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THE EFFECT OF AIR QUALITY AND SMOKING PREVALENCE ON DIFFERENT CATEGORIES OF HEALTH EXPENDITURES: AN EMPIRICAL EVIDENCE FROM MENA COUNTRIES

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ABSTRACT

This study aims to reveal the size and extent of the impact of income and smoking prevalence on health expenditures for MENA countries and 2010-2016 period, as well as exposure to Particulate Matter (PM2.5), which is one of the most important determinants of air quality. 1% increase in exposure to Particulate Matter (PM2.5) per capita creates an increase of 1.13% in total health expenditure per capita. 1% increase in GDP per capita leads to 1.03% increase in government health expenditure per capita, 0.5% increase in private health expenditure per capita and 0.42% increase in out-of-pocket health expenditure per capita. It was found for the MENA countries that the goverment health care service tends to be in the luxury goods category, but private healthcare service and out-of-pocket health care service are differentiated and included in the necessary goods category. 1% increase in the prevalence of smoking causes a minor increase of (0.030‰) in private health expenditure per capita, and also a minor increase of (0.036‰) in out-of-pocket health expenditures per capita.

Keywords: Air Quality, Health Expenditure Per Capita, Particulate Matter (PM2.5) Exposure Per Capita, Smoking Prevalence, GDP Per Capita

INTRODUCTION

Air pollution is one of the most important environmental risk factors for public health. Although around two hundred air pollutants are known to exist, the main pollutants are Carbon monoxide (CO_2), Sulfur dioxide (SO), Nitrogen dioxide (NO_2), Ozone (O_3) and Particulate Matter ($PM_{2.5}$). Particulate matter smaller than 2.5 micrometers also known as ($PM_{2.5}$) is the most risky pollutants to human health. Short and long term Particulate Matter ($PM_{2.5}$) exposure leads to lung and major respiratory disorders, hence creating significant pressure on public health. The increase in the number of people who get sick due to air pollution brings health expenditures higher as it increases people's demand for healthcare (Yahaya, 2017).

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WHO Air Quality Guidelines make the fundamentals for determining the global boundaries of air pollutants that pose significant risks to human health. The World Health Organization proposes targets for air quality where health risks are significantly reducedand provides guidance to countries regarding how to protect public health. Today, the air quality of the countries is still far above the limit accepted by WHO as a guide. Also in MENA countries which are the subject case the Particulate Matter ($PM_{2.5}$) level is above the limit values. Particulate Matter ($PM_{2.5}$) causing air quality deterioration density creates pressure on the health system in MENA countries and decreases the quality of the health system. Health expenditures in MENA countries are characterized as private, out-of-pocket and government expenditures the share allocated to the health system is a very small part of GDP. In MENA countries the share of the total health system in GDP is well below the world average. It is seen in MENA countries that government health expenditures on air pollution are very slim not enough importance is attributed to the health system and most MENA countries are dependent on private and out-of-pocket health expenditures for it. Thus, MENA countries are revealed to be in the need of implementation of necessary plans and policies to increase health expenditures per capita and to increase health expenditures.

The aim of this study is to estimate the magnitude and size effects of smoking prevalence and income per capita and Particulate Matter (PM2.5) emission per capita expressed in the literature and in various reports, which is one of the most important determinants of air quality, by categorizing health expenditures per capita as total, government, private and out-of-pocket health expenditures for MENA countries. Thus the gap on the topic in the literature is tried to be filled.

1. CONCEPTUAL FRAMEWORK

1.1. The Relationship of the Air Quality and Health

Air quality refers to the degree of air emissionssuitable or clean so that living things can remain healthy. Good air quality belongs to the degree to which air can remain clean and clear among other gaseous impurities as well as free from contaminants such as smoke and dust. Air quality is determined by evaluating various pollution indicators. Pollutants that impair air quality are emissions from tobacco smoke and household fuels as well as from motor vehicles, industry, heating and commercial resources. Quality air is a requirement to maintain ecological life balance. When air pollution reaches high concentrations human health, plants, animals and natural resources run the risk of being threatened (Air Now, 2019).

The air quality index reports daily air quality. The EPA calculates the AQI (Air Quality Index) for the five main air pollutants which are regulated by the Clean Air Act. These pollutants are ground level Ozone (O_3), Carbon monoxide(CO_2) ,Particulate matter ($PM_{2.5}$), Sulfur dioxide (SO_2) and Nitrogen dioxide (NO_2). It is known as the most deadly component of air pollution in many regions of the world especially in Central and Eastern Europe with its ability to spread very swiftly and suspend in the air for a long time. Light particles which are considered to be one thirds to one fifth of the diameter of a human hair represent a complex mixture of organic and inorganic substances.

