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Environmental and Behavioral Determinants of Septicemia Mortality in Türkiye: A Ten-Year Analysis

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ABSTRACT

This study examines the environmental and behavioral factors associated with variations in septicemia mortality rates across Turkish provinces. Province-level data spanning ten years were analyzed using ordinal logistic regression modeling to determine the predictors of septicemia mortality. Environmental factors such as humidity, temperature, and air pollutants, along with behavioral aspects including alcohol consumption, were evaluated. Analysis of the provided data revealed significant regional variations in septicemia mortality rates across areas with diverse environmental and social characteristics. Higher median humidity and stable environmental conditions (low variability in humidity and temperature) correlated with reduced mortality rates. Alcohol consumption was identified as a risk factor, moderately increasing the risk of septicemia mortality. The findings highlight the intricate relationship between environmental stability, personal behaviors, and septicemia outcomes. The study accentuates the need for targeted public health strategies and suggests that mitigating environmental risks and fostering healthy behaviors could effectively reduce septicemia mortality. Further studies should focus on individual-level data and explore the relationship between these factors in different climatic conditions.

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Keywords: Septicemia Mortality, Environmental Factors, Behavioral Factors, Ordinal Logistic Regression, Türkiye

INTRODUCTION

Given the millions of cases reported annually and the persistently high mortality rate, Sepsis, a life-threatening condition resulting from the body's dysregulated response to infection, continues to pose a substantial global health challenge (World Health Organization [WHO], 2020). While the terms 'septicemia' and 'sepsis' are often used interchangeably, septicemia specifically refers to the presence of bacteria in the bloodstream, leading to blood poisoning and ultimately triggering sepsis. Sepsis can result in tissue damage, organ failure, and, if left untreated, death. The global and regional patterns of sepsis incidence and mortality are influenced by a myriad of factors, including environmental, meteorological, and behavioral agents.

A 2016 systematic review by Fleischmann et al. (2016) revealed an alarming upsurge in sepsis incidence and mortality worldwide, with a substantial burden observed in low- and middle-income countries (LMICs). These disparities are attributed to various factors, including limited access to healthcare, inadequate sanitation, and antimicrobial resistance (AMR) (Fleischmann et al., 2016; WHO, 2020).

There is a discernible correlation between sepsis incidence and mortality rates and the developmental level of a country. Data from the Global Burden of Disease Study (GBD) 2017 indicated that sepsis is a leading cause of death in sub-Saharan Africa and Southeast Asia, while developed countries like the United States and Europe have reported declining sepsis mortality rates due to improved healthcare infrastructure (GBD 2017 Risk Factor Collaborators, 2018; Angus & Van der Poll, 2013).

Recent studies have linked air pollutants, including Particulate Matter 10 (PM10), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), and ozone (O_3), with increased sepsis incidence and mortality. These pollutants are known to exacerbate respiratory and systemic infections, potentially leading to severe sepsis outcomes (Pope III et al., 2015; Yue et al., 2020).

Meteorological factors, such as air pressure, humidity, rainy days, temperature fluctuations, wind speed, sunlight exposure, and sun radiation, also play

a notable role in the epidemiology of sepsis. Such climatic elements influence pathogen survival, transmission, and human immunity, thereby having a marked correlation with sepsis rates (Wu et al., 2016; Kim et al., 2016; Reilly et al., 2023).

Behavioral factors, such as smoking, alcohol consumption, and exposure to second-hand smoke, have been identified as significant contributors to sepsis risk and fatality. These behaviors impair immune function and increase susceptibility to infections, affecting both the incidence and severity of sepsis (Lee et al., 2018).

To date, there is no literature discussing the impact of environmental and climatic characteristics and sepsis mortality in Türkiye; therefore, in this report, we aim to provide a comprehensive overview of the national and regional patterns of sepsis over a 10-year time window, investigating the interplay of environmental, meteorological, and behavioral factors in influencing its incidence and mortality. By identifying high-burden areas and vulnerable populations, and monitoring temporal trends, we seek to inform effective public health policy and intervention strategies. Reports like ours will also inform other similar geographies globally.

MATERIALS AND METHODS

Population-adjusted septicemia mortality rates were calculated for the 81 provinces of Türkiye (2010-2019), and their ordinal changes were used as the primary outcome variable. As for the environmental domain, represented by longitudinal data values, the following markers were obtained at the regional level: Particulate Matter 10 (PM10), sulfur dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), and Ozone (O_3), air pressure, humidity, annual rainy days, maximum-average-minimum temperatures, wind speed as well as total sunlight, sun radiation, and electromagnetic field. These markers were further represented as the median values of the measurements collected between 2010 and 2019.

To assess the influence of environmental fluctuations on Septicemia incidence, we established the standard deviation (SD) and coefficient of variation (CV) of relevant environmental markers between 2010 and 2019 as indicators of variability. Additionally, our analyses incorporated established behavio-

ral risk factors, including tobacco smoking, alcohol consumption, and second-hand smoke exposure.

The TRAJ procedure developed by Jones, Nagin, and Roeder (2001) suggested three change-profiles for septicemia mortality based on the quality of fit diagnostics. To account for the ordered structure of these change profiles, (e.g., low, intermediate, high), an ordinal logistic regression model was utilized to evaluate the likelihood of transitioning to higher Septicemia trajectory categories with each unit increase in the univariate predictors. In this model, ordinal septicemia categories were treated as the response variable, and environmental and climatic variables were considered as independent univariable predictors. A total of 33 markers were investigated, with FDR correction (Benjamini & Hochberg, 1995) implemented to address the multiplicity of comparisons. To visualize the relationships between significant predictors, both the response variable and the independent variables were standardized to a mean value of zero and a variance of one. All analyses were conducted using SAS (R) Version 9.4 (Cary, North Carolina, USA).

RESULTS

Figure 1 presents a longitudinal analysis of septicemia mortality rates by region over time. The divergent trajectories by group suggest the heterogeneity of mortality patterns, influenced by the interplay of regional and temporal factors.

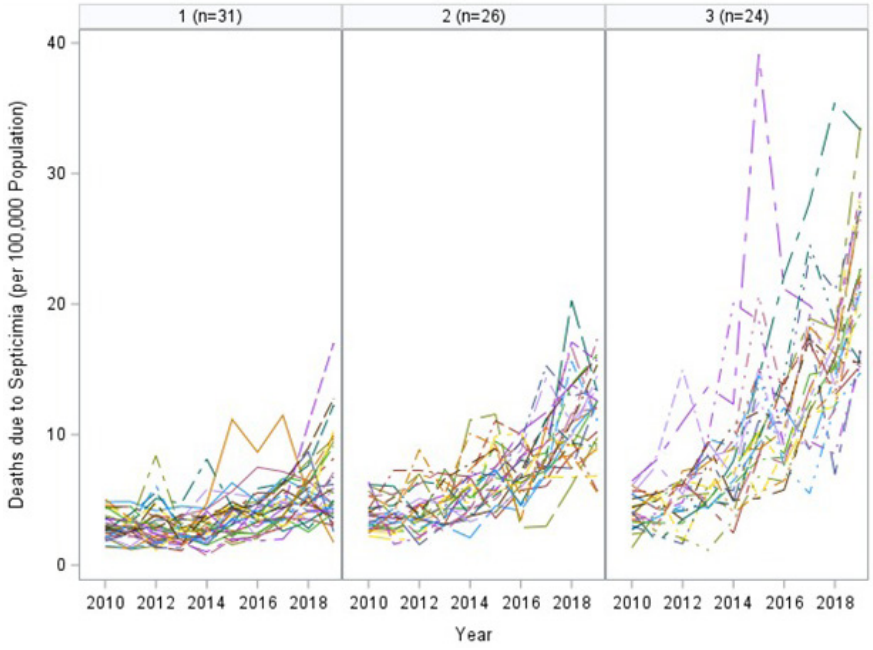

Figure 1. Septicemia Mortality Profiles by SAS TRAJ procedure

In alignment with the data in Table 1, we identified a positive association between median humidity and septicemia mortality (OR 1.08), implying that areas characterized by higher humidity levels may experience elevated mortality risks. Interestingly, increased variability in humidity, as quantified by the coefficient of variation (CV) and standard deviation (SD), demonstrated a protective effect against mortality (OR 0.90 and 0.81, respectively). These findings suggest that regions with greater fluctuations in humidity may experience lower mortality rates. Similar patterns were observed for temperature and precipitation. A higher degree of seasonal variation in both temperature and rainfall appeared to be inversely correlated with mortality risk.

Table 1: Summary of markers significantly associated with Septicemia Mortality Profiles (CV is Coefficient of Variance, SD is Standard Deviation)

Predictor	OR (95% CI)	p	FDR Corrected p
Ever Alcohol Use	1.06 (1.01,1.12)	0.0125	0.037392
Humidity (CV)	0.90 (0.85,0.94)	<.0001	0.000566
Humidity (Median)	1.08 (1.03,1.14)	0.0020	0.008801
Humidity (SD)	0.81 (0.73,0.90)	<.0001	0.001
Maximum Temperature (CV)	0.93 (0.88,0.98)	0.0071	0.023271
Maximum Temperature (SD)	0.63 (0.48,0.82)	0.0006	0.003868
Mean Temperature (SD)	0.42 (0.28,0.63)	<.0001	0.000566
Minimum Temperature (SD)	0.53 (0.35,0.79)	0.0022	0.008808
Particulate Matter-10 (SD)	0.89 (0.83,0.96)	0.0031	0.011009
Rainy Days (CV)	0.95 (0.91,0.98)	0.0012	0.00641
Sun Radiation (per 10-units)	0.92 (0.88,0.96)	0.0002	0.001777
Sunlight (per 10-units)	0.97 (0.96,0.99)	0.0005	0.0036

Elevated variability in particulate matter (PM10) concentrations, as measured by standard deviation, exhibited a protective association with septicemia mortality (OR=0.89), suggesting that increased PM10 variability may be instrumental in reducing mortality rates. Sun exposure metrics (solar radiation and sunlight per 10-unit increment) also demonstrated an inverse relationship with septicemia mortality, with odds ratios of 0.92 and 0.97, respectively, implying that increased levels of sun exposure are beneficial.

Figure 2 presents scatter plots that visualize the negative correlation between environmental stability (humidity and temperature) and septicemia mortality. This comprehensive analysis highlights the multifaceted nature of environmental and behavioral risk factors in determining Septicemia outcomes, suggesting the need for targeted public health interventions and personalized lifestyle modifications.

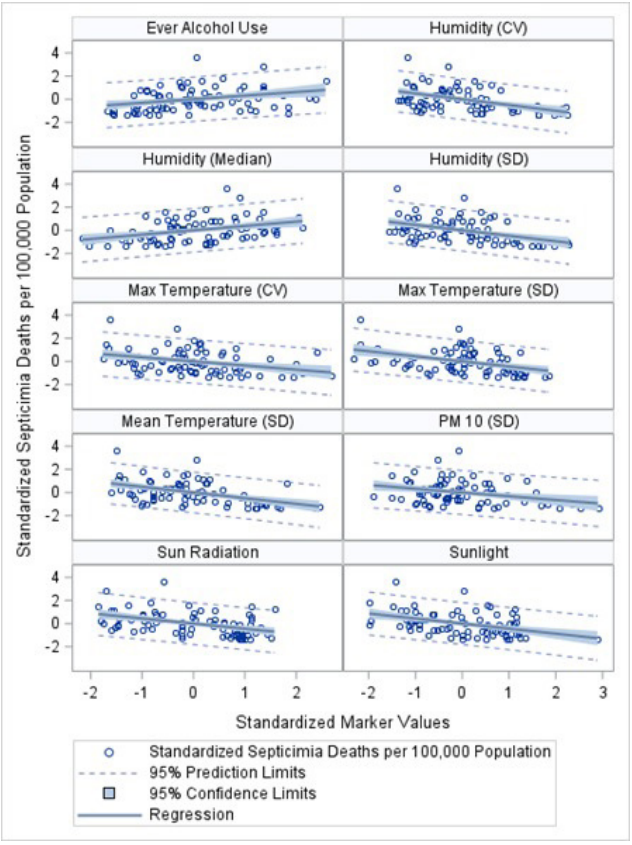

Figure 2. Significant markers indicative of an association with deaths due to Septicemia. CV: Coefficient of Variation, SD: Standard of Deviation

DISCUSSION AND CONCLUSIONS

Our decade-long analysis of septicemia mortality in Türkiye, depicted in Figure 1, suggests a temporal pattern potentially attributable to local environmental and behavioral influences on health outcomes. The significant predictors highlighted in Table 1, especially those associated with seasonal environmental variations in humidity and temperature, are consistent with contemporary research emphasizing the role of climate variables in infectious disease epidemiology (Lafferty, 2009). Each of the significant factors is discussed below in the light of the literature.

Ever Alcohol Use: Consistent with our findings, the literature indicates a correlation between alcohol use and increased risk of septicemia, potentially due to alcohol's immunosuppressive effects (Molina et al., 2010).

Humidity (CV, Median, SD): The results of this study observed a non-linear relationship between humidity and septicemia risk, with higher median humidity associated with increased risk while humidity variability (CV and SD) demonstrated a protective effect. These findings corroborate previous research suggesting that fluctuations in humidity levels may support immune function, while prolonged exposure to consistently high humidity could have adverse health consequences (Johnson & Morawska, 2009).

Temperature (CV, SD): The observed protective effect of temperature stability (lower SD) is in line with research suggesting that extreme temperature fluctuations can exacerbate health vulnerabilities, especially in infectious diseases (Lee et al., 2018).

Particulate Matter-10 (SD): Fluctuating PM10 exposure, as indicated by a higher median and standard deviation (SD), may be more effective in stimulating the immune system than sustained exposure to elevated PM10 levels (Zhang et al., 2018).

Rainy Days (CV): As corroborated by Brown and Murray (2013), our results suggest that stable precipitation patterns may serve as a protective factor against the health impacts of climate variability, particularly in relation to infectious diseases.

Consistent with the conclusions of this study, the literature suggests that stable precipitation patterns can mitigate health risks associated with climate variability, including infectious diseases (Brown & Murray, 2013).

Sun Radiation and Sunlight: These results suggest a positive association between sun exposure and immune function, potentially attributable to the immunomodulatory effects of vitamin D (Holick, 2017).

The study's strengths include its comprehensive environmental domain and robust statistical methods. However, potential limitations arise from the inability to control for all behavioral confounders, such as dietary habits and exposure to tobacco, alcohol, and other substances. Furthermore, individual-level data, rather than aggregate data, would have provided a more granular perspective.

Public health interventions informed by these findings might focus on mitigating environmental exposures and fostering health-promoting behaviors to decrease Septicemia-related mortality. Further research should delve into the

underlying causal pathways of these observed relationships, with a potential focus on individual-level data to facilitate a more comprehensive understanding of the subject matter.

Future research approaches, based on the findings of this study, could include:

- Longitudinal Individual-Level Studies: To further understand the causal pathways, future studies should investigate individual-level data over time, including genetic, lifestyle, and environmental risk factors.
- Interventional Studies: Evaluating the efficacy of public health initiatives aimed at mitigating environmental hazards and fostering health-promoting behaviors may contribute to a reduction in septicemia mortality rates.
- Climate Change Impact Assessment: Exploring the potential implications of climate variability on septicemia and formulating adaptive healthcare interventions to enhance resilience and reduce mortality.
- Technological Integration: This initiative seeks to leverage advanced analytics to develop sophisticated machine learning algorithms and robust predictive models, capable of predicting the onset of septicemia outbreaks by utilizing individual-level big data encompassing environmental and behavioral factors.
- Global Comparative Studies: Extending our study to various geographic and climatic contexts to explore the consistency of our findings beyond the Turkish population.

