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Priorities for Effective Management of Health Expenditures in OECD Countries: Fuzzy AHP Application

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OECD Ülkelerinde Sağlık Harcamalarının Etkin Yönetimi için Öncelikler: Bulanık AHS Uygulaması

Abstract

This study aims to identify the determinants of health expenditures through a comprehensive literature review, contributing to the design of effective health policies. The Fuzzy AHP method was used to evaluate the determinants of health expenditures, categorising OECD member countries into developed and developing groups. In both country groups, health services emerged as the most significant determinant. Education, income, and economic changes were prominent in developed countries, while governance and education were key in developing countries. The study highlights the need to establish different strategic pathways based on the priorities of each country group, offering unique insights.

Keywords : AHP, Fuzzy Logic, Health Expenditures, Health Policy.

JEL Classification Codes : H51, I15, D78.

Öz

Bu çalışmanın amacı, kapsamlı bir literatür taraması yoluyla sağlık harcamalarının belirleyicilerini tespit etmek ve etkili sağlık politikalarının tasarlanmasına katkıda bulunmaktır. Bulanık AHS yöntemi, OECD üyesi ülkeleri gelişmiş ve gelişmekte olan gruplar olarak sınıflandırarak sağlık harcamalarının belirleyicilerini değerlendirmek için kullanılmıştır. Her iki ülke grubunda da sağlık hizmetleri en önemli belirleyici olarak ortaya çıkmıştır. Gelişmiş ülkelerde eğitim, gelir ve ekonomik değişimler öne çıkarken, gelişmekte olan ülkelerde yönetişim ve eğitim kilit rol oynamıştır. Çalışma, her ülke grubunun önceliklerine göre farklı stratejik yolların belirlenmesi ihtiyacını vurgulamakta ve benzersiz bulgular sunmaktadır.

Anahtar Sözcükler : AHS, Bulanık Mantık, Sağlık Harcamaları, Sağlık Politikaları.

1. Introduction

The increasing proportion of gross domestic product (GDP) allocated to health expenditures (HEs) has become a prominent concern for developing and developed countries. It is widely acknowledged that the Organization for Economic Cooperation and Development (OECD) countries exhibited the highest proportion of HEs in their overall economies during the 1990s and early 2000s. Consequently, the proportion of HEs in GDP has increased regularly in countries belonging to the OECD (Middendorf, 2005). As expenditure increased at a rate that largely coincided with overall economic success across the OECD countries, the percentage remained comparatively stable throughout the economic crisis 2008. However, due to the severe curtailment of economic activity caused by the ongoing Coronavirus disease 2019 (COVID-19) crisis, it is anticipated that there will be a significant variation in the ratio of HEs to GDP. Before the advent of the pandemic, the average OECD country allocated 8.8% of its GDP to healthcare, which has remained consistent since 2013. In several OECD countries, preliminary predictions for 2023 indicate a notable increase in the ratio of HEs to GDP. This shows the elevated healthcare expenditure necessitated by the fight against the SARS-CoV-2 virus, coupled with the decline in GDP resulting from the curtailment of economic activities (Mehrara et al., 2010; OECD, 2021).

Over the past three decades, these countries' share of HEs in GDP has increased alarmingly. This trend can be attributed to several factors, including population ageing, technological advances, and epidemic outbreaks (Bloom & Finlay, 2009; Karim et al., 2023). Furthermore, the rise in the proportion of HEs to GDP has prompted concern among developed countries regarding the quality of these expenditures. Forecasts indicate that this increase will persist in the coming years, with healthcare expenditures for OECD countries reaching approximately 14% in 2060. However, this figure can be reduced to 9.5% (Younsi et al., 2016). The issue of controlling the increase in HEs, limiting it as much as possible, and increasing its effectiveness has become one of the most critical problems for governments. To guarantee the efficacy of national HEs, it is a process that necessitates the assessment of numerous factors to ascertain the optimal allocation of expenditures across different sectors (Jiang & Wang, 2023; Wang, 2015). This is an essential problem for countries at all levels of economic development. It is necessary to establish priorities to effectively function a country's HEs policies (Akca et al., 2017). To achieve this, governments, health policymakers and planners must be fully aware of the principal determinants of HEs and their impact. The relationship between economic growth, the environment, urbanisation, education, technological advances, population ageing, health services and HEs is multifaceted, complex and essential (Chaabouni & Saidi, 2017; Wu et al., 2020; Younsi et al., 2016).

The principal variables explored in numerous preceding studies on HEs encompass a range of factors, including the economy, the environment, urbanisation, education, technology, governance, population dynamics and the provision of health services. Although health services are a general variable, they encompass some crucial sub-variables, including social security, health outcomes, health resources, and health-seeking behaviour. These

discoveries are included in the studies in the following forms. For instance, İlgün et al. (2022) used the Granger causality test in their research to indicate the causal relationship between the GDP exchange ratio and per-capita HEs. The findings show significant correlations between a country's revenue and its HEs. Likewise, Lago-Peñas et al. (2013) discovered that GDP growth can influence HEs.

Kutlu and Örün (2022) have focused on economic growth and carbon dioxide (CO2) emissions. The findings show a long-term relationship between HEs, CO2 emissions, urban population, and per capita income. The impact of urban population, GDP per capita, and CO2 on expenditures is significant and positive. Also, according to Gövdeli's study (2019), economic growth and CO2 emissions are causal factors in HEs, whereas economic growth drives CO2 emissions.

