Relationship between skin disease mortality as of ICD-10 and health expenditure on purchasing power parity: A multi-country level analyses

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Abstract

Background: Diseases of the skin and subcutaneous tissues still cause mortality in some parts of the world. This research aimed to examine the relationship between diseases of the skin and subcutaneous tissue-related mortality as of ICD-10 and health expenditure on purchasing power parity from the World Bank Database.

Material and Methods: "Domestic private health expenditure per capita, PPP (current international $)" and "Domestic general government health expenditure per capita, PPP (current international $)" were collected from the World Bank Country Data for each country in which skin and subcutaneous tissue-related mortality were reported in the World Health Organization (WHO) ICD-10 Mortality database for 1996 to 2017.

Results: A total of 13 countries were reported for mortality. Male deaths related to skin and subcutaneous tissue in Oman, Sri Lanka, Azerbaijan, Turkmenistan, and Ukraine were higher than female deaths. In Seychelles, Brunei Darussalam, Syrian Arab Republic, Belarus, Kazakhstan, and Russian Federation, female deaths were higher than male deaths. The correlation direction was positive, showing that an increase in country codes in the WHO ICD-10 list causes an increase in deaths.

Conclusion: Deaths resulting even from skin diseases with an extremely low mortality level have been reported. At this point, when gender is discriminated, it is seen that women and men differ significantly in skin diseases. For this reason, studies and field applications must be carried out to raise awareness about skin diseases in the male gender.

Introduction

After evaluating the concept of health as a global public good, the importance of health indicators among countries has increased worldwide [1-6]. Health spending within a country is analyzed under two headings: government and private expenditures. While private expenditure refers to the health spending made by individuals from their own income, government expenditure refers to spending from the public body [7-9]. In fact, while a positive relationship between spending and healthcare outcomes is expected, the condition differs in real practice. Many concepts such as cost prices of health services in the country, access to different services, and macro indicators in the economy affect health expenditures.

Although diseases of the skin and subcutaneous tissue seem less important in public health than other chronic and high mortality diseases, it is an important issue in terms of the cost and quality of life of individuals. Developments in the treatment processes, especially, have provided important gains in the fight against the skin and subcutaneous soft tissue diseases [10-17]. However, despite all these developments, the ICD-10 mortality database prepared by WHO mentions these diseases to be the cause of mortality. The impact of direct health expenditures on these deaths, the effects of government and private expenditure, and purchasing powers is the subject of this research.

Although the relationship between health expenditures and health indicators is subjected to various studies, the literature does not report any studies on deaths caused by skin disease and subcutaneous tissue. Thus, the study aims to examine the relationship between diseases of the skin and subcutaneous tissue-related mortality as of ICD-10 and health expenditure on purchasing power parity from the World Bank Database.

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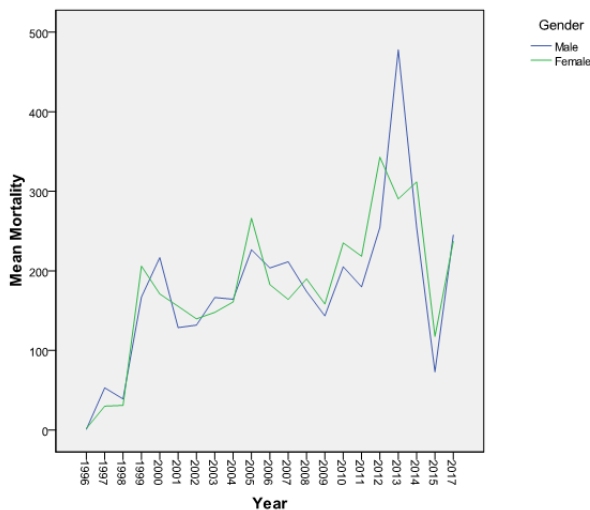Email address: drhamzaaktas21@gmail.com (Hamza Aktas)

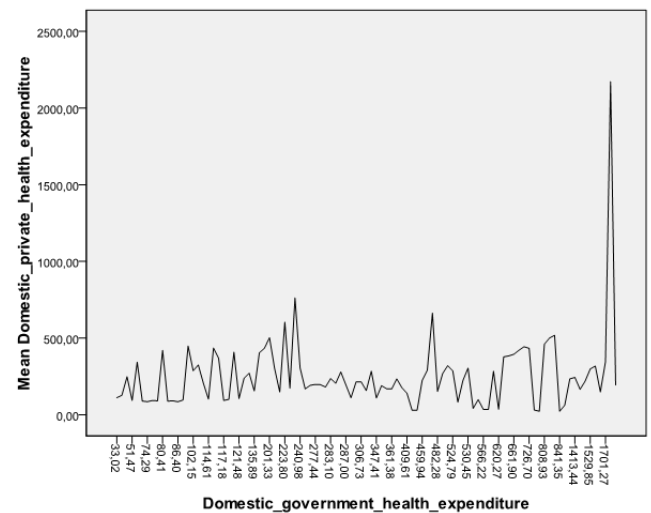**Figure 1.** Mortality rates of all countries according to year and gender

