

Causes of death in the Eastern Mediterranean Region during the years 1998-2000

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ABSTRACT

Objectives: This paper aims to consider the available mortality data as an insight to epitomize the mortality pattern and the main leading causes of death specific to the Eastern Mediterranean Region (EMR) in order to set priorities for future research in the region.

Methods: Data was taken from the last 3 World Health Organization (WHO) mortality statistics. Crude mortality rates were compared between the 6 WHO regions for the years 1998, 1999 and 2000. Proportional mortality and standardized proportional mortality ratios were calculated for the causes of death and types of malignant neoplasm deaths and compared between the EMR and the other regions of the world. Spearman coefficient rank-order correlation was calculated to detect significant correlation between the ranking of the main causes of death in EMR and the 3 basic demographic, socio-economic and health care indicators in the 6 regions of the world.

Results: The results of this study showed that approximately 9 per 1,000 of the world's population die annually. Africa and Europe have the highest mortality rates. The main causes of death worldwide are cardiovascular diseases, infectious or

parasitic diseases, malignant neoplasm, infectious respiratory diseases and other respiratory diseases. In EMR, approximately 8 per 1,000 die annually. The causes of death in EMR can be classified into 3 categories. 1) Non-prominent in EMR as compared to other regions of the world. 2) Prominent in EMR and significantly correlated to the basic indicators. 3) Prominent in EMR but not related to the basic indicators. These include deaths due to wars, congenital anomalies, perinatal conditions, genitourinary diseases, endocrine disorders, road traffic accidents, cancer bladder, lymphoma leukemia and cancers of the mouth or oropharynx, and ovaries.

Conclusion: The results of this study emerged the need for extensive epidemiological studies to investigate thoroughly the main causes of death influencing mortality in EMR, specially that they coincide with the health consequences of depleted uranium. Also, most of these health conditions were previously described among the United States and European veterans who served in the Gulf War.

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The health of nations is not a simple process, many complex factors intervene but the core partners in this process are demographic, social and economic dimensions that act concurrently. Health assessment is a very difficult mission that requires enormous efforts and techniques. As time passes, more evidence emerges and proves that the dominant underlying force that supports

better comprehension of health status of populations is the generation and application of new knowledge, which is only attained by research. According to the World Health Organization (WHO) classification,¹⁻³ the Eastern Mediterranean Region (EMR) encompasses 21 countries from the African and Asian continents in addition to Cyprus. The African countries include all countries in

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North Africa on the borders of the Mediterranean sea (except Algeria), in addition to Sudan, Djibouti and Somalia. The Asian countries include Syria, Lebanon, Jordan, Iraq, the 7 Gulf countries, Iran, Afghanistan and Pakistan. Thus, it is clear that the EMR occupies a strategic geographic location in the middle of the globe connecting the east to the west and the north to the south. The EMR has experienced numerous events during the 20th century including occupations, revolutions, and wars. Some of EMR countries suffered from economic crises while others profited from the economic boom and petrol economy.⁴ Finally, the century ended very dynamic in EMR with breaking wars and sanctions in some countries that have influenced all life aspects in the region. Among all these events, the EMR has shared with the whole world the revolution in information technology, the advancement in electronic communication, as well as, globalization.⁵ Industrialized countries were prepared to digest these developments. Developing countries in EMR, as in other regions of the world, were perplexed trying hard to follow the enormous rapid turnover. Concerns have been raised on the health situation of this area of the world, which reaps all these events. The advent of the new millennium prompts efforts to define health problems in EMR as a platform for setting future health research priorities and ascertaining equity of care. Parallel to globalization, international comparison of health events would be the ideal means for assessment of health problems in various regions. However, it is very difficult to attain global morbidity statistics especially as countries have different registration systems and health policies. The use of mortality data provides another reliable means of international comparison of health status. They give an idea on the incidence of diseases, the main prevalent conditions and their burden on health. Mortality statistics including the various causes of death are available from the WHO statistics. This paper aims to consider the available mortality data as an insight to epitomize the mortality pattern and the main leading causes of death specific to the EMR in order to set priorities for future research in the region.

