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Investigation of Climatic, Health and Economic Factors Affecting on Mortality in the Eastern Mediterranean Region

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Abstract

Background

Mortality is one of the indicators of community health and reflects the social, economic and environmental status of the residence of people. In this regard, countries in the Eastern Mediterranean Region (EMR) have many problems. Therefore, this study was conducted to investigate the factors affecting on mortality in the region.

Materials and Methods

This study was conducted in the 22 EMR countries. Required data on mortality were collected from WHO online database and Weather, Geneva, Switzerland. The data were analyzed by ArcGIS 10.6.1 software, graphic statistical methods, SPSS software version 23.0, descriptive statistical tests, ANOVA, and regression correlation coefficient.

Results

The results showed that in the 22 EMR countries, mortality in children under five, neonatal mortality rate, mortality rate attributed to household and ambient air pollution, mortality rate attributed to exposure to unsafe WASH services and mortality rate attributed to unintentional poisoning were 52 per 1000 live births, 26.6 per 1000 live births, 58.8 per 100,000 population, 13.1 per 100,000 population and 1.4 per 100,000 population, respectively. The results showed that the countries of Somalia, Yemen, Iraq, Afghanistan, Pakistan, Sudan, and Djibouti were in a very poor situation and there was an inequality in health in the countries of the region.

Conclusion

Based on the results, the main factors affecting mortality rate included: 1) Average precipitation, 2) Latitude, 3) Above sea level, 4) Food safety, and 5) Births attended by skilled health personnel.

Key Words: Climate, Eastern Mediterranean Region, Economic, Health, Mortality.

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1- INTRODUCTION

The World Health Organization (WHO) is the directing and coordinating authority for public health within the United Nations system. WHO member states are grouped into six WHO regions: African Region, Region of the Americas, South-East Asia Region, European Region, Eastern Mediterranean Region (EMR), and Western Pacific Region (WPR). The WHO Regional Office for the EMR is one of the six WHO regional offices around the world. It serves the WHO EMR, which comprises 22 member states (Afghanistan, Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Palestine, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arabic Emirates, Yemen, and Morocco), with a population of nearly 676,964 million people. In this regard, the population of other regions was in African Region (1,047,149), Region of the Americas (1,001,309), South-East Asia Region (1,968,463), European Region (919,458), and Western Pacific Region (1,891,987). Although the population of the EMR countries is not high compared to other areas, this region (EMR) had the highest mortality rates in the world after Africa (1, 2).

A study of mortality provides a good look at the overall health of the population. Mortality is one of the most serious challenges that the international community is faced with, so that one of the UN's Sustainable Development Goals (SDGs) has been to further reduce mortality, especially child and infant mortality (3). According to the WHO, in 2018, 56.9 million deaths occurred around the world (1), of which approximately 20% of all deaths were related to under-five children (4). Despite the significant progress made to reduce the mortality of under-five children around the world, child mortality still remains high (42.5), and the United Nations goals for sustainable development have not materialized (2). The results of studies have shown that mortality is one of the indicators of community health and reflects the social, economic and environmental status of the residence of people (5). According to the WHO, more than half of mortalities (54%) were due to coronary artery obstruction disease, stroke, chronic obstructive pulmonary disease, lower respiratory tract infection, Alzheimer's disease, lung, trachea and bronchus cancers, diabetes, crashes, diarrhea and tuberculosis (1), and the main cause of child mortality was also pneumonia, preterm birth complications, birth asphyxia, diarrhea and malaria (6), which are affected by spatial conditions.

The results of studies indicate that both life and pathogens are biological elements derived from nature, which are directly or indirectly affected by spatial conditions (climate, ecosystem and environment). For example, climate changes (7) (such as temperature, humidity, elevation, precipitation, and distance and proximity to water resources) have had an impact on health (8). Although previous studies have examined mortality and the factors affecting it, the role of location and related factors has been less studied (9, 10). This is due to the complexity of spatial analysis and patterns of disease and deaths in which the role of location has been neglected (11). In this regard, Geographic Information Systems (GIS) is an appropriate tool that can examine spatial patterns in epidemiological studies and health management (12).

According to the WHO, more than half of the millions of deaths that occur throughout the year result from conditions that can be prevented or treated with simple, cost-effective interventions (6). Considering that many factors are involved in death, in this regard, avoidable factors in mortality should be identified and effective interventions should be made to reduce it. Hence, drawing the profile of

mortality in communities in order to identify the causes of the occurrence and present its results to health planners and policy makers is one of the most important solutions for promoting health (13). The distribution of causes of mortality is different depending on the climatic conditions and the socio-economic, political, and cultural status; differences in its dispersion are observed and checking its status in different places is emphasized (14). The EMR countries face numerous economic, social and political problems, affecting the health of the inhabitants of this region affected by global tensions. On the other hand, according to our studies, no study has ever been done to investigate the spatial and health conditions in this area of the world. Therefore, the present study was conducted to investigate mortality and factors affecting it in the 22 EMR countries.