The barrier between these two particle fractions is usually between 1 and 2.5 µg / m^3. While small particles include secondary formed aerosols (gas-to-particulate conversion), combustion particles, re-condensed organic and metal vapors large particles are generally are comprised of soil crust materials, roads, industries and fugitive dust. Particles are sampled and described according to their aerodynamic diameters frequently simply called particle size (Green Facts, 2005).

WHO Air Quality Guidelines take a basic approach to what global boundaries should be on air pollutants posing significant risks to human health. Guidelines and targets have been established for pollutants such as Particulate Matter ($PM_{2.5}$), O_3, NO_2, SO_2 to measure and monitor the progress of countries over time (World Bank & Institute for Health Metrics and Evaluation, 2016).

The World Health Organization proposes three levels for Particulate Matter ($PM_{2.5}$), Ozone (O_3), Sulfur dioxide (SO_2) pollutants and sets them as targets.These pollution concentrations are proposed as a phased step in the process of reducing pollution and are intended to be used in areas with high pollution. These intermediate goals are based on an arbitrary basis and reflect the essence of the benefit (gain) assessment based on linear concentration in response unity (WHO, 2017).

WHO suggested three intermediate targets to aid with measuring the progress in reducing the exposure of the population to Particulate Matter ($PM_{2.5}$) pollutant.There are three intermediate air quality targets (IT) which were set for annual average fine particle ($PM_{2.5}$) concentrations.IT-1 ≤ 35 µg / m^3; IT-2≤ 25 ug / m^3; and IT-3 ≤ 15 ug / m^3 (World Bank, 2019). Intermediate Goal 1: IT-1 ≤ 35 µg / m^3 is the level corresponding to the highest concentration on average as a result of long-term effect. This level is associated with significant deaths in some countries (World Bank, 2019). Determined particulate matter targets is also shown Table 1.

Table 1: WHO Particulate Matter ($PM_{2.5}$) Quidelines

Particulate Matter ($PM_{2.5}$)	10 µg/m^3 annual mean guideline 15 µg/m^3 interim target 3 25 µg/m^3 interim target 2 35 µg/m^3 interim target 1

Source: World Health Organization (2006)

Particulate Matter ($PM_{2.5}$) exposure creates negative effects on health. Both acute and chronic exposure is emphasized (Kloog, Ridgway, Koutrakis, Coull and Schwartz, 2013; World Health Organization, 2016). Chronic exposure is the greatest danger for death while high Particulate Matter ($PM_{2.5}$) exposure at short intervals exacerbates lung heart and respiratory diseases (World Health Organization, 2006).

Short and long term effects of Particulate Matter ($PM_{2.5}$) exposure are worrying. The effects of prolonged exposure to Particulate Matter ($PM_{2.5}$) on mortality constitute some of the primary concerns (WHO, 2003).It is estimated that prolonged exposure to moderately fine particulate matter may be associated with a reduction in life expectancy up to several months. In many time series studies, the effects of short-term Particulate Matter ($PM_{2.5}$) exposure on mortality and morbidity peak ponits have been proven. “Disability Adjusted Life Years” (DALYs) were estimated for both types of effects. Analyses conducted show that the importance of the Particulate Matter ($PM_{2.5}$) on public health far outweighs then the importance of its short term effect (de Hollander et al., 1999).

The burden of polluted air exposure on public health is important.Some studies show that subjects living in bustling areas are more affected by the short and long-term effects of air pollution than those living in the distance. This situation brings about the unequal distribution of health risks on the population, environmental justice and equality issues (Green Facts, 2005).

About five million people are exposed to premature deaths each year due to air pollution and about one in ten deaths per year is caused by air pollution (World Bank and Institute for Health Metrics and Evaluation, 2016). According to WHO estimates it is reported that air pollution caused 4.2 million premature deaths worldwide in 2016.[3] Aside from premature death, reasons for cancer, cardiovascular and respiratory diseases such are stated to be related to exposure to 2.5 microns or less Particulate Matter ($PM_{2.5}$).91% of the early deaths occur predominantly in low and middle-income countries (mostly in South East Asia and the West Pacific regions) (WHO Newsroom, 2018).

In the World Health Organization (WHO) records it was determined that one of every eight deaths globally is associated with air pollution and in 2019, health problems arising as a result of air pollution and climate change were ranked in the top 10 health threats. In WHO 2016 report it is stated that outdoor air pollution causing “Particulate Matter ($PM_{2.5}$) and other particles smaller than 2.5 micrometers in diameter cause cardiovascular, respiratory problems and cancer diseases, 4.2 million people living in rural and urban areas are deceased by exposure to outdoor air pollution. (Particulate Matter ($PM_{2.5}$)). It is stated that 38 % of deaths due to outdoor air pollution are caused by heart attack, 20% are paralysis and 43 %are chronic discomfort (WHO Report, 2016).

