

Evaluation of Statistical Regions According to Preventive Health Service Indicators by Multidimensional Scaling and MOORA Methods

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ABSTRACT

Objective: This study aims to evaluate the positions of statistical regions from 2020 to 2022 based on preventive healthcare indicators and rank them by healthcare performance.

Methods: Statistical regions' positions were determined using multidimensional scaling analysis with SPSS 21 software. The MOORA ratio method was employed to rank statistical regions based on their performance scores derived from preventive health service indicators. The analysis was conducted using Microsoft Excel.

Results: The highest average visits to physicians per capita in primary care was 4.11 (± 0.65) in 2022, while the lowest was 2.95 (± 0.49) in 2021. The number of family health centers peaked at 2266.25 (± 1236.6) in 2020 and dropped to its lowest at 2228.08 (± 1282.74) in 2021. The top-performing regions according to MOORA were the East Black Sea in 2020, Aegean in 2021, and West Marmara in 2022, while Southeast Anatolia consistently ranked 11th across all three years.

Conclusion: There was an increase in follow-up and vaccination rates, among the indicators of preventive health services at the statistical region level, in 2021-2022 compared to 2020. Despite having the characteristics of a developed region, Istanbul ranked last in 2020 and 2022 according to performance scores.

Keywords: Family health, multidimensional scaling analysis, moora method



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Introduction

The COVID-19 pandemic has led to the death of approximately 7 million people worldwide in the 21st century, significantly impacting various systems, including health, economy, and social structures (Duran & Acar, 2020). In Turkey, the healthcare system responded by increasing capacity in areas such as healthcare personnel and hospital beds. Non-emergency surgeries and examinations were postponed to prioritize treatment services (TÜBA COVID-19 Global Pandemic Assessment Report, 2020). As part of preventive health services, individuals requiring vaccination, infant and child check-ups, and prenatal care were contacted via phone, and appointments were scheduled to reduce congestion at family health centers and minimize the risk of disease transmission. Routine laboratory tests and cancer screenings were also postponed during this period (Samanci, 2020).

Family physicians, as key providers in primary healthcare, play a vital role in improving public health (Uğurlu et al., 2012). However, challenges such as a high patient-to-physician ratio and extended working hours remain prominent issues in Turkey's primary healthcare system (Uğurlu et al., 2012). In Turkey, one of the primary challenges in healthcare is the high population-to-family physician ratio and the delivery of family health services within fixed working hours (Akman, 2014). During the COVID-19 pandemic, family physicians were tasked with additional responsibilities, including home follow-up for infected and contact patients, examining and referring patients, and monitoring chronic conditions (İşildar, 2021). While these additional duties increased the workload for primary healthcare personnel, they also contributed to the development and expansion of primary healthcare services.

Under the family health performance system, activities such as prenatal and infant follow ups, vaccinations, and mobile services for registered patients are evaluated as performance points for family physicians (Görmüş, 2015). Studies examining this system have revealed that the performance of family physicians varies depending on the residential area and socio-demographic characteristics of the region. Physicians are classified as successful or unsuccessful based on performance metrics (Karaman & Kazan, 2015; Taşlıdere et al., 2017). This study applied the Donabedian model (1992), including the dimensions of resources, services, and health outcomes, to analyze the performance of statistical regions based on preventive health service parameters. In this model, resources refer to

personnel, the working environment, and physical facilities (including material and technological resources); production is defined as the rate of health service utilization, and the health dimension includes all activities designed to meet the demand for health services.

Studies on family health implementation have highlighted that efficiency and performance analyses are conducted at the statistical region level (Gözlü, 2021; İlğün & Şahin, 2020; Köse, 2022; Özdemir, 2020). In Turkey, health service planning operates at this micro regional scale. The classification of statistical regional centers is a method used to identify similarities and differences between regions, not only in health services but also in areas like regional development and economic planning. Evaluating health service provision at the statistical region level is essential for shaping effective, region-specific health policies (Çağlar & Keten, 2019). Preventive health services are central to improving population health and represent a core objective of health policies. Reducing health inequalities requires equitable access to these services, which can be achieved through a well-functioning family health system. In this regard, policies that promote the employment of family physicians and family health personnel and regulatory measures that foster public engagement in preventive health initiatives are essential to sustain the effectiveness of the family health system.

