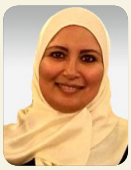
Cancer prevention: Modifiable risk factors

Randah Hamadeh, Professor of Community Medicine, Arabian Gulf University, Bahrain; **Ayoub Al-Jawaldeh,** Regional Advisor, Nutrition, WHO/EMRO, Cairo, Egypt; **Fatina Altahan,** Director of Cancer Control Programme, Ministry of Health, Saudi Arabia; **Fatimah El-Awa,** Regional Advisor, Tobacco Free Initiative, WHO/EMRO, Cairo, Egypt; **Khalid Saeed,** Regional Advisor, Mental Health and Substance Abuse, WHO/EMRO, Cairo, Egypt; **Mark Lodge,** Executive Director, International Network for Cancer Treatment and Research UK Office, Oxford, United Kingdom; **Maya Charafeddine,** American University of Beirut, Lebanon and **Ibtihal Fadhil,** Chair, Eastern Mediterranean NCD Alliance, Kuwait


RANDAH HAMADEH


AYOUB AL-JAWALEDH


FATINA ALTAHAN


FATIMAH EL-AWA


KHALID SAEED


MARK LODGE


MAYA CHARAFEDDINE


IBTIHAL FADHIL

In this chapter on cancer prevention, we consider the key modifiable cancer risk factors including tobacco use, excessive alcohol consumption, lack of physical activity and unhealthy diets. In each case we consider the current situation regarding these risk factors across the countries of the Eastern Mediterranean Region and describe the strategies that are in place, or not in place, to tackle them and how they should be best implemented, as well as the tools and policies provided by the World Health Organization, national governments and civil society. Social inequalities in cancer care are often made worse by conflict, forced migration and political instability, however, ensuring equitable access to preventive strategies of the most effective ways of minimizing cancer inequalities. Prevention remains the most cost-effective, long-term strategy for cancer control as it can be planned and implemented alongside other chronic disease prevention programmes, therefore increasing its impact.

Between 30–40% of all cancer cases are preventable. While estimated global combined annual costs of cancer diagnosis and management and the productivity loss due to disability and premature deaths may exceed even a high-income country's total annual budget, simple preventive measures can save lives, money and actually help governments to earn revenue *(1)*. Levying higher taxes on tobacco products and alcohol to reduce their consumption is a classic example of such a preventive intervention. Cancer prevention should be an essential and prioritized component of all cancer control plans *(2)*. In this chapter we will demonstrate that the most significant cancer risk factors (tobacco use, excessive alcohol consumption, lack of physical activity, unhealthy diet and environmental pollution) are also key risk factors for other chronic diseases such as cardiovascular diseases, Stroke, diabetes and respiratory diseases. Certain cancers associated with chronic infections are responsible for huge number of deaths among the most disadvantaged populations. Preventing such infections through vaccination and other measures cannot only save lives, but also reduce global inequality in cancer. Social inequalities in cancer are a crucial public health issue, transcending geographic borders and hitting particularly hard the most disadvantaged populations due to their gender, socioeconomic status and geopolitical situations. Ensuring equitable access to preventive strategies is one of the most effective means to minimize the existing cancer inequalities *(3)*.

Prevention offers the most cost-effective, long-term strategy for the control of cancer because it can be planned and implemented in the context of other chronic disease prevention programmes, as well as in the context of overall cancer control planning *(4)*. Despite cancer being a global public health problem, many governments in the Eastern Mediterranean Region (EMR) have not yet fully implemented cancer prevention measures within their health agendas *(4)*. This may be due more to a lack of political will within the region rather than to limited resources. Low-income and disadvantaged groups have less political influence, less access to health services, and lack the education that can empower them to make decisions to protect and improve their own health *(2)*. The World Health Organization (WHO) has developed a list of "best buys" for noncommunicable disease (NCD) control *(5)* that include effective interventions to reduce cancer risk and

that are appropriate and highly affordable even in resource-constrained settings. The following section will cover the most common risk factors for cancer primary prevention in the EMR.

Regardless of resource level, every country can take steps to curb the cancer epidemic by undertaking primary prevention actions and thereby avoid unnecessary suffering and premature death from cancer in its population *(2)*.

Tobacco control

Prevalence of tobacco use in the EMR

Globally, tobacco products cause 8 million deaths annually, of which 2.4 million are due to cancer *(6)*. In the EMR, smoking has the second highest population attributable fraction (PAF) (14.9%), after infections (15.3%), with respect to cancer risk factors *(7)*. In men and women, 14.9% and 0.4% of cancer cases, respectively, are attributed to smoking *(7)*. There was variation in PAFs from smoking between countries in the region with Tunisia having the highest among males (36.0%) and Lebanon, in females (5.2%). A recent study from Lebanon had shown that 79% of lung cancer cases in males and 72% in females were attributed to smoking *(8)*. Seven of the EMR countries have 0–9.9% of the deaths attributed to smoking, 12 countries have 10–19.9% and three countries have 20% or more *(9)*.

The latest WHO global report on trends in prevalence of tobacco use released in 2021 projects an overall worldwide decrease in smoking by 2025 as a result of tobacco control efforts. The EMR is expected to see a 22% relative reduction in tobacco use by 2025. Although an improvement from previous trend reports, the EMR is still tracking slower than the global average reduction rate of 24% as the second slowest out of the six WHO regions. Despite the decrease in relative tobacco use prevalence, the number of tobacco users in the EMR is still expected to rise due to population growth. Tobacco use for men in the EMR lies in the global middle ground, with rates projected to drop from 44% in 2000 to 31% in 2025, if current tobacco control efforts continue. For females in the region, tobacco use rates, already considerably low compared to prevalence in other regions, are expected to drop from 10.2% in 2000 to 3.4% in 2025 *(10)*. Fourteen of the EMR countries grow tobacco and seven manufacture it (Egypt, Iran, Jordan, Pakistan, Syria, Tunisia and Yemen *(11)*.