In their study, Yetim et al. (2020) sought to determine what factors affect HEs in the OECD. For this purpose, a panel data analysis covering 2000 to 2017 was performed. Income and education were found to have the most significant impact on HEs in the OECD, while the unemployment rate and dependence ratio had no statistically significant effect. The study conducted by Tian et al. (2018) the results reveals that while the changing patterns are different, the determinants of per capita HEs expansion, the growth of lagged health spending, per capita GDP, physician density, elderly population, life expectancy, urbanisation, and female labour force participation, on HEs.

In their study, Akca et al. (2017) identified the key variables of HEs in OECD countries using the decision tree method and categorised them according to the countries' HEs. GDP per capita was determined to be the crucial factor in this circumstance. Other significant factors included the life expectancy at birth, age dependency ratio, number of hospitals, and the percentage of the population whose health status was perceived as poor, and OECD member countries were categorised into six groups. Using the dynamic growth model method, Nghiem and Connelly (2017) examine the trends and determinants of HEs in OECD countries from 1975 to 2004. Authors discovered that advancements in technology are the primary cause of HEs. Kraipornsak's (2017) research focused on the determinants of HE and the variables that affect it for 30 OECD and 15 Asian countries. An econometric regression model determined that GDP, urban population density, and out-of-pocket payment significantly influence OECD HEs.

Apart from the literature, Vandersteegen et al. (2015) discussed the dynamics of the medical malpractice systems that influence HEs in OECD countries. According to the study results, no-fault insurance policies for medical injuries with a separation between deterrence and compensation lower healthcare costs per capita. In summary, a nation's medical liability system has a significant impact on national expenditures on healthcare. According to Blazquez-Fernandez et al. (2014), technological advancement may lessen the long-run income elasticity for healthcare, risking the sustainability of healthcare systems. According to country-specific requirements, country incomes can also influence healthcare spending. Hartwig and Sturm (2014) aim to disclose robust explanatory variables for HEs growth using

an Extreme Bounds Analysis method. The data from the 1970-2010 period and 33 OECD countries were included in the study. Finally, based on whether outliers are included or not, they discover up to six more significant drivers, including an increase in health administration expenditure, a change in the proportion of inpatient expenditure to total HE, a change in the insurance coverage ratio, an increase in land traffic fatalities, and an increase in the population's share of those undergoing dialysis. Hosoya (2014) reveals that in the long-term solid sample of 1985-2006, HEs were significantly related to GDP, female labour force participation rate, ageing, unemployment rate, and time (technical progress). According to De Meijer et al. (2013), acute and long-term care expenditures rise as the population ages, though at different rates. Using panel data, Lago-Peñas et al. (2013) analysed the relationship between income and HEs in 31 OECD countries; results show that HE is more susceptible to seasonal variations in per capita income than trends. Because income elasticity is not much more robust over the long term, countries with a higher private share of overall expenditures on health care adjust to changes in GDP faster. According to Sturm and Hartwig (2012), the growth in acute beds, unemployment, the increase in the number of patients undergoing renal dialysis, and the growth in per capita real expenditure on health administration indicators can drive HEs.

Astolfi and colleagues' study (2012) discovered three distinct types of HEs forecasting models: microsimulation, component-based, and macro-level. Here almost all the models examined here consider population demographic changes. Innovation and technical advancement in healthcare and the impact of changes in health-seeking behaviour on demand for care are vital for a better understanding and measuring the drivers of the growth in HEs. Mehrara et al. (2010), for 16 OECD countries between 1993 and 2007, estimated the relationship between HEs and income using a panel smooth transition regression model. Similarly, Bac and Pen (2002) used a panel data analysis to test the hypothesis of cointegration between HEs and per capita GDP paper by using data from 18 OECD countries from 1972 to 1995. So, per capita GDP can influence HEs. According to Di Matteo's (2003) study, the elasticity of HEs depends on analysis and the stage of economic development in which economic growth is occurring. However, the authors suggest that HEs become more income-inelastic as incomes rise.

2. Categorization of Identified Determinants of HEs

We did categorisation by taking notice of the results from the literature. The main variables for this study are income and economic changes (D_1), referring to various indicators such as GDP, per capita GDP, unemployment rate, marginal income effect, per capita income, GDP growth, public HE share, public financing, etc. (Akca et al., 2017; Bac & Pen, 2002; Blazquez-Fernandez et al., 2014; Di Matteo, 2003; Gövdeli, 2019; Hartwig & Sturm, 2014; Hosoya, 2014; İlgün et al., 2022; Kong et al., 2020; Kutlu & Örün, 2022; Lago-Peñas et al., 2013; Mehrara et al., 2010; Mosca, 2007; Kraipornsak, 2017; Sen, 2005; Tian et al., 2018; Yetim et al., 2020); environment (D_2) refers to carbon dioxide emission, water pollution (Gövdeli, 2019; Kutlu & Örün, 2022); urbanization (D_3) refers to urban population rate, (Kutlu & Örün, 2022; Kraipornsak, 2017; Tian et al., 2018); education (D_4) refers to

