Cancer Incidence and Mortality Estimates in Arab Countries in 2018: A GLOBOCAN Data Analysis

Mariam Al-Muftah[1,2] and Fares Al-Ejeh[1,2]

ABSTRACT

Background: Arab countries are projecting increase in cancer incidence and mortality; however, there are limited studies that compare the epidemiology of cancer in Arab countries compared with other parts of the world.

Methods: We used the 2018 Global Cancer Observatory data to compare the age-standardized incidence and mortality estimates in Arab-speaking countries to the rest of the world.

Results: Rates for incidence and mortality for all cancers in Arab countries were lower than the world's rates but the incidence rates of non-Hodgkin and Hodgkin lymphoma, bladder, breast, and liver cancers were higher. Arab countries generally had higher mortality-to-incidence ratio than the world's ratio. Incidence rates, even in age-specific groups, varied between subregions of Arab countries (the Levant, Arabian Gulf, and Arab African subregions), and Iraq and Egypt, suggesting some common and unique environmental factors and possible ethnic or genetic heritages.

Conclusions: There are essential scopes for improvements in Arab countries including better treatments to reduce the high mortality-to-incidence ratio, and supporting vaccination programs and antiviral treatments that would prevent the prevalent viral infection–related cancers. The high incidence of several cancers in younger Arabs suggests genetic factors and underlines the importance of genetic epidemiology studies.

Impact: This study is an essential reference to evaluate and monitor the progress of national cancer initiatives in Arab countries for surveillance and prevention programs and improving clinical management. The study also provides a comprehensive snapshot of cancers in a unique region that could shed light on the interplay of environmental, lifestyle, and genetic risk factors.

Introduction

An estimated 18.1 million new cancer cases (including nonmelanoma skin cancer) and 9.6 million cancer-related deaths occurred globally in 2018 (1, 2). It is expected that the global cancer burden will continue to increase to reach 28.4 million cases in 2040 (3). There are, however, considerable regional variations in incidence and mortality trends in the world attributed to the degree of economic development, and social and lifestyle changes (1). The Arab countries continue to show a rise in cancer incidence with a projected 1.8-fold increase by 2030 (4). Studies from Saudi Arabia (5), Egypt (6), Jordan (7), and Lebanon (8) reported an increasing age-standardized incidence rate (ASIR) during the past 10 years in the five most common cancers. In most Arab countries, cancer is the second cause of premature deaths following cardiovascular disease, except in Lebanon where it is the leading cause of death, while in Saudi Arabia and United Arab Emirates, cancer is one of the top three causes (9).

The total population of the Arab world, referring to the 22 members of the Arab League, has increased from 372.35 million in 2011 to 464.68 million in 2022 to become a larger population than the United States (333.29 million) and the European Union (447.96 million; ref. 10). Arab countries are contributing to the cancer burden worldwide. For example, in addition to the steady increase in cancer incidence (8, 11), Lebanon has the highest ASIR for bladder cancer cases in the world (12); the top 20 countries for bladder cancer ASIR also includes Syria and Egypt. Egypt is also of one of the top contributors to the world's burden of liver cancer incidence and deaths (3). Furthermore, an increase in cancer incidence is expected in the Arab region based on the gradual transition projected between 2000 and 2050 toward an aging population due to reduced fertility and increased life expectancy (13, 14). While the Middle East and Northern Africa (MENA region) is a geopolitical classification, it is mainly composed of Arab countries and shares cultural, economic, and environmental similarities. Arab countries in the MENA region may also share ethnic and genetic heritages. Nevertheless, there has been little effort in interrogating cancer trends and incidences in Arab countries. Such regional population-based information would be instrumental in focusing efforts to decrease cancer burden through systematic implementation of evidence-based interventions for prevention, early diagnosis, and treatment. In this study, we provide a comprehensive analysis of the estimated pattern of cancer incidence and mortality in 2018 in Arab countries using data from the Global Cancer Observatory (GCO) hosted by the International Agency for Research on Cancer (IARC).

Materials and Methods

The global cancer statistics for 2018 from GLOBOCAN 2018 (1, 2) was interrogated for the estimates of incidence and mortality in Arab countries. Data were accessed through the interactive web-based platform, GCO, hosted by the IARC (https://gco.iarc.fr/today). Age-standardized incidence and mortality rates (per 100,000 population), ASIR and ASMR, respectively, are reported in this study and compared between Arab countries, the worldwide rates, and the rates in the United States and Europe. All plots were generated in GraphPad Prism, version 9.4 (GraphPad Software).

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Data sources for Arab countries in GLOBOCAN

GLOBOCAN estimates were based on observed rates and other sources for different Arab countries, that were subjected to the different methods developed by GLOBOCAN (2) as described below.

GLOBOCAN Method 1 using observed rates over 10 years from population-based national cancer registries of six Arab countries:

- Bahrain Cancer Registry 2003–2012 data
- Kuwait Cancer Registry 2003–2012 data
- Oman Cancer Registry 2003–2012 data
- Saudi Arabia Cancer Registry 2003–2012 data
- Jordan Cancer Registry 2003–2012 data
- Lebanon Cancer Registry 2007–2016 data

GLOBOCAN Method 2a or 2b using observed rates over less than 10 years were from national cancer registry data of four Arab countries or from local/regional registries of five other Arab countries:

