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

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Abstract. 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.

Introduction

Health status is an essential component of people well-being (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 (Mărginean et al., 2006). At the society level, a good state of health of their members materializes in a high level of competitiveness (Albert and Kohler, 2004). The health status is related to income (Ettner, 1996; Mullahy et al., 2018; Ecob and Smith, 1999; Judge et al., 1998) and, consequently, to poverty (Bloom and Canning, 2003; Biggs et al., 2010; Murray, 2006), 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 (Tilak, 2002). The working poor concept points to the link between poverty and low-wage work (Leana et al., 2012) and refers to the individuals working and living in poor households (Kalugina, 2013). It envisages the individual for labor market activity and household for the poverty status (Peña-Casas and Latta, 2004; 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? And (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) and macroeconomic data (Eurostat Database), 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: the *Literature Review* section 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); *Data, Methods, and Variables* outlines a theoretical background of the methods used

in the quantitative analysis; *Results* 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 (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 (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 (Phelan et al., 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 (Blázquez et al., 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. Alcan and Özsoy (2020) highlighted that health positively influences wages, more in case of women, and conduces to economic growth (Monterubbianesi et al., 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 (Rosenberg and Wilson, 2000). Health is significantly influenced also by other socioeconomic factors, such as educational level, employment, and income (Kaleta et al., 2009).

According to Stampfer et al. (2005) and the WHO Global Health Risks (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 (Gerber and Puehse, 2009; De Mello et al., 2013; Durstine et al., 2013; Wang et al., 2014; Hegberg and Tone, 2015).

Another factor influencing health is represented by sport activity, even in the case of the elderly (Forbes et al., 2008; 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 (Devkota et al., 2021). Mental health is associated with smoking; 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 (Contoyannis and Rice, 2001; García-Gómez et al., 2013), alcohol consumption (Stampfer et al., 2005; Lang et al., 2007; Rehm et al., 2010; Frisher et al., 2015), alimentation (Haveman-Nies et al. 2003: Mujcic and Oswald, 2016), and social interactions (Unger, 1997; Dour et al., 2014; 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 et al. 2003); instead, fruit consumption leads to increased welfare (Mujcic and Oswald, 2016). Mental health is associated with social deprivation (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 (Holt-Lunstad et al., 2012). Instead, loneliness and social isolation lead to increased mortality (Steptoe et al., 2012).

Mental health is very strongly correlated with physical health, with Nabi et al. (2008), Surtees et al., (2008), and Ohrnberger et al. (2017) 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 (Mani et al., 2013). Mental health influences workers' productivity, depreciation, and overconfidence being correlated with mental health (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 (Wagstaff, 2002). The illnesses substantially influence household income (World Bank, 1999; Bloom and Sachs, 1998), whereas poverty and low income cause poor health (Pritchett, 1996). Godlonton and 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 (Falkingham and 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 (Batra and 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 (Murali and Oyebode, 2004). Studies have indicated that poverty can be a driver, but also a response of a poor mental health

(Langner and Michael, 1963). Poor people experience higher mortality and premature deaths, receiving less health care compared with less poor people (Reilly et al., 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 (Bindman et al., 1995).

Moreover, people experiencing poverty experience impaired health and acute diseases (Lasser et al., 2006; Barnett et al., 2012; Wilkinson and Marmot, 2003). In this context, poor people have less access to health care (Hart, 1971; Mercer and Watt, 2007), with the probability to have a family doctor and benefit from medical care being low (Hutchison, 2007; Lasser, 2006; 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 (Farmer, 1991). In developed countries (Kessler et al., 2005; WHO International Consortium in Psychiatric Epidemiology, 2000) and in some cases in developing ones (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 (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 (Rodrigues, 2014). Gupta and Mitra (2003) 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 (CSDH, 2008, Anderson and 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 (Pop, 2010).

Poor workers face both poverty and low wages, severely affecting work-related outcomes (Leana et al., 2001). Nolan (2012) demonstrated that monetary poverty depends on low work intensity at the household level, size of household, and a single-wage presence. Özsoy (2020) proved that health positively influences wages, more in case of women, and health conduces to economic growth (Monterubbianesi et al., 2017). People experiencing health problems or other problems are more likely to be needy workers (Zagorsky, 1999), working poor leading to unhealthy status, depressive symptoms and low quality of life (Lee and Lee, 2020). Working poor is defined by 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 (Knöpfel, 1999). 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, 2017). Poor mental and self-rated health explains job discomfort and uncertainty and acute diseases (Habib et al., 2020); individuals with low perception regarding health status use medical services more often and are more absent from work (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:

