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Research article

Intersectionality on the perception of health in two cross-national surveys (WVS and EVS)

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ABSTRACT

This article focuses on the health perceptions of people across social strata and nations using the combined dataset of the World Values Survey and the European Values Study (EVS/WVS). An intercategorical intersectional analysis model was developed to examine the social determinants underlying differences in health perceptions. Using logistic regression of the interactions between sex, age, level of educational attainment and income, we calculated the impact of these variables (main effects) and their interactions within the intersecting categories on health perceptions. The group with the best perception of their health includes men aged 16–49, with a high income and an upper-middle level of education. Comparative analysis has been carried out to identify differences in the influence of intersectional categories across countries. Of particular relevance is the number of Eastern European countries where the perception of people aged 50 and over with low income is very poor.

1. Introduction

Perceived health status is a widely used indicator to assess people's actual health and provides relevant information in relation to subjective social status [1]. It alerts us to the personal and contextual disadvantages that combine to make it difficult to have good health, both in terms of access to health resources and in one's own perception of well-being. Recognising and understanding this multidimensional interaction is essential to address and reduce inequalities, and to design public policies and strategies that prioritise the most vulnerable groups. This requires the identification and quantification of inequalities and an understanding of how they interact [2,3].

The World Values Survey [WVS] [4] and the European Values Study [EVS, GESIS] [5] aim to analyse changes in beliefs and values in different countries. Both surveys include a question about the perceived health status of individuals: "In general, how would you describe your health status these days, would you say it is … ?" The inclusion of questions on perceived health status provides a valuable tool for understanding how changes in values and beliefs in different contexts may influence people's perceptions of health. This information also allows us to analyse the differences in perceived health between different social strata and nations, and to understand how these factors interact to influence the health of populations more broadly.

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2. Intersectionality on the perception of health

Intersectionality has functioned as both a political project for social justice and a research paradigm from its first formulation to the present day. It addresses the problem of social inequalities, especially those between men and women and among women [6–9]. Quantitative intersectional analysis has focused on the intercategorical level of analysis [10–13], highlighting the multiple simultaneous interactions and patterns of inequalities in health perceptions [14,15]. As the World Health Organization points out, social inequalities in health' perceptions are rooted in inequalities in living conditions [16]. For example, inequalities in living conditions, the working environment and the ageing process explain differences in perceived health [17].

Gender factors imply an inequality in the perception of health between men and women [18]. Gender discrimination influences these differences, particularly in patriarchal societies with unequal power and wealth [19,20]. Although some countries have made major improvements in gender equality that have led to increases in women's life expectancy [21], structural patterns of inequality and the perpetuation of patriarchal norms persist, with the result that men continue to have better health perceptions than women [22].

Age also influences inequality in heath perceptions. Although ageing is a natural and inherent part of the human condition, being older means being part of a group that is particularly vulnerable to situations of social injustice. Age discrimination is intertwined with other factors of inequality, such as gender, socioeconomic status or geographical location [23,24], reflecting the importance of intersectionality in analyses [24].

The authors have also found a significant association between the level of education in a country and the health status of the population [25]. In general, higher educational attainment is associated with greater control over psychological resources, such as a larger network of social contacts and fewer traumatic life events [26]. These psychosocial factors have a positive impact on people's mental and physical health.

If we focus on the analysis of racism as a structural factor that intersects with other dimensions of inequality, such as gender and class [27], foreignness, defined as the absence of indigenous origin in the country or the lack of an indigenous background in one of the parents, can be considered a relevant factor to consider in the perception of health from an intersectional perspective [14]. Indeed, narratives promoted by pernicious discourses that seek to justify scientific racism, xenophobia or inequality may be based on biased perceptions that migrant populations have greater health vulnerability and use more health services [28]. Paradoxically, recent studies conclude that in countries of the Organization for Economic Co-operation and Development (OECD) between 2000 and 2015, "the increasing inflow of immigrants is significantly associated with out-of-pocket spending, but surprisingly not with public spending on health care" (p. 485) [29]. If poverty is one of the main motivations for migrating, then it can be assumed that income inequality determines inequality, including for foreigners [30].

Understanding poverty as a contextual phenomenon may explain why similar profiles in terms of gender, age, immigration status, income or education perceive their health differently depending on where they live [31]. Authors highlight that socio-economic inequalities influence the availability of resources and opportunities to maintain good health, with low income associated with poorer health [32] and high income associated with good health [33,34]. Self-perceived poverty is associated with poorer perceived health [35].

Research questions and hypothesis.

How do these variables - gender, age, level of educational attainment, migrant status and income - interact to determine the perceived good health of people around the world? This study addressed three fundamental questions from an intersectional perspective [36]. First, it explored the influence of different variables on perceptions of health status, specifically gender, age group, income level, educational level and immigrant status. The second was an analysis of the intersections between these variables in the context of the social stratification of health, because the perception of health is jointly shaped by multiple social positions and cannot be adequately understood by considering social positions independently [37]. Finally, a comparison was made of differences in perceived health status between countries.

Three hypotheses were formulated and tested. The first hypothesis [H1] stated that gender, origin (whether the person is native or foreign, i.e. whether the person is an immigrant or has immigrant parents), age, educational level, and income would have a significant effect on perceptions of health status. For the second hypothesis [H2], strata were constructed from the different categories of variables that were found to be significant. We wanted to test whether their interactions had a significant effect on the perception of health status. Finally, the third hypothesis [H3] aimed to test whether differences in the perception of health status in relation to the profile of the social stratum to which an individual belongs vary across countries.

3. Method

3.1. Data

For this study, we used the combined dataset of the World Values Survey [4] and the European Values Study [5], called Joint EVS/WVS [38]. The initial sample contained 153,595 respondents, 70,696 men (46.03 %) and 82,899 women (53.97 %), from 88 countries. After selecting only valid cases for all variables included in the analysis, the sample was reduced to 140,296 cases, 65,005 men (46.3 %) and 75,291 women (53.7 %).

Table 1
Variables.