- Qatar Cancer Registry 2008–2012 data
- Sudan Cancer Registry 2009–2013 data
- United Arab Emirates (UAE) Cancer Registry 2013–2015 data
- Iraq Cancer Registry 2018 data
- Morocco: Casablanca Cancer Registry and Rabat Cancer Registry 2008–2012 data
- Tunisia: Sousse Cancer Registry 2003–2007 data and North Tunisia Cancer Registry 2008–2010 data
- Algeria: Algiers Cancer Registry 2008–2012 data, Annaba Cancer Registry 2008–2010 data, Batna Cancer Registry 2008–2012 data, Sétif Cancer Registry 2008–2012 data, Sidi-Bel-Abbès Cancer Registry 2010–2012 data, Tizi Ouzou Cancer Registry 2015–2016 data, Tlemcen Cancer Registry 2012–2014 data
- Egypt: Aswan Cancer Registry 2009–2010 data, Damietta Cancer Registry 2009–2012 data, and El-Minia Cancer Registry 2009 data

GLOBOCAN Method 9 using observed rates from neighboring countries for four Arab countries:

- Somalia: Average of Ethiopia and Kenya rates
- Syria: Average of Iraq, Jordan, and Lebanon rates
- Mauritania: Rates from Western Africa
- Palestine: Average for Arabs from the Israel National Cancer Registry 2008–2012 data and from the Jordan Cancer Registry 2008–2012 data

Data availability

The data generated in this study are available within the article and its supplementary data files. The raw data for incidence and mortality age-adjusted standardized for all ages and different age groups in females and males for each Arab country, subregions of Arab countries, the world, the United States and Europe are shown in Supplementary Table S1. These data were extracted from the GLOBOCAN 2018 database. The large data in Supplementary Table S1 were organized to generate Supplementary Table S2, which can be queried by users to select and visualize the data of interest.

Results

Overall cancer trends in Arab countries

The age-adjusted rate for incidence (ASIR) of all cancers in 2018 in both sexes at all ages in Arab countries in the MENA region (MENA-Arab) was lower than the global ASIR; 131.9 versus 197.9 per 100,000 people, respectively (Supplementary Fig. S1A; Supplementary Tables S1 and S2). Similarly, the age-adjusted rate for mortality (ASMR) was lower than the global ASMR; 83.5 versus 101.1 per 100,000 people (Supplementary Fig. S1A). The mortality-to-incidence ratio (MIR) in 2018 for all cancers in both sexes in most Arab countries was higher compared with the global MIR (Supplementary Fig. S1B). It should be noted that MIR is not a proxy of relative cancer survival (15); however, it allows comparisons across countries and regions for mortality rates in relevance to incidence. The top 15 cancers diagnosed in Arab countries were similar to the global trends but differed in their distribution and their contribution to mortality (Supplementary Fig. S1C).

Cancer incidence and mortality in Arab countries remained lower than the worldwide rates when separating the data for females and males, but the MIR was higher than the world MIR for most cancer sites (**Fig. 1**). The ASIR of non-Hodgkin's lymphoma (NHL) and Hodgkin lymphoma, bladder, breast, and liver cancers were higher than the world rates. As shown in **Fig. 2**, the incidence of these five cancers varied across the Arab countries, but some subregional trends emerged. The higher ASIR of breast cancer was driven by the Levant region (Lebanon, Syria, Jordan, and Palestine). Bladder cancer ASIR was higher than the world age-standardized rate (ASR) for incidence in females in Lebanon, Syria, Egypt, and Iraq. In males, while the Levant region, Egypt, Tunisia, Libya, and Algeria had higher ASIR for bladder cancer than the world, the Arabian Gulf countries apart from Iraq (Saudi Arabia, Qatar, Kuwait, Oman, UAE, and Bahrain) had similar or lower ASIR.

For females and males in Egypt and Mauritania, the incidence of liver cancer was higher than the ASIR in the United States, Europe, and the world (**Fig. 2**). For NHL in females and males, Northern African Arab countries except Egypt had lower ASIR than the world rate, while the Levant region and half of the Arabian Gulf countries had higher rates. The ASIR of Hodgkin lymphoma in females and males was higher than the world ASIR in most Arab countries. The five cancers with higher ASIR in Arab countries had higher MIR than the worldwide MIR (Supplementary Fig. S2).

Leading incident cancers in females in Arab countries

The top ten leading cancer sites in females in 2018 for all ages varied across the different Arab countries thus, the top 13 cancers were investigated (Supplementary Fig. S3A). The ASIR for all cancers in females was lower than the world ASIR except for Lebanon. Despite some variations, the MIR for the top 13 cancers in females was generally higher in the Arab region compared with the world MIR (Supplementary Fig. S3B). Leading incident cancers in female Arabs included liver cancer in Egypt and Mauritania, lung cancer in the Levant, cervical cancer in Northern African Arab countries excluding Egypt, endometrial cancer (corpus uteri) in the Arabian Gulf and the Levant, breast and colorectal cancer in the Levant, and brain cancer in Iraq, Egypt, and the Levant.

Leading incident cancers in males in Arab countries

Like in females, the top ten leading cancer in males for all ages varied across different Arab countries and the top 13 cancers were investigated to represent all countries (Supplementary Fig. S3C). Apart from Lebanon, the incidence for all cancers in males in 2018 for the rest of Arab countries was lower than the world rate. Like in females, the Arab region had a higher MIR compared with the worldwide MIR (Supplementary Fig. S3D). Leading incident cancers in male Arabs included Egypt, lung cancer in the Levant, brain cancer in the Levant, Iraq and Egypt, colorectal cancer in the Levant and the Arabian Gulf, bladder cancer in the Levant, parts of Northern Africa, and Iraq, and prostate cancer in the Levant and Northern African countries.