There is great variation in the prevalence of tobacco smoking among countries in the region. The highest estimated age-standardized prevalence of tobacco use in the EMR countries in 2020 among adult (≥15 years) males (56.8%) was in Jordan, while that for females (28.9%), and both sexes (38.2%) was in Lebanon. Oman had the lowest prevalence among males (15.5%) and both sexes (8%), and shared the same lowest rate as Egypt for females (0.4%) *(10)*. Although females in the region generally have lower tobacco smoking rates than males, the gender gap is narrowing mostly in waterpipe smoking *(12)*. The region has the highest prevalence of waterpipe smoking among WHO regions *(13)*. A study of adults aged 40 years and over in nine EMR countries showed that age- and gender-adjusted proportions of ever-smoking cigarettes or waterpipe ranged from 15.3% in Morocco to 53.9% in Lebanon. Waterpipe smoking was most frequent in Saudi Arabia (8.5%) and lowest in the Maghreb countries (<1.5%). Among women, Lebanon had the highest proportion of ever-waterpipe smokers (48.4%), with one study showing that waterpipe smoking was higher among females than males in the country *(14, 15)*.

Current tobacco use rates amongst adolescents aged 13–15 years lie at 15.6% for boys and 8% for girls, amounting to an overall adolescent prevalence rate of 12%. The corresponding figures for use of smokeless tobacco are 4.7%, 3.1%, and 3.9%, respectively *(10)*. Studies have also shown that waterpipe smoking is increasing among the young in the EMR *(16)*. The most widespread form of tobacco use amongst youths in the EMR is cigarette smoking, which is highest in Palestine (17.5%), followed by Bahrain (13.4%), Kuwait (11.6%) and Lebanon (11.2%). The gender gap in tobacco use in adults also exists amongst adolescents, however it is narrower for smokeless tobacco, novel and emerging tobacco products, and waterpipe *(17)*.

Despite the harmful effects of smoking electronic cigarettes and electronic waterpipe *(18, 19)* manufacturers and marketers promote them as cheaper and safer alternatives to traditional cigarettes *(18)*, emphasizing their youth-friendly flavours and glamour, and even as a smoking cessation tool *(20)*. Other forms of tobacco use are becoming more popular in the region, for example *Midwakh* gained popularity particularly among the young in some countries of the region *(12, 21, 22)*. In the United Arab Emirates, it is the second most-common type of tobacco smoked among adult nationals (15%) *(23)*. Moreover, 9.7% of 13–15-year-old males smoke it compared to 3.4% of their female peers in the United Arab Emirates *(22)*. Among 7–12 grade students in Lebanon (12–18-year-olds), 6.7% (95% CI: 5.1,8.8) and 2.7 (95% CI: 1.9, 3.7%), respectively, smoke *midwakh (21)*.

The EMR has the highest percentage change (+65%) for cigarette consumption among all WHO regions from 1980 to 2016, greatly due to its significant population growth *(9)*. However, the degree of smoking behaviour varies, with more than one third of males and females in Lebanon being light smokers (<10 cigarettes/day), yet only 3.4% of males and 18% of females in Jordan being light smokers. Moreover, tobacco use is more common amongst those with lower education levels: a study showed how, compared to adults who had a primary school education or less, adults in Lebanon, Jordan and Palestine with a high school education and those

with a university education were significantly less likely to be current cigarette smokers *(15)*. Tobacco companies see growth potential in the region to offset declining consumption elsewhere *(24)*.

There are multiple challenges for tobacco control in the EMR including the implementation of existing legislation and the evidence based as well as the tobacco industry attempts to interfere and influence tobacco control policies.

Implementation of tobacco control interventions in the EMR

The WHO 2019 and 2021 reports compared to previous reports, showed encouraging trends in smoking rates, owing it to advanced monitoring and tobacco control measures *(5, 6)*. Thirteen out of 22 countries in the region have conducted adult, and in most cases also youth surveys, within the past five years, providing the essential insight needed to evaluate the current situation and way forward in the region *(10)*. Despite the efforts made by the EMR, it is still behind all the other WHO regions except for the African region in policy implementation and enforcement *(25)*. It is challenging for tobacco control to become a priority for decision-makers due to other competing health issues, especially in light of emergency situations and conflicts that several countries are going through. Furthermore, new tobacco products are being introduced, but not regulated, and are made accessible to young people, including novel tobacco and nicotine products *(16)*.

However, there is major political commitment to tobacco control from a legislative perspective, as well as from a public health one among several countries in the region. This has been observed particularly in the Gulf Cooperation Council countries, where a significant positive shift recently took place in the area of tobacco taxation, along with Saudi Arabia becoming the first country in the region to adopt the plain tobacco packaging policy. Although, much more is needed, particularly in public education and research *(26, 27)*. To strengthen political commitment, a High-level Ministerial Group on the Control of Tobacco and Emerging Tobacco and Nicotine Products was established in the 2021 Regional Committee. This group aims to foster high-level strategic leadership and policy dialogue to stimulate political commitment towards the WHO Framework Convention on Tobacco Control (FCTC) and MPOWER measures.

A total of 19 of 22 countries are parties to the FCTC with some implementing and imposing FCTC-mandated policies (28). In 2018, the Regional Committee approved a Regional Strategy and a Regional Framework for Action on Tobacco Control, which has supported countries in establishing comprehensive national tobacco control programmes. Evidence from Saudi Arabia revealed that the return on investment (RoI) for all tobacco control interventions is US$ 5.37 which means that every US$ 1 invested could save up to US$ 5.37 in future direct and indirect costs *(29)*. Overall, countries have had some success implementing the FCTC, but significant obstacles remain, particularly in terms of enforcing tobacco control measures and adapting legislation and regulation to address novel tobacco products.

Tobacco-free public places

Smoke-free legislation in public places is especially important to protect people from harmful second-hand smoke. This measure remains one of the key challenges in the region; although many countries have adopted tobacco-free public places policies (16 out of 22), implementation remains weak *(30)*. Despite countries having adopted this policy, many still allow the establishment of designated smoking areas, defeating the purpose of protection from second-hand smoke as recommended by the WHO FCTC. Moreover, a recent projection by WHO showed a correlation between the presence of second-hand smoke in public places and youth tobacco use prevalence *(31)*.

