by 22.50 % while increasing the probability of richness by 34.28 %. This result may be explained by the fact that the negative consequences of drinking appear only some years later. As emphasized by Verropoulou (2012, p. 306), "risky health behaviors such as smoking and drinking though associated with higher mortality are not necessarily related to worse self-rated health". Additionally, Huckle et al. (2010) point out that a frequent light consumption of alcohol can be associated with higher income. Individuals from higher socioeconomic groups have the material resources to purchase alcohol, are more likely to share social norms supportive of moderate consumption, and to participate in social and leisure activities.

The impact of smoking is not significant in our model, corroborating earlier-reported non-conclusive results. A possible explanation for this is advanced by Guindon and Contoyannis (2012), who suggest that the negative consequences of smoking habits may occur with a lag of 20–30 years.

6 Further analysis

Since, in our dataset, individuals fall into regions, we could consider the multilevel extension of the ordered probit model (in this case a two level model with individuals being level-1 units and regions being level-2 units). Multilevel models are suitable in the presence of correlated ordinal responses (see Agresti and Natarajan 2001). The first step in multilevel modeling is to estimate the so-called null model (i.e., a model without covariates for the dependent variable) in order to obtain an estimate of the intraclass correlation coefficient (ICC). This allows us to assess whether a multilevel model is justified. As stated by Schyns (2002, p. 22), "this model does not explain any variance, it just decomposes the variance into variance at the regional level and variance at the individual level".

In our case, the estimated intra-class correlation is 0.64 %. This evidence can be interpreted as level-1 units (individuals) being statistically independent and therefore the standard (single-level) model is appropriate.[6] Nevertheless, this is not consensual. For example, according to Hayes (2006, p. 394), "some argue that multilevel modeling is not necessary if ICC is sufficiently close to zero, as this implies that level-1 units are statistically independent. However, just how close to zero is "sufficiently close" depends on a number of things, and values of ICC as small as 0.05 can invalidate hypothesis tests and confidence intervals when multilevel modeling is not used. Furthermore, there are benefits to the use of multilevel modeling even when the ICC is near zero" (see also, Kreft and De Leeuw 1998).

Aiming to accommodate these considerations, we present the results for four different models. Below we will compare these results with the estimates from the ordered model, which we discussed in the previous section.

The first model is the null model that we have discussed above (Model 0). Next, we incorporate individual level-1 explanatory variables to capture the effects related to the individual (Model 1). In Model 2, level-2 explanatory variables related to the region in which the individual lives are introduced. In this case, we considered the variable "number of beds in health establishments per 1000 inhabitants" (hereinafter designated as BEDS). This variable can be considered as a synthetic indicator of the supply side conditions of the health system in each region. We tested other regional variables, namely those related to socio-economic conditions, but these were eliminated from the final model due to lack of statistical significance. The data on BEDS were taken from the "Statistics on Health Establishments" from Statistics Portugal. Finally, in Model 3, we put together in the set of regressors, explanatory variables from level-1 and level-2. The estimates for these regressions are in Table 5.

[6] One possible explanation for this result is that although the survey is collected at NUTS III level, researchers have information only at NUTS II level. Due to their size, regions defined using NUTS II level are very heterogeneous units.

Table 5 Multilevel ordered probit regressions

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	Standard errors	Coef.	Standard errors	Coef.	Standard errors	Coef.	Standard errors
Male			0.372***	(0.036)			0.372***	(0.036)
Age 16–24			Ref.				Ref.	
Age 25–39			−0.143**	(0.069)			−0.143**	(0.069)
Age 40–54			−0.308***	(0.069)			−0.308***	(0.069)
Age 55–64			−0.427***	(0.073)			−0.426***	(0.073)
Age 65–74			−0.462***	(0.081)			−0.461***	(0.081)
Age 75–84			−0.821***	(0.090)			−0.820***	(0.090)
Age >84			−0.864***	(0.149)			−0.863***	(0.149)
Single			0.016	(0.038)			0.015	(0.038)
Migrant			0.020	(0.108)			0.022	(0.108)
Noeduc			Ref.				Ref.	
Primary			0.189***	(0.048)			0.189***	(0.048)
Second			0.256***	(0.071)			0.256***	(0.071)
Tertiary			0.335***	(0.080)			0.336***	(0.080)
Worker			Ref.				Ref.	
Unemp			−0.194***	(0.074)			−0.194***	(0.074)
Retired			−0.277***	(0.053)			−0.276***	(0.053)
Inactive			−0.151***	(0.047)			−0.151***	(0.047)
Income 1			Ref.				Ref.	
Income 2			0.065	(0.048)			0.065	(0.048)
Income 3			0.155***	(0.058)			0.155***	(0.058)

