Simona-Andreea Apostu

Corresponding author

Bucharest University of Economic Studies;

Institute of National Economy, Bucharest, Romania

✉ simona.apostu@csie.ase.ro

Gina-Cristina Dimian

Bucharest University of Economic Studies, Bucharest, Romania

✉ gina.dimian@csie.ase.ro

Maria Denisa Vasilescu

Bucharest University of Economic Studies;

National Scientific Research Institute for Labor and Social Protection, Bucharest, Romania

✉ maria.vasilescu@csie.ase.ro

An In-Depth Analysis of the Relation of Health and Poverty in Europe

Summary: Our article aims to present an in-depth analysis of the correlation between health status and poverty in European countries. Our research is grounded on two types of data: a survey of the perceptions of the European citizens related to their own physical and mental health conducted in 2017 in European Union countries and the United Kingdom on a sample of 28,000 respondents and macroeconomic data retrieved from Eurostat Database, showing the incidence of poverty and working poor in Europe during the 2017-2019 time span. Multiple logistic regression has revealed that self-rated health status is influenced by the sociodemographic characteristics of the respondents, whereas TwoStep Cluster analysis and Mann-Whitney U test proved that health is an important driver of the differences between countries in terms of poverty and working poor. The originality of our research stems from both the integrated approach, the analysis being made at individual, group, and country levels, and by the results that bring new evidence about population health status as a determinant of quality of life and national competitiveness.

Keywords: Physical health, Mental health, Poverty, Working poor, Logistic regression, Cluster analysis.

JEL: C38, I15, P46.

Health status is an essential component of people well-being (Wilhelm Kohler 2004). At the individual level, a good state of health implies a good accomplishment of the activities, fulfillment of the objectives, and involvement in the society (Ioan Mărginean et al. 2006). At the society level, a good state of health of their members materializes in a high level of competitiveness (Kohler 2004). The health status is related to income (Susan L. Ettner 1996; Ken Judge, Jo-Ann Mulligan, and Michaela Benzeval 1998; Russel Ecob and George Davey Smith 1999; John Mullahy, Stephanie Robert, and Barbara Wolfe 2018) and, consequently, to poverty (David E. Bloom and David Canning 2003; Sally Murray 2006; Brian Biggs et al. 2010), poverty leading to poor health and vice versa. Essentially, a poor state of health affects the individual from the labor perspective, reducing work capacity and productivity, diminishing family's income, and worsening the quality of life, therefore determining or perpetuating poverty.

Poverty or, more precisely, income poverty is defined as the number of people below the poverty line. It is measured in different ways, predominantly as the income

inadequacy to procure a minimum level of calories (Jandhyala B. Tilak 2002). The working poor concept points to the link between poverty and low-wage work (Carrie R. Leana, Vikas Mittal, and Emily Stiehl 2011) and refers to the individuals working and living in poor households (Ekaterina Kalugina 2013). It envisages the individual for labor market activity and household for the poverty status (Ramón Peña-Casas and Mia Latta 2004; Sophie Ponthieux 2010).

In view of the recent global circumstances where citizens and countries face new medical problems, health is becoming an asset, both for the family and the country. In order to alleviate health crisis effects, the information about population health status and poverty burden becomes crucial. Therefore, evaluating population health status, even from the perspective of personal perception, becomes particularly important in terms of public policies that could be developed and applied in order to temper the impact of certain health problems on wealth, quality of life, and economic competitiveness. In this sense, the main aim of our article is to analyze the opinions of European citizens related to their own physical and mental health in order to identify the factors that influence this perception and to connect them with poverty and working poor.

To meet this objective, we envisaged three research questions: (i) Which are the factors that influence the perception on one's physical and mental health? (ii) Are there significant differences between social categories/countries in terms of the citizens perceptions about own physical and mental health? (iii) Could physical and mental health status of the citizens explain the existing differences between countries in terms of poverty and working poor?

Our research relies on two types of data: a survey of the perceptions of the European citizens related to their own physical and mental health conducted in 2017 in European Union countries and the United Kingdom on a sample of 28,000 respondents (Eurobarometer 88.4) (GESIS Leibniz Institute for the Social Sciences 2020)[1] and macroeconomic data (Eurostat Database 2020)[2], showing the incidence of poverty and working poor in Europe, during the 2017-2019 time span. We used multiple logistic regression models to demonstrate that self-rated health status is influenced by the sociodemographic characteristics of the respondents, and TwoStep Cluster analysis and Mann-Whitney U test (M-WUT) to prove that health is an important driver of the differences between countries in terms of poverty and working poor.

The originality of our research is given not only by the integrated approach, the analysis being made at the level of individuals, groups of people, and countries, but also by the results that bring new evidence about the population health status as a determinant of life quality and national competitiveness.

Therefore, the article is structured as follows: Section 1 offers an overview of the most relevant studies regarding the topics of interest that are investigated in our research (health, poverty, working poor, and their interconnection); Section 2 outlines

---

[1] **GESIS Leibniz Institute for the Social Sciences.** 2020.
Eurobarometer Data Service. https://www.gesis.org/en/eurobarometer-data-service/home (accessed November 02, 2020).
[2] **Eurostat.** 2020. People at Risk of Poverty or Social Exclusion. https://ec.europa.eu/eurostat/web/products-datasets/-/sdg_01_10 (accessed November 02, 2020).

a theoretical background of the methods used in the quantitative analysis; Section 3 details the empirical results, whereas the last sections present the discussion and main conclusions of the research.

1. Literature Review

Health is a key component of the human capital, a factor that brings consumption and production benefits (Michael Grossman 1972) and a determinant of the human well-being (Bloom and Canning 2003). Many decades ago, the World Health Organization (WHO) emphasized the usefulness and necessity of conducting a subjective health assessment, considering both somatic and mental health (World Health Organization 1952).

According to epidemiological data, health is influenced by four categories of factors: behavior, climate, anatomy, and health care services (Marc Lalonde 1974). Some of the most important are biological and social factors (material, psychosocial, and behavioral). The material factors influencing health status (income, living conditions, work, and environment) are the fundamental causes of health deterioration (Jo C. Phelan, Bruce G. Link, and Parisa Tehranifar 2010). Psychosocial factors are related to the stress that is faced throughout life: stressful living conditions or lack of social support, triggering or fueling the disease. The behavioral factors influencing health are as follows: smoking, alcohol consumption, type of diet, and physical activity. Material deprivation is associated with failure in meeting the basic needs of individuals, significantly influencing the health status (Maite Blázquez, Elena Cottini, and Ainhoa Herrarte 2014). Poor living conditions are associated with insecurity and stress generated by the effort to meet basic needs and maintain job and social relations.

The main unchangeable factors that influence health are gender and age. Higher life expectancy and lower mortality rates are experienced by women, whereas the risk of most diseases is increasing significantly with age. Seyer Alcan and Onur Özsoy (2020) highlighted that health positively influences wages, more in case of women, and conduces to economic growth (Daniel Pablo Monterubbianesi, Martín Grandes, and Carlos Dabús 2017). Other studies have indicated that although men live less than do women, women suffer from more diseases, with health measures and health behavior being differently explained by geographical area (Mark W. Rosenberg and Kathleen Wilson 2000). Health is significantly influenced also by other socioeconomic factors, such as educational level, employment, and income (Dorota Kaleta et al. 2009).

According to Meir J. Stampfer et al. (2005) and the WHO Global Health Risks (World Health Organization 2009), physical health and mental health are correlated with sport, tabacco, alcohol consumption, and alimentation. Physical activity is inversely correlated with depression, with depression leading to disease (Markus Gerber and Uwe Puehse 2009; Marco Tulio De Mello et al. 2013; J. Larry Durstine et al. 2013; H. Wang et al. 2014; Nicole J. Hegberg and Erin B. Tone 2015).

Another factor influencing health is represented by sport activity, even in the case of the elderly (Dorothy Forbes et al. 2008; Andrew P. Clegg et al. 2012). Healthy people, both physically and mentally, exercise more. Health is also significantly influenced by living and working conditions, family and financial needs, and lifestyle (Hriday Raj Devkota, Bishnu Bhandari, and Pratik Adhikary 2021). Mental health is

associated with smoking; Gemma Taylor et al. (2014) highlighted that quitting smoking leads to a low level of depression and stress.

Other factors influencing the health status are *sleep deprivation*, work-related stress (Paul Contoyannis and Nigel Rice 2001; Pilar García-Gómez et al. 2013), alcohol consumption (Stampfer et al. 2005; Iain Lang et al. 2007; Jürgen Rehm et al. 2010; Martin Frisher et al. 2015), alimentation (Annemien Haveman-Nies, Lisette C. P. G. M. de Groot, and Wija A. van Staveren 2003; Redzo Mujcic and Andrew J. Oswald 2016), and social interactions (Jennifer B. Unger, C. Anderson Johnson, and Gary Marks 1997; Halina J. Dour et al. 2014; Tsegaye Bekele et al. 2015). Moderate alcohol consumption is positively correlated with health (Stampfer et al. 2005; Lang et al. 2007), whereas *binge drinking* and abstinence negatively influence health (Rehm et al. 2010; Frisher et al. 2015). A poor diet leads to increased mortality (Haveman-Nies, de Groot, and van Staveren 2003); instead, fruit consumption leads to increased welfare (Mujcic and Oswald 2016). Mental health is associated with social deprivation (Lesley J. Robertson 2021) being positively and strongly correlated with social interaction (Dour et al. 2014; Bekele et al. 2015) and social relationships leading to low mortality rate (Julianne Holt-Lunstad, Timothy B. Smith, and J. Bradley Layton 2012). Instead, loneliness and social isolation lead to increased mortality (Andrew Steptoe et al. 2012).

Mental health is very strongly correlated with physical health, with Hermann Nabi et al. (2008), Paul G. Surtees et al. (2008), and Julius Ohrnberger, Eleonora Fichera, and Matt Sutton (2017a, b) highlighting great cross-effects, even in a controlled environment. Mental health can affect people's decisions and access to information regarding health and quality of medical services, thus influencing physical health (Anandi Mani et al. 2013). Mental health influences workers' productivity, depreciation, and overconfidence being correlated with mental health (Angus H. Thompson 2020).