The study aims to assess the positions of statistical regions concerning preventive healthcare services during the 2020–2022 period and to rank these regions based on their healthcare performance. Multidimensional scaling analysis was employed to position the statistical regions using preventive healthcare indicators, utilizing the SPSS 21 software. To rank the regions by performance scores derived from these indicators, the MOORA (Multi-Objective Optimization by Ratio Analysis) method was applied, with calculations performed in Microsoft Excel.

Methods

Type of research

This study adopts a cross-sectional design, focusing on evaluating data from a specific period based on selected parameters.

Research questions

How are the statistical regions ranked according to preventive healthcare indicators in Turkey during 2020–2022? How are the statistical regions ranked based on their

preventive health service performance in Turkey during 2020–2022?

Data Collection Tools

The parameters utilized in the study are presented in Table 1.

Table 1. Variables Used in the Study	
Variables	Description
Resource	
Number of Family Health Centers (NFHU)	Number of Family Health Centers
Health	
Pregnancy Monitoring (PM)	Rate of pregnancy monitoring performed by family health centers within a year
Infant Monitoring (IM)	Rate of infant monitoring performed by family health centers within a year
Child Follow-up (CF)	Rate of child follow up performed by family health centers within a year
5-in-1 vaccine (DBT)	Proportion of 5-in-1 vaccine vaccinations administered by family health centers within a year
Hepatitis B Vaccine (HBV)	Hepatitis B vaccination rate administered by family health centers within one year
Measles, Mumps, Rubella Vaccine (MMR)	MMR vaccination rate administered by family health centers within one year
Production	
Rate of visits to physicians per capita (RVPPC)	Rate of applications to 1 st level health institutions

The study utilized data from health statistical yearbooks to assess the healthcare performance of 12 statistical regions in Turkey: Mediterranean, West Black Sea, West Anatolia, West Marmara, East Black Sea, East Marmara, Aegean, Southeast Anatolia, Northeast Anatolia, Middle East Anatolia, Middle Anatolia, and Istanbul. For the evaluation covering 2020–2022, eight variables were identified across three dimensions: resource (e.g., the number of family health centers), health (e.g., follow-up and vaccination activities), and service (e.g., the rate of visits to primary healthcare institutions). This study focuses exclusively on data from 2020–2022, excluding 2023 due to the limited availability of data published as news bulletins.

Multidimensional scaling analysis aims to determine the position of these objects in multidimensional space by using the distance value between n number of objects. This process involves mapping observations into a 2- or 3-dimensional conceptual space, representing the dissimilarities between points. The choice of distance metric

in MDS depends on the data type: Euclidean distance, quadratic Euclidean distance, and Minkowski distance are applied when data are measured on equal interval or proportional scales. In contrast, chi-square distance is used for data measured on classificatory or ordinal scales (Gürsakar, 2019). Euclidean distance was used as the data were measured on equal interval and proportional scales. The analysis was conducted in two dimensions based on the distances between 12 statistical regions using eight variables. Stress values (S) were analyzed to evaluate the fit of the results to the data, with $S \geq 0.20$ indicating poor fit, $S=0.10$ moderate fit, $S=0.05$ good fit, and $S=0.00$ excellent fit (Ding, 2018).

The MOORA ratio method begins by constructing a matrix containing the values of various alternatives corresponding to different objectives.

$$X = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad \text{(Equation 1)}$$

X_{ij} : The value of alternative 1 in the jth objective

Using the MOORA ratio method, normalized values are calculated according to the formula below, and the process is proceeded.

$$X_{ij}^* = \frac{x_{ij}}{\sqrt{\sum_{j=1}^m x_{ij}^2}} \quad \text{(Equation 2)}$$

X^*_{ij} : is the normalised value of alternative i in the jth objective

Following normalization, values are optimized by summing them according to maximization or minimization objectives, and alternatives are ranked based on the difference between these summed totals.

$$y_j^* = \sum_{i=1}^{i=g} x_{ij}^* - \sum_{i=g+1}^{i=n} x_{ij}^* \quad \text{(Equation 3)}$$

In this study, the MOORA ratio method evaluated variables based on their orientation towards efficiency: follow-up and vaccination rates and physician visits per capita were designated as maximum orientation, while the number of family health centers was designated as minimum orientation. In this context, follow-up and vaccination rates, as well as the rate of visits to physicians per capita, were designated as maximum-oriented variables, and the number of family health centers was determined as minimum-

oriented. In the national literature, multidimensional scaling analysis has been applied to position statistical regions and the provinces within them according to health indicators. This method is used to assess the performance of health services by identifying similarities and differences across regions or provinces and subsequently to propose policy recommendations (Ataş & Gündüz, 2020; Işıkçelik & Günaltay, 2024). In the national literature, only one study has employed MOORA analysis to evaluate health indicators (Eren & Ömürbek, 2019), while no studies to date have applied this method at the statistical region level.