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

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

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

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

The main hypotheses in the case of logistic regression imply the independence between consecutive observations and the linear relationship between logit (x) and predictors $X_1, X_2, \ldots, X_k$ (Domínguez-Almendros et al., 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 (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:

$$\text{health_perception} = \text{logit}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 * \text{gender} + \beta_2 * \text{age} + \beta_3 * \text{education} + \beta_4 * \text{marital}_{\text{status}} + \beta_5 * \text{community}_{\text{type}} + \beta_6 * \text{income} + \beta_7 * \text{labour_market_status} + \mathcal{E} \quad (3)$$

The model II can be written as follows:

$$\text{life_expectancy} = \text{logit}\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 * \text{gender} + \beta_2 * \text{age} + \beta_3 * \text{education} + \beta_4 * \text{marital}_{\text{status}} + \beta_5 * \text{community}_{\text{type}} + \beta_6 * \text{income} + \beta_7 * \text{labour_market_status} + \mathcal{E} \quad (4)$$

(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 (Arminger et al. 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:

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

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

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

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

$$\hat{\pi}_{vjl} = \frac{N_{vjl}}{N_v}, \quad (9)$$

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 (Zenina et al. 2015).

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

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.

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. The descriptive statistics of the two indicators are presented in Table 2.

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

[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 taht 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).

Table 3. Results of the Logistic Regression Estimation
Source: Authors' computation using IBM SPSS Statistics 21.

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		

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).

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 (Annex 1).

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 (≥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%).

