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ORIGINAL ARTICLE

Measuring the effect of ethnic and non-ethnic discrimination on Europeans' self-rated health

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Abstract
Objectives The study of perceived discrimination based on race and ethnic traits belongs to a long-held tradition in this field, but recent studies have found that non-ethnic discrimination based on factors such as gender, disability or age is also a crucial predictor of health outcomes.
Methods Using data from the European Social Survey (2010), and applying Boolean Factor Analysis and Ordered Logistic Regression models, this study is aimed to compare how ethnic and non-ethnic types of discrimination might affect self-rated health in the European context.
Results We found that non-ethnic types of discrimination produce stronger differences on health outcomes. This result indicates that the probabilities of presenting a poor state of health are significantly higher when individuals feel they are being discriminated against for social or demographic conditions (gender, age, sexuality or disability) rather than for ethnic reasons (nationality, race, ethnicity, language or religiosity).
Conclusions This study offers a clear comparison of health inequalities based on ethnic and non-ethnic types of discrimination in the European context, overcoming analytical based on binary indicators and simple measures of discrimination.

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Keywords Ethnic discrimination · Non-ethnic discrimination · Self-rated health · Health inequalities · Europe

Introduction

Population health is determined by social and economic inequalities (Wilkinson and Marmot 2003). Among other factors such as differences in educational attainment, occupational status or income distribution (Mackenbach et al. 2008), literature shows that discrimination has important consequences, not only on people's social lives, but also on their physical and mental health (Albert et al. 2008; Alvarez-Galvez and Salvador-Carulla 2013; Gee et al. 2009; Gomez et al. 2011; Grollman 2014; Krieger 2014; Paradies 2006; Williams et al. 2008; Williams and Mohammed 2009). Recent studies indicate that those individuals who perceive themselves to be subjects of discrimination present higher probabilities of suffering health problems, especially those related to mental well-being such as depression, psychological distress, anxiety, phobias or high-risk health behaviors that tend to affect individuals' state of health (Pascoe and Smart Richman 2009; Todorova et al. 2010). On the other hand, individually perceived discrimination has also been connected to specific physical health problems including high blood pressure, hypertension, obesity, breast cancer, and other potentially risky behavior such as substance abuse (Williams and Mohammed 2009).

Studies focused on analyzing the relationship between perceived discrimination and health have highlighted the influence of ethnic discrimination on mental and physical health outcomes, either because of racial differences or ethnicity (Gomez et al. 2011; Miller et al. 2009; Pascoe and Smart Richman 2009; Williams et al. 2008; Williams and

Mohammed 2009). While race is based on phenotype differences related to skin color, facial and physical features, ethnicity represents a broader concept that emphasizes differences in language and/or cultural tradition. However, despite the conceptual differences between the terms race and ethnicity, in practice both concepts are generally associated since they produce a negative effect on health outcomes (Alvarez-Galvez and Salvador-Carulla 2013; Kim and Williams 2012). Conflicting relationships between persons with different ethnic and/or cultural backgrounds (i.e. religion, language, etc.) are often positively related to poor physical and mental health (Brown et al. 1999). In fact, previous research has revealed that discriminated ethnic minority collectives, including those with Asian, Latin, and Black ethnic origin, are associated with greater socio-economic inequalities and poor health outcomes (Gomez et al. 2011). Therefore, these groups still find significant barriers that reproduce inequality with respect to health (Nazroo 2003).

In addition, studies show that socio-demographic and socio-economic determinants such as gender, sexual orientation, language, religiosity, nationality, social class or disabilities can also lead to poor health outcomes (Kim and Williams 2012). The study of the effects on health of perceived discrimination based on race and ethnic traits has a long-standing and widespread tradition in epidemiological research (Bhui et al. 2005; Borrell et al. 2010; de Castro et al. 2008; Gee et al. 2009; Hunte and Williams 2009; Veling et al. 2008), but recent studies have found that non-ethnic discrimination based on factors such as gender, education or age is also a crucial predictor of health outcomes (Alvarez-Galvez and Salvador-Carulla 2013; Bradford et al. 2012; Ferrie et al. 2006; Kim and Williams, 2012; Oli and Onta 2012). In a broad sense, we might say that specialized literature has not paid the same attention to social determinants of health, which is the reason why these studies are trying to fill this gap in the literature.

