HEALTH RISKS OF THE ELDERLY POPULATION

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Abstract

People are living longer in every country in the world today. And in every country, the number and proportion of older people in the population is growing. The health risks of the ageing and elderly population are in some ways specific and different from other (younger) populations. The health status of older people is already developing differently than in the earlier years of life, as they have been exposed to negative substances and various influences for a long time, which can lead to a general weakening of the organism and the development of certain types of diseases. The aim of this article is to identify and quantify the risk factors associated with the health status, mortality and health care costs of the elderly population in the Czech Republic and in other EU countries. Data are taken from the Eurostat database. Multidimensional comparative analysis, Spearman's correlation, and cluster analysis were used to achieve the aim of this article.

Key words: Health, risk factors, comparative analysis, elderly population.

JEL Code: C38, I14, I15

Introduction

The health risks of the elderly population are in some ways specific and different from the rest of the (younger) population. The elderly population refers to the population aged 65 years and over. Their health status is already evolving differently than in earlier years of life. This phenomenon is related to the fact that if the body is exposed to negative substances, such as toxic substances, even in moderate amounts, over a long period of time, this long-term exposure can lead to the development of certain types of diseases. Of course, it is not possible to describe in detail the whole broad spectrum of factors that can either positively or negatively affect the health status of individuals, as many elements can be added to the risk factors.

1 Health risk factors of the elderly population

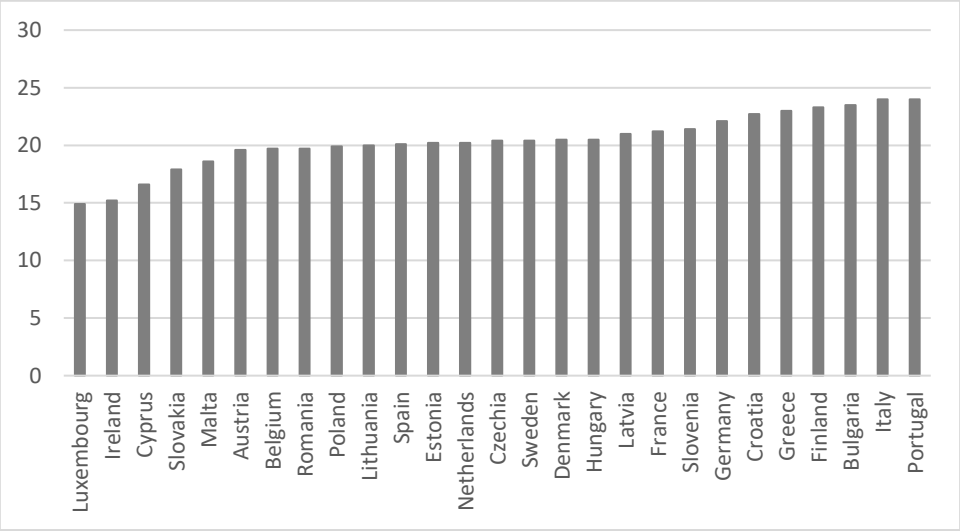
The ageing factor is most significantly related to the health risks of the elderly population. This phenomenon occurs across all countries, and the Czech Republic is no different. Population

ageing is the result of better living conditions (or lifestyle), higher quality of healthcare provision, and greater social protection. All these factors lead to fewer people dying prematurely in childhood or in working life. In addition, declining fertility rates are also contributing to this trend, so the average age of the population in a given country is steadily increasing. The chances of living a long life are now much higher than they were in the past, making old age a real experience and future for an increasing number of people. Several expert articles also demonstrate the topicality of the problem analysed, e.g. (Kocot et al., 2022), (Oliver et al., 2021).

One of the important factors that need to be integrated into policy-making in different areas is the increasing number and proportion of the elderly in the total population. For example, in (Kim et al., 2023) authors to identify the determinants of the share of the elderly population in a country's population. They found that the share is higher for high income countries in Europe and Central Asia. And for example, the authors (Pascual-Saez et al., 2017) studied the role of ageing society in the Spanish regions and they identified their geographic differences and explain them based on GDP differences. They found that the health care expenditure positively affects elderly population.