Variables	Description
A009 (State of Health)	All in all, how would you describe your state of health these days? Would you say it is … (read out): (1) Very Good; (2) Good; (3) Fair; (4) Poor; (5) Very poor
Recoding A009R	State of health (subjective) A009→ State of health (recoded) (A009R) (1) Very Good, & (2) Good (A009)→ (1) Good health (A009R) (3) Fair; (4) Poor; (5) Very poor (A009)→ (2) No Good health (A009R)
X001 (Sex)	Respondent's sex (Code respondent's sex by observation, don't ask about it!): (1) Men; (2) Women
X003 (Age)	This means you are _years old (write in age in two digits)
X003R2 (Age recoded 3 int)	(1) 15–29 years, (2) 30–49 years, (3) 50 and more years
X003R3 (Age recoded 2 int)	(1) Under 50 years, (2) 50 and more years
G027	Were you born in this country or are you an immigrant to this country? (Code one answer)
V001~V002	Are your mother ~ father immigrants to this country or not? Please, indicate separately for each of them (read out and code one answer for each)
Creation Immigrant	G027A #V002 #V001 #V001→ Immigrant (Respondent immigrant OR mother immigrant OR father immigrant): 1 No immigrant; 2 Yes immigrant. Excel: IF(G027A = 1; IF(V002 = 0; 1;IF(V001 = 0; 1;2)))
X025A-1 Highest educational level	What is the highest educational level that you, (…) have attained? (0) Less than primary, (1) Primary, (2) Lower secondary, (3) Upper secondary, (4) Post-secondary non tertiary, (5) Short-cycle tertiary, (6) Bachelor or equivalent, (7) Master or equivalent, (8) Doctoral or equivalent
Recoding: X025R	0-2 (X025A-1)→ 1 Lower (X025R); 3–4 (X025A-1)→ 2 Middle (X025R); 5–8 (X025A-1)→ 3 Upper (X025R)
X047E-EV5 & X047-WVS7 (Scale incomes)	On this card is an income scale on which 1 indicates the lowest income group and 10 the highest income group in your country. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that as in (Code one number)
Recoding: X047_R3	1-3 (X047)→ 1 Low (X047_R3); 4–7 (X047)→ 2 Middle (X047_R3); 8–10 (X047)→ 3 High (X047_R3)
X047_R2	(1) Low income, (2) Not low income (Middle & High)
Cntry_AN (Country)	Country (ISO 3166-1 Alpha-2 code): 88 countries WHO Regions (WHO, 2023a): African Region (AFR), Region of the Americas (AMR), South-East Asian Region (SEAR), European Region (EUR), Eastern Mediterranean Region (EMR), and Western Pacific Region (WPR).
Strata	Variable consisting of intersectional categories, generated by cross-stratification. X X X_{1234} X (Sex, Age, Income-level and Highest-educational-level). X1 (1-men, 2-women); X2 (1~16-29y., 2~30-49y.; 3–50 and morey.); X3 (1-Low, 2-Medium, 3-High); X4 (1-Lower; 2-Midle; 3-Higher): 54 strata
Strata_Cntry1	Variable made up of intersectional categories (cross-stratification) XX X X_{123} (Cntry_An, Age 2-int, Income 2-int): 352 strata
Strata_Cntry2	XX X X_{1234} X (Cntry_An, Sex, Age 2-int, Income 2-int): 704 strata

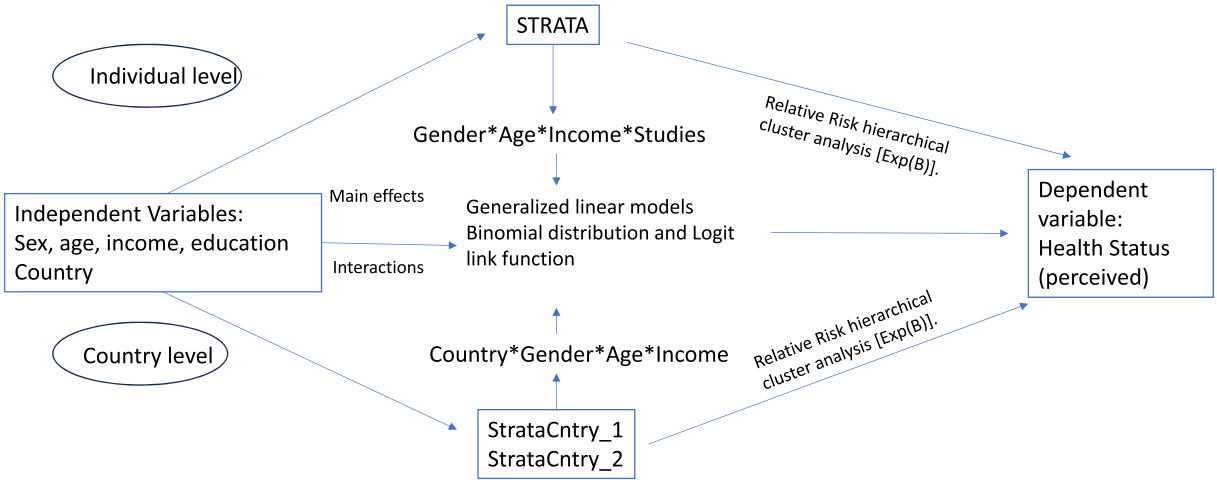

Fig. 1. Intersectional Analysis Design using multilevel regression models with binomial distribution and Logit link function*. * Fixed effects are the individual-level variables. The country variable is the random effects.

3.2. Variables

Table 1 shows the variables used in this study and their description, as well as the recodings developed for this study. Our dependent variable is subjective perception of health. The independent variables used are gender, age, migration status, educational

level and income level.

In order to facilitate the interpretation, several recoding were carried out. The variable “health status" was dichotomised into “good health status" and “not good health status", as other researchers have done [39,40]. The variable “immigrant" was created from the variables “respondent immigrant", “immigrant mother" and “immigrant father" to capture the situation in which the respondent or one of his/her parents is an immigrant. The values of the income variables have been unified. Finally, the variable “STRATA" was created by cross-combining the categories of the independent variables found to be relevant in predicting health perceptions, following the suggestions of Evans et al. [41].

3.3. Study design

An intercategorical intersectional analysis model was developed to examine the social determinants underlying differences in health perceptions [14]. Sex, age, income level and educational level were cross-stratified to create intersectional factors. The impact of these variables (main effects) and their interactions within the intersecting categories was then examined in relation to perceptions of poor health. A comparative analysis was conducted to identify differences in the influence of intersectional categories across countries. Binary logistic regression of the different variables and their interactions was used to calculate the Relative Risk [42] of perceiving poor health for each of the stratified categories.

Fig. 1 shows the scheme of the analysis carried out in this intersectional analysis. The choice of the dependent variable, perceived health, with a binomial distribution and stratified variables with a large number of categories (54 for STRATA, 352 for StrataCntry_1 and 704 for StrataCntry_2), determined the choice of the intersectional analysis design. This is a significant difference from other work using hierarchical or mixed models, where the dependent variable is continuous, such as body mass index [41], or where a dichotomous dependent variable results in a relatively small number of categories in the random effects analysis [43].

The dichotomous nature of the health status variable conditioned the decision to operationalise the analysis of the intersectional structures through logistic regression of the interactions between the independent variables. The number of categories (strata), both in the analysis of the interactions between the independent socio-demographic variables and in their interaction with the country variable, determined the use of generalised linear models with binomial distribution, logit link function, and based on the analysis of the interactions between the predictor variables (gender*age*income level*education level). Consequently, the analyses revealed the interactions between categories of variables of the same level (STRATA) and the interactions between variables of different levels (StrataCntry_1 and StrataCntry_2).

These interactions were the product of cross-stratifying the categories of these variables and their effect size, the Relative Risk of being unhealthy [Exp(B)] or the regression coefficient for each stratum [B]. This is an easily interpretable and widely used measure in epidemiology that allows comparison between strata (intercategorical). On the other hand, the possibility of cross-stratification between variables at different levels (individual and country) has made it possible to compare the Relative Risks resulting from the different strata by country.

3.4. Analysis

Before running the binary logistic regression, we checked (1) the association between each independent variable and the dependent variable, and (2) the non-collinearity between the independent variables. For this purpose, the cross-tabulation technique was used, calculating Chi-square, V-Cramer and Somers’ δ. For collinearity, the Durbin-Watson test was applied and the Variance Inflated Factor (VIF) was calculated.

The Relative Risk of being unhealthy was calculated in the null model [Exp $(\widehat{\beta}_0)$]. The variance of the null model, the variance of the proposed model, and the likelihood ratio or difference between the variances were used to assess the quality of the model fit.

The Nagelkerke R-squared $\left[R_L^2 = \frac{1-\left[\frac{-2LL_0}{-2LL_1}\right]}{1-(2LL_1)^{2/N}}\right]$ was calculated to determine the variability in health status explained by the model. The specificity [true negatives/(true negatives + false positives)] and sensitivity [true positives/(true positives + false negatives)] of the regression model were also determined to assess the rigour of its ability to classify.

