

Cancer incidence and mortality estimates in Arab countries in 2018: A GLOBOCAN data analysis

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Running Title: Cancer Incidence and Mortality in Arabs in 2018

The authors declare no potential conflicts of interest.

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 to 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 sub-regions of Arab countries (the Levant, Arabian Gulf and Arab African sub-regions), 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 anti-viral 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 non-melanoma skin cancer) and 9.6 million cancer 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 3 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 USA (333.29 million) and the EU (447.96 million) (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 towards an aging population due to reduced fertility and increased life expectancy (13,14). While the Middle East and Northern Africa (MENA region) is a geo-political 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, Global Cancer Observatory (GCO), hosted by the International Agency for Research on Cancer (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 of America (USA) and Europe. All plots were generated in GraphPad Prism, version 9.4 (GraphPad Software, CA, USA).

Data sources for Arab countries in GLOBOCAN

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

GLOBOAN Method 1 using observed rates over 10 years from population-based national cancer registries of 6 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 4 Arab countries or from local/regional registries of 5 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,

- 100 Sidi-Bel-Abbès Cancer Registry 2010-2012 data, Tizi Ouzou Cancer Registry 2015-
101 2016 data, Tlemcen Cancer Registry 2012-2014 data
102 • **Egypt:** Aswan Cancer Registry 2009-2010 data, Damietta Cancer Registry 2009-2012
103 data, and El-Minia Cancer Registry 2009 data

104 **GLOBOCAN Method 9** using observed rates from neighboring countries for 4 Arab countries:

- 105 • **Somalia:** Average of Ethiopia and Kenya rates
106 • **Syria:** Average of Iraq, Jordan, and Lebanon rates
107 • **Mauritania:** Rates from Western Africa
108 • **Palestine:** Average for Arabs from the Israel National Cancer Registry 2008-2012 data
109 and from the Jordan Cancer Registry 2008-2012 data

110 **Data Availability**

111 The data generated in this study are available within the article and its supplementary data files.
112 The raw data for incidence and mortality age-adjusted standardized for all ages and different
113 age groups in females and males for each Arab country, subregions of Arab countries, the world,
114 the USA and Europe are shown in **Table S1**. This data was extracted from the GLOBOCAN
115 2018 database. The large data in **Table S1** was organized to generate **Table S2** which can be
116 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 vs. 197.9 per 100,000 people, respectively (**Figure S1a, Table S1 and Table S2**). Similarly, the age-adjusted rate for mortality (ASMR) was lower than the global ASMR; 83.5 vs. 101.1 per 100,000 people (**Figure S1a**). The mortality-to-incidence ratio (MIR) in 2018 for all cancers in both sexes in most Arab countries was higher compared to the global MIR (**Figure 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 (**Figure 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 (**Figure 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 **Figure 2**, the incidence of these five cancers varied across the Arab countries, but some sub-regional 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 USA, Europe, and the world (**Figure 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 (**Figure 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 (**Figure 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 thirteen cancers in females was generally higher in the Arab region compared to the world MIR (**Figure 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 (**Figure 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 to the worldwide MIR (**Figure 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.

Sub-regional 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 deaths in 2018 (**Figure 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 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 (**Figure S5**). The incidence of Hodgkin lymphoma in children (**Figure 3a**) and adults (35 years and older, **Figure S5**) was higher than the world ASIR in most Arab countries for both females and males. The ASIR of non-Hodgkin's lymphoma (NHL, **Figure 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 (**Figure S5**). The incidence of leukemia in children under 15 years in the Arabian Gulf, Syria and Lebanon was higher than the world ASIR (**Figure 3c**). Leukemia in adults (35 years and older) in the Levant had higher incidence than the world rate (**Figure S5**). Multiple myeloma ASIR in 20-

54 years old females and males in more than 50% of Arab countries was higher than the world ASIR (**Figure 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 (**Figure S5**), except for 20-54 years old females in Lebanon (**Figure 4a**). In 20-54 years old males, the ASIR for lung cancer in Syria, Jordan, Lebanon, Libya, Tunisia, and Morocco was higher than the world rate (**Figure 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 (**Figure 4b**). When considering bladder cancer (**Figure 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 to 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 55-69 years 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 (**Figure 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 (**Figure 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 (**Figure 4d**) and the lower incidence at older age (55 years and older, **Figure S5**) in Arabs may be due to 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 (**Figure 5a**). The incidence in Morocco, Somalia and Mauritania was higher than the world rate in females between 35-54 years of age (**Figure 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 (**Figure S5**). Endometrial cancer ASIR in the Levant countries, UAE, Saudi Arabia, and Kuwait was higher than Arab countries in Northern Africa at all ages (**Figure S5**) and exceeded the world rate in females 55 years and older (**Figure 5b**).

The ASIR for breast cancer in 20-34 years old females (**Figure 5c**) and 35-49 years old females (**Figure S5**) was higher than the world ASIR in 11 out 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 out of 19) than the world ASIR (**Figure S5**), but higher than the world ASIR in some Arab countries in 55-69 years old females (**Figure 5d**). Testicular cancer ASIR was generally lower in Arab countries compared to the world rate, but young adults in the Levant had higher incidence than the world ASIR (**Figure 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 USA (**Figure 5f**). In contrast, only Lebanon had higher ASIR for prostate cancer in 40-54 years old men (**Figure 5f**), and only Lebanon and Kuwait had higher ASIR for prostate cancer in men aged 55 years and older (**Figure S5**).