Methods. This paper has made use of the WHO mortality statistics. The WHO divides the world into 6 regions: Africa (AFR), the Americas (AMR), Eastern Mediterranean (EMR), Europe (EUR), South East Asia (SEAR), and Western Pacific regions (WPR). The total deaths and the causes of death were defined by WHO for the year 1998, 1999 and 2000 taken from the corresponding WHO reports.¹⁻³ The crude mortality rates (CMR) reported during 1998, 1999 and 2000 were compared between the 6 WHO regions. The proportional mortality ratio for each cause of death (PMRc) and proportional mortality ratio for each type of malignant neoplasm death (PMRn) in EMR and the other WHO regions during the year 1998-2000 were calculated and used as an indirect indicator for the incidence of the

different health conditions and their burden on mortality. The PMRc and the PMRn were calculated as follows:

$$\text{PMRc} = \frac{\text{n of deaths due to a specific cause in a region}}{\text{Total number of deaths in same region}} \times 100$$

$$\text{PMRn} = \frac{\text{n of deaths due to a specific type of malignant neoplasm in a region}}{\text{Total number of deaths from all malignant neoplasm in same region}} \times 100$$

To compare the causes of death and the types of malignant neoplasm mortality between the EMR and other WHO regions, and as the causes of death were only known but not the structure of the population from which they arose, the standardized proportional mortality ratio for the causes of death (SPMRc) and the standardized proportional mortality ratio for the causes of neoplasm death (SPMRn) were calculated as shown below and compared between the regions:

$$\text{SPMRc} = \frac{\text{Observed deaths from a specific cause in a region}}{\text{Expected deaths from same cause in same region}}$$

$$\text{SPMRn} = \frac{\text{Observed deaths from a specific neoplasm in a region}}{\text{Expected deaths from same neoplasm in same region}}$$

Where the expected number of deaths was the number that would have occurred if the proportion of deaths from a specified cause (or specified neoplasm) relative to all deaths (or all neoplasm deaths) in the study population were the same as the corresponding proportion in the standard population, which was taken as the total deaths (or total neoplasm deaths) in all regions. The causes of death (or neoplasm mortality) were categorized according to SPMRc (or SPMRn) in EMR into: (i) Causes of death that appeared to be highly prominent in EMR. They were defined as the causes of death in which the SPMRc (or SPMRn) was >1 and occupied the first rank in EMR. (ii) Causes of death that appeared to be prominent in EMR. They were defined as the causes of death in which the SPMRc (or SPMRn) was higher than one but did not occupy the first rank in EMR. (iii) Causes of death that appeared to be not prominent in EMR. They were defined as the causes of death in which the SPMRc (or SPMRn) was ≤1 in EMR. The total fertility rate, maternal mortality ratio and infant mortality rate, known as basic indicators for the demographic, socio-economic status and health care services offered in the community were ranked in 6

WHO regions. The ranking of the basic indicators was compared to the ranking of the main causes of death and neoplasm deaths to find out if they coincide. The total fertility rate and the infant mortality rate available were those for the year 1998 while the available maternal mortality ratio was that recorded in 1990.¹⁻³ Data entry and analysis were carried out using SPSS for windows. The spearman coefficient rank-order correlation (rs) was calculated to detect significant correlation between the rank order of SPMRc or SPMRn and the ranking of the 3 basic indicators in the 6 WHO regions.

Results. The overall crude mortality rate (**Table 1**) fluctuated between 9.2 per 1,000 and 9.4 per 1,000. Africa was on the top of the regions in 3 years. Least rates were reported in AMR and WPR. The EMR occupied the 4th rank during the 3 years with a CMR of 8 per 1,000 in 1998, 8.7 per 1,000 in 1999 and then 8.4 per 1,000 in 2000. As shown in **Table 2**, the main causes of death worldwide were cardiovascular diseases, infectious/parasitic diseases, neoplasm, infectious respiratory diseases, and other respiratory diseases. Deaths from cardiovascular diseases, neoplasm, and respiratory diseases of non-infectious origin occurred mainly in EUR, AMR and WPR. Deaths from infectious or parasitic diseases and infectious respiratory diseases were mainly reported from AFR, SEAR and EMR. The main causes of neoplasm deaths worldwide (**Table 3**) were cancer of the trachea/bronchi/lungs, stomach, liver, colon or rectum and breast. Cancer of the trachea or bronchi or lungs was mainly reported from EUR, AMR and WPR; cancer of stomach was more prominent in WPR and EUR; cancer of the liver was mainly from WPR and AFR; cancer of the colon or rectum was mainly from EUR and AMR; while breast cancer was mainly reported from AMR, SEAR and EUR.