2- MATERIALS AND METHODS

The present study was an ecological cross-sectional and retrospective one that has used the panel data of the 22 countries located in the Eastern Mediterranean Region of the WHO. The data used in this study were obtained from the official websites of the WHO (https://www.who.int/gho/publications/world_health_statistics/2017/whs2017_AnnexB.xlsx?ua=1), and Weather Geneva, Switzerland (https://www.accuweather.com/en/ch/geneva/313082/weather-forecast/313082). No sampling was done in this study. The study population was the countries located in the EMR and with regard to the availability of the intended data, countries including Afghanistan, Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Palestine, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arabic Emirates, Yemen, and Morocco were studied.

2-1. Method

This study was conducted in the 22 EMR countries in 2017. Weather Geneva, Switzerland was used for average temperature, average high-temperature, average low-temperature, average precipitation, and average number of days with precipitation, average length of day, average relative humidity, average dew point, and average wind speed. Mortality data were extracted from the WHO.

2-2. Data Analyses

In this study, under-five mortality rate (per 1,000 live births), neonatal mortality rate (per 1,000 live births), mortality rate attributed to household and ambient air pollution (per 100,000 population, mortality rate attributed to exposure to unsafe water, sanitation, and hygiene (WASH) services (per 100,000 population), and mortality rate attributed to unintentional poisoning (per 100,000 population) as the dependent variable, and average low-temperature (˚C), average precipitation (mm), average number of days with precipitation (days), average length of day (hours), average relative humidity (%), average dew point (˚C), average wind speed (km/h), average temperature (˚C), average high-temperature, above sea level, longitude, latitude, food safety (%), births attended by skilled health personnel (%), children aged <5 years sleeping under insecticide-treated nets, reproductive, maternal, newborn and child health interventions, economic status (%), current health cost (CHE) as percentage of gross domestic product (GDP), concentrations of fine particulate matter (PM2.5) (%), population using at least basic sanitation services, physicians density (per 1,000 population), nursing and midwifery personnel density (per 1,000 population), increase in poverty gap due to household health expenditures at the $1.90-a-day poverty line, in cents of international dollars, increase in poverty gap due to household health expenditures

at the $3.10-a-day poverty line, in the cents of international dollars (%), infants exclusively breastfed for the first six months of life (%), early initiation of breastfeeding (%), prevalence of anemia in pregnant women, skilled health professionals density (in 10,000 population), average of 13 International Health Regulations core capacity scores, general government health expenditure as percentage of general government expenditures, proportion of population using improved drinking water sources (%), proportion of population using improved sanitation (%), and annual mean concentrations of fine particulate matter (PM2.5) in urban areas (μg/m3) as the independent variables were evaluated. Then, the data was transferred to Arc/GIS 10.6.1 software and after data digitization, the data were evaluated by graphic statistical models. Furthermore, the data were analyzed by SPSS software (version 23.0), descriptive statistic, analysis of variance and stepwise regression. In this study, mortality rates were the dependent variable and the climate, health, economic status, etc. were the independent variables (variables mentions above).

