POPULATION AGING AND PARKINSON‘S DISEASE

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Abstract

Population ageing has for a long time been a topic of discussion across Europe. There are several reasons for ageing. On the one hand, we can mention the positive fact that human life is getting longer. People are living longer thanks to advances in medical care and also due to changes in lifestyle. However, it is also necessary to mention the declining birth rate that can be observed in European countries.

Population aging also brings with it potential problems. It will be necessary to gradually adapt to developments, both in health and social care.

Population aging may also be associated with the spread of neurodegenerative diseases. These include, for example, different types of dementia or Parkinson's disease.

The aim of this paper will be to analyze the available data of people with Parkinson's disease (total counts and gender-disaggregated data). Attention will be focused, among other things, on the projection of the number of people with Parkinson's disease.

Key words: population aging, neurodegenerative diseases, Parkinson’s disease

JEL Code: J10, J11, J19

Introduction

The topic of population aging has been an important topic for a long time, not only among demographers. Its impacts and the necessary changes are being discussed. Population aging is caused on the one hand by the increasing life expectancy. On the other hand, it is also caused by the low birth rate (Langhamrová JI. et al. 2011, Šimpach, 2015).

Population aging brings with it a greater emphasis on forecasts of future population development (Arltová et al., 2013 or Arltová and Langhamrová JA., 2014).

The topic of aging is also related to the question of how many years of life a person will live in health and, conversely, whether the added years are not just years spent in illness (Cséfalvaiová et al., 2013 or Dotlačilová, 2024). Also related to this is the question of how the number of

people who will develop one of the neurodegenerative diseases during their lives will develop? This includes Alzheimer's or Parkinson's disease.

1 Methodology

The paper will focus on the analysis of the time series of the number of people with Parkinson's disease. Several indicators can be used for this. The basic ones include the arithmetic mean. It is also possible to mention absolute or procentual changes, which capture the change in the time series from year to year. Another possible approach is the use of regression models (Řezanková et al., 2019 or Arlt and Arltová, 2007).

Here, the possibility of modeling a time series using regression will be used. The aim of the article is to show the possibility of modeling a time series trend using a linear regression model. In the calculations, we will base our model on the form (Řezanková et al., 2019):

$$\hat{T}_t = \hat{y}_t = b_0 + b_{yt}t \tag{1}$$

where b_0 is the part of the trend that is not dependent on time and b_{yt} represents a parameter that expresses the development over time and t is the index of year.

To estimate b_0, we use the formula:

$$b_0 = \bar{y} - b_{yt}\bar{t}, \tag{2}$$

where $\bar{y}$ represents the average value of the modeled indicator (number of people with Parkinson's) and $\bar{t}$ is the average index created from the indices of individual years.

To estimate b_{yt} we use the formula represents the average value of the modeled indicator (number of people with Parkinson's) and $\bar{t}$ is the average index created from the indices of individual years.

To estimate b_{yt} we use the formula:

$$b_{yt} = \frac{\overline{t\bar{y}} - \bar{t}\bar{y}}{\overline{t^2} - \bar{t}^2} \tag{3}$$