Fig. 1 shows the proportion of population aged 65 years and more in EU countries in 2023. We see the smallest value for Luxembourg (14.9), followed by Ireland (15.2). For most countries we see that the appropriate share is around 20, with 20.4 in the Czech Republic. We see the highest proportion of people aged 65 and over for Italy (24) and Portugal (24).

Fig. 1: Proportion of population aged 65 years and more, 2023



Source: Eurostat database (2024)

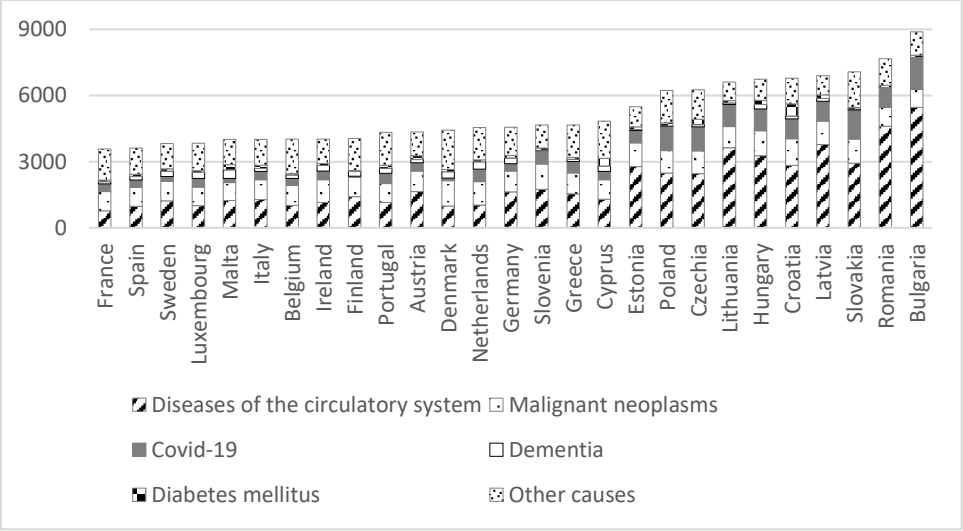
Other factors related to the health risks of the elderly population are the quality and availability of health care. In the Czech Republic, all health care facilities should develop and improve the quality and safety of health care (MZČR, 2024). Availability of health care in the Czech Republic (NZIP, 2024) is distinguished into local (determined by travel times to the appropriate treatment) and temporal (i.e., provision of urgent and acute covered services within a timeframe appropriate to the urgency).

The health care financing system is also related to the incidence of health risks. In the Czech Republic, this is a system based primarily on public health insurance, similar to that in Slovakia, Germany and France (OECD, 2024).

A healthy lifestyle is important for good health, not just for the elderly population. Here, the risk factors include smoking, alcohol consumption, poor diet and obesity, as well as lack of exercise.

For the elderly population, one of the main risk factors is the aforementioned ageing of the population, which also influences the main causes of death, which change with increasing age. (Health at a glance 2023, 2024) At older ages, deaths due to diseases of the circulatory system predominate mostly, as opposed to deaths due to cancer in the population aged 50 years and over. Furthermore, one of the main causes of death in the older population is dementia. The elderly population was one of the groups of people most at risk of death from Covid-19 disease, which was also reflected in the numbers of deaths during the pandemic. Fig. 2 shows selected main causes of death in the population aged 65 years and over in 2021.

Fig. 2: Causes of death in the population aged 65 years and over, standardised death rate, 2021.



Source: Eurostat database (2024), own processing

In Figure 2 we see that Bulgaria has the highest mortality rate for the elderly population, including the highest mortality rate for diseases of the circulatory system, and Covid-19 too. The country with the highest proportion of deaths in the elderly population due to dementia is Malta in 2021.

2 Data and methods

For the purposes of this article, Eurostat data (2024) for the most recent year was used to compare the situation in EU countries. In Tab. 1 we can see the list of these 15 variables. There are divided into four main group which corresponds with health risk factors for elderly population – health status, health care, risk factors, and selected main causes of death.

