Multivariate Analysis of Emergency Department Related Deaths in Europe and Türkiye

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ABSTRACT

Objective: In this research, it was aimed to evaluate Multivariate analysis of emergency department related deaths in the Europe (the EU) and Türkiye.

Methods: Data set was collected from the World Bank Country Reports for the EU and Türkiye from 2002 to 2021. Accident, suicide and disease related mortality rates were used as dependent variables. Independent variables were heath expenditure, rural population and population growth.

Results: Disease mortality, rural population and population growth were significantly higher in Türkiye, whereas suicide mortality and health expenditure were significantly higher in the EU (p<0.05). Location had significant correlation with suicide mortality (r=0.868; p<0.01), disease mortality (r=-0.728; p<0.01), health expenditure (r=0.866; p<0.01) and population growth (r=-0.866; p<0.01). In year-controlled correlation, location had significant correlation with suicide mortality (r=0.997; p<0.01), disease mortality (r=-0.976; p<0.01), health expenditure (r=0.957; p<0.01), rural population (r=-0.745; p<0.01) and population growth (r=-0.939; p<0.01). For Türkiye, accident mortality was significantly and positively correlated with population growth (r=0.572; p<0.01). Suicide mortality was significantly and negatively correlated with health expenditure (r=-0.710; p<0.01), and positively correlated with rural population (r=0.836; p<0.01). Disease mortality was significantly and negatively correlated with health expenditure (r=-0.486; p<0.01), and positively correlated with rural population (r=0.980; p<0.01). For the EU, accident mortality was significantly and negatively correlated with health expenditure (r=-0.798; p<0.01), and positively correlated with rural population (r=0.998; p<0.01). Suicide mortality was significantly and negatively correlated with health expenditure (r=-0.683; p<0.01), and positively correlated with rural population (r=0.889; p<0.01). Disease mortality was significantly and negatively correlated with health expenditure (r=-0.821; p<0.01), and positively correlated with rural population (r=0.998; p<0.01).

Conclusion: Mutual information exchange and health system model analyzes may be useful to prevent deaths due to disease in Türkiye and deaths due to suicide in the EU countries.

INTRODUCTION

Although health events requiring acute intervention are at the forefront in emergency departments, patients are directed to relevant units after the first intervention, and as a result, follow-up after the first intervention cannot be performed adequately.[1] Therefore, it is possible to state that there are some difficulties in evaluating the quality of emergency department services based on patient outcomes.[2] In general, birth and death statistics in health services are accepted as an indicator of the health system and social welfare level, and when associated with emergency services, it can be said that the statistical evaluation of

death rates is more appropriate compared to birth rates.[3] The main reason for this is that the services provided in emergency departments are mostly related to postpartum processes and acute situations.[4-6] Therefore, it is possible to evaluate mortality rates as an indicator of emergency services.[7-9] Among the mortality rates, the most relevant ones can be classified as accident, suicide, and disease statistics, which are also related to the content of emergency services.

Health is one of the important public services in Türkiye's EU harmonization process.[10-11] The European Union, as an indicator of social welfare and peace, shows the social structure in which individuals aim to receive a higher

quality and more egalitarian service.[12,13] In health services, compared to elective health services, compulsory health processes are among the health processes that individuals must receive and are a constitutional right. Among these, the health services provided in emergency departments are one of the most prominent health service areas, both financially, as they are financed from public resources, and because they involve urgent, acute health problems with high mortality rates.[14] In this regard, in terms of both Türkiye's compliance with the EU harmonization process and the performance of emergency services, the study included a multivariate analysis of the factors affecting deaths caused by emergency services through mortality rates.

Although studies have been conducted on the quality and cost of the service provided in emergency services, how many people it reaches, and what benefits it provides, today there is no consensus on a generally accepted performance measurement method and indicators for emergency services. For this reason, this research aimed to compare and reveal the mortality rates in emergency services in Türkiye and the EU in a multidimensional manner.

MATERIALS AND METHODS

Research Design

The research is a longitudinal study designed in a descriptive survey model. In this model, the relationship between variables over time is described in detail with the help of quantitative data, without intervention by the researcher. In this context, the study provided a multivariate description of the relationship between mortality levels associated with emergency services and basic indicators.