Causes of death in the Eastern Mediterranean Region. According to the SPMRc, the EMR occupied the first rank for deaths attributed to wars, congenital anomalies, perinatal conditions and genitourinary diseases (**Table 4**). The causes of death that were prominent in EMR but did not rank first were maternal conditions, nutritional deficiencies, nutrition or endocrine disorders, infectious or parasitic diseases, infectious respiratory diseases and road traffic accidents. Although, the overall role of malignant neoplasm on mortality was less important in EMR than in the other WHO regions, certain types of malignancies appeared to be more responsible for deaths in EMR than the rest of the world. The main types of malignant neoplasm (**Table 5**) that were found highly prominent in EMR were bladder cancer, lymphoma and leukemia. The prominent causes of neoplasm in EMR but did not rank first were cancers of mouth or oropharynx, cervix and ovaries. As shown in **Table 6**, the total fertility rate, maternal mortality ratio and infant mortality rate were highest in AFR, SEAR and EMR and were least in EUR. The 3 basic indicators were highly significantly correlated to each other (rs = 0.9, P-value = 0.005) but their

correlation with causes of death differed (**Table 7**). The ranking of the 3 basic indicators in the 6 WHO regions was not significantly correlated to the ranking of any of the highly prominent causes of death or neoplasm death in EMR except for the INFMR that was significantly correlated to the deaths from perinatal conditions (rs = 0.8, P = 0.042) as they share the early neonatal deaths. On the other hand, the ranking of at least two of the three basic indicators in the 6 WHO regions was significantly correlated to the ranking of the prominent causes of death or neoplasm death in EMR except for the nutritional or endocrine disorders, road traffic accidents, cancer of the mouth or oropharynx, and cancer of the ovaries.

DISCUSSION. It seems that there are considerable inequalities influencing mortality pattern worldwide. Our results have shown that approximately 9 per 1,000 of the globe population die annually and their distribution differs, being highest in the 2 regions on demographic, socio-economic and health care extremes, AFR and EUR. Africa suffers from low demographic, socio-economic and health care situation as was reflected by its highest total fertility rate, maternal mortality ratio and infant mortality rate. Conversely, EUR has much advanced demographic, socio-economic and health care conditions that were represented by the least rates for the 3 basic indicators. This shows that both rich and poor suffer but each has specific health problems. The main causes of death in the regions with better situation were cardiovascular, neoplasm and non-infectious respiratory deaths. On the other hand, the main causes of death in the regions with higher basic indicators were infectious or parasitic diseases, malignant neoplasm, infectious respiratory diseases and other respiratory diseases. In the EMR, approximately 8 per 1,000 die annually. The crude mortality rate during 1998-2000 in EMR occupied the fourth position being less than AFR and SEAR with nearly comparable demographic, socio-economic and health care facilities as was reflected by the 3 basic indicators. The crude mortality rate in EMR was still lower than that in EUR but this could be due to the age differences in the 2 population, as EUR is known to have older population than the EMR. The causes of death in EMR can be classified into 3 categories. The first category includes the causes of death that appeared to be non-prominent in EMR as compared to other regions of the world. This category includes cardiovascular diseases, diabetes mellitus, neuropsychiatric disorders, skin disorders, digestive diseases, non-infectious respiratory diseases, musculoskeletal diseases melanoma, as well as, cancer trachea/bronchi/lung, breast, esophagus, stomach, liver, pancreas, colon or rectum, uterus, and prostate. Although, this first category of diseases put load on EMR mortality but their burden on death in EMR are less than compared to other regions of the world. Consequently, the existing health actions in EMR directed to these conditions appear to be optimal to

Table 1 - Crude mortality rates in the 6 World Health Organization regions during the years 1998 and 1999.