To compare the proposed model with the null model, the Wald z-statistic was calculated based on the overall percentages of both models. Regression coefficients were identified and their statistical significance was assessed [44]. For each regression coefficient, its 95 % confidence interval was estimated [45].

$$IC_{\beta_J} = \widehat{\beta}_J \mp 1.96 \cdot Standard\ Error$$

In the case of the age, the regression equation was rewritten using the age variable instead of the recoded age variable to estimate the mean change in health perception per year.

The second hypothesis was that the perception of health status would depend on social stratum. In order to assess whether social stratum (STRATA) has a significant effect on health perception, the analysis of variance was conducted with the STRATA factor as a random effect. The SPSS mixed models tool [46] was used. The Wald-Z statistic and the Intraclass Correlation Coefficient (ICC) were calculated to estimate how much variance of the dependent variable (perceived health) is explained by social stratum membership [47]. That is, how similar respondents within the same social stratum are in comparison with those belonging to another social stratum.

Table 2
Calculation of prevalence and relative risk of perceived ill-health.

VD					Prevalence not in good health
		Good-health	Not-good-health		Prevalence (Cat 1) = b/(a+b)
VI	Cat 1	a	b	a+b	Prevalence (Cat 2) = d/(c + d)
	Cat 2	c	d	c + d	Relative Risk not in good health RR (Not in good health Cat2 vs Cat1) = $P/P_{cat2cat1}$

Table 3
Model if the term has been dropped based on conditional parameter estimates.

Variable		Log. model likelihood	Change in log. likelihood −2	gl	Sig. of change
Step 1	Age (recoded)	−57569,350	2670,640	1	0,000
Step 2	Age (recoded)	−56352,259	2578,656	1	0,000
	Income level	−56237,337	2348,812	1	0,000
Step 3	Age (recoded)	−56121,251	2426,585	1	0,000
	Income level	−55759,436	1702,957	1	0,000
	Educational level	−55063,020	310,123	1	0,000
Step 4	Sex	−54907,979	165,230	1	0,000
	Age (recoded)	−56094,057	2537,386	1	0,000
	Income Level	−55663,219	1675,710	1	0,000
	Educational Level	−54983,173	315,617	1	0,000

Table 4
Indicators of the association of the independent variables with the dependent variable (state of health).

Independent variables	Chi-square p-value	Cramer's V coefficient	Coefficient δ of Somers
Sex	<0.001	0.051	
age	0.000		+0.174
Revenues	0.000		−0.157
Educational Level	0.000		−0.099
Immigrant status	0.205		

For each independent variable and stratum resulting from their interaction, the prevalence and Relative Risk or ratio of the proportion of people in not good health to people in good health were calculated (Table 2).

To facilitate interpretation of the results, the logarithmic transformation of the Relative Risk [LogRR = Log_e (p_{cat2}/p_{cat1})] was performed. Higher values of Ln (RR) indicate worse health perception.

The analysis of interactions between variables was conducted using a generalised linear model with binomial distribution and logit link function. This model was constructed on the basis of the interaction between the variables considered. Regression coefficients were calculated for each stratum [Exp(B)] and their logit, [B], together with their 95 % confidence intervals.

From the results obtained, a new dataset was created and a Hierarchical Cluster Analysis was performed. The strata were grouped into three clusters according to the Relative Risk (B) of not good health: low (1), medium (2) and high (3).

The third hypothesis was that the perception of health status would depend on the country and social stratum to which one belongs. Since adding the country variable leads to an increase in the number of strata (4752 strata), which means that strata with few or empty subjects are created, it was decided which independent variables could be eliminated. The most relevant variables were age and income level. Gender and educational level had much smaller influence than age and income (Table 3). For theoretical reasons, the sex variable was retained for cross-country comparisons. For the analyses involving the country variable, the stratified variables Cntry_2 with country, sex, age and income level and Cntry_1 with country, age and income level were constructed.

In order to display and analyse the data geographically, the Relative Risk data for each country, as well as the regression coefficients [RR and Logit (RR)] of the variables Cntry_1 and Cntry_2, were added to the shapefile of the world countries [48].

The process followed in the analysis of hypothesis H2 was replicated to calculate the relative risk of poor health in three cases: (a) by country, (b) by Cntry_2 (country, sex, age and income level) and (c) by Cntry_1 (country, age and income level). QGISv3.32.0 was used for the analysis and geolocation, and SPSSv28 for statistical analysis.

4. Results

First, the relationship between health status and the other variables was analysed using Chi-Square. The p-values and Cramer's V and Somers' δ coefficients are shown in Table 4. The state of health is significantly associated with gender, age, income and level of education. Although the strength of the association is low, men perceive themselves to be healthier than women. The association with age is stronger (perceived good health declines with increasing age). The higher the income level, the better the perception of good health. In the case of immigrant status, the chi-square analysis yielded a value of 1.609 (p-value: 0.205), indicating that there is no significant relationship between perceived health status and the immigrant variable. Therefore, the immigrant variable was not

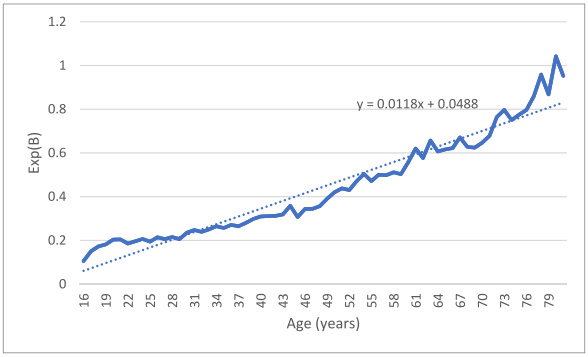

Fig. 2. Variation of Exp(B) of not good health by age.

included in the subsequent analyses as it does not have a significant effect on perceived health status.

A regression model of perceived health status with gender, age, income level and education level as independent variables was run to test for non-collinearity between the independent variables. This model explained 7.9 % of the variability in perceived health (R-squared: 0.079). The Durbin-Watson test yielded a value of 1.819, which allowed the assumption of independence of errors. A VIF (Variance Inflated Factor) value close to 1 was obtained for the four independent variables, indicating low collinearity (gender: 1.003; age: 1.015; income level: 1.076; education level: 1.079), which does not affect the quality of the regression model.

Our first hypothesis stated that gender, age, income level and educational level are significant in perceived health status.

In the null model the value of the constant B $\left[\widehat{\beta}_0 = Ln\left(No\ good\frac{healt}{good}health\right) = Ln\ 4966290634\right]$ is −0.602. That is, the proportion of respondents who have a perception of themselves as being in poor health is lower than the proportion of respondents who have a perception of themselves as beings in good health. Its natural transformation [Exp $(\widehat{\beta}_0)$= (e $^{-0,6015893655}$ = 0,5479] indicates that the Relative Risk (RR) value or proportion of those with poor health is 54.8 % of those who consider themselves healthy.

Rao's statistics [49] were calculated for the model and for each variable category. For the 'low' category of educational level the significance had a p-value of 0.02 (<0.05), for the rest it was 0.000 or < 0.0001. This allowed us to reject the null hypothesis and conclude that the four independent variables contributed significantly to improving the fit of the null model.

The deviance of the null model (-2LL$_0$ = 182349.938) represents the maximum possible misfit. The difference between the deviance of the proposed model ((-2LL$_1$ = 170743.262) is the likelihood ratio [$G^2_{0\text{-}1}$ = −2LL$_0$ – (-2LL$_1$) = 11606.676] or chi-squared likelihood ratio in the omnibus test, with Sig<0.05. This allowed us to reject the null hypothesis and to strengthen the evidence that the four independent variables make a significant contribution to the improvement of the fit of the null model.