Graphic health warnings on tobacco packaging

Placing graphic health warnings on tobacco packaging is another evidence-based measure recommended by the WHO FCTC, aiming to deter people from tobacco consumption *(32)*. This is one the most successful and widely adopted measures in the region, with 13 out of the 22 countries applying graphic health warnings at different sizes, and one country implementing plain packaging (Saudi Arabia). However, challenges remain due to countries not regularly renewing health warnings or missing essential characteristics of tobacco product labelling and packaging as recommended by the WHO FCTC and its guidelines *(33)*.

Tobacco cessation programmes

Multiple countries in the EMR have invested greatly in expanding their cessation services by increasing the number of cessation clinics, training healthcare professionals and cessation specialists, and increasing the availability of Nicotine Replacement Therapy (NRT). Repeated clinical tobacco-cessation counselling supported with accessible addiction treatments are cost-effective services *(34)*. The provision of quitting services and consistency in delivering them are necessary to guarantee long-term results. Training and skill among TDT providers remain a challenge, especially when not consistently incorporated as part of the curriculum of healthcare professionals *(35)*. A WHO Collaborating Centre specializing in tobacco cessation has been set up in Qatar's Hamad Medical Centre, which aims to fill this need through

specialized training for countries seeking to scale up their cessation services. Physicians giving even brief advice to their patients to quit smoking can increase their unassisted quit rate (2–3%) by an additional 1–3% *(36)*.

Support for smoking cessation services is available through primary healthcare services to less than half the EMR population. However, in Morocco, Saudi Arabia, Syria and Tunisia this support is available in most healthcare facilities. In addition, nine EMR countries have cessation support and treatment in hospitals. Cessation support is free in Bahrain, Jordan, Kuwait, Qatar and Saudi Arabia. National toll-free quit lines are available in Egypt, Iran, Kuwait, Saudi Arabia and the United Arab Emirates *(37)*. A study from the Quit Tobacco Clinics in Bahrain reported a higher quit rate among male shisha smokers than cigarette smokers *(38)*.

Almost 70% of individuals in the EMR have legal access to nicotine-replacement therapy (NRT). Of these people, treatment costs are covered only for 23%. In 10 countries, NRT is accessible in pharmacies without prescription. Bupropion is available at pharmacies with a written prescription in seven countries and varenicline in 10 countries (nine with written prescription and one without) *(37)*.

Taxation

Despite the recent changes that took place in most GCC countries, where an excise tax on tobacco products was adopted, the EMR ranks among all regions with respect to taxation on tobacco products. It is evident that the increase in taxation rates led to a reduction in smoking *(39)*. Saudi Arabia has witnessed a significant reduction following its 100% tax enforcement on tobacco products *(40)*. Smuggling of tobacco products maybe a significant barrier facing the implementation of tobacco taxation in some countries in the region, which can be addressed through the implementation of the FCTC Protocol *(41)*.

Tobacco advertising and promotion

All countries in the region, except Somalia, have adopted partial or complete bans on tobacco advertising, promotion and sponsorship in collaboration with non-governmental bodies. There is significant use of tobacco products including electronic nicotine delivery systems (ENDS) in EMR country television productions. The increase in tobacco use by actors of both sexes in regional television series is noted mostly in those aired during Ramadan. There has also been an increase of tobacco scenes in Iranian films. The proportion of 13–15-year-olds in the EMR who view tobacco use on television varies among countries (60–90%) *(42)*. These exposures frame smoking in a glamorous manner and were reported to have a positive association with smoking risk in adolescence *(43)*.

Waterpipe smoking and novel tobacco products

Waterpipe smoking poses a challenge in the implementation of tobacco control policies in the EMR. The waterpipe's attractive shapes and various tobacco flavours, its social acceptability and accessibility in most countries of the region, demand the adaptability and comprehensiveness of tobacco control policies *(38)*. In a study of four EMR countries, tobacco flavour accounted for 81.4% of the waterpipe smoking decisions of university students *(12)*. The social acceptability of waterpipe smoking poses another challenge. Over two thirds of university students in the EMR smoked their first waterpipe in the 15–19-year age group with over one third of females smoking it with family members *(12)*. There is a misconception among EMR university students about the harmful effects of waterpipe smoking. When compared to cigarettes, only 11% considered waterpipe smoking addictive in contrast to 64% for cigarettes *(19)*.

Novel and emerging tobacco products, including electronic nicotine delivery systems (ENDS), electronic non-nicotine delivery systems (ENNDS) and heated tobacco products (HTPs) have gained popularity in the region particularly among the young *(12, 44)*. The growing popularity of *midwakh* in some EMR countries is also alarming *(12, 21, 23)*. Furthermore, the tobacco industry is insistently encouraging these products in the region *(11)*. Moreover, the evolution of these products and the interchangeability of the component parts have posed a unique challenge to their monitoring, surveillance, classification and regulation *(7)*.

Research on tobacco smoking and regulation

Evidence-based research on tobacco is pivotal in tobacco control. The scoping review that was conducted in seven EMR countries has noted a four-fold increase in the number of tobacco publications in in the 14-year period from 2000 to 2013. However, the overall publication rate was generally low except for Lebanon and Bahrain. Most of the publications (69.8%) were on cigarette smoking and 21% on cigarettes and waterpipe. Less than 3% of the studies addressed policy with 27.4% having actionable messages to guide policy-makers *(45)*. The study concluded that there is lack of evidence-based research.

Recommendations for tobacco control:

- EMR countries are urged to scale up their implementation of WHO FCTC policies and the six components of the MPOWER package of measures. Countries need to coordinate and cooperate to adopt effective tobacco control policies;
- monitor the prevalence of all types of tobacco use including ENDS, ENNDS, HTPs and *midwakh*;

- continue to conduct tobacco surveys among adults and youth regularly;
- scale up tobacco prevention policies including:
  - enforcing total ban on tobacco use in indoors public places without designated smoking areas;
  - implementing large graphic health warnings and plain packaging on all tobacco and nicotine products;
  - strictly implementing a comprehensive ban on advertising, promotion and sponsorship of all nicotine and tobacco control products;
  - increasing taxation rates on all tobacco and nicotine products in line with international best practices and WHO recommendations;
- provide accessible and affordable tobacco cessation programmes including NRT insurance coverage with the establishment of quit lines;
- increase the role of family physicians and primary healthcare in tobacco control advocacy;
- include prevention and cessation of tobacco use in the curricula of health professionals and residency programmes;
- integrate tobacco use hazards in school curricula;
- regulate tobacco distribution and sales;
- negate the misconception that certain tobacco products are not harmful or less harmful than cigarettes;
- modify social norms associated with waterpipe smoking;
- limit the use of fruit flavours in waterpipe tobacco and accurately label the contents;
- conduct research to assess trends in tobacco use, and to evaluate the effectiveness of interventions;
- end tobacco industry interference into public health polices and tobacco control policies as per the WHO FCTC article 5.3 and its guidelines.