These investigative goals aim to elucidate the complex interplay between environmental and behavioral factors in the pathogenesis of septicemia, and to devise evidence-based preventative strategies to mitigate the incidence and severity of the disease.

In conclusion, our investigation elucidates the multifaceted nature of septicemia mortality in Türkiye for the first time in the literature by providing compelling evidence of the synergistic relationship between environmental factors and alcohol consumption in influencing patient outcomes. The study emphasizes the vital necessity for public health initiatives to consider regional climatic variations and take into account the individual behavioral influences. To advance our understanding, future research efforts must focus on granular individual-level examinations and engage in cross-cultural comparisons. By

elucidating these complex relationships, we can inform and empower healthcare systems to enhance management and prevention efforts at the regional level, ultimately mitigating the burden of septicemia mortality. This specific report on Türkiye also informs other similar geographies and paves the way for similar association studies for other regions and countries in the world.

Ethical Approval: Our research protocol was approved by Istanbul Medipol University Ethics Committee (Application number: 10840098-604.01.01-E.53819). The Ethics Committee waived the need for Informed Consent as there is no human subject involved in this research. Data is simply province-level mortality data provided by the Turkish Statistical Institute per year.

Authors' Contributions: HGK generated the research idea, carried out the literature search, wrote the initial and final draft of the manuscript; MT helped with the literature search, manuscript writing, and detailing the discussions; MK acquired the research data, carried out the data analyses and modeling, provided the materials and methods section of the manuscript, and approved the final manuscript.

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A Comparative Performance Analysis of Türkiye's Health System within OECD Countries

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ABSTRACT

A country's healthcare system represents one of its most vital infrastructures, profoundly impacting the well-being of its citizens. Examining key performance indicators (KPIs) helps policymakers understand the complex nature of the health system and identify areas for improvement. This paper provides a comparative performance analysis of Türkiye's health system compared to other Organization for Economic Co-operation and Development (OECD) countries. An Output-Oriented Categorical Data Envelopment (CAT-DEA) model is used, and K-means clustering were applied for categorizing countries based on health expenditures. In this study, inputs include health expenditure, availability of doctors and nurses, and hospital beds, while outputs consist of life expectancy at birth and citizen satisfaction with healthcare services. The efficiency scores of 36 OECD countries were calculated, and 6 of them were found to be efficient. However, the analysis shows that higher health expenditures, while placing countries in higher categories, do not necessarily correlate with greater efficiency scores. Therefore, policymakers should not rely solely on increasing per capita health expenditure as a strategy to improve efficiency;

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it must be paired with effective resource allocation to enhance system performance.

Keywords: Categorical DEA, Efficiency Analysis, Efficiency Measurement, Healthcare KPIs, Health System Performance

INTRODUCTION

The World Health Organization (WHO) defines a health system as all organizations, people, and actions whose primary purpose is to promote, restore, or maintain health. According to the Organization for Economic Co-operation and Development (OECD), a health system is the combination of all organizations, people, and resources whose primary purpose is to promote, restore, or maintain health within a specified population, usually within a country and bounded by national borders (OECD, 2023). Both definitions focus on the country-wide boundary of a health system that carries characteristics of complex systems as they consist of various stakeholders, organizations, and numerous functions (Yesilsirt et al., 2022). The complex nature of the health system also challenges the country's policymakers to improve the outcomes of the health system. Examining specific key performance indicators of the health system can assist policymakers in gaining deeper insights into its internal capacities and identifying areas for improvement. Unexpected disasters, with their recent global-scale impacts, have invariably affected health system performance. In the context of Data Envelopment Analysis (DEA), efficiency is defined as the performance of the Decision-Making Unit's (DMU) ability to maximize outputs relative to given inputs or minimize inputs for a desired level of output. DEA determines relative efficiency by comparing DMUs with similar input-output structures and assigning an efficiency score based on this relationship. Therefore, we focus on a comprehensive review of existing literature on performance analysis of healthcare systems, data collection and analysis, and performance evaluation using the categorical DEA model.

In health systems-related literature, there are various frameworks to evaluate health systems performance. In this study, two of these frameworks are referred to better understand the performance evaluation of health systems. Among these are the WHO's Monitoring Six Building Blocks (World Health Organization, 2007; World Health Organization, 2010) and the OECD's "As-

sessing Health System Performance" (Figueras et al., 2024). OECD is a global organization that collects, analyzes, and publishes health system-related data to provide insights to its member countries. The OECD's 'Health at a Glance' reports, initiated in 2001, provide extensive data on population health and system effectiveness across member and emerging economies. The health data shown in Figure 1 covers "health status", "risk factors for health", "access to and quality of healthcare", and "health system resources" (OECD, 2023). WHO releases health data with various indicators on its website, known as the Global Health Observatory (GHO). The GHO issues analytical reports on the current situation and trends for priority health issues. A key output of the GHO is the annual publication World Health Statistics, which compiles statistics for key health indicators on an annual basis are shown in Figure 2.

Health Status	Risk Factors of Health	Access to Care	Quality of Care	Health System Capacity and Resources
Life expectancy - years of life at birth Avoidable mortality - preventable and treatable deaths (per 100,000 people, age-standardised) Chronic conditions - diabetes prevalence (% adults, age-standardised) Self-rated health - population in poor health (% population aged 15+)	Smoking – daily smokers (% population aged 15+) Alcohol - liters consumed per capita (population aged 15+), based on sales data Obesity – population with body mass index (BMI) ≥30 (% population aged 15+) Ambient air pollution - deaths due to ambient particulate matter, especially PM2.5 (per 100,000 people)	Population coverage, eligibility – population covered for core set of services (% population) Population coverage, satisfaction - population satisfied with availability of quality healthcare (% population) Financial protection - expenditure covered by compulsory prepayment schemes (% total expenditure) Service coverage - population reporting unmet needs for medical care (% population)	Safe primary care - antibiotics prescribed (defined daily dose per 1,000 people). Effective primary care - avoidable hospital admissions (per 100,000 people, age- and sex-standardized) Effective preventive care - mammography screening within the past two years (% of women aged 50–69) Effective secondary care - 30-day mortality following acute myocardial infarction and ischemic stroke (per 100 admissions for people aged 45 and over, age- and sex-standardized)	Health spending - total health spending (per capita, USD using purchasing power parities) Health spending - total health spending (% GDP) Doctors - number of practicing physicians (per 1,000 people) Nurses - number of practicing nurses (per 1,000 people) Hospital beds - number of hospital beds (per 1,000 people)

*OECD (2023), Health at a Glance 2023: OECD Indicators, OECD Publishing, Paris, http://doi.org/10.1787/7a7afb35-en.

Figure 1. Indicators used by OECD (OECD, 2023)

HEALTH SYSTEM PERFORMANCE INDICATORS

HEALTH FINANCING	HEALTH WORKFORCE	HEALTH SERVICE DELIVERY
Domestic general government health expenditure (GGHE-D) as percentage of general government expenditure (GGE) (%) External health expenditure (EXT) as percentage of current health expenditure (CHE) (%) Domestic general government health expenditure (GGHE-D) as percentage of general government expenditure (GGE) (%) Current health expenditure (CHE) as percentage of gross domestic product (GDP) (%) Domestic private health expenditure (PVT-D) as percentage of current health expenditure (CHE) (%) Current health expenditure (CHE) per capita in US$ Domestic general government health expenditure (GGHE-D) as percentage of gross domestic product (GDP) (%) Out-of-pocket expenditure as percentage of current health expenditure (CHE) (%) Domestic general government health expenditure (GGHE-D) as percentage of current health expenditure (CHE) (%) External health expenditure (EXT) per capita in US$ Domestic general government health expenditure (GGHE-D) per capita in US$ Domestic private health expenditure (PVT-D) per capita in US$ Out-of-pocket expenditure (OOP) per capita in US$	Nursing and midwifery personnel (per 10,000 population) Nursing personnel (number) Nurses by sex (%) Midwifery personnel (number) Nursing and midwifery personnel (number) Environmental and Occupational Health and Hygiene Professionals (number) Environmental and Occupational Health Inspectors and Associates (number) Community Health Workers (number) Medical doctors (per 10,000 population) Medical doctors not further defined (number) Generalist medical practitioners (number) Medical doctors (number) Specialist medical practitioners (number) Medical doctors by sex (%) Medical and Pathology Laboratory Technicians (number) Medical and Pathology Laboratory scientists (number) Pharmacists (per 10,000 population) Pharmacists (number) Pharmaceutical Technicians and Assistants (number) Dentists (number) Dental Assistants and Therapists (number) Dentists (per 10,000 population) Dental Prosthetic Technicians (number) Physiotherapy Technicians and Assistants (number) Physiotherapists (number) Traditional and Complementary Medicine Professionals (number)	Hospital beds (per 10,000 population) Care-seeking by type of patient and source of care (%)

Figure 2. Indicators used by WHO (World Health Organization, 2024)

Based on these indicators, both OECD and WHO reports were analyzed, and the capacity of the health system is conceptualized through resources such as financing and the health workforce. This paper is organized as follows: The first part provides a background on measuring the performance of healthcare systems and KPIs of the health system's capacity and resources to construct a DEA evaluation framework. The second part presents studies on health system performance and efficiency analysis. The third section applies the DEA model and framework, followed by the concluding discussion.

LITERATURE REVIEW

The literature review is conducted in stages, beginning with exploring health system performance metrics, efficiency frameworks, and KPIs. As indicated, the indicators from WHO and OECD were examined. To find indicators in this study, we focused on methodologies for assessing health systems' capacity and resources, particularly through DEA. Recent studies on performance measurement and efficiency analysis provided a conceptual basis for this research.

Data Envelopment Analysis has been widely employed for decades to evaluate health system efficiency due to the complex nature of healthcare, which often involves multiple inputs and outputs (Po et al., 2009). Various articles have focused on different indicators to determine the effectiveness of the health system. Afonso & Aubyn (2005) used "hospital beds per 1000 people" and "number of doctors and nurses per 1000 population" as inputs and "healthy life expectancy" as output to determine health system efficiency with DEA. Kocaman et al. (2012) used inputs including "number of physicians per thousand people", "number of hospital beds per thousand people", "health expenditure per capita", "share of gross domestic product (GDP) allocated to health expenditures", "number of magnetic resonance imaging (MRI)", and the "rate of smoking population" to determine the effectiveness of the health system of 36 OECD countries. Life expectancy at birth and the mortality rate under five years are selected as outputs and measured by DEA. Cetin & Bahce (2016) assessed the efficiency of health systems in 36 OECD countries using input-oriented DEA analysis, employing doctors, patient beds, and health expenditure per capita as inputs, and life expectancy and infant mortality rates as outputs. The efficiency of 36 OECD countries' health systems is assessed using DEA, which included fourteen inputs (pharmaceutical consumption, average years of schooling, obesity, tobacco consumption, alcohol consumption, per capita health expenditure, percentage of health care expenditure, physicians, nurses, beds); and four outputs (life expectancy, infant mortality, population aged, and population aged 65 years and older) (Behr & Theune, 2017). The performance of 31 OECD countries' health systems is assessed using health system indicators, including the number of doctors, hospital beds, and health expenditures, as well as external variables such as GDP, population behavior, and socioeconomic factors. As a result, external determinants exert a stronger

influence on efficiency than health considerations (Hadad et al., 2013). In a recent study, by Lupu & Tiganasu (2022), thirty-one European countries' health systems efficiencies are analyzed during the COVID-19 Pandemic. Seven major fields of influence are considered: healthcare resources, health status, population, economic, cultural, societal, and governmental issues, all covering fifteen indicators.

METHODOLOGY

DEA is a method that was first created using a single input and a single output in 1957 in Michael J. Farrell's study on efficiency analysis. It is a non-parametric technique based on linear programming. This technique compares the performance of DMUs according to a predetermined definition of efficiency. It expresses whether DMUs are effective among themselves. The DMU is considered effective when compared to other, less efficient DMUs. One type of DEA model, developed by Charnes, Cooper, and Rhodes (CCR), assumes that production has constant returns to scale (CRS), meaning any change in the input will result in a proportionate change in the output (Ahmed et al., 2019; Charnes et al., 1978). Another model proposed by Banker, Charnes, and Cooper (BCC) suggests that production functions on variable returns to scale (VRS), which means that changes in input might result in either an increase or a drop in output. The CCR methodology is especially valuable for this study since it measures the effectiveness of organizational units or the health systems of various nations (Ahmed et al., 2019; Banker et al., 1984; Kim & Kang, 2014). DEA models typically assume homogeneous, controllable variables within DMUs, though some external factors may impact results.

The Categorical DEA was created by Banker and Moorey in 1986 as a DEA model that views uncontrolled variables as categorical variables. In this manner, the categorical variable will be used to separate the DMUs whose efficiency scores are to be computed into subgroups, and these sub-homogenous groupings will be considered while doing efficiency studies. For DEA analysis, two oriented models are the input and output-oriented models. An output-oriented DEA model aims to maximize the outputs with a given number of inputs, while input-oriented models focus on minimizing the inputs used to obtain a certain amount of output (Ahmed et al., 2019). The output-oriented method

was used for this study because outputs such as life expectancy and citizen satisfaction with the healthcare system are desired to be increased. The related mathematical formulation of the Categorical DEA model is shown in Figure 3.

Output-Oriented Categorical CCR Model

Objective Function

Max θ

Constraints

$$\sum_{j \in U_f^L} \lambda_j x_{ij} \leq x_{ik}, \forall i$$

$$\theta y_{rk} - \sum_{j \in U_f^L} \lambda_j y_{rj} \leq 0 \ \forall r$$

$$\lambda_j \geq 0, \forall j \in U_f^L$$

Notations

L= Category level

x_{ij}= Amount of input i used by DMU j

y_{rj}= Amount of output r produced by DMU j

λ_j=Weight assigned to DMU j in forming the reference set for the target DMU

θ = Efficiency score of the DMU under evaluation

x_{ik}= Amount of input i produced by DMU k

y_{rk}= Amount of output r produced by DMU k

U_f^L = Index of DMUs included under category L

Figure 3. Output-Oriented Categorical CCR Model (Taşköprü, 2014)

Data Collection

Hence, the efficiency assessment in this study will be undertaken using the most recent available data. Although data from 2021 or 2022 exist for certain criteria, the evaluation will mostly focus on 2021 data, the most recent accessible period, due to partial data and the unavailability of numerous variables. The data utilized in this analysis are derived from the World Health Organization's publication. The definitions of the selected inputs and outputs are shown in Table 1.

Table 1: Description of input and output variables

Inputs	Definition	Data	Data Source
Health Expenditure	Current health expenditure per capita in US$	2022	OECD Health Stat.
Number of Doctors	Practicing doctors per 100 000 population	2021	OECD Health Stat.
Number of Nurses	Practicing nurses per 100 000 population	2021	OECD Health Stat.
Number of Hospital Beds	Hospital beds include all inpatient beds for use per 100 000 population	2021	OECD Health Stat.
Outputs	**Definition**	**Data**	**Data Source**
Life Expectancy	The average number of years that a person might reasonably be expected to live at that age is known as life expectancy at birth	2021	OECD Health Stat.
Citizens Satisfaction with the Health System	Citizen satisfaction with the health system reflects the public's assessment of healthcare quality	2020	OECD Health Stat.