In the classification table of observed and predicted cases, the specificity or percentage of true negatives (88.8 %) and the sensitivity or percentage of true positives (29.7 %) were calculated [50,51]. The statistical significance of the change in sensitivity and specificity percentages was evaluated using the Z statistic [52]. When Z > 1.64 (normal distribution), it is possible to reject the null hypothesis. In our study, the difference between the overall percentage of the proposed model (67.9) and the null model (64.6), is $Z = \frac{0{,}679-0{,}646}{\sqrt{0.646(1-0{,}679)/140296)}} = 27,143 > 1.64$. That is, the proposed model adequately classifies respondents according to their characteristics (gender, age, income and education level) regarding how they perceive their health.

The significance of the regression coefficients was assessed using the Wald statistic [(B/Error standard)^2]. For example, for the coefficient corresponding to gender (women) with a value of 0.188 and a standard error of 0.012, the Wald statistic is (0.188/0.012)2 = 258.346, with a significance value of less than 0.001, which allows us to reject the null hypothesis. The same is true for all the remaining variables, which permits us to conclude that all independent variables are relevant in the prediction of the perception of health. The regression equation would be.

Logit (health status = 1 'not in good health') = β0 +β1 (gender)+ β2 (age)+ β3 (income) + β4 (educational level) = −0.594 + 0.188 (gender)+0.576 (age)-0.509 (income)-0.189 (educational level).

Analysing the β values for each of the categories of each variable, we found that for the sex variable, the coefficient β1 (0.188) indicates that the logit (RR) of not being in good health is 0.188 times higher for women than for men. Transforming these results to the natural scale, we observed a relative risk for men of 0.502, which corresponds to a probability of 0.36 [0,502/(0,502 + 1)], while for women the calculated relative risk was 1.209, which corresponds to a probability of 0.547 [1.207/(1.207 + 1)]. This means that the probability of perceiving oneself to be in poor health is higher for women (0.54) than for men (0.36).

For the variable age, β2 (age) = 0.576. The positive sign of the coefficient indicates that the perception of not being in good health is higher (worse) with increasing age. In relation to the 15–29 age group, the logit for the 30–49 age group was 0.389 and for the 50+ age group it was 1.088. When transformed to the natural scale, the RR for the 30–49 age group was 1.47, with a probability of not being in good health of 0.595, while for the 50+ age group it was 2.968, with a probability of not being in good health of 0.748. When a regression analysis was performed, substituting the recoded variable age [X003R2] for the variable age [X003], an increase in the RR of not being in good health of 1.18 % per year was observed, from a value of 0.106 (IC95 %:.036-0.307) at age 16 to 0.952(IC95 %:.782–1.159) at age 81 (Fig. 2).

For income (β3 = −0.509), the negative sign indicates how the logit (RR) changes with increasing category of analysis (low-middle-

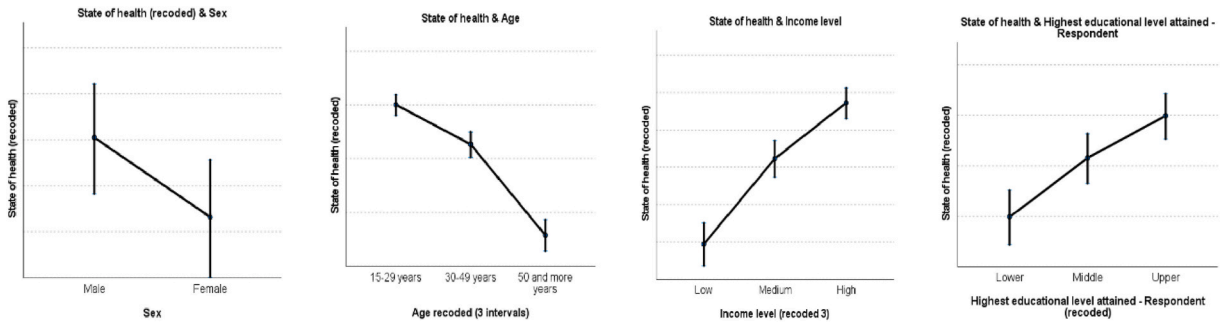

Fig. 3. Relation of perceived health status to gender, age, income level, education level.

high). The natural transformation of the logit coefficients for medium income ($\beta_{3medium} = 0.540$; Exp(B) = 1.716) and high income ($\beta_{3hight} = 0.981$; Exp(B) = 2.667) gave a probability of 0.632 for medium income and 0.727 for high income. That is, compared to the low income group, the probability of perceiving not good health is 0.632 times lower in the middle income group and 0.727 times lower in the high income group.

As for the educational level ($\beta 4 = -0.189$), the higher the level of education, the better the perception of health. The RR [Exp(B)] for the medium level was 1.24, with a probability of 0.553, and 1.449 for the high level, with a probability of 0.591 (Fig. 3).

Our second hypothesis was that the perception of health status would depend on social stratum. In this case, we first calculated the difference in deviance between the model that did not include the STRATA factor ($2LL_0 = 191156.03$) and the one that did ($2LL_{STRATA} = 179038.30$), and found that the resulting chi-squared value (12117.73) had a probability <0.001 of occurring by chance. On the other hand, the Wald-Z statistic (variance-estimated/typical-error) had a value of 5.11 (p-value<0.001), rejecting H_0. Therefore, the perception of health status differs significantly between strata. We calculated the intraclass correlation coefficient [ICC=Variance-estimated STRATA/(estimate-STRATA + estimate-residue)], which was 0.079. This means that the difference between the variability of subjects in the same stratum was 7.9 % [45].

We also calculated the relative risk of being in poor health. For the gender variable, the prevalence of not being in good health was found to be 0.33 % for men and 0.44 % for women, giving an RR of 1.33. The risk of perceiving oneself as not in good health is 1.33 times higher for women than for men. With regard to age, the prevalence of not being in good health was 0.25 % for those under 50 and 0.60 % for those over 50, giving an RR of 2.4. The risk of perceiving oneself to be in poor health is 2.4 times higher for those aged 50 and over than for those aged under 50. Regarding income, the prevalence of perceived poor health was 0.48 % for low income and 0.30 % for upper middle income, with an RR of 1.6. The risk of perceived poor health is 1.6 times higher for low income than for upper-middle income (Table 5).

Hierarchical cluster analysis was used to assess the RR of poor health (worst, average, and best) for the different strata (sex, age, income level, education level). Ranked from worst to best, health perception was worst (3) in strata 2311, 2312, 2313, 1312, 1311, 1313, 2321 and average (2) in strata 2211, 1321, 2322, 2331, 1322, 1331, 2212, 2323, 2213, 1211, 1213, 1212, 1323, 2221 (Fig. 4). In the 50+ strata, the RR ranged from 1.86 (95%CI: 1.76–1.96) for women with low income and education (worse) to 0.30 % (95%CI: 0.28–0.34) for men with high income and education (better) (Table 6) (see Table 7).

The third hypothesis was that perceptions of health status would vary by country and strata.

Logistic-binomial regression analysis was used to calculate the RR of poor health for each country, then cluster analysis was used to classify perceptions of health status by country into 5 clusters (5-very bad, 4-poor, 3-good, 2-very good, 1-excellent). The mean RR for poor health was 0.50 [logit (0.50) = -0.69]. Table 7 shows the countries included in each cluster. Fig. 5 shows the countries in the very bad health cluster.