education level (in different society groups) (Yetim et al., 2020); technology (D_5) refers to time related to technological development, innovations, advanced technology and technological progress (Astolfi et al., 2012; Blazquez-Fernandez et al., 2014; Hosoya, 2014; Nghiem & Connelly, 2017); governance (D_6) refers to decentralization, medical liability system (Mosca, 2007; Vandersteegen et al., 2015); population (D_7) refers to demographic shifts in population, ageing, population density, population above 65 or 80 years, age dependency ratio and etc. (Akca et al., 2017; Astolfi et al., 2012; De Meijer et al., 2013; Hosoya, 2014; Sen, 2005; Tian et al., 2018); and health services (D_8). Although health services are a general variable, it includes essential sub-variables such as health coverage ($D_{8.1}$), which refers to health coverage ratios, the change in the insurance coverage ratio, out of pockets, etc. (Hartwig & Sturm, 2014; Kraipornsak, 2017); health outcomes ($D_{8.2}$) refers to, life expectancy at birth, the proportion of inpatient, population with perceived poor health (Akca et al., 2017; Hartwig & Sturm, 2014; Phi, 2017; Tian et al., 2018); health resources ($D_{8.3}$) refers to health employment, hospital, and bed (acute and other types) quantity, the density of health personnel (physician and others), total HE ratio, etc. (Akca et al., 2017; Hartwig & Sturm, 2014; Kong et al., 2020; Mosca, 2007; Sturm & Hartwig, 2012; Tian et al., 2018), and health-seeking behaviour ($D_{8.4}$) refers to different health-seeking behaviours (Astolfi et al., 2012).

3. Identification of Subgroups of OECD Countries

The present study has concentrated on the determination of HEs for OECD countries. Applying an identical strategy-making procedure to all OECD countries would inevitably result in a degree of bias, given the distinct features and inherent heterogeneity of each. For this reason, the countries included in our study have been divided into groups based on their level of development, as defined by the United Nations (UN) World Economic Situation and Prospects Report. The world's countries have been classified into three broad categories: developed economies, economies in transition, and developing economies. This is intended to reflect the fundamental economic characteristics of each country. The research was designed based on groups, including OECD countries. However, as the economies in transition are not members of the OECD, only two subgroups have been formed. Chile, Colombia, Costa Rica, Estonia, Israel, Mexico, and Türkiye effectuate developing economies ($OECD_{d.ing}$), and the rest from Germany, United States (USA), Australia, Austria, Belgium, United Kingdom, Czech Republic, Denmark, Finland, France, South Korea, Netherlands, Ireland, Spain, Sweden, Switzerland, Italy, Iceland, Japan, Canada, Latvia, Lithuania, Luxembourg, Hungary, Norway, Poland, Portugal, Slovakia, Slovenia, Greece and New Zealand named developed economies ($OECD_{d.ed}$) (UN, 2022). To gain a comprehensive understanding of the subject matter, we requested the input of experts, who were asked to evaluate both developed and developing nations separately. In the initial survey, respondents were asked to evaluate $OECD_{d.ed}$ countries. In the subsequent survey, they were asked to assess $OECD_{d.ing}$ countries.

This study aims to determine which variables should be prioritised by health managers of OECD members in developed and developing countries to manage their health

systems effectively in the coming years. It also aims to compare the priorities of the main variables in health systems in developed and developing countries. As mentioned above, studies have focussed on a few dimensions affecting health expenditures. However, this study has reached the evidence to make a holistic evaluation by accessing the studies in the literature. The study's emphasis on a holistic approach to HEs and its original findings underscores the significance of this research.

In the first part of this study, basic information on the subject was introduced; in the second part, studies covering specific periods and OECD countries were listed to identify the determinants of HEs. The third section explains the method, analysis, and data collection tool. The analysis results are presented in the fourth part, and the results obtained by similar studies are discussed in the last part.

4. Materials and Methodology

4.1. Fuzzy Sets and Fuzzy Number

Zadeh developed fuzzy set theory to address uncertainty resulting from imprecision and ambiguity (Zadeh, 1965). One of its major contributions is its ability to represent ambiguous data. This theory also enables programming and mathematical operators in the fuzzy domain. A class of objects with a range of membership grades is called a fuzzy set. A membership (characteristic) function that awards each object a membership grade ranging from zero to one defines such a set (Kahraman et al., 2002).

Fuzzy logic is required for dealing with issues that are characterised by vagueness and imprecision, as demonstrated by the fact that human judgment on preferences is frequently ambiguous and difficult to estimate by definite numerical values (Büyüközkan & Çifçi, 2012).