Country	1998		1999		2000	
	Population (000)*	Death (000)* (% ^o) [†]	Population (000)*	Death (000)* (% ^o) [*]	Population (000)*	Death (000) (% ^o) [†]
Africa	601,783	9,621 (16)	616,435	10,436 (16.9)	639,632	10,572 (16.5)
The Americas	802,811	5,651 (7)	813,065	5,687 (7)	827,372	5,875 (7.1)
Eastern Mediterranean	473,644	3,773 (8)	485,266	4,218 (8.7)	481,655	4,036 (8.4)
Europe	870,128	9,255 (10.6)	871,845	9,057 (10.4)	873,575	9,664 (11.1)
South East Asia	1,485,056	13,484 (9.1)	1,508,242	14,270 (9.5)	1,535,634	14,157 (9.2)
Western Pacific	1,651,154	12,145 (7.4)	1,666,776	12,297 (7.4)	1,687,304	11,390 (6.8)
Total	5,884,576	53,929 (9.2)	5,961,628	55,965 (9.4)	6,045,172	55,694 (9.2)
*; [†] - per 1,000						

Table 2 - The proportion mortality ratio for the causes of death (%) in the 6 World Health Organization regions during the years 1998-2000.

Causes of death	Africa N = 30,620	The Americas N = 17,186	Eastern Mediterranean N = 12,020	Europe N = 27,940	South East Asia N = 41,894	Western Pacific N = 35,772	Total N = 165,432
Infectious/parasitic	50.1	6.4	20.2	2.3	20.9	5.5	18.3
Maternal conditions	2.3	0.3	1.3	0.1	1.1	0.2	0.9
Perinatal conditions	5.6	2.6	7.4	0.9	6.4	2.7	4.2
Nutritional deficiencies	1.5	1.2	1.3	0.2	1	0.4	0.9
Neoplasm	5.1	18.7	6.4	19.7	8.5	19.1	13
Diabetes	0.4	3.4	1.4	1.4	1.3	1.1	1
Nutrition/endocrine	0.3	1.1	0.6	0.3	0.1	0.4	0.4
Neuropsychiatric	0.6	2.9	1.6	2.2	1.4	1.4	1.6
Sense	0	0	0	0	0	0.1	0
Cardiovascular	9.5	35.1	29.6	51.0	29.1	31.9	30.4
Infectious respiratory	9.7	4.7	8.8	3.3	9.9	4.4	6.9
Other respiratory	2.2	5.3	3.7	4.3	3.8	14.8	6.1
Digestive	1.8	4.6	3.3	3.8	3.5	4.2	3.5
Genitourinary	1.1	2	2.3	1.3	1.5	1.6	1.5
Skin	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Musculoskeletal	0.1	0.4	0.1	0.3	0.1	0.3	0.2
Congenital anomalies	0.7	1.0	2.1	0.4	1.7	1	1.1
Road traffic accidents	1.7	2.7	2.4	1.5	2.7	2.3	2.2
Other unintentional injuries	3.1	3.4	3.7	3.7	4.7	4.7	4
Wars	1.9	0.2	2.0	0.5	0.3	0	0.7
Other intentional injuries	2.1	3.8	1.9	2.6	1.9	3.9	2.7

Table 3 - The proportion mortality ratio for the causes of neoplasm death (%) in the 6 World Health Organization regions during the years 1998-2000.

Neoplasm death	Africa N = 1,284	The Americas N = 2,64	Eastern Mediterranean N = 603	Europe N = 4,568	South East Asia N = 2,920	Western Pacific N = 5,972	Total N = 17,995
Mouth or oropharynx	5.5	2.8	9	3.2	15.7	2.9	5.4
Esophagus	7.6	3.4	6.1	2.9	7.6	10.8	6.8
Stomach	9.1	8.7	8.8	11.8	9.3	19.3	13.1
Colon or rectum	4.4	11.8	5.6	14.3	5.4	7.2	9.1
Liver	17.8	2.6	6.6	3.3	6.9	19	10.1
Pancreas	2.3	4.9	2.7	5.2	1.8	2.6	3.4
Trachea or bronchi or lung	6.2	24.1	16.7	24.6	15	21.3	20.3
Melanoma	1.8	1.4	1	1.3	0.8	0.8	1.1
Breast	7.2	10.1	7.3	9.2	10.1	3.6	7.4
Cervix	11.9	3.6	7.3	1.8	9	2.1	4.2
Corpus uteri	0.7	2.1	1	2.1	0.7	0.7	1.3
Ovary	2.1	2.4	2.2	2.5	2.5	1.0	2
Prostate	8.8	7.7	3.8	5.7	2.7	1.2	4.2
Bladder	3.7	2.8	5.1	3.4	2	1.4	2.5
Lymphoma	7.4	6.8	9	4.8	5.3	2.2	4.6
Leukemia	3.6	4.9	7.8	3.9	5.3	3.9	4.4