Data Set

The data set was collected from the World Bank Country Reports for the EU and Türkiye from 2002 to 2021. Accident, suicide, and disease-related mortality rates were used as dependent variables. Independent variables were health expenditure, rural population, and population growth. Details of variables were as follows:

Dependent variables

- Accident Mortality: Mortality caused by road traffic inju-

ry (per 100,000 population)

- Suicide Mortality: Suicide mortality rate (per 100,000 population)

- Disease mortality: Mortality from CVD, cancer, diabetes, or CRD between exact ages 30 and 70 (%)

Independent variables

- Health expenditure: Current health expenditure per capita (current US$)

- Rural population: Rural population (% of total population)

- Population growth: Population growth (annual %)

Statistical Methods

Scale variable descriptions were given by means and standard deviations. Kolmogorov-Smirnov test was used for normality of variables. Mann-Whitney U test was used for non-normally distributed variable differences, and independent samples t-test was used for normally distributed parameters. Because of linearization deviations,[15-17] Spearman's rho and year-controlled partial correlation analysis were used for relationship analysis. SPSS 25.0 for Windows was used for analysis at 95% Confidence Interval with 0.05 significance level.

Ethical Considerations

Because of the nature of the research, no ethical approval or informed consent was applicable. The data set used in the research is public data and may be reached on the official website of the World Bank Country Reports.

RESULTS

The same data or information given in a Table must not be repeated in a Figure and vice versa. It is not acceptable to repeat extensively the numbers from Tables in the text or to give lengthy explanations of Tables or Figures.

Tables and Figures

The difference between accident mortality per 100,000 population of the EU and Türkiye was similar, and the difference was insignificant (p>0.05). Suicide mortality per

Table 1. Mortality and related factors of Türkiye and the EU and difference analysis results

	Location		
	Türkiye	**Europe**	**p**
Accident mortality per 100.000 population	8.1±1.6	8.6±2.8	0.968[a]
Suicide mortality per 100.000 population	2.64±0.50	13.30±1.00	0.000[a]
Disease mortality, %	17.67±1.56	14.53±1.56	0.000[b]
Health Expenditure, current US$	413.25±132.30	2870.28±715.90	0.000[a]
Rural population, % of total population	29.06±3.69	26.98±1.33	0.017[b]
Population growth, annual %	1.34±0.33	0.19±0.14	0.000[a]

[a]Mann Whitney U Test. [b]Independent Samples t-test. SD: Standard Deviation.

Table 2. Spearman's rho correlation analysis for correlation between location and mortality with related factors

	r	p
Accident mortality per 100.000 population	-0.009	0.958
Suicide mortality per 100.000 population	0.868**	0.000
Disease mortality, %	-0.728**	0.000
Health Expenditure, current US$	0.866**	0.000
Rural population, % of total population	-0.276	0.070
Population growth, annual %	-0.866**	0.000

**p<0.01

Table 3. Year controlled partial correlation analysis for correlation between location and mortality with related factors

	r	p
Accident mortality per 100.000 population	0.125	0.450
Suicide mortality per 100.000 population	0.997**	0.000
Disease mortality, %	-0.976**	0.000
Health Expenditure, current US$	0.957**	0.000
Rural population, % of total population	-0.745**	0.000
Population growth, annual %	-0.939**	0.000

**p<0.01

Table 4. Spearman's rho correlation between mortality and related factors for Türkiye and the Europe

	Türkiye			Europe		
	Accident mortality	Suicide mortality	Disease mortality	Accident mortality	Suicide mortality	Disease mortality
Health Expenditure, current US$	0.277	-0.710**	-0.486**	-0.798**	-0.683**	-0.821**
Rural population, % of total population	-0.376	0.836**	0.980**	0.998**	0.889**	0.998**
Population growth, annual %	0.572**	-0.101	0.131	0.311	0.146	0.304

**p<0.01

100,000 population in the EU (13.30±1.00) was higher than in Türkiye (2.64±0.50), and the difference was statistically significant (p<0.05). Disease mortality percent in Türkiye (17.67±1.56) was higher than in the EU (14.53±1.56), and the difference was statistically significant (p<0.05). Health expenditure of the EU (2870.28±715.90) was higher than of Türkiye (413.25±132.30) with statistically significant difference (p<0.05). Rural population percentage and annual population growth in Türkiye were also significantly higher than in the EU (p<0.05) (Table 1).

Spearman's rho correlation analysis results for correlation between location and mortality with related factors showed that location had significant correlation with suicide mortality (r=0.868; p<0.01), disease mortality (r=-0.728; p<0.01), health expenditure (r=0.866; p<0.01), and population growth (r=-0.866; p<0.01) (Table 2).

Year-controlled partial correlation analysis results for correlation between location and mortality with related factors showed that location had significant correlation with

suicide mortality (r=0.997; p<0.01), disease mortality (r=-0.976; p<0.01), health expenditure (r=0.957; p<0.01), rural population (r=-0.745; p<0.01), and population growth (r=-0.939; p<0.01) (Table 3).