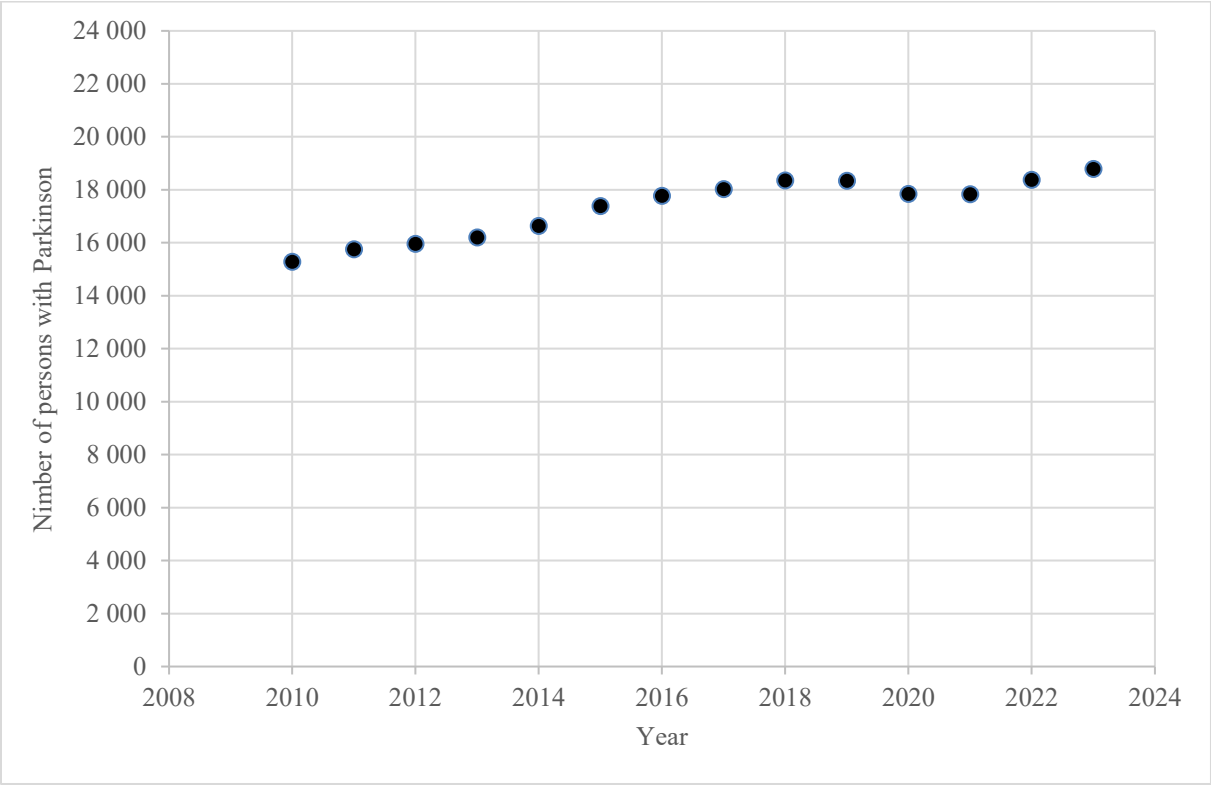
2 Results

The paper focuses on the analysis of data on people with Parkinson's disease. The aim is to try to describe the trend in a time series using a linear regression model. The focus will be on the total population and then calculations will be performed for men and women.

Then, based on the obtained estimate of the regression model of the trend, an estimate of the future development of the population with Parkinson's will be made. The calculations are based on data for the period 2010 - 2023.

The following graphs first show the obtained data series and are supplemented by a graph with a projection based on the estimated trend model.

Fig. 1: Number of people with Parkinson's disease in the Czech Republic (2010 – 2023)



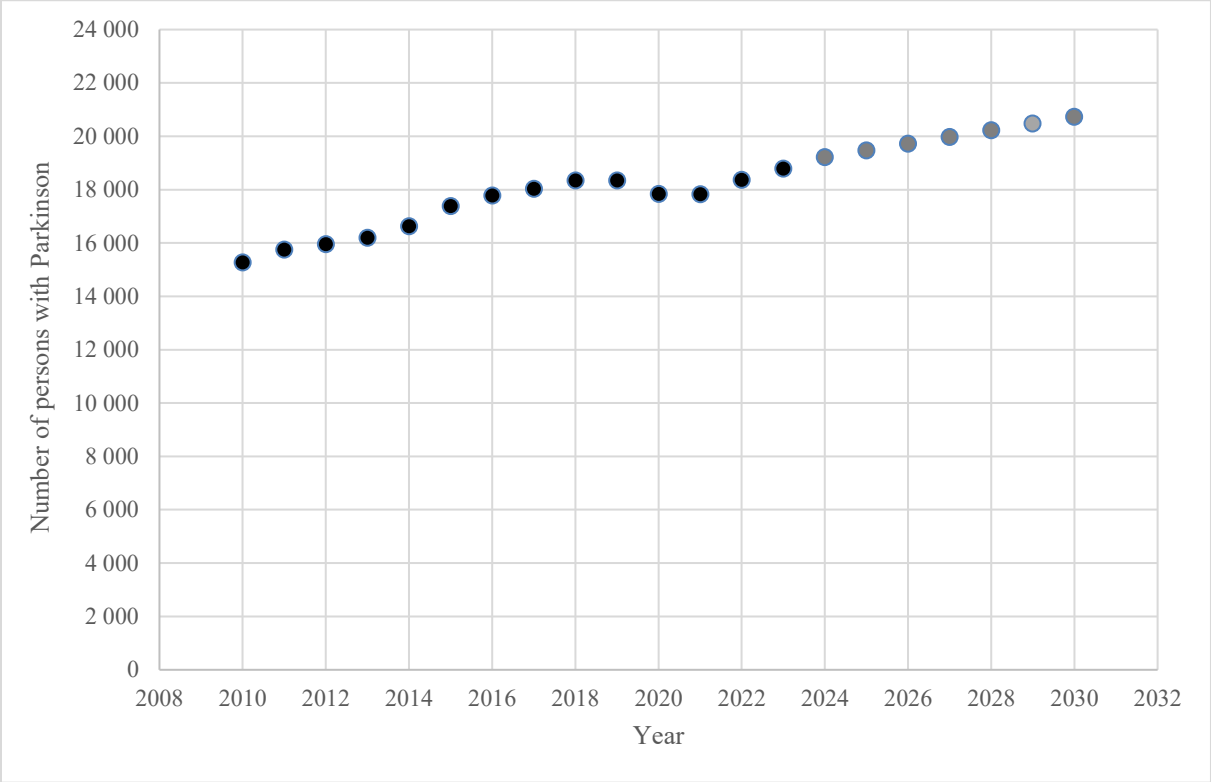
Source: data ÚZIS 2025, own construction