Finally, a regression analysis was carried out on the 704 intersectional categories involved in the interactions of the variables country, sex, age and income. From their regression coefficients [logit (RR)], a new data set (sav) was created with the information corresponding to each stratum. These strata were ranked according to their relative risks from highest to lowest and classified (hierarchical cluster analysis) into five categories according to their perceived health (from 5-very poor to 1-excellent).

5. Discussion

In this study we have analysed how different variables such as gender, age, income and educational level are related to perceived health. These variables were found to have a significant effect on the variability of perceived health.

However, in the case of the immigrant variable (being an immigrant or having a parent who is an immigrant), no significant effect was found on perceived health status. In other words, being an immigrant or having immigrant parents does not have a significant impact on how people perceive their health. It cannot be argued that immigrants have a worse perception of their health simply because they are immigrants [14]. Rather, it can be argued that income inequality determines inequality, even for foreigners [29,30].

Both Rao's statistics and the similarity ratio show that the proposed model, which includes the four independent variables (gender, age, income and educational level), contributes significantly to improving the null model. Furthermore, the Z-value confirms that the model is able to adequately classify subjects according to their characteristics (gender, age, income level and educational level) and

Table 5
Prevalence and relative risk of perceived unhealthiness.

		Good-health	Not-good-health	Prevalence and Relative Risk not in good health
Sex	Men	43704 (67.2 %) (a)	21301 (32.8 %) (b)	Prevalence (Men) = b/(a+b) = 21301/(43704 + 21301) = 0.33 %.
	Women	46930 (62.3 %) (c)	28361 (37.7 %) (d)	Prevalence (Women) = d/(c + d) = 28361/(46930 + 28361) = 0.44 %.
				RR (Not in good health Cat2 vs Cat1) = $P_{Women\ /Men\ =\ 0}$.44/0.33 = 1.33
Age (years)	Less than 50	60656 (73.1 %)	22299 (26.9 %)	Prevalence (Under 50years) = b/(a+b) = 22299/60656 + 22299 = 22299/90634 = 0.25 %.
	50 and over	29978 (52.3 %)	27363 (47.7 %)	Prevalence (50 and more years) = d/(c + d) = 29978/29978 + 27363 = 29978/49662 = 0,60 %.
				RR (No Good health 50 and more y. vs Under 50 y) = $P_{\ 50\ and\ more\ y.}$/$P_{Under\ 50}$ = 0,60/0,25 = 2,40
Income	Low	20617 (51.6 %)	19322 (48.4 %)	Prevalence (Low income) = b/(a+b) = 19322/20617 + 19322 = 20617/39939 = 0.48 %.
	No low	70017 (69.8 %)	30340 (30.2 %)	Prevalence (Not low income) = d/(c + d) = 30340/70017 + 30340 = 30340/100357 = 0,30 %.
				RR (No Good health women vs men) = P low income/P not low income = 0,48/0,30 = 1,6

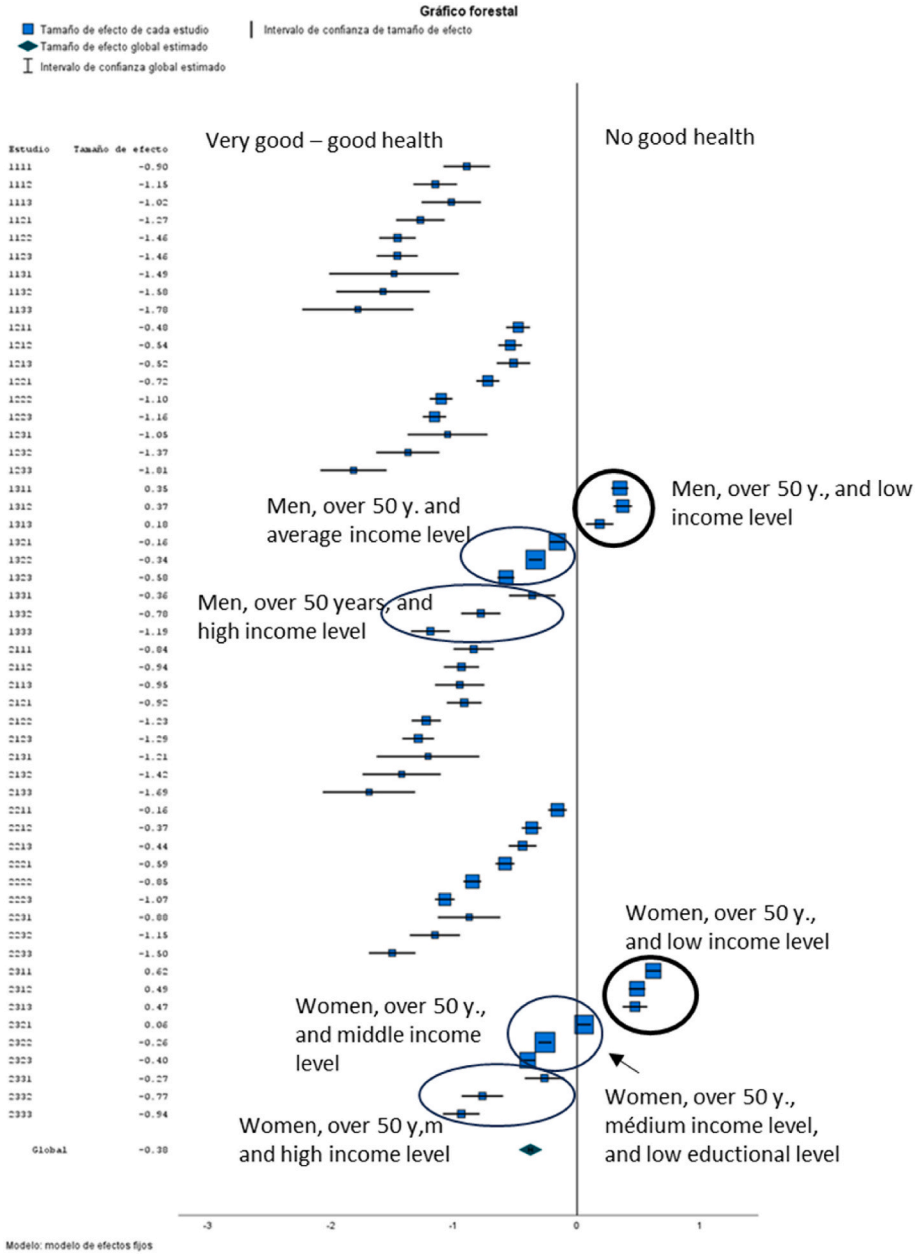

Fig. 4. Perceived health by strata.

Nagelkerke's R-squared indicates that it explains 10 % of the variability in health perception.

Statistical significance analysis of the regression model using the Wald statistic confirmed that all independent variables were relevant in predicting health perception. The regression equation would be as follows:

Logit (health status = 1 ′not in good health') = β0 +β1 (gender)+ β2 (age)+ β3 (income) + β4 (education) = −0.594 + 0.188 (gender)+0.576 (age)-0.509 (income)-0.189 (education).

The most influential variables are age (+0.576) and income level (−0.576), followed by sex (+0.188) and educational level (−1.89). The positive sign on the sex variable indicates that women (sex = 1) have a worse perception of health than men (sex = 0). For the age variable, the positive sign indicates that health perception worsens as age increases, and for the income and education variables, their negative signs indicate that health perception improves as income and education increase.

