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Article

Healthcare sectors in EU countries: Their impact on employment and infrastructure development

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Abstract: This scientific study aims to thoroughly assess the current status and evaluate key indicators influencing healthcare and the workforce in selected European Union (EU) member states. Building upon this ambitious research agenda, we focused on a comprehensive descriptive analysis of selected indicators within the healthcare sector, including healthcare financing schemes, overall employment in healthcare and social care, the number of graduates in healthcare (including physicians and general practitioners), as well as migration patterns within the healthcare sector. The data forming the basis of this analysis were systematically gathered from Organization for Economic Co-operation and Development (OECD) and Eurostat databases. Subsequently, we conducted a robust correlation analysis to explore the intricate relationships among these indicators. Our research endeavour aimed to identify and quantify the impact of these indicators on each other, with a focus on their implications for overall healthcare and the workforce in the respective countries. Based on the findings obtained, we derived several significant conclusions and recommendations. For instance, we identified that increasing employment in the healthcare sector may be associated with the overall quality of healthcare provision in a given country. These findings have important implications for policymaking and decision-making at the EU level. Therefore, we recommend that policymakers in these countries consider implementing measures to further develop the healthcare sector while also helping to retain and attract qualified professionals in the healthcare industry. Such recommendations could include improving healthcare infrastructure, incentivizing professional education and further training in the healthcare sector, and implementing policies to support healthcare provision more broadly.

Keywords: healthcare; healthcare employment; comparison; correlation analysis

1. Introduction

Healthcare sectors in European Union countries represent a crucial component of modern society. Their significance extends beyond providing healthcare to citizens, encompassing a broader influence on the economy, employment, and infrastructure development. These sectors play an irreplaceable role in ensuring quality care and promoting the overall quality of life in the EU. As major employers, they significantly impact the livelihoods of many individuals and shape the dynamics of the labor market. Moreover, their development directly affects infrastructural capacities, thereby influencing the accessibility and quality of services provided.

Addressing this issue is essential for several reasons. Firstly, healthcare is fundamental to the health and quality of life of the population, underscoring the importance of monitoring and supporting its development. Secondly, these sectors

have a significant economic impact, with their condition affecting the overall stability and prosperity of society. Thirdly, in today's world, there is an increasing emphasis on sustainable development and corporate social responsibility, highlighting the importance of examining and implementing environmental, social, and governance (ESG) factors within healthcare sectors.

Understanding the significance and role of healthcare sectors in the EU is crucial for the future development of society and ensuring quality care for all citizens. Analyzing these areas and seeking optimal solutions can lead to improvements in various aspects and contribute to the overall well-being and sustainable development of the European Union.

The integration of environmental, social, and governance (ESG) factors in the healthcare sector has become a subject of growing interest, reflecting a broader trend towards incorporating sustainability principles into organizational practices. Recent research has emphasized the potential impact of ESG activities on various aspects of Sustainable Development Goal (SDG) assessment, particularly concerning financial performance (Kalia and Aggarwal, 2022). Studies have demonstrated a positive correlation between ESG practices and the financial performance of healthcare companies in developed economies, although this correlation may vary in developing economies.

Furthermore, it has been observed that the influence of ESG factors on investment attractiveness varies across different industries, with the healthcare sector showing significant potential for performance improvement (Nazarova and Lavrova, 2022). This underscores the importance of integrating ESG aspects into the operations of healthcare facilities to promote sustainable growth and maximize impact.

In addition to financial implications, ESG measures are increasingly recognized for their role in promoting gender diversity and equality within healthcare organizations. Research focusing on the representation of women at various organizational levels has highlighted the importance of implementing ESG measures to address disparities and create an inclusive environment (Cho et al., 2020). By prioritizing gender diversity and equality, healthcare organizations can enhance their effectiveness and contribute to broader societal goals of inclusivity and social justice.

In the context of the healthcare workforce, understanding the impact of ESG factors becomes imperative, as they play a crucial role in shaping job satisfaction, organizational commitment, and overall staff well-being. Research has emphasized the significance of transformational leadership in enhancing medical staff job satisfaction and organizational commitment, thereby contributing to enhanced productivity, quality of healthcare services, and patient safety (Hussain and Khayat, 2021). Additionally, the challenges highlighted by the COVID-19 pandemic underscore the importance of early interventions to address concerns regarding job satisfaction, life satisfaction, and turnover intention among healthcare staff (Zhang et al., 2020).

Moreover, patient satisfaction and the quality of healthcare services are intricately linked to ESG-related factors. As patient satisfaction rises, it fosters trust between patients and medical staff, ultimately leading to heightened satisfaction among healthcare workers with their work (Gavurova et al., 2021). Furthermore, maintaining sustained communication with patients is identified as critical for the safe

and effective management of medical procedures, underscoring the significance of effective communication processes in healthcare delivery (Mitchell et al., 2020). This interconnectedness highlights the multidimensional impact of ESG factors across various facets of the healthcare sector.

The intricate relationship between patient satisfaction and healthcare quality underscores the importance of factors associated with ESG in shaping various aspects of the healthcare sector. As emphasized by Gavurova et al. (2021), patient satisfaction not only enhances trust between patients and healthcare personnel but also contributes to higher satisfaction among healthcare workers with their work. This interconnectedness highlights the multifaceted impact of ESG factors, extending far beyond financial considerations and encompassing both workforce well-being and patient-centered care.

In line with these principles, the sustainability of quality improvement initiatives within healthcare organizations becomes pivotal, as emphasized by Alasmari et al. (2021). Understanding the institutional characteristics that influence the implementation of these initiatives is essential given their impacts on healthcare delivery and quality improvement practices (Belostotsky et al., 2020). Additionally, Ghag et al. (2021) elucidated the importance of integrating key sustainability components into the implementation process to enhance the resilience of local educational programs and embed them within broader healthcare systems.