The first graph shows the total number of people with Parkinson's disease between 2010 and 2023. Until 2019, a continuous increase in the number of people can be observed. However, 2019 represents a turning point. At that time, there was a slight decrease in the number of registered people with Parkinson's. The cause could also be the Covid 19 pandemic. This could be behind the decrease in registered cases. In the following years, the number of people will increase again.

The second graph shows the obtained data enriched with a projection of people with Parkinson's disease. An estimated trend model was used for the projection.

The choice of a linear trend was based on the assumption of a gradual increase in previous years.

Fig. 2: Number of people with Parkinson's disease in the Czech Republic (2010 – 2030)



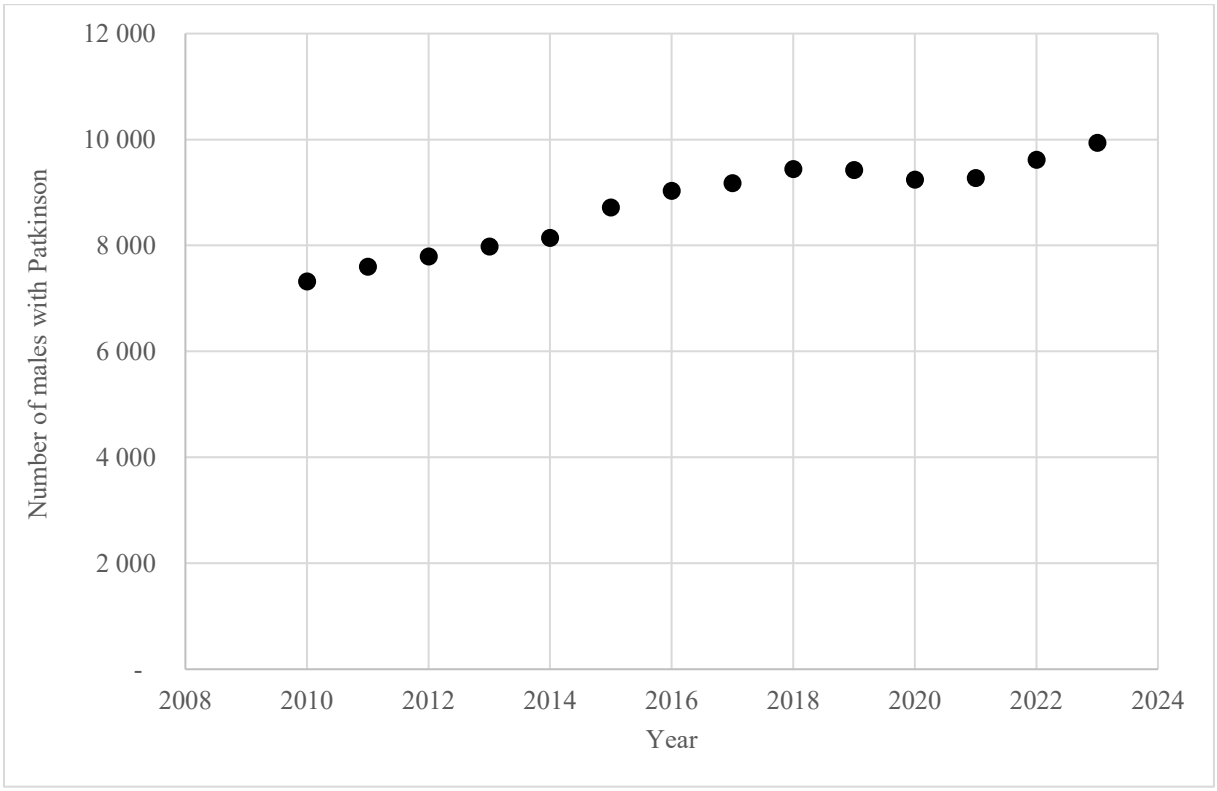
Source: data ÚZIS 2025, own construction