Alcohol consumption

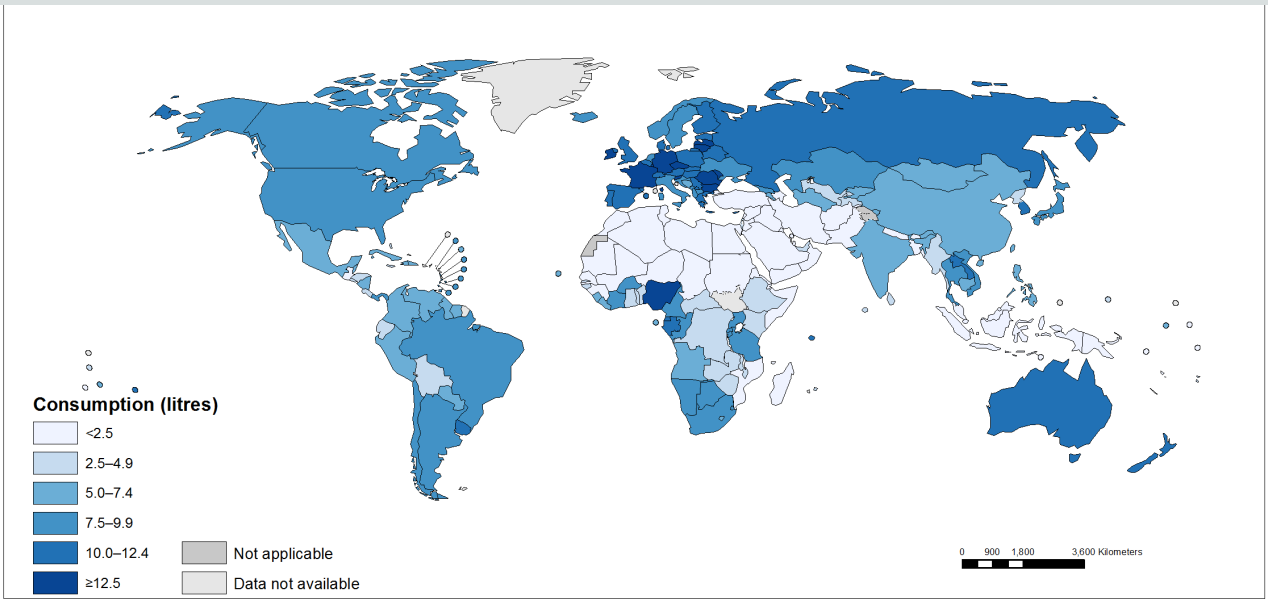
The harmful use of alcohol is a major risk factor for premature deaths and disabilities in the world. According to WHO, the harmful use of alcohol is one of the top 10 risks for burden of diseases and cause more than 5% of the global disease burden *(46)*. Globally, WHO estimates there is 3 million deaths annually

Table 1: WHO best buys – Harmful use of alcohol

WHO Best Buys aim to reduce the harmful use of alcohol

Effective interventions with cost effectiveness analysis (CEA) ≤ I$100 per DALY averted in low- and middle-income countries	Increase excise taxes on alcoholic beverages
	Enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media)
	Enact and enforce restrictions on the physical availability of retailed alcohol (via reduced hours of sale)