Determining Categories for DEA

The K-means clustering method, which groups DMUs based on similarities, is used in this categorical DEA study to establish categories. Countries were categorized into five categories based on the 2022 per capita health expenditure values. Values are divided into clusters using average expenditure values. It clarifies the link between efficiency scores and health resources.

RESULTS

Table 2, demonstrates that a country's health expenditure level, as indicated by its expenditure category, does not necessarily determine its technical efficiency score. For instance, the United States, with the highest health expenditure and classified in Category 5, holds a ranking of 1, indicating a technical efficiency score of 1. This same ranking and technical efficiency score are shared by countries like

Türkiye, Colombia, and Mexico, which belong to Category 1 with considerably lower health expenditure. Similarly, Luxembourg and Canada, in Category 3 with moderate spending, also achieve a ranking of 1 with a technical efficiency score of 1. This highlights that while expenditure level influences category placement, it does not directly correlate with technical efficiency rankings or scores.

Table 2: List of the countries' level category

Rank	DMU
Category 5	
1	United States
Category 4	
21	Norway
22	Switzerland
28	Germany
35	Austria
Category 3	
1	Luxembourg
1	Canada
7	Belgium
8	Japan
10	United Kingdom
11	Finland
12	Netherlands
14	Sweden
15	Denmark
17	New Zealand
19	Iceland
20	France
23	Australia
25	Ireland

Rank	DMU
Category 2	
9	Korea
13	Slovenia
16	Israel
24	Spain
26	Italy
Category 1	
31	Czech Republic
34	Portugal
36	Lithuania
1	Türkiye
1	Colombia
1	Mexico
18	Chile
27	Estonia
29	Hungary
30	Poland
32	Slovak Republic
33	Greece

The efficiency of the health systems of 36 OECD member countries was evaluated using the same methodology under the output-oriented CCR model shown in Table 3. By applying the output-oriented CCR model, the analysis emphasized output maximization relative to the available inputs, providing a comprehensive assessment of the efficiency levels across all 36 OECD members. The United States, Luxembourg, Canada, Türkiye, Colombia, and Mexico's efficiency score equals one, which means they have efficient health systems. These six countries use their resources efficiently and provide health services at an optimum scale. Contrarily, the remaining countries have efficiency scores lower than one. According to the model, they are not efficient.

Table 3: Ranking of efficiency scores of 36 OECD countries

Rank	DMU	Score	Rank	DMU	Score
1	United States	1	19	Iceland	0.7910
1	Luxembourg	1	20	France	0.7791
1	Canada	1	21	Norway	0.7578
1	Türkiye	1	22	Switzerland	0.7425
1	Colombia	1	23	Australia	0.7408
1	Mexico	1	24	Spain	0.7180
7	Belgium	0.9894	25	Ireland	0.6965
8	Japan	0.9849	26	Italy	0.6623
9	Korea	0.9746	27	Estonia	0.6588
10	United Kingdom	0.9439	28	Germany	0.6577
11	Finland	0.9424	29	Hungary	0.6549
12	Netherlands	0.9317	30	Poland	0.6373
13	Slovenia	0.9297	31	Czech Republic	0.6148
14	Sweden	0.9283	32	Slovak Republic	0.6131
15	Denmark	0.9111	33	Greece	0.5621
16	Israel	0.9095	34	Portugal	0.5602
17	New Zealand	0.8664	35	Austria	0.5569
18	Chile	0.8305	36	Lithuania	0.4821

Furthermore, Figure 4 shows the efficiency scores of health systems across countries divided into three main continents: America, Europe, and Asia-Oceania. The efficiency scores of 36 OECD countries' health system performances, using different colors, indicate different levels of efficiency. The color gradient from light to dark blue represents efficiency scores, countries with greater efficiency scores are shaded darker, while those with lower scores are shown in lighter. In the Americas, countries like the United States, Canada, and Mexico are darker than Chile, indicating that these countries have achieved relatively higher health system efficiency. In Europe, countries such as Luxembourg and Türkiye exhibit the highest efficiency scores with the darkest shading. Other European countries, Greece, Portugal, Austria, and Lithuania, fall into the inefficiency range, represented by a lighter color. In Asia-Oceania, Australia is indicated by the lighter shading, while Australia and Japan demonstrated darker.

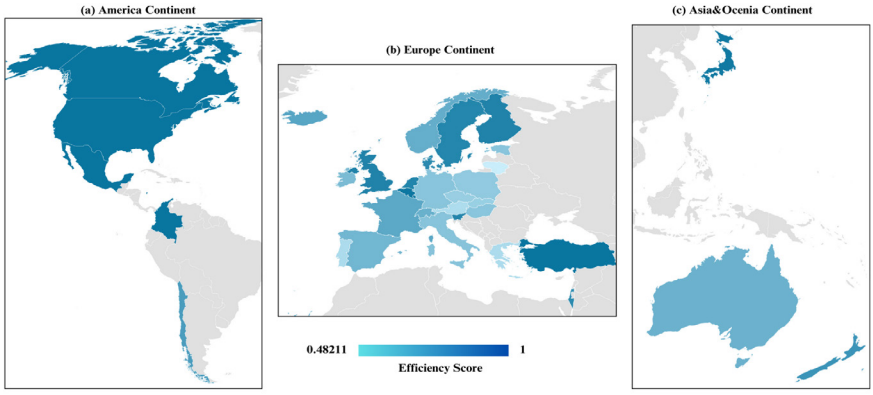

Figure 4. Colored map of the efficiency scores of the selected 36 OECD countries

The quadrant chart in Figure 5 compares the health expenditure per capita in US dollars and the efficiency scores of countries. Each country is represented by a point on the chart, with the y-axis representing efficiency scores and the x-axis representing health expenditure per capita. The graph is split into four quadrants to make it easier to distinguish between high and low-spenders and high and low-efficiency performers. The countries' health systems in the top-right quadrant are well-funded and efficient, as evidenced by their high expenditures and high efficiency. In contrast, the bottom-left quadrant demonstrates low efficiency and spending, indicating potential areas for improvement in health expenditure and management.

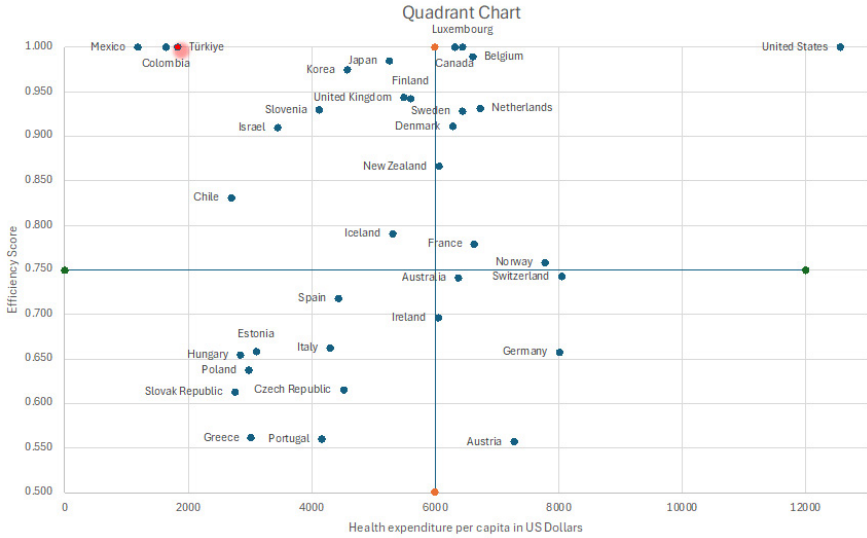

Figure 5. Quadrant chart of efficiency score and health expenditure

DISCUSSION

The results show that there are significant differences in the health system performance across OECD countries. For instance, Türkiye has the lowest number of practicing doctors per 100,000 population at 218, whereas Greece has the highest at 629. Similarly, Colombia has the fewest nurses at 159 per 100,000 population, while Finland leads with 1,892. This disparity mirrors the workforce availability findings in the study and emphasizes the critical impact of workforce distribution on system efficiency (Lupu & Tiganasu, 2022). This indicates significant inequalities in health expenditure, workforce distribution, and health outcomes across OECD countries. The United States leads in per capita health expenditure, which correlates with its high-efficiency score. Conversely, the efficiency scores of Norway, Switzerland, Germany, and Austria are lower than one. Therefore, they are not efficient even if they are in Category 4, which means they have higher health expenditure per capita than the rest of the countries except the United States. These results confirm that increased health expenditure does not necessarily guarantee greater efficiency, consistent with findings of the study that highlight that countries with moderate spending can achieve high efficiency through optimal resource utilization (Afonso & Aubyn, 2005). Therefore, while health expenditure is crucial,

converting this expenditure into high system performance through effective resource allocation is even more critical. Countries in the top-right quadrant in Figure 5 such as the United States, Belgium, and the Netherlands, can maintain high efficiency despite high spending, showing a well-funded and efficient system. In contrast, nations in the bottom-left quadrant, such as Greece and Portugal, face spending and efficiency difficulties, emphasizing possible areas for policy intervention to improve health system performance.

CONCLUSION

This research aimed to measure the efficiency of the health systems performance of 36 OECD countries as a benchmark to improve Türkiye's health system. According to the current literature and to the best of our knowledge, this study demonstrates academic originality by employing the CAT-DEA method to evaluate 36 OECD countries.

In this study, appropriate input and output variables were first identified for analyzing the healthcare systems of OECD countries. A thorough literature review was conducted to select the variables, and the most recent data were utilized to create a comprehensive dataset. To categorize the countries, k-means clustering was applied based on their health expenditure per capita, resulting in five categories. Following this, an output-oriented categorical DEA was performed using these categories. As a result of this analysis, six out of the 36 countries were found to be efficient. It was observed that the efficiency scores of these countries were not directly related to their category values, which were determined by health expenditure per capita. The results suggest that higher health spending alone does not guarantee efficiency; thus, policymakers should not rely solely on increasing per capita health expenditure to enhance efficiency. In addition to financial investment, attention must be given to other factors that contribute to healthcare system efficiency. Specifically, investments should also be directed toward addressing input or output variables where certain OECD countries fall below the average. For instance, Türkiye, achieving a high-efficiency score shows high performance in the health system, but increasing inputs such as the number of doctors below the OECD average is of great importance in maintaining and increasing the efficiency score.

Moreover, the findings of this research paper will provide inputs towards an ongoing research study focused on measuring the "adaptive" and "resilient" capacities of Türkiye's health system. By examining the adaptability of the health system in the face of unexpected events, this research will offer critical insights. These insights will serve as a foundation for evaluating current strategies and developing new approaches that strengthen the system's overall resilience and adaptability.

Ethical Approval: Not applicable.

Authors' Contributions: KÇ, ÖE, and MAK planned study design. ÖE and KÇ conducted the literature review. MAK constructed the method, and KÇ applied Categorical Data Envelopment Analysis. All the authors participated in the results and discussion. All authors read and approved the final version of the manuscript.

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Public Hospital Workers' Views on the Process of Switching from the Hospital Information Management System to the e-Health Information System in a Province

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ABSTRACT

The purpose of this study is to investigate the views, reasons for satisfaction, and difficulties encountered by healthcare professionals regarding the Hospital Information Management System (HIMS) in the state hospitals located in Amasya and its surrounding areas. It also assesses the knowledge and experiences of healthcare professionals with e-Health applications in public hospitals, emphasizing their opinions and recommendations for assistance, training, adaptation, and involvement throughout the integration of these applications into healthcare services. The goal of the study is to better understand how healthcare professionals feel about digital technologies and to provide suggestions for improving the quality of healthcare services. The Amasya Provincial Health Directorate oversees four facilities where the research was carried out. Following permission by the ethics committee, data gathering was underway on April 22, 2024, with pilot study carried out in April of the same year. There are 913 healthcare workers in the population, and a minimum sample size of 405 at a 95% confidence interval was found to be appropriate. Using stratified

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sampling, the sample was selected and split into three strata based on occupational groupings. With a median age of 37, 38.8% of the 405 participants were female. 34.2% of physicians, 33.7% of midwives, nurses, and health officers, and 40.4% of medical secretaries and data entry staff expressed satisfaction when HIMS satisfaction was analyzed. One of the key drivers of user satisfaction was the system's ability to reduce errors and streamline workflow. In addition, 42.7% of people worked nights. Physicians used e-Health applications such as e-Prescription and e-Report more often than nurses, midwives, health officials, and medical secretaries. Physicians were more likely to employ telemedicine than other healthcare professionals, who were less knowledgeable in this field. The study recommends developing training methodologies specific to various professional groups and expanding the use of e-Health applications. The study highlights the need for regular in-service training, a more robust technical infrastructure, and user-friendly interfaces to boost healthcare personnel's satisfaction with e-Health. In summary, this study offers important information for strengthening e-Health and HIMS applications and presents important suggestions for enhancing the quality of healthcare services through digital transformation.

Keywords: Digital Health Transformation, e-Health Applications, Hospital Information Management Systems (HIMS)

INTRODUCTION

The healthcare industry is complex and constantly evolving because of the factors like as demographic shifts and technological advancements. This change in areas such as service delivery, patient care, data management, and recordkeeping necessitates the widespread adoption of information technologies to enhance the effectiveness and efficiency of healthcare organizations (Republic of Türkiye Ministry of Health, 2003).

The emergence and widespread acceptance of information technologies in the healthcare industry has led to the use of Hospital Information Management Systems (HIMS). The extensive use of computers and other information technology in healthcare services marked the beginning of this transition (Yurt, 2004). A hospital or another healthcare facility can handle all of its operational and administrative procedures with the help of the Hospital Informa-

tion Management System (HIMS). HIMS is used to track and manage patient records, appointments, treatment plans, medical records, laboratory results, billing, and other operational activities. It also helps information flow between all hospital departments. The primary goals of HIMS are to increase hospital operations' effectiveness and raise the standard of care provided (Republic of Türkiye Ministry of Health, 2015, February 9).

It should be mentioned that HIMS offers benefits, for instance digitizing health data, enhancing patient care, and boosting business process efficiency. Its drawbacks, including significant investment costs, data security threats, and integration difficulties, should also be highlighted. It should be underlined that these systems may provide difficulties with regard to use and accessibility, particularly for small healthcare facilities (Ataklı & Kaplan, 2016; Palvia, 2012; Yui et al., 2012; Ajami & Bagheri-Tadi, 2013; Akça, 2013; Blumenthal, 2017; Mackert et al., 2016).

A larger information system known as "e-Health" is used to support the administration of healthcare services in a country or region. "e-Health" is a term used to describe the planning, monitoring, and assessment of healthcare services as well as the facilitation of information sharing among healthcare professionals. "e-Health" is used not just in operational procedures like hospital management but also in more general domains like epidemiological monitoring, public health management, medical research, and policy creation (Asaro et al., 2001; Eysenbach, 2001).