The holistic approach outlined not only addresses the immediate challenges faced by healthcare organizations but also ensures the long-term sustainability of interventions, thus alleviating the strain on limited resources and funding. Integrating environmental, social, and governance (ESG) factors into healthcare management is pivotal in this regard. From the perspective of ESG, particularly crucial are the social and governance aspects within this sector. The current landscape of human resources (HR) in healthcare is significantly influenced by a myriad of factors and practices shaping the industry. Numerous studies have delved into different facets of human resource management (HRM) in healthcare, offering valuable insights into this ever-evolving sector. By incorporating ESG principles into HRM practices, organizations can foster a culture of sustainability, thereby shaping the future of healthcare delivery and organizational management comprehensively.

Another noteworthy trend in healthcare sector management involves the adoption of lean strategies specifically tailored for human resource management (HRM). This strategic approach targets the optimization of HR processes to boost efficiency and effectiveness within healthcare organizations (Bektaş and Kiper, 2021). The emphasis on lean strategies underscores the ongoing efforts to refine HR practices and streamline operations to enhance the overall delivery of healthcare services.

Another emerging trend in healthcare sector management is the influence of green human resource management practices on sustainable performance within healthcare organizations. This conceptual framework underscores the necessity of environmentally sustainable HR practices in healthcare, mirroring the increasing emphasis on environmental responsibility within the industry (Mousa and Othman, 2020).

The COVID-19 pandemic has not only reshaped healthcare delivery but has also profoundly influenced human resource management practices within the sector. There

has been a notable emphasis on understanding telework preferences and determinants, as well as recognizing the pivotal role of HRM in bolstering organizational resilience and productivity amidst the pandemic (Al-Taweel, 2021; Elsafty and Ragheb, 2021; Jones et al., 2023). This global health crisis has catalyzed a transformation in work dynamics, underscoring the necessity of adapting HR practices to safeguard employee well-being and ensure organizational continuity.

Moreover, for services assessing, they encompass a wide array of factors that influence the management and allocation of healthcare personnel. The healthcare sector is experiencing rapid changes due to evolving healthcare systems, patient care demands, and the impact of global factors such as technology and globalization (Surji and Sourchi, 2020). The role of human resource management in health care is essential for facilitating optimal healthcare services and ensuring higher quality patient care (Surji and Sourchi, 2020). Additionally, the demand for healthcare services is increasing, leading to the need for strategic human resource management to address staffing challenges and workload imbalances (Yanchus et al., 2017).

In this context, nurse staffing and skill mix become critical considerations for healthcare outcomes, drawing attention from policymakers and hospital leaders due to their direct impact on care quality (Lankshear et al., 2005; Robinson et al., 2016). Furthermore, the COVID-19 pandemic has exacerbated existing challenges in human resource management within healthcare organizations, accentuating the importance of strategic HR practices for maintaining healthcare providers' satisfaction and effective management during times of turmoil (Eftimov and Bozhinovska, 2021).

Furthermore, effective healthcare human resources planning is crucial not only to tackle the challenges mentioned earlier but also to address the unequal distribution of healthcare human resources and to meet the escalating demand for healthcare services (Asamani et al., 2018; Roj, 2020). The equitable allocation of healthcare budgets and resources is paramount in mitigating the disease burden and ensuring consistent healthcare delivery (Bagepally et al., 2022). Additionally, the variation in staffing levels and skill mixes across different healthcare units presents an opportunity for optimizing staffing distribution to enhance patient outcomes (Sharma et al., 2016).

Moreover, the management of chronic diseases and its implications for the healthcare workforce remain a significant concern. A substantial portion of healthcare expenditures is attributed to chronic conditions (Gibbs and Sabine, 2022; Holman, 2020), underscoring the necessity for healthcare HRM to effectively address the challenges posed by the prevalence of chronic diseases and their impact on healthcare delivery. These challenges highlight the importance of strategic workforce planning and resource allocation in ensuring the sustainability and effectiveness of healthcare systems.

Additionally, the integration of Human Resource Information Systems (HRIS) into the healthcare system has garnered significant attention in research, shedding light on the advantages and consequences of HRIS implementation on workforce management, employee retention, and decision-making within healthcare environments (Udekwe et al., 2021). As data and technology play an increasingly vital role in healthcare systems, comprehending the utilization of existing data can be instrumental in optimizing healthcare information systems towards the establishment of a learning healthcare system (Wong et al., 2023).

Furthermore, the adoption of HRIS offers opportunities for streamlining HR processes, enhancing workforce efficiency, and facilitating evidence-based decision-making in healthcare organizations. By harnessing the power of HRIS, healthcare institutions can better manage their human capital, identify talent gaps, and implement targeted interventions to improve employee satisfaction and retention rates. Moreover, the integration of HRIS with other healthcare information systems enables seamless data exchange and interoperability, fostering a more holistic approach to healthcare management and delivery. As such, the effective utilization of HRIS holds the potential to revolutionize HR practices and drive positive outcomes across the healthcare continuum.

The current landscape of healthcare organizations underscores the critical need to effectively manage diversity through the implementation of strategies that prioritize diversity, equity, and inclusion (DEI) within their operations. Recognizing the paramount importance of DEI in healthcare, particularly in building effective healthcare teams to deliver quality patient care, has become increasingly evident (Powell et al., 2023). The heightened awareness of systemic racism and health disparities has spurred healthcare organizations to establish and fortify approaches to inclusion, diversity, equity, and accessibility (IDEA) (Mullin et al., 2021).

Incorporating systems and support tailored to address the unique needs of their diverse workforce is essential for healthcare organizations (Byers et al., 2021). Academic medical centers and healthcare institutions have responded to the imperative for equity, diversity, and inclusion (EDI) by formulating crucial guidelines aimed at mitigating the impacts of bias, discrimination, and racism on healthcare access and delivery (Ward et al., 2023).

Healthcare is a cornerstone of modern society, with its influence extending beyond mere citizen care. It encompasses economic, employment, and infrastructural aspects, impacting the quality of life and playing an indispensable role in ensuring quality care and overall well-being in the EU. The development of healthcare sectors directly affects infrastructural capacities, accessibility, and the quality of services provided. Ensuring quality care is fundamental to the health and standard of living of the population, hence the importance of monitoring and supporting its development. The economic impact of healthcare influences the stability and prosperity of society. In today's world, there is an increasing emphasis on sustainable development and corporate social responsibility, underscoring the significance of exploring and implementing ESG factors in healthcare sectors. Understanding the significance and role of healthcare sectors in the EU is crucial for the future development of society and ensuring quality care for all citizens. Analyzing these areas and seeking optimal solutions can lead to improvements in various aspects and contribute to the overall well-being and sustainable development of the European Union.