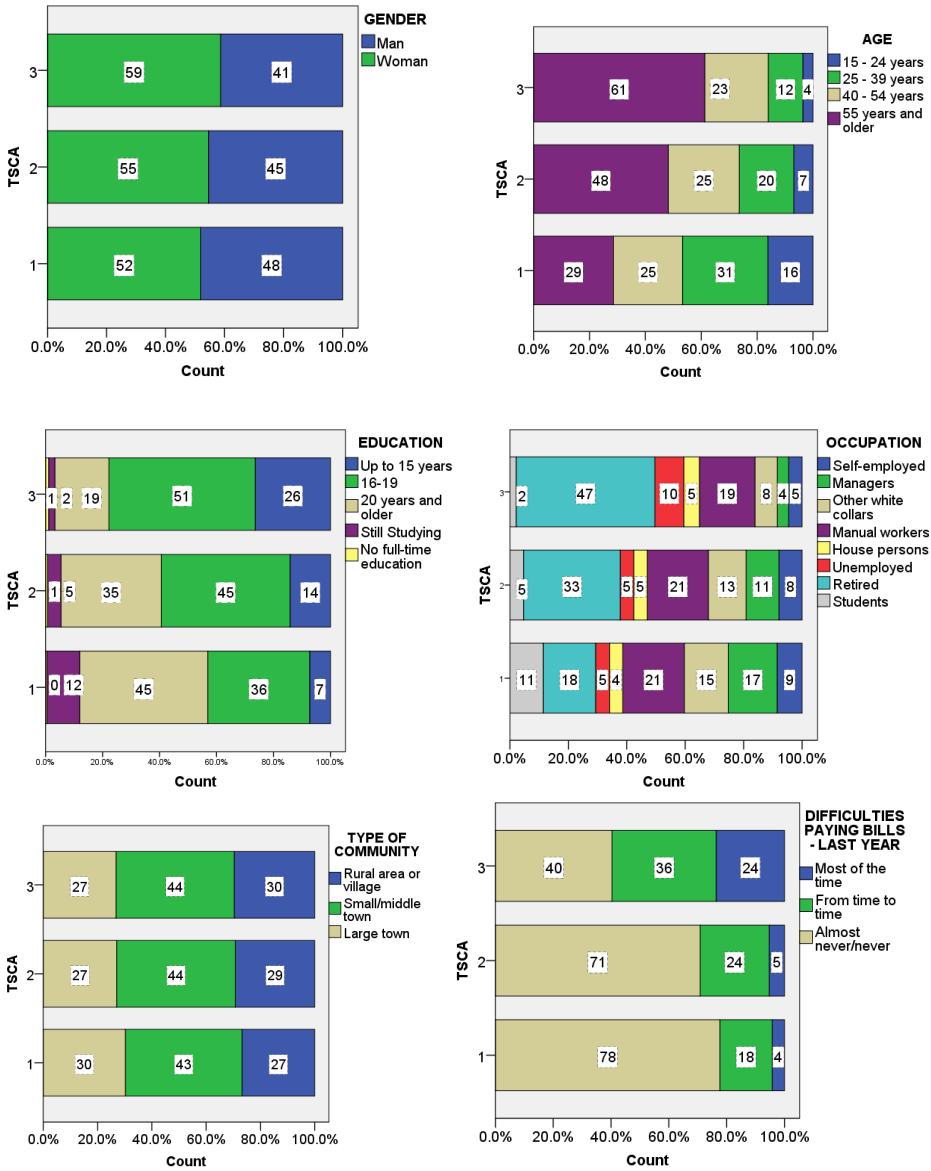

Figure 1. Demographic and social factors influencing physical and mental health.
Source: Authors' computation using IBM SPSS Statistics 21.

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).

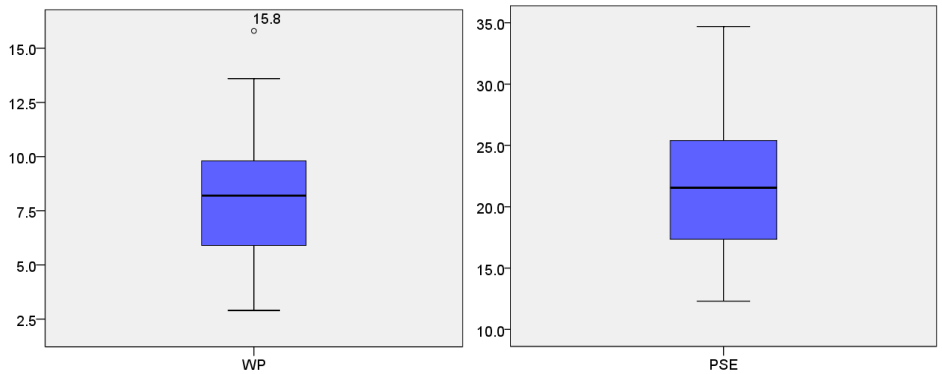

Figure 2. Box plot of the in-work at-risk-of-poverty rate (WP) and people at risk of poverty or social exclusion (PSE). Source: Authors' computation using IBM SPSS Statistics 21.

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 (Annex 2). 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 (Annex 3).

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.

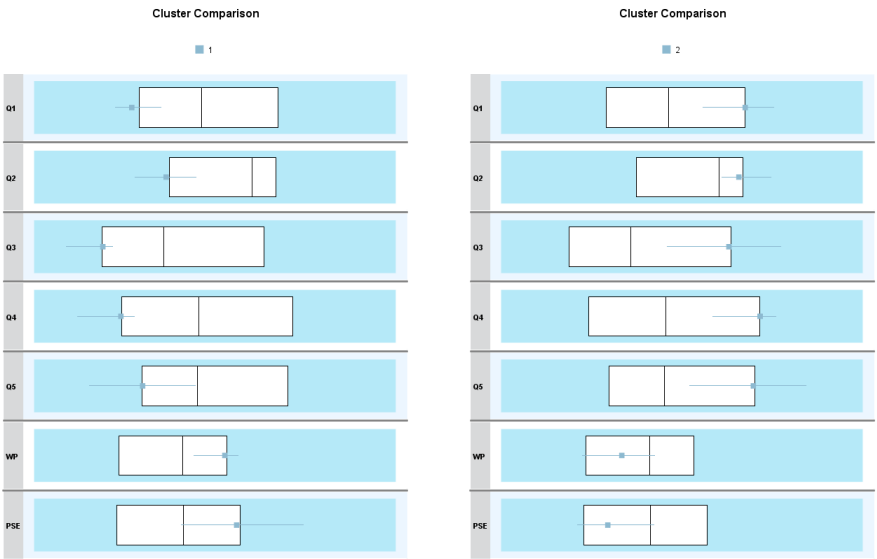

Figure 3. Cluster comparison
Source: Authors' computation using IBM SPSS Statistics 21

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) (Annex 4).

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]
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 (Annex 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 et al., 2017), both influencing workers' productivity and income (Thompson, 2020; CSDH, 2008; Anderson and al., 2009). 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.

