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# **A REVIEW OF THE EUROPEAN STRUCTURAL AND INVESTMENT FUNDS IN HEALTH**

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### ***Abstract***

*The aim of this paper is to investigate different aspects and give a synthesized review on the importance of the European Structural and Investment Funds (ESIFs) in health, an area that is less studied in previous research about the investments of the EU funds in the EU. Based on theoretical review, the paper confirms that health can be connected with most of the investment priorities of the EU cohesion policy. Regarding the structure of the ESIFs in health, the results of the multivariate cluster analysis show that EU Member States which have higher regional inequalities in health, lower public health service capacities, lower government expenditure on health and lower self-reported health as good or very good direct a significant share of funds to finance health infrastructure and access to health. In the context of building resilient societies, in using different investment opportunities of the ESIFs for health, it is necessary to strengthen other fields related to health, to combine instruments of financing through an integrative approach and to monitor and evaluate the effects of investments continually.*

***Keywords:*** EU cohesion policy, European Structural and Investment Funds, health, cluster analysis

## 1. INTRODUCTION

The global health and economic crisis triggered by the COVID-19 pandemic has produced the need to analyse opportunities to strengthen the resilience of the health sector. European Structural and Investment Funds (ESIFs) ensure an important source of financing for the Member States of the European Union (EU) and its regions, especially those with gross domestic product (GDP) per capita that is below the EU average. ESIFs finance wide areas contribute to various needs, from infrastructure and entrepreneurship to innovation and investments in research and development, green transition, social needs, etc. It can be seen that the funds cover different thematic priorities and represent an instrument that accelerates the attempts to achieve development objectives. This is possible because ESIFs are part of the EU cohesion (regional) policy, which is the main investment policy and which contributes to growth, competitiveness, social inclusion and quality of life in recovery and in building resilient societies. In the latest programming periods, the need to target investments was clearly highlighted.

Even though the ESIFs are available for all EU Member States, less developed EU Member States tend to rely on these sources. All EU Member States want to utilise the available EU funds as much as possible. The latter is the subject of many analyses, including different aspects of EU funds' absorption and effects, while statistics on allocated and paid ESIFs have been continuously improved, developed and published. However, more detailed analysis of the effects across specific areas is needed to provide more complex, relevant conclusions and policy recommendations for development policies. This aspect is often also constrained due to the data available and under investigated regarding the health sector. Continuous monitoring and evaluation as well as improvements in measuring the impacts of the EU cohesion policy implementation, especially considering specific areas of investment such as health, thus confirm the importance.

One of the key determinants of development, additionally highlighted in 2020 and 2021, is health. Like the whole world, the EU is faced with the COVID-19 pandemic, closures through the 'stay-at-home' policy, lockdowns and similar activities, connected socio-economic crises and an uncertain future. Insufficient information/knowledge about the new virus and attempts to create a vaccine that will enable protection of the population were significant challenges in 2020. In the EU, 2020 also brought negotiations on the EU budget, together with defining instruments for recovery and resilience. The need for studies that deal with the mentioned problems, causes, interdisciplinary effects of the crisis, adaptation and managing of the crisis, future preventions and building resilience is seen in different scientific articles, projects, experts' views and webinars performed during 2020 and 2021. It can be confirmed that this will also be a recurrent theme in the future pandemic and post-pandemic world through various approaches.

Cohesion policy was recognised as a significant policy in crisis situations, so there is a growing importance to investigate instruments of the EU cohesion policy which can be used to build stronger health systems as well as

resilient societies that will be prepared to respond to the permanent and future challenges. Various papers on health inequalities also confirm the importance of direct EU cohesion policy interventions in the health area. This paper will try to contribute to analyses and the monitoring of the ESIFs in health, which are investigated less in previous research about ESIFs investments.

The aim of this paper is to give a review on the importance of the ESIFs in health. After a theoretical review, including a survey of the literature, previously published researches, expert studies connected with broader frameworks on the importance of health in EU cohesion policy implementation and monitoring of ESIFs in health, a separate part of the paper also presents the EU Member State country grouping based on the results of the multivariate cluster analysis of the ESIFs investments in health. This section includes the methodological approach, data and the results of the cluster analysis. The results of the cluster analysis will be connected with the chosen health indicators to investigate in more detail the characteristics of the extracted groups of EU Member States. The final section presents concluding remarks and implications for future studies.