This study aims to analyze the association between nine types of perceived discrimination based on (1) race, (2) nationality, (3) religion, (4) language, (5) ethnicity, (6) age, (7) gender, (8) sexuality and (9) disability, and their global impact on the self-rated health of the European population. Specifically, the study will be divided into three sub-objectives: (I) the interrelationship between these modalities of discrimination will be analyzed; and (II) new indicators will be designed using multivariate techniques for the analysis of interdependence (Boolean Factor Analysis); (III) to predict individuals' states of health through an Ordered Logistic Regression analysis.

These specific objectives are based on the following hypotheses:

– H1: There is a strong interrelationship between social discrimination indicators, and also between ethnic ones.
– H2: Social types of perceived discrimination produce greater differences in health outcomes in the European context.

Methods

Data and variables

This study uses the fifth wave of the European Social Survey (Round ESS 5 2010). This dataset has a sample size of 52,458 units. The target population of this survey covered individuals over 15 years of age who were residents within private households, regardless of nationality or citizenship, language or legal status. The ESS 2010 is composed of 26 countries: Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Lithuania, Netherlands, Norway, Poland, Portugal, the Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom.

In this study, the outcome variable is self-rated health (SRH). This variable was included in the ESS 2010 questionnaire in question C15 *"How is your health in general? Would you say it is…"* and a response defined in a 5-point Likert scale where: 1 *'Very bad'*, 2 *'Bad'*, 3 *'Fair'*, 4 *'Good'*, and 5 *'Very good'*. This subjective measure combines elements of both actual physiological processes, as well as an individual's perception of his health, and in different studies this has been found to be a fundamental predictor of health outcomes (Idler and Benyamini 1997; McGee et al. 1999).

On the other hand, nine explanatory variables of perceived discrimination were included in the analysis. These variables were perceived discrimination by (1) color or race, (2) nationality, (3) religion, (4) language, (5) ethnic group, (6) age, (7) gender, (8) sexuality, and (9) disability (question C25 in the questionnaire: *"On what grounds is your group discriminated against?" with the following previous answer categories*). Additionally, four variables related to socio-demographic and socio-economic aspects were used as controls: gender (where 'male' was the reference category), age (encoded in six intervals: 0 '15–24', 1 '25–34', 2 '35–44', 3 '45–54', 4 '55–64', 5 '65 or over), education (where 0 'primary', 1 'lower secondary', 2 'upper secondary', 3 'tertiary or university') and household income (where 0 'quartile 1', 1 'quartile 2', 2 'quartile 3', 3 'quartile 4'). Gender and age were included as socio-demographic controls, whereas education and household income were added to adjust the model according to basic socio-economic determinants of health that might vary the global effect of the variables under consideration (Alvarez-

Table 1 Descriptive statistics for variables in the model

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Self-rated health	52,379	3.724	0.968	1	5
Discr. Color or race	52,458	0.010	0.102	0	1
Discr. Nationality	52,458	0.014	0.117	0	1
Discr. Religion	52,458	0.011	0.103	0	1
Discr. Language	52,458	0.007	0.081	0	1
Discr. Ethnic group	52,458	0.010	0.101	0	1
Discr. Age	52,458	0.009	0.096	0	1
Discr. Gender	52,458	0.005	0.072	0	1
Discr. Sexuality	52,458	0.003	0.050	0	1
Discr. Disability	52,458	0.005	0.071	0	1
Gender	52,437	1.546	0.498	1	2
Age	52,305	48.505	18.789	14	102
Education level	52,198	2.767	0.919	1	4
Household income	39,838	2.314	1.175	1	4

Source: Data from the European Social Survey 2010

Galvez and Salvador-Carulla, 2013). Descriptive information about all the variables used in the analysis is reported in Table 1.

