

## THE COVID-19 PANDEMIC AND THE NUMBER OF DOCTORS LICENSED TO PRACTICE MEDICINE IN POLAND

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### Abstract

This article evaluates the impact of the COVID-19 pandemic on the dynamics of change in the number of doctors licensed to practice medicine in Poland. The analysis was conducted in three periods: before the pandemic (2006–2019), during the pandemic (2020–2022) and after it ended (2023–2024). Data from Statistics Poland and statistical analysis methods were used, including the dependent t-test and calculation of effect sizes. The results revealed that the pandemic marked a significant turning point in prior trends: the average annual rate of change in the number of doctors increased markedly during the pandemic, and the difference relative to the pre-pandemic period was statistically significant. After the pandemic, further growth in the dynamics of change was recorded, but the difference compared to the pandemic period was no longer statistically significant. Spatial analysis indicated regional differences in the rate of change. The results demonstrate that the pandemic significantly accelerated the increase in the number of doctors, although sustaining this growth after it ended was less clear-cut. The findings of this article may be used for economic purposes in health policy planning, forecasting the costs of operating the healthcare system, and making decisions regarding the allocation of financial and human resources at the national and regional levels.

**Keywords:** COVID-19 pandemic; doctors; dynamics of change; healthcare professionals; statistical analysis; t-test; regional diversity; health economics.

### 1. Introduction

The COVID-19 pandemic has had a significant impact on the functioning of health systems around the world. In Poland, as in other European countries, it revealed staffing shortages that had existed previously but had not been identified by the authorities. It also highlighted the inequalities in the availability of healthcare professionals. The number of doctors licensed to practice medicine has become particularly important, as it is a key indicator of the healthcare system's capacity. Understanding the dynamics of change in the number of doctors before, during and after the pandemic allows us to assess the impact of the health crisis on human resources, identify ways to improve the situation and provide guidance for future health policy planning.

Previous analyses have indicated a relatively slow growth in the number of doctors in the years preceding the pandemic, which could have contributed to a shortage of healthcare professionals. However, the pandemic may have changed the existing trends by stimulating professional activity, simplifying administrative procedures, mobilising human resources, and increasing the influx of foreign workforce. Assessing the scale of these changes requires both statistical and spatial analysis.

### 2. Literature Analysis

Human resources in healthcare, particularly the number of doctors licensed to practice medicine, has long been a significant area of research and analysis of healthcare systems. This research has led to the conclusion that the structure of healthcare professional employment directly affects access to healthcare services, the quality of healthcare, and the system's resilience (OECD

2019; WHO 2020). Shortages in this area are common, but their scale and dynamics vary significantly between countries and regions.

Many studies and analyses have shown that, even before the COVID-19 pandemic, Poland faced a shortage of healthcare professionals, resulting in relatively few doctors per capita compared with other EU countries (OECD 2019; Eurostat 2020).

The COVID-19 pandemic has introduced a new dimension to research on human resources in healthcare. International literature emphasises that the health crisis has highlighted the scale of shortages in this area and the limited capacity of healthcare systems to adapt quickly to a surge in service demand (WHO 2020; Blumenthal et al., 2020). This resulted in a high number of cases among patients with diseases other than COVID-19. At the same time, the pandemic has become an impetus to adopt and implement rapid, extraordinary organisational solutions. Many legislative measures have also been adopted to increase the availability of doctors and thus reduce the number of cases.

Research indicates that many countries have introduced temporary measures to facilitate entry into the medical profession and have accelerated procedures for recognising foreign qualifications. In addition, retired doctors and final-year medical students were mobilised professionally (Buchan et al., 2021).

The literature also includes analyses indicating that the pandemic may have changed the perception of the medical profession and the importance of human resources policy in healthcare. The health crisis has drawn public attention to the role of the medical profession and prompted governments to intensify their efforts in human resource planning (WHO 2021). At the same time, the authors highlight the pandemic's adverse consequences, which have led the medical community to struggle with excessive workloads and burnout. This has prompted doctors to retire earlier. Such actions have limited the previously observed increases in the number of doctors (Morgantini et al., 2020).

A literature review indicates that, despite the growing number of studies on the impact of the COVID-19 pandemic on healthcare system functioning, relatively few studies attempt a quantitative analysis of changes in the dynamics of the number of doctors over many years, with a clear distinction between the pre-pandemic, pandemic, and post-pandemic periods. However, there is a lack of research that combines statistical analysis with a spatial approach at the country-wide scale. This gap justifies this study, which aims to assess the impact of the COVID-19 pandemic on the dynamics of change in the number of doctors licensed to practice medicine in Poland (Statistics Poland 2025).