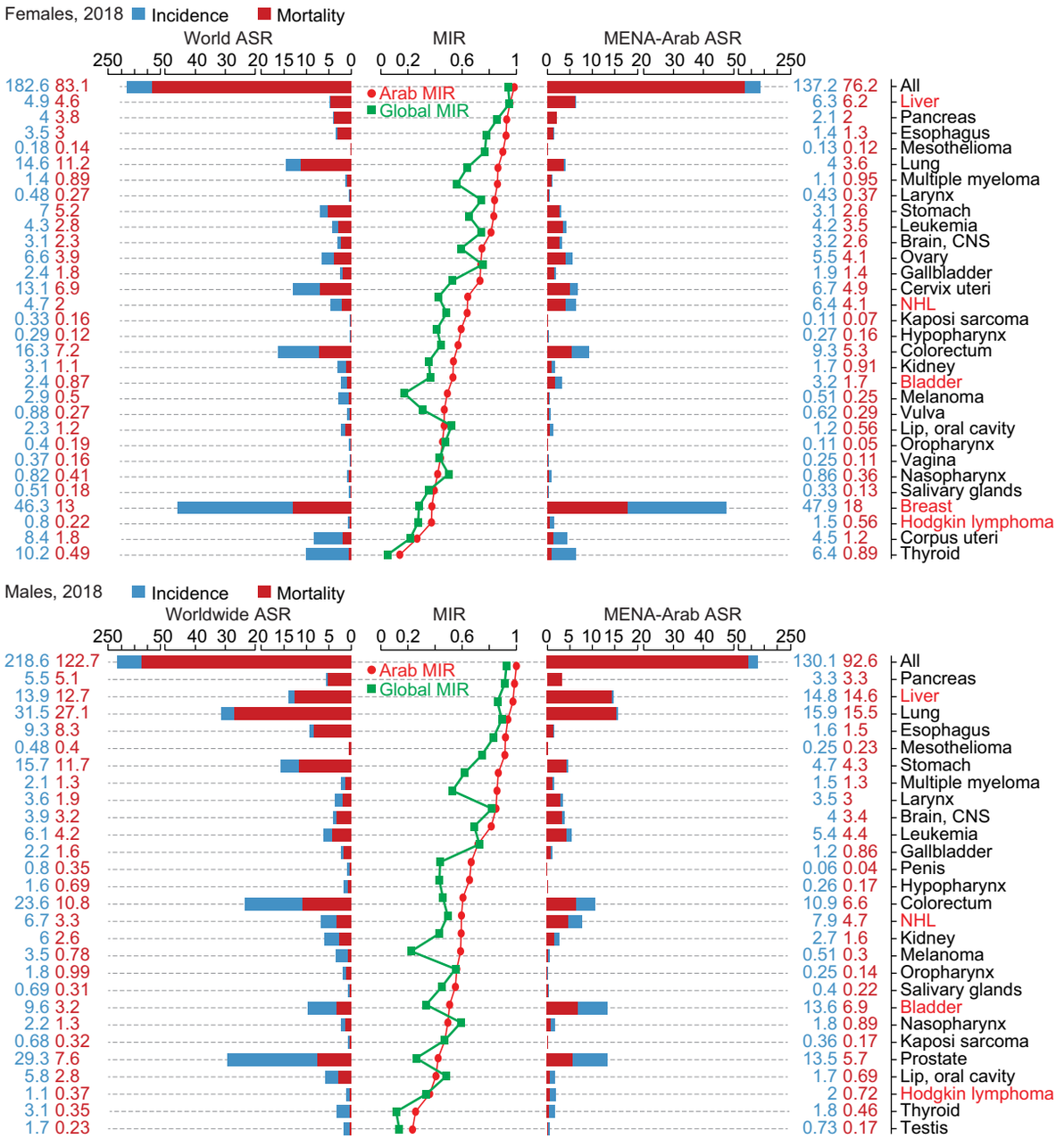

Figure 1.

Cancer incidence, mortality, and mortality-to-incidence ratio in the Arab region. The MENA-Arab and worldwide ASR for incidence (blue) and mortality (red) for all cancers and each cancer site for all ages in 2018 for females (top) and males (bottom) are shown. The ASR values for incidence and mortality are shown in blue and red, respectively. Cancer sites are ranked according to the mortality-to-incidence ratio (MIR) shown in the middle line graphs; MENA-Arab MIR in red and worldwide MIR in green. Note: Djibouti, Comoros and Yemen were not included due to missing data.

Subregional trends within the Arab countries in females and males

The country-specific analyses above suggest that Arab countries may be divided into subregions; the Levant, Iraq, the rest of Arabian Gulf countries (Qatar, Oman, Bahrain, Kuwait, Saudi Arabia, and UAE), Egypt, and the rest of the Northern African countries (Sudan, Libya, Algeria, Tunisia, Morocco, Mauritania, and Somalia). To this end, these Arab subregions were analyzed for the top 10 leading incident cancers and the top 10 leading causes of cancer-related deaths in 2018 (Supplementary Fig. S4). The contribution of cancer types to the total diagnoses varied across the subregions for females and males, suggestion unique genetic, environmental, and/or lifestyle differences. Similarly, the contribution of cancer types to cancer-related deaths also varied across the subregions, which may