3- RESULTS

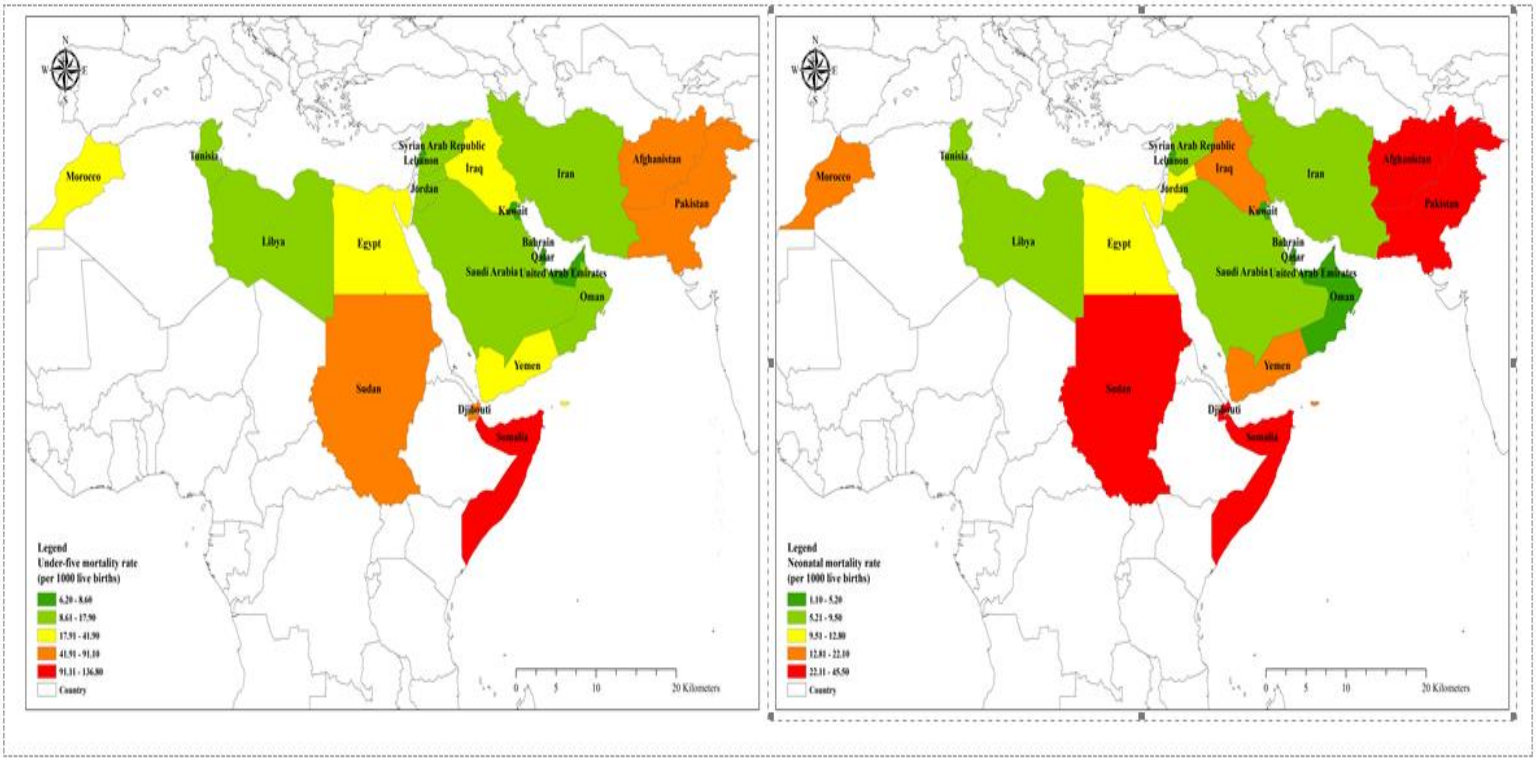
The findings of this study showed that the mortality rate for under-five children in the EMR countries was 33.69. Somalia (136.8), Afghanistan (91.1), Pakistan (81.1), Sudan (70.1), and Djibouti (65.3), respectively, had the highest mortality rates for under-five children. In this regard, Iran ranks tenth in the region. Iran was in a moderate position (**Table 1 and Figure 1**). The neonatal mortality rate in this region was 15.56; most of the cases were observed in Pakistan (45.5), Somalia (39.7), Afghanistan (35.5), Djibouti (33.4), Sudan (29.8), Yemen (22.1) and Iraq (18.4), respectively. Iran ranks eleventh in the EMR countries. Iran was in a moderate position (**Table.1 and Figure.1**).

Mortality rate attributed to household and ambient air pollution in the EMR was 43.37; most of the cases were observed in Somalia (116.9), Afghanistan (114.8), Pakistan (87.2), Djibouti (81.8), Sudan (64.5), Yemen (61.3), and Egypt (50.9), respectively. Mortality rate attributed to exposure to unsafe WASH services in the EMR was 11.59; most of the cases were observed in Somalia (98.8), Afghanistan (34.6), Djibouti (26.4), Pakistan (20.7) and Sudan (34.6), respectively. Mortality rate attributed to unintentional poisoning in the EMR was 1.20; most of the cases were observed in Sudan (4.2), Somalia (3.7), Yemen (2.9), Afghanistan (1.6), Pakistan (1.51), and Iran (1.4), respectively. Iran ranks ninth in the EMR countries. Iran was moderate compared to other countries (**Table.1 and Figure.1**).

Table-1: Statistics on the indices studied in the 22 EMR countries in 2017.

Variables	Afghanistan	Bahrain	Djibouti	Egypt	Iran	Iraq	Jordan	Kuwait	Lebanon	Libya	Morocco	Oman	Pakistan	Qatar	Saudi Arabia	Somalia	Sudan	Syria	Tunisia	United Arab Emirates	Yemen
Under-five mortality rate e (per 1000 live births)	91.1	6.2	65.3	24	15.5	32	17.9	8.6	8.3	13.4	27.6	11.6	81.1	8	14.5	136.8	70.1	12.9	14	6.8	41.9
Neonatal mortality rate e (per 1000 live births)	35.5	1.1	33.4	12.8	9.5	18.4	10.6	3.2	4.8	7.2	17.6	5.2	45.5	3.8	7.9	39.7	29.8	7	8.2	3.5	22.1

Mortality rate attributed to household and ambient air pollution p (per 100 000 population)	114.8	11.1	81.8	50.9	35.2	33.5	21.2	14.2	29.1	33.2	25.1	14.5	87.2	8.9	27.5	116.9	64.5	30	42.6	7.3	61.3
Mortality rate attributed to exposure to unsafe WASH services q (per 100 000 population)	34.6	0.1	26.4	1.6	0.9	3.9	1	0.1	0.4	0.6	3.4	0.4	20.7	0.1	0.2	98.8	34.6	1.8	0.8	0.1	13
Mortality rate attributed to unintentional poisoning k (per 100 000 population)	1.6	0.3	3	0.5	1.4	0.5	0.7	0.2	0.4	0.8	0.7	0.2	1.5	0.3	0.9	3.7	4.2	0.7	0.6	0.3	2.9
The numbers are in percent. EMR: the Eastern Mediterranean Region.																					