Age-specific incidence of other solid cancers

The incidence of pancreatic cancer in the 35-49 years 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 (**Figure 6a**). The incidence of brain cancer (**Figure 6b**) in Arab children under 15 years was similar or higher than the world ASIR in 13 and 15 out 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 (**Figure S5**). The incidence of thyroid cancer in females 5-19 (**Figure 6c**) and 20-39 (**Figure S5**) years old in Saudi Arabia, Kuwait, UAE, Oman, Syria, Jordan, and Lebanon was higher than the world ASIR, whereas for males in these 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 (**Figure 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 and non-Hodgkin's lymphomas 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 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 which can be attributed to the high prevalence of the human oncogenic viruses hepatitis B or C virus (HBV or HCV) (17-19). The high prevalence of HCV in Northern Africa may also relate to the higher incidence of non-Hodgkin lymphoma 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 non-Hodgkin's lymphoma 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. Modelling 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) (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) (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) (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 breast cancer patients (39-45). A meta-analysis of reported prevalence of *BRCA* mutations in Arab countries demonstrated that one in five hereditary breast and/or ovarian cancer patients are likely to carry *BRCA* mutations, and the Levant region showed higher prevalence of *BRCA* mutations compared to 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 since 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 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

343 mutational landscapes of the Arab population to better understand genetic risks for cancer and
344 to guide cancer management for reducing cancer burden in this region.

Acknowledgments

This work was supported by QBRI's Intramural Grant Program, Cycle 5 (IGP5) funding. All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Fares Al-Ejeh and Mariam Al-Muftah. All authors read and approved the final manuscript.

- 351 1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer
352 statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36
353 cancers in 185 countries. *CA Cancer J Clin* **2018**;68(6):394-424 doi
354 10.3322/caac.21492.
- 355 2. Ferlay J, Colombet M, Soerjomataram I, Mathers C, Parkin DM, Pineros M, *et al.*
356 Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and
357 methods. *Int J Cancer* **2019**;144(8):1941-53 doi 10.1002/ijc.31937.
- 358 3. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, *et al.* Global
359 Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide
360 for 36 Cancers in 185 Countries. *CA Cancer J Clin* **2021**;71(3):209-49 doi
361 10.3322/caac.21660.
- 362 4. Arafa MA, Rabah DM, Farhat KH. Rising cancer rates in the Arab World: now is the
363 time for action. *East Mediterr Health J* **2020**;26(6):638-40 doi 10.26719/emhj.20.073.
- 364 5. Alqahtani WS, Almufareh NA, Domiaty DM, Albasher G, Alduwish MA, Alkhalaf H, *et al.*
365 Epidemiology of cancer in Saudi Arabia thru 2010-2019: a systematic review with
366 constrained meta-analysis. *AIMS Public Health* **2020**;7(3):679-96 doi
367 10.3934/publichealth.2020053.
- 368 6. Ibrahim AS, Khaled HM, Mikhail NN, Baraka H, Kamel H. Cancer incidence in egypt:
369 results of the national population-based cancer registry program. *J Cancer Epidemiol*
370 **2014**;2014:437971 doi 10.1155/2014/437971.
- 371 7. Abdel-Razeq H, Attiga F, Mansour A. Cancer care in Jordan. *Hematol Oncol Stem Cell*
372 *Ther* **2015**;8(2):64-70 doi 10.1016/j.hemonc.2015.02.001.
- 373 8. Shamseddine A, Saleh A, Charafeddine M, Seoud M, Mukherji D, Temraz S, *et al.*
374 Cancer trends in Lebanon: a review of incidence rates for the period of 2003-2008 and
375 projections until 2018. *Popul Health Metr* **2014**;12(1):4 doi 10.1186/1478-7954-12-4.
- 376 9. Bray F, Laversanne M, Weiderpass E, Soerjomataram I. The ever-increasing
377 importance of cancer as a leading cause of premature death worldwide. *Cancer*
378 **2021**;127(16):3029-30 doi 10.1002/cncr.33587.
- 379 10. The World Bank. World Development Indicators, Population, total - Arab World (ARB).
380 <https://api.worldbank.org/v2/en/indicator/SP.POP.TOTL?downloadformat=excel>
381 .Updated on 29th June 2023.
- 382 11. Khachfe HH, Rahal Z, Sammour J, Kheil M, Baydoun H, Chatila D, *et al.* Cancer in
383 Lebanon: A Review of Incidence Rates from 2008 to 2015 and Projections Till 2025.
384 *South Asian J Cancer* **2020**;9(3):147-52 doi 10.1055/s-0040-1721291.
- 385 12. Saginala K, Barsouk A, Aluru JS, Rawla P, Padala SA, Barsouk A. Epidemiology of
386 Bladder Cancer. *Med Sci (Basel)* **2020**;8(1) doi 10.3390/medsci8010015.
- 387 13. Hajjar RR, Atli T, Al-Mandhari Z, Oudrhiri M, Balducci L, Silbermann M. Prevalence of
388 aging population in the Middle East and its implications on cancer incidence and care.
389 *Ann Oncol* **2013**;24 Suppl 7:vii11-24 doi 10.1093/annonc/mdt268.
- 390 14. Economic and Social Commission for Western Asia (ESCWA). Regional Profile of the
391 Arab Region Demographic of Ageing: Trends, Patterns, and Prospects into 2030 and
392 2050. 2017.
393 [https://archive.unescwa.org/sites/www.unescwa.org/files/page_attachments/demogra](https://archive.unescwa.org/sites/www.unescwa.org/files/page_attachments/demographics-ageing-arab-region-final-en_0.pdf)
394 [phics-ageing-arab-region-final-en_0.pdf](https://archive.unescwa.org/sites/www.unescwa.org/files/page_attachments/demographics-ageing-arab-region-final-en_0.pdf) p.
- 395 15. Ellis L, Belot A, Rachet B, Coleman MP. The Mortality-to-Incidence Ratio Is Not a Valid
396 Proxy for Cancer Survival. *J Glob Oncol* **2019**;5:1-9 doi 10.1200/JGO.19.00038.
- 397 16. Farrag NS, Cheskin LJ, Farag MK. A systematic review of childhood obesity in the
398 Middle East and North Africa (MENA) region: Prevalence and risk factors meta-
399 analysis. *Adv Pediatr Res* **2017**;4 doi 10.12715/apr.2017.4.8.
- 400 17. Daw MA. Chapter 3.2 - Hepatitis C in North Africa (Arabic Maghreb Region). In: Kamal
401 SM, editor. *Hepatitis C in Developing Countries: Academic Press*; 2018. p 57-70.