For Türkiye, accident mortality was significantly and positively correlated with population growth (r=0.572; p<0.01). Suicide mortality was significantly and negatively correlated with health expenditure (r=-0.710; p<0.01), and positively correlated with rural population (r=0.836; p<0.01). Disease mortality was significantly and negatively correlated with health expenditure (r=-0.486; p<0.01), and positively correlated with rural population (r=0.980; p<0.01) (Table 4).

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(r=0.889; p<0.01). Disease mortality was significantly and negatively correlated with health expenditure (r=-0.821; p<0.01), and positively correlated with rural population (r=0.998; p<0.01) (Table 4).

DISCUSSION

This study aimed to multidimensionally examine and compare emergency department-related deaths and basic health and population-related variables in Türkiye and the EU countries. In this context, the research analyzed deaths due to accidents, suicides, and diseases, and the effects of health expenditures, urbanization, and population growth rates on these deaths, including the time effect.

The main events that are subject to emergency services are accidents, injuries, suicides, febrile seizures of diseases, intense pain, or similar acute health problems. The most basic feature of these diseases and health conditions is that they have life-threatening mortality and morbidity.[18] For this reason, although not all of them end in death in emergency departments, it is possible to state that there are more health situations with a high risk of death, followed by events with a high risk of organ loss. Although emergency services are used for other purposes than for individuals to get priority in a busy healthcare system, basically, emergency services are units that provide services for health problems with high mortality and morbidity rates.[19-20] Therefore, it is possible to argue that the services provided in emergency departments are related to mortality rates. These mortality rates include deaths due to accidents, suicide, and disease.

The World Bank (WB) and the World Health Organization (WHO) take mortality and birth rates as basic indicators when making an evaluation about a disease or health problem or determining the welfare levels of societies. Among these, birth rates mostly concern the relevant clinics of family health centers and hospitals, while mortality is related to health conditions that are subject to emergency services. Both WB and WHO keep and share mortality rates regularly and share these data anonymously. In this regard, it is possible to state that mortality rates are among the most important and reliable health indicators internationally.[22-24] The comparison made in this regard between Türkiye and the EU, which is shown as a welfare project and which Türkiye has wanted to join for a long time, reveals the mortality rates and relevant population variables subject to emergency services.

Although health is seen as a social right, health services, especially elective ones and some compulsory health services, are seriously dependent on the economy. Therefore, the cost of health is measured as both public and private expenditures, and it is accepted that there is a significant relationship between health and the economy. In the comparison between Türkiye and the EU, health expenditures have differed significantly since 2002, and the average general health expenditure for the EU is much higher than Türkiye's health expenditures. This may be due to the higher cost of health services in EU countries or the provision of more services. However, evaluating per capita health expenditures in USD indicates that more intensive and high-cost health services are provided.

Population density and age structure of the population are also important variables in health services, and it can be stated that the health expenditures and needs of the elderly population are higher than the young population. The age structure of the population in EU countries is higher than in Türkiye, and the population growth rate in Türkiye is significantly higher than in EU countries. This situation also affects health expenditures and may be one of the reasons why health expenditures are higher in EU countries.

Mortality rates are not only related to the quality of health services, but also to the age, urbanization, and economic structure of the population. Therefore, when evaluating mortality rates, it is necessary to take into account not only the quality of health services, but also the annual growth rate, which is an indicator of health expenditures and the urbanization structure of the population and age. In the comparison between Türkiye and the EU, although deaths due to accidents do not show a statistically significant difference, deaths due to disease are statistically significantly higher in Türkiye and deaths due to suicide in EU countries. Correlation analysis results showed that deaths due to suicide and disease were related to location between Türkiye and the EU. Therefore, while living in EU countries increases suicide rates, living in Türkiye increases deaths due to disease. A similar situation exists in time-dependent partial correlation analyses, and deaths due to suicide are significantly higher in EU countries than in Türkiye.

Limitations of the Study

The most important limitation of the study is that there is not enough data to determine how many of the deaths caused by the emergency department are related to the emergency department and how many are related to other services. Therefore, instead of directly comparing deaths in emergency departments, mortality rates for the types of deaths most common in emergency departments were compared. This situation is valid not only for Türkiye or the World Bank, where research data are obtained, but also for the World Health Organization and the whole world. Therefore, more advanced data collection and evaluation systems are needed in emergency departments.

Another important limitation of the research is the possibility that social and cultural differences between Türkiye and the EU may affect the research results. Many variables such as family structure, economic structure, and social structure may be important, especially in deaths caused by suicide. Therefore, further studies are needed on this subject, especially in the EU countries. Although deaths due to disease are very high in Türkiye, the solution is a little clearer compared to the EU countries; it is possible to solve this situation with higher health services.