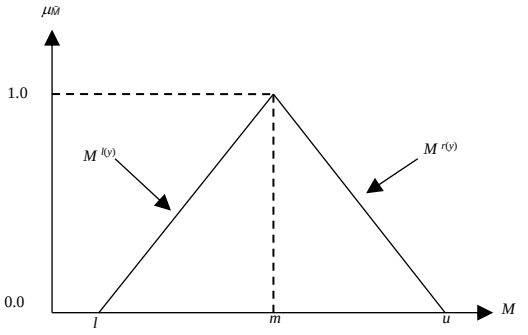
A triangular fuzzy number ($\tilde{M}$), shown in Figure 1, can be denoted as a (*l/m, m/u*) or (*l/m/u*). The values *l*, *m*, and *u* are the smallest, most promising, and most significant possible values that may be used to define a fuzzy event, respectively. Each triangular fuzzy number has linear representations on all of its sides, allowing Eq. (1) to be used to construct its membership function (Yüksel & Dağdeviren, 2010).

$$\mu(x|\tilde{M}) = \begin{cases} 0, x < l \\ (x-l)/(m-l), l \le x \le m \\ (u-x)/(u-m), m \le x \le u \\ 0, x > u \end{cases} \quad (1)$$

A fuzzy number's left and right representations for each degree of membership may always be utilised for offering it; *l (y)* and *r(y)* represent the left-side representation and the right-side representation of a fuzzy number, respectively, Eq. (2) (Yüksel & Dağdeviren, 2010).

$$\tilde{M} = (M^{l(y)}, M^{r(y)}) = (l + (m-l)y, u + (m-u)y), \; y \in [0,1], \quad (2)$$

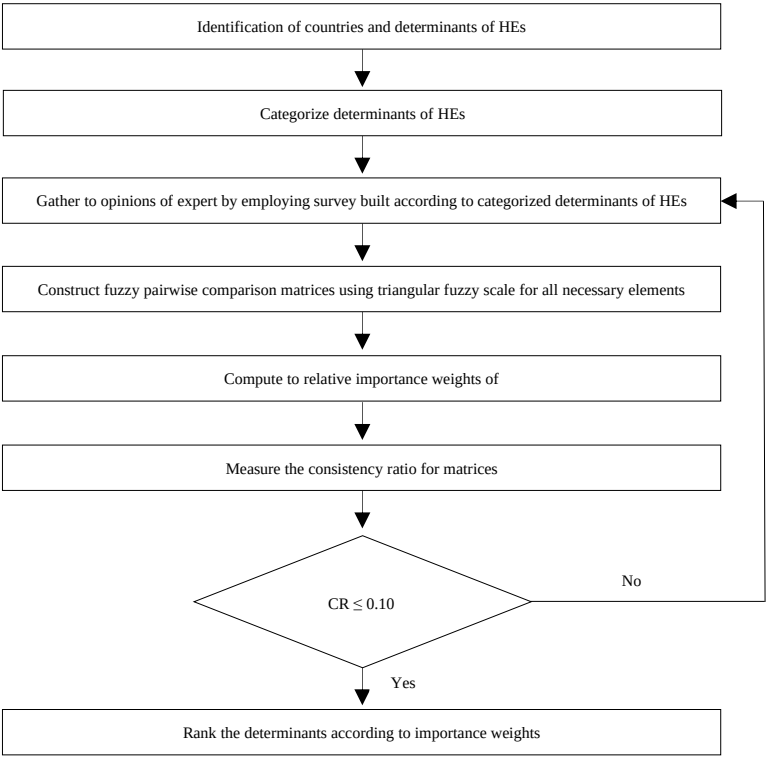
Figure: 1
A Triangular Fuzzy Number, $\tilde{M}$



4.2. Fuzzy AHP

AHP is a well-known multi-criteria decision-making method presented by Saaty (1996) first. AHP uses a bidirectional hierarchical relationship between decision levels (Meade & Sarkis, 1999). The human inclinations between the various alternatives are converted into equal, moderate, vigorous, strong, or extremely preferred preferences using a nine-point scale (1-9) in the conventional AHP. To avoid bias, the AHP exclusively employs absolute scale values for assessments and the consequent priority. It is difficult for the decision-maker to state their preferences using exact numerical values. To provide accurate pairwise comparison evaluations since some of the evaluation criteria are subjective and qualitative in personality traits. Uncertain decision-making situations cannot be effectively solved with the standard AHP. To avoid this restriction, which can deal with the ambiguity and imprecision of the service evaluation procedure. Interval or fuzzy evaluations are preferred for dealing with the ambiguity of the data involved in multi-criteria decision-making problems (Kumar & Kumar, 2008). For this research, the steps of the applied Fuzzy AHP methodology are given in Figure 2.

Figure: 2
Applied Fuzzy AHP



A group of decision-makers is organised to evaluate the criteria and attributes as linguistic variables with the agreement of all their numbers (Xiaoqiong et al., 2004). The decision-makers develop Pairwise comparison matrices using the scale given in Table 1.

Table: 1
Triangular Fuzzy Scales and Their Reciprocal Forms with Saaty Scale

Linguistic Term	Abbreviation	Relative Importance	Fuzzy Scales	Inverse Fuzzy Scales
Equal	E	1	1,1,1	(1/1, 1/1, 1/1)
Moderate	MS	3	2,3,4	(1/4, 1/3, 1/2)
Strong	S	5	4,5,6	(1/6, 1/5, 1/4)
Very Strong	VS	7	6,7,8	(1/8, 1/7, 1/6)
Extremely Strong	ES	9	9,9,9	(1/9, 1/9, 1/9)
Intermediate Values	IV	2; 4; 6; 8	1,2,3; 3,4,5; 5,6,7; 7,8,9	(1/3, 1/2, 1; 1/5, 1/4, 1/3; 1/7, 1/6, 1/5; 1/9, 1/8, 1/7)