Table 4 - The standardized proportion mortality ratio for the causes death in the 6 World Health Organization regions during the years 1998-2000.

Causes of death	Africa	The Americas	Eastern Mediterranean	Europe	South East Asia	Western Pacific
Most prominent in Eastern Mediterranean						
Wars	2.7	0.3	2.9	0.8	0.5	0.1
Congenital anomalies	0.6	0.9	1.9	0.4	1.6	0.9
Perinatal conditions	1.3	0.6	1.8	0.2	1.5	0.6
Genitourinary	0.7	1.3	1.5	0.9	1	1
Less prominent in Eastern Mediterranean						
Maternal conditions	2.5	0.4	1.5	0.1	1.3	0.3
Nutritional Deficiencies	1.7	1.4	1.5	0.3	1.2	0.4
Nutrition/endocrine	0.9	2.8	1.5	0.8	0.3	1
Infectious respiratory	1.4	0.7	1.3	0.5	1.4	0.6
Infectious/parasitic	2.7	0.4	1.1	0.1	1.1	0.3
Road traffic accidents	0.8	1.2	1.1	0.7	1.2	1.1
Not prominent in Eastern Mediterranean						
Cardiovascular	0.3	1.2	1	1.7	1	1.1
Diabetes	0.3	2.6	1	1.1	1	0.8
Neuropsychiatric	0.4	1.9	1	1.4	0.9	0.9
Skin	1.6	1.6	1	1.1	0.5	0.7
Digestive	0.5	1.3	0.9	1.1	1	1.2
Other unintentional injuries	0.8	0.9	0.9	0.9	1.2	1.2
Other intentional injuries	0.8	1.4	0.7	1	0.7	1.5
Other respiratory	0.4	0.9	0.6	0.7	0.6	2.4
Neoplasm	0.4	1.4	0.5	1.5	0.7	1.5
Musculoskeletal	0.5	2.1	0.4	1.3	0.5	1.5
Sense	0.2	0.4	0	0	0.2	4.1

Table 5 - The standardized proportional mortality ratio for the causes of neoplasm death in the 6 World Health Organization regions during the years 1998-2000.

Neoplasm deaths	Africa	The Americas	Eastern Mediterranean	Europe	South East Asia	Western Pacific
Most prominent in Eastern Mediterranean Region						
Bladder	1.5	1.1	2.1	1.4	0.8	0.6
Lymphoma	1.6	1.5	1.9	1	1.1	0.5
Leukemia	0.8	1.1	1.8	0.9	1.2	0.9
Less prominent in Eastern Mediterranean Region						
Mouth or oropharynx	1	0.5	1.7	0.6	2.9	0.5
Cervix	2.8	0.9	1.7	0.4	2.1	0.5
Ovary	1.1	1.2	1.1	1.3	1.3	0.5
Not prominent in Eastern Mediterranean Region						
Breast	1	1.4	1	1.2	1.4	0.5
Melanoma	1.7	1.3	0.9	1.2	0.7	0.7
Esophagus	1.1	0.5	0.9	0.4	1.1	1.6
Prostate	2.1	1.9	0.9	1.4	0.6	0.3
Pancreas	0.7	1.4	0.8	1.5	0.5	0.8
Trachea or bronchi or lung	0.3	1.2	0.8	1.2	0.7	1.1
Corpus uteri	0.6	1.7	0.8	1.7	0.6	0.5
Stomach	0.7	0.7	0.7	0.9	0.7	1.5
Liver	1.8	0.3	0.7	0.3	0.7	1.9
Colon or rectum	0.5	1.3	0.6	1.6	0.6	0.8

Table 6 - Comparison of the 3 basic indicators in the 6 World Health Organization regions.