18. Daw MA, El-Bouzedi A, Ahmed MO, Dau AA, Agnan MM. Hepatitis C Virus in North Africa: An Emerging Threat. *ScientificWorldJournal* **2016**;2016:7370524 doi 10.1155/2016/7370524.
19. Madihi S, Syed H, Lazar F, Ziad A, Benani A. A Systematic Review of the Current Hepatitis B Viral Infection and Hepatocellular Carcinoma Situation in Mediterranean Countries. *BioMed Research International* **2020**;2020:7027169 doi 10.1155/2020/7027169.
20. Farawela H, Khorshied M, Shaheen I, Gouda H, Nasef A, Abulata N, *et al.* The association between hepatitis C virus infection, genetic polymorphisms of oxidative stress genes and B-cell non-Hodgkin's lymphoma risk in Egypt. *Infect Genet Evol* **2012**;12(6):1189-94 doi 10.1016/j.meegid.2012.04.007.
21. Brisson M, Kim JJ, Canfell K, Drolet M, Gingras G, Burger EA, *et al.* Impact of HPV vaccination and cervical screening on cervical cancer elimination: a comparative modelling analysis in 78 low-income and lower-middle-income countries. *Lancet* **2020**;395(10224):575-90 doi 10.1016/S0140-6736(20)30068-4.
22. Al-Kuraya K, Narayanappa R, Al-Dayel F, El-Solh H, Ezzat A, Ismail H, *et al.* Epstein-Barr virus infection is not the sole cause of high prevalence for Hodgkin's lymphoma in Saudi Arabia. *Leuk Lymphoma* **2006**;47(4):707-13 doi 10.1080/10428190500286879.
23. Sughayer MA, Haddad HA, Al-Yousef RM, El-Khateeb M, Abu-Rass H. Epstein-Barr virus and Hodgkin lymphoma in Jordan. *Hematol Oncol Stem Cell Ther* **2014**;7(2):85-9 doi 10.1016/j.hemonc.2013.12.002.
24. Al-Salam S, John A, Daoud S, Chong SM, Castella A. Expression of Epstein-Barr virus in Hodgkin lymphoma in a population of United Arab Emirates nationals. *Leuk Lymphoma* **2008**;49(9):1769-77 doi 10.1080/10428190802270894.
25. Dhiab MB, Ziadi S, Saad H, Louhichi T, Trimeche M. Changing patterns in the Epstein-Barr virus (EBV) and Hodgkin lymphoma association in Tunisia. *Ann Hematol* **2016**;95(9):1537-43 doi 10.1007/s00277-016-2737-4.
26. Habeeb R, Al Hafar L, Monem F. EBV Plasma Epstein-Barr Virus (EBV) DNA as a Biomarker for Diagnosis of EBV-positive Hodgkin Lymphoma in Syria. *J Infect Dev Ctries* **2021**;15(12):1917-22 doi 10.3855/jidc.14919.
27. Weiss LM. Epstein-Barr virus and Hodgkin's disease. *Curr Oncol Rep* **2000**;2(2):199-204 doi 10.1007/s11912-000-0094-9.
28. Global Health Observatory (GHO) data. Age-standardized estimates of current tobacco use, tobacco smoking and cigarette smoking (Tobacco control: Monitor). <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-tobacco-control-monitor-current-tobaccouse-tobaccosmoking-cigarrettesmoking-agestd-tobagestdcurr> . World Health Organization; 2022 update.
29. Temraz S, Haibe Y, Charafeddine M, Saifi O, Mukherji D, Shamseddine A. The unveiling of a new risk factor associated with bladder cancer in Lebanon. *BMC Urol* **2019**;19(1):16 doi 10.1186/s12894-019-0445-9.
30. Makhlof NA, Abdel-Gawad M, Mahros AM, Lashen SA, Zaghloul M, Eliwa A, *et al.* Colorectal cancer in Arab world: A systematic review. *World J Gastrointest Oncol* **2021**;13(11):1791-8 doi 10.4251/wjgo.v13.i11.1791.
31. Guraya SY. The Prevalence and Evolving Risk Factors for Colorectal Cancer in the Arab World. *Biomedical and Pharmacology Journal* **2018**;11(4).
32. Alsanea N, Abduljabbar AS, Alhomoud S, Ashari LH, Hibbert D, Bazarbashi S. Colorectal cancer in Saudi Arabia: incidence, survival, demographics and implications for national policies. *Ann Saudi Med* **2015**;35(3):196-202 doi 10.5144/0256-4947.2015.196.
33. Younes S, Ibrahim A, Al-Jurf R, Zayed H. Genetic polymorphisms associated with obesity in the Arab world: a systematic review. *Int J Obes (Lond)* **2021**;45(9):1899-913 doi 10.1038/s41366-021-00867-6.
34. Soltani G, Poursheikhani A, Yassi M, Hayatbakhsh A, Kerachian M, Kerachian MA. Obesity, diabetes and the risk of colorectal adenoma and cancer. *BMC Endocr Disord* **2019**;19(1):113 doi 10.1186/s12902-019-0444-6.