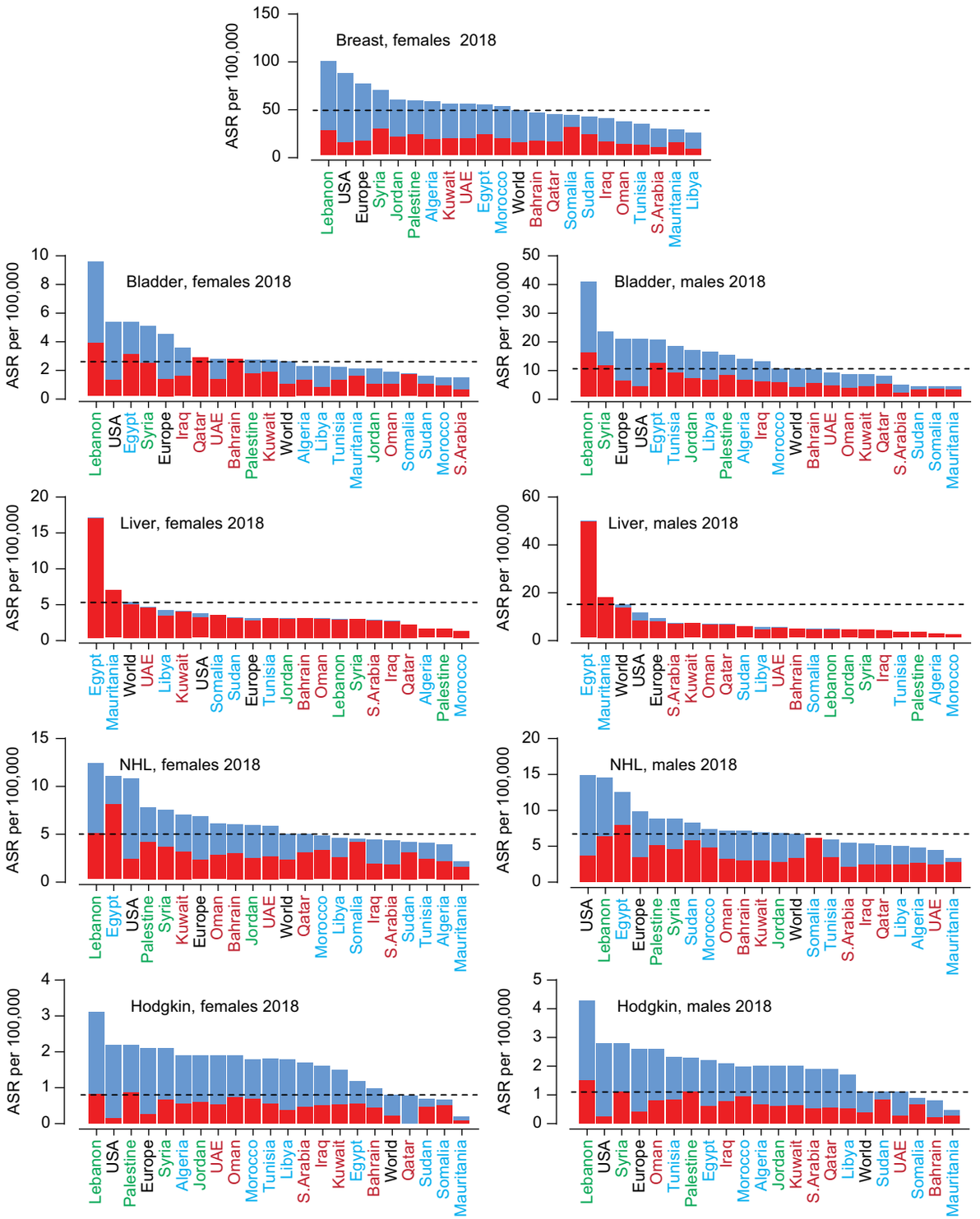

Figure 2.

Incidence and mortality rates of five cancers with higher incidence in the Arab region compared with the worldwide incidence. ASR for incidence (blue) and mortality (red) for Arab countries, United States, Europe, and the world for all ages. The dotted lines mark the world ASR for incidence. Arab countries are labeled as those in the Arabian Gulf (maroon), the Levant (green), and North Africa (blue).

reflect differences in the subtypes diagnosed and/or patient management.

Age-specific incidence of blood cancers

The incidence of blood cancers in many Arab countries was higher than the global rate, particularly at younger age (Supplementary Fig. S5). The incidence of Hodgkin lymphoma in children (**Fig. 3A**) and adults (35 years and older, Supplementary Fig. S5) was higher than the world ASIR in most Arab countries for both females and males. The ASIR of NHL (**Fig. 3B**) in children under 15 years of age particularly in females and in Northern African Arab countries was higher than the world rate. In older Arab females and males, the ASIR for NHL in approximately half of the Arab countries was higher than the world ASIR (Supplementary Fig. S5). The incidence of leukemia in children under 15 years in the Arabian Gulf, Syria, and Lebanon was higher than the world ASIR (**Fig. 3C**). Leukemia in adults (35 years and older) in the Levant had higher incidence than the world rate (Supplementary Fig. S5). Multiple myeloma ASIR in 20- to 54-year-old females and males in more than 50% of Arab countries was higher than the world ASIR (Supplementary Fig. S5).

Age-specific incidence of smoking-related cancers

The incidence of lung cancer in females was lower than the worldwide ASIR in all Arab countries at all ages (Supplementary Fig. S5), except for 20- to 54-year-old females in Lebanon (**Fig. 4A**). In 20- to 54-year-old males, the ASIR for lung cancer in Syria, Jordan, Lebanon, Libya, Tunisia, and Morocco was higher than the world rate (**Fig. 4A**). In line with lung cancer in these countries, the incidence of laryngeal cancer in the 30–54 age group in the Levant for both females and males, and in Libya, Tunisia, and Morocco for males was higher than the world ASIR (**Fig. 4B**). When considering bladder cancer (**Fig. 4C**), the higher incidence in Syria, Lebanon, Jordan, and Iraq in females and in males in 12 out of 19 Arab countries for 20–54 years old compared with the world ASIR is also in line with the higher incidence of lung and laryngeal cancers in these countries. These patterns suggest tobacco-related causes. Higher bladder cancer incidence in 55- to 69-year-old females in several Arabian Gulf countries, and in the 20–54 age group in Mauritania for females, Sudan for males, and Egypt for females and males (Supplementary Fig. S5) were at odds with the lower incidence of lung and laryngeal cancers, suggesting other factors such as exposure to chemicals other than tobacco smoke.