Figure 2. Domestic private and government health expenditure distribution relation

Material and Methods

In this research, the WHO ICD-10 mortality database and the World Bank Country Database were used. In the World Bank Country Database, two parameters, "Domestic private health expenditure per capita, PPP (current international \$)" and "Domestic general government health expenditure per capita, PPP (current international \$)" were collected for each country in which skin and subcutaneous tissue-related mortality were reported in the WHO ICD-10 Mortality database for all these years. In the WHO ICD-10 database, the years between 1996 and 2017 were reported as skin and subcutaneous tissue-related mortality event years. In the database, a total of 13 countries were reported for mortality, as shown in Table 1 with ICD-10 Database codes.

The Wilcoxon Signed Rank Test was used for male and female mortality differences between countries. Spearman's rho correlation analysis was used for correlation between parameters. All analyses were performed using the SPSS 17.0 for windows at 95% confidence interval at 0.05 significance level. This study was a retrospective and statistical study. Therefore, ethics committee approval was not obtained.

Results

Male deaths related to the skin and subcutaneous tissue in Oman, Sri Lanka, Azerbaijan, Turkmenistan, and Ukraine were higher than the female deaths. In Seychelles, Brunei Darussalam, Syrian Arab Republic, Belarus, Kazakhstan, and Russian Federation, female deaths were higher than male deaths. Difference analysis results showed that male-female death differences were statistically significant for Oman, Sri Lanka, Syrian Arab Republic, and Russian Federation ($p < 0.01$) (Table 2).

Mortality rates of male and females had a similar distribution amid time interval. Three main shifts were reported during time period, with peaks in 2000, 2005, and 2013 (Figure 1).

Domestic private health expenditure was higher than government expenditure in Cyprus, the Syrian Arab Republic, Andorra, Azerbaijan, and Turkmenistan. Domestic government health expenditure was higher than private expenditure in Seychelles, Brunei Darussalam, Oman, Sri Lanka, Belarus, Kazakhstan, Russian Federation, and Ukraine. All differences were significant except that for Sri Lanka and Ukraine ($p < 0.05$) (Table 3).

Domestic government and private health expenditure distributions were not correlated, as found in Spearman's rho correlation analysis ($p > 0.05$) (Figure 2).

Correlation analysis results showed that domestic private health expenditure and male deaths had a positive correlation ($r = 0.228$; $p < 0.05$). The country's data correlated in terms of male, female, and total deaths ($p < 0.01$). Correlation direction was obtained to be positive, showing that an increase in the country codes in the WHO ICD-10 list causes an increase in deaths (Table 4).

Discussion

Health expenditure and health purchasing power are among the indicators that determine the development levels of countries in the present time. Considering that the state generally receives taxes and has a larger economic structure, government expenditure in health spending is expected to be greater than spending by individuals [18-21]. However, in Cyprus, Syrian Arab Republic, Andorra, Azerbaijan, and Turkmenistan, where deaths from the skin and subcutaneous tissue diseases were reported, the health expenditures of the state were lower than the expenditures of the citizens. While for Sri Lanka and Ukraine, there was no significant difference between government and private health spending. This indicates that deaths may occur even in diseases with low mortality in cases where the state is generally less effective in all health services than the citizens.

The mortality rates and gender distribution analyzed by countries demonstrate that female deaths are higher than male deaths. The literature reports that studies indicat-

Table 1. Country codes and reported years for skin and subcutaneous diseases in ICD-10 Mortality Database

Country Codes	Country	Reported years
1400	Seychelles	2001, 2002, 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015
3030	Brunei Darussalam	1996, 2001, 2004, 2005, 2006, 2007, 2008, 2009, 2010
3080	Cyprus	1999, 2000
3285	Oman	2009
3365	Sri Lanka	1997, 1998, 1999, 2000, 2001, 2002, 2003
3370	Syrian Arab Republic	1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009
4008	Andorra	2011
4012	Azerbaijan	2001, 2002, 2003, 2004
4018	Belarus	2002, 2003, 2007, 2008, 2009, 2010, 2011, 2013, 2014
4182	Kazakhstan	2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012
4272	Russian Federation	1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014
4302	Turkmenistan	2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015
4303	Ukraine	2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2014, 2015, 2017