Table 5 continued

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	Standard errors	Coef.	Standard errors	Coef.	Standard errors	Coef.	Standard errors
NHS			Ref.				Ref.	
RHS			−0.269***	(0.078)			−0.294***	(0.077)
ADSE			−0.077	(0.057)			−0.085	(0.057)
OSYS			0.080	(0.067)			0.075	(0.067)
Weight			−0.117***	(0.041)			−0.117***	(0.041)
Alcohol			0.169***	(0.035)			0.170***	(0.035)
Smoking			0.029	(0.044)			0.029	(0.044)
Food 1			Ref.				Ref.	
Food 2			0.220***	(0.053)			0.220***	(0.053)
Food 3			0.261***	(0.058)			0.261***	(0.058)
Beds					0.039*	(0.023)	0.077***	(0.023)
Ancillary parameters								
μ_1	−1.220***	(0.059)	−1.202***	(0.153)	−1.049***	(−9.08)	−0.858***	(0.144)
μ_2	0.741***	(0.058)	0.976***	(0.153)	0.913***	(7.91)	1.320***	(0.145)
Region level variance	0.021	(0.012)	0.081	(0.046)	0.016	(0.115)	0.137	(0.035)
Log likelihood	−5351.31		−4895.35		−5350.25		−4895.23	

Note: *, **, *** Significant at 10 5 and 1 %, respectively

From the evidence in this table, if we focus more specifically on Model 3, we conclude that the estimates are very close to those obtained from the ordered probit model previously analyzed. The coefficients of the level-1 explanatory variables (i.e., individual related variables) are not only qualitatively the same as before but also quantitatively very similar.

The variability in the health states of the individuals in the sample is in part explained by individual characteristics, but also by regional variables, which in our case is captured through the number of beds available in each region, being statistically significant and helping to explain the probability of having a given health state.

7 Policy implications

From the analysis conducted in this paper, we verify the existence in the case of Portugal of significant levels of health inequality. For policy, our study highlights the dual purpose of promoting health gains and reducing health inequalities. Different ways of addressing social inequalities in health have been debated (Dahlgren and Whitehead 2006; Whitehead and Dahlgren 2006), and governments should define their perspective. Recent studies that start providing evidence about best practices and the impact of policy interventions at the international level are very inspiring and create opportunities for policy learning and, therefore, for more efficient policy interventions.[7]

The evidence obtained allows us to emphasize the importance of some other features with closer links with more active policy interventions. Let us explore three of them.

First, there is undoubtedly a strong case for highlighting education as a major determinant of health and health inequalities. In general terms, qualifications improve people's chances of getting a job and of having better pay prospects. This, in turn, improves opportunities to obtain the prerequisites for health (nutritious food, safe housing, good working conditions, social participation, among other things). The extreme importance of education as a determinant of health is confirmed by our results, giving high priority to the development of measures devoted to improve education outcomes. This is crucial for a country in which, despite a recent positive trend, educational levels still lag behind the European average, posing an obstacle to stronger economic growth. Critical at this level is to foster the efficiency of public expenditure in order to increase the results derived from the considerable investment already in place (Cunha and Braz 2006).

Another remarkable result emerging from the analysis of the Portuguese case is that the spatial dimension really matters. We concluded that there are remarkable differences across regions, which reinforces the idea that Portugal exhibits strong economic and social asymmetries that effective cohesion programs could help to reduce.[8]

[7] The recently launched DRIVERS project brings together leading organizations to review existing scientific evidence, develop guidelines for effective advocacy on health inequalities, and test the newly developed knowledge in real-life situations on the ground across Europe (http://eurohealthnet.eu/organisation/driversyes-we-can-reduce-health-inequali).