[3]According to WHO estimates, 58% of early deaths due to outdoor air pollution in 2016 were due to ischemic heart disease and stroke, 18% were caused by chronic obstructive pulmonary disease and acute lower respiratory tract disease and 6% was due to lung cancer.

2. LITERATURE REVIEW

The determinants of health expenditures are widely researched in the literature. Many economic and non-economic factors are considered among the determinants of health expenditures. Among the factors discussed are the following; income, population, population over 65, population under 15, number of doctors and nurses, hospital beds, health price index, female labor force participation rate, amount of foreign aid, urbanization rate, share of population living in cities, federal transfer revenues. (Newhouse (1977), Hitiris & Posnett (1992), Gerdthan et al (1992), Matteo & Matteo (1998), Karatzas (2000), Tang (2009), Peykerjou et al (2011), Rao et al (2008), Samudram et al (2009) Pope & Dockery (2013)).

It is stated that air pollution is an environmental pollution cost. Environmental pollution costs cause the economy to be suppressed causing labor productivity losses and increased health expenditures and forcing government budgets under more pressure (Gerdtham & Jonsson (1991), Anand (2004), Li et al (2015), Liu (2017)). More specifically air pollution causes direct medical expenses which impose heavy financial burdens such as health commodities and services on the other hand it leads to expenditure on drug use (Deschenes et all., 2017).

In the literature studies investigating the effect of air pollution on health expenditures are gradually increasing. Most of the studies conducted in line with this have investigated the effects of emissions such as sulfur dioxide(SO_2), carbon monoxide (CO_2), carbon dioxide, nitrogen dioxide (NO_2)as indicators of air pollutants. Jerrett et al. (2003) discussed the impact of environmental pollution and environmental expenditure per capita on health expenditure using the two-stage regression model for 49 counties located in Ontario, Canada. According to the results of the study, it has been found that both total pollution emission and environmental expenditures per capita are effective on health expenditures and that districts with higher pollution make higher health expenditures per capita. In addition, it was found that the districts that spend higher in order to increase the environmental quality spend less on health services. Narayan & Narayan (2008) analyzed the impact of environmental quality and income per capita on health expenditure per capita for the 1980-1999 period by using panel co-integration and dynamic OLS methods for 8 OECD countries. According to the results of the study, it was determined that health expenditure per capita, income per capita carbon monoxide emission, sulfur oxide emission and nitrous oxide emission are co-integrated. It was seen that income and carbon monoxide emission had had a statistically significant impact on health expenditures in the short term as well as a statistically significant and positive effect on health expenditures on income, carbon monoxide emission and sulfur oxide emissions. Zheng et al. (2010) analyzed the impact of environmental pollution on health expenditures for the 1997-2003 period by using panel co-integration and panel VECM methods for 31 states in China. According to the results of the study, it has been determined that government health expenditures affected not only on the state economy but also on the quality of the environment in both the long and short term. Odusanya et al. (2014) analyzed the impact of environmental pollution on health expenditures for the 1960-2011 period using the ARDL method for Nigeria.