The paper is organized as follows: it begins with an introduction, followed by a methodology section detailing the data and methods used. The third section presents the results of the study, while the fourth section delves into the discussion. Finally, the conclusion summarizes the key findings of the paper.

2. Materials and methods

The second section of this paper delineates the methodology employed. The aim of this scientific study is to thoroughly assess the current status and evaluate key indicators influencing healthcare and the workforce in selected European Union (EU) member states. Secondary data were garnered from the OECD and Eurostat portals, focusing on essential indicators pertinent to the healthcare and workforce sectors. Specifically, data from the OECD (OECD Stat, 2023) portal were chosen for indicators such as healthcare financing as a share of GDP, total health and social care employment per 1000 inhabitants, general practitioners, and population density. Additionally, data were sourced from the Eurostat portal for indicators including medical graduates per 100,000 population and workforce migration - doctors. The selection of these portals was predicated on the availability of comprehensive and reliable data, facilitating detailed analysis within this domain.

These indicators are paramount to our study, furnishing indispensable insights into the healthcare and workforce landscape of EU member states. For instance, healthcare financing, delineated by its share of GDP, directly influences service availability and quality. Similarly, data on total healthcare workers and general practitioner density provide valuable insights into personnel distribution across the populace. Moreover, information on medical graduates and doctor migration patterns aids in understanding education and workforce dynamics within the healthcare sector, pivotal for future planning. Thus, these indicators play a pivotal role in our comprehensive assessment of the healthcare system and workforce in the EU.

The methodology section encompasses descriptive statistics, comparison of individual data, and subsequent basic statistical analyses among selected indicators, constituting an integral part of this study. These fundamental statistics entail conducting correlation analyses among selected indicators and subsequently testing their significance levels using the *F*-test and *t*-test. These methodologies were chosen for their interconnectedness and relevance in evaluating the healthcare and social sectors. For instance, analyzing the correlation between total healthcare and social care employment and the number of general practitioners is crucial for understanding personnel distribution. Likewise, comparing total employment in healthcare and social care in hospitals with the number of medical graduates helps discern trends in education and the labor market, vital for anticipating future healthcare workforce needs. Such an approach fosters a profound and comprehensive comprehension of the dynamics and interactions among various facets of healthcare and the workforce.

One of the possible analytical approaches used to address the issue is correlation analysis. Correlation is a measure of the relationship between two or more statistical variables and can be assessed in various ways, depending on the type of variables involved. One of the most commonly used correlation coefficients is Pearson's correlation coefficient. The selection correlation coefficient is given by:

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \overline{y})^2}} \quad (1)$$

The values of the Pearson correlation coefficient are in the range [−1, 1]. Boundary values indicate a perfect linear relationship. The values of the correlation

coefficient can be verified by a statistical test. In the case of the *t*-test, the null hypothesis is tested, which is the assertion that the selection comes from the two-dimensional normal distribution in which a correlation coefficient of zero (e.g., Hebak et al. (2007), Hendl (2004)). The test statistic is then defined as follows:

$$t = r_{xy}\sqrt{\frac{n-2}{1-r_{xy}^2}} \quad (2)$$

where it has a distribution t of $n - 2$ degrees of freedom, where n is the number of pairs (x_i, y_i). The meaning of the resulting values of the correlation coefficients is as follows:

$p(x,y) = 1$—there is perfect direct dependence between the quantities x and y;
$p(x,y) = 0$—quantities x and y are not correlated;
$p(x,y) = -1$—there is a perfect inverse relation between the quantities x and y.

3. Results

The following section (section 3) delves into the results of this paper. This mentioned section is divided into two parts, where in the first part of the section 3.1., the authors of the paper focused on the descriptive statistics of the selected indicators. Another subsection, namely 3.2., pays attention to the statistical calculations that were discussed in the previous section (see section 2).

3.1. Selected secondary data on health indicators in EU countries

The **Table 1** below examines the healthcare financing system in EU countries from 2015 to 2021. This indicator reflects the proportion of GDP allocated to healthcare expenditures, encompassing all providers. Analysis of the data reveals that the highest share of GDP during the study period was primarily observed in Germany (i), France (ii), Austria (iii), and Sweden (iv). Conversely, the lowest values were predominantly recorded in Romania (i), Luxembourg (ii), and Poland (iii). Recent estimates indicate a decrease in the average ratio of OECD health expenditure to GDP, declining from its peak of 9.7% during the height of the pandemic in 2021 (OECD, 2023).

Table 1. Healthcare financing scheme as a share of GDP in EU countries (Source: OECD, own processing).

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Austria	10.37	10.35	10.38	10.35	10.49	11.39	12.1
Belgium	10.8	10.79	10.8	10.86	10.8	11.2	11.04
Bulgaria	7.39	7.46	7.49	7.33	7.09	8.48	8.56
Croatia	6.69	6.73	6.66	6.75	6.8	7.73	8.1
Cyprus	6.79	6.65	6.62	6.83	7.07	8.41	9.43
Czechia	7.37	7.45	7.38	7.47	7.6	9.21	9.49
Denmark	10.33	10.24	10.1	10.1	10.15	10.56	10.82
Estonia	6.64	6.7	6.6	6.69	6.82	7.58	7.49
Finland	9.65	9.38	9.13	9.04	9.17	9.63	10.25

Table 1. (*Continued*).