Today, one of the key methods to ensure that healthcare institutions are successful and efficient is to exploit the opportunities afforded by information technology while maximizing attention to the privacy and security of personal data. While cutting-edge technology like artificial intelligence (AI) and data analytics can be utilized to optimize treatment and care processes for patients, electronic health record systems improve the coordination of patient care. Furthermore, mobile health applications enable "digitally literate" people to monitor and control their health issues, while telemedicine and remote healthcare services increase access to healthcare. These technological advancements could hasten the "human-centered" shift in the healthcare industry, raising the standard of care and elevating patients' quality of life (Turkish Informatics Association, 2004).

The main objective of this study is to investigate the degree of satisfaction and challenges faced by healthcare professionals with the present Hospital Information Management System (HIMS) at the state hospitals in Amasya province and its districts. Additionally, it aims to ascertain their familiarity with, and knowledge of e-Health applications used in public hospitals, as well as their opinions and suggestions about things like assistance, education, flexibility, and participation in the process of incorporating these applications into healthcare services.

METHODOLOGY

Five sites connected to Amasya Provincial Health Directorate are to host the study. These hospitals include Sabuncuoğlu Şerefeddin Training and Research Hospital in the city center, which has 600 beds; Karamustafa Paşa State Hospital in the Merzifon district, which has 250 beds; Suluova State Hospital, which has 105 beds; Gümüşhacıköy State Hospital, which has 50 beds; and Taşova State Hospital, which has 50 beds. However, 600-bed Sabuncuoğlu Şerefeddin Training and Research facility was excluded from the study's sampling because of the low level of cooperation from this facility throughout the research procedure.

Amasya Provincial Health Directorate and Marmara University Clinical Research Ethics Committee granted their consent for the study on April 22, 2024 (22.04.2024/09.2024.542). After being informed, the study's participating healthcare professionals gave their approval. Data were actively gathered between May and June 2024, and pilot test of the study was carried out in April 2024. The Cronbach's Alpha coefficient (α=0.81) was used to assess the data collection tool's dependability, and professional views were sought regarding its validity. In order to assess the survey's efficacy and comprehensibility, pilot research was also carried out in April 2024 with a small sample of participants. Based on the input obtained, the necessary modifications were implemented.

Physicians, nurses, midwives, health officials, medical technicians, technologists, medical secretaries, and data entry staff employed by four public hospitals functioning in four districts of the province of Amasya (N=913) make up the research population. With a 95% confidence interval, 270 people were determined to be the minimal sample size required for the study in order to

accurately reflect the population. With a 50% response rate assumed, 405 (270 x 1.5) was the extended sample size. Using a "stratified sampling" technique, the study's sample was chosen from the population.

Considering the subject of the research and the sample unit and taking into account that the professional requirements related to the use of hospital information management systems and e-Health applications in the population are not homogeneous, it has been deemed more appropriate to select a stratified sample based on professions. Professional groups have been categorized into three separate strata based on the similarities of the services.

The sample unit of the study, which constitutes the universe of the research, consists of a total of 405 employees in four hospitals, with 18% being doctors, 60% being nurses, midwives, health officers, and health technicians, and 22% being medical secretaries and data entry personnel. In this context, 73 doctors from each of the four hospitals, 243 nurses, midwives, health officers, and health technicians, as well as 89 medical secretaries and data entry personnel were selected using simple random sampling from the current lists provided by the Personnel Affairs Department of Amasya Provincial Health Directorate's Personnel Support Services Directorate. In the study, no substitutes were selected, and the aim was to reach the employees chosen through sampling (Table 1).

Table 1: Strata and sample distribution in the study

Strata	Healthcare Workers in Stratum	Population Size	Stratum Weight	Sample Size
1	Doctor	163	18.0	73
2	Nurse, Midwife, Health Officer, Health Technician	542	60.0	243
3	Medical Secretary, Clerk, Data Entry	201	22.0	89
Total		913	100.0	405

The data for the research was obtained through an online survey tool specifically built by the researcher. There are four sections in the data collection tool. The first section includes questions about the socio-demographic characteristics of the participants; the second section addresses their opinions regarding the currently used Hospital Information Management System (HBYS), the reasons for their satisfaction, and any challenges they may have experienced. Questions about e-Health (Electronic Health) apps used in public hospitals can be found in the third section. The opinions and recommendations of the participants on the use, contribution, training, and adaptation of e-Health applications in the shift to healthcare services are finally assessed in the fourth section.

Researchers transferred the data to a Microsoft Excel chart and used IBM SPSS Statistics (Version 24.0) to analyze them. Descriptive data of the participants are presented with summary data such as number, percentage, mean, standard deviation, median. The normality of the data was examined using the Kolmogorov-Smirnov test. Chi-square, Fisher's Exact, Mann-Whitney U, and Kruskal-Wallis tests were used to analyze the differences between groups. All statistical significance was determined at the $p<0.05$ level.

RESULTS

The 405 people who were chosen for the study's sample had all of their data fully gathered. 38.8% of the participants (n=248) were female. The participants' median age was 37 years old (min: 22, max: 64, n=405). Male participants had a median age of 42 years (SD: 10.6, min: 22, max: 64, n=157), while female participants had a median age of 36 years (SD: 8.4, min: 22, max: 58, n=248) (pmwu=0.006). Table 2 displays the distribution of the sociodemographic traits of the individuals.

The median total duration of practice for the doctors participating in the study was 3.0 ± 5.9 years (SD: 6.3, min: 1, max: 25). The median total duration of practice for midwives, nurses, and health officers was 12.0 ± 13.6 years (SD: 8.85, min: 1, max: 44) (n=243). The median duration for medical secretaries and data entry personnel was also 16.0 ± 15.4 years (SD: 7.8, min: 1, max: 39) (n=89). Additionally, 42.7% of the participants (n=173) reported that they worked night shifts, while 57.3% (n=232) indicated that they did not (Table 2).

Table 2: Socio-demographic characteristics distribution of participants

Features	Frequency (n)	The Percentage (%)
Gender		
Female	248	38.8
Male	157	61.2
Age Group		
<24	13	3.2
25-29	83	20.5
30-34	67	16.5
35-39	54	13.3
40-44	83	20.5
45-49	53	13.1
50+	52	12.8
Professional Group		
Doctor	73	18.0
Nurse, Midwife, Health Officer, Health Technician	243	60.0
Medical Secretary, Clerk, Data Entry	89	22.0
Total Years in Profession		
<5	115	28.4
5-9	39	9.6
10-14	84	20.7
15 and above	167	41.2
Night Shift		
Yes	173	42.7
No	232	57.3
Total	405	100.0

Examining how satisfied various professional groups were with the Hospital Information Management System (HBYS), it was discovered that 40.4% of medical secretaries and data entry staff (n=36), 34.2% of doctors (n=25), and 33.7% of midwives, nurses, and health officers (n=82) were "satisfied". Data entry employees and medical secretaries were reported to be happier with HBYS (p=0.057, Table 3).

Table 3: HBYS satisfaction distribution by professional groups

	Very Satisfied		Satisfied		Neutral		Dissatisfied		Very Dissatisfied		p
Professional Group	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Doctor	8	11.0	25	34.2	12	16.4	17	23.3	11	15.1	0.057
Nurse, Midwife, Health Officer, Health Technician	14	5.8	82	33.7	79	32.5	50	20.6	18	7.4	
Medical Secretary, Clerk, Data Entry	17	19.1	36	40.4	10	11.2	14	15.7	12	13.5	
Total	39	9.6	143	35.3	101	24.9	81	20.0	41	10.1	

*Kruskal Wallis-Test

The reasons for satisfaction and the challenges faced by users of the Hospital Information Management System (HIMS) were examined. Since participants were allowed to specify multiple reasons for satisfaction and difficulties encountered, the total percentages exceed 100%. According to the results, the majority of users expressed satisfaction with the system due to its ability to reduce errors (86.9%) and improve workflow (75.3%). However, users also reported experiencing difficulties with certain aspects of the system. Specifically, 58.5% of participants stated that they faced challenges due to occasional system failures and interruptions, while 50.1% mentioned that the time-consuming nature of data entry and update processes was among the most common difficulties (Table 4).

Table 4: Reasons for satisfaction and challenges faced in HIMS usage

Reasons for Satisfaction	n	%	Challenges Faced	n	%
Quick Access to Patient Information	275	67.9	Complexity of Menu Navigation	83	20.5
Data Security	207	51.1	Time-Consuming Data Entry and Update Processes	203	50.1
Improvement of Workflow	305	75.3	System Failures and Interruptions	237	58.5
Error Reduction	352	86.9	Data Transfer and Integration Issues	54	13.3

In this study, the usage rates of e-Health applications among different professional groups and the statistical differences among them were examined. The use of e-Prescriptions, e-Reports, e-Health records (e-Nabız), and telemedicine was found to be significantly higher among doctors compared to other professional groups (p=0.001, Table 5). Uniform Accounting System (TDMS) and similar applications were not used at all by doctors, while low usage rates were also observed among other professional groups (p=0.001, Table 5). However, the usage rates of the Central Hospital Appointment System (MHRS) did not show a significant difference among the professional groups (p=0.669, Table 5).

Table 5: Status of e-Health application usage among professional groups

Health Professions Groups									
	Doctor		Nurse, Midwife, Health Officer, Health Technician		Medical Secretary, Clerk, Data Entry		Total		p
e-Health Applications	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
e-Prescription									
Yes	58	79.5	78	32.1	45	50.6	181	44.7	* 0.001
No	15	20.5	165	67.9	44	49.4	224	55.3	
e-Report									
Yes	55	75.3	70	28.8	40	44.9	165	40.7	* 0.001
No	18	24.7	173	71.2	49	55.1	240	59.3	
e-Nabız									
Yes	44	60.3	71	29.2	41	46.1	156	38.5	* 0.001
No	29	39.7	172	70.8	48	53.9	249	61.5	
Telemedicine									
Yes	30	41.1	6	2.5	17	19.1	53	13.1	* 0.001
No	43	58.9	237	97.5	72	80.9	352	86.9	
Uniform Accounting System (TDMS)									
Yes	0	0.0	5	2.1	14	15.7	19	4.7	** 0.001
No	73	100.0	238	97.9	75	84.3	386	95.3	
Core Resource Management System (ÇKYS)									
Yes	0	0.0	8	3.3	10	11.2	18	4.4	** 0.001
No	73	100.0	235	96.7	79	88.8	387	95.6	
Material Resource Management System (MKYS)									
Yes	0	0.0	1	0.4	11	12.4	12	3.0	** 0.001
No	73	100.0	242	99.6	78	87.6	393	97.0	
Centralized Hospital Appointment System (MHRS)									
Yes	56	76.7	197	81.1	73	82.0	326	80.5	* 0.669
No	17	23.3	46	18.9	16	18.0	79	19.5	
Integrated Corporate Transaction Platform Portal (Ekip Sağlık)									
Yes	59	80.8	182	74.9	69	77.5	95	23.5	* 0.561
No	14	19.2	61	25.1	20	22.5	310	76.5	
Total	73	100.0	243	100.0	89	100.0	405	100.0	

*Pearson Chi-Square ** Fisher's Exact Test

The study found that healthcare workers most frequently request training in user education for e-Health applications, with 74% of doctors, 70.9% of nurses, midwives, health officers, and 69.7% of medical secretaries requesting this training. Technical support demand varied across professional groups, with 58.4% of medical secretaries requesting it. Data security and data analysis training were deemed unnecessary (Table 6).

Table 6: Educational needs and participation distribution of healthcare professionals

Training Topic	Doctor (n=73)		Nurse, Midwife, Health Officer, Health Technician (n=243)		Medical Secretary, Clerk, Data Entry (n=89)		Total (n=405)	
	n	%	n	%	n	%	n	%
Technical Support	16	21.9	60	24.7	52	58.4	128	31.6
User Training	54	74.0	171	70.4	62	69.7	287	70.9
Data Security Training	8	11.0	20	8.2	20	22.5	48	11.9
Data Analysis and Reporting	6	8.2	21	8.6	15	16.9	42	10.4

The familiarity levels and contribution rates of professional groups with e-Health (Electronic Health) applications while providing services have been examined. There was no significant difference in contribution levels and familiarity among the professional groups. The high contribution rate is 61.6% in the doctor group, while it is 50.2% in the nurse/midwife/health officer group; and it is 60.7% in the medical secretary and data entry personnel group. The difference between the groups in terms of contribution levels is not significant (p=0.140). In terms of familiarity, 61.6% of doctors, 49.4% of the nurse/midwife/health officer group, and 50.6% of medical secretaries and data entry personnel indicated that they were “familiar”. The difference between these groups is also not statistically significant (p=0.258, Table 7).

Table 7: Distribution of familiarity with e-Health applications and contribution levels to service provision by professional groups

	High Contribution		Middle Contribution		Low Contribution		p	Familiar		Slightly Familiar		No Familiarity		p
Professional Group	n	%	n	%	n	%		n	%	n	%	n	%	
Doctor	45	61.6	11	15.1	17	23.3		45	61.6	11	15.1	17	23.3	
Nurse, Midwife, Health Officer, Health Technician	122	50.2	65	26.7	56	23.0	**0.140**	120	49.4	54	22.2	69	28.4	**0.258**
Medical Secretary Clerk, Data Entry	54	60.7	21	23.6	14	15.7		45	50.6	18	20.2	26	29.2	
Total	221	54.6	97	24.0	87	21.5		210	51.9	83	20.5	112	27.5	

*Kruskal Wallis-Test

Health professional groups expressed similar opinions, with 75.3% of doctors, 67.5% of midwives/nurses/health officers, and 64.0% of medical secretaries and data entry personnel stating that e-Health applications are "good but need improvement" (p=0.289, Table 8). Regarding the improvement of e-Health applications, 87.7% of doctors, 70.4% of midwives/nurses/health officers, and 79.8% of medical secretaries and data entry personnel suggested that regular in-service training should be provided (p=0.006, Table 8). On the implementation of a reward system, 26.0% of doctors, 39.1% of midwives/nurses/health officers, and 48.3% of medical secretaries and data entry personnel indicated that rewarding is necessary (p=0.015, Table 8). In terms of ease of use, 31.5% of doctors, 32.9% of midwives/nurses/health officers, and 41.6% of medical secretaries and data entry personnel stated that using e-Health applications is easy (p=0.283, Table 8). Regarding the user-friendliness of these applications, 35.6% of doctors, 38.3% of midwives/nurses/health officers, and 37.1% of medical secretaries and data entry personnel noted that these applications are user-friendly (p=0.915, Table 8). On the other hand, concerning data security, 27.4% of doctors, 39.9% of midwives/nurses/health officers, and 30.3% of medical secretaries and data entry personnel believe that data security is ensured (p=0.074, Table 8).