## **2. THEORETICAL REVIEW**

### **2.1. The importance of health in the EU cohesion policy**

Good health is important in different aspects: in microeconomic terms (for financial success) and in macroeconomic terms (as an integral part in developing human and social capital, as a determinant of economic growth) (Holecki, Kowalska-Bobko, Fraczkiewicz-Wronka & Wegrzyn, 2020). Health is connected with economic outcomes, productivity, competitiveness, employment, research and development, poverty reduction, social inclusion, public administration reform, liberalisation of health professions and inequalities (European Commission, 2014). Access to healthcare services is necessary for the health of society and to prevent economic losses due to a lack of health and economic activity (Holecki et al., 2020).

The importance of health was also recognised in the Treaty on the Functioning of the EU. The EU has pointed out the significance of achieving equal opportunities and reducing inequalities among people in the Common Market. The health sector (policy) belongs to the social policy and it is one of the most important sectors in public spending in the EU (European Commission, 2014). Employment in health-related fields includes 15% of the total European workforce, and health sector spending accounts for 10% of the EU's GDP (Goran, Rossi Hernandez & Talenti, 2021). Regional health inequalities in the EU are confirmed through different indicators (Santana, Costa, Freitas, Stefanik,

Quintal, Bana e Costa, Borrell et al., 2017; Eurostat, 2021b)<sup>1</sup>, which can also influence financing and differences in the structure of the health financing requirements.

As can be seen, the health sector is connected with well-being and social protection, but it is also faced with different issues, such as the need to reform national health systems, pressures related to an ageing population, chronic diseases, increasing demand for health care, structural changes and crises. It is necessary to increase the efficiency and cost-effectiveness of healthcare systems and improve access to and the quality of health services with regard to inequalities (European Commission, 2014), where ESIFs investments in the fields related to health can play a significant role.

The improved use of EU funds is expected to help with health inequalities that remain a constant problem (Lane, 2017b). With its approach towards reducing inequalities and regarding instruments which can be used across regions and countries through different thematic objectives, the EU cohesion policy contributes to achieving health goals. Based on the European Commission (2021c), it can be seen that the EU cohesion policy recognises that health is important for regional development and competitiveness and that one of the fields which is supported by funding is health. Even though it is not defined as a single thematic objective, according to the European Commission (2014), health is connected with different priorities that include, for example, various thematic areas: innovation in health (by strengthening research, technological development and innovation as one of the priorities); e-health (by enhancing access to and use and quality of information and communication technologies); small and medium-sized enterprises (SMEs) and health (by enhancing the competitiveness of SMEs, the agricultural sector, the European Agricultural Fund for Rural Development and the fisheries and aquaculture sector, the European Maritime and Fisheries Fund); health workforce; active and healthy ageing; health and human capital; health in the workplace (by promoting employment and supporting labour mobility); cost-effectiveness and sustainability of health care; transition from institutional care to community-based care; infrastructure; access to health care; reducing health inequalities; mental health (by promoting social inclusion and combating poverty); investing in health professionals' education and lifelong learning (by investing in education, skills and lifelong learning); cross-border care and cooperation between Member States; supporting health system capacities (by enhancing institutional capacity and ensuring an efficient public administration). It is also related to other areas (where it is not directly relevant), such as supporting the shift towards a low-carbon economy in all sectors (healthy grassland), promoting climate change adaptation and risk prevention and

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<sup>1</sup> More about health indicators, health system information and best practice, and expert studies on health sector challenges, which are accessible for studies and policymakers, can be found in the State of Health in the EU (European Commission, 2020). An overview of useful health indicators for monitoring and evaluation, targeting access to health care is given in Eurostat (2021c), European Core Health Indicators, Social Scoreboard, OECD Better Life Index, results of social surveys regarding the data on inequalities and social determinants of health, data on Sustainable Development Agenda 2030, etc. (McGuinn, Gancheva, Castro, Jones, O'Brien, Markowska, EuroHealthNet & Health ClusterNET, 2019).

management (protecting human health), protecting the environment and promoting resource efficiency (potential health risks). Some interventions are important for more than one thematic objective, which must be observed through possible integrated funding. Non-direct health investments can also contribute significantly to achieving health gains.