Region	Total fertility rate	Maternal mortality ratio	Infant mortality rate
Africa	5.4	940	91
The Americas	2.4	140	28
Eastern Mediterranean	4.4	440	69
Europe	1.6	59	21
South East Asia	2.9	610	68
Western Pacific	1.9	120	38

Table 7 - Spearman coefficient rank order correlation (rs) and the P-value (P) for the ranking of the total fertility rate (TFR), the maternal mortality ratio (MMR) and the infant mortality rate (INFMR) and the ranking of main causes of death and causes of neoplasm death of the EMR during the years 1998-2000 in the 6 World Health Organization regions

Causes of death and neoplasm deaths	TFR		MMR		INFMR	
	rs	P	rs	P	rs	P
Highly prominent causes of death						
Wars	0.6	0.208	0.4	0.397	0.5	0.266
Congenital anomalies	0.4	0.397	0.4	0.468	0.4	0.468
Perinatal conditions	0.8	0.072	0.7	0.111	0.8	0.042
Genitourinary	-0.0	0.957	-0.2	0.704	-0.1	0.872
Prominent causes of death						
Maternal conditions	0.8	0.042	0.9	0.005	0.8	0.072
Nutrition deficiencies	0.9	0.005	0.8	0.042	0.8	0.042
Nutrition/endocrine	0.1	0.872	-0.1	0.787	0.0	0.957
Infectious respiratory	0.8	0.042	0.9	0.005	0.8	0.072
Infectious/parasitic	0.9	0.037	1.0	0.000	0.9	0.037
Road traffic accidents	0.1	0.827	0.2	0.700	-0.0	0.957
Highly prominent neoplasm death						
Bladder cancer	0.5	0.266	0.3	0.544	0.4	0.397
Lymphoma	0.7	0.052	0.7	0.156	0.7	0.156
Leukemia	0.3	0.544	0.3	0.623	0.1	0.787
Prominent neoplasm death						
Cancer mouth/oropharynx	0.8	0.104	0.6	0.285	0.8	0.104
Cervical cancer	0.9	0.005	1.0	0.000	0.9	0.019
Ovarian cancer	-0.4	0.468	-0.2	0.623	-0.5	0.266

health needs. The second category includes the causes of death that appeared to be prominent in EMR and was significantly correlated to the basic indicators. This second category includes maternal conditions, nutritional deficiencies, infectious respiratory diseases, infectious parasitic diseases and cervical cancer. This category of diseases requires prompt evaluation for the existing health actions and efforts to strengthen the role of the health programs aiming to reduce fertility rate and improve maternal and child health. The third category includes the causes of death that appeared to be either highly prominent (including deaths due to wars, congenital anomalies, perinatal conditions, genitourinary diseases, cancer bladder, lymphoma and leukemia) or prominent in EMR (including endocrine disorders, road traffic accidents, cancer mouth or oropharynx and ovarian cancer) but not related to the basic indicators. This package of causes of death demands special attention and should be put on top of priorities. Road traffic accidents is an emerging cause of death in EMR and needs special care and strict multidisciplinary efforts to be controlled. In general, all morbid conditions are multifactorial and issue of many intervening determinants but could be there a single factor in common among the causes of death in this third category? Looking to the package, the word 'war' necessitated the identification of the nature of wars in EMR. Many studies⁶⁻⁹ were published on the use of depleted uranium (DU) in the Gulf War and its health consequences on the residents of the war area, as well as the United States of America (USA) and European veterans who served in the war. There is no dispute that tons of DU were released during the Gulf War.⁹ Depleted uranium is radioactive substance that gives off decay products or radon progeny and were those given out during the Gulf War. Depleted uranium remains radioactive for billions of years and its decay products are more radioactive. Depleted uranium and its decay products resist gravity, travel tens of kilometers in air, seeps into water, food and air and can be carried far in the bodies of animals, fish, birds and insects. External exposure to DU leads to radiological toxicity ending in DNA damage and genetic mutation. On the other hand, internal exposure to DU leads to both radiological toxicity and chemical toxicity, which mainly affects the proximal tubules of the kidneys.⁹⁻¹³ Thus, on exposure to DU we expect different types of cancers, malformations and renal disorders.⁹⁻¹⁴ Internal exposure to DU is by far more important on human health than external exposure.⁹⁻¹³ Depleted uranium mainly enters the human body by ingestion or inhalation. Most of the DU (>95%) reaching the gastrointestinal tract passes with the feces and the remaining part is absorbed into the blood. Most of the DU reaching the blood is filtered through the kidneys and approximately 90% are excreted in urine within within few days. The unexcreted DU is stored for many years in many tissues of the body mainly the bones, kidneys and liver. Thus, on human internal exposure to DU, all tissues of the body are at risk of