According to the results of the study, when carbon dioxide emission increased, health expenditures increased significantly in both long and short terms. Erden & Koyuncu (2014) analyzed the impact of environmental pollution and economic development on human health for 1980-2012 using the VAR method for Turkey. According to the results of the study, it was determined that economic development increased health expenditures by increasing the carbon emission. Fattahi (2015) analyzed the impact of air pollution and urbanization rate on government and private health expenditures for the period 1995-2011 using the dynamic panel data method for developing countries. According to the results of the study, it has been determined that air pollution has a positive effect on government and private health expenditures also the rate of urbanization strengthens this relationship. Yahaya et al. (2016) analyzed the impact of environmental quality on health expenditure per capita for the period of 1995-2012 using the panel co-integration method for a total of 125 economies. According to the results of the study, in addition to environmental quality being a strong determinant on the health expenditures in developing economies, the variable with the highest explanatory capacity on the health expenditures per capita was determined as carbon dioxide emission. Abdullah et al. (2016) analyzed the impact of environmental quality on health expenditures for the period 1995-2017 using the ARDL method for Malaysia. According to the results of the study, it has been determined that variables such as carbon dioxide emission, nitrogen dioxide emission, sulfur dioxide emission, mortality rate and birth rate are associated with health expenditures in the long term and that sulfur dioxide emission, birth rates and death rates have a positive effect on the country's health expenditures. Chaabouni et al. (2016) analyzed the impact of carbon dioxide emissions and economic growth on health expenditures for the period 1995-2013 using the dynamic synchronous equation models method for 51 countries with low income, low middle income and upper middle income. According to the results of the study, the existence of one-way causality relationship from carbon dioxide emission to health expenditures has been identified. Yazdi & Khanalizadeh (2017) analyzed the impact of carbon dioxide emission and income on health expenditures for the period 1995-2014 by using Panel ARDL method for the Middle East and MENA countries. According to the results of the study, income and (CO_2) emissions were found to have a positive impact on health expenditures. In addition, the income elasticity of health expenditures was identified as less than one. Lu et al. (2017) analyzed the impact of environmental pollution on health expenditures for the period 2002-2014 using the two-stage least squares method for 30 states in the Middle East and China. According to the results of the study, it was found that environmental pollution has a negative impact on public health. Raeissi et al. (2018) analyzed the impact of air pollution on government and private health expenditures for the period 1972-2014 using the time series method for Iran. According to the results of the study, it has been determined that long-term air pollution has a significant and apparent impact on health expenditures, an increase of 1.00% in carbon dioxide caused an increase of3.32% in government health expenditures and 1.16% in private health expenditures. In addition, air pollution has been calculated to cause more impact on health expenditures in the long term than it does in the short term. Hao et al. (2018) analyzed the impact of air pollution on government health expenditures for the period 1998-2015 using the panel data method for China.

According to the results of the study, it has been determined that the increase in sulfur dioxide and institutional emission has a negative impact on public health, thereby leading to a significant increase in government health expenditures. Karasoy & Demirtaş (2018) analyzed the impact of air pollution, income, average life expectancy, improvements in the governance index and the rate of dependent population on health expenditures for the period 2000-2015 using the panel data method for 27 OECD countries. According to the results of the study, it was determined that the average life expectancy, improvements in the governance index and the rate of the dependent population positively affect health expenditures. In addition, while the coefficients of azotoxide and carbon dioxide emissions were found significant and positive, carbon monoxide and azotoxide emissions were found positive but insignificant. Haseeb et al. (2019) analyzed the impact of economic growth, environmental pollution and energy consumption on health and R&D expenditures for the 2009-2018 period using the ARDL method for ASEAN countries. According to the results of the study, it has been found that although environmental pollution, energy consumption and economic growth have a positive impact on health expenditures of ASEAN countries in the long term, there is no significant impact in the short term. Apergis et al. (2018) analyzed the impact of environmental pollution on health expenditures for the period 1995-2017 using the panel data method for 178 countries with different income groups. According to the study results, it was found that 1% increase in carbon dioxide emission increased health expenditures by2.9% in low income groups,1.2%in low middle income groups, 2.3 % in upper-middle income groups and 2.6% in high income groups. Dumrul (2019) analyzed the impact of environmental pollution and economic growth on health expenditures for ASEAN-5 countries for the period 2000-2014 using Pedroni, Kao and panel FMOLS co-integration method. According to the results of the study, it has been determined that there is a long-term relationship and positive correlation between health expenditures, environmental pollution and economic growth. Şahin & Durmuş (2019) analyzed the impact of environmental pollution and real GDP per capita on health expenditures per capita for the period of 1990-2014 using the causality analysis method for 21 OECD countries. According to the results of the study, one-way causality relationship has been determined from carbon dioxide emission to health expenditures in countries Finland, Spain, Sweden, Portugal and Greece. Finland, Sweden, Switzerland, Italy, the Netherlands, Poland, Greece, Australia, Spain, Canada and Norway havealso been found to have a one-way causal relationship from economic growth to health expenditures. Usman et al. (2019) analyzed the impact of air pollution economic and non-economic factors on government and private health expenditures per capita for the period 1994-2017 using the panel data analysis method for 13 emerging economies. According to the results of the study, it has been determined that carbon dioxide emission and environmental index have a positive impact on government health expenditures. Fernandez & Prieto (2019) analyzed the impact of air pollution and income per capita on health expenditures for the period 1995-2014 using the panel data analysis method for 29 OECD countries. According to the study result, it was determined that income per capita had a positive effect on health expenditures but was not statistically significant as expected upon inclusion of the delay period.