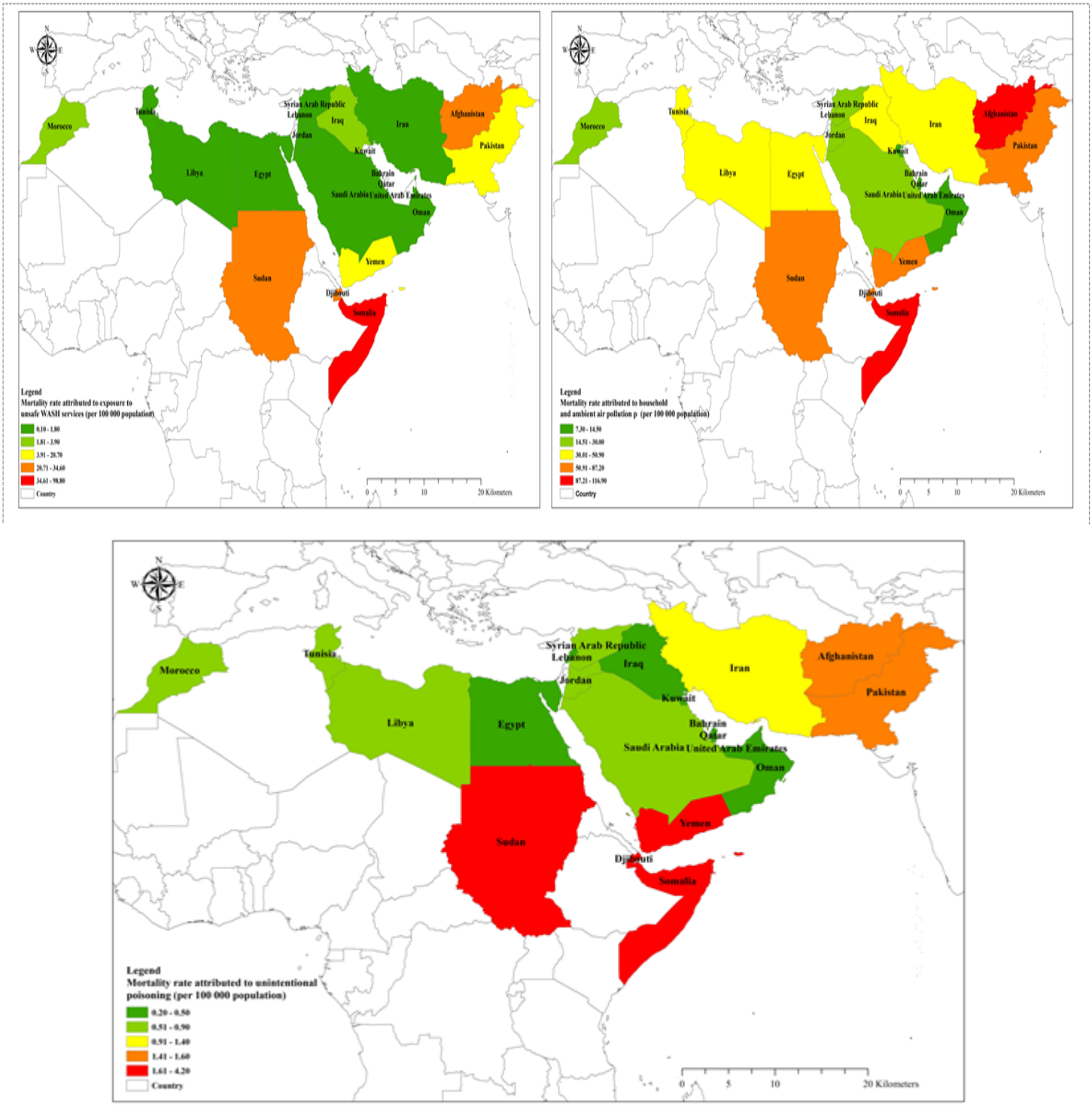


Fig.1: Mortality rate in the 22 EMR countries in year 2017.
EMR: the Eastern Mediterranean Region.

The findings of this study showed that there was a significant relationship between average precipitation, births attended by skilled health personnel, skilled health professionals' density with under-five mortality rate, neonatal mortality rate and mortality rate attributed to household and ambient air pollution ($P<0.05$). Furthermore, there was a significant relationship between food

safety, population using at least basic sanitation services, physicians' density and latitude with under-five mortality rate, neonatal mortality rate, mortality rate attributed to household and ambient air pollution, mortality rate attributed to exposure to unsafe WASH services and mortality rate attributed to unintentional poisoning (P<0.05) **(Table.2)**.