Table 8: Opinions on the use of e-Health applications and recommendations from healthcare personnel for increasing usage

Health Professions Groups							
	Doctor		Nurse, Midwife, Health Officer, Health Technician		Medical Secretary, Clerk, Data Entry		p
	n	%	n	%	n	%	
Opinions							
Very good, it should be promoted	18	24.7	79	32.5	32	36.0	0.289
Good, but there is a need for improvement	55	75.3	164	67.5	57	64.0	
Suggestions							
Regular In-Service Training							
Yes	64	87.7	171	70.4	71	79.8	0.006
No	9	12.3	72	29.6	18	20.2	
Rewarding System							
Yes	19	26.0	95	39.1	43	48.3	0.015
No	54	74.0	148	60.9	46	51.7	
Ease of Use							
Yes	23	31.5	80	32.9	37	41.6	0.283
No	50	68.5	163	67.1	52	58.4	
User-Friendly							
Yes	26	35.6	93	38.3	33	37.1	0.915
No	47	64.4	150	61.7	56	62.9	
Data Security							
Yes	20	27.4	97	39.9	27	30.3	0.074
No	53	72.6	146	60.1	62	69.7	
Total	73	100.0	243	100.0	89	100.0	

*Pearson Chi-Square

DISCUSSION

The levels of satisfaction and challenges experienced by healthcare personnel working in public hospitals in four districts of Amasya Province regarding the current Hospital Information Management System (HBYS) were examined, along with the use of e-Health applications and suggestions for increasing their utilization. Data was collected through an online survey from a total of 405 individuals, with 38.8% being female and 61.2% male. According to the research results, the satisfaction rate of employees with the HBYS is found to be approximately 45%.

When examining the satisfaction levels of different professional groups, it was observed that the satisfaction levels towards the HBYS were generally similar among the professional groups, but doctors showed more dissatisfaction, while medical secretaries and data entry personnel had higher satisfaction levels. This difference was not found to be statistically significant. In the study by Gökkaya and İzgüden (2022), it was found that physicians showed lower satisfaction with digital hospital applications compared to administrative staff. This situation suggests that physicians have a more negative perception of digital applications and that the intensity of clinical duties may affect their experience of using these digital applications.

The main reasons contributing to the high levels of satisfaction with the Hospital Information Management System (HBYS) are workflow improvement and error reduction. These findings indicate that the system offers significant advantages, such as enhancing efficiency and reducing error rates. Furthermore, ease of access to patient information and data security emerges as other important sources of satisfaction. However, the main issues encountered in system usage include system failures and interruptions, as well as the time-consuming processes of data entry and updates. These issues can negatively affect users' daily workflows and reduce satisfaction. Complexity between menus and integration problems have also been occasionally raised, but these problems are reported less frequently compared to other issues. These findings are similar to the results of Bayer et al. (2019). These results indicate that improvements are necessary for HBYS systems, particularly in speeding up technical failures and data processes. Additionally, simplifying the user interface and integration processes can positively impact user experience.

The rates of e-Health application usage among occupational groups and the statistical differences between these groups have been examined. It was found that doctors have a higher usage rate of e-Prescription and e-Report compared to other occupational groups. The study by Yetkin (2021), examined doctors' views on electronic prescription applications within health information systems and found similarities with our study.

When we examined employees' usage of Sağlık.NET (e-Nabız) and telemedicine, our results showed significant differences in e-Health and telemedicine usage among occupational groups when compared to the findings of Çabuk (2023) and Kaya (2020). In Kaya's (2020) study, it was found that the e-Health knowledge of managerial/responsible doctors was different from that of other healthcare workers, while our study determined that doctors' telemedicine usage was higher than that of other healthcare workers. Çabuk's (2023) study revealed that healthcare personnel had a positive attitude towards telemedicine applications and that licensed healthcare workers had a higher awareness than doctors. These findings support the overall positive trends toward telemedicine and e-Health applications and indicate significant differences in e-Health and telemedicine usage among occupational groups. Furthermore, administrative applications such as the Uniform Accounting System (Tekdüzen Muhasebe Sistemi - TDMS), Core Resource Management System (Çekirdek Kaynak Yönetim Sistemi - ÇKYS), and Material Resource Management System (Mal Kaynakları Yönetim Sistemi - MKYS) were not used at all by doctors at all, and it had very low usage rates among other occupational groups. This situation indicates that there are differences in the use of applications specific to each occupational group and highlights the need for customized training and support strategies tailored to the needs of each group. It can be said that these differences emphasize the importance of customized approaches for the more effective adoption of e-Health applications.

In our study, it was determined that there is no statistically significant difference in the usage rates of the Integrated Corporate Process Platform Portal (Ekip Sağlık) and the Central Hospital Appointment System (Merkezi Hekim Randevu Sistemi - MHRS) among occupational groups. However, it was found that the usage rates of Integrated Corporate Process Platform Portal and Central Hospital Appointment System are higher than those of other digital health

applications. This finding indicates that Integrated Corporate Process Platform Portal and Central Hospital Appointment System are widely and similarly used by healthcare personnel, thereby not creating a significant difference among occupational groups. As Alay & Tüfekci (2023) state that applications developed for healthcare workers, such as Sağlık TİM, İnme 112, EKİP, and UMKE, facilitate communication and coordination, balance the workload more effectively, and provide opportunities for quick actions and interventions. Additionally, it was found that the usage rates of MHRS among healthcare workers are high. Çiftçi & Bostan (2016) state that changes made within the framework of the Health Transformation Program positively affect the quality of services, costs, healthcare worker satisfaction, and the understanding of service in hospitals. Uysal & Ulusinan (2020) emphasize the importance of e-Nabız and MHRS in accessing health information and making appointments, stating that these applications play critical roles in the healthcare sector. Thanks to these applications, patients can make appointments without wasting time, while healthcare professionals can perform their processes more efficiently.

When examining the views and suggestions of occupational groups regarding e-Health applications, it was observed that they generally made similar assessments about these applications; however, there are some differences among occupational groups regarding areas for improvement. Doctors, nurses/health officers, and medical secretaries/data entry personnel mostly stated that the applications are good but need improvement (p=0.289). Particularly among doctors, the demand for regular in-service training is high (87.7%), and this demand is widespread among occupational groups (p=0.006). Regarding rewards, medical secretaries requested more rewards (48.3%), while doctors were less demanding in this regard (26.0, p=0.015). There was no significant difference among occupational groups regarding ease of use and user-friendliness (p=0.283 and p=0.915). However, concerning data security, doctors expressed more concern than other groups (p=0.074). The study by Baş (2023) emphasizes that healthcare workers resist digital applications and find using paper more practical. In contrast, in our study, healthcare workers generally expressed positive views on e-Health applications. This difference may be due to the fact that face-to-face interview methods were utilized in Baş's study and the observation of employees' difficulties in abandoning their habits. However, both studies highlight the com-

mon finding that there is a need for improvements in education and technological infrastructure. While Baş's study addressed deficiencies in alert systems, our study also emphasized the training needs of occupational groups, indicating that there are still areas open for improvement in the use of digital systems. These findings indicate that e-Health applications are generally accepted, but there are expectations for some improvements from occupational groups.

CONCLUSION

The study examined the satisfaction levels of healthcare workers regarding the existing Hospital Information Management System (HBYS) in public hospitals in Amasya and the challenges they face. Among the 405 healthcare personnel who participated in the research, a satisfaction rate of 45% highlights the positive impacts of HBYS on employees, emphasizing benefits such as the system's user-friendly nature and increased efficiency. Particularly, medical secretaries and data entry personnel showed higher satisfaction than other professional groups due to their more intensive daily use of the system. This satisfaction is thought to be related to HBYS's facilitation of work processes and enhancement of operational efficiency.

However, significant challenges encountered in the use of HBYS include technical issues such as system failures and the time-consuming nature of data entry and update processes. These problems can adversely affect users' workflows and diminish satisfaction. In this context, there is a need to focus on technical improvements for the system, specifically reducing technical failures and accelerating data processing.

Furthermore, examining the usage rates of e-Health applications reveals that doctors utilize applications such as e-Prescription and e-Report more than other professional groups. Additionally, significant differences among professional groups were observed in the use of telemedicine and e-Nabız. Telemedicine usage is particularly prevalent among doctors, while other healthcare personnel have less familiarity with it. This situation indicates the necessity for broader dissemination of e-Health applications and the development of training strategies tailored to different professional groups. Systems like Integrated Corporate Process Platform Portal (Ekip Sağlık) and the Central Hospital Appointment System (Merkezi Hekim Randevu Sistemi - MHRS) exhibit similar usage rates across professional groups, indicating that these applications are widely and effectively used.

This research has some limitations. Due to being a cross-sectional study, while the current situation can be identified, definitive conclusions about cause-and-effect relationships cannot be drawn. Additionally, sufficient participation could not be achieved from the 600-bed Sabuncuoğlu Şerefeddin Training and Research Hospital because the study is based on voluntary participation. The online survey method used in the data collection process may have prevented some healthcare workers with limited digital literacy or time constraints from participating. Data obtained from different regions and types of hospitals could increase the applicability of the results to a broader population. In our study, potential influencing variables such as demographic factors were overlooked, so more comprehensive analyses that include factors like age and education level can be conducted in the future. Compared to the findings in the literature, the result that doctors show lower satisfaction with digital hospital applications is noteworthy. In future studies, it would be beneficial to conduct further research on the reasons behind any dissatisfaction. In conclusion, the limitations of our study provide a foundation that encourages broader and more in-depth analyses of digital health applications and HIS satisfaction.

Finally, to enhance the overall satisfaction of healthcare workers regarding e-Health applications, it is emphasized that additional training, strengthening of technical infrastructure, and the provision of user-friendly interfaces are essential. Although there are varying expectations among professional groups, all employees have communicated similar demands for the improvement of systems. This study provides significant data for improvements in both HBYS and e-health applications and offers roadmaps for the development of these systems.

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Authors' Contributions: The data of the study were collected and analyzed by İN. The authors are taken parts in the writing of the article for abstract and introduction İN, for methods İN, for results İN also, for discussion and conclusion both authors have part in. Besides, the parts of article were arranged by İN and ANÖ. Both authors read and approved the final version of the manuscript.

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Comparing Level of Happiness and Depression Between Turkish and International Medical Students

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ABSTRACT

This cross-sectional study was aimed to compare happiness and depression levels among group Turkish and international medical students in Istanbul, Türkiye. Data were collected through an online survey that included demographic inquiries, the Oxford Happiness Scale, and Beck's Depression Inventory II. Significant contrasts emerged in demographic and lifestyle factors between Turkish and international students**.** Turkish medical students displayed a higher prevalence of unhappiness, although this difference was not statistically significant (66.3% for Turkish students vs. 59.1% for international students; χ^2=2.472, p=0.116). Conversely, no marked differences were observed in the severity of depression between the two groups (χ^2=0.028, p=0.986). Conversely, no marked differences were observed in the severity of depression between the two groups (χ2=0.028, p=0.986). Logistic regression analyses revealed noteworthy associations. Factors such as age, academic phase, family history of psychiatric illness, and prior psychiatry treatment were linked to heightened odds of experiencing unhappiness among students. Similarly, sig-

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nificant predictors of depression included a family history of depression and prior psychiatry treatment. However; gender, age, relationship status, accommodation, alcohol consumption, smoking habits, and repeated academic years did not exhibit significant associations with unhappiness among the sampled medical students. While the models demonstrated modest explanatory power, these findings emphasize the urgent need to address mental health issues among medical students. Tailored interventions targeting specific vulnerable subgroups are crucial and further research is needed to identify additional factors contributing to psychological distress in this demographic.
Keywords: Depression, Happiness, Medical Students

INTRODUCTION

In the realm of medical education, the psychological well-being of medical students has emerged as a focal point of concern globally. Despite their initial enthusiasm for their medical careers, medical students have been found to experience a decline in life satisfaction due to academic pressures, ethical dilemmas, and personal sacrifices (Tjia et al., 2005). The perception of medical students and doctors as 'invincible' has caused decreased levels of help-seeking for psychiatric problems and increased the risk of experiencing symptoms of depression, anxiety, and burnout, indicating a collective vulnerability to psychological distress (Hankir et al., 2014). These factors lead many medical students to cease their educational pursuits or turn to destructive habits throughout their education.

Depression among medical students has been a topic neglected in Türkiye, even more so with regard to international medical students. International medical students face the same challenges as their Turkish counterparts with added stressors in the form of cultural changes. International students often face language barriers, social adjustment, loneliness, and isolation while studying abroad and the pursuit of medicine only exacerbates these feelings (Sümer et al., 2008). These intense feelings of isolation and hopelessness can quickly manifest as depression, further alienating these students from medical education (Mori, 2011).

In the past decade, Türkiye has experienced significant growth in its international medical student population, largely due to the expansion of programs

offering medical education in English. Despite this rapid rise in the international student population, insufficient research has been conducted to examine the mental health of international students, especially those in medicine. When considering the demands of medical education alongside the experience of being an international student, it raises the question of whether international medical students face a heightened risk of unhappiness and depression compared to their domestic counterparts. This study aims to investigate and shed light on this proposed hypothesis within the context of medical education.

METHODOLOGY

Study Design

This is a descriptive study designed to demonstrate and compare levels of happiness and depression among medical students in Istanbul, Türkiye, specifically focusing on the disparity between Turkish and international medical students. The study adhered to ethical guidelines and was conducted during April 2024 at Istanbul Medipol University and Istanbul Medipol University Mega Hospital Complex.

Population and Sample Size

The study population consisted of medical students enrolled at Istanbul Medipol University, totaling 1,880 individuals, including 1,476 Turkish students and 404 international students. Efforts were made to reach all students; however, due to various constraints, the final sample included 249 Turkish students (16.9%) and 208 international students (51.5%), who participated voluntarily.

Data Collection

Data were collected through an online survey distributed to participants. The purpose of the study was to compare levels of happiness and depression between medical students from Türkiye and international medical students by using the Oxford Happiness Scale and Beck's Depression Inventory. These scales do not provide a clinical diagnosis for depression but allow for self-assessment and can be used to ascertain further follow-up.

The students were given a survey consisting of 61 questions and students provided verbal consent prior to completion. Eleven of the questions were related subject's demographic characteristics, 29 questions were the Oxford Happiness Scale questionnaire and were used to assess the level of happiness of the participants, and 21 questions were the Beck's Depression Inventory II (BDI-II) questionnaire to assess the subject's mental health and depression. The surveys were given in both English and Turkish with the Turkish forms of the Oxford Happiness Index (Doğan & Çötok, 2011) and Beck's Depression Inventory (Kapci et al., 2008). The demographic characteristics surveyed included: age, sex, year in medical school, repeated years in medical school, romantic relationship status, accommodation, consumption of alcoholic beverages, smoking habits, family history of depression, and prior psychiatric treatment. Accommodation was specifically categorized based on responses to the statements: "I live at home with my family," "I live in a student dormitory," "I live with other students in an apartment," and "I live in an apartment alone."

Interpretation of Results

The scores on the Oxford Happiness Scale were classified into ≤4 "unhappiness" and >4 "happiness" to clearly distinguish between lower and higher levels of happiness. Beck's Depression Inventory scores were categorized as follows: 0–10 points "not depressed", 11–17 points "moderately depressed", and 18–63 points "clinically relevant depression" (Beck et al., 1996). The distribution of happiness and depression statuses were interpreted based on demographic and background characteristics.

Statistical Analysis

Data analysis was conducted using IBM SPSS Statistics 23 (Statistical Package for Social Sciences). Descriptive statistics were used to summarize participant characteristics. Chi-square test was performed to assess the relationship between the demographic characteristics and level of happiness and depression.

Ethical Considerations

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Istanbul Medipol University (decision number 385 received

on 26.04.2024) and the deaneries of the Turkish Medicine department and International School of Medicine. Participant confidentiality and anonymity were ensured throughout the study, and informed consent was obtained from all participants prior to their involvement. All participants, regardless of their results, were educated on the importance of mental health and were encouraged to consult a health professional for further support and guidance.