There are few studies to have investigated the economic cost of particulate matter emissions on health. Patankar & Trivedi (2011) analyzed the monetary burden of the impact of air pollution on health via the logistic regression method for the province of Mumbai in India in regard to public health policies, in that the disease cost burden method had been utilized to measure the monetary burden of these effects. According to the results of the study, it has been determined that particulate matter and nitrogen dioxide emissions are critical pollutants for various health effects such as COPD, shortness of breath, wheezing, cold symptoms and allergic rhinitis. The total monetary burden of these effects including government effects, social cost and personal burden was found to be 113.08 million US $ for 50-µg / m^{3}..Quah & Boon (2003) predicted the mortality and morbidity effects of particulate air pollution on the population and the economic values of health effects were calculated in regard to statistical lifetimes and disease costs. According to the results of the study, the total economic cost is estimated to be around 4.31 % of GDP. Maji et al (2017) analyzed the health effects of particulate matter ($PM_{2.5}$) and (PM_{10}) the resulting pollution by examining the provinces of Mumbai and Delhi for the period 1991-2015 in terms of disability-adjusted life years (DALYs) and economic cost.

The air quality index found in the Environmental Performance Index has included DALY indicators originating from particulate exposure and particulate overdose and solid fuel consumption (EPI, 2018, https://epi.envirocenter.yale.edu/2018-epi-report/air-quality). In many developing countries, solid fuel is mainly used for cooking and other domestic energy requirements due to poor economic conditions of households and lack of access to clean fuels (Walsh, 2013). 3 billion people globally (World Health Organization, 2016) and 700 million people in Africa rely on solid fuels for cooking (Energy AR, 2014).

Particulate matter are emissions less than 2.5 µg/m^3triggered by households, especially as a result of using solid fuels such as biomass and fossil fuels in cooking and other household activities, thus increasing the emission of indoor air pollution as well as outdoor air pollution. Particulate matter is among the emissions having a negative impact on human health reducing life expectancy and increasing health expenditures. The Global Burden of Disease (GBD) study reported that the Particulate Matter ($PM_{2.5}$) emission was the most common cause of environmental deaths throughout the world and around 2.9 million people worldwide were deceased in 2013 (Brauer et al. (2015), Forouzanfar et al. (2015)). In addition, prolonged exposure to particulate matter emission($PM_{2.5}$)is assumed to be leading to negative respiratory effects such as cardiovascular mortality, decreased lung function and development of asthma (Burnett et al (2014), Crouse et al (2012), Pope et al (2011), Pope & Dockery (2006)).

A couple of studies on the impact of air pollution on health expenditures approached particulate matter emissions as an indicator for air pollution ($PM_{2.5}$,PM_{10}). Mastorakis et al. (2014) analyzed the impact of environmental quality and income on health expenditures for the period 1967-2010 using Peer Integration and ARDL methods for Iran.

According to the results of the study, it has been found that the emission of sulfur dioxide, carbon monoxide and suspended particulate matter (Suspended Particulate Matter) have a positive impact on health expenditures both in the long and short term. Yazdi & Khanalizadeh (2017) analyzed the impact of environmental quality and economic growth on health expenditures for MENA countries using the ARDL method for the period 1995-2014. According to the study results, health expenditures, income, carbon dioxide and particulate matter (PM_{10}) emissions were found to be co-integrated. While income, carbon dioxide and particulate matter emissions have a positive impact on health expenditures in the long term, income elasticity has been found to be inelastic. Badamassi et al. (2018) analyzed the impact of environmental pollution on health expenditures for the period 1995-2010 by using GMM method for 44 Sub-Saharan African countries by addressing emissions from other sectors such as housing fuel emission, construction fuel emission, transportation fuel emission and manufacturing fuel emission. According to the results of the study, it is determined that the emission that has the most impact amog health expenditures from carbon monoxide, nitrogen oxide and sulfur dioxide emissions is particulate matter emission ($PM_{2.5}$). It was found that the burning in the housing sector caused more health expenditures. Badamassi et al. (2018) analyzed the impact of emission on life expectancy that was triggered by household burning by controlling the environmental emission ($PM_{2.5}$) produced by other sectors through consideration of various covariate variables for the period 1995-2010 using GMM and co-integration method for 43 Sub-Saharan African countries. According to the results of the study, it was found that long-term life expectancy and household emissions ($PM_{2.5}$) were negatively related to both methods. It has been determined that this effect is higher in female life expectancy. Controlling variable originating from the transportation sector ($PM_{2.5}$) emissions were found to be more effective in men's life expectancy. Various efforts were determined to should have been combined to reduce household emissions ($PM_{2.5}$) and increase life expectancy. Yang & Zhang (2018) analyzed the impact of air pollution and socioeconomic factors (GDP per capita, household income, number of beds per 1000 people, level of medical service received per person, number of households, number of households over 60, number of children under 15, cigarette consumption) on household health expenditures via the instrumental variables strategy based on spatial air pollution spreads for China. According to the results of the study, it was seen that even a 1% increase in annual fine ($PM_{2.5}$) emission exposure increased household health expenditures by 2.942%. (An & Heshmati (2019) analyzed the impact of air quality (monthly air quality index of five air pollutants) and socioeconomic factors (personal income, population share of the elderly and young people, cars registered and operated per capita, number of industries and atmospheric factors) on health expenditures for the 2010-2017 period via balanced monthly panel data for 16 provinces in South Korea. According to the results of the study, nitrogen dioxide, ozone and particulate matter (PM_{10}) emissions were determined to have a positive impact on health expenditures.