Ethical Considerations

The research adhered to the principles of the Declaration of Helsinki, and since the data used were secondary, ethics committee approval was not required.

Results

Table 2 presents the values, means, and standard deviations of preventive health service indicators across statistical regions. In 2020, Southeast Anatolia had the lowest rates of pregnant, infant, and child follow-up, while the East Black Sea region recorded the highest rates of pregnant and infant follow-up, and West Marmara had the highest rate of child follow-up. The highest vaccination rates for DBT, MMR, and HBV were in West Marmara, with the Mediterranean and Aegean regions also excelling in DBT and HBV vaccinations. Northeast Anatolia had the lowest vaccination rates across all three vaccine groups. Physician visit rates per capita in primary care were highest in West Marmara and lowest in Istanbul, while the number of family health centers was highest in Istanbul and lowest in Northeast Anatolia. In 2021, the highest infant and child follow-up rates were observed in the West Black Sea, and the lowest rates were in Southeast Anatolia. The East Black Sea had the highest pregnant follow-up rates, while the Mediterranean region had the lowest. Vaccination rates for DBT, MMR, and HBV were again highest in West Marmara, with the lowest rates found in Middle Anatolia, Southeast Anatolia, and Middle East Anatolia. The highest primary care physician visit rate per capita remained in West Marmara, while Istanbul continued to record the lowest. Istanbul also maintained the highest ratio of family health centers. In 2022, the West Black Sea region recorded the highest infant and child follow-up rates, while the lowest rates were in Southeast Anatolia. Pregnancy follow-up rates were highest in the East Black Sea region and lowest in the Mediterranean. West Marmara had the highest vaccination rates for DBT, MMR, and HBV vaccines, while East Marmara, Aegean,

Table 2.
Mean and standard deviation values of preventive health indicators of statistical regions

2020	PM	IM	CF	DBT	HBV	MMR	RVPPC	NFHU
West Black Sea	98.7	96.5	94.6	0.99	0.98	0.94	3.3	1507
Istanbul	96.1	91.2	90.9	0.98	0.98	0.93	2.4	4964
East Black Sea	99.2	96.5	94.6	0.98	0.99	0.94	3.3	857
West Marmara	98.7	94.5	94.9	1	1	0.99	3.7	1951
East Marmara	97.6	93.4	94.1	0.99	0.99	0.95	3.3	2516
Mediterranean	94.7	92	90.1	1	1	0.98	3.5	3263
Aegean	98.7	93.1	94.1	1	1	0.97	3.6	3383
M. Anatolia	96.3	93.7	92.3	0.96	0.96	0.93	3.3	1350
West Anatolia	95.5	94.2	93.8	0.98	0.98	0.95	2.7	2521
Southeast Anatolia	94.2	85.1	85.1	0.98	0.98	0.96	2.7	2869
Middle East Anatolia	96	89.7	89.8	0.97	0.97	0.92	2.5	1273
Northeast Anatolia	97.6	92.4	92.2	0.95	0.95	0.90	2.5	741
Mean	96.94	92.69	92.2	0.98	0.98	0.94	3.06	2266.25
SD	1.7	309	2.87	0.01	0.01	0.02	0.47	1236.6
2021	PM	IM	CF	DBT	HBV	MMR	RVPPC	NFHU
West Black Sea	98.6	98.1	95.8	0.95	0.95	0.96	3.2	1519
Istanbul	96.1	93.2	92.8	0.96	0.97	0.95	2.1	4969
East Black Sea	99.4	98.1	95.3	0.96	0.96	0.96	3.2	882
West Marmara	98.9	96	94.3	1	1	1	3.6	1175
East Marmara	97.2	95.1	93.1	0.95	0.95	0.97	3.1	2547
Mediterranean	93.8	94	91.9	0.97	0.97	0.98	3.4	3308
Aegean	98.8	94.4	94.3	0.97	0.97	0.98	3.4	3403
M. Anatolia	96	94.9	95.4	0.93	0.93	0.94	3.4	1361
West Anatolia	94.6	95.3	95.3	0.95	0.95	0.96	2.5	2542
Southeast Anatolia	94.7	88.5	91	0.93	0.93	0.96	2.7	2995
Middle East Anatolia	96.5	93.5	93.8	0.96	0.96	0.94	2.4	1290
Northeast Anatolia	98.1	95	94.7	0.96	0.96	0.94	2.5	746
Mean	96.89	94.67	93.97	0.95	0.95	0.96	2.95	2228.08
SD	1.89	2.48	1.50	0.01	0.01	0.01	0.49	1282.74
2022	PM	IM	CF	DBT	HBV	MMR	RVPPC	NFHU
West Black Sea	98.7	97.9	98.1	0.97	0.97	0.93	4.6	1571
Istanbul	96	93.1	95.9	0.99	0.99	0.93	2.9	4992
East Black Sea	99.4	98.1	97.7	0.97	0.97	0.93	4.5	912
West Marmara	99	95.4	98.1	1	1	1	4.7	1219
East Marmara	97.4	94.8	96.9	1	1	0.96	4.2	2694
Mediterranean	94.5	93.6	96.1	0.99	0.99	0.96	4.6	3440
Aegean	98.8	94.1	97.5	1	1	0.97	4.7	3331
M. Anatolia	96.7	94.5	97.5	0.95	0.95	0.92	4.9	1393
West Anatolia	95.1	95.3	97.2	0.98	0.98	0.94	3.9	2627
Southeast Anatolia	95.1	88.1	94.8	1	1	0.95	3.5	2884
Middle East Anatolia	97.1	93.2	96.8	0.98	0.98	0.93	3.4	1347
Northeast Anatolia	98.1	94.8	97.4	1	1	0.92	3.5	762
Mean	97.1	94.4	97	0.98	0.98	0.94	4.11	2264.33
SD	1.69	2.55	0.97	0.01	0.01	0.02	0.65	1276.36