The ASIR for colorectal cancer in 15–34 years old females and males (**Fig. 4D**) was higher than the world ASIR in several Northern African Arab countries, Saudi Arabia, Oman, and Iraq. The higher incidence of colorectal cancer at young age (**Fig. 4D**) and the lower incidence at older age (55 years and older, Supplementary Fig. S5) in Arabs may be because of hereditary factors or reflecting a generational change in diet rather than tobacco or alcohol consumption.

Age-specific incidence of sex-specific cancers

Cervical cancer had an alarming ASIR in 55–69 years old females in four Northern African Arab countries; Libya, Morocco, Somalia, and Mauritania (**Fig. 5A**). The incidence in Morocco, Somalia, and Mauritania was higher than the world rate in females between 35 and 54 years of age (Supplementary Fig. S5). These trends implicate human papillomavirus (HPV) infections, which is supported by the high ASIR in Northern African Arab countries for vaginal cancer in females, and oropharyngeal, nasopharyngeal, and esophageal cancers in both females and males (Supplementary Fig. S5). Endometrial cancer ASIR in the Levant countries, UAE, Saudi Arabia, and Kuwait was higher

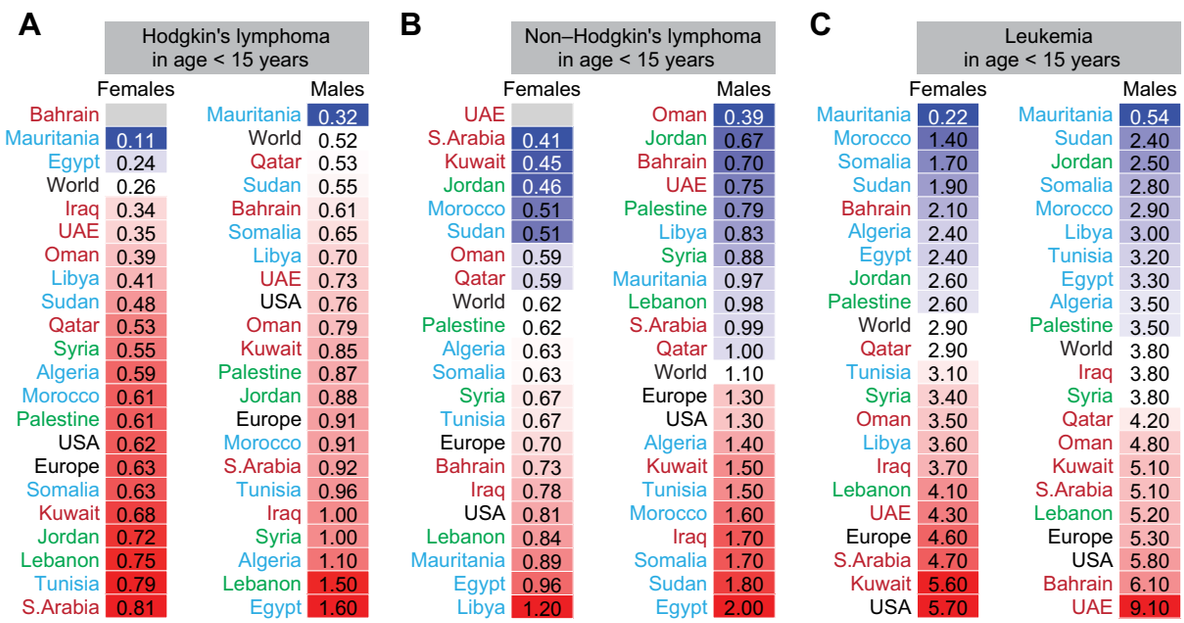

Figure 3.

Age-specific incidence of blood cancers in Arab countries. ASR for incidence for Hodgkin lymphoma (**A**), non-Hodgkin's lymphoma (**B**), and leukemia in females and males (**C**). Arab countries are labeled as those in the Arabian Gulf (maroon), the Levant (green), and North Africa (blue). The ASR for the world, United States, and Europe are in black font. ASR for specific age groups is shown; for all age groups and for multiple myeloma refer to Supplementary Fig. S5.

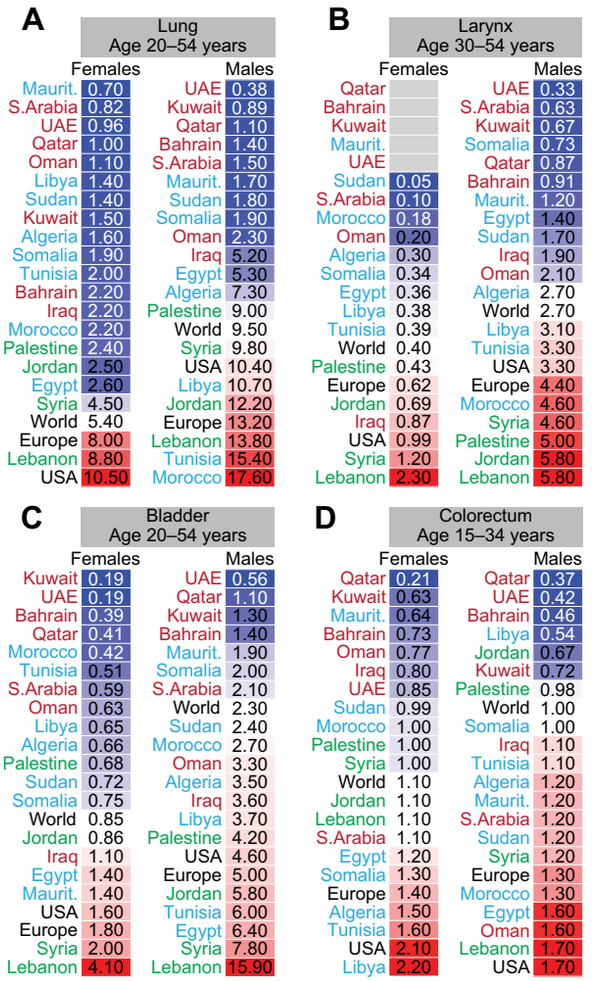

Figure 4.