The fuzzy judgment matrix uses triangular fuzzy scales via pairwise comparison (Eq. 3).

$$\tilde{A} = \begin{pmatrix} c_{11}^l, c_{11}^m, c_{11}^u & \cdots & c_{1n}^l, c_{1n}^m, c_{1n}^u \\ \vdots & \ddots & \vdots \\ c_{m1}^l, c_{m1}^m, c_{m1}^u & \cdots & c_{mn}^l, c_{mn}^m, c_{mn}^u \end{pmatrix} \quad (3)$$

The element c_{mn}, which is given by $(c_{ij}^l, c_{ij}^m, c_{ij}^u)$, represents the comparison of the criteria m with criteria n (i= j=1, 2, 3, …., n). Owing to the operational laws of fuzzy, the matrix $\tilde{A}$ can be denoted as Eq. (4) by c_{mn} with the corresponding reciprocal values (Sevkli et al., 2012; Tuzkaya & Önüt, 2008).

$$\tilde{A} = \begin{pmatrix} 1,1,1 & \cdots & c_{1n}^l, c_{1n}^m, c_{1n}^u \\ \vdots & \ddots & \vdots \\ \frac{1}{c_{m1}^l}, \frac{1}{c_{m1}^m}, \frac{1}{c_{m1}^u} & \cdots & 1,1,1 \end{pmatrix} \quad (4)$$

One way to estimate fuzzy priorities is to use the logarithmic least squares method. This is the most effective and efficient method, as calculated in Eq.(5) and Eq.(6). This method allows one to calculate the triangular fuzzy weights for the variables' relative importance, their feedback, and possible alternatives based on the factors separately (Ramík, 2007).

$$w_k^s = \frac{\left(\prod_{j=1}^n c_{kj}^s\right)^{1/n}}{\sum_{i=j}^n \left(\prod_{j=1}^n c_{ij}^m\right)^{1/n}}, \; s \in \{l,m,u\} \quad (5)$$

$$\widetilde{w}_k = w_k^l, w_k^m, w_k^u \; k: 1,2,3, \ldots.., n \quad (6)$$

The consistency ratio for each matrix and the hierarchy's total inconsistency are calculated to regulate the method's result. The pairwise comparisons' consistency is directly estimated using the consistency ratio (CR), which must be lower than 0.10. If so, the comparisons can be claimed to be acceptable; if not, they are not. Then, experts in the assessment process reach a consensus on their opinions, which are transferred to a chart as linguistic and fuzzy evaluation matrices.

4.3. Defuzzication of Calculated Weights

For the defuzzification of weights obtained from fuzzy matrices, Eq. (7) can be used (Büyüközkan & Çifçi, 2012).

$$F\left(\tilde{t}_{ij}\right) = \frac{1}{2}\int_0^1 \left(\inf_{x \in R}\left(\tilde{t}_{ij}^{\alpha}\right) + \sup_{x \in R}\left(\tilde{t}_{ij}^{\alpha}\right)\right) d\alpha \quad (7)$$

For the income and economic changes (D_1), one of the determinants of HEs (for $OECD_{d.ed}$) and has been included in the model, the fuzzy weight is obtained as w_k^l=0.1766, w_k^m=0.2122, and w_k^u=0.2468. Then, using this fuzzy vector and apply in Eq. (7), the defuzzied weight would be 0.2119.

4.4. Data Gathering Tool and Characteristics of Participant

The purposive sampling method was used in the study. This method increases the reliability of the research by allowing researchers to select the most appropriate participants or cases according to specific criteria (Campbell et al., 2020). In the study, the requirements of having at least 10 years of experience in the health sector and having research in the field of health management, health economics and health expenditures were determined, and five experts were evaluated accordingly. Detailed information is illustrated in Table 2. The variables collected under each determinant were first clearly described for gathering data. And *"What should be the top priority for governments to effectively manage their health expenditures in the next decade?"* was the question. The participants were requested to respond to the question above using the AHP form, which is regulated by the authors and allows for relative comparison. In this form, the participants evaluated two different determinants using linguistic expressions. The data were obtained through face-to-face interviews with the participants in their offices between 12-16 June 2023.

Table: 2
Detailed Information About Participants

Participant	Experience	Education	Speciality
Expert 1	15 years	Ph.D.	Health Management, Health Economics
Expert 2	10 years	M.Sc.	Health Management
Expert 3	11 years	M.Sc.	Health Management
Expert 4	12 years	Ph.D.	Health Economics, Health Expenditures
Expert 5	18 years	Ph.D.	Health Economics

4.5. Limitations

The present study focused on a specific group of specialists, namely those residing in Türkiye, and thus did not extend to include any other professionals or experts from abroad. This circumstance represents a significant limitation of the research. Furthermore, the study examined the determinants of HEs in line with existing literature, and experts were not asked to identify any additional variables. The data presented in this cross-sectional study reflect the participants' views during data collection. These are also offered as a limitation.

5. Results

Pairwise comparison matrices were used to gather the information necessary for applying the fuzzy AHP method. The experts who are theoretically and practically skilled in the topic have offered their thoughts. For instance, D_1 and D_2 are compared using the question, *"How important is income and economic growth when compared with environment?".* If the answer is *"Extremely strong"* in linguistic terms, it would be *"9,9,9"* in the relevant cell in triangular fuzzy scale matrices. The technique used to build each fuzzy evaluation matrix is the same.