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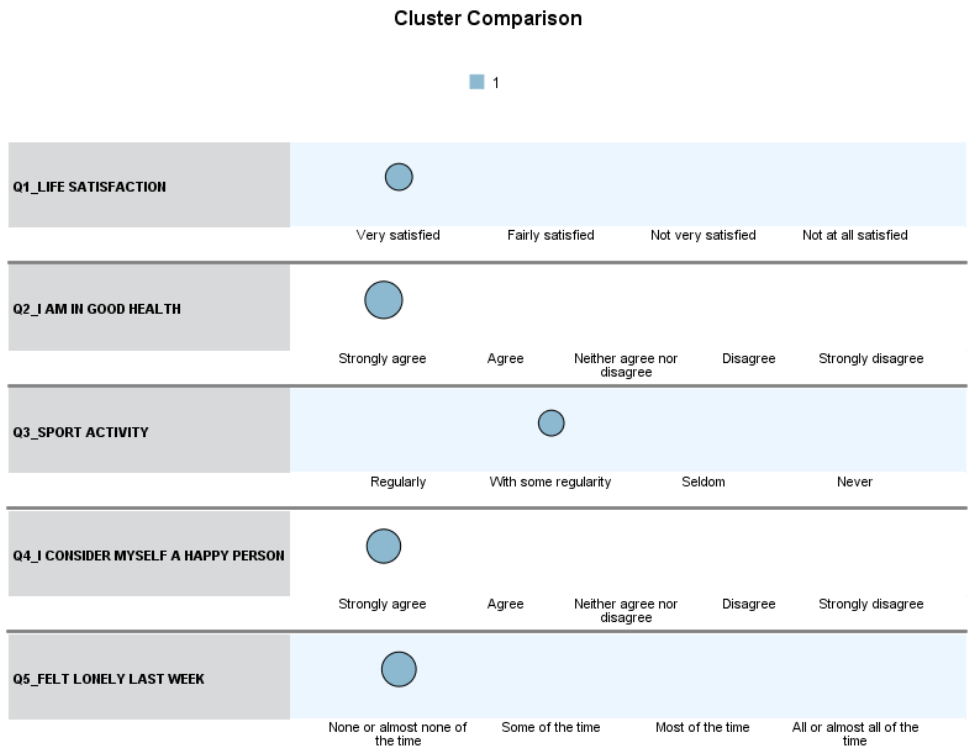
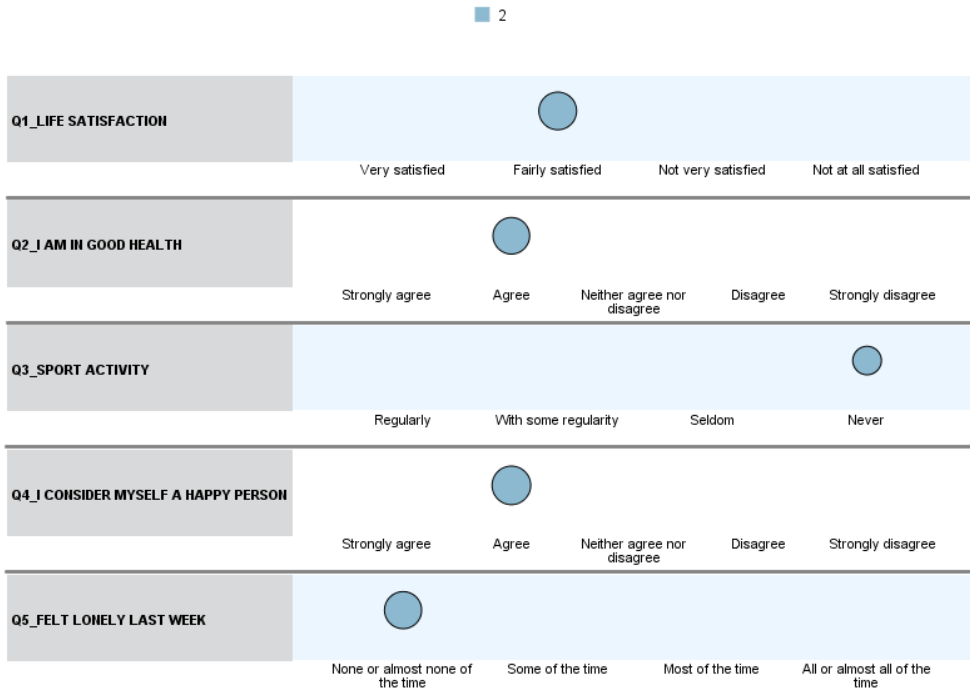
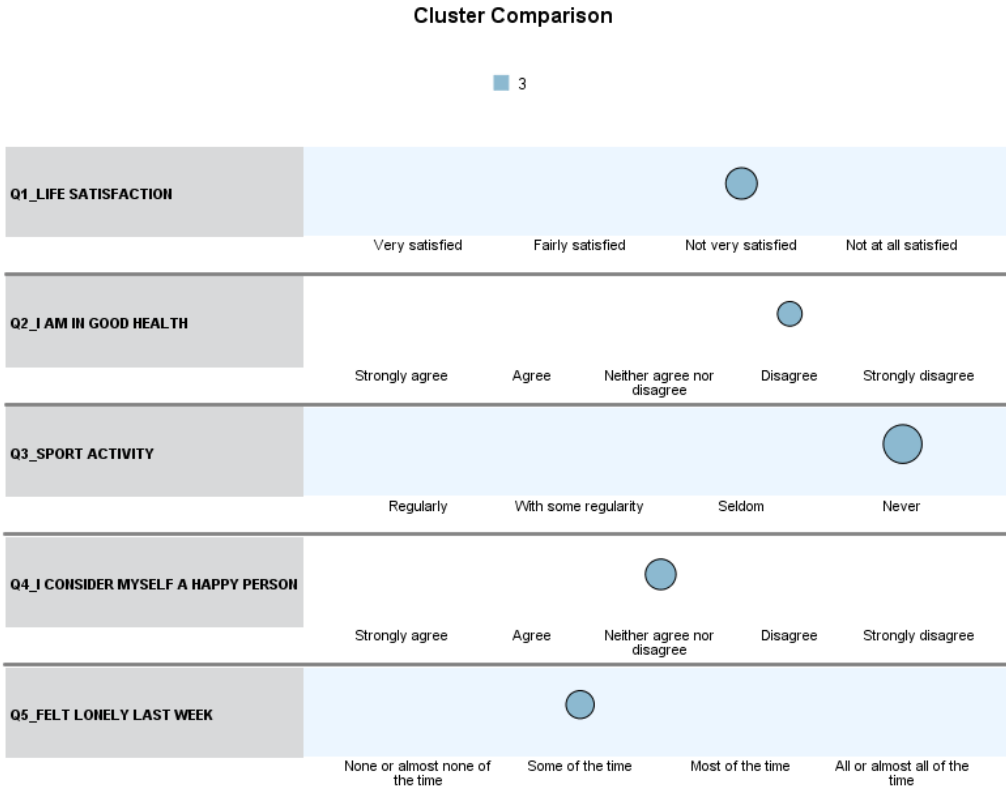
Annex 1. TwoStep Cluster Analysis Results