Tab. 1: Table of variables

Health status	Life expectancy in absolute value at 65 (2021)	HS1
	Healthy life years in absolute value at 65 (2021)	HS2
Health care	Health care expenditure (total); Purchasing power standard (PPS) per inhabitant (2021)	HC1
	Physicians (practising); Per hundred thousand inhabitants (2021 or nearest)	HC2
	Nurses (practising); Per hundred thousand inhabitants (2021 or nearest)	HC3
Risk factors	Obese by body mass index (BMI), 65 years or over; Percentage (2019)	RF1
	Everyday alcohol consumption, 65 years or over; Percentage (2019)	RF2
	Daily smoker of tobacco products, 65 years or over; Percentage (2019)	RF3
	Daily consumption of fruit and vegetables - 0 portions, 65 years or over; Percentage (2019)	RF4
	Performing health-enhancing physical activity, 65 years or over; Percentage (2019)	RF5
Causes of death	Causes of death - Diseases of the circulatory system - 65 years or over; Standardised death rate (2021)	CD1
	Causes of death - Malignant neoplasms - 65 years or over; Standardised death rate (2021)	CD2
	Causes of death - COVID-19, virus identified, 65 years or over; Standardised death rate (2021)	CD3
	Causes of death - Dementia - 65 years or over; Standardised death rate (2021)	CD4
	Causes of death - Diabetes mellitus - 65 years or over; Standardised death rate (2021)	CD5

Source: own processing

According to the above mentioned goals of analysis of these variables we have used the multidimensional comparative analysis, Spearman's correlation and cluster analysis.

Multidimensional comparative analysis deals with the methods and techniques of comparing multi-feature objects, in our case EU countries. The objective to establish a linear

ordering among a set of objects in a multidimensional space of features, from the point of view of certain characteristics which cannot be measured in a direct way. Application of these methods to compare health and health care in selected countries can be found for example in (Jindrová, 2019), (Pacáková & Kopecká, 2018) or (Jindrová & Boháčová, 2023).

At the beginning of the analysis, the type of each variable X_j should be defined, j = 1,…15. It is necessary to identify whether the great values of a variable positively influence the analysed processes (such variables are called stimulants) or whether their small values are favourable (these are called destimulants). The original variables are measured in different units, than the normalization is the second step, which is to bring them to comparability. Normalisation have been performed according to formula (1) for stimulants and to formula (2) for destimulants:

$$b_{ij} = \frac{\max_j x_{ij} - x_{ij}}{\max_j x_{ij} - \min_j x_{ij}} \tag{1}$$

$$b_{ij} = \frac{x_{ij} - \min_j x_{ij}}{\max_j x_{ij} - \min_j x_{ij}} \tag{2}$$

The synthetic indicator for each country has been calculated as the average of the b_{ij}, for i = 1, …, 27 and for j = 1, …, m, when m is number of variables in the main groups of variables (see Tab. 1). According to the formulas (1), (2) obviously implies that the higher the value of synthetic variable, the higher the level of the multidimensional object.

The match of the ordering of the countries by each pair of synthetic variables can be quantified using Spearman's rank correlation coefficient. The correlation coefficient ranges between -1 and +1 and it represents the degree of compliance of the ranks.

The objective of cluster analysis is to classify multidimensional objects into a small number of mutually exclusive groups based on the similarities among the objects. Ward’s method, which has been used for clustering, defines the distance between two clusters in terms of the increase in the sum of squared deviations around the cluster means that would occur if the two clusters were joined. The results of the analysis can be displayed in several ways, including a dendrogram. Working from the bottom up, the dendrogram shows the sequence of joins that were made between clusters. Lines are drawn connecting the clusters that are joined at each step, while the vertical axis displays the distance between the clusters where they are joined.