NFHU: Number of Family Health Centers, PM: Pregnancy Monitoring, IM: Infant Monitoring, CF: Child Follow-up, DBT: 5-in-1 vaccine, HBV: Hepatitis B Vaccine, MMR: Measles, Mumps, Rubella Vaccine, RVPPC: Rate of visits to physicians per capita, M Anatolia: Middle Anatolia, SD: Standard Deviation

Southeast, and Northeast Anatolia also showed strong rates for DBT and HBV. Middle Anatolia consistently had low vaccination rates across DBT, HBV, and MMR vaccines.

Physician visits per capita in primary care were highest in Middle Anatolia and lowest in Istanbul. Istanbul maintained the highest ratio of family health centers, while Northeast Anatolia had the lowest. Between 2020 and 2022, the highest follow-up averages included 97.1% (± 1.69) for pregnant follow-up in 2022, 94.67% (± 2.48) for infant follow-up in 2021, and 97% (± 0.97) for child follow-up in 2022. Vaccination rates showed the lowest averages in 2021 for DBT and HBV (both 0.95 ± 0.01) and the highest for MMR in 2022 (0.96 ± 0.01). Physician visits per capita in primary care peaked at an average of 4.11 (± 0.65) in 2022, with the lowest average of 2.95 (± 0.49) in 2021. The mean number of family health centers was highest in 2020 at 2266.25 (± 1236.6) and lowest in 2021 at 2228.08 (± 1282.74).

Table 3 presents the correlation matrix of the variables for 2020–2022, calculated using the Spearman correlation coefficient due to the non-normal distribution of the sample ($n < 30$) (Sümbüloğlu & Sümbüloğlu, 2012). In 2020, significant correlations were identified between the rate of visits to physicians per capita at the primary care level and child follow-up ($r = 0.604$) and between DBT vaccination rates and the number of family health centers ($r = 0.578$) $p < .05$. A significant relationship was determined at $p < .01$ level between pregnant follow-up and infant follow-up ($r = 0.728$); between child follow-up and pregnant follow-up ($r = 0.765$); between child follow-up and infant follow-up ($r = 0.714$); between DBT and HBV vaccination rates ($r = 0.734$); between DBT and MMR vaccination rates ($r = 0.672$); and between DBT and the rate of visits to primary care physicians per capita ($r = 0.769$). In 2021, a significant relationship was determined at the $p < .05$ level between pregnant follow-up and infant follow-up ($r = 0.585$) and between MMR vaccination rate and the rate of visits to physicians per capita at the primary care level ($r = 0.644$). A significant relationship was determined between child follow-up and infant follow-up ($r = 0.754$), and between DBT and HBV vaccination rates ($r = 0.672$) at $p < .01$ level. In 2022, a statistically significant relationship was determined between child follow-up and infant follow-up ($r = 0.751$); between child follow-up and pregnant follow-up ($r = 0.701$); and between DBT and HBV vaccination rates ($r = 0.780$) at $p < .01$ level. In 2022, there was a statistically significant correlation between pregnant follow-up and infant follow-up ($r = 0.656$); between child follow-up and the rate of physician visits per capita in the primary health care centre ($r = 0.679$); between DBT and MMR vaccination rates ($r = 0.594$), between pregnant follow-up and number of family health centers ($r = -0.588$), between