35. Liu PH, Wu K, Ng K, Zauber AG, Nguyen LH, Song M, *et al.* Association of Obesity With Risk of Early-Onset Colorectal Cancer Among Women. *JAMA Oncol* **2019**;5(1):37-44 doi 10.1001/jamaoncol.2018.4280.
36. Najjar H, Easson A. Age at diagnosis of breast cancer in Arab nations. *Int J Surg* **2010**;8(6):448-52 doi 10.1016/j.ijssu.2010.05.012.
37. Daly AA, Rolph R, Cutress RI, Copson ER. A Review of Modifiable Risk Factors in Young Women for the Prevention of Breast Cancer. *Breast Cancer (Dove Med Press)* **2021**;13:241-57 doi 10.2147/BCTT.S268401.
38. Anders CK, Johnson R, Litton J, Phillips M, Bleyer A. Breast cancer before age 40 years. *Semin Oncol* **2009**;36(3):237-49 doi 10.1053/j.seminoncol.2009.03.001.
39. Troudi W, Uhrhammer N, Sibille C, Dahan C, Mahfoudh W, Bouchlaka Souissi C, *et al.* Contribution of the BRCA1 and BRCA2 mutations to breast cancer in Tunisia. *J Hum Genet* **2007**;52(11):915-20 doi 10.1007/s10038-007-0195-5.
40. Cherbal F, Salhi N, Bakour R, Adane S, Boualga K, Maillet P. BRCA1 and BRCA2 unclassified variants and missense polymorphisms in Algerian breast/ovarian cancer families. *Dis Markers* **2012**;32(6):343-53 doi 10.3233/DMA-2012-0893.
41. Mahfoudh W, Bouaouina N, Ahmed SB, Gabbouj S, Shan J, Mathew R, *et al.* Hereditary breast cancer in Middle Eastern and North African (MENA) populations: identification of novel, recurrent and founder BRCA1 mutations in the Tunisian population. *Mol Biol Rep* **2012**;39(2):1037-46 doi 10.1007/s11033-011-0829-8.
42. Riahi A, Kharrat M, Ghourabi ME, Khomsi F, Gamoudi A, Lariani I, *et al.* Mutation spectrum and prevalence of BRCA1 and BRCA2 genes in patients with familial and early-onset breast/ovarian cancer from Tunisia. *Clin Genet* **2015**;87(2):155-60 doi 10.1111/cge.12337.
43. Bu R, Siraj AK, Al-Obaisi KA, Beg S, Al Hazmi M, Ajarim D, *et al.* Identification of novel BRCA founder mutations in Middle Eastern breast cancer patients using capture and Sanger sequencing analysis. *Int J Cancer* **2016**;139(5):1091-7 doi 10.1002/ijc.30143.
44. Alhuqail AJ, Alzahrani A, Almubarak H, Al-Qadheeb S, Alghofaili L, Almoghrabi N, *et al.* High prevalence of deleterious BRCA1 and BRCA2 germline mutations in arab breast and ovarian cancer patients. *Breast Cancer Res Treat* **2018**;168(3):695-702 doi 10.1007/s10549-017-4635-4.
45. Abu-Helalah M, Azab B, Mubaidin R, Ali D, Jafar H, Alshraideh H, *et al.* BRCA1 and BRCA2 genes mutations among high risk breast cancer patients in Jordan. *Sci Rep* **2020**;10(1):17573 doi 10.1038/s41598-020-74250-2.
46. Abdulrashid K, AlHussaini N, Ahmed W, Thalib L. Prevalence of BRCA mutations among hereditary breast and/or ovarian cancer patients in Arab countries: systematic review and meta-analysis. *BMC Cancer* **2019**;19(1):256 doi 10.1186/s12885-019-5463-1.
47. Saad M, Mokrab Y, Halabi N, Shan J, Razali R, Kunji K, *et al.* Genetic predisposition to cancer across people of different ancestries in Qatar: a population-based, cohort study. *Lancet Oncol* **2022**;23(3):341-52 doi 10.1016/S1470-2045(21)00752-X.
48. Al-Ghanim KA. Consanguineous marriage in the Arab societies. *Journal of Psychology and Clinical Psychiatry* **2020**;11(6):166–8.
49. Rahman S, Zayed H. Breast cancer in the GCC countries: A focus on BRCA1/2 and non-BRCA1/2 genes. *Gene* **2018**;668:73-6 doi 10.1016/j.gene.2018.05.045.
50. Abedalthagafi MS. Precision medicine of monogenic disorders: Lessons learned from the Saudi human genome. *Front Biosci (Landmark Ed)* **2019**;24(5):870-89 doi 10.2741/4757.

Figure Legends

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.