	2015	2016	2017	2018	2019	2020	2021
France	11.45	11.47	11.36	11.21	11.09	12.13	12.31
Germany	11.19	11.24	11.34	11.48	11.72	12.69	12.93
Greece	8.22	8.45	8.14	8.12	8.2	9.5	9.17
Hungary	6.85	6.99	6.74	6.58	6.28	7.29	7.38
Ireland	7.34	7.47	7.13	6.88	6.71	7.11	6.72
Italy	8.86	8.73	8.68	8.68	8.66	9.63	9.38
Latvia	5.65	6.13	5.97	6.19	6.61	7.24	9.05
Lithuania	6.49	6.64	6.46	6.53	6.99	7.48	7.82
Luxembourg	5.08	5.07	5.14	5.28	5.47	5.74	5.67
Malta	8.9	8.97	8.73	8.57	9.15	10.75	N/A
Netherlands	10.32	10.29	10.11	10.02	10.14	11.21	11.29
Poland	6.4	6.57	6.58	6.31	6.46	6.5	6.44
Portugal	9.32	9.39	9.31	9.41	9.51	10.55	11.14
Romania	4.94	5.08	5.19	5.52	5.71	6.23	6.48
Slovakia	6.76	6.97	6.76	6.67	6.92	7.13	7.75
Slovenia	8.52	8.48	8.19	8.28	8.5	9.43	9.48
Spain	9.12	8.95	8.95	9	9.15	10.75	10.74
Sweden	10.8	10.85	10.79	10.94	10.83	11.33	11.25

The **Table 2** focuses on total healthcare and social care employment in selected European Union countries from 2010 to 2021 (n = 12), displaying values per density of 1000 inhabitants. Analysis of this indicator reveals the highest density during the study period primarily in Denmark (i), Sweden (ii), Norway (iii), and the Netherlands (iv), while the lowest values are observed in Romania (i), Greece (ii), Latvia (iii), and Slovakia (iv).

Table 2. Total health and social employment based on density per 1000 inhabitants (number of inhabitants) (Source: OECD, own processing).

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	47.86	48.53	49.19	49.52	49.83	50.74	51.09	51.99	52.69	52.53	53.17	55.06
Belgium	48.55	49.46	50.28	50.87	51.55	52.37	53.41	54.65	55.46	56.39	56.94	57.62
Czechia	28.58	29.47	29.9	30.11	30.78	30.98	31.71	32.51	33.29	33.41	34.51	35.88
Denmark	94.27	92.09	90.67	91.01	90.02	89.03	88.34	88.64	89.41	90.12	91.06	94.76
Estonia	25.39	25.7	26.33	27.34	28.64	29.34	29.18	29.54	30.25	30.12	30.08	30.96
Finland	69.36	70.89	72.48	72.79	72.73	73.44	74.21	75.14	77.35	80.16	80.17	84.41
France	55.91	56.67	57.02	57.43	57.83	58.14	58.3	58.43	58.3	58.36	58.68	59.54
Germany	59.61	61.85	63.24	64.38	65.66	67.24	68.99	70.31	71.45	72.67	73.87	75.34
Greece	21.57	21.45	21.66	22.32	22.9	22.53	23.47	23.36	24.14	25.06	25.74	26.8
Hungary	26.53	27.72	27.28	28.29	29.63	30.13	31.1	31.06	31.97	32.61	33.22	33.33
Ireland	55.26	55.58	55.83	56.29	56.64	57.3	57.51	58.29	58.24	58.81	57.65	61.01
Italy	29.35	29.92	30.18	30.16	30.5	31.07	31.68	32.09	32.73	33.19	33.75	33.96

Table 2. (*Continued*).

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Latvia	21.57	22.69	23.98	23.62	23.37	23.89	24.61	25.17	25.66	26.3	26.98	28.1
Lithuania	28.29	28.85	28.61	28.66	28.88	30.91	32.13	32.73	33.66	35.59	34.59	N/A
Luxembourg	63.06	65.47	68.14	71.41	72.4	73.46	73.77	75.39	76.52	78.39	79.99	80.47
Netherlands	83.9	85.07	85.71	84.92	82.83	81.35	80.8	81.9	83.51	86.08	87.78	89.72
Poland	23.66	23.34	23.74	24.66	24.56	24.85	25.41	25.76	25.82	25.88	26.48	29.08
Portugal	32.5	33.17	33.25	33.56	34.48	35.27	36.7	37.96	38.92	39.43	40.4	41.67
Romania	17.99	18.02	17.28	17.27	18.04	19.07	19.28	20.39	20.61	21.4	21.32	21.52
Slovakia	22.87	23.15	23.05	22.9	23.8	24.13	24.78	25.12	25.05	25.68	26.03	26.32
Slovenia	26.75	27.23	27.93	28	28.2	28.76	29.87	30.81	31.59	32.19	33.12	34.72
Spain	28.5	28.95	28.03	27.76	28.64	29.19	30.16	31.17	31.98	32.8	32.58	35.08
Sweden	78.48	79.48	78.58	79.16	80.14	82.46	84.95	83.62	83.83	82.79	82.39	96.78

According to the OECD (2021), healthcare and social care systems in OECD countries have experienced unprecedented growth in employment. In 2019, one in ten jobs (10%) were in healthcare or social care, up from less than 9% in 2000. More than 15% of all jobs in healthcare and social care are found in Nordic countries and the Netherlands. Between 2000 and 2019, the share of healthcare and social care workers increased in all countries except the Slovak Republic, where it declined in 2000 and remained stable since, and Sweden, where it decreased in recent years but remains among the highest. Particularly notable is the rapid increase in the proportion of healthcare and social care workers in Ireland and Luxembourg, which increased by approximately 4 percentage points over the past two decades.

Employment in the healthcare sector and its quality are primarily influenced by the number of graduates in the healthcare sector. Based on this assumed correlation, the authors of the paper focused on the **Table 3**, which examines graduates in healthcare from selected European Union countries over a specified time period (n = 10). This indicator focuses on graduates in medical fields of the healthcare sector, with values presented in the table per 100,000 inhabitants, expressing the number of medical graduates in a given year. Nearly all OECD countries implement some form of control over admissions to medical schools, often by limiting the number of available training positions. Maintaining or increasing the number of doctors requires either investing in the training of new doctors or recruiting trained doctors from abroad. Since it takes approximately ten years to train a doctor, any current shortage can only be addressed by recruiting qualified doctors from abroad if there are no unemployed doctors domestically. Conversely, an excess or sudden drop in demand could mean that new graduates will struggle to find vacancies domestically. Medical graduates are defined as the number of students who graduated from medical schools or similar institutions in a given year. Graduates of dentistry, public health, and epidemiology are excluded. This indicator is measured per 100,000 inhabitants. Further details on this indicator can be obtained through OECD (2023). The exclusion of graduates in dentistry, public health, and epidemiology from the definition of medical graduates may be based on the specific objectives and focus of your analysis, ensuring relevant results for the given area. Different educational programs and

professional skills of these graduates compared to medical graduates may justify their exclusion, allowing the analysis to better focus on relevant aspects of medical education. Such limitations in the scope of analysis can contribute to easier interpretation of results and achievement of research goals. The data presented in the table below are primarily influenced by data availability obtained within the Eurostat portal. From the availability of complete data presented in the table, it can be noted that the highest share of the indicator is reported in Malta (i), Ireland (ii), and Romania (iii). It should be noted that the order is influenced by available data. The order of the lowest values of the indicator will not be provided in this table.