[8] In light of our results, as stressed by an anonymous referee, further exploring spatial inequalities in health would be an interesting research avenue.

With this is mind, it seems necessary to amplify the actions taken within the context of the regional European policy. A suggestion at this level is the substitution of *per capita* income as exclusive reference variable by a more comprehensive development measure that takes into account other crucial dimensions, including health disparities. The spatial asymmetries are not a specificity of the Portuguese economy; indeed, they seem quite substantial at the European-wide level, as recognized by the WHO Regional Office for Europe.

Finally, our results also suggest the importance of good eating habits for better overall health. Nevertheless, the measures implemented in the last years in Portugal are especially directed to reduce smoking and drinking. Not neglecting the importance of such measures, it appears useful to adopt complementary interventions. These could include direct measures, for example, by making more campaigns about healthful eating habits. From a medium- and long-term perspective, educational interventions during childhood can be a key strategy. Eating habits are acquired at an early age and the diversity of foods introduced in youth is a predictive factor of the variety of food in adult life (Nicklaus 2009).

To address health inequalities that are deeply rooted in social and behavioral determinants, concerted actions are required, mostly outside the health sector. Also called for are greater roles for the for-profit and not-for-profit sectors and civil society. In order to manage these stakeholders, health ministries have to increasingly take a leadership role. Finally, interventions at different levels and in different sectors should be evaluated in terms of their health equity impact. The efficacy of such policy actions critically depends, obviously, on the financial envelope but also on how it is used. More general development policies, targeting economic growth and a fair distribution of these resources, are indispensable conditions to improve health.

Moreover, a few studies reveal the direct and indirect economic burden of health disparities (e.g., LaVeist et al. 2009). It appears that eliminating health inequality can provide an important source of savings and can have a direct impact on productivity and wages. Hence, focusing on the goal of health equity is not only consistent with the promise of opportunity and social justice, but for our long-term economic interest as well.

8 Final remarks

Some years ago, the Director-General of the World Health Organization, Jong-wook Lee, argued for a need to gather and review evidence on what needed to be done in order to reduce health inequalities and provide guidance for governments on how to reduce the differences between population groups, both within and among countries (WHO 2004). Since then much work has been undertaken to accurately measure the factors that explain health inequalities. Recently, WHO (2013) concluded that social determinants are mostly responsible for the persistent evidence of high levels of health inequality. Nevertheless, it is also clear that further evidence is necessary from different groups and countries, as the determinants of health may well be context-specific.

The present study contributes to this line of research by providing evidence on the Portuguese case, which, despite its importance and specificities, has not received sufficient attention so far. This study also emerges from a different strand of research that has been extending the evaluation of poverty, richness, and inequality to other critical variables beyond income.

In the previous section, we summarized the results of our empirical analysis and discussed some of the most important policy implications from the study. Additionally, there are some pressure points that can, to some extent, motivate changes in the picture we have drawn. In the long run, three factors should be stressed. First, one of the main concerns in the Portuguese case is the aging phenomenon (EC, 2012). Life expectancy is increasing and, because the fertility rate is dropping, health distribution is very likely to change gradually, and it is reasonable to expect more individuals in older age groups and fewer in younger. Given that age is negatively correlated with health, this trend creates an important pressure toward more inequality and poverty in terms of health.

Second, there is an almost consensual opinion that the current pension scheme has to undergo substantial reforms to enhance the sustainability of the social security system. The purchasing power of retirees may therefore suffer a structural decrease which in turn may have important implications for health because, as we have seen, income is a key health determinant.

Third, the need to follow stricter rules concerning fiscal imbalances will force governments to keep public spending within more controlled boundaries (namely due to the Fiscal Pact). Given their weight in total government spending, health and education will be seriously affected by these financial restrictions. Although efficiency and organizational gains can be pursued to minimize the impact, choices will have to be made and large cuts seem inevitable.

When we look at the last 5 years, we can already see the emergence of the difficulties caused by all of these features. In fact, these structural trends are exacerbated by the turbulent macroeconomic context that has characterized the Portuguese economy, with special emphasis on the negative consequences of the sovereign debt crisis and the bailout program that followed the financial crisis.

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