Economic growth, living conditions enhancement, and progress in the medical field have substantially contributed to the improvement of population health, but differences between countries still exist. Poor countries register less healthy populations compared with the countries with better economic situations (Adam Wagstaff 2002). The illnesses substantially influence household income (Bloom and Jeffrey D. Sachs 1998; World Bank 1999), whereas poverty and low income cause poor health (Lant Pritchett and Lawrence H. Summers 1996). Susan Godlonton and Malcolm Keswell (2005) highlighted that households with more unhealthy members are poorer than those with fewer unhealthy people, and this finding seems invariable in choosing the poverty line.

Poverty represents a multidimensional phenomenon, being associated with lack of materials or limited resource consumption, reduced achievement in education and health, and vulnerability to external events (Jane Falkingham and Ceema Namazie 2002). Poverty is a complex and insidious determinant of health caused by systemic factors that can persist for generations in a family. Beginning before birth and continuing throughout an individual's life, poverty can significantly impact health and health outcomes. Poverty leads to social marginalization, depriving the individual of fundamental rights and freedom in order to meet their primary and social needs, thus preventing the individual potential development and the society development. Poverty

conduces to poor health (Akansha Batra and Rita Hamad 2021). Health influences households' income and economic growth, being an essential factor that can contribute to poverty reduction (Bloom and Canning 2003).

Poverty is closely related to social inequality, influencing the individual's social, mental, and physical well-being (Vijaya Murali and Femi Oyebode 2004). Studies have indicated that poverty can be a driver, but also a response of a poor mental health (Thomas S. Langner and Stanley T. Michael 1963). Poor people experience higher mortality and premature deaths, receiving less health care compared with less poor people (Brendan M. Reilly, Gordon Schiff, and Terrence Conway 1998). The correlation between poverty and health is significantly influenced by barriers to accessing health care, greater access to health care leading to a good health, usual use of outpatient services, and reduced hospitalization rates (Andrew B. Bindman, Kevin Grumbach, and Dennis Osmond 1995).

Moreover, people experiencing poverty experience impaired health and acute diseases (Richard Wilkinson and Michael Marmot 2003; Karen E. Lasser, David U. Himmelstein, and Steffie Woolhandler 2006; Karen Barnett et al. 2012). In this context, poor people have less access to health care (Julian Tudor Hart 1971; Stewart W. Mercer and Graham C. M. Watt 2007), with the probability to have a family doctor and benefit from medical care being low (Lasser, Himmelstein, and Woolhandler 2006; Brian Hutchison 2007; Dennis Raphael 2007).

All over the world, many individuals are facing poverty, which represents an inextricable issue associated with health (Wagstaff 2002). Poor people experience higher mortality rates (Frank L. Farmer 1991). In developed countries (Ronald C. Kessler et al. 2005) and in some cases in developing ones (Jishnu Das et al. 2007), strong and significant correlations between socioeconomic level and morbidity caused by psychiatric disease have been highlighted. In order to reduce poverty, economic growth is required, and also the development of financial sector, but moderately, providing funds with better economic conditions (Yilmaz Bayar 2017). However, all social and fiscal policy instruments have to be considered in order to reduce inequality and poverty, all benefits except pensions being the most cost-efficient (Carlos Farinha Rodrigues and Isabel Andrade 2014). Indrani Gupta and Arup Mitra (2004) have shown that economic growth leads to poverty reduction, whereas in order to reduce poverty, it is necessary to improve health. The correlation between economic growth and health is positive - good health improves productivity; therefore, economic growth leads to human capital *accumulation*.

Income is the main determinant of inequalities in terms of health status, for individuals and also for the society (Robert Anderson et al. 2009). Well-educated and healthy human resources contribute to higher labor productivity, better organization of economic activity, higher production, and higher income. These, in turn, make possible investment in education and health, leading to more educated and healthier human resources (Cosmina-Elena Pop 2010).

Poor workers face both poverty and low wages, severely affecting work-related outcomes (Leana, Mittal, and Stiehl 2011). Ive Marx and Brian Nolan (2012) demonstrated that monetary poverty depends on low work intensity at the household level, size of household, and a single-wage presence. Alcan and Özsoy (2020) proved that

health positively influences wages, more in case of women, and health conduces to economic growth (Monterubbianesi, Grandes, and Dabús 2017). People experiencing health problems or other problems are more likely to be needy workers (Jay L. Zagorsky 1999), working poor leading to unhealthy status, depressive symptoms and low quality of life (Jin-Hwa Lee and Bokim Lee 2020). Working poor is defined by Joseph L. Schäfer (1997) as people whose individual income is below a certain threshold. Other definitions refer to all members of a poor household in which there is at least one worker (Carlo Knöpfel 1999). Wolfgang Strengmann-Kuhn (2002) defined working poor as: (i) all employees in a needy family unit; (ii) all full-time employees in a needy family unit; and (iii) all persons in a needy family unit, with at least one member working.

Physical health and mental health mutually impact working poor. A poor state of health, both physical and mental, is associated with deprivation on productivity and reduced access to healthy alimentation and environment, negatively influencing physical health (Ohrnberger, Fichera, and Sutton 2017a, b). Poor mental and self-rated health explains job discomfort and uncertainty and acute diseases (Rima R. Habib et al. 2020); individuals with low perception regarding health status use medical services more often and are more absent from work (Seppo Miilunpalo et al. 1997).

Based on the previous theoretical considerations, in order to determine the factors influencing the physical and mental health of the European citizens and the connection to poverty and working poor, the following three hypotheses have been formulated:

Hypothesis 1 (H1): There are certain factors (gender, age, education, occupation, and social status) that influence the perception of own physical and mental health.

Hypothesis 2 (H2): There are differences between social categories/countries in terms of perceptions about own physical and mental health.

Hypothesis 3 (H3): Physical and mental health could explain the existing differences between countries related to poverty and the working poor.

2. Data, Methods, and Variables

The data used to verify the research hypotheses comes from two sources:

(a) The Eurobarometer 88.4 (December 2017), which reflects the opinions of 28,000 citizens from 27 European Union countries and United Kingdom;

(b) Macroeconomic data, describing the incidence of poverty and working poor: in-work at-risk-of-poverty rate (WP) and people at risk of poverty or social exclusion (PSE), retrieved from the Eurostat Database (the averages of the period 2017-2019 have been computed and used).

In order to test the three hypotheses of our research, we used a three-step methodology: (i) logistic regression; (ii) cluster analysis, and (iii) M-WUT.

(i) In order to verify the first hypothesis, we used the *logistic regression* models, testing the influence of certain factors on physical and mental health, as these models are able to evaluate the relationship between a group of endogenous variables x_i and a binary exogenous variable y.

The equation describing the logistic model can be written as follows:

$$y = \text{logit}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \mathcal{E}, \tag{1}$$

where P ($y = 1 \mid x_1, x_2,\ldots, x_k$) is the probability of the event and $x_1, x_2, \ldots x_k$ are the explanatory variables.

In terms of probability, the model can be written as follows:

$$p = \frac{1}{1+\exp-(\beta_0+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_k x_k)} + \mathcal{E}. \tag{2}$$

The main hypotheses in the case of logistic regression imply the independence between consecutive observations and the linear relationship between logit (x) and predictors $X_1, X_2,\ldots, X_k$ (S. Domínguez-Almendros, Nicolás Benítez-Parejo, and A. R. Gonzalez-Ramirez 2011).

For the first model, we used the people perception about good health, transforming the Eurobarometer question on this subject into a binary variable with value 1 if the individual strongly agrees or agrees that he is in good health and 0 if the respondent disagrees or strongly disagrees with the statement of being in good health.

The second model used as a dependent variable a question regarding life satisfaction. Because there is no actual mental health question in the questionnaire, we used life satisfaction as a proxy because these two are strongly correlated (Patrick Lombardo et al. 2018). We constructed a binary variable with value of 1 for good mental health (the respondent is very satisfied or fairly satisfied with his life) and 0 for poor mental health (the individual is not very satisfied or not at all satisfied with his life).

As explanatory variables, we used for both models the following: gender (1 = man, 0 = woman), age (four categories: 15-24, 25-39, 40-54, and ≥ 55 years), education (low, medium or high), marital status (1 = married or living with partner, 0 = unmarried, divorced, or widow), type of community (three categories: rural area/village, small/middle town, and large town), income (difficulties in paying bills as proxy: most of the time, from time to time, or almost never/never), and labor market status (three categories: not working, self-employed, and employed).

Therefore, the model I can be written as follows:

$$\text{health\_perception} = \text{logit}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 * \text{gender} + \beta_2 * \text{age} + \beta_3 * \text{education} + \beta_4 * \text{marital}_{\text{status}} + \beta_5 * \text{community}_{\text{type}} + \beta_6 * \text{income} + \beta_7 * \text{labour\_market\_status} + \mathcal{E}. \tag{3}$$

The model II can be written as follows:

$$\text{life\_expectancy} = \text{logit}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 * \text{gender} + \beta_2 * \text{age} + \beta_3 * \text{education} + \beta_4 * \text{marital}_{\text{status}} + \beta_5 * \text{community}_{\text{type}} + \beta_6 * \text{income} + \beta_7 * \text{labour\_market\_status} + \mathcal{E}. \tag{4}$$

(ii) In order to test the second hypothesis, we used cluster analysis for grouping people/countries in terms of citizens' perceptions about own physical and mental health. Cluster analysis can be very meaningful for grouping a set of objects where the objects in the same group are more similar to each other than to those in other groups, or clusters.

TwoStep Cluster is an algorithm that groups observations into clusters, using the method of agglomerative hierarchical aggregation. Compared with classical cluster analysis methods, TwoStep Cluster allows continuous and categorical attributes, automatically determining the optimal number of clusters. The algorithm involves the measurement of distance, using two types of distance: Euclidean distance and log-likelihood distance (Gerhard Arminger, Clifford C. Clogg, and Michael E. Sobel 1995).