3 Results and discussion

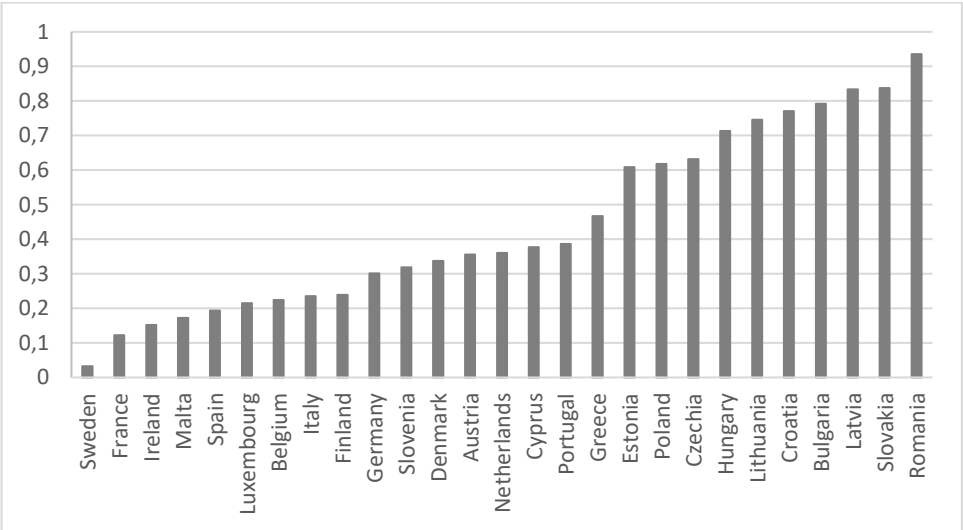
Multidimensional comparative analysis has been used for comparing the situation among Europeans countries via health status of elderly people, health care, risk factors, and selected main causes of death of elderly people.

The synthetic variable allows to replace the set of variables into one aggregated variable. By this it allows to transform multidimensional problem to one dimensional. We construct four synthetic variables S1, S2, S3, and S4 – each for four main areas above. The synthetic variable S1 made up of 2 indicators of health status for elderly people, when variables HS1-HS2 were stimulants. The synthetic variable S2 made up of 3 indicators of health care, when all these 3 indicators were stimulants. The synthetic variable S3 made up of 5 indicators of risk factors of elderly people, where RF1-RF4 were destimulants and RF5 was stimulants. S4 made up of 5 variables of selected main causes of death of elderly people and all of them were destimulants.

These synthetic variables will make it possible to compare the monitored countries and arrange them from the best to the worst situation in the monitored areas.

Fig. 3 shows the situation of health status for people at 65 (variable S1). We can see that the best situation is in Sweden, where is the highest life expectancy at 65 (= 20.4 years) and heathy life years at 65 too (= 14.6 years). The worst situation is in Romania, where we can find life expectancy at 65 only 14.6 years and healthy life years at 65 only 4 years.

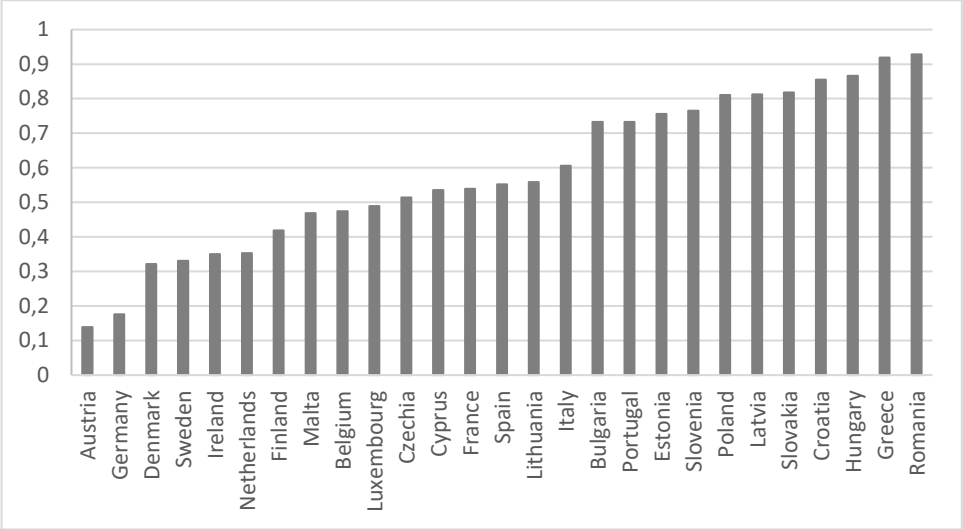
Fig. 3: Synthetic variable S1 (Health status)



Source: Eurostat database (2024), own processing

In Fig. 4 we can compare situation in EU countries in health care area (variable S2). We can see the best situation in Austria and Germany. The worst situation we can see in Romania.