Figure 2: Incidence and mortality rates of five cancers with higher incidence in the Arab region compared to the worldwide incidence. ASR for incidence (blue) and mortality (red) for Arab countries, USA, Europe, and the world for all ages. The dotted lines mark the world ASR for incidence. Arab countries are labelled as those in the Arabian Gulf (maroon), the Levant (green) and North Africa (blue).

Figure 3: Age-specific incidence of blood cancers in Arab countries. ASR for incidence for (a) Hodgkin lymphoma, (b) non-Hodgkin's lymphoma and (c) Leukemia in females and males. Arab countries are labelled as those in the Arabian Gulf (maroon), the Levant (green) and North Africa (blue). The ASR for the world, USA, and Europe are in black font. ASR for specific age groups is shown; for all age groups and for multiple myeloma refer to **Figure S5**.

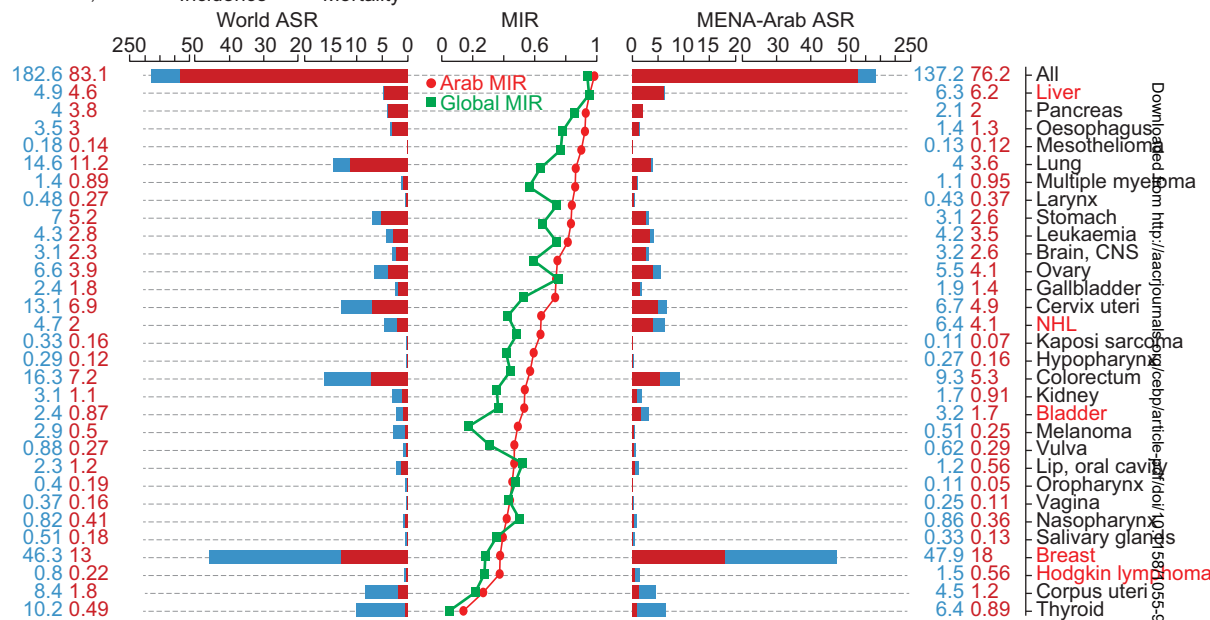
Figure 4: Age-specific incidence of smoking-related cancers in Arab countries. ASR for incidence for cancers of the (a) lung, (b) larynx, (c) bladder and (d) colorectum in females and males. Arab countries are labelled as those in the Arabian Gulf (maroon), the Levant (green) and North Africa (blue). The ASR for the world, USA, and Europe are in black font. ASR for specific age groups is shown; for all age groups refer to **Figure S5**.

Figure 5: Age-specific incidence of sex-specific cancers in Arab countries. ASR for incidence for sex-specific cancers in females (top panel) in the (a) cervix uteri, (b) corpus uteri, (c) breast, and (d) ovary, and in males (bottom panel) in the (e) testis and (f) prostate. Arab countries are labelled as those in the Arabian Gulf (maroon), the Levant (green) and North Africa (blue). The ASR for the world, USA, 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 **Figure S5**.

Figure 6: Age-specific incidence of other solid cancers in Arab countries. ASR for incidence for cancers of the (a) pancreas, (b) Brain, central nervous system (CNS), and (c) thyroid in females and males. Arab countries are labelled as those in the Arabian Gulf (maroon), the Levant (green) and North Africa (blue). The worldwide ASR is marked with bold font, USA, and Europe in black font. ASR for specific age groups is shown; for all age groups and other cancer sites refer to **Figure S5**.