It was found that the probability of perceiving poor health was higher for women (0.547) than for men (0.36), which mean that policies of gender equality or inequality influence perceptions of health [54] and that gender discrimination influences the unequal perception of health [19,20].

Regarding age, the probability of not being in good health was 0.595 for those aged 30–49 and 0.748 for those aged 50 and over

Table 6
Strata with relative risk of poor health strata (50 and over). From worse to better.

Strat.	B	Error est.	-IC95 % (B)	+IC95 % (B)	Chi2-Wald	Sig.	Exp(B)	-IC95 % Exp(B)	+IC95 % Exp(B)	RR Cluster
2311	0.62	0.03	0.56	0.67	475.98	0.00	1.86	1.76	1.96	Worst (3)
2312	0.49	0.03	0.43	0.55	249.86	0.00	1.63	1.53	1.73	Worst (3)
2313	0.47	0.05	0.38	0.56	102.92	0.00	1.60	1.46	1.75	Worst (3)
1312	0.37	0.04	0.30	0.44	103.02	0.00	1.45	1.35	1.56	Worst (3)
1311	0.35	0.03	0.28	0.41	105.87	0.00	1.42	1.33	1.51	Worst (3)
1313	0.18	0.06	0.07	0.29	10.64	0.00	1.20	1.08	1.34	Worst (3)
2321	0.06	0.03	0.00	0.11	3.89	0.05	1.06	1.00	1.12	Worst (3)
1321	−0.16	0.03	−0.22	−0.10	27.22	0.00	0.85	0.80	0.90	Medium (2)
2322	−0.26	0.03	−0.31	−0.21	98.47	0.00	0.77	0.73	0.81	Medium (2)
2331	−0.27	0.08	−0.42	−0.11	11.28	0.00	0.77	0.66	0.90	Medium (2)
1322	−0.34	0.03	−0.39	−0.29	162.81	0.00	0.71	0.68	0.75	Medium (2)
1331	−0.37	0.09	−0.54	−0.19	16.41	0.00	0.69	0.58	0.83	Medium (2)
2323	−0.40	0.03	−0.46	−0.34	177.19	0.00	0.67	0.63	0.71	Medium (2)
1323	−0.58	0.03	−0.64	−0.52	359.95	0.00	0.56	0.53	0.60	Medium (2)
1332	−0.78	0.06	−0.91	−0.66	151.74	0.00	0.46	0.40	0.52	Best (1)
1333	−1.19	0.05	−1.29	−1.09	569.94	0.00	0.30	0.28	0.34	Best (1)

Strata: Sex, Age-group, Economic-level, Educational-level; B: Regression coefficient (Logit (RR-not-good-health); Exp(B): Relative risk-not-good-health; Cluster: (1) RR-low not-good-health, (2) RR-medium; (3) RR-high.

Table 7
Relative Risk of non-good-health by country.

Clusters	Countries and areas according to the World Health Organisation [53]
Very poor health	Georgia (EUR) y Zimbabwe (AFR).
Poor health	Belarus (EUR), Estonia (EUR), Latvia (EUR), Ukraine (EUR), Albania (EUR), Bolivia (AMR), Armenia (EUR), Philippines (WPR), Tunisia (EMR), Russian (EUR), Lithuania (EUR), Japan (WPR), Hungary (EUR), Serbia (EUR), Bangladesh (SEAR), Slovakia (EUR), Peru (AMR), Croatia (EUR), Morocco (EMR), Iraq (EMR), Poland (EUR), Egypt (EMR), Myanmar (SEAR), Bulgaria (EUR), Mongolia (WPR), Azerbaijan (EUR), China (WPR), Slovenia (EUR)
Good health	Kazakhstan (EUR), Maldives (SEAR), Vietnam (SEAR), Bosnia-Herzegovina (EUR), Germany (EUR), Finland (EUR), Italy (EUR), Brazil (AMR), Romania (EUR), Czechia (EUR), France (EUR), Nicaragua (AMR), United States (AMR), Iran (EMR), Malaysia (WPR), Argentina (AMR), Netherlands (EUR), Pakistan (EMR), United Kingdom (EUR), Mexico (AMR), Indonesia (SEAR), Ireland (EUR), Ecuador (AMR), Canada (AMR), Lebanon (EMR), Singapore (WPR), Sweden (EUR), Tajikistan (EUR), North Macedonia (EUR), Turkiye (EUR), Thailand (SEAR), United States (AMR), Chile (AMR), Denmark (EUR), Austria (EUR), Montenegro (EUR), Colombia (AMR), Kyrgyzstan (EUR), Iceland (EUR), Venezuela (AMR), Australia (WPR), New Zealand (WPR), Spain (EUR), Guatemala (AMR)
Very good health	Uruguay (AMR), Norway (EUR), Kenya (AFR), Switzerland (EUR), Greece (EUR), Jordan (EMR), Cyprus (EUR), Nigeria (AFR), Andorra (EUR)
Excellent health	Ethiopia (AFR), Libya (EMR), South Korea (WPR)

(1.3 times higher for those aged 50 and over than for those aged 30–49). Between the ages of 16 and 81, the deterioration in health perception was quantified at 1.18 % per year. As the authors point out, age discrimination is intertwined with other factors of inequality, such as gender, socio-economic status or geographical location [23,24], reflecting the importance of intersectionality in analyses [24].

With respect to income, the probability of perceiving poor health was 0.632 higher for those with a low income than for those with a medium income and 0.727 higher than for those with a high income. This supports the idea that health perception is a contextual phenomenon [31] and that people with low incomes perceive themselves to be in poorer health [32], while people with high incomes perceive themselves to be in better health [33,34]. Self-perceived poverty is associated with a worse perceived state of health [35].

The probability of being in poor health is lower for the medium educational attainment group (0.553) than for the low educational attainment group. In the high education group (0.591) it is very similar to the medium education group. This is in line with the findings of Ellwardt, Präg and Steverink [26].

The analysis of deviance and the Wald-Z statistic, between the model with or without the STRATA variable at random, confirmed that the perception of health status varies significantly between the different strata. The intra-class correlation coefficient (ICC) indicated that 7.8 % of the total variability in perceived health corresponded to the difference between the means of the social strata of belonging.

The risk of perceived poor health is 1.33 times higher for women than for men, 2.4 times higher for those aged 50 and over than for those under 50, and 1.6 times higher for those with a low income than for those with a medium or high income.

The results showed that women, especially those aged 50 and over with low income and low education, had a higher relative risk of poor health. It was also observed that men aged 50 and over with high income and medium-high education had a good perception of their health. The group with the best perception of their health included men aged 16–49, with high income and upper-middle educational level.