Figure 1: Total alcohol per capita consumption (15+ years), worldwide *(53)*

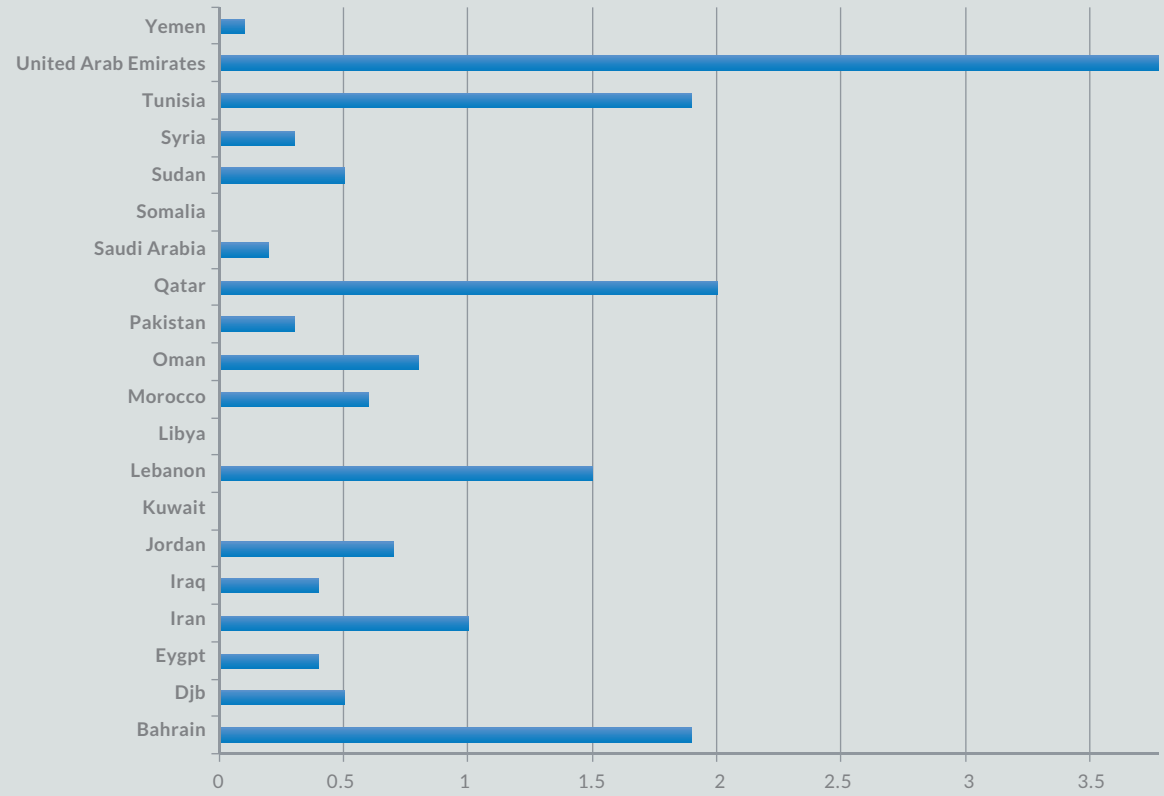


The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Information Evidence and Research (IER)
World Health Organization

World Health Organization

Figure 2: **Total alcohol per capita consumption, litres of pure alcohol per capita in the EMR .** *Source (WHO NCD Data Finder).*



attributable to alcohol consumption. Over three quarters of the deaths were among men *(47)*. The relationship between the harmful use of alcohol and major NCDs including cancer is well documented *(48,49,50)*. Harmful use of alcohol is known to cause heart disease, liver cancer, with strong associations with oropharynx, larynx, oesophagus, liver, colorectal and breast cancer *(49, 50, 51, 52)*. Globally, 30% of deaths of oral and pharyngeal cancers, and 12% of the deaths caused by liver cancer were attributed to alcohol consumption *(47)*. Some other cancers, such as pancreas and prostate cancer and melanoma, appear to be associated with the consumption of alcohol. However, the evidence needs further evaluation. In most cases, cancer risk is dose-dependent *(48)*.

With regard to alcohol consumption, the EMR is the lowest compared to other WHO regions. Recent data published by WHO, shows the total per capita consumption of alcohol by individuals above 15 years of age is 0.6 litre of pure alcohol per year. This low level estimated to be almost 10 times lower than global consumption of 6.4 litres of pure alcohol per person aged 15 years or older per capita per year *(47, 48)*. The low consumption rate is related to religious, muslim-majority countries that have enforced strict regulations banning alcohol sale and consumption, which is the case in most Arab countries *(48)*. (Figures 1, 2). The region has also consistently had the highest prevalence of countries with alcohol-availability restrictions, with 100% of responding countries reporting regulations for on-premise alcohol outlet locations and 88% for off-premise locations *(47, 48)*.

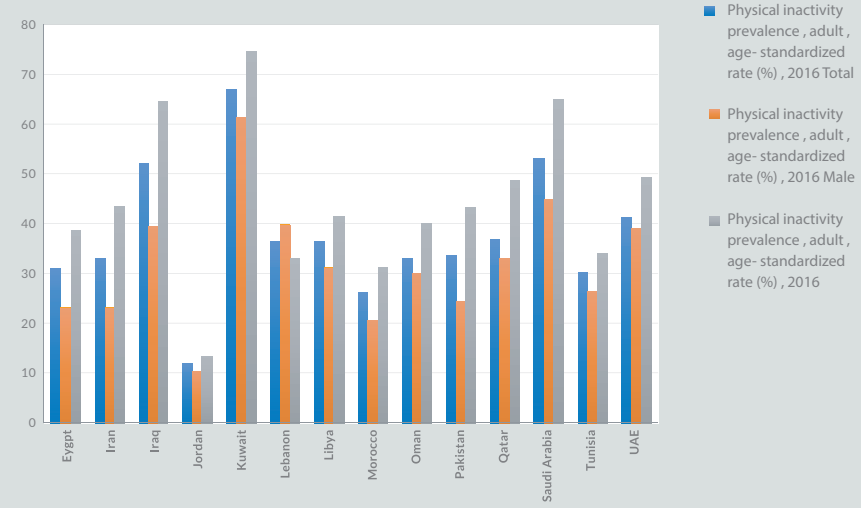
As for mortality data, all deaths attributable to alcohol consumption were lowest in the EMR where 0.7% of all deaths and 0.7% of all DALYs were attributable to alcohol consumption *(42, 43)*. However, at individual level use, there is a wide variation between the countries and age groups in the region.

To prevent a rising trend, it is important for countries to implement the key evidence-based cost effective interventions recommended in the global strategy on the harmful use of alcohol and the WHO best buys (Table 1) *(54, 55)*. Reducing the harmful use of alcohol is critical towards achieving NCD-related Sustainable Development Goals (SDGs), including the reduction of NCD premature mortality bt 30% by 2030.

Physical activity

Cancer occurrence is largely influenced by lifestyle and behavioural factors including physical activity. Physical inactivity is a global health challenge and has been identified

Figure 3: **Physical inactivity prevalence among adult (18+) years, age-standardized rate (%) , 2016** *(source , WHO NCD Data Finder)*



as the fourth leading risk factor for global mortality (6% of deaths globally) and is reported to be associated with many types of cancers. *(56)*. According to a recent WHO report, more than one-third of adults aged 18 years and older are physically inactive globally *(1)*. Women were less active than men, with 32% of women and 23% of men not achieving the recommended levels for physical activity *(57)*.

The health benefits of physical activity have been well documented. Regular physical activity has been shown to be associated with a lower risk of cardiovascular disease, diabetes, obesity, hypertension, hypercholestrolemia, arthritis, mental illnesses, and cancer, namely breast, endometrial and colorectal cancer. Some of this effect seems to be independent of weight control *(58)*.

As for as cancer, evidence has shown that regular physical activity reduces the risk of breast and colon cancer, and possibly reduces the risk of uterine (endometrial) and prostate cancers *(59, 60)*.

In the EMR, the prevalence of physical inactivity is one of the highest worldwide, reaching almost 70% in some countries *(61)*. Based on data reported by the WHO STEPWise survey in the region, there is a significant difference in the level of physical inactivity among countries ranging from 68%, the highest, in Kuwait to 12%, the lowest, in Jordan *(62)* (Figure 3).