Table 3. Medical graduates (doctors) per 100,000 population (Source: Eurostat, own processing).

	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Austria	13.8	14.73	14.52	13.94	14.19	15.23	13.99	14.44	16.25	N/A
Belgium	10.54	11.5	12.05	14.24	14.8	28.72	17.58	16.61	16.38	15.78
Bulgaria	9.51	10.69	11.66	12.05	14.87	15.69	19.35	20.39	22.74	N/A
Croatia	10.46	15.01	12.19	14.55	14.02	15.33	16.94	16.73	16.56	N/A
Cyprus	0	0	0	0	0	0	5.1	8.63	11	N/A
Czechia	12.73	13.99	13.56	15.1	17.13	15.99	16.1	16.72	17.04	N/A
Denmark	15.1	14.46	17.05	21.47	22.22	23.04	21.22	22.02	N/A	N/A
Estonia	9.71	10.57	10.11	11.02	11.46	10.29	10.4	10.38	11.8	12.31
Finland	10.37	11.65	11.41	12.03	10.42	11.69	11.9	12.19	N/A	N/A
France	7.65	8.09	9.05	9.46	10.84	9.52	9.97	11.96	N/A	N/A
Germany	12.15	11.85	11.28	11.71	12.01	11.53	12.32	12.03	12.4	N/A
Greece	9.32	8.91	10.74	10.22	12.4	12.52	13.51	13.69	N/A	N/A
Hungary	14.2	13.65	13.4	14.14	14.41	15.96	15.76	15.71	16.21	N/A
Ireland	20.13	21.66	23.54	24.44	24.88	25.76	24.83	25.43	26.03	N/A
Italy	11.13	11.48	12.35	13.25	15.07	16.84	17.6	18.86	18.24	N/A
Latvia	13.46	14.04	16.18	16.33	17.35	22.21	23.51	23.89	27.33	27.56
Lithuania	14.81	14.63	16.39	16.11	19.27	19.77	19.76	20.43	20.39	N/A
Luxembourg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malta	20.19	25.77	24.49	22.62	32.91	33.84	33.53	26	25.07	N/A
Netherlands	14.4	14.53	14.64	15.33	15.94	15.78	15.11	14.33	15.46	N/A
Poland	9.88	9.7	10.24	10.49	10.95	10.55	11.97	12.24	13.42	N/A
Portugal	13.64	14.94	15.85	16.44	16.09	17.11	15.84	15.72	16.29	N/A
Romania	14.83	17.56	19.64	22.17	23.53	26.07	25.64	26.3	26.18	N/A
Slovakia	15.94	13.51	15.63	16.04	16.88	17.66	18.04	19.8	19.17	N/A
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.95	N/A
Spain	10.23	11.99	13.03	13.39	14.48	14.24	13.95	13.93	14.17	N/A
Sweden	10.28	11.25	12.41	11.98	12.74	13.11	13.47	13.57	14.15	N/A

Table 4 provides an overview of the density of general practitioners per 1000 inhabitants spanning a 12-year period (n = 12). It's important to note that these values are influenced by data availability, which may vary across different countries. Notably, Austria (i) stands out with the highest indicator value, underscoring its robust

healthcare infrastructure, while Poland (i) shows the lowest density, indicating potential healthcare resource challenges in the country.

Table 4. General practitioners, density per 1000 inhabitants (number of inhabitants) (Source: OECD, own processing).

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	4.77	4.82	4.87	4.96	5.02	5.06	5.11	5.16	5.22	5.29	5.32	5.41
Belgium	2.92	2.92	2.93	2.96	2.98	3.02	3.07	3.08	3.13	3.16	3.21	3.25
Bulgaria	3.77	3.85	3.87	3.95	3.98	4.04	4.11	4.18	4.22	4.24	4.28	4.3
Croatia	2.86	2.92	2.99	3.03	3.14	3.19	3.24	3.36	3.44	3.52	3.52	3.71
Czechia	3.6	3.64	3.67	3.69	N/A	N/A	N/A	N/A	4.04	4.07	4.1	4.26
Denmark	3.73	3.79	3.84	3.85	3.88	3.93	4	4.11	4.2	4.25	4.38	N/A
Estonia	3.24	3.29	3.28	3.33	3.36	3.41	3.46	3.47	3.48	3.47	3.48	3.43
Finland	3.18	3.26	3.26	3.33	3.38	3.41	3.42	3.47	3.49	3.57	3.61	N/A
France	3.04	3.06	3.07	3.09	3.09	3.11	3.12	3.14	3.14	3.16	3.17	3.18
Germany	3.71	3.88	3.95	4.04	4.11	4.14	4.19	4.25	4.31	4.4	4.47	4.53
Hungary	2.87	2.96	3.09	3.21	3.32	3.1	3.21	3.32	3.38	3.49	3.14	3.3
Ireland	N/A	2.67	2.71	2.67	3.01	3.12	3.19	3.26	3.28	3.32	3.46	4.02
Italy	3.82	3.9	3.87	3.9	3.88	3.84	3.95	3.99	3.98	4.05	4	4.1
Latvia	3.11	3.13	3.14	3.19	3.22	3.2	3.21	3.21	3.3	3.27	3.34	3.36
Lithuania	3.95	4.1	4.22	4.28	4.31	4.34	4.47	4.56	4.6	4.57	4.48	4.47
Luxembourg	2.77	2.78	2.81	2.83	2.88	2.91	2.89	2.98	N/A	N/A	N/A	N/A
Netherlands	N/A	N/A	N/A	N/A	3.42	3.49	3.54	3.6	3.67	3.75	3.85	3.9
Poland	2.19	2.21	2.23	2.24	2.31	2.33	2.42	2.38	2.36	3.3	3.33	3.44
Romania	2.51	2.54	2.61	2.64	2.7	2.77	2.84	2.93	3.05	3.19	3.33	3.51
Slovenia	2.43	2.49	2.54	2.63	2.77	2.83	3.01	3.1	3.18	3.26	3.3	3.34
Spain	3.76	3.84	3.82	3.81	3.8	3.85	3.82	3.88	4.02	4.4	4.58	4.49
Sweden	3.81	3.89	3.97	4.04	4.11	4.17	4.23	4.27	4.32	4.29	4.32	N/A