Table 3 provides an example of evaluating determinants with a sub-group of health indicators (D_8) of HEs.

Table: 3
Pairwise Comparison Matrix of Determinants of HEs for $OECD_{d.ed}$

	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	$D_{8.1}$	$D_{8.2}$	$D_{8.3}$	$D_{8.4}$
D_1	1	ES	S	MS	MS	1/ES	VS	VS				
D_2		1	1/ES	1/ES	1/ES	1/VS	E	1/ES				
D_3			1	1/MS	1/MS	1/ES	S	E				
D_4				1	MS	1/ES	VS	1/MS				
D_5					1	1/ES	VS	E				
D_6						1	VS	MS				
D_7							1	1/MS				
D_8								1				
$D_{8.1}$									1	1/MS	VS	ES
$D_{8.2}$										1	S	S
$D_{8.3}$											1	S
$D_{8.4}$												1

Following data collection utilising pairwise comparison matrices for each country group ($OECD_{d.ed}$ and $OECD_{d.ing}$), the relevant matrices were transformed into triangular fuzzy numbers, as indicated in Table 1. Subsequently, an integrated matrix was generated using the geometric mean of each expert's assessment (Table 4), and these fuzzy averages were employed to calculate fuzzy weights, as demonstrated in Table 5. The weights were clarified using Eq. (7) to ascertain the final importance weights.

Table: 4
The Combination Matrix

for OECD$_{d.ed}$

	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8
D_1	(1,1,1)	(6,6.77,7.47)	(4.82,5.81,6.73)	(0.66,0.89,1.12)	(1,1.27,1.55)	(0.92,1.16,1.43)	(5.53,6.43,7.30)	(1.43,1.72,2.00)
D_2	(0.17,0.15,0.13)	(1,1,1)	(0.16,0.19,0.24)	(0.14,0.16,0.20)	(0.17,0.21,0.26)	(0.25,0.30,0.37)	(0.37,0.44,0.53)	(0.14,0.16,0.18)
D_3	(0.21,0.17,0.15)	(6.21,5.16,4.10)	(1,1,1)	(0.24,0.28,0.33)	(0.17,0.20,0.26)	(0.24,0.29,0.34)	(0.55,0.64,0.76)	(0.20,0.21,0.24)
D_4	(1.52,1.13,0.89)	(7.13,6.12,5.10)	(4.19,3.55,3)	(1,1,1)	(3.10,3.68,4.19)	(2.35,2.85,3.37)	(2.70,3.33,4.10)	(0.56,0.67,0.80)
D_5	(1,0.79,0.64)	(5.86,4.83,3.78)	(5.86,4.90,3.87)	(0.32,0.27,0.24)	(1,1,1)	(1.12,1.31,1.52)	(2.55,3.21,4)	(0.31,0.34,0.37)
D_6	(1.08,0.86,0.70)	(4,3.38,2.70)	(4.19,3.50,2.93)	(0.43,0.35,0.30)	(0.89,0.76,0.66)	(1,1,1)	(1.55,1.94,2.49)	(0.25,0.31,0.37)
D_7	(0.18,0.16,0.14)	(2.70,2.26,1.89)	(1.83,1.55,1.32)	(0.37,0.30,0.24)	(0.39,0.31,0.25)	(0.64,0.52,0.40)	(1,1,1)	(0.19,0.23,0.30)
D_8	(0.70,0.58,0.50)	(7.30,6.43,5.53)	(5.10,4.66,4.19)	(1.78,1.50,1.25)	(3.18,2.95,2.70)	(3.96,3.27,2.70)	(5.40,4.43,3.37)	(1,1,1)

for OECD$_{d.ing}$

	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8
D_1	(1,1,1)	(1.18,1.38,1.61)	(1.40,1.63,1.84)	(0.52,0.61,0.72)	(0.33,0.39,0.45)	(0.19,0.20,0.22)	(0.80,0.97,1.15)	(0.23,0.28,0.34)
D_2	(0.85,0.72,0.62)	(1,1,1)	(2.17,2.54,2.86)	(0.26,0.32,0.39)	(0.17,0.21,0.26)	(0.24,0.30,0.37)	(0.21,0.24,0.28)	(0.23,0.26,0.30)
D_3	(0.72,0.61,0.54)	(0.46,0.39,0.35)	(1,1,1)	(0.37,0.46,0.55)	(0.24,0.30,0.37)	(0.19,0.21,0.24)	(0.44,0.53,0.64)	(0.21,0.24,0.28)
D_4	(1.93,1.63,1.38)	(3.87,3.16,2.55)	(2.70,2.18,1.83)	(1,1,1)	(1.74,1.99,2.22)	(1.43,1.72,2.10)	(2.22,2.67,3.10)	(0.32,0.39,0.50)
D_5	(3.03,2.58,2.22)	(5.86,4.83,3.78)	(4.10,3.33,2.70)	(0.58,0.50,0.45)	(1,1,1)	(1.15,1.38,1.64)	(0.87,1.09,1.32)	(0.61,0.78,1)
D_6	(5.40,4.99,4.55)	(4.10,3.33,2.70)	(5.28,4.74,4.19)	(0.70,0.58,0.48)	(0.87,0.72,0.61)	(1,1,1)	(2.22,2.58,3.03)	(1,1.23,1.50)
D_7	(1.25,1.04,0.87)	(4.70,4.15,3.57)	(2.30,1.87,1.55)	(0.45,0.37,0.32)	(1.15,0.92,0.76)	(0.45,0.39,0.33)	(1,1,1)	(0.38,0.46,0.59)
D_8	(4.34,3.56,2.93)	(4.44,3.88,3.29)	(4.70,4.15,3.57)	(3.10,2.54,2.00)	(1.64,1.29,1)	(1,0.81,0.67)	(2.62,2.16,1.70)	(1,1,1)