Investments in health under the EU cohesion policy are connected with the health policy framework (European Commission, 2021c). As described by European Commission (2014), all this is in line with Europe 2020, European Innovation Partnerships (e.g. the one on Active and Healthy Ageing), Commission Staff Working Document on Investing in Health, and Health Strategy. The importance of health system reforms is recognised in the recommendations to EU Member States in the European Semester; there is also the ex-ante conditionality for health in using ESIFs, including a strategic policy, budget and monitoring framework for health investments. Prioritisation of investments in the different health areas on the basis of needs assessments and the reinforcement of thematic concentration is necessary (European Commission, 2014). The EU cohesion policy helps in the fight against the COVID-19 pandemic, e.g. through concrete measures, such as the Coronavirus Response Investment Initiative (CRII), the Coronavirus Response Investment Initiative Plus (CRII+), Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU) package, which are directed at the health sector and business sector to support people and also at resilient recovery (European Commission, 2021a). But, as Lane (2017c) states ‘there is concern across the EU that health does not figure prominently enough in the economic development plans of Member States at both national and regional levels’. Considering that health was not defined as a specific investment priority, as mentioned previously, based on the EU cohesion policy implementation in the period 2014-2020 and the growing need to monitor health investments and target health in more detail in strategic development planning, it is necessary to develop evidence-based studies that will investigate different aspects of the ESIFs for health, by connecting studies on monitoring EU cohesion policy implementation and studies on health investments.

## **2.2. Monitoring of ESIFs in health**

There are various scientific articles and expert studies about the monitoring and evaluation of the ESIFs investments, estimating macro, regional and micro effects, where quantitative and qualitative methods are used. Different approaches and methods are applied also regarding the observed typology of investments. Butkus, Mačiulytė-Šniukienė, Matuzevičiūtė and Cibulskienė (2019) employ econometric analysis to investigate the return on EU structural fund investments at a regional (NUTS 3) level. In line with the studies that investigate separate categories of expenditure, they include data on different expenditure categories and find differences regarding the effects of the total amount of EU structural funds vs. specific expenditure category. Their results suggest that

investments in productive environment and basic infrastructure had positive returns, while investing in human resources did not show a significant effect. Besides research methodology, the expenditure category and intervention area of the structural funds, the diverse sample of regions and conditions in the regions are also recognised in the literature as the reasons for the differences in the results (with other limitations of the studies) (Butkus et al., 2019). Some authors research the effects of the EU funds' investments on various projects. For example, Vignetti, Giffoni, Pancotti and Pagliara (2019) combine a cost-benefit analysis with a qualitative analysis and evaluate the major transport projects co-financed by EU funds. Outcomes of the transport projects that were financed from EU funding were also analysed by a cost-benefit analysis in Kelly, Laird, Constantini, Richards, Carbajo and Nellthorp (2015), where the authors discuss the role of the tools, such as cost-benefit analysis and multi-criteria analysis in the decision-making process. Florio, Morretta and Willak (2018) use the mentioned cost-benefit analysis, as a methodology with a long tradition, on a large number of projects, including also the health infrastructure sector. The authors confirm the importance of observing the effects of investments in the different sectors of investments. Startiene, Dumciuviene and Stundziene (2015) present the analysis of the relationship between the structural support and chosen economic indicators of the EU (e.g. final consumption expenditure, total intramural research and development expenditure, labour productivity, unemployment and GDP of the whole EU) and do not find a significant correlation, which opens up the question on the efficiency of the use of the funds across countries and confirms differences in results regarding the context of the analysis of the ESIF investments.

In investigating the previous works about the ESIFs investments in health, it can be seen that scientific papers which deal with the monitoring and evaluations of the ESIFs investments in health are scarce and constrained by data availability, but it should be highlighted here that there are some significant contributions and results in this field. McCarthy (2012) studies the potential of using the EU structural funds for public health research. He elaborates that in Central and Eastern Europe and the Mediterranean, the levels of public health research are at their lowest and that public health research should be prioritised more in the EU's structural funds programmes. In a theoretical overview of funds available to the new EU Member States, McCarthy (2013) describes how EU structural funds can support health systems through the development of health care services for the increasing proportions of elderly people by upgrading acute hospitals, increasing suitable community support and fostering (public) health research. The importance of evaluating the health outcomes and impacts of the funds is also recognised. The contributions of EU structural funds to financing health sector needs in Poland with regard to health services, (building and renovating) health centres and clinical toxicology centres are confirmed in Wiszniewiecka, Cejrowski and Sein Anand (2015). Murauskiene and Karanikolos (2017) analysed the available ESIFs and their structure for the health sector in Lithuania in the period 2007-2013. They also note some important challenges and constraints, such as the lack of a formal evaluation of the implementation of projects funded by the ESIFs, the need for a comprehensive agreement on goals and prioritised actions in the