child follow-up and number of family health centers ($r = -0.596$), between infant follow-up and number of family health centers ($r = -0.613$) at $p < .05$ level.

			PM	IM	CF	DBT	HBV	MMR	RVPPC	NFHU
2020	PM	r	1.000	0.728	0.765	0.223	0.266	-0.016	0.440	-0.381
		p		.007	.000	.486	.403	.961	.153	.222
	IM	r	0.728	1.000	0.714	0.230	0.230	0.141	0.497	-0.361
		p	.007		.000	.471	.471	.662	.100	.249
	CF	r	0.765	0.714	1.000	0.431	0.431	0.280	0.604	-0.214
		p	.000	.000		.162	.162	.377	.038	.504
	DBT	r	0.223	0.230	0.431	1.000	0.734	0.672	0.769	0.578
		p	.486	.471	.162		.000	.000	.003	.049
	HBV	r	0.266	0.230	0.431	0.734	1.000	0.772	0.769	0.514
		p	.403	.471	.162	.000		.000	.003	.088
	MMR	r	-0.016	0.141	0.280	0.672	0.772	1.000	0.770	0.562
		p	.961	.662	.377	.000	.000		.003	.057
2021	PM	r	1.000	0.585	0.396	0.399	0.354	0.205	0.293	-0.469
		p		.046	.202	.198	.258	.523	.355	.124
	IM	r	0.585	1.000	0.754	0.059	-0.014	0.245	0.372	-0.567
		p	.046		.005	.854	.965	.443	.234	.054
	CF	r	0.396	0.754	1.000	-0.206	-0.262	-0.258	0.216	-0.551
		p	.202	.005		.521	.410	.419	.500	.063
	DBT	r	0.399	0.059	-0.206	1.000	0.672	0.495	0.309	-0.022
		p	.198	.854	.521		.000	.101	.328	.947
	HBV	r	0.354	-0.014	-0.262	0.672	1.000	0.450	0.206	0.093
		p	.258	.965	.410	.000		.142	.520	.774
	MMR	r	0.205	0.245	-0.258	0.495	0.450	1.000	0.644	0.327
		p	.523	.443	.419	.101	.142		.024	.300
2022	PM	r	1.000	0.656	0.701	0.046	0.046	0.054	0.350	-0.588
		p		.020	.002	.888	.888	.868	.264	.044
	IM	r	0.656	1.000	0.751	-0.296	-0.296	-0.039	0.435	-0.613
		p	.020		.000	.350	.350	.903	.158	.034
	CF	r	0.701	0.751	1.000	-0.273	-0.273	-0.018	0.679	-0.596
		p	.002	.000		.391	.391	.956	.015	.041
	DBT	r	0.046	-0.296	-0.273	1.000	0.780	0.594	-0.169	0.197
		p	.888	.350	.391			.042	.600	.540
	HBV	r	0.046	-0.296	-0.273	0.780	1.000	0.594	-0.169	0.197
		p	.888	.350	.391			.042	.600	.540
	MMR	r	0.054	-0.039	-0.018	0.594	0.594	1.000	0.300	0.411
		p	.868	.903	.956	.042	.042		.344	.185
	RVPPC	r	0.350	0.435	0.679	-0.169	-0.169	0.300	1.000	-0.098
		p	.264	.158	.015	.600	.600	.344		.761
	NFHU	r	-0.588	-0.613	-0.596	0.197	0.197	0.411	-0.098	1.000
		p	.044	.034	.041	.540	.540	.185	.761	

NFHU: Number of Family Health Centers, PM: Pregnancy Monitoring, IM: Infant Monitoring, CF: Child Follow-up, DBT: 5-in-1 vaccine, HBV: Hepatitis B Vaccine, MMR: Measles, Mumps, Rubella Vaccine, RVPPC: Rate of visits to physicians per capita

According to the correlation matrix, there was no relationship between the variables used in the study that would cause multicollinearity problem. Correlation coefficients ($r > 0.80$) between variables cause multicollinearity problems (Büyüköztürk, 2017).