Boolean factor analysis

First of all, the structural interdependence of the nine binary predictors referring to different types of perceived discrimination was assessed through the Boolean Factor Analysis (BFA) (Mickey et al. 1990). BFA is a specific nonlinear factor analysis of binary data, based on the reduction of binary space dimension. Compared to linear factor analysis, BFA uses Boolean algebra, so matrices of factor scores and loadings are both binary. BFA analysis specifically aims to discover hidden relationships in binary variables p ($x1$, $x2$,…, xp) and reduce their multidimensionality to a smaller number of m factors ($f1$, $f2$,…, fm), where $m < p$ (m is significantly smaller than p). The BFA model can be written as follows:

$$X = F \odot A$$

$$\begin{bmatrix} x_{1,1} & \cdots & x_{1,p} \\ \vdots & \ddots & \vdots \\ x_{n,1} & \cdots & x_{n,p} \end{bmatrix} = \begin{bmatrix} x_{1,1} & \cdots & x_{1,p} \\ \vdots & \ddots & \vdots \\ x_{n,1} & \cdots & x_{n,p} \end{bmatrix} \odot \begin{bmatrix} a_{1,1} & \cdots & a_{1,p} \\ \vdots & \ddots & \vdots \\ a_{m,1} & \cdots & a_{m,p} \end{bmatrix}$$

For n cases, we have a data matrix X, composed by factor scores matrix F, and factor loadings matrix A. The elements of all matrices are dichotomous (i.e. binary 0 or 1).

Ordinal logistic regression analysis

The second phase aimed to study how the extracted factor could explain the outcome variable (SRH). Given that our dependent variable is an ordinal with 5 possible values, an ordered logistic regression model (OLR) was carried out to estimate the effect of the new explanatory variables, as latent dimensions of ethnic and non-ethnic discrimination. The OLR model in this study is built around a latent regression as follows:

$$y^* = x'\beta + \varepsilon \tag{1}$$

where y^* is the unobserved dependent variable, x is the vector of independent variables, and β is the vector of regression coefficients to be estimated in the analysis. Additionally, while y^* remains unobserved, we can only observe the categories of response instead:

$$y = \begin{cases} 0 & \text{if} \quad y^* \leq \mu_1, \\ 1 & \text{if} \quad \mu_1 < y^* \leq \mu_2 \\ 2 & \text{if} \quad \mu_2 < y^* \leq \mu_3, \\ \cdots & \\ N & \text{if} \quad \mu_N \leq y^* \end{cases} \tag{2}$$

We assume that ε is normally distributed throughout the observation. Finally, Brant's test (Brant 1990) for proportional odds was assessed to provide evidence that the parallel assumption had not been violated.

Results

Types of discrimination: ethnic vs. non-ethnic?

As could be expected, there is an important interdependence between the nine variables referring to perceived discrimination. The tetrachoric correlation matrix presented in Table 2 indicates higher correlations between variables related to ethnic types of discrimination (i.e. perceived discrimination due to race, nationality, religion, language or ethnic origin), and the same pattern can be found for non-ethnic types (age, gender, sexuality and disability).

As seen in Table 3, the BFA indicates that 72 % (0.718) of the total variance can be explained by two factors. The first factor explains 46 % (0.456) of the total variance in the model, while the second extracted factor explains the other 26 % (0.262). This result indicates that the initial nine predictors of perceived discrimination can be reduced to two new latent dimensions. However, how are these factors internally composed?

Table 4 presents the rotated factor loadings and the uniqueness of the variables in the BFA model. In factor 1, variables related to ethnic types of discrimination (race,

Table 2 Correlations between types of perceived discrimination (tetrachoric correlation matrix)

	Race	Nationality	Religion	Language	Ethnic	Age	Gender	Sexuality	Disability
Race	1								
Nationality	0.6883	1							
Religion	0.6877	0.7501	1						
Language	0.7165	0.8705	0.8051	1					
Ethnic	0.7526	0.7263	0.7332	0.8048	1				
Age	0.2868	0.2252	0.1927	0.2696	0.2981	1			
Gender	0.3302	0.3324	0.3474	0.3819	0.3619	0.6001	1		
Sexuality	0.4054	0.3898	0.3772	0.3999	0.4208	0.3340	0.4771	1	
Disability	0.2945	0.3139	0.2806	0.3777	0.3410	0.5080	0.4003	0.4834	1

All coefficients are statistically significant at the level of $P < 0.001$. Source: Data from the European Social Survey 2010

Table 3 Proportion of variance explained by factor analysis

Factor	Variance	Difference	Proportion	Cumulative
Factor 1	4.1037	1.7452	0.456	0.456
Factor 2	2.3585	–	0.2621	0.718

LR test: independent vs. saturated: Chi^2 (36) = 3.2e + 05 Prob > Chi^2 = 0.0000; N = 52,458

Source: Data from the European Social Survey 2010

Table 4 Distribution of variables in the resulting factors (rotated factor loadings and uniqueness)