Based on the obtained data series, a trend model was estimated: $\hat{T}_t = \hat{y}_t = 252 + 25\,433t$. Based on this model, future development was estimated until 2030.

Using the estimated model, a projection of the number of people with Parkinson's was made. Since the model assumes a linear development, the obtained numbers of sick people in subsequent years also correspond to this. However, it should be emphasized that the model does not take into account possible fluctuations in the time series. It also means that linear decomposition is not the most suitable for projection. The following two graphs show how the numbers of men with Parkinson's disease changed over time. The first graph contains the registered numbers and the next is enriched with the projection of men with Parkinson's.

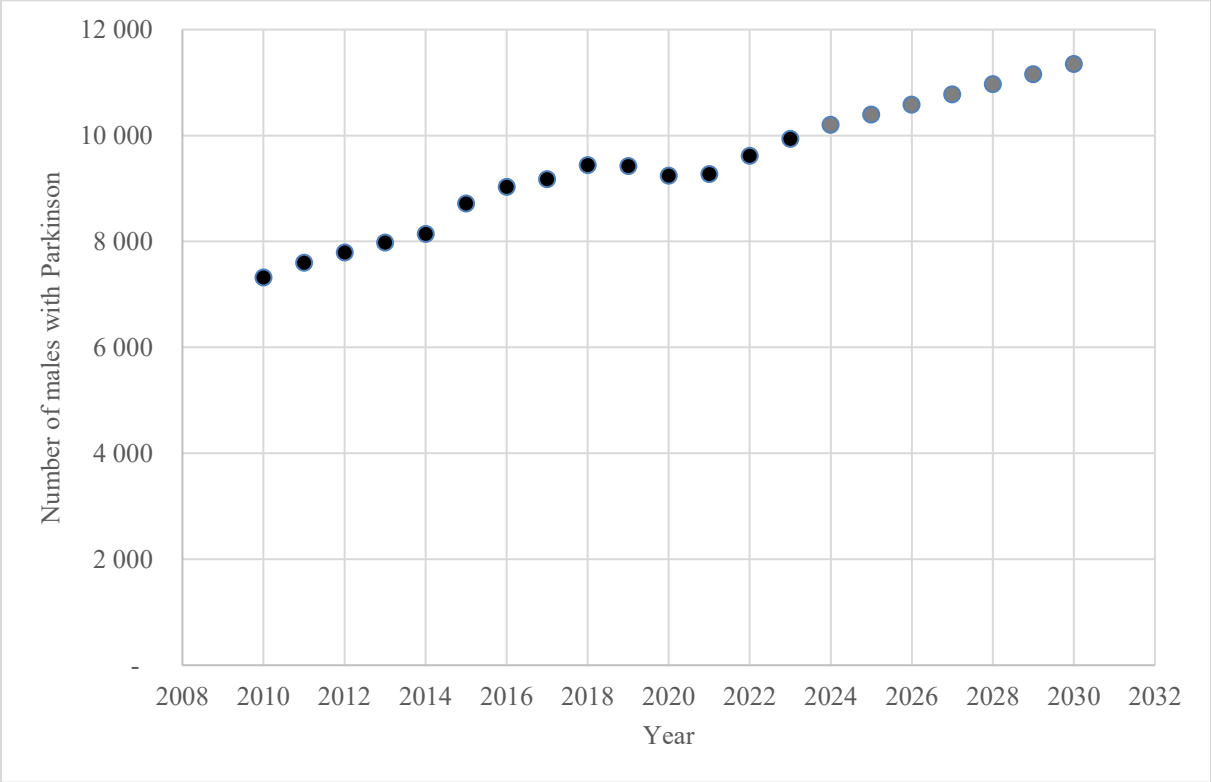
Based on the obtained data on the number of men with Parkinson's, it can be said that these data also show a similar trend. Up to the year, it is possible to observe an increase in the registered numbers. This then continues since 2021.