Graph 1 shows the 2-dimensional positioning Euclidean distance model of the indicators of hospital enterprises in the health systems of the countries in 2020. In 2020, there is a good fit between the 2-dimensional positioning $R^2 = 0.97712$, stress = 0.05934, i.e., data distances and display distances.

Graph 2 shows the Euclidean distance model of 2D positioning of the indicators of hospital enterprises in the health systems of the countries in 2021. $R^2 = 0.94931$, stress = 0.09727 of 2D positioning in 2021, i.e., there is a good fit between data distances and display distances.

Graph 3 shows the 2-dimensional positioning Euclidean distance model of the indicators of hospital enterprises in the health systems of the countries in 2022. $R^2 = 0.93232$, stress = 0.10847 of 2D positioning in 2022; that is, there is a moderate fit between data distances and representation distances.

Table 4 presents the coordinate values of statistical regions based on a two-dimensional geometric representation for 2020-2022. In 2020, Northeast Anatolia (CASE 12) and West Marmara (CASE 4) were the least similar regions in dimension 1, while Southeast Anatolia (CASE 10) and Northeast Anatolia (CASE 12) were the most distant in dimension 2. The key discriminators for 2020 were West Marmara (CASE 4) in dimension 1 and Northeast Anatolia (CASE 12) in dimension 2. In 2021, West Marmara (CASE 4) and Southeast Anatolia (CASE 10) were the least similar in dimension 1, with Middle Anatolia (CASE 8) and the Mediterranean (CASE 6) being the most distant in dimension 2. The primary discriminators for 2021 were West Marmara (CASE 4) in dimension 1 and Middle Anatolia (CASE 8) in dimension 2. For 2022, Middle Anatolia (CASE 8) and Southeast Anatolia (CASE 10) were the least similar in dimension 1, while Middle Anatolia (CASE 8) and West Marmara (CASE 4) were the most distant in dimension 2. Middle Anatolia (CASE 8) emerged as the most significant discriminator in both dimensions for 2022.

Table 5 presents the MOORA score ranking of statistical regions between 2020-2022. In 2020, the East Black Sea region achieved the highest performance score of 1.95, securing the top position, while Istanbul ranked last with a score of 1.36.

In 2020, the East Black Sea region achieved the highest performance score of 1.95, securing the top position, while Istanbul ranked last with a score of 1.36.

Table 4.
2D positioning coordinate values of statistical regions between 2020-2022 based on variables

YEAR	Statistical Region	Code	1. dimension	2. dimension
2020	West Black Sea	CASE 1	0.6037	0.8985
	Istanbul	CASE 2	-0.7346	-1.0153
	East Black Sea	CASE 3	0.6823	1.088
	West Marmara	CASE 4	1.6914	0.0697
	East Marmara	CASE 5	0.5287	0.0922
	Mediterranean	CASE 6	0.7199	-1.3166
	Aegean	CASE 7	1.4295	-0.1911
	Middle Anatolia	CASE 8	-0.7204	0.8335
	West Anatolia	CASE 9	-0.0762	0.0231
	Southeast Anatolia	CASE 10	-1.2109	-1.8312
	Middle East Anatolia	CASE 11	-1.2557	0.0232
	Northeast Anatolia	CASE 12	-1.6576	1.3261
YEAR	Statistical Region	Code	1. dimension	2. dimension
2021	West Black Sea	CASE 1	0.6966	0.9825
	Istanbul	CASE 2	-0.9494	-1.1942
	East Black Sea	CASE 3	0.9922	0.775
	West Marmara	CASE 4	2.3376	-0.9116
	East Marmara	CASE 5	-0.0891	-0.827
	Mediterranean	CASE 6	-0.2222	-1.4516
	Aegean	CASE 7	0.8581	-0.5105
	Middle Anatolia	CASE 8	-0.5276	1.4438
	West Anatolia	CASE 9	-0.4715	0.1966
	Southeast Anatolia	CASE 10	-2.299	-0.4248
	Middle East Anatolia	CASE 11	-0.5013	0.3562
	Northeast Anatolia	CASE 12	0.1756	0.8213
YEAR	Statistical Region	Code	1. dimension	2. dimension
2022	West Black Sea	CASE 1	1.512	-0.0393
	Istanbul	CASE 2	-1.5398	0.8967
	East Black Sea	CASE 3	1.5261	-0.601
	West Marmara	CASE 4	0.5765	-1.7693
	East Marmara	CASE 5	-0.4316	-0.5386
	Mediterranean	CASE 6	-0.9079	0.2732
	Aegean	CASE 7	-0.1901	-1.1651
	Middle Anatolia	CASE 8	1.5203	1.3516
	West Anatolia	CASE 9	0.0543	0.5279
	Southeast Anatolia	CASE 10	-2.2071	0.3122
	Middle East Anatolia	CASE 11	0.0092	0.6326
	Northeast Anatolia	CASE 12	0.0781	-0.4218