Observational evidence on the relationship between having births attended by skilled health personnel, skilled health professionals' density, food safety, population using at least basic sanitation services, physicians' density, average precipitation, latitude and reduced mortality. There was a significant relationship between nursing and midwifery personnel density with under-five mortality rate, neonatal mortality rate, mortality rate attributed to household and ambient air pollution and mortality rate attributed to exposure to unsafe WASH services (P<0.05). There was a significant relationship between children aged <5 years sleeping under insecticide-treated nets with neonatal mortality rate and mortality rate attributed to household and ambient air pollution.

Moreover, there was a significant relationship between infants exclusively breastfed for the first six months of life and neonatal mortality rate, as well as above sea level and mortality rate attributed to unintentional poisoning (P<0.05). Mortality rate attributed to unintentional poisoning was negatively affected by proportion of population using improved sanitation, healthy life expectancy at birth and latitude (**Table 2 and 3**). The results of regression analysis showed that among independent variables, life expectancy at birth (female and male), and average relative humidity were effective in under-five mortality rate. The results showed that the variables entered into the model explained 93.5% of variance. The standardized regression coefficient (beta) for the variables of life expectancy at birth (female and male), and average relative humidity were -1.743, 0.836, and 0.154, respectively. Women's life expectancy had a negative effect on under-five child mortalities, but men's life expectancy and average relative humidity had a positive effect on it (**Table.3**).

Findings of the regression model showed that population using at least basic sanitation services (-0.885) and early initiation of breastfeeding (-0.200) had an impact on neonatal mortality rate. Furthermore, in relation to mortality rate attributed to household and ambient air pollution, the results showed that life expectancy at birth (female) (-0.869) and increase in the poverty gap due to household health expenditures at the $3.10-a-day poverty line, in cents of international dollars (0.260) were influential.

Moreover, in relation to mortality rate attributed to exposure to unsafe WASH services, the results showed that the effect of independent variables was: life expectancy at birth (female) (-0.856), average dew point (0.324), and proportion of births attended by skilled health personnel (-0.185) affected the dependent variable (**Table.3**). The findings regarding mortality rate attributed to unintentional poisoning showed that proportion of population using improved sanitation (-0.623), latitude (-0.374), general government health expenditure as % of general government expenditure (0.271), healthy expectancy at birth (-0.382), skilled health professionals' density (0.158), and infants exclusively breastfed for the first six months of life (0.123) were influential.

Table-2: Results of analysis of variance and the indices studied in relation to mortality in the 22 EMR Countries in 2017.