Contribution of the Research to the Literature

The most important contribution of the research to the literature is that it covers the mortality rates in a broad scope by comparing the mortality rates regarding the diseases and health conditions subject to the emergency department between the EU and Türkiye. In this way, the impact of health expenditures and population and urbanization on health services was revealed both in the EU and in Türkiye. In this respect, the research can serve as a source in the literature.

Another importance of the research comes from its findings. In the light of real data obtained directly from the field in the research, deaths due to suicide are more common in EU countries compared to Türkiye, by a very high difference. This situation reveals Türkiye's potential to be an important role model in correcting this situation in EU countries. In this respect, the research contributes to both field practice and literature.

Conclusion

According to the research results, health expenditures and urbanization have an impact on deaths due to disease and suicide in the EU and Türkiye. While health expenditures and urbanization significantly affect accident-related deaths in EU countries, no significant effect was detected in Türkiye. As a result, mutual information exchange and health system model analyses may be useful to prevent deaths due to disease in Türkiye and deaths due to suicide in the EU countries.

Ethics Committee Approval

Since data used in the study are anonymous and may be reached by public, neither ethical approval nor institute permission is not applicable.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: E.B.; Design: E.B.; Supervision: E.B.; Fundings: E.B.; Materials: E.B.; Data: E.B., K.Y.; Analysis: E.B., K.Y.; Literature search: E.B.; Writing: E.B.; Critical revision: E.B.

Conflict of Interest

None declared.

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Avrupa ve Türkiye'de Acil Servise Bağlı Ölümlerin Çok Değişkenli Analizi

Amaç: Bu araştırmada Avrupa (AB) ve Türkiye'de acil servise bağlı ölümlerin çok değişkenli analizinin değerlendirilmesi amaçlandı.

Gereç ve Yöntem: Veri seti olarak, 2002-2021 yılları arasında AB ve Türkiye için Dünya Bankası Ülke Raporlarından derlenmdi. Bağımlı değişken olarak kaza, intihar ve hastalığa bağlı ölüm oranları kullanıldı. Bağımsız değişkenler sağlık harcamaları, kırsal nüfus ve nüfus artışı seçildi.

Bulgular: Hastalık mortalitesi, kırsal nüfus ve nüfus artışı Türkiye'de anlamlı derecede yüksekken, intihar mortalitesi ve sağlık harcamaları AB'de anlamlı derecede yüksekti (p<0.05). Lokasyonun intihar mortalitesi (r=0.868; p<0.01), hastalık mortalitesi (r=-0.728; p<0.01), sağlık harcamaları (r=0.866; p<0.01) ve nüfus artışı (r=-0.866; p<0.01) ile ilişkisi istatistiksel olarak anlamlıydı. Yıl kontrollü korelasyon analizi sonuçlarına göre lokasyon ile intihar mortalitesi (r=0.997; p<0.01), hastalık mortalitesi (r=-0.976; p<0.01), sağlık harcamaları (r=0.957; p<0.01), kırsal nüfus (r=-0.745; p<0.01) ve nüfus artışı (r=-0.939; p<0.01) ile anlamlı ilişkisi vardı. Türkiye için kaza ölümleri ile nüfus artışı arasında anlamlı ve pozitif bir korelasyon vardı (r=0.572; p<0.01). İntihar mortalitesi ile sağlık harcamaları arasında anlamlı ve negatif bir korelasyon (r=-0.710; p<0.01), kırsal nüfusla ise pozitif bir korelasyon vardı (r=0.836; p<0.01). Hastalık mortalitesi ile sağlık harcamaları arasında anlamlı ve negatif bir korelasyon (r=-0,486; p<0,01), kırsal nüfusla ise pozitif bir korelasyon vardı (r=0.980; p<0.01). AB için kaza ölümleri sağlık harcamaları ile anlamlı ve negatif bir korelasyona sahipken (r=-0.798; p<0.01), kırsal nüfus ile pozitif bir korelasyona sahipti (r=0.998; p<0.01). İntihar mortalitesi ile sağlık harcamaları arasında anlamlı ve negatif bir korelasyon (r=-0.683; p<0.01), kırsal nüfusla ise pozitif bir korelasyon vardı (r=0.889; p<0.01). Hastalık mortalitesi ile sağlık harcamaları arasında anlamlı ve negatif bir korelasyon (r=-0.821; p<0.01), kırsal nüfusla ise pozitif bir korelasyon vardı (r=0.998; p<0.01).

Sonuç: Karşılıklı bilgi alışverişi ve sağlık sistemi modeli analizleri, Türkiye'de hastalık kaynaklı ölümlerin, AB ülkelerinde ise intihar kaynaklı ölümlerin önlenmesinde faydalı olabilir.

Anahtar Sözcükler: Acil duruma bağlı ölümler; hastalıktan ölümler; intihar; kaza.