The differences in the prevalence of physical activity was also reported between the two sexes in the EMR. women reported a higher prevalence of insufficient physical activity *(62)*. The lower prevalence of physical activity among females is more likely caused by cultural and social variables rather than biological factors. Culturally, women are not expected to practice physical activities in public. Although walking for fitness is relatively acceptable for women living in cities, it may not be the case in rural regions *(61)*.

The global agenda and its commitments highlighted the importance of introducing policies and actions aimed at increasing physical activity in the entire population, including all aspects of daily living *(56, 58)*.

Obesity and overweight

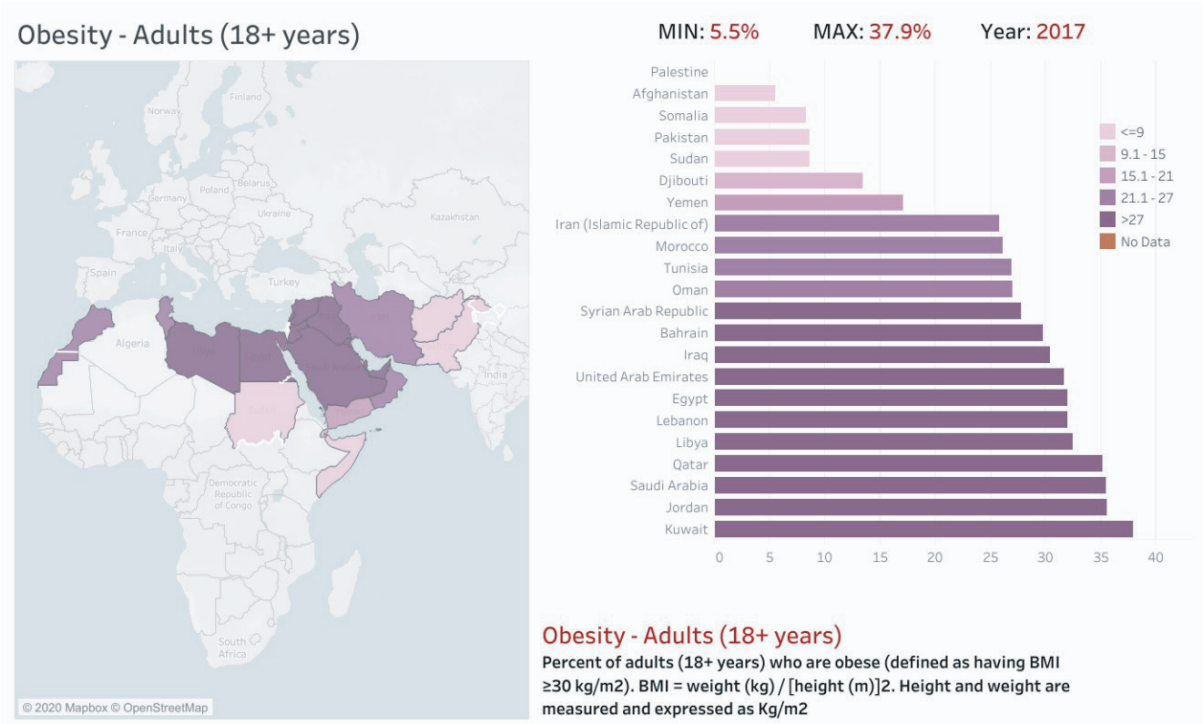
Owing to the worldwide rise in overweight and obesity prevalence, concerns about their impact on health have also been increasing worldwide. In 2016, global surveys revealed that 38.9% of the adult population were overweight (BMI ≥25kg/m^2) and 13.1% were obese (BMI ≥30 kg/m^2). In the EMR, the latest prevalence of obesity in 2016 was estimated at 20.8%, while the prevalence of overweight was around 49%. The highest prevalence of more than 70% overweight has been reported in the Gulf countries, Kuwait and Qatar. Similarly, the highest prevalence of more than 30% obesity has been reported in Kuwait, Jordan, Saudi Arabia, Qatar, Libya, Lebanon, Egypt, United Arab Emirates and Iraq. Overweight prevalence among adults increased in the EMR by 27.2% while, obesity prevalence among adults increased by 56.3% between 2000 and 2016 *(63)* (Figure 4, Table 2).

In 2019, total cancers caused 23.6 million incident cases, 10 million deaths, and 250 million DALYs globally. In 2019, total cancers were the second-leading cause of death and DALYs globally *(64)*. Worldwide, an estimated 19.3 million new cancer cases (18.1 million excluding non-melanoma skin cancer) were diagnosed in 2020, with about 10 million cancer deaths (9.9 million excluding non-melanoma skin cancer) *(65)*. According to long-term predictions, the EMR countries will suffer from a startling increase in cancer patients, with a 1.8-fold increase by 2030 *(66)*. Pakistan has the greatest number of cancer cases (170,668) in the EMR in 2020, followed by Egypt (129,577) and Iran (127,548) *(67)* (Figure 5; Table 2). Bahrain, Qatar, Iran, and Lebanon reported a 16% mortality rate due to cancer, Kuwait reported 15%, while Egypt reported 13% *(68)*.

It is noticeable that most of the EMR countries revealed a relatively high rate of cancer incidence as nine countries in the region have cancer rates of more than 200/100,000. The highest cancer rates as revealed in 2020 have been reported in Egypt (258/100,000) followed by Lebanon (252.5/100,000) then Jordan (251.8/100,000) and Iran (245.2/100,000) followed by Syria (241.5/100,000), and Morocco (238.8/100,000) *(67)* (Figure 6; Table 2).

In the EMR, the total number of fatalities due to cancer

Figure 4: **Percentage of obese adults (both sexes) in the EMR by country, WHO Regional Office of the Eastern Mediterranean Region, 2017** *(91).*



was 431,312 in 2019. Pakistan recorded the highest number (124,328) followed by Egypt (85,226), Iran (61,063), then Morocco (33,845) *(63)* (Figure 7; Table 2).