Variable	Factor 1: ethnic	Factor 2: non-ethnic	Uniqueness
Race	**0.8292**	0.1945	0.2746
Nationality	**0.8918**	0.1449	0.1837
Religion	**0.8829**	0.1228	0.2054
Language	**0.9158**	0.2001	0.1212
Ethnic	**0.8665**	0.2195	0.2009
Age	0.0992	**0.8309**	0.2998
Gender	0.2458	**0.7689**	0.3484
Sexuality	0.3635	**0.6135**	0.4915
Disability	0.2219	**0.7378**	0.4123

Source: Data from the European Social Survey 2010

nationality, religion, language, and ethnicity) are highly correlated among themselves; therefore, these indicators present stronger loads in the main component or latent dimension. Whereas the second latent dimension is composed of social and demographic types of perceived discrimination (age, gender, sexuality, and disability). This result indicates that the BFA technique can extract two factors that independently describe (a) ethnic and (b) non-ethnic types of perceived discrimination. In association with our first hypothesis, ethnic discrimination indicators are strongly correlated among themselves, as are non-ethnic ones.

Although theoretical differences between racial and ethnic types of discrimination can be assumed to exist, the BFA indicates that in practice these concepts are closely interrelated.

How do ethnic and non-ethnic types of discrimination affect our health?

Table 5 describes the effect of ethnic (Factor 1) and non-ethnic (Factor 2) types of perceived discrimination on SRH. Socio-economic and socio-demographic indicators such as gender, age, educational attainment and household income were included to adjust the model. Results show that both ethnic and non-ethnic types of discrimination are negatively correlated with SRH. In other words, people who perceive themselves to be discriminated against will probably present poor SRH. Therefore, the general state of health of people reduces when perceived discrimination increases either for ethnic or non-ethnic reasons. Taking into account that the two extracted factors are standardized measures, the effect of ethnic discrimination seems to be slightly higher than that of non-ethnic discrimination. The effects of control variables on health are in line with the results obtained in previous literature.

Predicted probabilities were computed to test the specific contribution of ethnic and non-ethnic types of perceived discrimination on the different categories of the outcome variable. Figure 1 shows predicted probabilities of experiencing discrimination for ethnic (F1) and non-ethnic reasons (F2) causing people to report a specific state of health. To offer the reader an easy interpretation, these measures were rescaled on a new interval from 0 to 10 (0 "does not perceive discrimination", and 10 "maximum perceived discrimination"). Despite the global effect of ethnic discrimination over health is slightly higher than that of non-ethnic discrimination, the effect of non-ethnic discrimination on poor health outcomes is observed to

Table 5 Effect of ethnic and non-ethnic discrimination on self-rated health (OLR model)

	OR	S.E.	z	$P > z$	C.I. 95 %	
Ethnic discrimination	0.947	0.018	−2.860	0.004	0.912	0.983
Non-ethnic discrimination	0.737	0.018	−12.700	0.000	0.703	0.773
Man (Ref. category)						
Woman	0.810	0.015	−11.130	0.000	0.780	0.841
Age 18–24 (Ref. category)						
Age 25–34	0.706	0.028	−8.760	0.000	0.653	0.763
Age 35–44	0.455	0.018	−20.300	0.000	0.422	0.491
Age 45–54	0.249	0.010	−35.980	0.000	0.231	0.269
Age 55–64	0.171	0.007	−45.360	0.000	0.158	0.184
Age 65–	0.103	0.004	−58.520	0.000	0.095	0.111
Primary (Ref. category)						
Lower secondary	0.944	0.035	−1.550	0.121	0.877	1.015
Upper secondary	1.072	0.036	2.090	0.036	1.004	1.145
Tertiary	1.536	0.059	11.210	0.000	1.425	1.656
Income Q1 (Ref. category)						
Income Q2	1.471	0.038	14.860	0.000	1.398	1.548
Income Q3	1.661	0.046	18.480	0.000	1.574	1.753
Income Q4	2.060	0.057	26.090	0.000	1.951	2.175
Threshold 1	−6.047	0.101			−6.244	−5.850
Threshold 2	−4.205	0.095			−4.391	−4.019
Threshold 3	−2.229	0.093			−2.411	−2.046
Threshold 4	−0.197	0.092			−0.378	−0.017