Figure 1

Females, 2018 Incidence Mortality



Males, 2018 Incidence Mortality

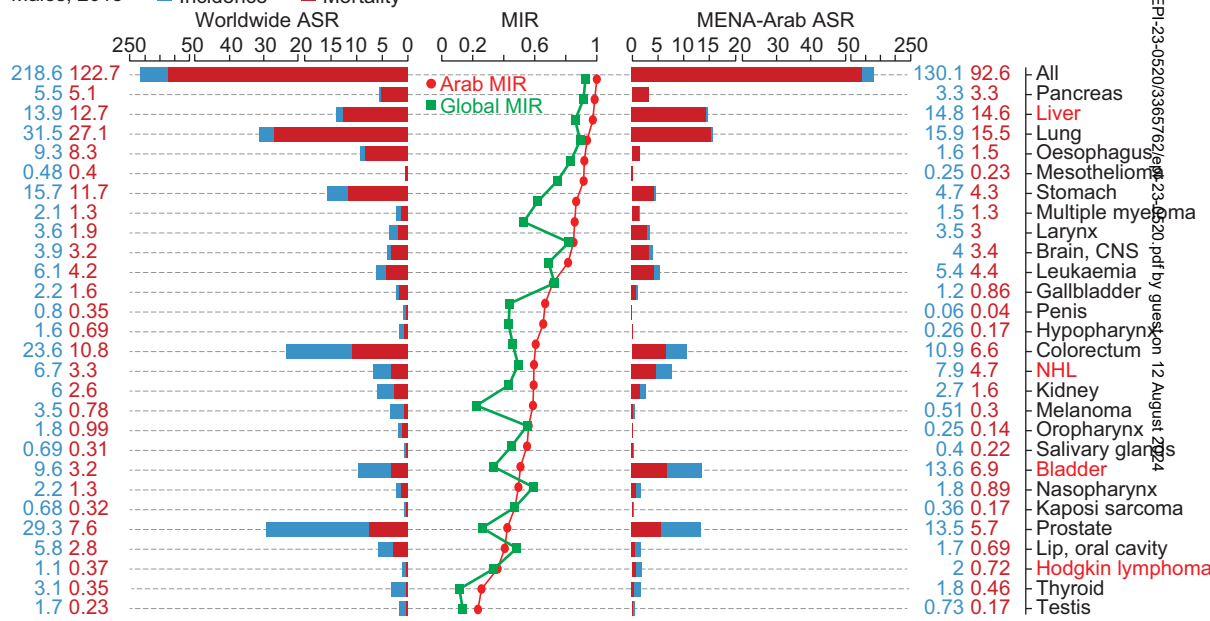


Figure 2

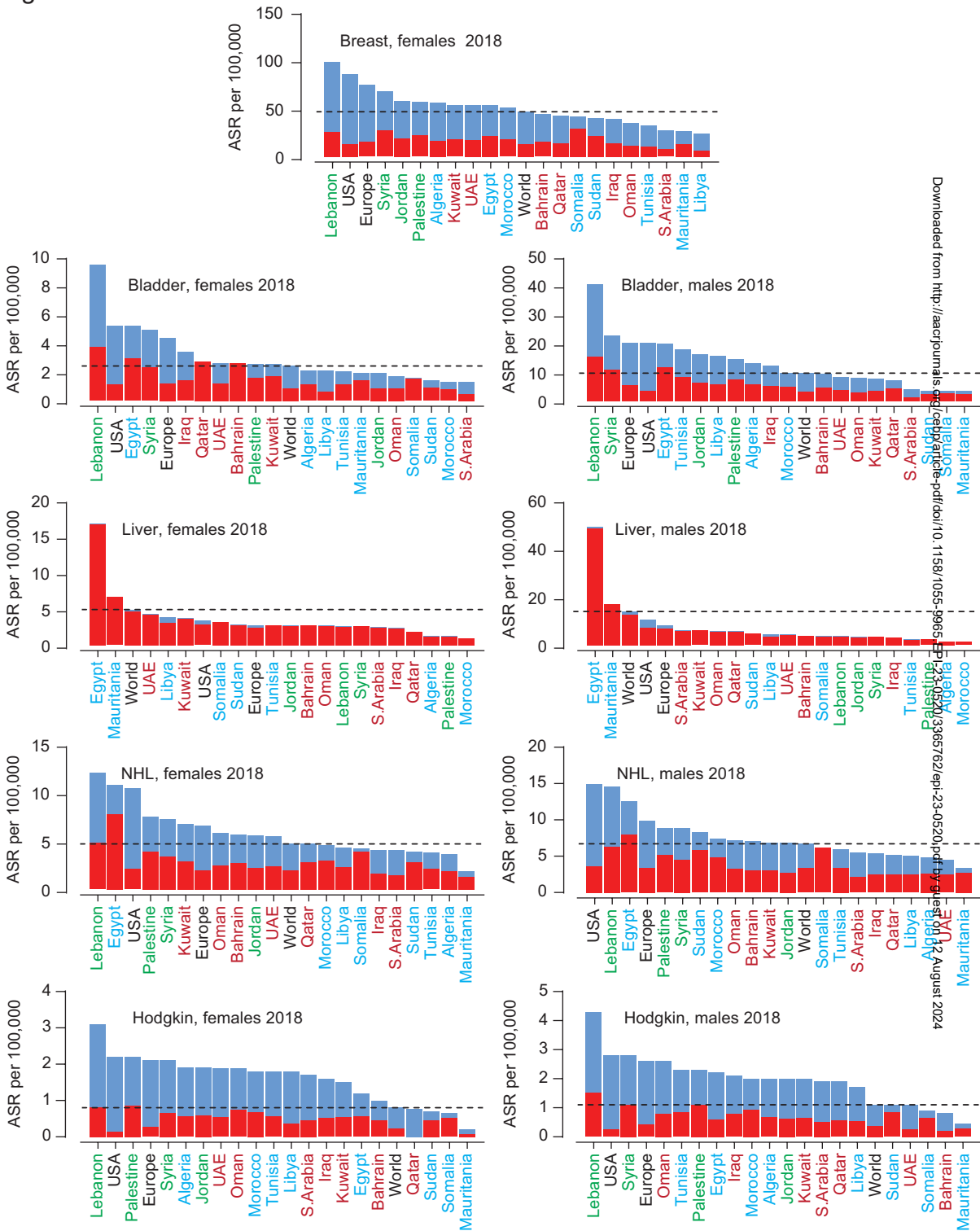


Figure 3

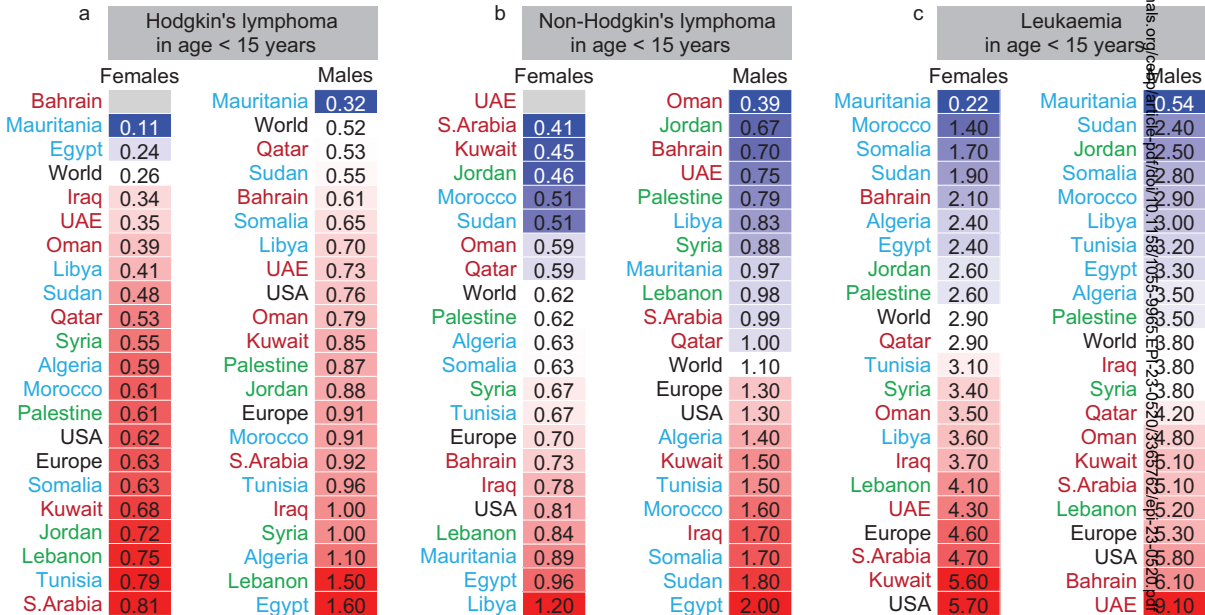
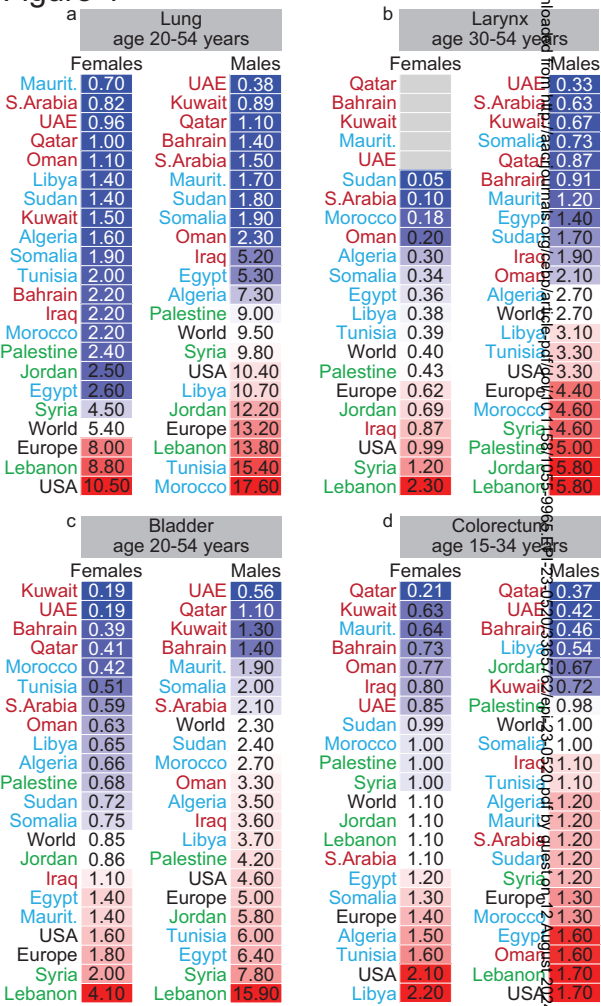


Figure 4



Age Group	Prevalence (%)
55-69	11.2
70-74	12.6
75-79	12.6
80-84	12.7
85-89	13.2
90-94	13.5
95-99	16.1
100-104	16.6
105-109	17.8
110-114	19.9
115-119	20.9
120-124	21.5
125-129	21.6
130-134	22.0
135-139	23.3
140-144	25.1
145-149	25.5
150-154	31.2
155-159	31.2
160-164	32.9
165-169	33.7
170-174	34.4
40-54	0.65
55-69	0.71
70-74	0.81
75-79	1.00
80-84	1.30
85-89	1.60
90-94	1.70
95-99	1.80
100-104	1.80
105-109	1.90
110-114	2.30
115-119	2.70
120-124	2.80
125-129	3.00
130-134	3.00
135-139	3.10
140-144	4.70
145-149	5.40
150-154	8.90
155-159	14.70
160-164	22.00
165-169	53.30