This article poses the following research questions:

1. Has the COVID-19 pandemic changed the existing trends in the average annual rate of change in the number of doctors licensed to practice medicine?
2. Did the average rate of change in the number of doctors during the pandemic differ significantly from the rate observed before the pandemic?
3. Did the accelerated growth in the number of doctors continue after the pandemic ended, and if so, did it differ significantly from the rate recorded during the pandemic?
4. Did the dynamics of change in the number of doctors vary across regions, and if so, how did this variation play out spatially during the periods studied?

### 3. Method of Analysis

The analysis was conducted using data from Statistics Poland on the number of doctors licensed to practice medicine in Poland between 2005 and 2024. The primary objective was to determine whether the COVID-19 pandemic affected the dynamics of change in the studied population and whether differences between periods were statistically significant.

In the first stage, the average annual rate of change (AARC) in the number of doctors was calculated for three time intervals:

1. The pre-pandemic period (2006–2019),
2. The pandemic period (2020–2022),
3. The post-pandemic period (2023–2024).

The AARC enabled comparison of the direction and strength of changes across regions and among the three key phases of the analysis.

In the second stage, a dependent t-test was conducted to assess whether differences in average rates of change across individual periods were statistically significant. Two comparisons were made:

- Between the pre-pandemic period and the pandemic period, and
- Between the pandemic period and the post-pandemic period.

The t-test made it possible to assess the extent to which the pandemic modified existing trends. The assessment covered mean values, standard deviations, t-statistics, and one-tailed and two-tailed significance levels.

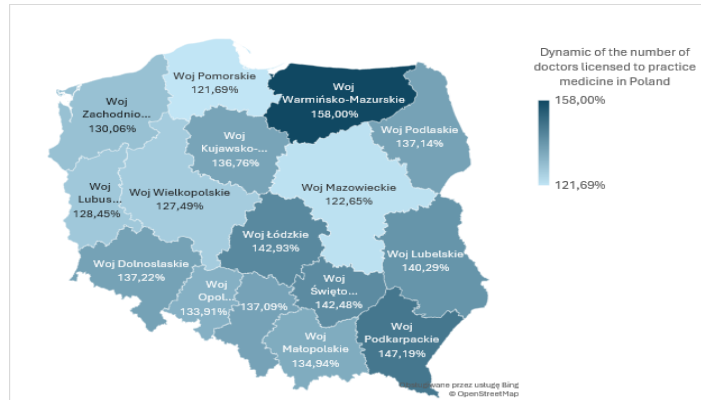
In the third stage, effect sizes (Cohen's *d* and Hedges' *g*) were calculated to determine the strength of the observed differences. The effect sizes allowed for an assessment of the practical significance of the changes, regardless of their statistical significance.

The analysis was supplemented with a spatial layer, creating a map (Map 1) showing the variation in dynamic trends in the number of doctors per 10,000 inhabitants by province. Additionally, the chart (Chart 1) shows the average rate of change for individual periods, which provides a synthetic depiction of the nature of the changes.

The statistical procedures and spatial analysis provided a comprehensive picture of changes in the number of doctors in Poland, enabling an assessment of the pandemic's impact on their dynamics.

### 4. Results

The map shows the spatial variation in the number of doctors licensed to practice medicine per 10,000 inhabitants in Poland from 2005 to 2024. The distribution of values indicates that the growth rate in the number of doctors was not uniform across the country. Some provinces experienced higher growth in the availability of healthcare professionals, while in other regions the growth rate has remained low or stable. These differences provide important background for further analysis of the pandemic's impact on the rate of change in the number of doctors over specific periods.