In the preclustering stage, when Cluster Feature Tree and cluster centers are obtained, the log-likelihood distance between any two clusters i and j is computed as follows:

$$d(i,s) = \xi_i + \xi_s - \xi_{(i,s)}, \tag{5}$$

$$\xi_i = -n_i \left(\sum_{j=1}^{p} \frac{1}{2} log\left(\hat{\sigma}_{ij}^2 + \hat{\sigma}_j^2 \right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{ijl} \log\left(\hat{\pi}_{ijl} \right) \right), \tag{6}$$

$$\xi_s = -n_s \left(\sum_{j=1}^{p} \frac{1}{2} log\left(\hat{\sigma}_{sj}^2 + \hat{\sigma}_j^2 \right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{sjl} \log\left(\hat{\pi}_{sjl} \right) \right), \tag{7}$$

$$\xi_{(i,s)} = -n_{(i,s)} \left(\sum_{j=1}^{p} \frac{1}{2} log\left(\hat{\sigma}_{(i,s)j}^2 + \hat{\sigma}_j^2 \right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{(i,s)jl} \log\left(\hat{\pi}_{(i,s)jl} \right) \right), \tag{8}$$

$$\hat{\pi}_{vjl} = \frac{N_{vjl}}{N_v}, \tag{9}$$

where $d_{(i,s)}$ represents the distance between cluster i and cluster j; ζ_i, ζ_s is the variation measure of clusters i and j; ζ_{is} is the variation measure of continuous variables within the cluster; N_v is the number of data registered in the sr cluster; j^A is the number of continuous variables; $\hat{\sigma}_j^2$ and $\hat{\sigma}_{vj}^2$ are the estimated variances of the variable j in total observations and in cluster v, respectively; j^B is the number of categorical variables; $\hat{\pi}_{vjl}$ are the estimated probabilities of distribution of the categorical variables a_j in cluster v; N_{vjt} is the number of records in cluster whose categorical variable j takes l category.

After the first case identification, the new cases join the existing node or forms a new one, based on the similarity criterion. The algorithm identifies atypical cases, being able to exclude them from the analysis (Nadezda Zenina, Andrejs Romanovs, and Yuri Merkuryev 2015).

The subclusters are grouped into clusters comparing the distance with a threshold; in case of exceeding a threshold, both subclusters are grouped (Jianming Ma and Kara Kockelman 2002).

The ideal number of clusters is established using two criteria: Bayesian or Akaike information criterion. The two criteria evaluate the informational content of the different statistics within the models.

The second research question is whether there are significant differences between social categories/countries in terms of the citizens' perceptions about own physical and mental health. In order to highlight the existence of certain groups more vulnerable than others in terms of self-rated physical and mental health and more prone to be affected by poverty and working poor, we clustered the European citizens starting

from the perceptions on their own physical and mental health. We used five questions (variables) from the Eurobarometer 88.4:

Q1. On the whole, how satisfied or not are you with the life you lead (4 = very satisfied, 3 = fairly satisfied, 2 = not very satisfied, 1 = not at all satisfied)?

Q2. Please tell me to what extent you personally agree or disagree with the following statement: I am in good health (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree).

Q3. How often do you exercise or play sport (4 = regularly, 3 = with some regularity, 2 = seldom, 1 = never)?

Q4. Please tell me to what extent you personally agree or disagree with the following statement: In general, I consider myself a happy person (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree).

Q5. During the past week, you felt lonely (4 = none or almost none of the time, 3 = some of the time, 2 = most of the time, 1 = all or almost all time).

Used also in the regression analysis, the first two questions assess life satisfaction (a proxy for mental health) and health status (a proxy for physical health). In addition, with the main aim to obtain an in-depth understanding of people perceptions about own physical and mental health, we have included in the cluster analysis another three questions. Q3 refers to frequency of exercising and playing sport, given that physical and mental health are strongly correlated with sport activity, even in the case of elderly (Forbes et al. 2008; Clegg et al. 2012). Q4 and Q5 measure the perceived happiness or loneliness, given that depression is a frequent cause of disease (Gerber and Puehse 2009; De Mello et al. 2013; Durstine et al. 2013; Wang et al. 2014; Hegberg and Tone 2015).

(iii) In order to verify the third hypothesis, the first step was to separate the 28 countries from our sample in function of the perceived physical and mental health (the five questions used in the previous stage of our analysis: Q1-Q5) and investigate if there are significant differences between these clusters in terms of poverty or working poor. To obtain the data centralized by country, we calculated weighted averages of the citizens' answers to the questions for each of the 28 countries and the five items analyzed. The descriptive statistics of the results are displayed in Table 1. Thus, in terms of life satisfaction (Q1), citizens of Denmark seem to be the most content about the life they lead, whereas people from Greece are, moreover, not very satisfied. Concerning the perceived health (Q2), citizens of Ireland declared to have a very good health status, whereas people from Estonia neither agree nor disagree with this statement. In Finland, citizens seem to play sport (Q3) more often than those from countries such as Bulgaria, whereas in Denmark, people declared to be very happy (Q4). In terms of the perceived loneliness (Q5), there are no major differences between the European citizens, as the standard deviation from the mean showed.

In order to evaluate the resulted clusters in terms of poverty and working poor indicators, we computed for all the countries the averages of WP ("the share of persons who are employed and have an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income, after social transfers") and PSE ("persons with an equivalised disposable

income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income, after social transfers"), for the period 2017-2019, from the data retrieved from Eurostat Database (2020). The descriptive statistics of the two indicators are presented in Table 2.

Table 1   Descriptive Statistics of the Five Items Analyzed and 28 Countries

Items	N	Minimum	Maximum	Mean	Standard deviation
Q1	28	2.499 (Greece)	3.649 (Denmark)	3.05246	0.285126
Q2	28	3.284 (Estonia)	4.361 (Ireland)	3.84711	0.262739
Q3	28	1.504 (Bulgaria)	2.664 (Finland)	1.98211	0.340233
Q4	28	3.571 (Lithuania)	4.502 (Denmark)	4.00325	0.274290
Q5	28	3.309 (Estonia)	3.767 (Ireland)	3.53668	0.131124

Source: Authors' computation using IBM SPSS Statistics 21.

Table 2   Descriptive Statistics of the Poverty and Working Poor Indicators and 28 Countries (2017-2019, Averages)

Indicators		WP (%)	PSE (%)
Mean		8.289	22.096
Median		8.200	21.550
Mode		5.9[a]	15.9[a]
Standard deviation		3.0856	5.7412
Minimum		2.9 (Finland)	12.3 (Czechia)
Maximum		15.8 (Romania)	34.7 (Bulgaria)
Percentiles	25	5.900	17.275
	50	8.200	21.550
	75	9.800	25.700
N	Valid	28	28

Notes: [a] Multiple modes exist. The smallest value is shown.

Source: Authors' computation using IBM SPSS Statistics 21.

In order to test the existence of differences between countries (grouped in clusters in the previous step) in terms of poverty and working poor, we used M-WUT. Mann-Whitney *U* test is a nonparametric method that can be applied to populations that are not normally distributed and in the presence of outliers.

3. Results

The first hypothesis of our study was that sociodemographic characteristics influence the perception related to own physical and mental health. To test this hypothesis, we used two logistic regression models, one for assessing the physical health and the other for mental health of the individuals.

Regarding physical health, the results of the logistic regression estimation indicated that the considered variables are statistically significant; therefore, the sociodemographic characteristics considered influence self-perceived physical health.

For age, we used as a reference category people 55 years or older, with the results indicating that all other individuals are in better health than the elderly. Young people perceive themselves as healthy, with the chances of a young person declaring

himself in good health being almost 10 times higher compared with an elderly person. This perception of good health decreases with age: people between the ages of 25 and 39 years are 5.2 times more likely to consider themselves healthy, whereas people in the 40- to 54-year category are only 1.9 times more likely to perceive themselves in good health compared with the elderly.

Regarding gender, the results indicated that men are more likely to consider themselves healthy, compared with women. Marital status is also a significant factor, those who are married or living with a partner are 80% more likely to consider themselves in good health compared with those who are single (unmarried, widowed, or divorced).

For the level of education, we used as a reference category the low level of education (up to 15 years of school). Those with an average level of education (between 15 and 19 years of school) are 16% more likely to consider themselves in good health, and those with higher education are 71% more likely to consider themselves healthy compared with those with a low level of education. Thus, it is observed that higher education is associated with a better perception of health.

Analyzing the type of community where people live, we noticed that those in large cities are more likely to consider themselves in good health compared with those in rural areas.

Labor market status has proven to be an important factor: compared with those who do not work, the self-employed are 3.9 times more likely to consider themselves in good health, and those employed are 2.9 times more likely to have this opinion (Table 3).

Income is correlated with health status; the results of the econometric estimate indicated that, compared with people who have difficulty paying bills often, people who encounter financial difficulties only from time to time are twice as likely to consider that they register good health; also, those who never or almost never have problems paying bills are 3.5 times more likely to consider themselves in good health (Table 3).

The second model focused on the mental health of the respondents. Once again, age is a significant influencing factor; the younger a person is, the more likely he/she is to have good mental health. Young people (15-24 years old) are 1.5 times more likely than the elderly to perceive themselves as mentally healthy, and those aged 25 to 39 years are 29% more likely to consider that they have good mental health compared with those 55 years or older.

In terms of gender, the results indicated that men are less likely to think that their mental health is good compared with women. People who are married or living with their partner are 89% more likely to believe that their mental health is good compared with the single ones (unmarried, divorced, or widowed) (Table 3).

Education is also a predictor of mental health: the higher the level of education, the higher the chance to consider having a good mental health. Compared with individuals with a low level of education, those with average education are 32% more likely to have good mental health, and university graduates are 117% more likely to believe that they have good mental health (Table 3).

Looking at the type of community, the results indicated that the differences are significant only between those living in large cities and those in rural areas, with the coefficient obtained for small/medium cities not being statistically significant. Unlike physical health, this time it is observed that those who live in large cities are less likely to consider themselves with good mental health compared with those in rural areas.

An active life on the labor market is associated with better mental health: compared with those who do not work, self-employed or employed people are more likely to consider themselves to have good mental health.

In a nutshell, the first logistic regression showed that the most important factors that influence the Europe citizens' perceptions of own physical health are age, labor market status, and income, whereas the second regression model, which focused on mental health, revealed that income and education are, by far, the most important drivers of good perceptions of own mental health.

An essential factor turned out to be represented by income: those who have difficulty paying bills from time to time are 3.6 times more likely to consider that their mental health is good, compared with those who have difficulties most of the time (Table 3). Moreover, those who do not have difficulty in paying bills are 16.7 times more likely to believe that they have good mental health, compared with those with frequent financial difficulties (Table 3).