3. DATA and METHODOLOGY

Since the deterioration in environmental quality will affect human health negatively, it is stated that more health expenditures will be made for the increase in the demand for health services (Yahaya et al., 2017). The bivariate model, which is used by most of the literature and firstly applied by Newhouse (1977), addresses the relationship of the between income and health expenditures, in this study health expenditure per capita was expanded as a function of environmental quality and prevalence of smoking.

Particulate Matter (PM2.5) and other particles smaller than 2.5 micrometers in diameter have been reported to cause cardiovascular respiratory problems and cancer diseases (WHO Report 2016). In line with the before mentioned it has been determined as a preliminary hypothesis that the more the exposure to the Particulate Matter (PM2.5) emission, which is considered to be the determinant of the environmental quality or more specifically the air quality, the more the expenditures on health will increase; also as the prevalence of smoking and the more per capita income increases, expenditure on health will increase. Furthermore the effects of per capita income, air quality and smoking prevalence on total, government, private and out-of-pocket health expenditures are discussed for identified MENA countries and 2010-2016 period in this study. Contribution of this research is tried to be filled by categorizing health expenditures under total, government, private, out of pocket, by making a comprehensive panel data analysis and by using Particle Matter (PM2.5) exposure for air quality. The models used are expressed as follows:

$$\mathrm{pcLTHE_{it}} = \beta_0 + \beta_1 \mathrm{pcLPM2.5_{it}} + \beta_2 \mathrm{SP_{it}} + \beta_3 \mathrm{pcLGDP_{it}} + \alpha_i + \delta_{it} \quad (1)$$

$$\mathrm{pcLGHE_{it}} = \partial_0 + \partial_1 \mathrm{pcLPM2.5_{it}} + \partial_2 \mathrm{SP_{it}} + \partial_3 \mathrm{pcLGDP_{it}} + \in_{it} \quad (2)$$

$$\mathrm{pcLPHE_{it}} = \gamma_0 + \gamma_1 \mathrm{pcLPM2.5_{it}} + \gamma_2 \mathrm{SP_{it}} + \gamma_3 \mathrm{pcLGDP_{it}} + \varphi_{it} \quad (3)$$

$$\mathrm{pcLOHE_{it}} = \theta_0 + \theta_1 \mathrm{pcLPM2.5_{it}} + \theta_2 \mathrm{SP_{it}} + \theta_3 \mathrm{pcLGDP_{it}} + \vartheta_{it} \quad (4)$$

i indicates the country and t indicates the time. pcLTHE indicates total health expenditure per capita, pcLGHEpc indicates government health expenditure per capita, pcLPHE indicates private health expenditure per capita, pcLOHE indicates out-of-pocket expenditure per capita, pcLPM2.5 indicates average annual exposure per capita (PM2.5) (micrograms per cubic meter), SP indicates percentage of smoking prevalence (total (ages (15+) (% of adults)), pcLGDP indicates GDP per capita, α indicates constant effect and δ, $\in, \varphi, \vartheta$ indicate error terms of models. pcLPM2.5exposure and pcLGDP were taken from the World Bank database, pcLTH, pcLGHE, pcLPHE, pcLOHE were taken from the World Health Organization database and SP was taken from ourworldindata.org website.

Since the population density varies in each region, datas per capita are used. Analysis was made by taking the logarithm of that variables (pcLTHE, pcLGHE, pcLPHE, pcLOHE, pcPM2.5, pcLGDP). A sample was created by selecting the MENA countries, whose data are available. Sample countries are Algeria, Bahrain, Egypt, Iran, Israel, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, The United Arab Emirates, Tunisia and Turkey. Since smoking prevalence data in the used sample cover until 2016, it was researched for the period of 2010-2016 and analyzed with panel data models.