being affected but the main pathway and storage tissues are those mostly affected. By comparing the health effects of internal exposure to DU with the prominent causes of death in EMR not correlated with the basic health indicators, it is apparent that the main organs affected by DU are the upper aerodigestive tract with increased risk for cancer of mouth/oropharynx; lymph nodes and lymphoid tissue of lungs and gut with increased risk of lymphoma; the blood that could lead to disturbance in the activation and transmission of endocrine hormones, the bones which leads to increased risk of leukemia; the kidneys and urinary system with increased risk of kidney diseases and cancer bladder; the gonads and increased risk of genital disorders and cancer ovary; and finally genetic damage and increased risk of congenital anomalies and perinatal conditions. Moreover, most of these conditions were previously reported among the USA and European veterans who served in the Gulf war. Renal pathology and renal toxicity were previously blamed by US veterans' administration to be the primarily adverse effect of the Gulf War DU.^{9,15,16} Previous studies reported cancers of the upper aerodigestive tract, lymphoma and leukemia as health consequences of exposure to DU.^{9,15,17} Increased incidence of congenital anomalies and perinatal mortality were reported among Iraqi and Kuwaiti newborns,¹⁸⁻²⁰ as well as, among newborns of US veterans who took part in the Gulf war.²¹ If these results were just a coincidence and can be explained by the difference in reporting, then why the reporting procedures mainly influenced the incidence of this package of diseases in the EMR than other parts of the World? Also, if there was no Gulf War consequences and all was an invented myth, why mainly most of the health conditions that were previously described among American and European veterans who took part in the Gulf War and are known to be related to DU, were mainly those which appeared to be more prominent in EMR? If the health consequences of DU were only confined to Iraq and Kuwait, will it be that apparent on the causes of death in the whole region especially that the total population of these 2 countries represents only 0.4% of the EMR population.¹⁻³ Also, research has shown that those who served in Iraq and Kuwait were more affected than others who served in farther areas who still suffered and the longer they stayed the more they were affected.²² Uranium aerosol resists gravity and is able to travel tens of kilometers in air with possible human contamination through contaminated air, food chain and water,⁹⁻¹⁴ thus, which countries could be suffering, are they only those of the war theater or the problem is crossing the boundaries? Depleted uranium remains radioactive literally for billions of years and over this long period of time it will continue to produce its radioactive decay products, thus radioactive uranium actually becomes more radioactive as centuries go by.⁹⁻¹⁴ Should one expect to see increased incidence of congenital anomalies, malignancies and fatal diseases in future in EMR? As we are dealing with highly

aggregated data and a serious situation, these findings should be interpreted with caution and further independent evidence should be investigated more in depth. The results of this study are not enough to condemn DU but still they cannot rule out its effects on the mortality pattern in EMR. Just in case, this is reality and not merely a suspicion, lot of issues need to be resolved through extensive public health actions on this theme in all countries of the region. Programs to address issues on environmental pollution and population safety should be implemented. Intense epidemiological studies should thoroughly investigate this subject in all parts of the EMR. Maybe we are wrong in accusing DU but sure we are not mistaken if we ask to put priority and rectify research on the package of causes of death that appeared to be prominent in EMR and not explained by basic indicators, as well as, call for research on the health effects of DU.

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