RESULTS

Significant differences were observed in several demographic and lifestyle characteristics between the Turkish and international medical school participants (Table 1). Turkish medical school participants exhibited a lower proportion of females compared to international medical students (55.0% vs. 65.4%, p=0.024). Additionally, a greater percentage of international participants were ≤20 years old (45.2% vs. 30.9%, p<0.001) and were in the pre-clinical years of medical school (73.1% vs. 61.8%, p=0.011). Moreover, a larger proportion of international medical students reported repeating a year in medical school (27.4% vs. 10.4%, p<0.001). Significant differences were also observed in romantic relationship status (p=0.004), accommodation (p<0.001), alcohol consumption (p<0.001), and smoking habits (p=0.002) between Turkish and international medical students. However, no significant disparities were found in family history of depression (p=0.595) or prior psychiatry treatment (p=0.125) between the two groups.

Table 1: Impact of demographic characteristics on unhappiness and depression among medical students (Istanbul-Türkiye, 2024)

		Characteristics of Students					
		Turkish		International			
		n	%	n	%	X^2	p
Sex	Male	112	45.0	72	34.6	5.06	0.024
	Female	137	55.0	136	65.4		
Age	≤20	77	30.9	94	45.2	15.74	**<0.001**
	21-22	80	32.1	70	33.7		
	≥23	92	36.9	44	21.2		
Period in Medical School	Pre-Clinic	154	61.8	152	73.1	6.46	0.011
	Clinic	95	38.2	56	26.9		
Repeat Year in Medical School	Yes	26	10.4	57	27.4	21.94	**<0.001**
	No	223	89.6	151	72.6		
Romantic Relationship Status	Yes	92	36.9	51	24.5	8.14	0.004
	No	157	63.1	157	75.5		
Accommodation	Family	94	37.8	67	32.2	18.34	**<0.001**
	Dormitory	74	29.7	35	16.8		
	Apartment	31	12.4	39	18.8		
	Alone	50	20.1	67	32.2		
Alcohol	Yes	137	55.0	44	21.2	54.34	**<0.001**
	No	112	45.0	164	78.8		
Smoking	Never	144	57.8	153	73.6	12.54	0.002
	Occasionally	53	21.3	30	14.4		
	Daily	52	20.9	25	12.0		
Family History of Depression	Yes	50	20.1	46	22.1	0.28	0.595
	No	199	79.9	162	77.9		
Prior Psychiatric Treatment	Yes	81	32.5	54	26.0	2.35	0.125
	No	168	67.5	154	74.0		

The comparison of results from the Oxford Happiness Scale and Beck's Depression Inventory between Turkish and international medical students revealed notable differences in reported levels of happiness and depression severity (Table 4). Turkish medical students exhibited a higher proportion reporting unhappiness on the Oxford Happiness Scale compared to international students (66.3% vs. 59.1%), although this difference was not statistically significant ($\chi 2=2.472$, $p=0.116$). Additionally, there were no significant differences in the distribution of depression severity levels between Turkish and international students according to Beck's Depression Inventory ($\chi 2=0.028$, $p=0.986$).

Table 2: Distribution of Oxford Happiness Scale and Beck's Depression Inventory Scores by nationality of the participants (Istanbul-Türkiye, 2024)

	Oxford Happiness Scale				Beck's Depression Inventory					
	Unhappy		Happy		None		Moderate		Clinical	
	n	%	n	%	n	%	n	%	n	%
Turkish Medical Students	165	66.3	84	33.7	90	36.1	70	28.1	89	35.7
International Medical Students	123	59.1	85	40.9	76	36.5	57	27.4	75	36.1
	$X^2=2.472$ p=0.116				$X^2=0.028$ p=0.986					

Analysis of the Oxford Happiness Scale findings and their association with various demographic and lifestyle factors revealed that alcoholic beverages consumption ($\chi 2=4.69$, $p=0.030$), family history of depression ($\chi 2=13.60$, $p<0.001$), and prior psychiatry treatment ($\chi 2=11.44$, $p<0.001$) emerged as significant predictors (Table 2). However, sex, age, academic progression, smoking habits, and accommodation did not significantly associate with happiness levels. Regarding the results of Beck's Depression Inventory, gender ($\chi 2=0.27$, $p=0.875$), age ($\chi 2=4.83$, $p=0.305$), and characteristics of students ($\chi 2=0.03$, $p=0.986$) showed no significant associations with depression severity (Table 3). However, significant associations were observed for repeated year in medical school ($\chi 2=7.20$, $p=0.027$), smoking habits ($\chi 2=14.01$, $p=0.007$), family history of depression ($\chi 2=22.13$, $p<0.001$), and prior psychiatry treatment ($\chi 2=28.66$, $p<0.001$). Notably, students with a family history of depression, and those who had received prior psychiatry treatment, exhibited higher rates of clinically relevant depression.

Table 3: Distribution of Oxford Happiness Scale results by some characteristics of the participants (Istanbul-Türkiye, 2024)

		Oxford Happiness Scale					
		Unhappy		Happy			
		n	%	n	%	X^2	p
Gender	Male	119	64.7	65	35.3	0.36	0.548
	Female	169	61.9	104	38.1		
Age	≤20	105	61.4	66	38.6	1.79	0.407
	21-22	91	60.7	59	39.3		
	≥23	92	67.6	44	32.4		
Characteristics of Students	Turkish	165	66.3	84	33.7	2.47	0.116
	International	123	59.1	85	40.9		
Year in Medical School	Pre-Clinic	199	65.0	107	35.0	1.61	0.204
	Clinic	89	58.9	62	41.1		
Repeated Year in Medical School	Yes	57	68.7	26	31.3	1.39	0.238
	No	231	61.8	143	38.2		
Romantic Relationship Status	In a Relationship	93	65.0	50	35.0	0.36	0.547
	Single	195	62.1	119	37.9		
Accommodation	Family	109	67.7	52	32.3	6.55	0.088
	Dormitory	73	67.0	36	33.0		
	Other Students	43	61.4	27	38.6		
	Alone	63	53.8	54	46.2		
Alcohol	Yes	125	69.1	56	30.9	4.69	0.030
	No	163	59.1	113	40.9		
Smoking	Never	184	62.0	113	38.0	3.05	0.218
	Occasionally	49	59.0	34	41.0		
	Daily	55	71.4	22	28.6		
Family History of Depression	Present	76	79.2	20	20.8	13.60	**<0.001**
	Absent	212	58.7	149	41.3		
Prior Psychiatry Treatment	Present	101	74.8	34	25.2	11.44	**<0.001**
	Absent	187	58.1	135	41.9		

Table 4: Distribution of Beck's Depression Index Inventory results by some characteristic of the participants (Istanbul-Türkiye, 2024)

		Beck's Depression Inventory							
		None		Moderate		Clinical			
		n	%	n	%	n	%	X^2	p
Gender	Male	69	37.5	49	26.6	66	35.9	0.27	0.875
	Female	97	35.5	78	28.6	98	35.9		
Age	≤20	70	40.9	46	26.9	55	32.2	4.83	0.305
	21-22	53	35.3	37	24.7	60	40.0		
	≥23	43	31.6	44	32.4	49	36.0		
Characteristics of Students	Turkish	90	36.1	70	28.1	89	35.7	0.03	0.986
	International	76	36.5	57	27.4	75	36.1		
Year in Medical School	Pre-Clinic	112	36.6	76	24.8	118	38.6	4.77	0.092
	Clinic	54	35.8	51	33.8	46	30.5		
Repeated Year in Medical School	Yes	22	26.5	21	25.3	40	48.2	7.20	0.027
	No	144	38.5	106	28.3	124	33.2		
Romantic Relationship Status	Relationship	44	30.8	44	30.8	55	38.5	2.82	0.244
	Single	122	38.9	83	26.4	109	34.7		
Accommodation	Family	53	32.9	52	32.3	56	34.8	4.53	0.605
	Dormitory	37	33.9	31	28.4	41	37.6		
	With Other Students	27	38.6	18	25.7	25	35.7		
	Alone	49	41.9	26	22.2	42	35.9		
Alcohol	Yes	55	30.4	54	29.8	72	39.8	4.62	0.099
	No	111	40.2	73	26.4	92	33.3		
Smoking	Never	125	42.1	72	24.2	100	33.7	14.01	0.007
	Occasionally	24	28.9	29	34.9	30	36.1		
	Daily	17	22.1	26	33.8	34	44.2		
Family History of Depression	Present	19	19.8	24	25.0	53	55.2	22.13	**<0.001**
	Absent	147	40.7	103	28.5	111	30.7		
Prior Psychiatry Treatment	Present	24	17.8	50	37.0	61	45.2	28.66	**<0.001**
	Absent	142	44.1	77	23.9	103	32.0		

Post-hoc analysis revealed significant deviations from expected cell frequencies among different levels of smoking frequency, with never smokers showing a higher-than-expected count of not depressed individuals (adjusted residual=3.5, p=0.00048) and daily smokers displaying a lower count of not depressed individuals compared to expected values (adjusted residual=-2.9, p=0.0044). Additionally, individuals with a family history of depression demonstrated a significantly higher prevalence of clinically relevant depression (adjusted residual=4.4, p<0.001) and a lower prevalence of not being depressed (adjusted residual=3.8, p<0.001), while those without such history showed the opposite pattern (adjusted residual=3.8, p<0.001 for not depressed; adjusted residual=-4.4, p<0.001 for clinically relevant depression). Moreover, there was a significant association between prior psychiatric treatment and the severity of depressive symptoms, with treated individuals displaying lower adjusted residuals for not depressed scores (-5.3, p<0.001) and higher residuals for mild to moderate (2.9, p=0.004) and clinically relevant depression scores (2.7, p=0.007) compared to untreated individuals, who exhibited the opposite pattern.

The impact of demographic characteristics, regardless of whether students were Turkish or international, on unhappiness and depression among medical students was examined (Table 5). Students aged 23 years and above, belonging to the clinic phase of their medical education, and those with a family history of psychiatric illness exhibited increased odds of experiencing unhappiness, as evidenced by statistically significant estimates and odds ratios (ORs) of 2.38 (CI: 1.09-5.20, p=0.030), 2.34 (CI: 1.22-4.49, p=0.010), and 2.17 (CI: 1.23-3.84, p=0.008), respectively. Additionally, individuals reporting prior psychiatry treatment displayed elevated odds of unhappiness (OR=1.74, CI: 1.07-2.84, p=0.026). Conversely, residing alone was associated with decreased odds of unhappiness (OR=0.53, CI: 0.31-0.90, p=0.018). Notably, factors such as gender, age, relationship status, accommodation, alcohol consumption, smoking habits, and repeated academic years did not exhibit statistically significant associations with unhappiness among the sampled medical students. The fit of the model was moderate, with a McFadden pseudo-R^2 value of 0.072, indicating that about 7.2% of the variability in unhappiness could be explained by the variables considered. Regarding depression, significant asso-

ciations were found with family history of depression (OR=2.10, 95% CI: 1.32-3.33, p=0.002) and prior psychiatry treatment (OR=1.87, 95% CI: 1.25-2.79, p=0.002), indicating increased vulnerability in medical students with such backgrounds (Table 5). The model's explanatory power was relatively low, with a McFadden pseudo-R^2 value of 0.0475, indicating that approximately 4.75% of the variance in depression among medical students could be accounted for by the variables examined.

Table 5: Impact of demographic characteristics on unhappiness and depression among medical students (Istanbul-Türkiye, 2024)

	Unhappiness		Depression	
Characteristics	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**
Gender				
Female	1.00		1.00	
Male	1.26 (0.83-1.93)	0.276	1.07 (0.74-1.55)	0.705
Age				
≤20	1.00		1.00	
21-22	1.17 (0.70-1.98)	0.547	1.36 (0.86-2.14)	0.190
≥23	2.38 (1.09-5.20)	**0.030**	1.59 (0.82-3.09)	0.167
Nationality				
International Medical Students	1.00		1.00	
Turkish Medical Students	1.05 (0.66-1.67)	0.824	0.86 (0.57-1.28)	0.455
Year in Medical School				
Clinic	1.00		1.00	
Pre-Clinic	2.34 (1.22-4.49)	**0.010**	1.54 (0.89-2.68)	0.125
Repeated Years				
No	1.00		1.00	
Yes	1.10 (0.61-2.00)	0.743	1.35 (0.81-2.24)	0.246
Relationship Status				
Single	1.00		1.00	
In a Relationship	0.90 (0.56-1.43)	0.648	0.98 (0.66-1.47)	0.936

	Unhappiness		Depression	
Characteristics	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**
Accommodation				
Family	1.00		1.00	
Dormitory	0.88 (0.50-1.55)	0.661	1.05 (0.65-1.71)	0.838
Other Students	0.73 (0.39-1.37)	0.331	0.83 (0.48-1.43)	0.502
Alone	0.53 (0.31-0.90)	**0.018**	0.79 (0.50-1.25)	0.311
Alcohol				
No	1.00		1.00	
Yes	1.65 (0.96-2.81)	0.068	1.18 (0.75-1.85)	0.475
Smoking				
Never	1.00		1.00	
Occasionally	0.63 (0.35-1.14)	0.128	1.27 (0.77-2.09)	0.354
Daily	1.00 (0.51-1.96)	0.989	1.49 (0.85-2.60)	0.167
Family History				
Absent	1.00		1.00	
Present	2.17 (1.23-3.84)	**0.008**	2.10 (1.32-3.33)	0.002
Prior Psychiatry Treatment				
Absent	1.00		1.00	
Present	1.74 (1.07-2.84)	**0.026**	1.87 (1.25-2.79)	0.002

DISCUSSION

This study aimed to investigate and compare levels of happiness and depression among medical students in Istanbul, Türkiye, with a specific focus on the disparity between Turkish and international medical students. The results of our study showed that Turkish medical students felt less happiness than their international counterparts (33.7% vs. 40.9%). Despite this, results showed that both groups felt less happiness than reported in other research. In a study by Kamthan et al. (2019), 60.8% of the medical students in the study reported feelings of happiness. In another study among medical students in Saudi Arabia, 45.6% of students reported feelings of happiness, which is also higher than the perceived happiness in our study (Moghadam et al., 2016). Although no

research examining the levels of happiness among medical students in Türkiye has been conducted, studies on the happiness of other Turkish students were found. In the studies by Doğan and Sapmaz (2012), and Demirbatir (2015), the Turkish students had higher levels of happiness than both the Turkish medical students and international medical students in our study. The increased unhappiness in our students could be due to the stressors of medical school. In a study by Pelzer et al. (2022), the factors of mental overload and performance pressure among medical students explained the higher levels of unhappiness compared to non-medical students However, more research should be conducted in Türkiye to get a clearer answer.