In addition to examining trends in employment and the number of healthcare professionals across different countries, it's crucial to consider workforce migration, especially among doctors. Labor force migration within the healthcare sector provides valuable insights into the number and annual influx of foreign-trained doctors, as depicted in **Table 5** below. This phenomenon of international migration among healthcare workers is a longstanding and growing trend, influenced by various factors such as educational opportunities, working conditions, and salary disparities between countries. The COVID-19 pandemic has further accelerated this trend.

While significant migration and mobility occur within the same region or context, the increasing international recruitment of healthcare professionals from low- and middle-income countries to address shortages in high-income countries could exacerbate imbalances. Poorly managed migration of health workers from countries already facing shortages may strain their healthcare systems and deepen existing inequalities.

To address these challenges, the World Health Organization (WHO) introduced the WHO Global Code for the International Recruitment of Health Personnel in 2010.

This code aims to minimize the negative impacts of health worker migration and promote sustainable workforce practices. Regular reports on the implementation of this code help identify trends in healthcare worker mobilization and prioritize areas for action.

Table 5. Workforce migration—Doctors (number) (Source: Eurostat, own processing).

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Austria	35,842	36,772	37,685	37,651	37,963	38,252	39,207	39,694	40,471	40,957
Belgium	57,623	59,070	60,138	61,899	63,615	66,561	68,724	70,452	72,657	74,518
Bulgaria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Croatia	N/A	N/A	N/A	N/A	13,885	14,075	14,312	14,256	14,656	N/A
Cyprus	N/A	2880	3046	3209	3325	3544	3768	4163	4419	N/A
Czechia	42,174	41,671	41,893	42,682	43,283	43,951	43,994	44,388	44,932	45,506
Denmark	21,610	21,881	22,335	22,904	23,689	24,306	24,715	25,522	N/A	N/A
Estonia	6159	6293	6420	6535	6664	6786	6882	6972	7065	7161
Finland	22,055	22,439	22,774	23,097	23,326	23,469	23,718	23,916	N/A	N/A
France	203,227	205,018	206,688	208,245	210,017	210,549	213,180	214,293	215,722	N/A
Germany	326,945	334,277	339,728	346,390	352,869	359,099	367,100	373,298	378,629	N/A
Greece	63,736	63,906	63,866	65,972	65,240	65,513	66,058	66,290	66,504	N/A
Hungary	32,668	32,791	30,486	31,515	32,543	33,078	34,137	30,610	32,026	N/A
Ireland	18,160	19,066	20,454	21,920	22,693	23,012	23,574	25,005	25,959	N/A
Italy	383,886	387,405	390,702	394,906	396,007	402,811	408,442	422,333	429,552	434,631
Latvia	8317	8275	8287	8076	8022	7848	7686	6422	6406	N/A
Lithuania	N/A	14,281	14,270	14,320	14,578	14,836	13,908	13,819	13,795	14,101
Luxembourg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Malta	N/A	1566	1636	1743	1855	1969	2029	2158	2252	N/A
Netherlands	55,681	57,762	59,144	60,233	61,730	63,278	65,121	67,100	68,363	N/A
Poland	127,183	129,031	131,059	133,283	135,468	138,036	140,589	142,718	146,107	N/A
Portugal	N/A	N/A	N/A	N/A	51,937	N/A	N/A	N/A	N/A	N/A
Romania	42,179	39,858	48,412	50,697	55,603	55,716	56,465	57,845	59,150	N/A
Slovakia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Slovenia	5416	5712	5830	6012	6311	6409	6514	6645	6838	7098
Spain	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sweden	39,638	40,637	40,900	42,003	42,938	43,969	44,061	44,719	N/A	N/A

The recommendations outlined in the WHO Global Code for the International Recruitment of Health Personnel and the related WHO List of Support and Guarantees in the Health Sector until 2023 underscore the importance of investing in health system strengthening in all countries. Well-managed migration of healthcare workers can enhance their well-being and benefit healthcare systems in both source and destination countries. Additionally, it contributes to achieving Sustainable Development Goals related to health, gender equality, decent working conditions, economic growth, and reduced inequalities (WHO, 2023).

The table below highlights countries with the highest and lowest values of the

migration indicator. Italy (i) and Germany (ii) demonstrate the highest values, while Malta (i) and Cyprus (ii) exhibit the lowest values. As with previous tables, it's essential to consider data availability, which may vary depending on the overall context.

3.2. Statistical calculations based on selected indicators

For conducting statistical analysis in our study, we have chosen two main tests: the *F*-test and the *t*-test. The *F*-test is used to compare variances between groups. In our case, this means comparing the variances of indicators between different countries in the EU. We have opted for a higher significance level, typically 0.05, because higher variability among the data can lead to uncertainty in the results. On the other hand, the *t*-test focuses on comparing means between two groups. In our study, we use the *t*-test to compare average indicator values between individual countries. Means tend to be less variable than variances, so we have chosen a lower significance level, such as 0.01, to minimize the risk of Type I error and ensure a higher reliability in detecting significant differences between means. These tests will allow us to carefully analyze and interpret our data to identify significant patterns and relationships between indicators and EU countries.

Table 6. Statistical calculations based on indicators: total health and social employment and general practitioners (Source: own processing).