Fig. 3: Number of males with Parkinson's disease in the Czech Republic (2010 – 2023)



Source: data ÚZIS 2025, own construction

Fig. 4: Number of males with Parkinson's disease in the Czech Republic (2010 – 2030)



Source: data ÚZIS 2025, own construction

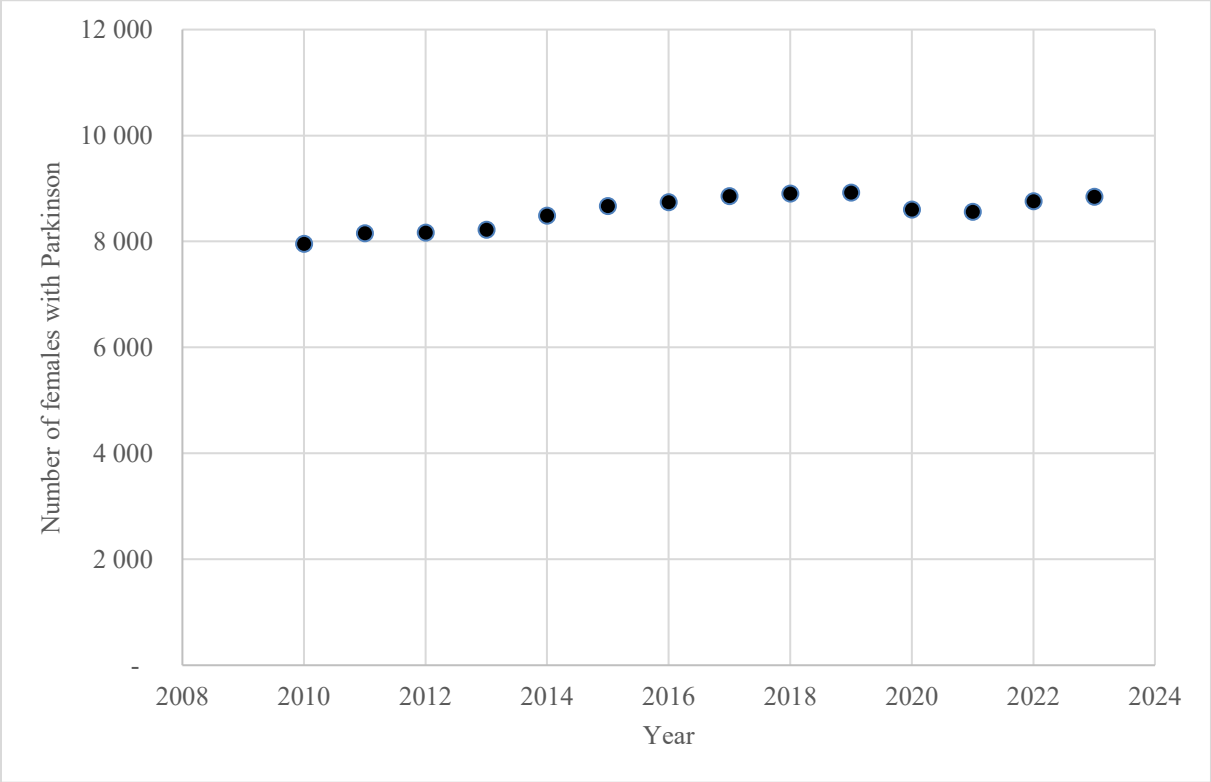
Based on the available data, a trend model was estimated for men: $\hat{T}_t = \hat{y}_t = 192 + 7\,326t$. It was used to calculate the projection of the number of men with Parkinson's until 2030.

Given the chosen model, the development in the following years is not surprising. When, taking into account the model used, the number of men with Parkinson's disease will also increase in the following years.

The last two graphs show data related to the female population.

Graph 5 shows the development since 2010. Here too, a continuous increase is evident, which was interrupted in 2019 (as in men). However, women also experienced a decrease in the following year. The increase continues again from 2022.