We found that the countries with the worst overall perception of their health were Georgia (RR: 2.29), Zimbabwe (RR: 1.58),

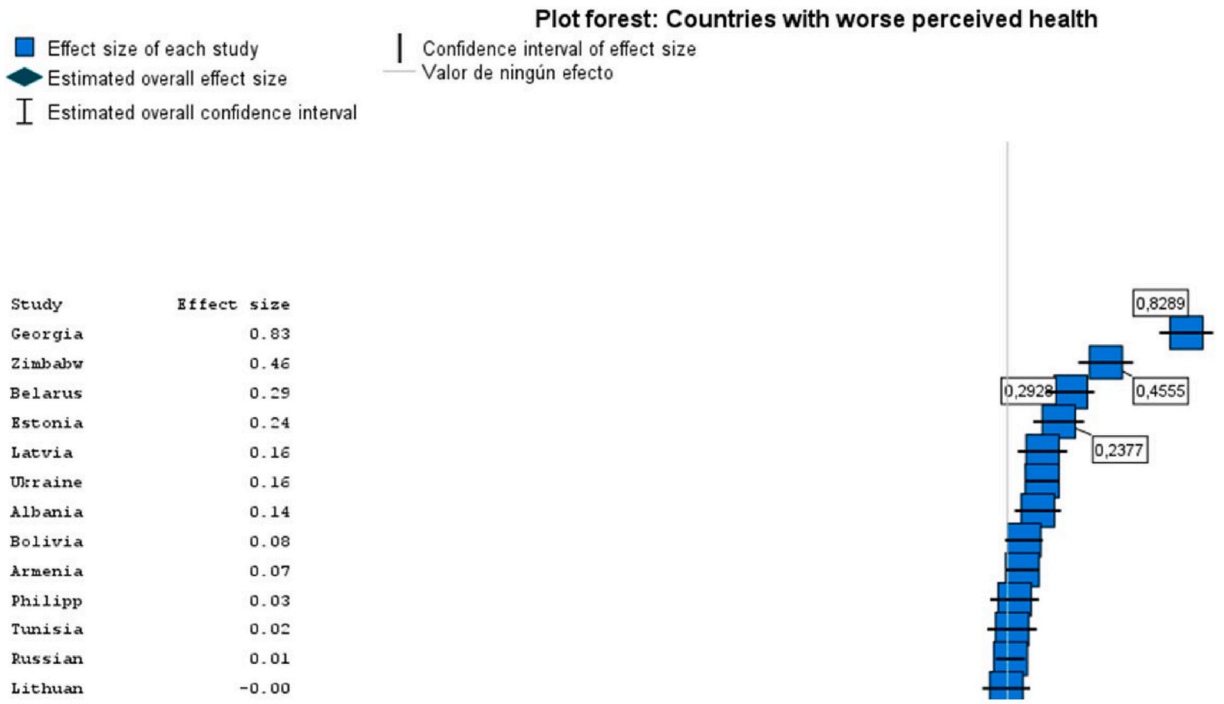

Fig. 5. Countries with worse perceived health.

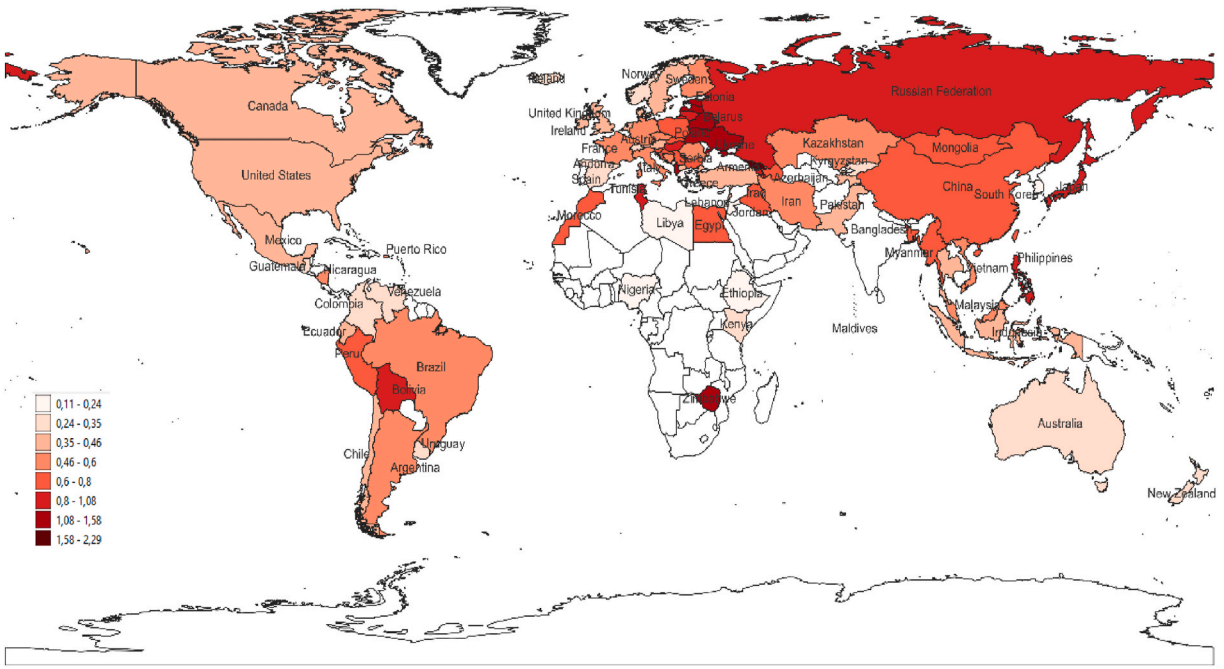

Fig. 6. Relative Risk of not good health by country.

Belarus (RR: 1.34) and Estonia (RR: 1.27). Latvia, Ukraine, Albania, Bolivia, Armenia, Philippines, Tunisia and Russia had a logit (RR) close to 0. Considering that the average is −0.69, in all these countries the perception of their health is significantly worse than expected (Fig. 6).

The groups with the worst perception of health are men and women aged over 50 and on a low income living in Georgia-EUR, Ukraine-EUR, Zimbabwe-AFR, Egypt-EMR, Lithuania-EUR, Belarus-EUR, Russia-EUR, Kazakhstan-EUR, Latvia-EUR, Kazakhstan-