Being obese is usually linked to an increased risk of hypertension and many NCDs, including diabetes, cardiovascular disease (CVD), and cancers. Obesity is the key risk factor for type 2 diabetes, CVDs cancer, and premature death. The correlation between excess BMI and the risk of cancer incidence in esophagus, colon kidney, rectum, pancreas, gall bladder, post-menopausal breast, ovarian and endometrial

Figure 5: **Number of Cancer cases, both sexes, in the EMR, 2020** *(67)*

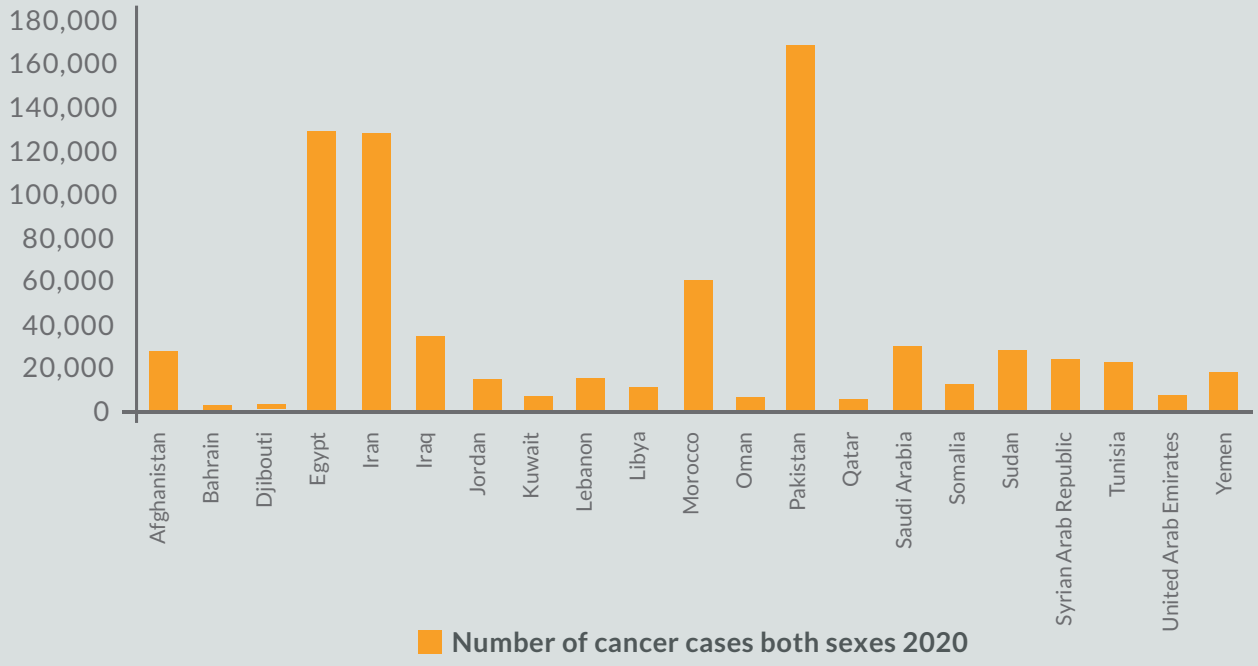


Table 2: **Number of deaths, probability of dying attributed to cancer among adults, cancer trends, obesity prevalence, overweight prevalence and cancer trends attributable to excess body mass in the EMR** *(63, 67, 76)*

	Number of deaths attributed to cancer	Probability of death due to cancer	Cancer cases (N)	Cancer rates/ 100000 (Age St.)	Cumulative cancer risk	Obesity prevalence among adults, BMI &≥; 30 (Age St.)	Overweight prevalence among adults, BMI &≥; 25 (Age-St.)	Cancer (%) due to excess BMI	Number of cancer cases among both sexes attributable to excess BMI
	Both	Both	Both	Both	Both	Both	Both	Both	Both
	2019	2016	2020	2020	2020	2016	2016	2012	2012
Afghanistan	15,565	8.00	20975	175.4	20	5.5	23	0.64	109
Bahrain	640	16.00	1177	180.6	26.66	29.8	65.8	5.2	43
Djibouti	508	7.00	737	146.6	15.21	13.5	38.6	2	10
Egypt	85,226	13.00	129577	258	31.39	32	63.5	4.4	4 400
Iran	61,063	16.00	127548	245.2	35.6	25.8	61.6	3.1	2 400
Iraq	15,004	11.00	31801	217.6	25.86	30.4	64.6	3.7	834
Jordan	6,075	12.00	11107	251.8	29.63	35.5	69.6	7.2	417
Kuwait	1,815	15.00	3716	185.3	27.97	37.9	73.4	7.2	107
Lebanon	9,078	16.00	11287	252.5	30.53	32	67.9	5.4	464
Libya	3,557	12.00	7388	212.8	28.17	32.5	66.8	5.1	287
Morocco	33,845	14.00	57772	238.8	26.96	26.1	60.4	3.2	1 000
Oman	1,750	11.00	3557	165.4	17.58	27	62.6	3.8	50
Pakistan	124,33	8.00	170668	178.7	19.81	8.6	28.4	1.7	2 300
Qatar	716	16.00	1435	172.2	28.55	35.1	71.7	4.9	45
Saudi Arabia	10,615	10.00	26505	152.1	20.13	35.4	69.7	6.8	1 000
Somalia	8,335	4.00	9140	189.7	20.24	8.3	28.4	1.2	79
Sudan	17,892	6.00	25347	153.4	17.85	8.6	28.9	1.3	236
Syria	13,742	9.00	20193	241.5	28.61	27.8	61.4	5.5	1 100
Tunisia	10,246	12.00	19031	214.9	28.05	26.9	61.6	4.4	504
UAE	2,103	12.00	4611	170.7	28.49	31.7	67.8	4.8	106
Yemen	9,210	6.00	14848	154.4	21.81	17.1	48.8	2.5	220