One of the tests applied for the selection of panel data model estimation method is the Breusch Pagan LM Test. According to the Breusch Pagan (1980) test approach, if the variance of unit effects in the panel data model is zero, the model can be solved with the Least Squares Method. Otherwise, the Generalized Least Squares (GLS) Method should be used in the random effect model structure. The null hypothesis (Prob> chibar2 = 0.0000), which are applied for all models and stated that the unit effect variance is equal to zero, was rejected. In this case it has been determined that it is not appropriate to use the Least Squares Method for all models.

The Hausman (1978) identification test was applied to make a choice between Fixed Effects and Random Effects Models. The null hypothesis of the Hausman test is that there is no correlation with the explanatory variables in the unit effect model or the difference in coefficients is not systematic. For Model 1, the null hypothesis was rejected (Prob> chi2 = 0.0013) and the Fixed Effects Model was found to be unbiased and consistent. The significance of the obtained model was determined with the Wald Test (Prob>chi2 = 0.0000). The null hypothesis was accepted for Model 2 (Prob> chi2 = 0.0451) and the Random Effects Model (GLS) was found to be unbiased and consistent. The significance of the obtained model was determined with the Wald Test (Prob> chi2 = 0.0000). The null hypothesis was accepted for Model 3 (Prob> chi2 = 0.9097) and the Random Effects Model (GLS) was found to be unbiased and consistent. The significance of the Random Effects Model obtained was determined by Wald Test (Prob> chi2 = 0.0000). The null hypothesis was accepted for model 4 (Prob> chi2 = 0.4353) and the Random Effects Model (GLS) was found to be unbiased and consistent. The significance of the obtained random effects model was determined by Wald Test (Prob> chi2 = 0.0000). The obtained estimation results are shown in the Table 2.

Table 2: Estimation Result

Model 1. Dependent Variable: $pcLTHE$	
$pcLPM2.5$	1.1392***
SP	-0.0023
$pcLGDP$	0.6855
Cons.	-3.6168
R^2	0.5813
F test	25.10
Breusch Pagan LM Test Statistics (chibar2)	83.33
Hausman Test Statistics (chi2)	15.79
Model 2 Dependent Variable: $pcLGHE$	
$pcLPM2.5$	-0.2365
SP	0.00002
$pcLGDP$	1.0318***
Cons.	-2.9023***

R^2	0.8940
Wald Test chi2	191.61
Breusch Pagan LM Test Statistics (chibar2)	36.87
Hausman Test Statistics (chi2)	8.04
Model 3 Dependent Variable: $pcLPHE$	
$pcLPM2.5$	-0.0835
SP	0.0030**
$pcLGDP$	0.4989***
Cons.	0.8211
R^2	0.4116
Wald Test chi2	29.19
Breusch Pagan LM Test Statistics (chibar2)	264.98
Hausman Test Statistics (chi2)	0.54
Model 4 Dependent Variable: $pcLOHE$	
$pcLPM2.5$	-0.2098
SP	0.0036***
$pcLGDP$	0.4247***
Cons.	1.6773
R^2	27.20
Wald Test chi2	55.55
Breusch Pagan LM Test Statistics (chibar2)	255.65
Hausman Test Statistics (chi2)	2.73
*** 1% ** 5% * 10% levels of significance is expressed.	

RESULT AND DISCUSSION

In order to talk about environmental quality, air quality must be in good condition first. Evidence in the literature shows that one of the most important determinants of air quality is the Particulate Matter Emission (PM2.5) and that it leads to negative health effects (Patankar & Trivedi (2011), Quah & Boon (2003), Maji et al. (2017), EPI (2018), Brauer et al. (2015), Forouzanfar et al. (2015), Burnett et al. (2014), Crouse et al. (2012), Pope et al. (2011), Pope & Dockery (2006)). Accordingly the aim of this study to reveal the impact of Particulate Matter (PM2.5) exposure per capita, the prevalence of smoking and income per capita on health expenditures per capita. According to this our hypothesis was identified as that the expense towards Particulate Matter (PM2.5) exposure per capita, which is the determinant of environmental degradation, income per capita and prevalence of smoking will increase the health expenditures.

Accordingly, the effects of determinants such as Particulate Matter (PM2.5) exposure per capita, prevalence of smoking and income per capita on total, government, private and out-of-pocket health expenditures were analyzed for 14 MENA countries and 2010-2016 period and the gap in the literature was tried to be eliminated. It was seen upon screening of the literature that the relationship between Particulate Matter (PM2.5) and health expenditures, which few studies have considered for different samples, was positive (Mastorakis et al. (2014), Badamassi et al (2018), Yang & Zang (2018)).