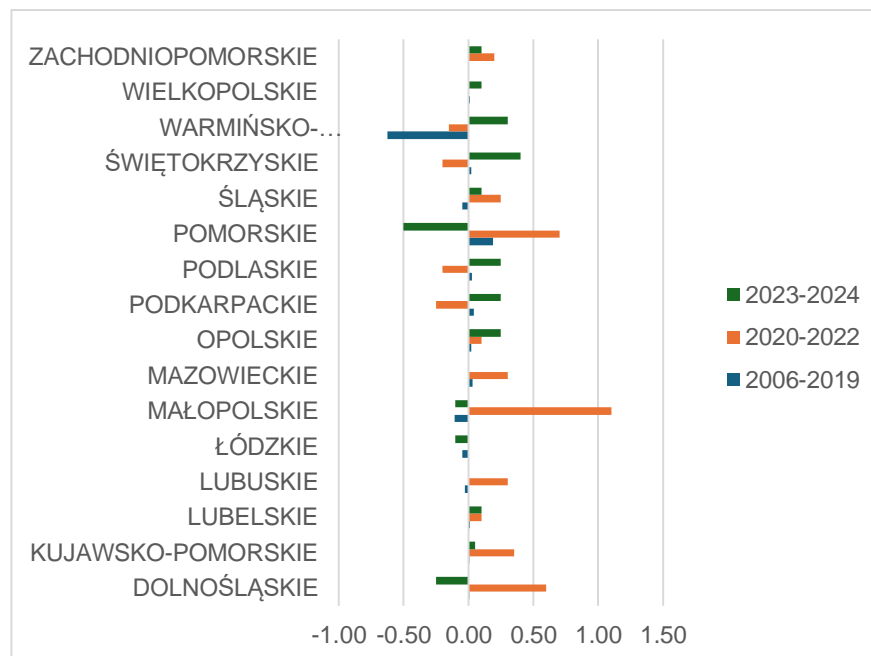
Map 1. Dynamics of the number of doctors per 10,000 inhabitants in 2005–2024 by province  
 Source: Own study based on data from Statistics Poland

Table 1 contains descriptive statistics for the three periods analysed. Key observations:

- **2006–2019:** the average annual rate of change was negative (-0.030416), indicating stagnation or a minimal decline in growth.
- **2020–2022:** during the pandemic, the rate increased to 0.200000, which is a rapid growth.
- **2023–2024:** after the pandemic, the highest rate of 0.593750 was achieved, confirming the further acceleration of change.

Standard deviations indicate greater variation in these dynamics during the pandemic than before it.

Chart 1. Average annual rate of change in the number of doctors licensed to practice medicine per 10,000 populations in 2006–2019, 2020–2022, 2023–2024 by province



Source: Own study based on data from Statistics Poland

**Table. 1.** Average annual rate of change

| Average annual rate of change | Mean      | Standard deviation | N  |
|-------------------------------|-----------|--------------------|----|
| (AARC) 2006–2019              | -0.030416 | 0.170071           | 16 |
| (AARC) 2020–2022              | 0.200000  | 0.366060           | 16 |
| (AARC) 2023–2024              | 0.593750  | 0.224513           | 16 |

*Source:* Own study based on data from Statistics Poland

**Table.2** Test for dependent samples

| Average annual Rate of change         | Mean      | Standard deviation | Standard error of the T | df     | Significance | Significance two-tailed P |       |
|---------------------------------------|-----------|--------------------|-------------------------|--------|--------------|---------------------------|-------|
| (AARC) 2006–2019 and (AARC) 2020–2022 | -0.230416 | 0.371770           | 0.929425                | -2.479 | 15           | 0.013                     | 0.026 |
| (AARC) 2020–2022 and (AARC) 2023–2024 | 0.140625  | 0.556542           | 0.139135                | 1.011  | 15           | 0.164                     | 0.328 |

*Source:* Own study based on data from Statistics Poland

**Table. 3** Effect sizes for dependent samples

| Average annual rate of change         | Cohen's D | Hedges' g |
|---------------------------------------|-----------|-----------|
| (AARC) 2006–2019 and (AARC) 2020–2022 | -0.620    | -0.588    |
| (AARC) 2020–2022 and (AARC) 2023–2024 | 0.253     | 0.240     |

*Source:* Own study based on data from Statistics Poland

The question was whether the pandemic had changed the observed trends in the rate of change in the number of doctors licensed to practice medicine at the onset of the pandemic. It was proven that the average annual rate before the pandemic (-0.030416) was lower than during the pandemic (0.200000). The dependent t-test analysis showed that this difference was statistically significant:  $t(15) = -2.479$ ;  $p = 0.026$ . Cohen's d of -0.620 indicates a moderate effect size, suggesting that there is a correlation between the onset of the pandemic and an increase in the dynamics of change during the pandemic (Chart 1, Tables 1, 2, 3) (Bedyńska, Brzezicka 2007).

The question was whether the pandemic changed the trends examined, specifically the variation in the rate of change in the number of doctors licensed to practice medicine at the end of the pandemic. It was shown that the average annual rate of change during the pandemic (0.2) was lower than after the pandemic (0.593750). The dependent t-test analysis showed that this difference was not statistically significant:  $t(15) = 1.011$ ;  $p = 0.328$ . Cohen's d of 0.253 indicates a small effect size, so there is little correlation between the pandemic and the increase in the dynamics of change after the pandemic (Chart 1, Tables 1, 2, 3) (Bedyńska, Brzezicka 2007).