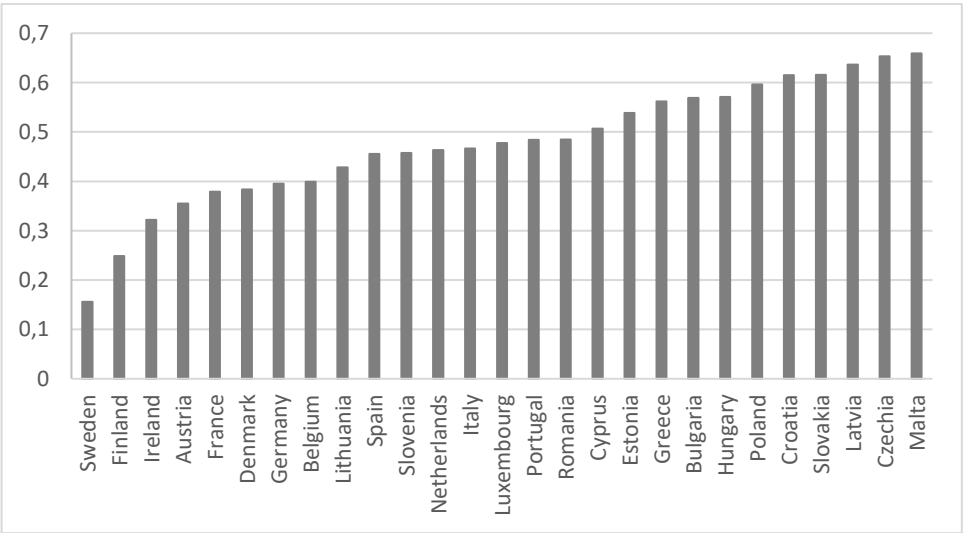
Fig. 4: Synthetic variable S2 (Health care)



Source: Eurostat database (2024), own processing

In Fig. 5 we can see the situation in risk factors for elderly population (variable S3). The best situation is shown in Sweden and opposite the worst situation is shown in Malta.

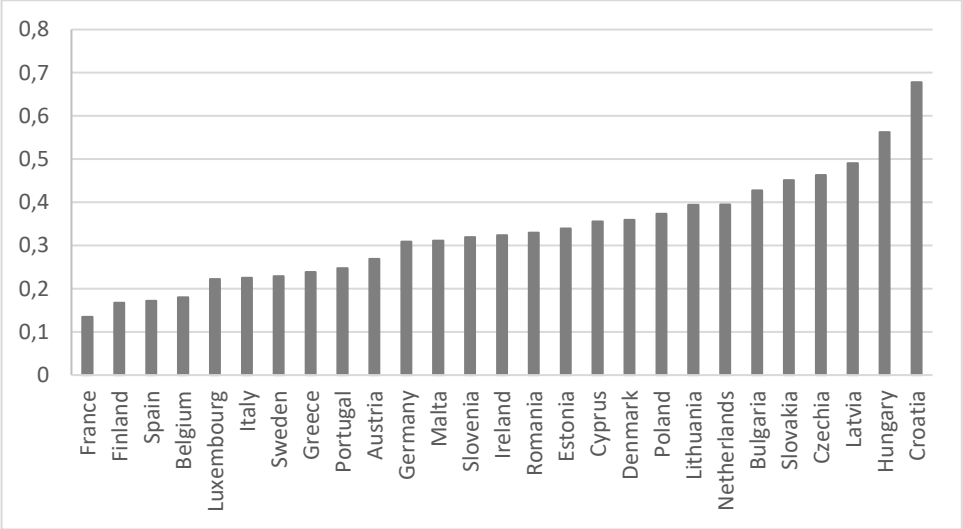
Fig. 5: Synthetic variable S3 (Risk factors)



Source: Eurostat database (2024), own processing

Fig. 6 compares situation in EU countries via selected main causes of death of elderly population (variable S4). We can see the differences are not so big in comparison with synthetic variable S1. The best situation we can see in France and the worst in Croatia.