The Aegean region rose to 1st place in 2021 with a performance score of 1.73, while Middle Anatolia dropped to 12th place with a score of 1.07. In 2022, West Marmara led with a performance score of 1.99, and Istanbul again ranked last with a score of 1.51. The Mediterranean region held the 10th position, and Southeast Anatolia ranked 11th throughout 2020-2022. Notably, the rankings of Istanbul,

East Marmara, Aegean, West Anatolia, Middle East Anatolia, and Northeast Anatolia regions remained unchanged in 2022 compared to 2020.

Table 5.
The MOORA score rankings of statistical regions from 2020 to 2022

Statistical Region	2020		2021		2022	
	score	rank	score	rank	rank	score
West Black Sea	1.87	3	1.14	8	4	1.92
Istanbul	1.36	12	1.24	3	12	1.51
East Black Sea	1.95	1	1.16	7	2	1.97
West Marmara	1.88	2	1.17	6	1	1.99
East Marmara	1.76	7	1.13	9	7	1.82
Mediterranean	1.68	10	1.125	10	10	1.76
Aegean	1.70	8	1.73	1	8	1.81
Middle Anatolia	1.86	4	1.07	12	3	1.93
West Anatolia	1.69	9	1.19	5	9	1.78
Southeast Anatolia	1.59	11	1.120	11	11	1.72
Middle East Anatolia	1.77	6	1.21	4	6	1.84
Northeast Anatolia	1.83	5	1.28	2	5	1.91

Discussion

Statistical regional planning for health services in Turkey aims to minimize regional disparities and promote equitable access to healthcare (Boyacı, 2021). Between 2020 and 2022, Istanbul had the lowest primary care physician visit rate per capita, largely due to its high population density and the availability of numerous treatment-focused health institutions. The visit rate declined in 2021 but rebounded in 2022. A study in a family health center reported an 80% reduction in examination rates during the pandemic (Esmeray et al., 2021). Similarly, research on unmet health needs in Europe during the pandemic indicated that “no need to report health problems” was the most cited reason (Köse, 2024). Early in the pandemic, routine healthcare services were postponed, and later, fear of COVID-19 exposure further delayed health-seeking behavior, contributing to the reduced consultation rates in 2021, followed by a recovery in 2022.

In 2021, the number of family health centers decreased compared to 2020 but increased again in 2022, with Istanbul having the highest ratio and Northeast Anatolia the lowest. However, Istanbul’s population density limits the effectiveness of its family health centers, as family physicians struggle to provide sufficient attention to communities, contributing to the underutilization of family health as a first contact point in healthcare services (Köse, 2022). During the pandemic, a study found that 58% of primary care physicians considered resigning, reflecting

higher rates of dissatisfaction compared to other physicians (Aker & Gülörten, 2023). Another study highlighted that positive organizational attitudes helped reduce burnout and resignation intentions among family physicians (Avan & Şantaş, 2024).

Despite declining DBT and HBV vaccination rates in 2021, rates improved in 2022, with the West Marmara region achieving the highest vaccination rates across DBT, MMR, and HBV. Based on the performance score, the West Marmara region ranked 2nd in 2020 and 1st in 2022. Conversely, Northeast Anatolia had the lowest vaccination rates in 2020 and ranked 5th in performance that year. In 2021-2022, the Middle Anatolia region recorded the lowest vaccination rates and ranked last in performance in 2021. Vaccination services aim to prevent diseases, reduce infection-related morbidity and mortality, and increase life expectancy at birth (Gülcü & Arslan, 2018).