	a	b	c	d
	Cervix uteri	Corpus uteri	Breast	Ovary
	55-69	55-69	20-34	55-69
Females	Palestine	Libya	Qatar	Oman
	Iraq	Iraq	Kuwait	Tunisia
	Egypt	Mauritania	Bahrain	Mauritania
	S.Arabia	Algeria	UAE	Iraq
	Jordan	Sudan	Mauritania	Libya
	Syria	Somalia	Libya	S.Arabia
	Kuwait	Tunisia	S.Arabia	Palestine
	USA	Morocco	Iraq	Algeria
	Qatar	Oman	World	Kuwait
	Tunisia	Qatar	Oman	Egypt
	Lebanon	Egypt	Jordan	Jordan
	Bahrain	Bahrain	Tunisia	Syria
	Oman	Syria	Palestine	World
	Europe	Palestine	USA	Morocco
	UAE	Jordan	Egypt	Qatar
	Sudan	World	Europe	Somalia
	Algeria	Lebanon	Morocco	Sudan
	World	Kuwait	Sudan	USA
	Libya	S.Arabia	Somalia	Lebanon
	Morocco	Europe	Algeria	UAE
Somalia	USA	Syria	Europe	
Mauritania	UAE	Lebanon	Bahrain	
Males	e	f		
	Testis	Prostate		
	10-24	25-54	25-39	40-54
	Mauritania	Mauritania	Qatar	UAE
	Somalia	Somalia	Palestine	S.Arabia
	Libya	UAE	Kuwait	Kuwait
	Sudan	Bahrain	Bahrain	Egypt
	Oman	Qatar	Jordan	Somalia
	Algeria	Egypt	Libya	Qatar
	Tunisia	Tunisia	Mauritania	Iraq
	Egypt	Oman	UAE	Bahrain
	Morocco	Sudan	S.Arabia	Algeria
	Bahrain	Algeria	Morocco	Sudan
	Qatar	Libya	Egypt	Jordan
	Iraq	Kuwait	Iraq	Libya
	S.Arabia	Morocco	Europe	Morocco
	Kuwait	S.Arabia	Sudan	Palestine
	Palestine	Iraq	World	Tunisia
	Syria	World	Oman	Mauritania
	Jordan	Jordan	Syria	Oman
Lebanon	Palestine	Algeria	Syria	
UAE	Syria	Somalia	World	
USA	Lebanon	USA	Lebanon	
Europe	USA	Lebanon	Europe	
	Europe	Tunisia	USA	

Figure 6

a Pancreas in age 35-49 years				b Brain, CNS in age < 15 years				c Thyroid in age 5-19 years			
Females		Males		Females		Males		Females		Males	
Qatar		UAE		Mauritania	0.23	Mauritania	0.33	Mauritania		Mauritania	
UAE		Kuwait	0.55	Somalia	0.37	Sudan	0.36	Sudan	0.14	Bahrain	0.29
Oman	0.49	Qatar	0.61	Sudan	0.53	Somalia	0.48	Somalia	0.23	Sudan	0.38
Tunisia	0.85	Bahrain	0.76	S.Arabia	0.93	Qatar	1.00	Libya	0.24	Libya	0.41
S.Arabia	0.86	Iraq	1.00	Morocco	0.97	Bahrain	1.30	Iraq	0.27	UAE	0.56
Mauritania	0.90	Sudan	1.00	Oman	0.97	World	1.30	Kuwait	0.29	Somalia	0.65
Bahrain	0.97	Somalia	1.20	World	1.10	Kuwait	1.30	Egypt	0.41	Iraq	0.74
Palestine	0.98	Algeria	1.40	Iraq	1.10	Libya	1.40	Algeria	0.56	Tunisia	0.80
Kuwait	1.00	Morocco	1.40	Kuwait	1.10	S.Arabia	1.40	Tunisia	0.58	Qatar	0.83
Algeria	1.10	Mauritania	1.50	Qatar	1.10	Iraq	1.50	Morocco	0.60	Morocco	0.91
World	1.10	S.Arabia	1.50	Tunisia	1.20	UAE	1.50	Qatar	0.73	Egypt	0.92
Iraq	1.10	Oman	1.80	Jordan	1.40	Oman	1.90	Bahrain	0.83	Oman	0.97
Lebanon	1.20	World	2.10	Syria	1.40	Egypt	2.00	Palestine	0.84	Kuwait	1.40
Morocco	1.20	Tunisia	2.50	Libya	1.50	Syria	2.00	Lebanon	0.85	Algeria	1.40
Sudan	1.30	Palestine	2.80	Algeria	1.80	Algeria	2.10	World	0.89	Jordan	1.60
Syria	1.30	Syria	3.00	Lebanon	1.80	Morocco	2.10	Syria	0.95	Syria	1.90
Egypt	1.40	Egypt	3.30	Egypt	1.90	Tunisia	2.20	Jordan	1.10	Palestine	2.10
Jordan	1.50	Jordan	3.30	Palestine	1.90	Jordan	2.40	Oman	1.20	World	2.30
Somalia	1.50	Libya	3.40	UAE	1.90	Palestine	2.40	S.Arabia	1.70	S.Arabia	2.80
Libya	1.70	USA	3.50	Europe	2.20	Europe	2.50	Europe	1.80	Europe	2.80
Europe	2.20	Europe	3.90	Bahrain	2.70	Lebanon	2.50	UAE	1.80	Lebanon	3.20
USA	2.50	Lebanon	4.60	USA	3.40	USA	3.80	USA	4.10	USA	5.80