Table 3 Results of the Logistic Regression Estimation

Explanatory variables	Model 1 Physical health			Model 2 Mental health		
	B	Wald	Exp(*B*)	*B*	Wald	Exp(*B*)
Constant	−0.937	158.542*	0.392	−1.178	301.737*	0.308
Age (15-24 y)	2.300	146.033*	9.971	0.428	15.827*	1.534
Age (25-39 y)	1.651	422.945*	5.210	0.258	18.894*	1.294
Age (40-54 y)	0.645	122.805*	1.906	−0.062	1.351	0.940
Age (≥ 55 y) (reference)	—	—	—	—	—	—
Gender	0.099	5.863**	1.104	−0.166	18.271*	0.847
Marital status	0.585	203.503*	1.795	0.637	258.486*	1.890
Low education (up to 15 y) (reference)	—	—	—	—	—	—
Medium education (15-19 years)	0.146	8.416**	1.158	0.279	31.563*	1.322
High education (20 years or more)	0.539	86.881*	1.714	0.776	172.614*	2.172
Type of community (rural area) (reference)	—	—	—	—	—	—
Type of community (small/middle town)	−0.030	0.412	0.970	−0.086	3.502	0.917
Type of community (large town)	0.123	5.056**	1.131	−0.201	15.329*	0.818
Labor market (not working) (reference)	—	—	—	—	—	—
Labor market (self-employed)	1.365	158.778*	3.917	0.482	32.766*	1.619
Labor market (employed)	1.075	413.718*	2.931	0.525	119.663*	0.690
Difficulties paying bills (most of the time) (reference)	—	—	—	—	—	—
Difficulties paying bills (time to time)	0.701	107.754*	2.016	1.280	573.919*	3.597
Difficulties paying bills (almost never)	1.246	394.228*	3.475	2.819	2607.12*	16.765
No. of observations		17705			20315	
Cox and Snell R^2		0.155			0.170	
Nagelkerke R^2		0.259			0.286	

Source: Authors' computation using IBM SPSS Statistics 21.

By means of TwoStep Cluster Analysis, the Europeans were clustered into three groups. Cluster 2 contains most of the respondents (54.5%), citizens who perceived themselves in good physical and mental condition. Cluster 1 (24% of the respondents) comprises Europeans who have very good perception of their physical and mental health, whereas cluster 3 (21.4% of the respondents) includes people dissatisfied with their physical and mental condition (Appendix Figure A1).
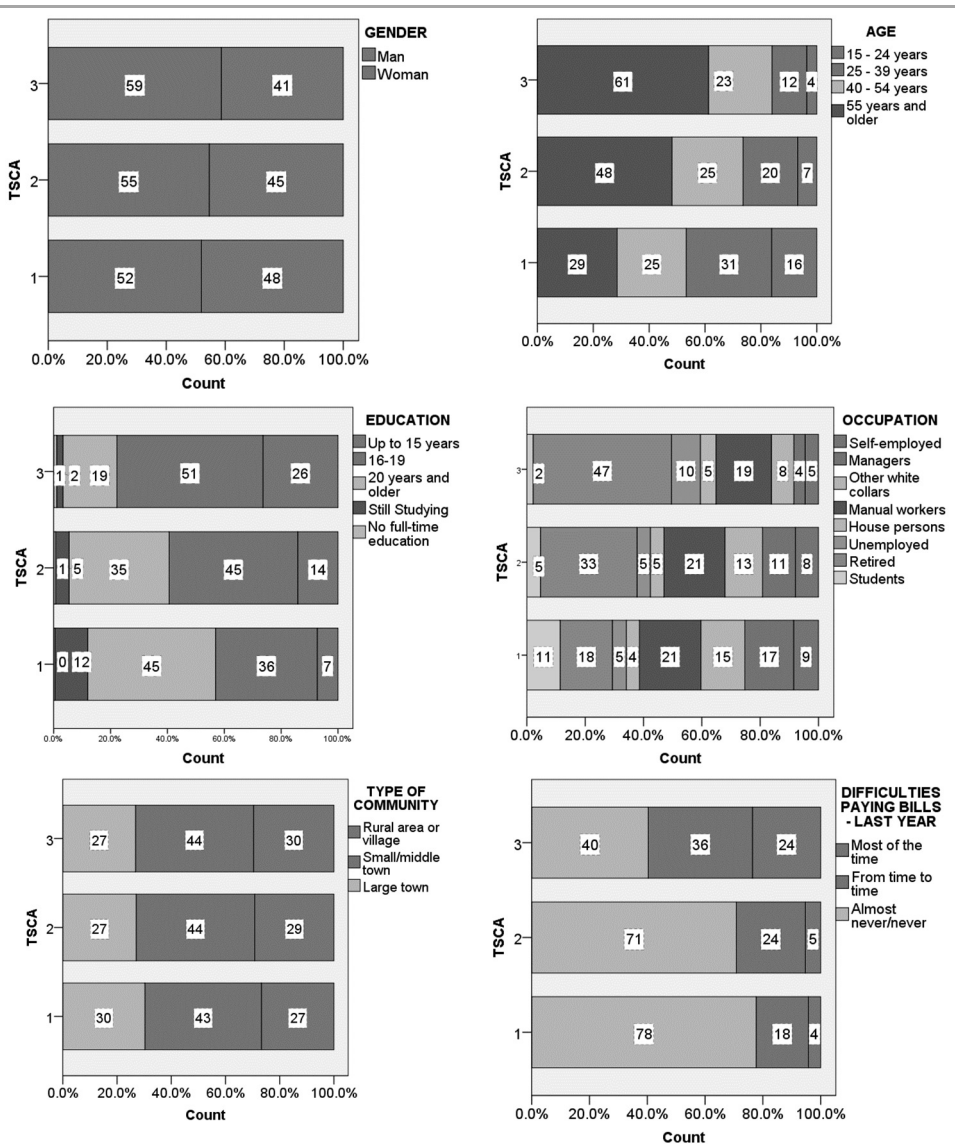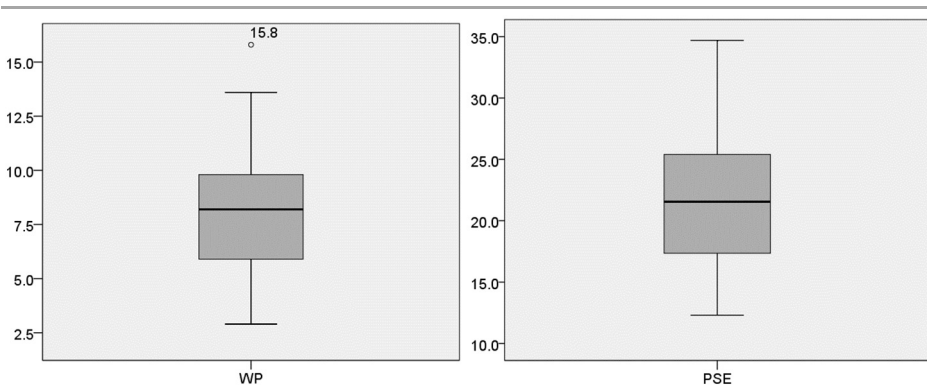

Source: Authors' computation using IBM SPSS Statistics 21.

Figure 1 Demographic and Social Factors Influencing Physical and Mental Health

The obtained clusters were then evaluated from the perspective of demographic and social factors (Figure 1): gender, age, level of education, occupation, type of community, and income (difficulty paying bills). In order to respond to the second research question, we have focused our attention on analyzing cluster 3, which comprises individuals less satisfied with their physical and mental health. In terms of the gender composition, as expected, in cluster 3, we find a large percentage of women (almost 59%). More than 60% of the individuals grouped in cluster 3 are 55 years or older, a very high percentage compared with cluster 1, with approximately 29% of people 55 years or older, and cluster 2, with slightly greater than 48% of people 55 years or older. From the point of view of the level of education, half of the individuals from cluster 3 have a medium level of education (between 16 and 19 years), and 26% have a reduced level of education (up to 15 years). On the contrary, in cluster 1, more than half of the respondents have a high level of education ($\geq$ 20 years) or are still studying.

Taking into consideration also the age, in cluster 3 we find in a large percentage retired people (47%) and manual workers (19%), whereas in cluster 1, we find many students, self-employed, managers, and other white collars (> 50% of the respondents of cluster 1). In terms of the type of community, the composition of the three clusters is not significantly different, even though, as expected, in cluster 1 many of the respondents come from large towns (over 30%).

In the surveyed countries, during 2017-2019, the median of WP was 8.2%, whereas the median of PSE was 21.6%. The countries registering the lowest percentages were Finland (WP = 2.9%) and Czech Republic (PSE = 12.3%), whereas the highest poverty rates were registered in Romania (WP = 15.8%) and Bulgaria (34,7%). The largest differences between European countries are in terms of people at risk of poverty or social exclusion, as demonstrated by standard deviation around the mean and the interquartile range. Concerning WP, Romania qualifies as an outlier (Figure 2).

Source: Authors' computation using IBM SPSS Statistics 21.

Figure 2 Box Plot of the in-Work at-Risk-of-Poverty Rate (WP) and People at Risk of Poverty or Social Exclusion (PSE)

The correlation between health status and poverty is significant and strong, as demonstrated by the Spearman correlation coefficient (Table 4). The highest values connect PSE indicator with life satisfaction (Q1) and physical (Q3) and mental (Q4 and Q5) health.

Table 4 Correlation between Perceived Health Status and Poverty Rates

			Q1	Q2	Q3	Q4	Q5
Spearman ρ	WP	Correlation coefficient	−0.486**	−0.094	−0.496**	−0.345	−0.317
		P (two-tailed)	0.009	0.632	0.007	0.072	0.101
		n	28	28	28	28	28
	PSE	Correlation coefficient	−0.609**	−0.216	−0.578**	−0.587**	−0.597**
		P (two-tailed)	0.001	0.269	0.001	0.001	0.001
		n	28	28	28	28	28

Source: Authors' computation using IBM SPSS Statistics 21.