Number of obs = 39553, LR Chi^2 (14) = 9340.43, Prob > Chi^2 = 0.0000, Log likelihood = −48563.886, Pseudo R2 = 0.0877. Source: Data from the European Social Survey 2010

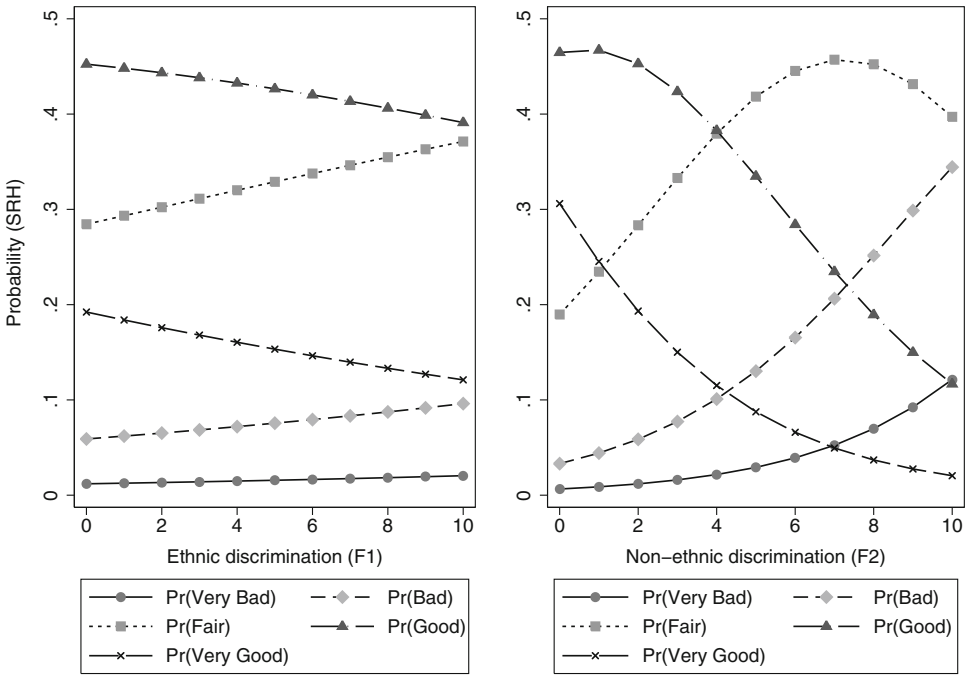

Fig. 1 Predicted probabilities (Pr) for the effect of ethnic and non-ethnic discrimination on Self-Rated Health of European population. Source: Data from the European Social Survey 2010

produce stronger variations on SRH than the effect of ethnic discrimination, a result that supports the second hypothesis (H2). This result indicates that the probabilities of presenting a poor state of health are even higher when individuals feel they are being discriminated against for non-ethnic traits rather than for ethnic ones. For instance, probabilities of reporting a "very bad" or "bad" state of health increased drastically when individuals perceived

non-ethnic discrimination, while this trend was slightly lower for ethnic types of discrimination. In fact, the probabilities of reporting a poor state of health do not go beyond 10 % when individuals perceive ethnic discrimination, while values reach 30 % for individuals who experience non-ethnic discrimination.

Discussion

Our study suggests that ethnic and non-ethnic types of perceived discrimination tend to produce different health outcomes in Europe. Although both types of indicators are relevant to explain health inequalities, this work indicates that the non-ethnic types can produce stronger differences in poor health outcomes. This result shows that, although perceived discrimination based on ethnic traits is essential to explain current health inequalities in Europe (Bhui et al. 2005; Borrell et al. 2010; de Castro et al. 2008; Gee et al. 2009; Hunte and Williams 2009; Veling et al. 2008), researchers should also pay special attention to non-ethnic types of discrimination based on socio-demographic determinants of health such as age, gender, sexuality or disability, which in combination with ethnic types might increase health inequalities in Europe (Riach and Rich 2002). Particularly, our study points out the need to face problems related to ethnic discrimination, as well as those based on gender/sexuality (Bradford et al. 2012; Oli and Onta 2012), aging or disability (Alvarez-Galvez and Salvador-Carulla 2013).