The prevalence of moderate or clinical depression between Turkish and international medical students was similar (63.8% vs. 63.5%) in our study. In a meta-analysis by Rotenstein et al. (2016) spanning 43 countries, the summary estimate of the prevalence of depression or depressive symptoms among medical students ranged between 9.3% and 55.9%. According to this study, the values determined in our study showed that the medical students at the university faced higher than normal levels of depression. When examining the local literature for data on Turkish medical students, the results were comparable to a study by Doğan and Doğan (2019), where 60.2% of the medical students presented with moderate or clinical depression. The study also highlighted that medical students in countries such as Cameroon, Pakistan, Syria, Sudan, Malaysia, Egypt, Iran, and India all had comparable depression results to students in Türkiye, whereas medical students who studied in Europe had lower levels of depression. Although the following studies were not conducted on medical students, studies by Bayram and Bilgel (2008), Deniz and Sümer (2010), Karaoğlu and Şeker (2010), Öncü et al. (2013), Pesen and Mayda (2020), and Üstün and Bayar (2015) showed comparable levels of depression among students in Türkiye. When looking at the results between the Turkish and international students regarding clinical depression (35.7% vs. 36.1%), the results are comparable to a cross-sectional study by Alshahrani et al. (2024) in Saudi Arabia, with 26.8% of the medical students feeling depression. Puthran et al. (2016) conducted a study among 62,728 medical students and demonstrated a global prevalence of depression among the students of 28.0%, with higher levels of depression seen in Middle Eastern countries.

In studies done by Mirza et al. (2021) and Hamasha et al. (2019), it was found that the prevalence of depression increases in females, younger age groups, lower-class years, and those living alone in rented rooms. Additionally, these studies showed that students with substance abuse had higher levels of depression. Our data showed no significant difference between men and women regarding happiness and depression. However, students in the middle age bracket (21-22) showed higher levels of unhappiness and depression than those in the lower (≤20) or higher (≥23) age groups. This can be explained as the majority of these students tend to be in their 3rd year of medical school, which is known to be the most difficult. Our study agreed with the findings of Mirza et al. (2021) and Hamasha et al. (2019) regarding lower-class years, as students in the pre-clinical years had higher levels of depression and unhappiness than those in the clinical years. Furthermore, our study found that students who consumed alcoholic beverages and smoked had higher levels of unhappiness and depression, and the more they drank and smoked, the higher the prevalence was. In terms of accommodation, no significant differences were noted across all levels of accommodation, differing from the studies by Mirza et al. (2021) and Hamasha et al. (2019).

The most significant factors identified in our study influencing increased unhappiness and depression among students were a family history of depression and prior psychiatric treatment. These findings align with existing research indicating that students with a positive family history of depression are more likely to experience depressive symptoms during medical school (Khan et al., 2006). Similarly, Ghodasara et al. (2011) found that a family history of depression is a strong predictor of higher levels of depression among medical students. Regarding prior psychiatric treatment, studies by Honney et al. (2010) and Coentre et al. (2016) revealed that students with a personal history of depression are more likely to develop or experience worsening depressive symptoms during medical school. Based on our findings and supporting literature, it is evident that medical students with a family history of depression, a personal history of psychiatric issues, or previous treatment require targeted support to alleviate the burden of unhappiness and depression. Tailored interventions, such as support groups for high-risk individuals identified in similar studies, may be warranted to mitigate the risk of depressive symptoms and promote overall well-being among medical students throughout their educational journey (Dhanoa et al., 2022).

Although this study provides valuable insight into medical students' happiness and depression levels, several limitations should be acknowledged. Firstly, the sample size, especially among international medical students, was small, potentially limiting the generalizability of findings. Additionally, the voluntary nature of participation may introduce selection bias, as individuals with more severe mental health issues may be less likely to participate. The "one-shot data collection" design impedes the establishment of causal relationships between variables, necessitating longitudinal studies to capture the dynamics of happiness and depression among medical students. Moreover, reliance on self-report measures may introduce response bias and inaccuracies due to social desirability or recall bias. Language proficiency and cultural differences may have influenced participants' responses, particularly among international students. Furthermore, the study's location in Istanbul, Türkiye, raises questions about the applicability of findings to other medical student populations globally. While Beck's Depression Inventory provides insights into depression severity, its lack of clinical diagnoses limits its utility in capturing the full spectrum of psychiatric disorders impacting mental health outcomes. Finally, the omission of confounding variables such as socioeconomic status, coping mechanisms, and academic performance may influence levels of happiness and depression among medical students. While the study identified demographic factors associated with mental health outcomes, the underlying mechanisms driving these associations remain unclear. Future research could explore the mediating and moderating factors that contribute to the observed disparities in happiness and depression among medical students.

CONCLUSION

This study contributes to our understanding of the psychological challenges faced by medical students attending in a medical school in Istanbul, Türkiye. Although there were no significant differences in mental health outcomes among Turkish and international students, there were still high levels of unhappiness and depression amongst all medical students. Addressing the unique needs of medical students and implementing proactive measures to foster a supportive learning environment are crucial steps toward mitigating the risk of depression and enhancing overall student satisfaction and success in medical education.

Ethical Approval: The study was initiated upon receiving approval from the Istanbul Medipol University's Non-Interventional Clinical Research Ethics Committee, decision dated April 18, 2024, numbered 385.

Authors' Contributions: A.A. conceived the study. A.A., O.K., A.D., and B.G.D. contributed equally to the study design, survey distribution and collection, and data analysis. E.D. assisted in survey collection. All authors (A.A., O.K., A.D., B.G.D., and E.D.) contributed to drafting and revising the manuscript. O.H. finalized the manuscript edits and approved the final version.

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Communication in Health Diplomacy

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ABSTRACT

Health is increasingly becoming a critical element in countries' trade agreements, development strategies, security, and foreign policy. It is recognised that threats to health can jeopardise the security and stability of a country. For centuries, countries have taken action to stop diseases at the border through quarantine measures, recognising the central importance of health security to national security. As diseases cross borders and are similar to each other, these health challenges can only be solved through global negotiations and agreements. Global health diplomacy is a governance process involving governments, non-governmental organisations, international organisations, and multinational corporations for a healthy world. Successful global health diplomacy is based on political and diplomatic experience and practice, which must be combined with public health knowledge and evidence-based medicine. Rapidly spreading epidemics, wars, refugee problems, and development goals have made the integration of health into foreign policy imperative. Communication is important to develop an effective exchange of information and understanding between different actors in order to find solutions to global health-related problems and increase cooperation. It helps decision-makers better understand health issues, develop evidence-based policies and increase coordination at the global level. Especially in epidemics or emergencies, accurate communication supports rapid response processes. In health diplomacy, communication is not only a tool for inter-state negotiations, but also for raising awareness

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of the public and relevant actors on global health issues. Accurate and effective communication of any work to both internal and external public opinion is at least as important as the work being done, and successful health diplomacy depends on successful communication, and successful communication depends on accurate information sharing. Transparent and reliable communication raises public awareness and increases public support for health diplomacy initiatives. Communication also plays a critical role in overcoming language and social barriers in different cultures. Communication skills prevent intercultural misunderstandings and contribute to the development of more inclusive and sustainable solutions to the needs of different societies. In this context, a correct and effective dialogue culture builds trust and strengthens cooperation in diplomatic negotiations. As a result, communication in health diplomacy helps to achieve health goals at national and international level by facilitating actors to interact with each other. In this study, the actors, activities, implementation forms and tools of health diplomacy, which is an increasingly popular foreign policy tool, will be discussed and the importance of communication in health diplomacy will be emphasised.

Keywords: Health Diplomacy, Global Health Diplomacy, Communication

INTRODUCTION

Diplomacy is defined as the skill and practice of conducting negotiations. International relations are usually conducted through the intervention of professional diplomats in matters such as war, peace and trade. In recent years, there has been an increase in the number of international agreements on environmental and health issues, and it is now recognised that these issues have important consequences on national economies. Diplomacy, which started with economy and trade in the 1950s, focused on environmental issues in the 1980s and health issues in the 21st century (Kickbusch et al., 2007).

Diplomacy plays a vital role in health. Health is increasingly becoming a critical element in countries' trade agreements, development strategies, security and foreign policy. Today's growing health challenges require not only technical equipment but also political negotiations, solutions and diverse actors (WHO, 2022a). The term global health diplomacy aims to encompass the multi-stage and multidisciplinary processes of agreement that shape and gov-

ern global policy in the field of health. Global health diplomacy is carried out through international agreements and conventions by institutions and organisations such as the United Nations General Assembly, the World Health Assembly, international non-governmental organisations and the Human Rights Council (Kickbusch et al., 2007; WHO, 2022a).

Global health security is an integral part of foreign policy to protect and promote health worldwide. Coordination of health and foreign policy has significant health benefits. Global public health is shown to be intertwined with issues such as communication, economy, social justice, sustainable development, foreign relations and social development goals in the Millennium Development Goals. As an objective of foreign policy, health is recognised as a factor that contributes significantly to poverty alleviation, development, social justice, human rights and peace.

Health diplomacy is a field that combines foreign affairs with medicine and law, with a focus on negotiations that affect the global health-related policy environment. Successful health diplomacy is based on political and diplomatic experience and practice, which must be combined with public health knowledge and evidence-based medicine. The basic principle of health diplomacy is based on the concept of bringing nations together in diplomatic missions to counter public health threats that all countries should prepare for (Karacic et al., 2021). Health diplomacy addresses health at both social and economic levels. It also deals with health problems individually or collectively. Thus, it has an important role in supporting sustainable development. Health diplomacy supports countries in addressing issues of concern such as access to health security, health promotion, disease control, access to medicines and technologies, food security, water and the post-2015 agenda, and in protecting common interests (WHO, 2022a).

Foreign Policy and Health

Health is one of the most important but widely neglected long-term foreign policy issues of our time. Investments in health are fundamental to economic progress and empowerment. Threats to health are known to jeopardise a country's security and stability. For centuries, countries have taken action to stop disease at the border through quarantine measures and have recognised the

central importance of health security to national security. Today, it is beginning to be recognised that health security is more than a national concern. It is a global issue affecting not only countries, but also national industry and international business, demonstrating the growing interconnectedness between domestic and foreign policy. A stronger strategic focus on health is needed on the international agenda. Since diseases cross borders and are similar to each other, the solution to these health problems can only be realised through global negotiations and agreements (Kahraman, 2019; WHO, 2022b).

Diplomacy should not be used to serve interests that are detrimental to health, nor should health be used as a political tool at the expense of people's lives. But health can be a bridge to peace, bringing significant benefits to crisis situations, diffusing tensions and helping to create positive environments for political dialogue.

Global health requires a governance process involving states, non-governmental organisations, international organisations and multinational companies. Therefore, health has become not only a technical issue but also a political one. It is crucial that foreign policy is well informed about the growing threat to global health security and expected risks, such as disease outbreaks and antimicrobial resistance. Foreign policy, together with other sectors and ministries, should increase its role in advocating for and adopting an all-hazards approach to health security (Kahraman, 2019; WHO, 2022b).

Pibulsonggram et al. 2007, the Oslo Declaration, as part of the Global Health and Foreign Policy initiative, emphasised the need to ensure global health security, prepare for health crises and build strong cooperation among countries.

Many global health issues such as pandemic influenza, severe acute respiratory syndrome (SARS) and HIV/AIDS are seen as threats to foreign policy interests and national security. This has contributed to the intersection of global health, diplomacy and foreign policy (Michaud & Kates, 2013). Today, states attach importance to health issues while determining their foreign policies. Developments in recent years have made this process compulsory and in this context, the phenomenon of global health diplomacy has emerged (Çamyamaç, 2020). In the twenty-first century, the need for coordinated global health action among countries has increased and the importance of global health diplomacy has become evident in foreign policy circles (Brown et al., 2014).

Global Health Diplomacy

Definition and History

Health diplomacy and global health diplomacy are defined by Lee and Smith (2011) as 'the chosen method of interaction between public health and policy stakeholders for the purpose of representation, co-operation, conflict resolution, improving health systems and securing the right to health for vulnerable populations'; Fidler (2013); 'countries, intergovernmental organisations and non-state actors consult on responses to health problems through policy shaping processes or use notions or operations of health in policy shaping and negotiation strategies to achieve their political, economic and social goals.'; Michaud and Kates (2013); 'refers to international diplomatic activities that address issues of global health importance and are concerned with how and why these issues are linked to foreign policy'; Ruckert et al. (2016); 'an emerging concept to describe the practices of states and non-state actors seeking to coordinate efforts to improve global health'; Birn et al. (2017) as 'the interplay between health and foreign policy concerns (such as "health security"), involving both multilateral and bilateral decision-making on health and negotiations and co-operation between state and non-state actors'(2017).

The historical foundations of global health date back to a series of international health conferences held in Paris in 1851 to prevent the spread of infectious diseases such as plague, cholera, and yellow fever. The first humanitarian health organisation, the International Committee of the Red Cross (ICRC), was established in 1863 and international health conventions began to be adopted in 1892 (Maglen, 2003; Ata, 2021).

Health diplomacy plays a central role at the regional and national level as well as at the global level. As globalisation processes expand, it becomes imperative for countries to manage a two-way process. As the interdependence of countries and the number of international agreements increase, the impact on national policy making also increases. All these national health policies have an important global dimension. Global health diplomacy focuses on common health problems that require the cooperation of many countries (Kickbusch et al., 2007; WHO, 2022a).

Global Health Diplomacy Activities

- International bilateral and multilateral official negotiations
  - Traditional negotiations on formal bilateral health assistance between donor and recipient countries at the World Health Assembly
  - Agreements around the World Health Organisation's Framework Convention on Tobacco Control
  - Partnership Framework agreements between the United States and partner countries on HIV/AIDS and the Emergency Plan for AIDS Relief
- Multi-stakeholder diplomacy involving non-state actors and countries
  - Global Fund to Fight AIDS, Tuberculosis, Malaria and the GAVI alliance (Global Alliance for Vaccines and Immunisation)
  - 2012 London Family Planning Summit
- Interactions between health actors operating in one country and another
  - US Agency for International Development staff advocating for the inclusion of family planning services in the national health insurance programme in Ghana
  - A call by the US Ambassador for Malawi to provide more funding in its national budget for child survival programmes (Michaud and Kates, 2013).

The cross-border economic and security implications of developments in areas such as human health and the environment have made it clear that these problems can no longer be solved at the national level. In this context, new types of international agreements, instruments and organisations such as the Global Fund to Fight AIDS, Tuberculosis and Malaria (2002), International Health Regulations (2005), Paris Agreement on Climate Change (2015), COVAX Facility for the equitable distribution of COVID-19 vaccines (2020) (Kickbusch et al., 2021).

Global health diplomacy is a political activity that strengthens relations between states while meeting mutual objectives to improve health (Brown, 2016). Global health diplomacy is a critical tool in foreign relations. The use of global health by countries and non-state actors to achieve hidden foreign policy objectives is part of health diplomacy (Feldbaum & Michaud, 2010; Jones, 2010).

The goal of global health diplomacy is to achieve scientifically credible and politically achievable agreements. Successful global health diplomacy is based on political and diplomatic experience and practice, which must be combined

with public health knowledge and evidence (Kickbusch et al., 2021).

The increase in transportation and the development of communication technologies, which is one of the results of globalisation, have led to the similarity of people's lifestyles, consumption habits and health problems. With globalisation, health problems also cross borders. It is imperative for countries to work together and communicate in order to prevent and control the spread of diseases. Initially, International Health Conferences were organised to prevent disruption of trade. In later years, the World Health Organization (WHO), a global health organisation, was established for this purpose (Kahraman, 2019).

Over the last two decades, many situations have contributed to the advancement of global health diplomacy, including increased global funding to fight HIV/AIDS, the threat of emerging infectious diseases, and the need for pandemic preparedness (Brown et al., 2014). The COVID-19 pandemic has demonstrated the vital importance of global solidarity against common public health threats, and WHO has played a central role in supporting countries to respond in a coordinated manner and bringing together many actors to jointly address the global impact of the pandemic (Kickbusch et al., 2021).