Variables	UMR[a]		NMR[b]		MRAHAAP[C]		MRAEUWS[d]		MRAUP[e]	
	F	Sig	F	Sig	F	Sig	F	Sig	F	Sig
Average Low Temperature (°C)	0.028	0.973	0.141	0.869	0.070	0.933	0.406	0.672	0.088	0.916
Average Precipitation (mm)	4.480	0.026	4.164	0.033	4.430	0.027	3.165	0.066	1.742	0.203
Average Number of Days With Precipitation (Days)	3.369	0.057	2.454	0.114	3.306	0.060	2.907	0.081	1.236	0.314
Average Length of Day (Hours)	0.317	0.580	0.301	0.590	0.001	0.982	0.220	0.644	0.258	0.617
Average Relative Humidity (%)	0.111	0.896	0.022	0.987	0.214	0.809	0.464	0.633	0.077	0.926
Average Dew Point (°C)	0.508	0.610	0.113	0.893	0.077	0.926	1.382	0.276	1.805	0.193
Average Wind Speed (km/h)	0.781	0.473	1.071	0.363	0.722	0.499	0.693	0.513	0.336	0.719
Average Temperature (°C)	0.504	0.613	0.141	0.869	0.135	0.875	1.353	0.285	1.937	0.173
Average High Temperature (°C)	0.361	0.702	0.240	0.789	0.326	0.726	0.379	0.690	0.204	0.817
Food safety	20.430	0.000	34.659	0.000	16.805	0.000	7.593	0.004	13.109	0.000
Births attended by skilled health personnel (%)	3.645	0.047	5.377	0.015	6.177	0.009	1.770	0.199	2.951	0.078
Children aged < 5 years sleeping under insecticide-treated nets (%)	4.077	0.058	5.243	0.034	8.445	0.009	1.522	0.232	1.888	0.185
Reproductive, maternal, newborn and child health interventions Economic status	0.922	0.416	2.565	0.105	1.007	0.385	0.065	0.937	1.359	0.282
Current health expenditure (CHE) as percentage of gross domestic product (GDP) (%)	0.428	0.659	0.729	0.496	0.507	0.610	0.461	0.638	1.174	0.332
Concentrations of fine particulate matter (PM2.5)	0.117	0.890	0.075	0.928	0.270	0.766	0.715	0.502	0.296	0.747
Population using at least basic sanitation services (%)	18.446	0.000	33.000	0.000	16.127	0.000	7.509	0.004	14.510	0.000
Physicians density (per 1000 population)	5.747	0.012	5.525	0.013	4.756	0.022	4.698	0.023	8.098	0.003
Nursing and midwifery personnel density (per 1000 population)	8.400	0.003	12.842	0.000	12.953	0.000	3.638	0.047	3.359	0.058
Increase in poverty gap due to household health expenditures at the $1.90 a day poverty line, in cents of international dollars	0.737	0.492	2.014	0.162	1.957	0.170	0.114	0.893	0.240	0.789
Increase in poverty gap due to household health expenditures at the $3.10a day poverty line, in cents of international dollars	0.737	0.492	2.014	0.162	1.663	0.217	0.084	0.920	0.085	0.919
Infants exclusively breastfed for the first six months of life (%)	2.838	0.085	4.820	0.021	3.507	0.052	1.476	0.255	2.468	0.113
Early initiation of breastfeeding (%)	0.434	0.655	0.105	0.901	0.368	0.697	0.658	0.530	0.231	0.796
Prevalence of anemia in pregnant women (%)	0.682	0.518	0.640	0.539	0.769	0.478	0.636	0.541	0.207	0.815
Skilled health professionals density t (per 10 000 population)	6.956	0.006	11.598	0.001	8.288	0.003	2.747	0.091	1.906	0.178
Average of 13 International Health Regulations core capacity scores u	10.590	0.001	7.871	0.003	17.662	0.000	8.467	0.003	9.281	0.002
General Government Health Expenditure as % of General government expenditure v	0.108	0.899	0.019	0.981	0.168	0.847	0.647	0.536	0.540	0.592
Proportion of population using improved drinking-water sources (%)	7.804	0.004	7.371	0.005	7.045	0.005	6.113	0.009	8.979	0.002
Proportion of population using improved sanitation x (%)	15.268	0.000	10.804	0.001	13.755	0.000	40.367	0.000	13.755	0.000
Annual mean concentrations of fine particulate matter (PM2.5) in urban areas (µg/m3)	0.298	0.746	0.376	0.692	0.183	0.754	0.834	0.767	0.563	0.580
Above sea level	0.662	0.528	1.514	0.247	1.253	0.309	0.287	0.754	6.462	0.008
Longitude	0.428	0.658	0.412	0.663	0.781	0.473	0.317	0.733	0.622	0.548
Latitude	20.589	0.000	13.638	0.002	19.760	0.000	20.374	0.000	136.001	0.000

a) Under-five mortality rate e (per 1000 live).
b) Neonatal mortality rate e (per 1000 live births)
c) Mortality rate attributed to household and ambient air pollution p (per 100 000 population).
d) Mortality rate attributed to exposure to unsafe WASH services q (per 100 000 population).
e) Mortality rate attributed to unintentional poisoning k (per 100 000 population).
EMR: the Eastern Mediterranean Region.

Table-3: Results of regression analysis in relation to mortality in the 22 EMR countries in 2017.

Model Dependent variable	R	R Square	Adjusted R Square	Independent variable	B	Std. Error	Beta	*t*-test	P-value
Under-five mortality rate	.972	.945	.935	Life expectancy at birth (Female)	-9.679	1.153	-1.743	-8.391	.000
				Life expectancy at birth (Male)	4.373	1.086	.836	4.027	.001
				Average Relative Humidity	.325	.121	.154	2.691	.015
Neonatal mortality rate	.970	.941	.930	Population using at least basic sanitation services	-.441	.031	-.885	-14.102	.000
				Early initiation of breastfeeding	-.116	.035	-.200	-3.282	.004
Mortality rate attributed to household and ambient air pollution	.961	.923	.915	Life expectancy at birth (Female)	-4.513	.348	-.869	-12.966	.000
				Increase in poverty gap due to household health expenditures at the $3.10a day poverty line, in cents of international dollars	8.132	2.098	.260	3.877	.001
Mortality rate attributed to exposure to unsafe WASH services	.952	.906	.882	Life expectancy at birth (Female)	-3.118	.303	-.856	-10.286	.000
				Average Dew Point	.958	.232	.324	4.121	.001
				Proportion of births attended by skilled health personnel	-.125	.056	-.185	-2.252	.039
Mortality rate attributed to unintentional poisoning	.993	.985	.979	Proportion of population using improved sanitation	-.021	.002	-.623	-10.175	.000
				Latitude	-.037	.004	-.374	-9.577	.000
				General Government Health Expenditure as % of General government expenditure	.076	.011	.271	7.196	.000
				Healthy life expectancy at birth	-.080	.013	-.382	-6.047	.000
				Skilled health professionals density	.008	.002	.158	3.499	.004
				Infants exclusively breastfed for the first six months of life	.008	.002	.123	3.225	.006

EMR: The Eastern Mediterranean Region.