In line with the present finding, it is necessary to mention how a recent study highlights the relevance of discrimination based on age, weight, physical disability, and appearance to produce poor subjective health, greater disease burden, and lower life satisfaction (Sutin et al. 2015). This work shows how perceived discrimination based on age, disabilities, and personal characteristics might even produce stronger effects on health outcomes than other types of discrimination based on race, ethnicity or sexual orientation. Obviously, this surprising result should not dismiss the relevance of racial or ethnic types of discrimination to explain health outcomes, however, this study—as ours—indicates that discrimination based on age may have particularly adverse consequences on health and well being (Alvarez-Galvez and Salvador-Carulla 2013; Sutin et al. 2015).

Compared to previous studies, the advantage of the present approach is that it uses complex latent dimensions of perceived discrimination to explain, in a linear manner, their relationship with health outcomes. Instead of using unique binary variables, the multidimensionality of the initial nine indicators of perceived discrimination has been concentrated in two basic indexes of non-ethnic and ethnic discrimination. Finally, the extraction of the new indexes combined with the ORL model and its graphical representation through predicted probabilities made it possible to compare the effects that non-ethnic and ethnic types of discrimination generate in health inequalities.

Although this analysis could be criticized at the methodological level because of the reduction in initial dimensions that theoretically could be incompatible, the BFA indicates that there are clear associations between these discrimination forms, especially between the ethnic ones. In addition, it should also be taken into account that, actually, people who are socially discriminated against because of their race would probably also experience this discrimination for other associated reasons: ethnicity or cultural differences, religiosity, nationality, or language. This argument could also clearly be applied to types of non-ethnic types of social rejection such as those related to aging or disabilities.

Therefore, political actions should be carried out to eliminate these intolerance problems that tend to reduce our health. In essence, social difficulties which are linked to specific minorities (such as immigrants, homosexuals, aged or handicapped people) that can undermine both the physical and mental health of these groups; problems that are difficult to resolve through any one specific approach and that should be addressed by current and future health and social policies. These problems should also be fought by education policies that enhance general information about these groups and their problems, as a way of fighting the social reproduction of prejudice and stereotypes.

Studies on discrimination have found that intolerance towards social and ethnic minorities are not only associated with the socio-demographic or ethnic characteristics of these groups, but also with their socio-economic position. Researchers have discovered that racial discrimination is closely associated with the social class of ethnic minorities, especially with groups in lower classes (Hainmueller and Hiscox 2010). Consequently, future policies should incorporate an integral perspective on the persistent problem of discrimination. For example, in the specific case of discrimination due to aging, European governments should enhance health and social policies to cover the health inequality experienced by the elderly, and specifically design adjusted labor market protection that guarantees future retirement, maintaining a minimum package of protection and education policies aimed to protect these socially excluded groups (Bytheway et al. 2007).

In consequence, to eradicate discrimination and health inequities, what will probably be required is a broad package of social policies that provides, on the one hand, equity in socio-economic resources for these disadvantaged groups and, on the other, public support and the tolerance of civil society to address the persistent problems of discrimination and social exclusion (WHO 2008). The

suppression of ethnic and non-ethnic types of social rejection in our societies cannot be guaranteed if the situations of social exclusion remain hidden from view. For this reason, future educational policies should play an important role in enhancing the visibility of these socially excluded collectives, and ultimately in reducing the health inequalities they suffer.

Limitations and future orientation

This work also faces some limitations that should be considered in future studies: (1) this work shows a general model applied to a wide European sample, but in future studies it could be interesting to compare results between specific countries or even welfare states characterized by specific health and social policies; (2) the inclusion of the income variable in the OLR model reduced the initial sample. However, taking into account that that global sample was still appropriated in terms of size ($N = 39{,}553$ units), it was preferred to exclude the missing values. In future studies, in case we want to compare cross-country differences, missing values should be imputed or alternative variables should be considered in order to gain statistical representativeness for every country sample.

A challenge for future research will be to apply this approach to health databases with specific biomarkers (e.g. blood pressure, cholesterol, obesity indexes, depression diagnosis, etc.) as objective health measures. In addition, future studies should improve indicators of perceived discrimination through the use of wide-ranging scales that make it possible to understand the overall complexity and dimensionality of the phenomenon of discrimination, and also go beyond the binary measures that cannot describe the linearity and polarity (e.g. rejection–tolerance) in feelings of perceived discrimination.

Finally, the next step in this research will be to contextualize these findings in specific European countries in order to analyze possible variations associated with varying socio-political, economic and cultural scenarios.

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