Age-specific incidence of smoking-related cancers in Arab countries. ASR for incidence for cancers of the lung (**A**), larynx (**B**), bladder (**C**), and colorectum (**D**) in females and males. Arab countries are labeled as those in the Arabian Gulf (maroon), the Levant (green), and North Africa (blue). The ASR for the world, United States, and Europe are in black font. ASR for specific age groups is shown; for all age groups refer to Supplementary Fig. S5.

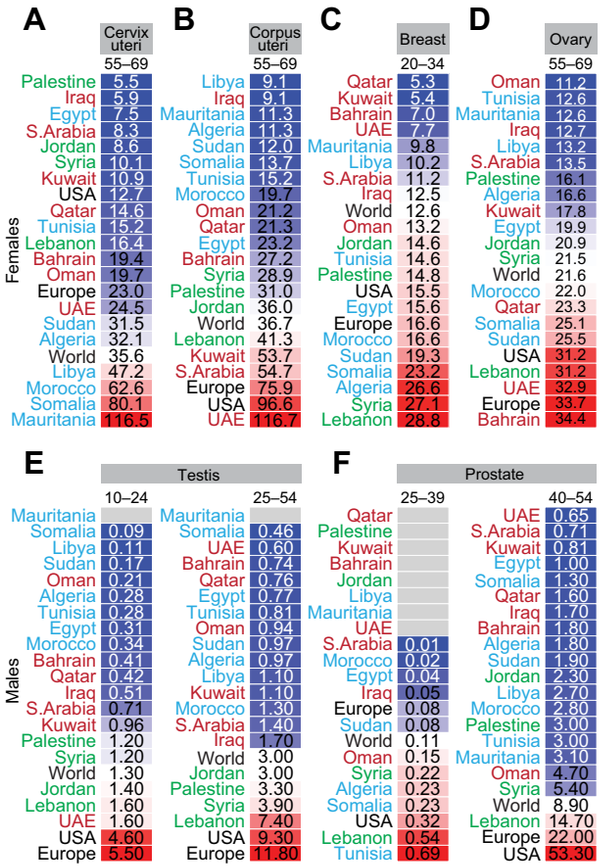

Figure 5.

Age-specific incidence of sex-specific cancers in Arab countries. ASR for incidence for sex-specific cancers in females (top) in the cervix uteri (**A**), corpus uteri (**B**), breast (**C**), and ovary (**D**), and in males (bottom) in the testis (**E**) and prostate (**F**). Arab countries are labeled as those in the Arabian Gulf (maroon), the Levant (green), and North Africa (blue). The ASR for the world, United States, and Europe are in black font. ASR for specific age groups is shown; for all age groups and for other sex-specific cancers refer to Supplementary Fig. S5.

than Arab countries in Northern Africa at all ages (Supplementary Fig. S5) and exceeded the world rate in females 55 years and older (**Fig. 5B**).

The ASIR for breast cancer in 20- to 34-year-old females (**Fig. 5C**) and 35- to 49-year-old females (Supplementary Fig. S5) was higher than the world ASIR in 11 of 19 Arab countries mainly in the Levant and Northern African Arab countries. The incidence of ovarian cancer in females under 55 years was lower in most Arab countries (17 of 19) than the world ASIR (Supplementary Fig. S5), but higher than the world ASIR in some Arab countries in 55- to 69-year-old females (**Fig. 5D**). Testicular cancer ASIR was generally lower in Arab countries compared with the world rate, but young adults in the Levant had higher incidence than the world ASIR (**Fig. 5E**). In men under 40 years, six Arab countries (Oman, Syria, Algeria, Somalia, Lebanon, and Tunisia) had higher incidence of prostate cancer than the world, and the ASIR in Lebanon and Tunisia exceeded the ASIR in the United States (**Fig. 5F**). In contrast, only Lebanon had higher ASIR for prostate cancer in 40- to 54-year-old men (**Fig. 5F**), and only Lebanon and Kuwait had higher ASIR for prostate cancer in men aged 55 years and older (Supplementary Fig. S5).

Age-specific incidence of other solid cancers

The incidence of pancreatic cancer in the 35- to 49-year age group was higher than the world ASIR for females in the Levant, Morocco, Sudan, Egypt, Somalia, and Libya, and for males in the Levant, Tunisia, Egypt, and Libya (**Fig. 6A**). The incidence of brain cancer (**Fig. 6B**) in Arab children under 15 years was similar or higher than the world ASIR in 13 and 15 of the 19 Arab countries for females and males, respectively. Higher ASIR for brain cancer in the Levant, Iraq, Tunisia, Algeria, and Egypt was also observed in the 15–29 years and 30–54 years groups (Supplementary Fig. S5). The incidence of thyroid cancer in females 5–19 (**Fig. 6C**) and 20–39 (Supplementary Fig. S5) years old in Saudi Arabia, Kuwait, UAE, Oman, Syria, Jordan, and Lebanon was higher than the world ASIR, whereas for males in these