health sector, which represents a prerequisite for the effective use of the funds, a lack of transparency in funding allocations and a failure to select appropriate indicators for implementing, monitoring and assessing the effects of investments and reforms. By using data on healthcare research grants from the 7<sup>th</sup> Framework Programme and the Horizon 2020 allocation (from 2007-2016), Kaló, van den Akker, Vokó, Csanádi and Pitter (2019) investigate the distribution of the grants across EU member countries and the effect of the potential influencing factors on grant allocation. Significant differences were confirmed when comparing EU-15 and EU-13 ('old' and 'new' EU Member States), where EU-13 countries are benefitting less, so a disproportionate country group allocation was confirmed. They warn of the need to implement more effective policy measures to improve the unfair allocation of research grants. Kaló et al. (2019) highlight that when considering the principles of equity and fair distribution, grant allocation across countries should depend on the need for healthcare research and not on the economic status and population size. Holecki et al. (2020) investigate the EU's cohesion policy in the field of health care, implemented programmes, funding sources and activities related to objectives in health care in the countries of the Visegrad Group in the period 2014-2020. They have evaluated the outcomes of the healthcare systems also from the consumer/patient perspective, by using the European Health Consumer Index (which gives information on the social impact assessment of investments in health care). The authors found the positive relationship between the financing under EU cohesion policy funds and observed results in the healthcare system, highlighting the need to use the EU programmes according to internal requirements, while a coordination mechanism should be included in public management. Their work also confirms the importance of investigating the country group specificities in ESIFs allocation and spending for health. Country group specificities in ESIFs allocation for health for the EU Member States will be investigated in the second part of our paper.

One of the main goals of ESIFs investments in health is to reduce health inequalities (on different levels of governance). Social inequalities in health and connected determinants and evidence-based strategies to tackle inequalities are presented in Dahlgren and Whitehead (2006). Pons-Vigués, Díez, Morrison, Salas-Nicás, Hoffmann, Burstrom, van Dijk and Borrell (2014) recognise that adequate health and social policies should involve community groups and cross-sectoral and participative multilevel governments to address health inequalities. They have carried a scoping review of the policies or interventions that are aimed at reducing health inequalities in European cities and have identified the determinants of health inequalities in urban areas or neighbourhoods (regarding physical context, including the built environment and the socioeconomic context, such as economic factors, employment, public services, safety, etc.). In their discussion, they also warn of the lack of experience in evaluating the impact of interventions to reduce health inequalities, while evaluations of universal policies represent an important part in this. Urban health inequalities (in Barcelona) and the importance to include this issue in the political agenda are also addressed in a review by Borrell, Pasarín, Díez, Pérez, Malmusi, Pérez and Artazcoz (2020). Freitas, Rodrigues and Santana (2020) have used a multidimensional and participatory approach (of different local stakeholders, municipal departments,

non-governmental and community-based organisations) to investigate (the determinants of) health inequities. They have analysed urban health inequities, connected it with the geographic patterns of inequality in the social, economic and environmental conditions within a city (determinants of health) and confirmed the importance of a place-based approach. The main output of their approach is a matrix of the representative health determinants of inequities. The authors also discuss the challenges to urban health equity due to the COVID-19 pandemic. Fayet, Praud, Fervers, Ray-Coquard, Blay, Ducimetiere, Fagherazzi and Faure (2020) investigate spatial inequalities in health that depend on different exposures to health risk factors. Cluster analysis (K-means clustering) was used to classify French municipalities according to ten contextual scores measuring physical, social environment and healthcare accessibility in the nationwide classification called the Geographical Classification for Health studies. The results were then used to analyse inequalities in age-standardised mortality. Their analysis confirms the contribution of the geographical context in the constitution of health inequalities and public health studies. Ding, Cai, Zhu and Fu (2020) use a principal component analysis and factor analysis to measure the public health service capacity scores in the 27 EU countries, which provides a basis for further analysis. The TOBIT model was applied to investigate the driving factors that contribute to spatial differences in public health service capabilities. Besides other conclusions, this paper confirms the differences between Western Europe and Northern and Southern Europe in terms of public health service capacities and the need to increase the level of investment related to public health services. The results and discussion in the paper were also combined with the data of the COVID-19 pandemic.

In different papers and projects that deal with health inequalities, the EU cohesion policy, with its instruments, was recognised as important. Neagu, Michelsen, Watson, Dowdeswell and Brand (2017) investigate the areas eligible for investment in health equity in the financial periods 2007-2013 and 2014-2020, by using the results of two extensive health projects financed through European funds, and document analyses to investigate possible interventions for health equity under the regulations. Changes in the financing were explained, from intervention in capital infrastructure to social determinants and health systems' sustainability. The authors confirm 'as health has not been singled out as a priority, public health actions like health equity are funded as part of thematic objectives which have as a primary focus another policy area' (Neagu et al., 2017, p. 303). In the programming period 2014-2020, there are more opportunities for health investments, where the combination of financing can be useful, together with the integrated approach that creates synergies. Differences in health status between the 'new' and 'old' Member States, between the north and the south in the EU and health inequalities within counties were also pointed out, as well as the need for an evidence-based approach to policy and decision-making. As the authors state, choices for investments should be the result of an 'informed critical assessment of evidence' (Neagu et al., 2017, p. 305). The importance of ESIFs in tackling health inequalities was also presented in Santana, Freitas, Costa, Stefanik, Santana, Krafft and Pilot (2020b). The authors investigate regional