The Northeastern Anatolia region, which has the lowest vaccination rates across all three vaccine groups, also has the lowest number of family health centers. Taken together, these findings suggest that the limited availability of family health centers restricts residents’ access to vaccination services, thereby contributing to reduced vaccination coverage. Additionally, rising vaccine refusal rates may further exacerbate this situation. Public awareness of preventive health services plays a critical role in encouraging participation in family health initiatives. Parental refusal of childhood vaccines a key service provided by family health impacts not only individual families but also the broader communities. Vaccine refusal decreases immunization rates and facilitates the spread of preventable infectious diseases. Parental refusal of vaccination is often associated with concerns about vaccine content, experiences of adverse effects, distrust in vaccination practices, and religious beliefs (Çitak & Aksoy, 2020). In this context, midwives, as key family health personnel, can play an important role in addressing these challenges by providing counseling, alleviating parental concerns, and guiding families throughout the vaccination process. Public awareness of preventive health services plays a critical role in encouraging participation in family health initiatives.

Child and infant follow-up rates increased in 2022 compared to 2020-2021. Despite these advances, Southeast Anatolia consistently exhibited the lowest rates of follow-up for pregnant women, infants, and children, and ranked 11th in performance scores for 2020-2022. According to clustering analyses, Southeast Anatolia remains the most disadvantaged region regarding health status (Çınaroğlu & Avcı, 2014). Additionally, it was identified as having the lowest accessibility to health services and human resources

parameters (Sezgin & Köse, 2024). Midwives are responsible for vaccination services and the monitoring of pregnant women, infants, and children in family health centers. As of 2022, 12,147 of the 59,632 midwives in Turkey (20%), approximately one in every five, were employed as family health personnel at family health centers (Health Statistical Yearbook, 2022). According to 2022 data, Southeastern Anatolia, which records the lowest rates of monitoring for pregnant women, infants, and children within the scope of preventive health services, also has the second lowest number of midwives per 100,000 population. This suggests that insufficient midwife employment may contribute to the region's low performance in maternal and child health monitoring.

Previous research on the midwifery profession and practices indicates that midwives working in family health centers face significant challenges, including contracted employment, high workload due to large patient populations per unit, and limited time for preventive health services and home visits (Yücel, 2016). In addition, family health performance-based payment systems, which apply incentives or deductions linked to vaccination and follow-up rates, further increase workload and may exacerbate inequalities in access to healthcare services (Köse, 2022). Consequently, the increasing workload may lead midwives employed as family health personnel to withdraw from their roles and resign quietly.

Conclusion and Recommendations

The introduction of the family health model in Turkey in 2010 aimed to improve access to preventive health services and overall health indicators. However, disparities persist, particularly in underserved regions like Southeast Anatolia. Since 2020, the COVID-19 pandemic shifted healthcare priorities toward emergency and disease-focused services, leading to delays in other health programs. In 2021-2022, the sustainability of health services was supported by the increase in community immunity achieved through vaccination efforts and public health measures.

In Turkey, health services planning is conducted at the statistical region level, with family medicine playing a pivotal role in delivering preventive health services. Follow up and vaccination rates key performance indicators of family medicine showed improvement in 2021-2022 compared to 2020. However, geographical, cultural, and socio-demographic factors significantly influence the effectiveness of health services (Pekkaya & Dökmen, 2019). To enhance performance in areas such as pregnant, infant,

and child follow-ups and vaccination rates, fostering community participation is essential. The counsellor role of midwives in addressing parental concerns during the vaccination process has the potential to reduce vaccine refusal rates.

Despite being a highly developed region with the highest labor force participation rate, Istanbul ranked last in 2020 and 2022 based on preventive health service performance scores. The region's high population density and the inadequate number of family health centers per capita contributed to its lower performance in preventive health services.

The Southeast Anatolia region consistently ranked 11th in the performance scores of preventive health indicators from 2020 to 2022. This low performance score reflects the influence of social, health, and economic challenges in the region, which hinder the effectiveness of preventive health services. Addressing these disparities requires targeted policies that prioritize improving health indicators in disadvantaged regions like Southeast Anatolia.

With the implementation of family medicine in Turkey in 2010, preventive health services aimed to enhance accessibility and improve health indicators. Strengthening primary healthcare services, the foundation for preventive health measures, is essential for delivering economically and medically efficient healthcare. Despite significant efforts to minimize regional disparities, factors such as geographical location, population characteristics, and socio-economic development levels continue to influence the demand and supply of health services. Community participation is crucial for achieving performance targets in preventive health services. Incentive policies are essential to encourage community participation in preventive health services. Health policies must also focus on enhancing the efficiency of the family medicine system, which plays a vital role in delivering preventive care, and on optimizing resource utilization to address regional disparities. In this regard, financial incentives should be introduced to promote family physician specialization, particularly in regions with a shortage of family physicians.

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