Fig. 6: Synthetic variable S4 (Selected causes of death)



Source: Eurostat database (2024), own processing

Spearman's correlation coefficient was used to test the relationships between synthetic variables S1-S4. Its values are statistically significant for $\alpha = 0.01$ between all pairs of variables except the pairs S2 (Health care) and S4 (Causes of death) (p-value = 0.0367) – see Tab. 2.

Tab. 2: Table of Spearman's correlation coefficients

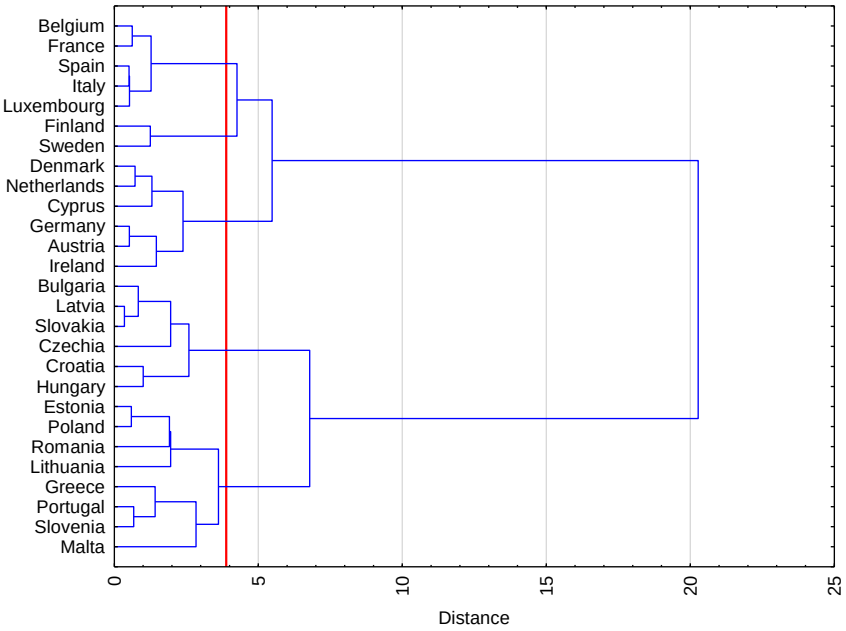
	S1 (Health status)	S2 (Health care)	S3 (Risk factors)	S4 (Causes of death)
S1 (Health status)	1.0000	0.6746***	0.6349***	0.7729***
S2 (Health care)	0.6746***	1.0000	0.6435***	0.3797**
S3 (Risk factors)	0.6349***	0.6435***	1.0000	0.6288***
S4 (Causes of death)	0.7729***	0.3797**	0.6288***	1.0000

Note: **statistically significant for $\alpha = 0.05$; ***statistically significant for $\alpha = 0.01$
Source: own processing

Since a statistically significant relationship was verified between the pairs of synthetic variables S1-S4, these variables were replaced by 4 artificial variables via principal components. Their independence allows the use of Ward's clustering method with Euclidean distances. Fig. 7 shows result in dendrogram. Based on the evolution of the semi-partial graph, 5 main clusters were created. The first cluster includes Belgium, France, Spain, Italy, and Luxembourg. The second cluster includes Finland and Sweden. Cluster number three includes Denmark, Netherlands, Cyprus, Germany, Austria, and Ireland. These first three clusters include the traditional EU countries that showed good performance in each of the areas monitored. The fourth cluster includes Bulgaria, Latvia, Slovakia, Czechia, Croatia, and Hungary, and in the last cluster are Estonia, Poland, Romania, Lithuania, Greece, Portugal, Slovenia, and Malta. The last two clusters contain all post-socialist EU countries with Greece,

Portugal, and Malta. This result confirms the still persistent large differences between post-socialist EU countries and other member states, including in our analysed area - health risks of elderly population.

Fig. 7: Dendrogram



Source: own processing (via Statistica 14)

Conclusion

The situation in EU countries was analysed using 15 variables, which correspond with health risk factors for elderly population. The observed countries showed differences in the individual synthetic variables, which were created using multivariate analysis for the four areas under study - health status, health care, risk factors, and selected main causes of death. The dependence between these domains was tested using Spearman correlation. Finally, cluster analysis was used to compare the issues of interest between EU countries. The still large differences between post-socialist countries and the remaining EU members were confirmed.

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