4- DISCUSSION

The mortality of children in the EMR countries is alarming, and the situation appalling. According to the results of other studies and the WHO's reports, this region after Africa is ranked second in the world for the mortality of children and even exceeds the global average (2, 15). Hence, this study examined mortality and factors affecting it in the EMR countries. The results of our study showed that the mortality of under-five children in the EMR countries was 52 per 1,000 live births. This was more than the global rate (42.5), the Western Pacific Region (WPR) (13.5), the European Region (11.3), the Southeast Asia Region (42.5) and the Region of The Americas (14.7) (2). There was also considerable difference between countries in the region (Table 1 and Figure 1). This difference in the mortality rate is affected by the spatial, climatic, health-care and socioeconomic conditions of the

countries of the region as shown in our study (Tables 2 and 3). The results of other studies have also suggested that inequalities in health, inappropriate conditions of everyday life, violence, war and unpleasant political conditions are effective in this regard (16, 17). These findings suggest that children are at greater risk, and life in unsanitary and unsafe conditions has increased the mortality of under-five children (16). Hence, the United Nations Organization must take more serious measures to solve the problems of countries with inappropriate status. Our study findings indicated that neonatal mortality rate in the EMR countries was 26.6. This was more than the global rate (2.19), WPR (6.7), the European Region (6), the Southeast Asia Region (24.3), and the Region of The Americas (7.7) (2). Neonatal mortality rate in the countries of the region also showed significant differences, so that Pakistan (45.5), Somalia (39.7), Afghanistan (35.5), Djibouti (33.4), Sudan (29.8), Yemen (22.1) and Iraq (18.4) were in poor condition (Table 1 and Figure 1).

In this regard, our findings showed that population using at least basic sanitation services and early initiation of breastfeeding had a negative impact on neonatal mortality rate, which was similar to the study in South Sudan (16, 18). In other studies, the quality of health services systems, the economic situation and the cultural conditions of societies have been considered effective (19). In addition, gender inequality can also lead to infant mortality by reducing access to education, economic opportunities and health care resources (20), and endangering pregnancy and childbirth health and increasing the likelihood of infant mortality (21). Easy access to health services is one of the essential requirements in development programs, however developing countries have devoted fewer shares of their facilities and resources to this section for various reasons, such as the lack of national health planning, the inadequate system of health services and the inadequacy of the health sector. Hence, the need to strengthen the delivery system of health care services to provide the necessary care at any time and place for pregnant women is essential in these countries (22). Mortality rate attributed to household and ambient air pollution in the EMR countries was 58.8, which was higher than the European Region (64.2), and the Region of the Americas (7.7). However, it was less than the global rate (92.4), WPR (133.5), the Southeast Asia Region (119.9), and the African Region (80.2) (2). In this regard, it can be argued that the European Region and the Region of the Americas have better managed environmental pollution than other parts of the world. In these regions, renewable energies, including the wind and solar energies, have been used (23).

Therefore, it is recommended that other areas of the world also use these experiences. Furthermore, in the EMR, Somalia (116.9), Afghanistan (114.8), Pakistan (87.2), Djibouti (81.8), Sudan (64.5), Yemen (61.3), and Egypt (50.9) were in a poor position. This situation in developing countries has had adverse and undeniable effects on human health and has caused a variety of congenital malformations and cancers, especially in children (24, 25). Mortality rate attributed to exposure to unsafe WASH services in the EMR countries was 13.1, which was more than the global rate (12.4), WPR (0.8), the European Region (0.6), the Region of The Americas (1.5), and less than the African Region (43.1), and the Southeast Asia Region (20.1) (2). Furthermore, in the EMR, Somalia (98.8), Afghanistan (34.6), Djibouti (26.4), Pakistan (20.7), and Sudan (34.6) had the highest mortality rate in terms of this index, respectively. Results of other studies show, in low-income countries,

inadequate water, sanitation and hygiene, which are important risks to health (26), are considered to be effective in mortality rate attributed to exposure to unsafe Water, sanitation and hygiene (WASH) services. Evidence from epidemiological studies has also shown that exposure to unsafe water, sanitation and hygiene habits is, among others, directly linked to diarrheal diseases, intestinal nematode infections and other diseases, and thus have been effective in mortality (27, 28), but in our study, life expectancy at birth (female) and proportion of births attended by skilled health personnel have been effective in mortality rate attributed to exposure to unsafe WASH services (Table.3).