	The correlation coefficient	**FTEST** ***p* value**	**Significance**	**TTEST** ***p* value**	**Significance**
Austria	0.98	2.83902×10^{-9}	$p \leq 0.05$	6.86128×10^{-28}	$p < 0.01$
Belgium	0.99	1.03136×10^{-13}	$p \leq 0.05$	2.69661×10^{-25}	$p < 0.01$
Czechia	0.99	8.06881×10^{-6}	$p \leq 0.05$	4.38987×10^{-18}	$p < 0.01$
Denmark	−0.45	2.65144×10^{-8}	$p \leq 0.05$	1.241×10^{-32}	$p < 0.01$
Estonia	0.94	9.40208×10^{-13}	$p \leq 0.05$	2.68102×10^{-23}	$p < 0.01$
Finland	0.96	1.45515×10^{-13}	$p \leq 0.05$	5.4869×10^{-24}	$p < 0.01$
France	0.95	9.17284×10^{-13}	$p \leq 0.05$	5.26212×10^{-37}	$p < 0.01$
Germany	0.99	1.78301×10^{-12}	$p \leq 0.05$	6.60521×10^{-23}	$p < 0.01$
Hungary	0.72	1.98238×10^{-10}	$p \leq 0.05$	6.35984×10^{-22}	$p < 0.01$
Ireland	0.95	0.000115637	$p \leq 0.05$	2.54458×10^{-30}	$p < 0.01$
Italy	0.91	5.66798×10^{-12}	$p \leq 0.05$	6.50098×10^{-26}	$p < 0.01$
Latvia	0.93	4.35499×10^{-13}	$p \leq 0.05$	5.65883×10^{-22}	$p < 0.01$
Lithuania	0.86	2.09545×10^{-10}	$p \leq 0.05$	5.84051×10^{-20}	$p < 0.01$
Luxembourg	0.92	1.71623×10^{-12}	$p \leq 0.05$	3.54907×10^{-18}	$p < 0.01$
Netherlands	0.90	1.28905×10^{-7}	$p \leq 0.05$	6.02565×10^{-25}	$p < 0.01$
Poland	0.81	0.000556571	$p \leq 0.05$	8.11286×10^{-24}	$p < 0.01$
Romania	0.93	6.16583×10^{-6}	$p \leq 0.05$	1.4688×10^{-20}	$p < 0.01$
Slovenia	0.96	8.14808×10^{-8}	$p \leq 0.05$	3.58652×10^{-21}	$p < 0.01$
Spain	0.87	7.8011×10^{-8}	$p \leq 0.05$	6.92438×10^{-22}	$p < 0.01$
Sweden	0.87	8.79014×10^{-13}	$p \leq 0.05$	9.19322×10^{-24}	$p < 0.01$

Continuing with the statistical analysis outlined earlier, **Table 6** delves into the

specific calculations regarding the influence on the indicators, particularly focusing on total health and social employment, followed by general practitioners. Basic statistical calculations were conducted, including correlation analysis, tests, and significance levels. Upon examining the table, it becomes evident that the correlation coefficient across most EU countries indicates a strong positive correlation. The *F*-test revealed statistically significant differences among the countries examined, while the *t*-test identified statistically significant values between variables demonstrating dependency. These findings contribute to a deeper understanding of the relationships and patterns within the data, facilitating insightful interpretations regarding the influence of various factors on healthcare employment across different countries.

The initial **Table 7** continues to explore the total health and social employment in hospitals and among graduates (doctors) within selected EU countries. This analysis builds upon the statistical calculations outlined in the preceding table. Notably, countries such as Bulgaria (i), Ireland (ii), Lithuania (iii), and Romania (iii) demonstrate a strong positive correlation coefficient. These findings shed light on the robustness of healthcare employment within these nations, particularly in terms of hospital staffing and the number of graduating doctors.

Table 7. Statistical calculations based on indicators: total hospital employment and medical graduates (Source: own processing).

	The correlation coefficient	**FTEST *p* value**	**Significance**	**TTEST *p* value**	**Significance**
Belgium	−0.84	9.2236×10^{-6}	$p \leq 0.05$	0.380529	$p > 0.01$
Bulgaria	0.96	5.9004×10^{-9}	$p \leq 0.05$	0.00399	$p < 0.01$
Croatia	0.80	0.02236531	$p \leq 0.05$	0.000726	$p < 0.01$
Czechia	0.88	0.1444835	$p \geq 0.05$	0.210159	$p > 0.01$
Denmark	−0.54	0.00025717	$p \leq 0.05$	0.282311	$p > 0.01$
Estonia	0.30	0.15033932	$p \geq 0.05$	1.8×10^{-5}	$p < 0.01$
Finland	−0.45	0.68856344	$p \geq 0.05$	6.38×10^{-11}	$p < 0.01$
France	−0.61	5.0556×10^{-6}	$p \leq 0.05$	8.36×10^{-12}	$p < 0.01$
Germany	0.58	0.10298029	$p \geq 0.05$	3.33×10^{-12}	$p < 0.01$
Greece	0.75	0.00275632	$p \leq 0.05$	0.006437	$p < 0.01$
Hungary	−0.42	0.0219963	$p \leq 0.05$	6.94×10^{-9}	$p < 0.01$
Ireland	0.91	0.17068266	$p \geq 0.05$	3.59×10^{-10}	$p < 0.01$
Italy	0.68	8.7866×10^{-7}	$p \leq 0.05$	0.00087	$p < 0.01$
Latvia	0.86	1.4271×10^{-8}	$p \leq 0.05$	9.61×10^{-5}	$p < 0.01$
Lithuania	0.90	5.06×10^{-6}	$p \leq 0.05$	0.00442	$p < 0.01$
Netherlands	−0.27	0.51408991	$p \geq 0.05$	0.027071	$p < 0.01$
Portugal	0.52	0.54179429	$p \geq 0.05$	5.11×10^{-5}	$p < 0.01$
Romania	0.90	0.0006169	$p \leq 0.05$	7.48×10^{-8}	$p < 0.01$
Spain	0.69	0.3219299	$p \geq 0.05$	0.158656	$p > 0.01$