In 2011, Katz et al. categorised health diplomacy into three categories: 'core', 'multi-stakeholder' and 'informal'. Each category of global health diplomacy practice involves different tools and actors:

- Basic health diplomacy utilises bilateral and multilateral agreements between government and state actors,
- Multi-stakeholder diplomacy uses partnerships between government agencies and multilateral organisations,
- Informal health diplomacy uses agreements with donor, academic and humanitarian organisations (Brown et al., 2014).

A health attaché is defined as a diplomat who collects, analyses and acts on health-related information about foreign countries, ensuring important and sensitive relationships between public health and foreign policy stakeholders. The health attaché, appointed by a country's ministry of health or foreign affairs according to the procedures set out in the Vienna Convention on Diplomatic Relations in 1961, presents the diplomatic title and the duty to represent the interests of his or her government on behalf of his or her government. Therefore, a health attaché should be able to practise global health diplomacy

and conduct relevant policy negotiations on behalf of his or her government. Negotiations may cover relevant sectors such as trade, security and human rights. The core competencies of a health attaché should therefore include in-depth technical knowledge of public health issues, as well as broad-based general knowledge, sound judgement and strong interpersonal communication skills. A core practitioner of global health diplomacy should have technical skills in understanding global health risks as well as skills in traditional diplomatic areas such as political, economic, commercial, public relations and military diplomacy. Global health policy implementation requires balancing these elements across multiple stakeholders to mutually address foreign policy and global health objectives (Brown et al., 2014).

Diplomats need to interact with other diplomats as well as with scientists, media, the private sector, civil society organisations and activists. These actors are part of the negotiation process (Kickbusch et al., 2007). Health threats with a high degree of national security impact, such as pathogenic avian influenza, the spread of the Ebola virus, the ongoing scourge of HIV/AIDS, and challenges to the security of the global drug supply are urgent international public health challenges. There is a growing need for diplomats with an understanding of health issues who can effectively negotiate these issues in the international foreign policy arena (Brown et al., 2014).

While much of the focus of global health diplomacy is on carefully planned engagements between actors with common interests and goals, some global health diplomacy activities are undertaken to address unexpected problems that arise. For example, when many politicians and community groups in northern Nigeria stopped supporting polio vaccination in 2003, the US State Department, the CDC, the UN, the WHO, the Organisation of Islamic Cooperation, the UN, the WHO and the Organisation of Islamic Cooperation joined together in an international diplomacy effort to restart vaccination. As can be seen, non-state actors (private companies, foundations and charities, NGOs and civil society groups) can play an important role in global health diplomacy (Michaud & Kates, 2013).

Communication

Health Diplomacy is a method of interaction chosen for securing the right to health in vulnerable societies, improving health systems, cooperation between stakeholders dealing with public health and politics, and resolving disputes. It is the interface between international health and political relations and brings together various disciplines such as public health, international relations, management, law, economics, trade policy (Radha, 2021). One of the cornerstones of health diplomacy is communication. Effective communication is vital in ensuring coordination and co-operation between countries on health issues (Chattu, 2022; Javed & Chattu, 2020). Since infectious diseases can spread across continents, epidemics have been fought throughout history. For centuries, countries have taken actions to stop diseases at the border through quarantine measures and have recognised the central importance of health security for national security. These experiences have led to the emergence of new forms of communication and governance alongside scientific developments in the field of health (Kahraman, 2019). For example, during the COVID-19 pandemic, communication has become critical in the distribution of vaccines and sharing of health information between countries.

Under the umbrella of WHO, agreements on global health problems are made with the participation of countries, non-governmental organisations, international organisations and multinational companies. In these negotiations, communication activities such as advocacy are carried out by NGOs and international organisations (Kahraman, 2019). At this point, effective communication in health diplomacy can be a common catalyst for many initiatives by helping to overcome barriers. Thus, it contributes to the development of more inclusive and sustainable solutions to the needs of different societies, coordinating and cooperating countries (WHO, 2022b).

The importance of communication in health diplomacy has been understood once again with the COVID-19 pandemic. The similar measures taken by countries against the pandemic are important in terms of following the same course and reducing the spread of the epidemic. In our country, very important studies have been carried out to ensure international communication and coordination. These studies can be summarised as video conferences, books, websites, infographic studies, panels, short films and video content (Özcan

& Tokdemir, 2022). The biggest communication problem at the beginning of the pandemic was the announcement of the absence of human-to-human transmission, which caused a delay in the implementation of protective public health measures and taking the situation seriously. Without guidance from the United Nations, countries took quarantine and social distancing measures on their own, and these protective measures varied between countries. Therefore, it has been very difficult to obtain reliable sources of information. This caused a global mistrust and protest (Karacic et al., 2021).

During the pandemic, Turkey carried out intensive telephone diplomacy to establish global cooperation with the Presidency and participated in three critical international summits via video conferencing on 17-26 March 2020 and 10 April 2020. Within the scope of combating the COVID-19 pandemic, the telephone and video conference calls made at the international level during this process were shared with the public on the website and social media accounts of the Directorate of Communication. In this way, it is aimed to convey accurate and reliable information to the widest audience through all digital platforms as soon as possible. With the active, effective, accurate and functional use of digital platforms, a healthy communication could be ensured during crisis periods such as the national and international COVID-19 pandemic (Öksüz & Görpe, 2021).

Digital platforms enable the rapid spread of current health information, allowing governments and international health organizations to communicate directly with the public. Real-time information sharing about global health crises, pandemics, or key health issues helps raise public awareness. The use of digital technologies, especially during the pandemic, has accelerated communication in health diplomacy and expanded accessibility (Chattu, 2022). Governments, international organizations, civil society groups, and healthcare professionals establish a global communication network that accelerates health diplomacy processes. Furthermore, discussions about global health issues can be initiated, and solutions can be shared. Effective use of social media presents health diplomacy actors with great opportunities for information exchange, collaboration, and direct communication with the public, contributing to the achievement of shared global health goals.

Transparent and effective communication on digital platforms is essential for gaining public trust and increasing support for health diplomacy initiatives. It plays a crucial role in correcting misconceptions about health policies and ensuring the public receives accurate information. During health crises, clear communication helps prevent the spread of misinformation and promotes informed decision-making. By leveraging digital technologies, health diplomacy actors can foster engagement, clarify health measures, and strengthen the credibility of their actions, which is vital for public cooperation. This approach not only supports the implementation of health policies but also contributes to achieving global health objectives.

During the 2014 Ebola outbreak in West African countries (Liberia, Sierra Leone, and Guinea), local leaders played a crucial role in educating the public about the transmission of the disease and preventive measures. To combat the spread, changes were made to funeral practices, which are central to many local traditions. Health officials suggested alternative traditional practices to ensure safety, which helped build trust within the community. Effective communication during health crises, as demonstrated in the Ebola response, is critical for managing the crisis and minimizing its impact. Timely delivery of accurate information is a strategic step to gain public trust and ensure coordination between all parties involved (Delamou et al., 2017; WHO, 2024).

Additionally, countries such as China, Cuba, and South Korea actively supported the effort by sending medical supplies and healthcare personnel to the affected areas, highlighting the importance of international cooperation during global health emergencies.

During health crises like pandemics, countries can support each other through health diplomacy. During the COVID-19 pandemic, Turkey strengthened its relationships with African and Middle Eastern countries by sending medical supplies and equipment. Similarly, China built trust by communicating in culturally sensitive ways while sending medical aid and vaccines to various countries. India's "Vaccine Maitri" initiative played a key role in vaccine distribution to developing countries, strengthening its position both nationally and internationally in vaccine supply. These examples highlight the strategic role of communication in health diplomacy, especially during global health crises. They demonstrate how health diplomacy not only provides humanitarian

assistance but also strengthens international relations and political strategies. Health diplomacy plays a crucial role in fostering collaboration and trust between countries, which is vital for effective crisis management and long-term international cooperation (Altılı, 2021).

South Africa has played a significant role in regional and global health diplomacy, particularly in tackling health issues prevalent in Sub-Saharan Africa. For example, the country has led regional meetings to address HIV/AIDS, sexually transmitted diseases, and viral hepatitis, ensuring that the experiences and perspectives of these nations are incorporated into global health strategies. South Africa has also been instrumental in reducing the cost of HIV/AIDS and tuberculosis medications by advocating for affordable treatment, making them more accessible. In terms of malaria control, South Africa spearheaded the MOSASWA (Mozambique, South Africa, and Swaziland) Cross-Border Malaria Initiative. This initiative facilitated regional coordination in the fight against malaria, aiming for elimination in the participating countries. Through these efforts, South Africa has demonstrated strong regional health leadership, contributing significantly to global health diplomacy (Mufamadi, 2018).

In health diplomacy, communication is not just about exchanging information, but also about building trust, fostering cross-cultural understanding, and enabling swift and effective responses during health crises. Strong communication skills are essential for health diplomats as they navigate complex global health issues, persuade various stakeholders, and promote cooperation in international health initiatives. This type of communication helps clarify health challenges, facilitates collaboration, and ensures timely and appropriate interventions during emergencies. Effective communication, therefore, is key to the success of health diplomacy, as it strengthens both global relationships and health systems in response to crises (Chattu, 2022).

CONCLUSION AND RECOMMENDATIONS

The principle that "no country is safe until everyone is safe" underscores the interconnected nature of global health and the importance of global solidarity. Health diplomacy, driven by communication and negotiation processes, plays a central role in strengthening this solidarity. To tackle global challenges effectively, a more holistic, inclusive, comprehensive, and coordinated strategy is

needed, particularly since developing and underdeveloped countries are often the most affected by diseases. These countries must leverage health diplomacy in foreign policy to amplify their voices in global discussions and ensure their health needs are addressed on the international stage. By doing so, they can better advocate for solutions and policies that prioritize their health systems and access to resources.

Ensuring safe and prosperous populations is beneficial for every country in the long term, and diplomatic communication plays a crucial role in achieving these goals. For international agreements related to health and foreign policy to be effective, there needs to be greater participation from both foreign policy practitioners and global health advocates. Global health experts should make additional efforts to communicate by clearly explaining the connection between their activities and foreign policy. If global health specialists and foreign policy practitioners work in a more coordinated and mutual understanding, they can help create conditions where all parties benefit from an enhanced profile in global health diplomacy. This kind of collaboration is essential for tackling complex health challenges that require collective action across borders.

In the evolving landscape of global health diplomacy, the integration of social media platforms and digital communication tools has created dynamic, real-time networks that enable quicker and more effective interaction among state and non-state actors. Traditional, bilateral, or multilateral interactions can benefit from the immediacy and wide reach of these platforms. Social media, in particular, facilitates broader discussions on global health issues, encouraging public participation and engagement, making it a powerful tool for advancing health diplomacy. However, the rapid spread of both correct and incorrect information on these platforms presents significant challenges, especially in health diplomacy. Misinformation can undermine public trust in health authorities and decrease adherence to health guidelines. The spread of false information is particularly harmful to vulnerable populations, whose ability to discern credible health information may be limited. This issue highlights the need for robust communication strategies that emphasize the importance of accurate and reliable information in health diplomacy. To overcome these challenges, it is crucial to increase health literacy, promote the responsible use of digital technologies, and implement effective regulatory mecha-

nisms for digital platforms. Additionally, combating misinformation requires community engagement and targeted health campaigns that correct false narratives. Successful health diplomacy hinges on effective communication, which is rooted in the timely and transparent sharing of information, underscoring the importance of collaboration between policymakers, health professionals, and communication experts. Through these combined efforts, the potential of social media in health diplomacy can be harnessed, while mitigating its risks.

Strong collaboration between international organizations and governments can enhance the impact of health interventions by creating a common language for communication. Effective diplomacy can foster this collaboration and enable a coordinated approach to health crises. In this context, establishing binding contracts and agreements is crucial, particularly to prevent the spread of infectious diseases. These agreements can ensure a unified response and strengthen global health security.

Effective and accurate data sharing between countries is crucial for quick responses to global health issues. Encouraging the exchange of health data and research between nations will help develop more effective health policies. Establishing a common health communication network and early warning systems can facilitate the rapid sharing of health data and ensure better coordination in exceptional situations. This approach enhances global health monitoring, enables prompt action, and fosters international collaboration during health emergencies.

In health emergencies such as pandemics or natural disasters, transparent communication plays a critical role in ensuring effective management. Governments and health organizations must prioritize the sharing of accurate, timely information to prevent misinformation, which can undermine public cooperation. Clear communication builds trust, facilitates informed decision-making, and enables communities to take the necessary preventive actions. By avoiding the spread of false information and ensuring that the public receives reliable updates, health crises can be better managed, and the impact on society can be minimized.

In health communication, it is essential to design programs that respect cultural norms, local traditions, and languages to avoid misunderstandings and resistance. By tailoring strategies to fit the cultural context, health initiatives

can be more effective in reaching and educating the population. For example, vaccination campaigns or HIV prevention projects should align with local values and beliefs. Collaborating with community leaders is crucial in building trust and encouraging behavioral changes, ensuring that the target population feels both understood and supported in adopting health recommendations. This approach increases the likelihood of success and improves the long-term impact of public health interventions.

In health diplomacy, it is crucial to consider social determinants such as ethnicity, race, gender, and economic inequality in communication efforts. These factors can significantly impact access to healthcare and the effectiveness of health policies. Especially in low-income and vulnerable communities, developing inclusive health policies is essential to ensure equal access to healthcare services for everyone. By addressing these disparities and creating targeted interventions, health diplomacy can be more effective in improving health outcomes and fostering equity across diverse populations. Moreover, ensuring that health policies are culturally sensitive and accessible to marginalized groups is key to promoting broad public engagement and trust in health initiatives.

Governments can enhance the effectiveness of health programs in low-income regions by collaborating with private sector partners, including pharmaceutical companies, technology firms, and non-governmental organizations. These partnerships can help provide the necessary resources and expertise to expand the reach and impact of health initiatives. By leveraging the capabilities of the private sector, such as innovation in health technology and distribution networks, the scope of health programs can be broadened, making healthcare services more accessible and efficient. These collaborations can also help address challenges related to infrastructure, affordability, and the sustainability of health interventions, ultimately improving the health outcomes of underserved populations.

It is crucial for diplomats to enhance their knowledge and skills in health-related matters. This enables them to engage in more effective negotiations on national health policies and advocate for equitable health policies. For this reason, diplomats should receive training in public health areas such as health rights, health management, and health economics. Such education would

not only improve their ability to negotiate and influence international health agreements but also help promote universal access to healthcare and sustainable health solutions. This training would foster a deeper understanding of the links between health and development, making it easier for diplomats to contribute to global health diplomacy, especially in negotiations regarding health interventions, funding, and policy implementation.

In conclusion, communication plays a critical role in the effective implementation of global health policies and solving health challenges. Effective communication strategies are essential for fostering international collaboration and achieving public health goals. By enhancing communication, countries and health organizations can share vital health information, coordinate responses during crises, and advocate for equitable health policies that benefit all populations. Additionally, fostering partnerships between governments, international organizations, and private sectors can further strengthen these efforts. Building these communication networks ensures that solutions are not only efficient but also inclusive and accessible on a global scale.

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