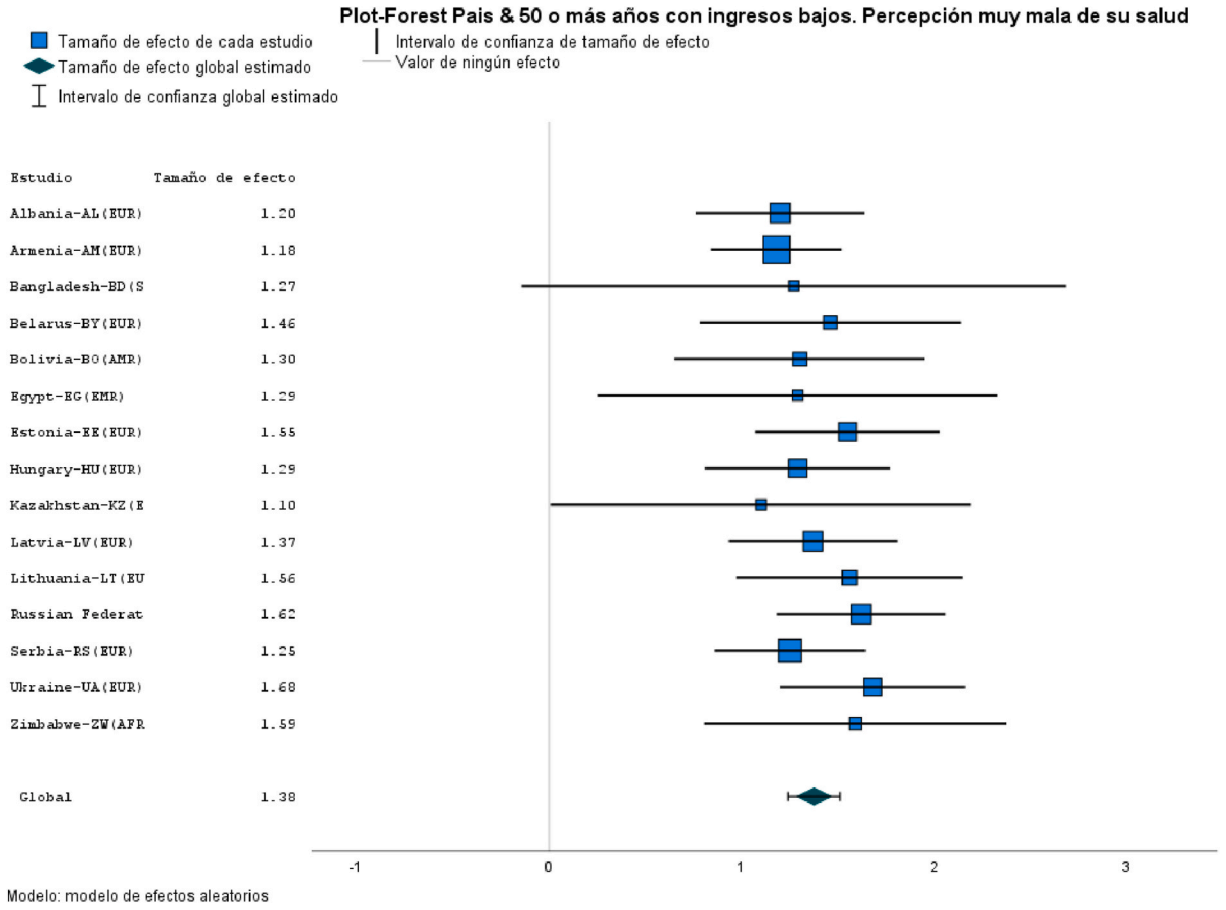

Fig. 7. Countries with the worst perceived health of people over 50 with low incomes.

EUR, Latvia-EUR, Estonia-EUR, Lithuania-EUR, Estonia-EUR, Ireland-EUR, Bangladesh-SEAR, Armenia-EUR, Albania-EUR, Serbia-EUR, Hungary-EUR, Bolivia-AMR, Bolivia-AMR, Tunisia-EMR, Hungary-EUR, Serbia-EUR, Iraq-EMR, Poland-EUR. In Georgia, women aged 50 and over with an upper-middle income are also included.

The strata with the best perception of their health are men and women aged under 50, with a medium or high income and resident in Andorra-EUR, Austria-EUR, Cyprus-EUR, Ethiopia-AFR, France-EUR, Greece-EUR, Jordan-EMR, Libya-EMR, Norway-EUR, Romania-EUR, South Korea-WPR, Spain-EUR. In particular, people aged under 50 with a medium or high income have a better perception of their health than the country average in all cases.

In short, it is the low-income group of the over-50s who have the worst perception of their health. This situation is particularly worrying in countries such as Georgia-GE (EUR) (RR:7.26), Ukraine-UA (EUR) (RR:5.37), Russia-Federal (EUR) (RR:5.08), Zimbabwe-ZW (AFR) (RR:4. 40), Lithuania-LT (EU) (RR:4.40), Estonia-EE (EUR) (RR:4.69), Belarus-BY(EUR) (RR:4.32), Latvia-LV (EUR) (RR:3.94), Bolivia-BO(AMR) (RR:3.68) or Hungary-HU(EUR) (RR:3.64) (Fig. 7).

Very relevant is the number of Eastern European countries where the perception of people aged 50 years and over with low income is very poor (Fig. 8), in line with the findings of Muntaner et al. [55]. In health, social inequalities persist and are particularly important in some countries [55].

5.1. Limitations

Finally, we would like to mention the strengths and limitations of this study, both of which are related to the sample used. It is a very large and open sample, but there is little representation from the African continent, which can be explained by the limitations of the survey instrument in countries with low levels of health literacy, especially in rural areas and hard-to-reach populations [56–58]. Likewise, in very large countries such as the United States, Russia, China or Australia, the sample provides a homogeneous view that is far from reality.

Moreover, the object of analysis, health, is not perceived in the same way in all parts of the world. The perception of health varies according to the individual's perception of his or her position in his or her personal context [59], so it would be desirable to carry out local studies to appreciate the specific differences in perception, and the use of alternative information collection techniques such as

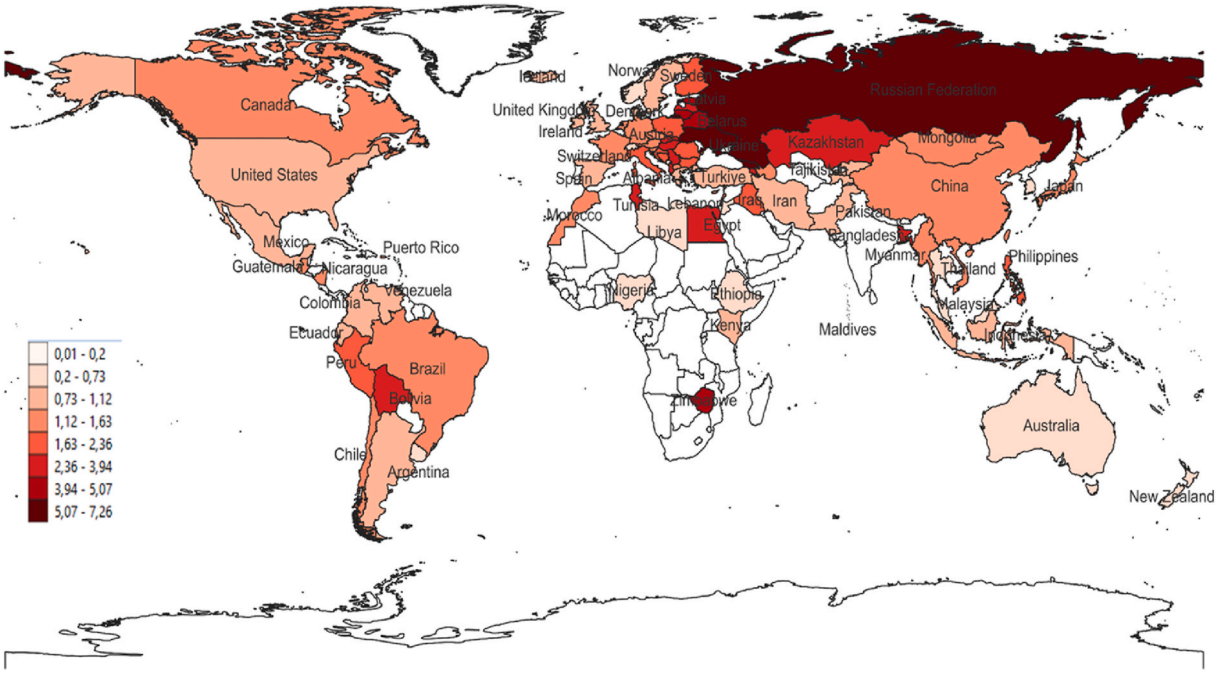

Fig. 8. Map of countries where the over-50s and those on low incomes have the worst perceptions of their own state of health.

indepth interview [56,57].

Finally, we would like to highlight that the cross-sectional nature of this work does not allow us to know the evolution of the perception of health in the world over time in different countries. It would be interesting to analyse it in the context of the six previous waves of the WVS and four waves of the EVS [5].

Ethical Statement

The research presented in this article represents secondary analysis of data of human subjects. No data with human participants was collected as part of this study and manuscript.

Data availability statement

The World Values Survey makes the database used for the analysis of this work publicly available at https://www.worldvaluessurvey.org/WVSEVSjoint2017.jsp.

CRediT authorship contribution statement

Pilar Rodriguez Martinez: Formal analysis, Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Francisco Villegas Lirola:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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