planned investments for allocating funds of the EU cohesion policy in the period 2014-2020, as well as the connection between these investments and regional health gaps, measured with the Population Health Index (PHI). This index provides an evidence-based analysis of regional health gaps and represents a multidimensional approach used to measure population health inequalities across 10 areas, with 17 dimensions and 39 indicators representing health determinants and health outcomes, for the 269 NUTS 2 regions in the EU (Santana et al., 2020b). The authors have confirmed that less developed regions perform worse on the PHI and that more needs to be done to focus regional investments into key regional health determinants due to the fact that they are underrepresented, missing the Cohesion Policy's investment fields. '... There is room for improvement on how to use cohesion funds to improve the health systems' effectiveness, accessibility and resilience, and accordingly achieve an integrated development in population health-related fields' (Santana et al., 2020b, pp. 17-18). The population health measurement is investigated in more detail in Santana, Freitas, Stefanik, Costa, Oliveira, Rodrigues, Vieira, Ferreira, Borrell, Dimitroulopoulou, Rican, Mitsakou, Mari-Dell'Olmo, Schweikart, Corman & Bana e Costa (2020a), where the authors highlight the need to have the appropriate tools in public health monitoring and policy-making, also regarding regional inequalities in health outcomes. That paper also presents the construction and results of the PHI.

A comprehensive analysis of the investments of the EU funds in health in the period 2014-2020 was also performed through the project 'ESI Funds for Health' (McGuinn et al., 2019). With a large team of experts, the project mapped and classified over 7,000 health-related projects in Member States and Interreg and analysed contributions made to health policy goals. It was determined that over EUR 8 billion was spent on these projects, where projects were classified in the following themes: improving access to health care; reforms of health systems; e-health; research and innovation in health; ageing and health promotion; health workforce. The highest share was directed to ageing and health promotion, reform of the health system, research and innovation. The need to demonstrate the full range of impacts of projects was emphasised as well as the challenges on collecting and using data on actual spending for health-related projects (McGuinn et al., 2019; Milieu Ltd, Maastricht University, EuroHealthNet & Health Cluster Net, 2019).

Significant contributions have been seen through other projects (e.g. EUREGIO III (2009-2011), Health Equity 2020, EURO-HEALTHY and numerous other project examples; more in Lane, 2017a; Santana et al., 2020a; Goran et al., 2021), so it would be interesting to analyse the impacts of health investments on the outcomes of specific projects. In the programming period 2021-2027, a contribution through the EU4 Health programme is expected that will address healthcare systems' resilience and synergies with other funds, such as European Social Fund Plus, ERDF, Horizon Europe, Recovery and Resilience Facility, etc. (European Commission, 2021b).

To evaluate the implementation of the EU cohesion policy, the European Commission produced annual summary reports (2014-2020) and strategic reports

in 2017 and 2019. In the last report from the Commission, *‘European Structural and Investment Funds 2014-2020 Summary report of the programme annual implementation reports covering implementation in 2014-2019’* (European Commission, 2021c), it is confirmed that ESI funds support long-term investment strategies but can also be used to respond to emerging needs. The importance of ESI funds for investments in health and social care (besides in other areas) and in alleviating the impacts of the health and economic crisis caused by the COVID-19 pandemic is presented in more detail, which again confirms the importance of the EU cohesion policy for the health sector.<sup>2</sup>

Based on the presented review, the importance of the EU cohesion policy and ESIFs investments for health can be confirmed, as well as the fact that the empirical investigations of the progress results of the ESIFs in health are still scarce. Significant differences were confirmed in comparison between EU Member States. The aim of the following chapter is to investigate the country group specificities regarding ESIFs in health in the programming period 2014-2020, by using data on progress results in the ESIFs in health, which were not used before in the presented studies. Data availability on ESIFs in health represents a constraint on being able to apply more complex analysis and evaluations.