The results of the correlation analysis are also supported by the Cluster Analysis outcomes. In order to perform TwoStep Cluster Analysis, first, we evaluated the five items in terms of correlation and normal distribution in order to verify if TwoStep Cluster Analysis is suitable for our purpose, namely, to separate the countries in clusters. Nonparametric tests (Kendall τ-*b* coefficient) have shown that there is a significant relationship between variables, but of moderate intensity, ranging from 0.329 between Q2 and Q5 to 0.744 between Q1 and Q4 (Appendix Table A1). Regarding normal distribution, for all five variables, the null hypothesis of normality was accepted; the decision was based on the results of Shapiro-Wilk test (Appendix Table A2).

Second, we grouped the countries according to the five items using TwoStep Cluster Analysis, silhouette measure of cohesion, and a separation of 0.6, demonstrating a good quality of grouping in the two clusters. To form the two clusters, the largest contribution had, in order, the following items: Q4, Q1, Q3, Q2, and Q5.

Cluster 1 is the smallest and includes 13 countries: Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Romania, and Slovakia.

The countries from cluster 1 recorded scores below the median of the entire group in terms of all the five items analyzed. Conversely, in terms of indicators that reflect the poverty rate (WP and PSE), the countries in cluster 1 registered values of medians above the group median and close to quartile 3 of the whole group (approximately 9.7% for WP and 25% for PSE) (Figure 3).

Cluster 2 is the largest and contains 15 countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Ireland, Luxembourg, Malta, Netherlands, Slovenia, Spain, Sweden, and United Kingdom.

The citizens of these countries stand out with a very positive perception of the life they lead and of their physical and mental health. For these countries, the indicators that reflect the degree of poverty and working poor are well below the median of the group of countries analyzed.

Nonparametric tests (M-WUT) used to assess the differences between the two clusters have shown that they differ statistically not only in terms of perceptions of

one's physical and mental health (Table 5), but also in terms of poverty indicators (WP and PSE) (Appendix Figure A2).
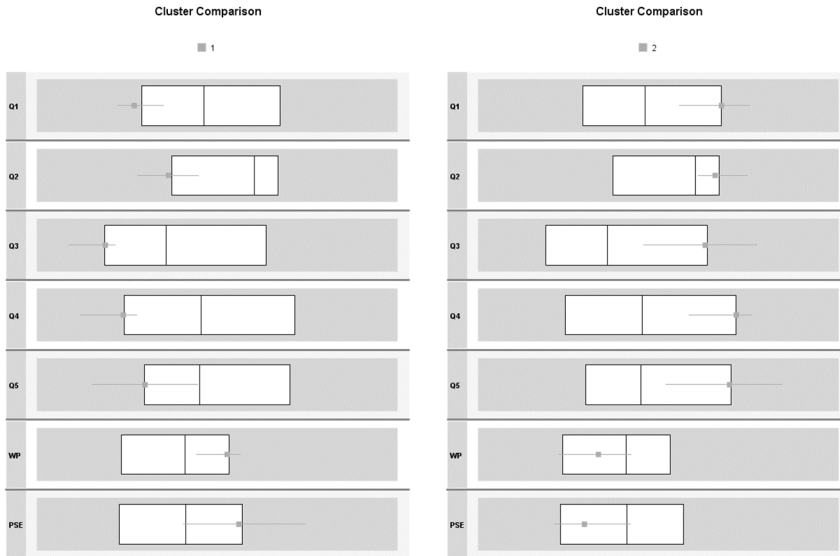
Source: Authors' computation using IBM SPSS Statistics 21.

Figure 3 Cluster Comparison

Table 5   Mann-Whitney *U* Test for the Five Items and Two Clusters

Test statistics[a]

	Q1	Q2	Q3	Q4	Q5
Mann-Whitney *U*	1.000	15.500	9.000	0.000	23.000
Wilcoxon *W*	92.000	106.500	100.000	91.000	114.000
Z	−4.445	−3.778	−4.077	−4.492	−3.432
Asymp. *P* (two-tailed)	0.000	0.000	0.000	0.000	0.001
Exact *P* [2*(one-tailed *P*)]	0.000[b]	0.000[b]	0.000[b]	0.000[b]	0.000[b]

Notes: [a] Grouping variable: TwoStep cluster number. [b] Not corrected for ties.

Source: Authors' computation using IBM SPSS Statistics 21.

Even though for the indicator WP, M-WUT is significant only at the level of significance of 0.10, for the indicator PSE, the test is significant at the level of 0.05, demonstrating that quality of life, in general, and the state of health, in particular, are important factors in explaining the differences between countries in terms of the level of poverty and working poor (Appendix 4).

4. Discussion

The aim of our article was to disentangle the factors that influence the perception of European citizens on their physical and mental health and to determine whether health status is one of the factors that could explain the differences between countries in terms of poverty and working poor.

In line with other studies (Kaleta et al. 2009; Alcan and Özsoy 2020), we found that certain sociodemographic characteristics (such as educational level, employment, and income) influence self-perceived physical and mental health. We demonstrated that, in terms of physical health, men, those married or living with a partner, people with a medium or higher level of education, people living in large cities, self-employed and employed, people who encounter financial difficulties only from time to time, and those who never or almost never have problems paying bills are more likely to consider themselves healthy. Regarding mental health, women, people who are married or living with their partners, persons registering medium and higher level of education, people living in rural areas, self-employed or employed people, those who have difficulty paying bills from time to time, and those who do not have difficulties in paying bills are more likely to think that their mental health is good. Moreover, the younger a person is, the more likely he/she is to have good mental health. Young people are more prone to consider that they have good mental health compared with those 55 years or older.

Many studies have shown that physical health is strongly correlated with mental health (Nabi et al. 2008; Surtees et al. 2008, and Ohrnberger, Fichera, and Sutton 2017a, b), both influencing workers' productivity and income (Anderson et al. 2009; Thompson 2020). In this regard, we found evidence of a mutual impact. More precisely, TwoStep Cluster Analysis revealed that one of the most important factors that can explain the differences between individuals who consider themselves in good physical and mental health and the others is the level of income. Approximately three quarters of the individuals of Cluster 3 (which includes people dissatisfied with their physical and mental condition) declared having difficulties paying bills last year most of the time or from time to time, whereas more than 77% of the respondents of cluster 1 (that comprises the Europeans who have a very good perception of their physical and mental health) almost never or never had difficulties paying bills last year.

As already highlighted in the literature, people experiencing health problems are more likely to be needy workers (Zagorsky 1999), whereas working poor leads to unhealthy status, depressive symptoms, and low quality of life (Lee and Lee 2020). In this regard, our analysis comes to enrich these findings and cast some light on the most vulnerable groups of people in terms of physical and mental health. The TwoStep Cluster Analysis results demonstrated that the group of individuals less satisfied with their physical and mental health comprises rather women, elderly people, persons with 16 to 19 years of education, and people retired and who most of the time or from time to time had problems paying their bills last year. As the regression analysis has shown, these are the social categories more affected by health problems.

As shown by Rosenberg and Wilson (2000), health measures and health behavior are geographical area-related. Our results support these findings, demonstrating

that there are significant differences between countries in terms of people's perceptions about their own physical and mental health.

Moreover, as poverty can be a determinant, but also a response of a poor health (Langner and Michael 1963), our research demonstrated that physical and mental health could explain the differences between countries related to poverty and the working poor.

5. Conclusions

In the context of coronavirus disease 2019 (COVID-19) health crisis, population health status becomes extremely important in terms of public policies that could be developed and applied in order to mitigate the effects of certain health problems on wealth, quality of life, and economic competitiveness. As the WHO pointed out several decades ago (World Health Organization 1952), the recent pandemic developments demonstrate that there is still need for conducting comprehensive health assessment, useful for assisting policy makers finding the most suitable and targeted solutions to health crisis.

In this regard, the originality of our research stems from both the integrated approach; the analysis being made at individual, group, and country levels; and by the results that bring new evidence about population health status as a determinant of quality of life and national competitiveness.

We endeavored to bring into attention the factors that determine the physical and mental health of individuals, the most vulnerable groups of people in terms of health status and more prone to become poor, as well as evidence that the health status of citizens can help explain the differences between countries in terms of poverty and working poor.

The multilevel analysis we conducted confirmed the research hypotheses and brought arguments in favor of concentrating public policy decisions toward consistent and coordinated measures to improve population health. We provided scientific arguments in favor of the need for complex policies (combining increased accessibility to education, health services, and better-paying jobs) focused on vulnerable groups, but also for measures coordinated at European level to reduce the differences between countries in terms of poverty and working poor.

The main limitation of our article is related to data availability (the survey being carried out in 2017); therefore, a future research that compares the COVID-19 and post-COVID-19 periods will be compelling.

References

Alcan, Sezer, and Onur Özsoy. 2020. "Relation between Health and Wages in Turkey." *Panoeconomicus*, 67(1): 111-126. http://dx.doi.org/10.2298/PAN170120011A

Anderson, Robert, Branislav Mikuliç, Greet Vermeylen, Maija Lyly-Yrjanainen, and Valentina Zigante. 2009. *Second European Quality of Life Survey: Overview*. Luxembourg: Office for Official Publications of the European Commission.