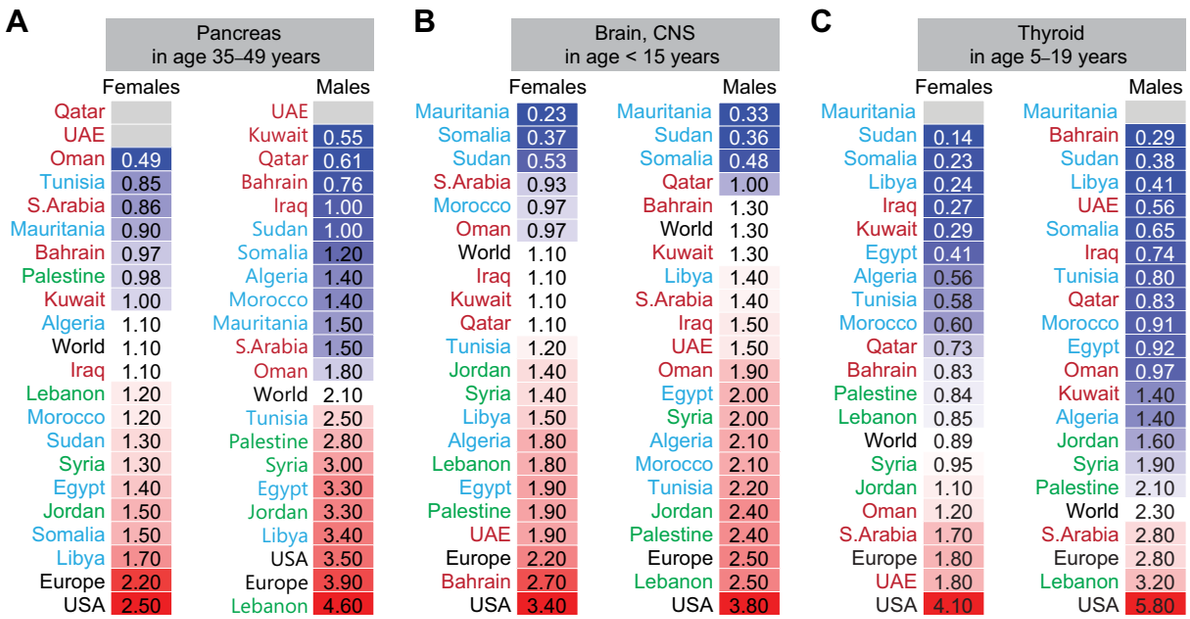

Figure 6.

Age-specific incidence of other solid cancers in Arab countries. ASR for incidence for cancers of the pancreas (**A**), brain, central nervous system (CNS; **B**), and thyroid (**C**) in females and males. Arab countries are labeled as those in the Arabian Gulf (maroon), the Levant (green), and North Africa (blue). The worldwide ASR is marked with bold font, United States, and Europe in black font. ASR for specific age groups is shown; for all age groups and other cancer sites refer to Supplementary Fig. S5.

age groups had higher ASIR than the world ASIR only in Saudi Arabia and Lebanon. Thyroid cancer ASIR for over 39 years of age for males in Saudi Arabia, Oman, UAE, Kuwait, Bahrain, Sudan, and Lebanon, and for females in Saudi Arabia, Kuwait, UAE, Lebanon, Jordan, Palestine, Morocco, and Libya was higher than the world ASIR (Supplementary Fig. S5).

Discussion

The 2018 age-standardized incidence and mortality rates for all cancers combined and at the organ-specific level in both sexes in Arab countries were lower than the global rates except for the higher incidence of Hodgkin, NHL and cancers of the bladder, liver, and breast. The generational and demographical structure in Arab countries cannot be ignored as a factor behind the lower cancer incidence. Older Arabs (55–75 years and older) diagnosed with cancer in 2018 were born between 1943 and 1963 and had a different lifestyle and less affected by modernization and industrialization. Recently, modern lifestyles in the Arab region have started to impact obesity, including childhood obesity, especially in the Arabian Gulf area (16). The transition to western lifestyles in the Arab region may change the profile of cancer incidence in the future. Furthermore, the Arab region showed a delayed decline in infertility compared to the rest of the world, and it is projected that by 2050 there will be several folds increase in the proportion of the population aged above 65 years old (13).

Cancer incidence in Arab countries in 2018 revealed clear trends such as in Northern African Arab countries with high incidence of HPV-related cancers (cervical, vaginal, oropharyngeal, nasopharyngeal, and esophageal cancers), and liver cancer that can be attributed to the high prevalence of the human oncogenic viruses hepatitis B or C virus (HBV or HCV; refs. 17–19). The high prevalence of HCV in Northern Africa may also relate to the higher incidence of NHL in children under 15 years of age in several Northern African Arab countries in 2018. In support, HCV infection has been shown to increase the risk by 14-fold for developing NHL in Egyptian patients (20). HPV and HBV vaccination and treating hepatitis chronic inflammation to avoid liver scarring (cirrhosis), are obvious approaches to reduce the burden of these virus-related cancers. Modeling analysis predicts that high-coverage girls-only HPV vaccination with once or twice lifetime screening can eliminate cervical cancer in low income and lower-middle-income countries including North Africa and the Middle East (21).

Most Arab countries showed higher ASIR in 2018 than the worldwide incidence of Hodgkin's lymphoma in children and adults of both sexes. Although Epstein–Barr virus (EBV) has been suspected to increase the incidence of Hodgkin's lymphoma in developing countries, the percentages of EBV positivity in Hodgkin's lymphoma in several Arab countries such as Saudi Arabia (22), Jordan (23), UAE (24), Tunisia (25), and Syria (26) are not higher than the 40% to 50% rate detected in Western countries (27). While exposure to EBV, particularly in children under 15 years of age, cannot be excluded as a main factor, genetic susceptibility to this type of lymphoma should be considered in countries where EBV infection may not be the major driver as noted in the study from the Saudi Arabia population with high consanguinity (22).