### **3. CLUSTER ANALYSIS OF THE ESIFs IN HEALTH**

#### **3.1. Methodological approach and data**

There are different studies that confirm cluster analysis is a suitable method of dividing countries or regions into groups (Vintilă, Onofrei & Țibulcă, 2014; Žitek, Klímová & Králová, 2016). As a multidimensional statistical method, it is often used to divide observed units into groups where similar units are included in the same cluster while the clusters differ (Halásková & Halásková, 2015). It is useful to describe each group of formulated clusters, to create a better understanding of the differences among the groups (Härdle & Simar, 2015). In this paper a multivariate cluster analysis is applied to group the countries with similar characteristics in terms of the progress results in the ESIFs in health. Based on this analysis, the extracted groups will be described, including also regional health inequalities and other chosen health indicators in a broader discussion, in order to give more detailed conclusions about the group-specificities.

In the previous chapter, it was determined that health was not defined as a specific priority of the ESIFs investments in the period 2014-2020, which presents a constraint on the monitoring and evaluation of health investments. However, the European Commission published synthesised data on cohesion policy investments in health services and access in the regions, which were used

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<sup>2</sup> ‘A total of €19.7 billion in cohesion policy resources had been mobilized/reprogrammed to counter the crisis...’... ‘39 million people now benefit from improved health services across the EU’... (European Commission, 2021c, p. 5, 11-12).

in this analysis (European Commission – DG Regio, 2021; Goran et al., 2021). For the purpose of this study, progress results were analysed according to the last available data included in the programming period 2014-2020 (at most 2020). In more detail, data on EU spent funds across EU Member States, in the four intervention fields connected with health were included in the analysis. Data on spending share are more relevant for estimating the effects of investments in comparison with the planned and decided funds. This database includes investments under the European Regional Development Fund (ERDF) and European Social Fund (ESF) as the two main ESIFs connected with health. In more detail, according to the European Commission DG Regio (2021) database, it can be seen that the majority of funds were planned for and spent on health infrastructure, followed by enhancing access to services, ICT solutions addressing the healthy, active ageing challenge and e-health services and applications, while active and healthy ageing is at the end of this distribution. ERDF support is more important for the health infrastructure and ICT solutions addressing the healthy active ageing challenge and e-health services and applications, while the other two fields rely on financing from the ESF (Goran et al., 2021). Differences can be confirmed when comparing the distribution of the funds by the observed intervention fields, based on the European Commission DG Regio (2021) database (e.g. Poland, Italy and France invest in four intervention fields, while some other countries direct the funds in one of the observed health intervention fields). According to data availability, 25 EU Member States are included in the further analysis<sup>3</sup>. Variables and databases used in the analysis are presented below in Table 1.

Table 1

## Variables used in the analysis

Variables used in cluster analysis	
VAR 1	EU spending per capita in the field of active and healthy ageing (2014-2020), in euros
VAR 2	EU spending per capita in the field of ICT solutions addressing the healthy, active ageing challenge and e-health services and applications (2014-2020), in euros
VAR 3	EU spending per capita in the field enhancing access to affordable, sustainable and high-quality services, including health care and social services of general interest (2014-2020), in euros
VAR 4	EU spending per capita in the field health infrastructure (2014-2020), in euros
Variables used for the comparison based on the results of the cluster analysis	
VAR 5	Health inequalities measured by the Population Health Index (PHI) - determinants
VAR 6	Health inequalities measured by PHI - outcomes
VAR 7	EU public health service capacity scores
VAR 8	General government expenditure by function – health, % GDP
VAR 9	Self-perceived health (people who perceived their own health as good or very good), %

Sources: VAR 1-VAR 4: Eurostat (2021d), European Commission – DG Regio (2021); VAR 5-VAR 6: EURO-HEALTHY consortium (2017); VAR 7: Ding et al. (2020), VAR 8: Eurostat (2021a), VAR 9: Eurostat (2021e).

<sup>3</sup> See Table 2 for the EU Member States included in the analysis. Data for Denmark and Luxembourg were not included in the analysis (because of data availability).

As can be seen from the Table 1, after performing the cluster analysis, the discussion will include several health indicators that will be compared between clusters (to describe and compare the characteristics of the homogeneous groups). The justification for using these variables for comparison can be seen in the theoretical review and is briefly confirmed hereinafter. The EURO-HEALTHY PHI was chosen as a multidimensional measure that evaluates health inequalities based on Santana et al. (2020a, 2020b). PHI can ‘provide guidance for the evaluation and selection of policies with the greatest potential to address inequalities’ (Santana et al., 2020a, p. 9). This index shows where regions are lagging behind and where investments are more needed to close the health gap. For the purpose of our analysis, the average inequality was calculated at EU Member State (national) level, due to the fact that the data on the ESIFs spending share in the field of health are available across the EU Member States. The analysis in this paper can also contribute to previous studies (e.g. Santana et al., 2020b) that analyse the extent of the planned investments for 2014-2020 addressing the regional health gaps. Furthermore, public health service capacity scores calculated in Ding et al. (2020) were included in the comparison. It is interesting to include these indicators, which combine different aspects of health inequality and health capacities, and compare them with the EU spending on different health areas in addition to individual attributes that can be ascertained by observing one-dimensional indicators. Additionally, the latest available data (2019) on government expenditure in health (which is an important source of financing health needs and one of the largest items of government expenditure) and self-perceived health will be compared across clusters. The share of people with good or very good perceived health represents a subjective indicator based on EU Statistics on Income and Living Conditions (Eurostat, 2021e), which can be useful in presenting a subjective view on the state of health in the analysed countries. Differences were confirmed when comparing observed EU Member States based on minimum and maximum values of the mentioned indicators (that can be seen in more detail in databases below the Table 1).