Arminger, Gerhard, Clifford C. Clogg, and Michael E. Sobel. 1995. *Handbook of Statistical Modeling for the Social and Behavioral Sciences*. New York: Plenum Press. http://dx.doi.org/10.1007/978-1-4899-1292-3

Barnett, Karen, Stewart W. Mercer, Michael Norbury, Graham Watt, Sally Wyke, and Bruce Guthrie. 2012. "Epidemiology of Multimorbidity and Implications for Health Care, Research, and Medical Education: A Cross-Sectional Study." *Lancet*, 380: 37-43. http://dx.doi.org/10.1016/S0140-6736(12)60240-2

Batra, Akansha, and Rita Hamad. 2021. "Short-Term Effects of the Earned Income Tax Credit on Children's Physical and Mental Health." *Annals of Epidemiology*, 58: 15-21. http://dx.doi.org/10.1016/j.annepidem.2021.02.008

Bayar, Yilmaz. 2017. "Financial Development and Poverty Reduction in Emerging Market Economies." *Panoeconomicus*, 64(5): 593-606. http://dx.doi.org/10.2298/PAN150403014B

Bekele, Tsegaye, Sean B. Rourke, Ruthann Tucker, Saara Greene, Michael Sobota, Jay Koornstra, Laverne Monette, Sergio Rueda, Jean Bacon, James Watson, Stephen W. Hwang, James Dunn, and Dale Guenter. 2015. "Direct and Indirect Effects of Perceived Social Support on Health-Related Quality of Life in Persons Living with HIV/AIDS." *Aids Care*, 25(3): 337-346. http://dx.doi.org/10.1080/09540121.2012.701716

Biggs, Brian, Lawrence King, Sanjay Basu, and David Stuckler. 2010. "Is Wealthier Always Healthier? The Impact of National Income Level, Inequality, and Poverty on Public Health in Latin America." *Social Science & Medicine*, 71(2): 266-273. http://dx.doi.org/10.1016/j.socscimed.2010.04.002

Bindman, Andrew B., Kevin Grumbach, and Dennis Osmond. 1995. "Preventable Hospitalizations and Access to Health Care." *JAMA*, 274(4): 305-311. http://dx.doi.org/10.1001/jama.1995.03530040033037

Blázquez, Maite, Elena Cottini, and Ainhoa Herrarte. 2014. "The Socioeconomic Gradient in Health: How Important Is Material Deprivation?" *The Journal of Economic Inequality*, 12(2): 239-264. http://dx.doi.org/10.1007/s10888-013-9248-5

Bloom, David E., and Jeffrey D. Sachs. 1998. "Geography, Demography and Economic Growth in Africa." *Brookings Papers on Economic Activity*, 2: 207-295. http://dx.doi.org/10.2307/2534695

Bloom, David E., and David Canning. 2003. "The Health and Poverty of Nations: From Theory to Practice." *Journal of Human Development*, 4(1): 47-71. http://dx.doi.org/10.1080/1464988032000051487

Clegg, Andrew P., Sally E. Barber, John B. Young, Anne Forster, and Steve J. Iliffe. 2012. "Do Home-Based Exercise Interventions Improve Outcomes for Frail Older People? Findings from a Systematic Review." *Reviews in Clinical Gerontology*, 22(1): 68-78. http://dx.doi.org/10.1017/S0959259811000165

Contoyannis, Paul, and Nigel Rice. 2001. "The Impact of Health on Wages: Evidence from the British Household Panel Survey." *Empirical Economics*, 26(4): 599-622. http://dx.doi.org/10.1007/s001810000073

Das, Jishnu, Do Quy-Toan, Jed Friedman, David McKenzie, and Scott Kinnon. 2007. "Mental Health and Poverty in Developing Countries: Revisiting the Relationship." S*ocial Science & Medicine*, 65(3): 467-480. http://dx.doi.org/10.1016/j.socscimed.2007.02.037

De Mello, Marco Tulio, Valdir de Aquino Lemos, Hanna Karen Moreira Antunes, Lia Bittencourt, Rogerio Santos-Silva, and Sergio Tufik. 2013. "Relationship between Physical Activity and Depression and Anxiety Symptoms: A Population Study." *Journal of Affective Disorders*, 149(1-3): 241-246. http://dx.doi.org/10.1016/j.jad.2013.01.035

Devkota, Hridaya Raj, Bishnu Bhandari, and Pratik Adhikary. 2021. "Perceived Mental Health, Wellbeing and Associated Factors among Nepali Male Migrant and Non-Migrant Workers: A Qualitative Study." *Journal of Migration and Health*, 3. http://dx.doi.org/10.1016/j.jmh.2020.100013

Domínguez-Almendros, S., Nicolás Benítez-Parejo, and A. R. Gonzalez-Ramirez. 2011. "Logistic Regression Models." *Allergologia et Immunopathologia*, 39(5): 295-305. http://dx.doi.org/10.1016/j.aller.2011.05.002

Dour, Halina J., Joshua F. Wiley, Peter Roy-Byrne, Murray B. Stein, Greer Sullivan, Cathy D. Sherbourne, Alexander Bystritsky, Raphael D. Rose, and Michelle G. Craske. 2014. "Perceived Social Support Mediates Anxiety and Depressive Symptom Changes Following Primary Care Intervention Depress." *Anxiety*, 31(5): 436-442. http://dx.doi.org/10.1002/da.22216

Durstine, J. Larry, Benjamin Gordon, Zhengzhen Wang, and Xijuan Luo. 2013. "Chronic Disease and the Link to Physical Activity." *Journal of Sport and Health Science*, 2(1): 3-11. http://dx.doi.org/10.1016/j.jshs.2012.07.009

Ecob, Russel, and George Davey Smith. 1999. "Income and Health: What Is the Nature of the Relationship?" *Social Science & Medicine*, 48(5): 693-705. http://dx.doi.org/10.1016/S0277-9536(98)00385-2

Ettner, Susan L. 1996. "New Evidence on the Relationship between Income and Health." *Journal of Health Economics*, 15(1): 67-85. http://dx.doi.org/10.1016/0167-6296(95)00032-1

Falkingham, Jane, and Ceema Namazie. 2002. *Measuring Health and Poverty: A Review of Approaches to Identifying the Poor*. London: DFID Health Systems Resource Centre.

Farmer, Frank L., C. Shannon Stokes, Robert H. Fiser, and Dennis P. Papini. 1991. "Poverty, Primary Care and Age-Specific Mortality." *Journal of Rural Health*, 7(2): 153-169. http://dx.doi.org/10.1111/j.1748-0361.1991.tb00716.x

Forbes, Dorothy, Sean Forbes, Debra G. Morgan, Maureen Markle-Reid, and Jennifer Wood. 2008. "Physical Activity Programs for Persons with Dementia." *Cochrane Database of Systematic Review*, 16(3). http://dx.doi.org/10.1002/14651858.CD006489.pub2

Frisher, Martin, Marina Mendonça, Nicola Shelton, Hynek Pikhart, Cesar de Oliveira, and Clare Holdsworth. 2015. "Is Alcohol Consumption in Older Adults Associated with Poor Self-Rated Health? Cross-Sectional and Longitudinal Analyses from the English Longitudinal Study of Ageing." *BMC Public Health*, 15(703). http://dx.doi.org/10.1186/s12889-015-1993-x

García-Gómez, Pilar, Hans van Kippersluis, Owen O'Donnell, and Eddy van Doorslaer. 2013. "Long Term and Spillover Effects of Health Shocks on Employment and Income." *Journal of Humam Resources*, 48(4): 873-909. http://dx.doi.org/10.3368/jhr.48.4.873

Gerber, Markus, and Uwe Puehs. 2009. "Review Article: Do Exercise and Fitness Protect against Stress-Induced Health Complaints? A Review of the Literature Scand." *Journal of Public Health*, 37(8): 801-819. http://dx.doi.org/10.1177/1403494809350522

Godlonton, Susan, and Malcolm Keswell. 2005. "The Impact of Health on Poverty: Evidence from the South African Integrated Family Survey." *South African Journal of Economics*, 73(1): 133-148. http://dx.doi.org/10.1111/j.1813-6982.2005.00010.x

Grossman, Michael. 1972. "On the Concept of Health Capital and Demand for Health." *Journal of Political Economy*, 80(2): 223-225. http://dx.doi.org/10.1086/259880

Gupta, Indrani, and Arup Mitra. 2004. "Economic Growth, Health and Poverty: An Exploratory Study for India." *Development Policy Review*, 22(2): 193-206. http://dx.doi.org/10.1111/j.1467-7679.2004.00245.x

Habib, Rima R., Nataly W. El-Haddad, Kareem Elzein, and Safa Hojeij. 2020. "Mental and Self-Rated Health of Bakery Workers in Lebanon: A National Study." *Sage Open Medicine*, 8. http://dx.doi.org/10.1177/2050312120962345

Hart, Julian Tudor. 1971. "The Inverse Care Law." *Lancet*, 297(7696): 405-412. http://dx.doi.org/10.1016/S0140-6736(71)92410-X

Haveman-Nies, Annemien, Lisette C. P. G. M. de Groot, and Wija A. van Staveren. 2003. "Dietary Quality, Lifestyle Factors and Healthy Ageing in Europe: The SENECA Study." *Age Ageing*, 32(4): 427-434. http://dx.doi.org/10.1093/ageing/32.4.427

Hegberg, Nicole J., and Erin B. Tone. 2015. "Physical Activity and Stress Resilience: Considering Those at-Risk for Developing Mental Health Problems." *Mental Health and Physical Activity*, 8: 1-7. http://dx.doi.org/10.1016/j.mhpa.2014.10.001

Holt-Lunstad, Julianne, Timothy B. Smith, and J. Bradley Layton. 2012. "Social Relationships and Mortality Risk: A Meta-Analytic Review." *PLoS Medicine*, 7(7): 1-20. http://dx.doi.org/10.1371/journal.pmed.1000316

Hutchison, Brian. 2007. "Disparities in Healthcare Access and Use: Yackety-Yack, Yackety-Yack." *Health Policy*, 3(2): 10-18. http://dx.doi.org/10.12927/hcpol.2007.19387

Judge, Ken, Jo-Ann Mulligan, and Michaela Benzeval. 1998. "Income Inequality and Population Health." *Social Science & Medicine*, 46(4-5): 567-579. http://dx.doi.org/10.1016/S0277-9536(97)00204-9

Kaleta, Dorota, Kinga Polańska, Elzbieta Dziankowska-Zaborszczyk, Wojciech Hanke, and Wojciech Drygas. 2009. "Factors Influencing Self-Perception of Health Status." *Central European Journal of Public Health*, 17(3): 122-127. http://dx.doi.org/10.21101/cejph.b0017

Kalugina, Ekaterina. 2013. "The Working Poor." In *Growing Income Inequalities*, ed. Joël Hellier and Nathalie Chusseau, 76-103. London: Palgrave Macmillan. http://dx.doi.org/10.1057/9781137283306_4

Kessler, Ronald C., Wai Tat Chiu, Olga Demler, Kathleen R. Merikangas, and Ellen E. Walters. 2005. "Prevalence, Severity, and Comorbidity of 12-Month DSM-IV Disorders in the National Comorbidity Survey Replication." *Archives of General Psychiatry*, 62(6): 617-627. http://dx.doi.org/10.1001/archpsyc.62.6.617

Knöpfel, Carlo. 1999. "Working Poor: Stand des Wissens in der Schweiz." In *Berichterstattung zur Armut: Aktueller Stand und Perspektiven aus der Sicht der Statistik*, ed. Robert Fluder, Marion Nolde, Tom Priester, and Antonin Wagner. Neuchâtel: Bundesamt für Statistik.