for OECD$_{d.ed}$ ***for OECD$_{d.ing}$***

	$D_{8.1}$	$D_{8.2}$	$D_{8.3}$	$D_{8.4}$	$D_{8.1}$	$D_{8.2}$	$D_{8.3}$	$D_{8.4}$
$D_{8.1}$	(1,1,1)	(0.62,0.75,0.92)	(2.35,2.90,3.48)	(2.61,3.00,3.37)	(1,1,1)	(4.90,5.79,6.64)	(1.41,1.50,1.57)	(4.56,5.54,6.45)
$D_{8.2}$	(1.61,1.33,1.08)	(1,1,1)	(1.08,1.29,1.52)	(0.50,0.63,0.80)	(0.20,0.17,0.15)	(1,1,1)	(0.47,0.54,0.66)	(2.06,2.59,3.22)
$D_{8.3}$	(0.43,0.34,0.29)	(0.92,0.78,0.66)	(1,1,1)	(2.67,2.95,3.25)	(0.71,0.67,0.64)	(2.15,1.85,1.52)	(1,1,1)	(5.42,6.30,7.14)
$D_{8.4}$	(0.38,0.33,0.30)	(2.00,1.58,1.25)	(0.37,0.34,0.31)	(1,1,1)	(0.22,0.18,0.16)	(0.49,0.39,0.31)	(0.18,0.16,0.17)	(1,1,1)

Here, the weights of the key determinants were determined independently for the two country groups. The weights of other determinants in the sub-group of health services were also determined. The final importance weights are presented in Table 5.

Table: 5
The Final Importance Weights

	for OECD$_{d.ed}$		***for OECD$_{d.ing}$***	
The Determinants of HEs	**Weight**	**Rank**	**Weight**	**Rank**
Key determinants				
D_1: Income and economic changes	0,2119	3	0,0690	6
D_2: Environment	0,0252	8	0,0503	7
D_3: Urbanization	0,0443	7	0,0446	8
D_4: Education	0,2119	2	0,1694	3
D_5: Technology	0,1227	4	0,1584	4
D_6: Governance	0,1021	5	0,1904	2
D_7: Population	0,0509	6	0,0981	5
D_8: Health services	0,2310	1	0,2198	1
Sub-determinants				
$D_{8.1}$: Health Coverage	0,3796	1	0,4932	1
$D_{8.2}$: Health Outcomes	0,2414	2	0,1327	3
$D_{8.3}$: Health Resources	0,2241	3	0,3118	2
$D_{8.4}$: Health seeking-behaviour	0,1549	4	0,0622	4

The data collected from the experts indicate that the developed OECD countries should prioritise health services (D_8 - weighted 0.2310) and their sub-factors to manage their HEs more efficiently during the next decade. In fact, among these determinants, health coverage-related concerns ($D_{8.1}$ - weighted 0.3796) should be given priority, followed by health outcomes ($D_{8.2}$ - weighted 0.2414), health resources ($D_{8.3}$ - weighted 0.2241), and health-seeking behaviours ($D_{8.4}$ - weighted 0.1549). It has been revealed that, among the key determinants, education (D_4 - weighted 0.2119), income and economic developments (D_1 - weighted 0.2119), technology (D_5 - weighted 0.1227), governance (D_6 - weighted 0.1021), population (D_7 - weighted 0.0509), urbanisation (D_3 - weighted 0.0443), and, eventually, the environment (D_2 - weighted 0.0252), rank next after health services (D_8).

For developing countries to manage their HEs more efficiently over the next decade, their evaluation should prioritise health services (D_8 - weighted 0.2198) and their sub-factors. Actuality, among these aspects, the emphasis should be primarily on problems with inclusion ($D_{8.1}$ - weighted 0.4932), followed by issues with health resources ($D_{8.3}$ - weighted 0.3118), health outcomes ($D_{8.2}$ - weighted 0.1327), and health-seeking behaviours ($D_{8.4}$ - weighted 0.0622), in that priority. Regarding the key determinants, it was revealed that governance (D_6 - weighted 0.1904), education (D_4 - weighted 0.1694), technology (D_5 - weighted 0.1584), population (D_7 - weighted 0.0981), income and economic changes (D_1 - weighted 0.0690), environment (D_2 - weighted 0.0503), and finally urbanisation (D_3 - weighted 0.0446) are, respectively, the most crucial determinants after health services.

6. Discussion and Conclusion

Those responsible for formulating health policy and planning are engaged in developing solutions to effectively manage the global rise in HEs. Effective and efficient resource utilisation is viable when health management is planned and organised

appropriately. Consequently, health managers require evidence-based information to develop the optimal policy and plan. This study aims to determine the priorities of the variables to facilitate effective future management of HEs by health managers in OECD countries, which are categorised as developed and developing.