## 5. Discussion

The results clearly indicate that the COVID-19 pandemic was a turning point in the dynamics of change in the number of doctors licensed to practice medicine in Poland. In the pre-pandemic period (2006–2019), stagnation was observed, with a slight negative average annual rate of change, confirming earlier findings regarding growing staffing problems in the healthcare system. This situation may have been caused by years of neglect in human resource planning. The

increasing emigration of doctors and the limited number of medical graduates may also have significantly contributed to this.

The COVID-19 pandemic has clearly changed this trend. A statistically significant increase in the average annual rate of change in 2020–2022, confirmed by a dependent sample test and the average effect size, suggests that the health crisis caused by mass COVID-19 infections has become a powerful stimulus for mobilising the healthcare system. It can be assumed that this process was influenced both by ad hoc measures, such as simplifying administrative procedures, speeding up the recognition of foreign doctors' medical qualifications and encouraging retired doctors to return to work, as well as by an increase in social and institutional demand for healthcare services.

At the same time, it is worth noting regional variation in the dynamics of change, as evidenced by the spatial analysis. The uneven growth in the number of doctors across provinces indicates that the pandemic did not have a uniform impact on processes occurring in different regions of Poland. This may be due to differences in the attractiveness of the labour market, the level of urbanisation, the availability of academic facilities or medical infrastructure. As a result, the pandemic may have helped reduce staffing shortages in some regions, while in others it has perpetuated or even exacerbated existing disparities.

An analysis of the post-pandemic period (2023–2024) revealed clear differences. Although a further increase in the average annual rate of change was observed, the difference relative to the pandemic period was no longer statistically significant, and the effect size was small. This may suggest that the acceleration observed after the pandemic is largely due to the continuity of recovery processes initiated during the crisis, rather than to a qualitatively different stage of development.

These results have important implications for health policy. They show that a rapid increase in the number of doctors is possible, but only with strong state support, i.e. through systemic and institutional changes. At the same time, the lack of significant changes in dynamics after the pandemic indicates that, without lasting structural reforms, there is a risk of a renewed slowdown in growth. Another important factor influencing such changes is the introduction of appropriate legislative measures, i.e. laws and regulations. Future research could include qualitative analyses or microeconomic data to better understand the sustainability of the observed trends.

To conclude, the analysis of the results and studies confirms that the COVID-19 pandemic influenced the dynamics of growth in the number of doctors in Poland. However, without state support and systemic solutions appropriate to the situation, its long-term impact remains limited. These results confirm the need for long-term planning for training healthcare professionals.

## **6. Conclusion**

The analysis enabled an assessment of whether the COVID-19 pandemic affected the rate of change in the number of doctors licensed to practice medicine in Poland. The results clearly indicate that the pandemic period was a turning point at which previous trends underwent a marked change. Between 2006 and 2019, the number of doctors grew at a slow, negative rate, indicating stagnation or a slight decline in healthcare personnel resources. Only the onset of the pandemic caused a statistically significant increase in the rate of change, as confirmed by a dependent t-test.

A marked acceleration in growth was observed between 2020 and 2022, which may reflect actions taken by the healthcare system in response to the pandemic, such as intensifying doctor registration, encouraging them to return to the profession, or increasing the influx of foreign

doctors. After the pandemic, the growth rate of the number of doctors increased again, reaching its highest level during the period under review, but the difference relative to the pandemic period was not statistically significant, and the effect was minor.

Spatial analysis of the map confirmed that the dynamics of change varied across regions, indicating that the impact of the pandemic was not uniform across Poland. The results of the analyses, therefore, provide important grounds for further research into the structural factors that may have influenced the increase in the number of doctors in individual provinces.

In summary, the COVID-19 pandemic has significantly affected the dynamics of change in the number of practising doctors, resulting in a noticeable acceleration of these processes. Although the upward trend continued after the pandemic, its scale does not suggest any significant change compared to the pandemic period. These results emphasise that the health crisis has become a factor mobilising the healthcare system to intensify efforts to increase healthcare personnel resources.

The findings of this article may be used for economic purposes in health policy planning, forecasting the costs of operating the healthcare system, and making decisions regarding the allocation of financial and human resources at the national and regional levels.

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