Kohler, Wilhelm. 2004. "Aspects of International Fragmentation." *Review of International Fragmentation*, 12(5): 793-816. http://dx.doi.org/10.1111/j.1467-9396.2004.00482.x

Lalonde, Marc. 1974. *A New Perspective on the Health of Canadians: A Working Document*. Ottawa: Government of Canada.

Lang, Iain, Robert B. Wallace, Felicia A. Huppert, and David Melzer. 2007. "Moderate Alcohol Consumption in Older Adults Is Associated with Better Cognition and Well-Being than Abstinence." *Age Ageing*, 36(3): 256-261. http://dx.doi.org/10.1093/ageing/afm001

Langner, Thomas S., and Stanley T. Michael. 1963. *Life Stress and Mental Health*. London: Collier-Macmillan.

Lasser, Karen E., David U. Himmelstein, and Steffie Woolhandler. 2006. "Access to Care, Health Status, and Health Disparities in the United States and Canada: Results of a Cross-National Population-Based Survey." *American Journal of Public Health*, 96(7): 1300-1307. http://dx.doi.org/10.2105/AJPH.2004.059402

Leana, Carrie R., Vikas Mittal, and Emily Stiehl. 2011. "PERSPECTIVE - Organizational Behavior and the Working Poor." *Organization Science*, 23(3): 888-906. http://dx.doi.org/10.1287/orsc.1110.0672

Lee, Jin-Hwa, and Bokim Lee. 2020. "Working Poverty and Health Disparities in Korean Workers." *Journal of Korean Academy of Community Health Nursing*, 31(4): 514-524. http://dx.doi.org/10.12799/jkachn.2020.31.4.514

Lombardo, Patrick, Wayne Jones, Liangliang Wang, Xin Shen, and Elliot M. Goldner. 2018. "The Fundamental Association between Mental Health and Life Satisfaction: Results from Successive Waves of a Canadian National Survey." *BMC Public Health*, 18(1): 342. http://dx.doi.org/10.1186/s12889-018-5235-x

Ma, Jianming, and Kara Kockelman. 2006. "Crash Frequency and Severity Modeling Using Clustered Data from Washington State." In *Proceedings of 2006 IEEE Intelligent Transportation Systems Conference*, 1621-1626. Toronto: Institute of Electrical and Electronics Engineers. http://dx.doi.org/10.1109/ITSC.2006.1707456

Mani, Anandi, Sendhil Mullainathan, Eldar Shafir, and Jiaying Zhao. 2013. "Poverty Impedes Cognitive Function." *Science*, 341(6149): 976-980. http://dx.doi.org/10.1126/science.1238041

Mărginean, Ioan, Iuliana Precupeţu, Vassil Tsanov, Ana Maria Preoteasa, and Bogdan Voicu. 2006. *First European Quality of Life Survey: Quality of Life in Bulgaria and Romania*. Luxembourg: Office for Official Publications European Communities.

Marx, Ive, and Brian Nolan. 2012. "In-Work Poverty." Gini Discussion Paper 51.

Mercer, Stewart W., and Graham C. M. Watt. 2007. "The Inverse Care Law: Clinical Primary Care Encounters in Deprived and Affluent Areas of Scotland." *Annals of Family Medicine*, 5(6): 503-510. http://dx.doi.org/10.1370/afm.778

Miilunpalo, Seppo, Ilkka Vuori, Pekka Oja, Matti Pasanen, and Helka Urponen. 1997. "Self-Rated Health Status as a Health Measure: The Predictive Value of Self-Reported Health Status on the Use of Physician Services and on Mortality in the Working Age Population." *Journal of Clinical Epidemiology*, 50(5): 517-528. http://dx.doi.org/10.1016/S0895-4356(97)00045-0

Monterubbianesi, Daniel Pablo, Grandes Martín, and Carlos Dabús. 2017. "New Evidence of the Health Status and Economic Growth Relationship." *Panoeconomicus*, 64(4): 439-459. http://dx.doi.org/10.2298/PAN150505020M

Mujcic, Redzo, and Andrew J. Oswald. 2016. "Evolution of Well-Being and Happiness after Increases in Consumption of Fruit and Vegetables." *American Journal of Public Health*, 106(8): 1504-1510. http://dx.doi.org/10.2105/AJPH.2016.303260

Mullahy, John, Stephanie Robert, and Barbara Wolfe. 2018. *Health, Income, and Inequality*. 2nd ed. London: Routledge. http://dx.doi.org/10.4324/9780429494468-66

Murali, Vijaya, and Femi Oyebode. 2004. "Poverty, Social Inequality and Mental Health." *Advances in Psychiatric Treatment*, 10(3): 216-224. http://dx.doi.org/10.1192/apt.10.3.216

Murray, Sally. 2006. "Poverty and Health." *Cmaj*, 174(7): 923-923. http://dx.doi.org/10.1503/cmaj.060235

Nabi, Hermann, Mika Kivimaki, Roberto De Vogli, Michael G. Marmot, and Archana Singh-Manoux. 2008. "Positive and Negative Affect and Risk of Coronary Heart Disease: Whitehall II Prospective Cohort Study." *BMJ*, 337(7660): 32-36. http://dx.doi.org/10.1136/bmj.a118

Ohrnberger, Julius, Eleonora Fichera, and Matt Sutton. 2017a. "The Relationship between Physical and Mental Health: A Mediation Analysis." *Social Science & Medicine*, 195(C): 42-49. http://dx.doi.org/10.1016/j.socscimed.2017.11.008

Ohrnberger, Julius, Eleonora Fichera, and Matt Sutton. 2017b. "The Dynamics of Physical and Mental Health in the Older Population." *Journal of Economic Ageing*, 9: 52-62. http://dx.doi.org/10.1016/j.jeoa.2016.07.002

Peña-Casas, Ramón, and Mia Latta. 2009. "Working Poor in Belgium: Factors and Policies." European Social Observatory.

Phelan, Jo C., Bruce G. Link, and Parisa Tehranifar. 2010. "Social Conditions as Fundamental Causes of Health Inequalities: Theory, Evidence, and Policy Implications." *Journal of Health and Social Behaviour*, 51(1): S28-S40. http://dx.doi.org/10.1177/0022146510383498

Ponthieux, Sophie. 2010. *In-Work Poverty in the EU*. Luxembourg: European Commission.

Pop, Cosmina-Elena. 2010. "The Health Status of the Romanian Population in a European Context: An Approach from the Perspective of Quality of Life." *Quality of Life Magazine*, 3-4: 274-305.

Pritchett, Lant, and Lawrence H. Summers. 1996. "Wealthier Is Healthier." *Journal of Human Resources*, 31(4): 841-868. http://dx.doi.org/10.2307/146149

Raphael, Dennis. 2007. *Poverty and Policy in Canada: Implications for Health and Quality of Life*. Toronto: Canadian Scholars Publishers.

Rehm, Jürgen, Dolly Baliunas, Guilherme L. G. Borges, Kathryn Graham, Hyacinth lrving, Tara Kehoe, Charles D. Parry, Jayadeep Patra, Svetlana Popova, Vladimir Poznyak, Michael Roerecke, Robin Room, Andriy V. Samokhvalov, and Benjamin Taylor. 2010. "The Relationship between Different Dimensions of Alcohol Consumption and Burden of Disease: An Overview." *Addiction*, 105(5): 817-843. http://dx.doi.org/10.1111/j.1360-0443.2010.02899.x

Reilly, Brendan M., Gordon Schiff, and Terrence Conway. 1998. "Primary Care for the Medically Underserved: Challenges and Opportunities." *Disease Month*, 44(7): 320-346. http://dx.doi.org/10.1016/S0011-5029(98)90011-6

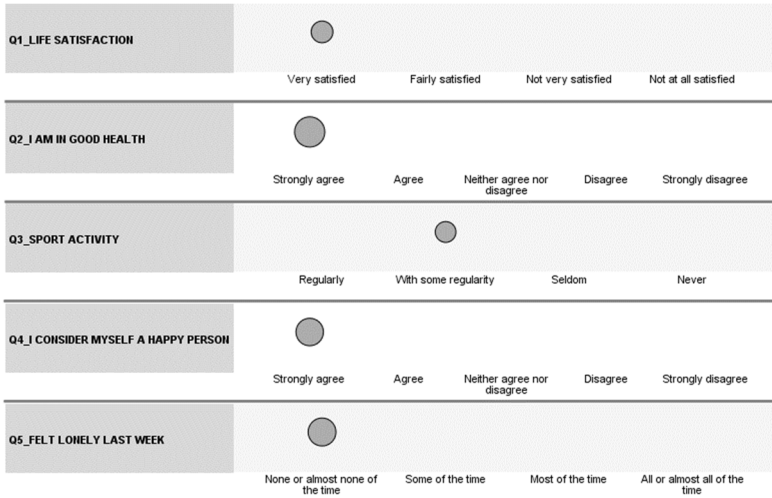**Robertson, Lesley J.** 2021. "Mental Illness: South Africa's Blind Spot." *South African Medical Journal*, 111(2). http://dx.doi.org/10.7196/samj.2021.v111i2.15463

Rodrigues, Carlos Farinha, and Isabel Andrade. 2014. "Robin Hood versus Piggy Bank: Income Redistribution in Portugal 2006-2010." *Panoeconomicus*, 61(Special Issue): 617-630. http://dx.doi.org/10.2298/PAN1405617R

Rosenberg, Mark W., and Kathleen Wilson. 2000. "Gender, Poverty and Location: How much Difference Do They Make in the Geography of Health Inequalities?" *Social Science & Medicine*, 51(2): 275-287. http://dx.doi.org/10.1016/S0277-9536(99)00453-0

Schäfer, Joseph L. 1997. *The Analysis of Incomplete Multivariate Data*. London: Chapman & Hall. http://dx.doi.org/10.1201/9781439821862