Cluster Comparison





Annex 2. 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
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

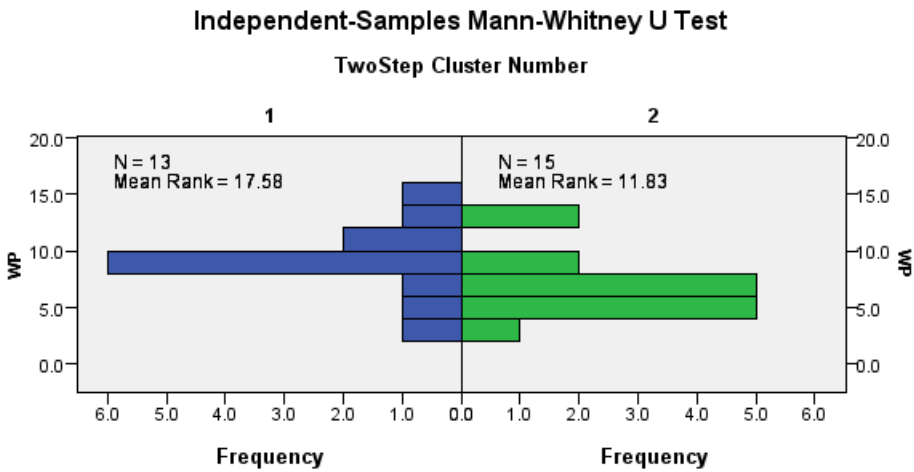
Source: Authors' computation using IBM SPSS Statistics 21

Annex 3. 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
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Source: Authors' computation using IBM SPSS Statistics 21

Annex 4. Mann-Whitney U test for WP/PSE and the 2 clusters



Total N	28
Mann-Whitney U	57.500
Wilcoxon W	177.500
Test Statistic	57.500
Standard Error	21.693
Standardized Test Statistic	-1.844
Asymptotic Sig. (2-sided test)	.065
Exact Sig. (2-sided test)	.065

Source: Authors' computation using IBM SPSS Statistics 21