According to the estimation results that have been obtained, it was found that 1% increase in Particulate Matter (PM2.5) exposure per capita caused an increase of 1.13% in total health expenditures per capita. It is seen that our study are confirmed the literature on this topic. Moreover in the models that we have created by categorizing health expenditures under government, private and out-of-pocket health expenditures, the relationship between Particulate Matter (PM2.5) and health expenditures was found to be statistically insignificant. It can be stated that this result can be explained with some features characteristic to MENA countries. Eyob et al. (2017) stated that the health system in MENA countries constituted a small share of GDP, MENA countries were below the world average with 5.3% as the share of the total health system in GDP in 2014, the share allocated to health expenditures in the general government expenditure in MENA countries is about half the world average, out-of-pocket health expenditure is much higher than household income, and most MENA countries are dependent on out-of-pocket health expenditure. Thus we are of the idea that the fact that MENA countries have a weak health system leads to the relationship between categorized health expenditures and air quality to be statistically insignificant. In other words we have detected that health expenditures, which are categorized under government, private and out-of-pocket health expenditures for MENA countries, do not have a significant relationship with air quality, but have a statistically significant and positive relationship with air quality when total health expenditures are considered. This situation reveals the necessity to increase the government health expenditures per capita especially among the per capita health expenditures that we categorize under government, private and out-of-pocket health expenditures per capita. We think that this increase will be possible by increasing the financial capacity of the government and this should be realized through tax increases and also the governments should give more importance to health. An increase of 1% in GDP per capita results in 1.03% increase in government health expenditure per capita, 0.50% increase in private health expenditure per capita and 0.42% increase in out-of-pocket health expenditure per capita. In addition the effect of income per capita on total health expenditures per capita was found statistically insignificant. As can be seen, private and out-of-pocket health expenditure per capita does not increase as much as income per capita, apart from government health expenditure per capita. While Mehrara et al. (2012) concluded that the increase in income per capita for 13 MENA countries did not increase the total health expenditure per capita as much as itself, likewise Yazdi &Kahanalizadeh (2017) concluded that the increase in income per capita for 11 MENA countries did not increase the total health expenditure per capita as much as itself.

According to the low income elasticity result found by Mehrara et al. (2012) and Yazdi & Kahanalizadeh (2017), health care that cannot be regarded as part of the luxury goods category is found to be consistent with the outcome that we founded for private and out-of-pocket health care. Additionally even though the effect of change in income per capita on private and out-of-pocket health expenditure is in the direction of low income elasticity (0.49, 0.42 respectively), the effect of change in income per capita is on the government health expenditure per capita approximately (1.03) as much as itself. In other words we find that government health care is differentiated from private healthcare and out-of-pocket health care and is included in the luxury goods category, while the others (private and out-of-pocket health care) are in the necessary goods category. In other words we find out that government increases health expenditure at least as much as income when income level in the MENA countries increase. In the literature, according to the studies conducted for OECD countries in recent years, it is seen that the income elasticity for health expenditures is high and health care is generally in the luxury goods category (Gerdtham et al. (1992), Hitris & Posnet (1992), Roberts (2000), Okunade & Murthy (2002), Bhat & Jain (2004), Wang & Rettenmaier (2006)). In this case in parallel with the OECD countries, we can say that the income elasticity for government health care in the MENA countries tends to be in the luxury goods category (1.03) but private and out-of-pocket health care is in the category of necessary goods in the MENA countries. 1% increase in the prevalence of smoking causes a small increase in private health expenditures per capita (0.030‰) and in out-of-pocket health expenditures per capita (0.036‰). Yang & Zang (2018) found that household cigarette consumption in China increased household health expenditure by 0.015%. With this result, it is seen the result that we found for MENA countries turned out to be consistent.

Accordingly it was concluded that the deterioration in air quality experienced in 14 MENA countries in 2010-2016 period, the increase in per capita income and increase smoking prevalence have increased health expenditures per capita generally. The obtained results indicate that the preliminary hypothesis of the study is supported. The period after 2016 and some MENA countries could not be included in the analysis due to the inaccessibility of data for the countries included in the study sampling and the apparent lack of dataset regarding the used variables until 2016. Furthermore, with this study we are contributing to the lack of research on the field by revealing the impact of air quality (the emission of particulate matter (PM2.5) per capita), smoking prevalence and income per capita on health expenditures per capita, by categorizing as total government, private and out-of-pocket expenditure and by implementing a comprehensive panel data analysis, by considering for 14 MENA countries in the period of 2010-2016. Additionally, we are contributing to the field by determining that government health care tends to be in the luxury goods category; however private health care and out-of-pocket health care are differentiated and are in the necessary goods category for 14 MENA countries and by categorizing the income elasticity of health expenditures as total, government, private and out of pocket health expenditure for MENA countries.

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