Stampfer, Meir J., Jae Hee Kang, Jennifer Chen, Rebecca Cherry, and Francine Grodstein. 2005. "Effects of Moderate Alcohol Consumption on Cognitive Function in Women." *New England Journal of Medicine*, 352(3): 245-253. http://dx.doi.org/10.1056/NEJMoa041152

Steptoe, Andrew, Aparna Shanker, Panayotes Demakakos, and Jane Wardle. 2012. "Social Isolation, Loneliness and All-Cause Mortality in Older Men and Women." *Proceedings of the National Academy of Sciences of the United States of America*, 111(15): 5797-5801. http://dx.doi.org/10.1073/pnas.1219686110

Strengmann-Kuhn, Wolfgang. 2002. "Working Poor in Europe: A Partial Basis Income for Workers?" Paper presented at the 9th Basic Income European Network International Congress, Geneva. http://dx.doi.org/10.2139/ssrn.386540

Surtees, Paul G., Nicholas W. J. Wainwright, Robertr N. Luben, Nicholas J. Wareham, Sheila A. Bingham, and Kay-Tee Khaw. 2008. "Psychological Distress, Major Depressive Disorder, and Risk of Stroke." *Neurology*, 70(10): 788-794. http://dx.doi.org/10.1212/01.wnl.0000304109.18563.81

Taylor, Gemma, Ann McNeill, Alan Girling, Amanda Farley, Nicola Lindson-Hawley, and Paul Aveyard. 2014. "Change in Mental Health after Smoking Cessation: Systematic Review and Meta-Analysis." *BMJ*, 348(7946): 1-22. http://dx.doi.org/10.1136/bmj.g1151

Thompson, Angus H. 2020. "Measures of Mental Health and Addictions Conditions Show a U-Shaped Relationship with Self-Rated Worker Performance." *Social Psychiatry and Psychiatr Epidemiology*, 56(10): 1823-1833. http://dx.doi.org/10.1007/s00127-020-01894-w

Tilak, Jandhyala B. 2002. "Education and Poverty." *Journal of Human Development*, 3(2): 191-207. http://dx.doi.org/10.1080/14649880220147301

Unger, Jennifer B., C. Anderson Johnson, and Gary Marks. 1997. "Functional Decline in the Elderly: Evidence for Direct and Stress-Buffering Protective Effects of Social Interactions and Physical Activity." *Annals of Behavioral Medicine*, 19(2): 152-160. http://dx.doi.org/10.1007/BF02883332

Wagstaff, Adam. 2002. "Poverty and Health Sector Inequalities." *Bulletin of the World Health Organization*, 80(2): 97-105.

Wang, H., J. Fu, Q. Lu, F. Tao, and J. Hao. 2014. "Physical Activity, Body Mass Index and Mental Health in Chinese Adolescents: A Population Based Study." *Journal of Sports Medicine Physical Fitness*, 54(5): 518-525.

Wilkinson, Richard, and Michael Marmot. 2003. *Social Determinants of Health: The Solid Facts*. Copenhagen: World Health Organization Regional Office for Europe.

World Bank. 1999. *Confronting AIDS: Public Priorities in a Global Epidemic*. Washington, D. C.: World Bank Group.

World Health Organization. 1952. "Constitution of the World Health Organization." In *Handbook of Basic Documents*, 3-20. Geneva: World Health Organization.

World Health Organization. 2009. *Global Health Risks Mortality and Burden of Disease Attributable to Selected Major Risks*. Geneva: World Health Organization.

Zagorsky, Jay L. 1999. "Health and the Working Poor." *Eastern Economic Journal*, 25(2): 169-189.

Zenina, Nadezda, Andrejs Romanovs, and Yuri Merkuryev. 2015. "Transport Simulation Model Calibration with Two-Step Cluster Analysis Procedure." *Information Technology and Management Science*, 18(1): 49-56. http://dx.doi.org/10.1515/itms-2015-0008
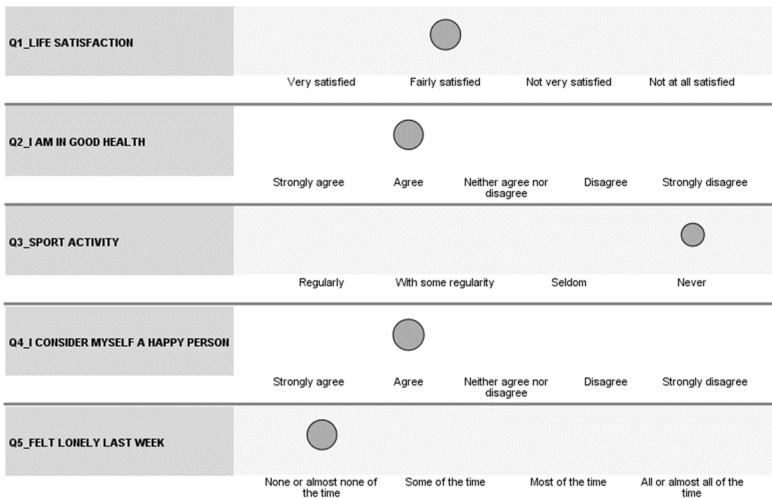
Appendix

Cluster Comparison

■ 1

Q1_LIFE SATISFACTION	Very satisfied / Fairly satisfied / Not very satisfied / Not at all satisfied
Q2_I AM IN GOOD HEALTH	Strongly agree / Agree / Neither agree nor disagree / Disagree / Strongly disagree
Q3_SPORT ACTIVITY	Regularly / With some regularity / Seldom / Never
Q4_I CONSIDER MYSELF A HAPPY PERSON	Strongly agree / Agree / Neither agree nor disagree / Disagree / Strongly disagree
Q5_FELT LONELY LAST WEEK	None or almost none of the time / Some of the time / Most of the time / All or almost all of the time

Cluster Comparison

■ 2

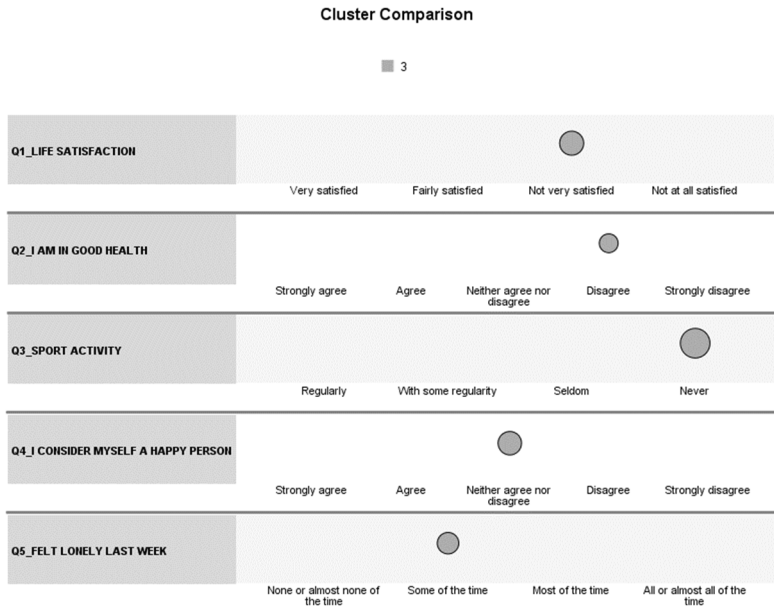|	
Q1_LIFE SATISFACTION	Very satisfied / Fairly satisfied / Not very satisfied / Not at all satisfied
Q2_I AM IN GOOD HEALTH	Strongly agree / Agree / Neither agree nor disagree / Disagree / Strongly disagree
Q3_SPORT ACTIVITY	Regularly / With some regularity / Seldom / Never
Q4_I CONSIDER MYSELF A HAPPY PERSON	Strongly agree / Agree / Neither agree nor disagree / Disagree / Strongly disagree
Q5_FELT LONELY LAST WEEK	None or almost none of the time / Some of the time / Most of the time / All or almost all of the time

Cluster Comparison

Source: Authors' calculations.

Figure A1 TwoStep Cluster Analysis Results

Table A1 Correlation Analysis between Physical and Mental Health Indicators

			Q1	Q2	Q3	Q4	Q5
Kendall's tau_b	Q1	Correlation coefficient	1.000	.458**	.730**	.744**	.628**
		Sig. (2-tailed)	.	.001	.000	.000	.000
		N	28	28	28	28	28
	Q2	Correlation coefficient	.458**	1.000	.400**	.615**	.329*
		Sig. (2-tailed)	.001	.	.003	.000	.014
		N	28	28	28	28	28
	Q3	Correlation coefficient	.730**	.400**	1.000	.596**	.623**
		Sig. (2-tailed)	.000	.003	.	.000	.000
		N	28	28	28	28	28
	Q4	Correlation coefficient	.744**	.615**	.596**	1.000	.562**
		Sig. (2-tailed)	.000	.000	.000	.	.000
		N	28	28	28	28	28
	Q5	Correlation coefficient	.628**	.329*	.623**	.562**	1.000
		Sig. (2-tailed)	.000	.014	.000	.000	.
		N	28	28	28	28	28

Notes: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).
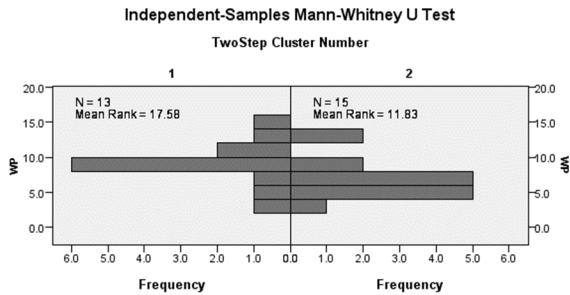
Source: Authors' computation using IBM SPSS Statistics 21.

Table A2 Normality Analysis for Physical and Mental Health Indicators

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q1	.129	28	.200[*]	.974	28	.702
Q2	.169	28	.039	.932	28	.069
Q3	.137	28	.192	.943	28	.133
Q4	.133	28	.200[*]	.954	28	.256
Q5	.104	28	.200[*]	.965	28	.444

Notes: * This is a lower bound of the true significance. [a] Lilliefors significance correction.

Source: Authors' computation using IBM SPSS Statistics 21.

Source: Authors' computation using IBM SPSS Statistics 21.

Figure A2 Mann-Whitney U Test for WP/PSE and the 2 Clusters