As a result of the study, health services for both $OECD._{ded}$ and $OECD._{ing}$ were determined by experts as the group with priority in the coming years. However, it was additionally demonstrated that the priorities within the subgroup varied. Finally, it has been uncovered that developing and organising the health system's resources to manage HEs effectively is a priority issue relative to the other groups in developing OECD countries. Similar to Eriksen and Wiese (2019) state that short-term cost savings in health resources will increase HEs in the long run. Also, Sfakianakis et al. (2021) state that increases in unemployment will cause the restriction of health resources; for developed countries, it has been realised that pertinent policies should emphasise improving health outcomes. Similarly, Jakovljevic et al. (2020) state a positive correlation between healthy life expectancy as a health status indicator. Furthermore, Ivanková (2020) states that healthcare efficiency in OECD countries is associated with HEs and is represented by health outcomes such as life expectancy at birth, perceived health status, and health quality indicators. In the priority key group, we revealed that health-seeking behaviour should be another critical factor for the issue. In some studies, the importance of this determinant accented; for instance, the study of Wranik (2012) states that policy tools that directly target patient behaviours, such as insurance coverage and cost-sharing, and policy tools that directly target physician behaviours, such as physician payment methods are important determinants.

The growth of education significantly affects society's understanding of health issues and its ability to receive healthcare. Therefore, increasing education can have a positive impact on healthcare expenditures. Thus, enhancing education can aid in raising health consciousness, promoting early disease detection, improving healthcare usage, and training health workers. These factors can contribute to reducing HEs. Thus, in other studies, researchers have also highlighted this issue. For instance, Yetim et al. (2021), in their research with panel data analysis covering the period of 2000-2017, state that the most critical factors affecting HEs in OECD are income and education. In addition, Çelik et al. (2016) stated that the direct and indirect effects of HEs on sustainable development goals and non-health sectors, including labour productivity, education level, and social development, should be considered.

Governance for $OECD_{d.ing}$ has ranked second while ranked 5^{th} for $OECD_{d.ed}$. Political instability, weak institutions, corruption, a lack of funds and knowledge, and poor infrastructure may have all contributed to events that led experts to propose this topic as the top concern for policymakers. Implementing successful policies and initiatives that support responsible behaviour, the rule of law, and good governance can be challenging due to these issues. On the other hand, developed countries' lack of progress in this area can frequently be attributed to their stronger institutions, superior educational systems, and excellent financial resources for infrastructure and governance. However, the study of Wranik (2012)

denoted that financial systems like Beveridge and Bismarck or gatekeeping are insignificant determinants of the efficiency of health systems because of policy tools that directly target patient and physician behaviours.

Income and economic changes are the third highest priority determinant for $OECD_{d.ed}$ for policymakers. Factors such as financing health services, qualified human resources, technology, and infrastructure directly relate to adequate income and economic development levels in developed countries, as higher wealth and economic development levels in developed countries translate into more resources available to pay for healthcare. In countries with advanced economies, qualified physicians, nurses, and other health professionals also earn excellent salaries. Additionally, health technology is more advanced, and novel treatments are available in industrialised nations. Therefore, economic development and the development of health services are interdependent and must support each other. Some studies have emphasised this issue, like Yetim et al. (2021), which state that income and education are the most critical factors affecting HEs in OECD. Badulescu et al. (2019), in their study covering the period 2000-2014 in 28 EU countries, found that GDP has the most significant impact on HEs; that a 1% increase in GDP can lead to an average of 2% increase in HEs in the long run. Wang and Chen (2021) found that income and Baumol's cost sickness had a significant positive effect on the rise in HEs, and spatial sprawl had a significant impact on the growth of HEs.

Contrary to our findings, the determinants of environment and urbanisation are among the top highlighted topics in many studies, even though they rank last for both subgroups in our study. Thus, in some of the studies, authors stated that urbanisation or the degree of urbanisation affects HEs in the OECD and Asian countries (Boz et al., 2020; Jakovljevic et al., 2020). Zhang and Rahman (2020) also stated that the factors affecting HEs in China are the degree of urbanisation and urban differences. Other authors Badulescu et al. (2019), in their study covering the period 2000-2014 in 28 EU countries, CO2 emissions determine a decrease in HEs in the short run and a growth in the long run, states that a 1% increase in CO2 emissions per capita can lead to a rise of between 0.6% and 1% in HEs.

In conclusion, this study aimed to prioritise the factors that affect health spending in developed and developing OECD nations. The study found that while both groups' top priorities should be health services, their priorities varied within each group. It was determined that growing health outcomes were more important for wealthy countries than organising and managing health resources effectively for developing countries. Education and income were also recognised as significant drivers for both groups, and governance was evaluated more highly for developing countries than developed ones. Finally, although they have been emphasised in previous studies, environmental and urbanisation factors were not considered the highest priority in this study.

Overall, this study offers evidence-based information to the OECD's health policymakers and managers that they can use to create efficient HE allocation plans and

policies. The results may serve as a roadmap for further study in this area and assist in efforts to increase healthcare access, affordability, and quality.

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