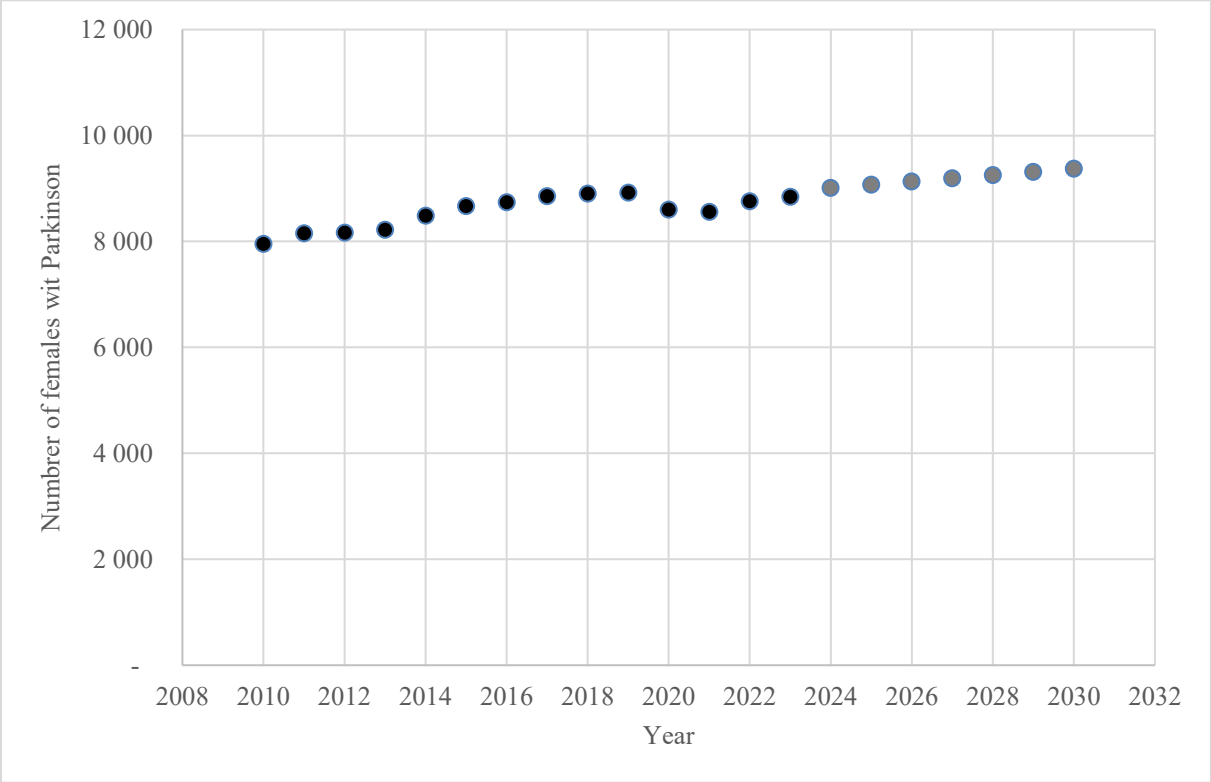
Fig. 5: Number of females with Parkinson's disease in the Czech Republic (2010 – 2023)



Source: data ÚZIS 2025, own construction

The last graph shows the number of women with Parkinson's disease, supplemented by a projection to 2030.

Fig. 6: Number of females with Parkinson's disease in the Czech Republic (2010 – 2030)



Source: data ÚZIS 2025, own construction

Based on the available data, a trend model was estimated: $\hat{T}_t = \hat{y}_t = 60 + 8\,108t$. This was subsequently used to model future developments.

Given the chosen trend model, it is evident from the forecasted data that there will be an increase in the number of women with Parkinson.

Conclusion

The paper analyzed the data about people with Parkinson's disease in the Czech Republic. Attention was focused on the total population and then also on the population of men and women.

Based on the available data, it can be said that in recent years there has been a steady increase in the number of people with Parkinson's (the exception was 2019, 2020). A linear regression model was chosen to model the trend of the time series. Based on this choice, it can be said that the number of people with Parkinson's disease will also increase in the coming years (this corresponds to the nature of the model). However, it should be emphasized that the linear model will not capture any deviation in the data. It also means that linear decomposition is not

the most suitable for projection. As a topic for further research, it is suggested to try other regression models that would be able to better describe the fluctuation in the time series.

It is also important to note that the number of women with Parkinson's disease is higher than that of men. However, it is important to note that women live longer. This may also be one of the reasons for the higher number of women with the disease.

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