4. Discussion

The fourth section delves into the paper's discussion, beginning with a

description of the data (secondary data) pertaining to healthcare and employment in the sector. Central to quality healthcare is the role of healthcare financing, relative to the GDP share, which reflects on employment dynamics within the sector. Presently, healthcare and social care systems are experiencing unprecedented levels of employment, largely influenced by the COVID-19 pandemic. Another crucial metric analyzed in the paper is the number of graduates in the healthcare sector, which significantly impacts the potential healthcare workforce's quality and potential migration across states. Notably, training a doctor span approximately ten years, and in the event of shortages, recruitment from abroad becomes imperative, highlighting the challenge of general practitioner scarcity in certain EU countries. The section also scrutinizes static calculations between pairs of indicators, including a correlation analysis between total health employment and general practitioners, revealing strong correlation coefficients in most countries with statistically significant indicators. Additionally, a correlation was explored between total health and social employment in hospitals and the number of healthcare graduates, uncovering mostly strong positive correlations, albeit with few instances of negative correlations. These analyses indicate a significant dependency between variables.

Furthermore, the discussion accentuates the pivotal role of talent management in healthcare, as emphasized in studies advocating for talent retention and organizational citizenship behavior to bolster effective talent management (Obum and Kelana, 2023). The influence of organizational culture and human resource management on fostering innovation within the healthcare workforce is paramount (Botelho, 2020). Notably, research on high-performance work systems underscores the need for synergistic HR practices to enhance quality and productivity in healthcare settings (Botelho, 2020; Obum and Kelana, 2023).

The limitations of this research should be acknowledged to provide a comprehensive understanding of its scope and implications. Firstly, the study's findings are based on data retrieved from OECD and Eurostat databases, which may inherently contain inaccuracies or inconsistencies. Additionally, the availability of data may have constrained the depth of the analysis, particularly in countries where data collection practices differ or where data may be incomplete.

Furthermore, the study primarily focuses on quantitative analysis of selected indicators within the healthcare sector, potentially overlooking qualitative aspects that could provide additional insights. For instance, factors such as cultural norms, healthcare policies, and socioeconomic dynamics may influence the observed correlations but were not extensively explored in this study.

Moreover, the study's analysis is limited to the selected EU member states, and therefore, the findings may not be directly generalizable to other regions or countries outside this scope. Variations in healthcare systems, workforce demographics, and economic conditions across different regions could impact the applicability of the findings beyond the studied context.

Finally, while correlation analysis offers valuable insights into potential relationships among variables, it does not establish causation. Therefore, further research employing longitudinal or experimental designs may be necessary to elucidate causal relationships between healthcare indicators and workforce dynamics.

Acknowledging these limitations is essential for interpreting the study's findings

accurately and guiding future research efforts towards addressing these gaps to enhance our understanding of the complex interactions between healthcare and the workforce.

The results of our statistical analysis, including data description, comparison, and correlation analysis, underscore the critical importance of the dataset in shaping our findings. Therefore, future research efforts will focus on gathering additional data and conducting further statistical analyses to deepen our understanding of how these indicators affect the healthcare sector and its workforce. This includes considering primary research methods, which offer distinct advantages in evaluating healthcare workforce dynamics within the context of the identified indicators.

Our study stands out for its comprehensive analysis of key indicators in the healthcare sector, providing deep insights into employment focus and care quality. We particularly emphasize the significance of talent management and its positive impact on innovation and productivity among healthcare workers. A transparent assessment of study limitations contributes to an open and critical approach. A meticulous discussion represents another significant aspect of our work, demonstrating our endeavor for a comprehensive understanding of healthcare dynamics. Additionally, we propose a clear path for future research, emphasizing the need for further data collection and deeper analysis to better understand the relationships between healthcare indicators and the workforce.

5. Conclusion

The aim of this scientific study was to thoroughly assess the current status and evaluate key indicators influencing healthcare and the workforce in selected European Union (EU) member states. This study sheds light on the critical significance of several key indicators, including healthcare financing, total health and social employment, health graduates, and the migration of the health workforce, in shaping the landscape of healthcare provision across EU countries. These indicators serve as fundamental pillars underpinning the delivery of quality healthcare services. As the study reveals, the effective management of healthcare workload emerges as paramount, especially considering the demographic shifts and the aging population prevalent in many EU nations. Thus, ensuring a robust healthcare system capable of meeting increasing demands becomes imperative for safeguarding the well-being of citizens.

Moreover, the correlation analysis conducted in this study underscores the intricate relationship between healthcare employment and service accessibility. Specifically, it highlights the essential role of adequate healthcare employment levels in guaranteeing widespread access to medical care, particularly through the availability of general practitioners. Furthermore, the study elucidates the significant impact of overall health employment in hospitals on the sustainability of the healthcare workforce pipeline, particularly in nurturing and supporting the next generation of healthcare professionals.

As the healthcare landscape continues to evolve, the study underscores the importance of adopting a balanced approach to healthcare workforce migration. While acknowledging the benefits of a diverse and dynamic workforce, it emphasizes the

need for policies and practices that promote sustainable migration patterns to ensure continuity and stability within the healthcare sector.

Overall, this study contributes valuable insights into the complex interplay between healthcare indicators and workforce dynamics, offering policymakers and stakeholders a comprehensive understanding of the factors influencing healthcare provision. By illuminating these dynamics, the study provides a foundation for informed decision-making and the development of strategic interventions aimed at enhancing healthcare systems' resilience and effectiveness, both in the present and in anticipation of future challenges.

The scientific merit of this paper resides in its thorough investigation of key indicators shaping healthcare provision across EU countries. By scrutinizing factors such as healthcare financing, employment trends, and workforce migration, the paper provides valuable insights into the complex dynamics of the healthcare sector. Furthermore, the correlation analysis conducted sheds light on the interconnectedness between these indicators, offering a nuanced understanding of their impact on healthcare accessibility and workforce sustainability. This holistic approach not only enriches our theoretical understanding of healthcare systems but also offers practical implications for policymakers and stakeholders. By identifying strengths and areas for improvement, the paper empowers decision-makers with the knowledge needed to craft targeted interventions aimed at enhancing the quality, accessibility, and resilience of healthcare services in the EU and beyond.

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