Moreover, mortality rate attributed to unintentional poisoning in the EMR was 1.4. This was less than the global rate (1.5), the Southeast Asia Region (1.5) and the African Region (2.8) and more than the Region of The Americas (0.8) and the European Region (1) (2). Furthermore, in the EMR, most of the cases were observed in Sudan (4.2), Somalia (3.7), Yemen (2.9), Afghanistan (1.6), and Pakistan (1.51), respectively (Table 1 and Figure 1). In our study, mortality rate attributed to unintentional poisoning was negatively affected by proportion of population using improved sanitation, healthy life expectancy at birth and latitude. This situation indicates inappropriate management in these countries' health systems. Another possible reason is also the use of weapons, destruction of structures and refineries, fire, military transport and chemical releases. These conditions can also endanger the health of those who are still alive. Our findings showed that food safety had a significant relationship with mortality in the EMR. Other studies have also shown that changes in the production, distribution and consumption of foods, changes in the environment, new and emerging pathogens, and the antimicrobial resistance of foods have contributed to this. Increasing travel and trade has also expanded the likelihood of international pollution (29-31). Despite the WHO's emphasis on improving food safety, unsafe food remains a problem in the EMR countries. It is therefore proposed that the Food and Agriculture Organization and the WHO warn the countries of the region about food safety more often. In this study, the women's life expectancy showed negative effects on under-five mortalities, mortality rate attributed to household and ambient air pollution, and mortality rate attributed to exposure to unsafe WASH services. This situation is probably due to the negative impact of socio-economic inequalities on mortality rates and, consequently, on life expectancy, as the results of other studies have shown (32). On the other hand, women are at risk of violence, sexual abuse, exploitation and life-threatening illnesses (16), which may influence their life expectancy in the EMR. Other reasons for justifying this are the deterioration of the economic situation, military conflicts and increased insecurity in the EMR countries.

In our study, mortality due to the environmental pollution was associated with the poverty gap in society (Table.3). The results of studies have shown that approximately 92% of mortality from pollution occurs in low-income and middle-income countries, and in countries at each income level, pollution-related illnesses are more common among the poor (24, 33). The environmental pollution accounted for about 16% of all deaths worldwide in 2015, three times more than deaths from AIDS, tuberculosis, malaria and 15 times more than all wars and other forms of violence (33). This indicates that the environmental pollution is the largest and most prevalent cause of premature mortality, especially among children in today's world. Therefore, it is suggested that at the level of the EMR, necessary

measures be considered by international, national and local organizations. The results of our study showed that the climate conditions in the EMR were related to mortality (Tables 2 and 3). The results of the study by Xu et al. (2012) also indicated the impact of the climate conditions on mortality and related diseases (8). As shown in other studies, increased temperature and humidity have facilitated and accelerated the spread of diseases, and increased mortality (34, 35). Increasing mortality due to the climate conditions has increased negative aspects such as: reducing economic flourishing, increasing medical costs and demand for health care systems. Indeed, the climate changes will reduce the chances of achieving all the Millennium Development Goals (MDGs), and will reduce the speed of efforts to eradicate poverty, improve health and protect the environment (36).

In this study, a significant relationship was found between above sea level and mortality rate attributed to unintentional poisoning. The results were similar with other studies that have shown that mortality and disease are largely related to the climate patterns (37). The results of studies have shown that the inversion of temperature is related to height, resulting in pollutants remaining in the vicinity of the earth for a long time. This condition causes a lot of heart and respiratory problems (38). Another possible cause is the impact of economic, political and military activities on the rate of air pollutants in the EMR countries.

4-1. Limitations of the study

The limitations of our study were that we failed to study variables such as gender, age groups, race, and social classes. Furthermore, because our data was a cross-sectional one, we could not evaluate annual mortality changes. In addition, we failed to examine the political situation and the neighborhood in different countries (especially those countries that have low health status), the diversity of ethnicities and cultures in this study.

5- CONCLUSION

The mortality in the 22 EMR countries is alarming, and the situation appalling. Furthermore, there was a great deal of difference between countries in the region. Factors affecting mortality were average precipitation, latitude, above sea level, food safety, births attended by skilled health personnel, children aged <5 years sleeping under insecticide-treated nets, population using at least basic sanitation services, physicians density, nursing and midwifery personnel density, infants exclusively breastfed for the first six months of life, skilled health professionals' density, average of 13 International Health Regulations core capacity scores, proportion of population using improved drinking-water sources and proportion of population using improved sanitation. Implementing cost-effective health interventions to improve the environmental conditions of the household, such as access to improved drinking water supplies and sanitation facilities, can have a positive impact on increasing environmental health and thus, reduce mortality in the region.

It is therefore proposed that international organizations and the international community, in support of the deprived countries, take appropriate measures to address inappropriate environmental conditions, unsafe food and access to health services (births attended by skilled health personnel, children aged < 5 years sleeping under insecticide-treated nets, population using at least basic sanitation services, physicians density, nursing and midwifery personnel density, infants exclusively breastfed for the first six months, skilled health professionals density, average of 13 International Health Regulations core capacity scores, proportion of population using improved drinking-water sources, and proportion of

population using improved sanitation). In addition, it is suggested that separate studies be conducted at the level of each country (in particular, Somalia, Afghanistan, Pakistan, Sudan, Djibouti and Yemen) in relation to the causes of mortality in order to show internal differences at the local level, and to manage the dominant structures on mortality, take the necessary measures.

6- CONFLICT OF INTEREST: None.

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