The low incidence of lung, laryngeal, and bladder cancers in females from most Arab countries is in line with their lower prevalence of tobacco use. The maximum age-standardized prevalence estimates of tobacco use in females in year 2000 and year 2018 was 10.1% and 12.6%, respectively, in all Arab countries except for Lebanon which ranked 8th out of the 164 countries listed in the WHO's tobacco use

prevalence estimates (29.4% in 2018; ref. 28) and had high ASIR for smoking-related cancer in females. Lung, laryngeal, and bladder cancers had high incidence in 2018 in males in countries with high prevalence tobacco use including Lebanon (tobacco use prevalence 47.3% in 2018), Jordan (55.6% in 2018), Tunisia (48.7% in 2018), and Morocco (29.4% in 2018; ref. 28).

Several Arab countries showed lower than the world's ASIR for lung and laryngeal cancers in 2018 but presented higher ASIR for bladder and/or colorectal cancers suggesting other causes than tobacco use. Unfortunately, there are insufficient studies investigating the genetics and mutational profiles in Arab countries to understand the epidemiology of bladder cancer. Environmental exposures cannot be excluded in bladder cancer, for example contamination of drinking water with halogenated chemical species has contributed to 8.6% of bladder cancer cases in Lebanon (29). The increasing trend in colorectal cancer in young Arab adults (below 50 years old; refs. 30–32) may be driven by the rapid environmental, lifestyle and industrialization changes in the last two decades. The average prevalence of obesity has drastically increased in Arab countries in the past three decades (6.5% in 1975 to 20% in 2016) which has been associated with unique genetic polymorphism in Arabs (33). This increase in obesity might explain the increase of colorectal cancer in younger Arabs given the association of diabetes with higher risk for colorectal cancer (34), including younger women (35).

It has been reported that between 1950 and 2008 the average age at diagnosis of breast cancer in 11 Arab countries (Egypt, Jordan, United Arab Emirates, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Sudan, Tunisia, and Yemen) was a decade earlier than in Western countries (36). Most Arab countries showed higher than the world's ASIR for breast cancer in females under 50 years of age, and Arab countries in the Levant region and Northern Africa had higher incidence for breast cancer in females under the age of 35 years than the world's ASIR. While other factors such as reproductive history, taking hormones, and alcohol consumption may increase the risk for breast cancer in young women (37), genetic hereditary may be the main factor (38). This is supported by the higher ASIR for cancers associated with *BRCA* mutations at younger age, including pancreatic (under 50 years of age), gastric (under 40 years), and prostate cancers (under 40 years), in Arab countries with higher breast cancer ASIR. Several studies on Arabs reported high number of mutations and novel pathogenic mutations in *BRCA1* and *BRCA2* genes in patients with breast cancer (39–45). A meta-analysis of reported prevalence of *BRCA* mutations in Arab countries demonstrated that one in five patients with hereditary breast and/or ovarian cancer are likely to carry *BRCA* mutations, and the Levant region showed higher prevalence of *BRCA* mutations compared with other Arab countries; however, this meta-analysis had high heterogeneity (46) and there is a need for better genetic epidemiology studies in Arabs. A study from Qatar points to another limitation in our study regarding the genetic risk for certain cancers, such as breast, ovarian, and colorectal cancers because Arabic-speaking countries span across two continents with different ethnic compositions across and possibly within these countries. Whole-genome sequencing of the Qatar Genome Programme cohort consisting of 6,000 individuals across six ancestry groups in Qatar found that 56.4% of the identified *BRCA1/BRCA2* variant carriers were in Qataris of Persian origin, and those pathogenic variants were completely absent in Qataris of Arabian Peninsula origin (47). Other limitations in our study include the variation across the MENA region, including Arab countries, in terms of the human development index (HDI), which are associated with different types of cancers at varying magnitudes, and that high-quality cancer registry data are not available for all countries analyzed in GLOBOCAN (1, 2). Nonetheless, it should be noted that the data sources for Arab countries (detailed in the Materials and Methods section) were mainly from population-based national or local cancer registries with similar quality of the overall GLOBOCAN data sources.

Our study of the estimated cancer incidence and mortality rates in Arab countries for 2018 from the GLOBOCAN provides a baseline for future analyses of the next releases of the GLOBOCAN estimates to follow trends over time. We also shed some light on risk factors that may associate with cancers in the Arab countries, particularly based on the analysis of age-standardized rates across different age groups which emphasized the need for more well-designed genetic epidemiologic studies. In addition to the abovementioned ethnic diversities across and within Arab countries, consanguineous marriages which accounts for 35%–50% of marriages in Arab countries (48–50) further underlines the importance of genetic epidemiology studies for the region. In conclusion, much effort is required to identify the genetic and mutational landscapes of the Arab population to better understand genetic risks for cancer and to guide cancer management for reducing cancer burden in this region.

Authors' Disclosures

No disclosures were reported.

Authors' Contributions

M. Al-Muftah: Conceptualization, resources, data curation, formal analysis, investigation, visualization, methodology, writing–original draft, writing–review and editing. **F. Al-Ejeh:** Conceptualization, resources, data curation, formal analysis, supervision, funding acquisition, investigation, visualization, methodology, writing–original draft, project administration, writing–review and editing.

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Note

Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (http://cebp.aacrjournals.org/).

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