Table 2. Diseases of the skin and subcutaneous tissue-related mortality rates according to gender and countries, and difference analysis results for gender (1996-2017)

Country	Male Deaths	Female Deaths	Total deaths	p
Seychelles	1.33±1.07	1.92±1.44	3.25±2.14	0.190a
Brunei Darussalam	0.89±0.78	1.11±1.27	2.00±1.66	0.608a
Cyprus	1.00±1.41	1.00±1.41	2.00±0.01	p > 0.05
Oman	13.00±0.01	6.00±0.01	19.00±0.01	p < 0.05
Sri Lanka	46.71±8.32	27.57±3.41	74.29±6.32	0.018a
Syrian Arab Republic	4.09±2.02	6.91±2.43	11.00±2.90	0.037a
Andorra	1.00±0.01	–	1.00±0.01	N/A
Azerbaijan	5.00±4.08	3.75±2.50	8.75±4.65	0.465a
Belarus	34.67±8.26	35.67±10.11	70.33±16.19	0.779a
Kazakhstan	43.22±9.54	44.00±12.90	87.22±20.77	0.866a
Russian Federation	893.63±65.46	965.00±119.28	1858.63±170.12	0.011a
Turkmenistan	2.76±1.48	2.06±1.92	4.82±2.70	0.148a
Ukraine	254.55±34.81	254.09±24.48	508.64±53.81	0.624a
Total	167.69±312.49	177.17±339.46	344.86±651.05	0.564a

a. Wilcoxon Signed Rank Test, N/A: Not applicable.

Table 3. Domestic private and government health expenditure distribution according to countries and difference analysis results

Country	Domestic private health expenditure (PPP)	Domestic government health expenditure (PPP)	p
Seychelles	43.80±24.30	626.16±152.86	0.002a
Brunei Darussalam	241.56±72.94	1584.63±141.63	0.012a
Cyprus	663.18±0.01	473.42±0.01	p < 0.05
Oman	233.80±0.01	1016.29±0.01	p < 0.05
Sri Lanka	100.21±5.06	117.92±2.85	0.068a
Syrian Arab Republic	90.29±4.04	76.46±11.30	0.007a
Andorra	2172.29±0.01	1838.03±0.01	p < 0.05
Azerbaijan	207.27±109.19	40.62±10.09	p < 0.05
Belarus	260.80±99.23	516.15±122.75	0.008a
Kazakhstan	175.92±26.70	378.63±64.80	0.008a
Russian Federation	330.90±128.22	530.85±232.09	0.001a
Turkmenistan	391.81±152.17	138.06±46.01	0.000a
Ukraine	233.85±53.99	270.14±29.08	0.114a
Total	251.62±245.56	458.44±436.11	0.000a

a. Wilcoxon Signed Rank Test.

Table 4. Spearman's rho correlation analysis for the relationship between mortalities and expenditures

	Male deaths	Female deaths	Total deaths
Domestic private health expenditure (PPP)	0.228*	0.138	0.177
Domestic government health expenditure (PPP)	-0.014	0.043	-0.024
Country	0.528**	0.450**	0.500**
Year	0.073	0.088	0.062

*p < 0.05 **p < 0.01

ing skin diseases and subcutaneous soft tissue diseases are more prevalent in females than males. On the other hand, in these studies, the samples, including either non-mortality diseases or skin cancer, if there is mortality, are predominant [22-27]. As skin cancer has been reported separately according to the WHO ICD-10 database, deaths due to skin and subcutaneous diseases other than cancer have been reported in this study. From this point of view, although the rates are low, it can be stated that the situation is serious according to the cause of mortality.

Correlation analysis results showed that there is a statistically significant relationship between private sector health expenditures and male deaths. However, there was no significant relationship between deaths in women and health expenditures. At this point, research results play a significant role. Since the state's health spending does not have a significant effect on female and male deaths, it can be stated that men spend less on health and their mortality levels are high. Therefore, this indicates that males tend to have less information about skin diseases or tend to spend less on health than women.

According to the research results, deaths can occur even from skin diseases with an extremely low mortality level. At this point, when gender is discriminated, it is seen that women and men differ significantly in skin diseases. For this reason, studies and field applications can be carried out to raise awareness about skin diseases in male gender.

Declarations

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

The author declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version

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