### 3.2. The results of the cluster analysis

Classifications of countries relying on the results of the cluster analysis (performed after checking the necessary preconditions) are given below. Table 2 presents the classifications of the EU Member States, based on a hierarchical cluster analysis (using Ward’s method with squared Euclidean distances<sup>4</sup>) and a non-hierarchical cluster analysis (using the K-means method<sup>5</sup>).

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<sup>4</sup> Classification in Table 2 is presented based on dendrogram (a graphical representation of the sequence of clustering (Härdle & Simar, 2015)). As explained in Härdle & Simar (2015), the aim of the Ward procedure is to unify groups and the resulting groups are as homogeneous as possible.

<sup>5</sup> Application and more about the advantages of the K-means method can be found in Jurun, Ratković and Ujević (2017). The number of clusters in our study was confirmed by analysis of variance.

Table 2

## Classifications of EU Member States based on the results of a hierarchical and non-hierarchical cluster analysis

EU member state	Number of cluster, based on hierarchical cluster analysis (Ward's method)	Number of cluster, based on non-hierarchical cluster analysis (K-means method)
Belgium	1	1
Bulgaria	2	2
Czechia	2	2
Germany	1	1
Estonia	3	2
Ireland	1	1
Greece	2	2
Spain	1	1
France	1	1
Croatia	3	2
Italy	1	1
Cyprus	1	1
Latvia	2	2
Lithuania	3	2
Hungary	2	2
Malta	3	3
Netherlands	4	4
Austria	1	1
Poland	3	2
Portugal	2	1
Romania	2	2
Slovenia	4	4
Slovakia	2	2
Finland	1	1
Sweden	1	1

Source: authors' calculation based on data from Table 1

It can be seen that Member States can be grouped in four clusters. Based on Ward's method, in cluster 1 are Belgium, Germany, Ireland, Spain, France, Italy, Cyprus, Austria, Finland and Sweden. Cluster 2 includes: Bulgaria, Czechia, Greece, Latvia, Hungary, Portugal, Romania and Slovakia. Estonia, Croatia, Lithuania, Malta and Poland are in cluster 3, while the Netherlands and Slovenia are in cluster 4. There are some minor differences in the classification by using different methods. By using the K-means method, Estonia, Croatia and Lithuania are classified in cluster 2, while Portugal is classified in cluster 1. A more detailed analysis of the given clusters regarding the included variables shows that cluster 2 and 3, according to hierarchical classification, have higher

values of the variable connected with investments in health infrastructure, which is also confirmed in cluster 2 according to the K-means method. Enhancing access to services is also seen as important in these clusters.

Table 3 presents average values for the chosen health indicators (VAR 5-VAR 9 from Table 1) that were calculated for the extracted clusters in order to analyse the characteristics of clusters in more detail. The results of the hierarchical classification were used for further interpretation.

Table 3

Average values of the chosen health indicators for the given clusters

Number of cluster	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9
Cluster 1	75,23	79,39	0,79	6,70	73,12
Cluster 2	60,69	43,31	0,70	5,73	62,46
Cluster 3	64,40	54,66	0,67	5,64	59,34
Cluster 4	77,83	75,42	0,77	7,20	70,70

Source: authors' calculation

Cluster 2 and cluster 3 have lower values on PHI, outcomes and determinants (which means they have higher health inequalities), lower values for public health service capacities, general government expenditure on health and lower self-perceived health as good or very good, in comparison with other clusters. These countries are new EU Member States. It can also be seen that these countries are classified into clusters that focus investments on health infrastructure and access to services, which confirms the differences in ESIFs investments in health. In the long term, it is necessary to consider other health-related fields and to achieve transition towards other health needs, also including prevention. As Goran et al. (2021) highlight, ERDF health investments are concentrated in the less developed countries and regions, which mobilise ERDF funding for health service modernisation and focus the investments on improving health infrastructure and access.

#### 4. CONCLUDING REMARKS

This paper contributes to the important (especially at the time of a global pandemic) but insufficiently explored area of health investments through ESIFs, to studies that deal with the monitoring of the ESIFs investments in health and studies of health as the determinant of growth, competitiveness and regional development. According to previous studies, under researched areas can be found in investigations about the importance of the EU cohesion policy and evaluations of the ESIFs in health.

The study reviews and confirms the importance of the EU cohesion policy for health investments, as well as the fact that the health sector can use the

opportunities to finance different health-related fields by ESIFs, through numerous thematic funding objectives presented in this review. In some of the thematic objectives, health is not directly covered, but interventions are indirectly connected with health and can have a significant impact. A connection with various priorities also represents a constraint on tracking, evaluating and estimating the effects of investments. Theoretical review confirms differences, disproportionate country group allocation and impacts of the investments in health.

A multivariate cluster analysis was applied in this paper as a suitable method to analyse the country groupings of EU Member States with regard to ESIFs in health. Data on EU spending funds across EU Member States in intervention fields connected with health were used in this analysis. It was confirmed that EU Member States that have higher health inequalities, lower public health service capacities, lower government expenditure on health and lower self-reported health as good or very good also direct a significant share of funds to finance health infrastructure and access to health. A shift towards other fields is also necessary, which should be considered in the 2021-2027 programming period. The cross-cutting nature of health investments calls for an integrative approach and the need to combine different financial instruments. In the new programming period, a framework for the implementation of the EU cohesion policy and financing priorities of the EU Member States should be flexible to achieve resilience and be able to respond in a timely manner to the different urgent challenges that can occur, especially in the health sector. This part of the paper also contributes to previous studies that include planned and decided ESIFs investments in health.

Even though the paper focuses on ESIFs (for health), in the concluding remarks it is important to briefly highlight other considerable possible health-related investments, such as the Horizon 2020 programme, the EU Health Programme and the European Fund for Strategic Investment, which should be investigated in other studies, together with a more detailed analysis of the European Territorial Cooperation programmes within ESIFs that are related to health.

It can be foreseen that further analyses of the contribution of the observed instruments to promote effective, accessible and resilient health systems and to reduce health inequalities will represent important studies in this new programming period, as well as the evaluation of the different COVID-19 pandemic responses of the EU cohesion policy. EU Member States' institutional framework was not part of the analysis in this paper, which can be investigated in a more detailed analysis of the specific EU Member States. The heterogeneous sample and data availability represent constraints on performing a more complex analysis. A disaggregated dataset and better data availability on a regional level regarding payments of ESIFs in health will represent a contribution to future studies. Specific analysis in future papers can also be derived from the role of the EU cohesion policy in solving specific health issues and by including country and regional health specificities as the basis for the ESIFs financing. The results can be interesting with a view to directing future EU cohesion policy implementation as well as against the background of stimulating more complex evaluations of the ESIFs in health.

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## **EUROPSKI STRUKTURNI I INVESTICIJSKI FONDOVI U ZDRAVSTVU – PREGLEDNI RAD**

***Sažetak***

*Cilj je ovog rada različitim pristupima istražiti i dati sintetizirani pregled važnosti Europskih strukturnih i investicijskih fondova za financiranje zdravstva, područja koje se manje istraživalo u dosadašnjim istraživanjima ulaganja iz fondova u Europskoj uniji. Na temelju teorijskog pregleda u radu se potvrđuje da se većina ulagačkih prioriteta kohezijske politike EU-a može povezati s financiranjima potreba u zdravstvu. S obzirom na strukturu ulaganja Europskih strukturnih i investicijskih fondova u zdravstvu, rezultati multivarijatne klaster analize pokazuju da države članice EU-a koje imaju veće regionalne nejednakosti u zdravstvu, manje kapacitete javnih zdravstvenih usluga, manju državnu potrošnju na zdravstvo i niži stupanj zadovoljstva stanovništva zdravljem znatan udio sredstava usmjeravaju u područja povezana sa zdravstvenom infrastrukturom i pristupom zdravstvenim uslugama. Uzimajući u obzir šire mogućnosti iskorištavanja raznih ulagačkih prilika iz Europskih strukturnih i investicijskih fondova u zdravstvu, potrebno je više ulagati u ostala područja koja su povezana sa zdravstvom, povezati instrumente financiranja integrativnim pristupom te neprestano pratiti i vrednovati učinke ulaganja.*

***Ključne riječi: kohezijska politika EU-a, Europski strukturni i investicijski fondovi, zdravstvo, klaster analiza.***

***JEL klasifikacija: F15, F33, F36, I10, I18.***