Figure 6: **Cancer rates/100,000, age-standardized, both sexes 2020** *(67)*

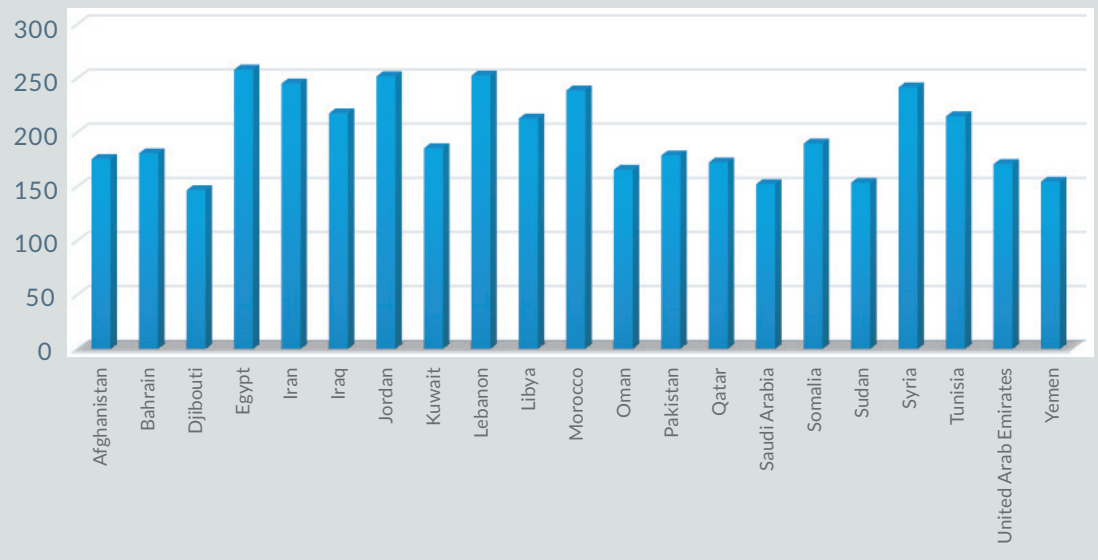


Figure 7: Number of deaths attributed to cancer, 2019 *(63)*

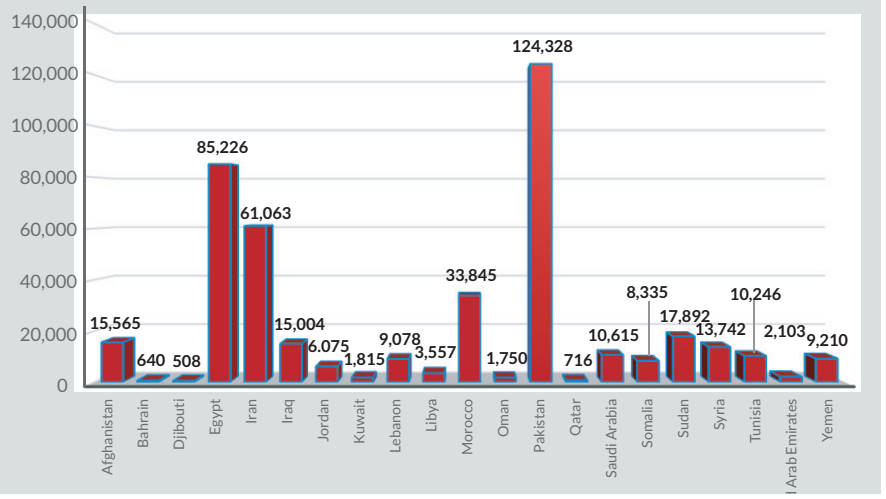


Figure 8: Number of cancer cases among both sexes due to excess BMI *(67)*

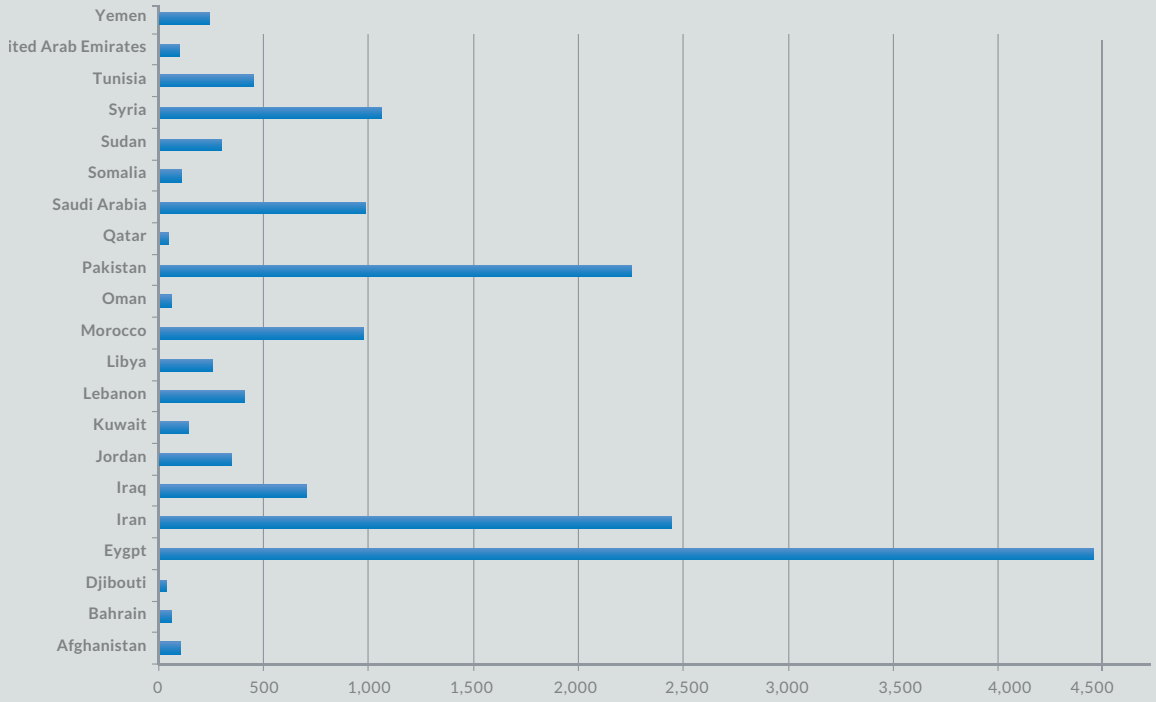


Figure 9: Cancer incidence sites in the EMR due to excess BMI *(67, 76)*

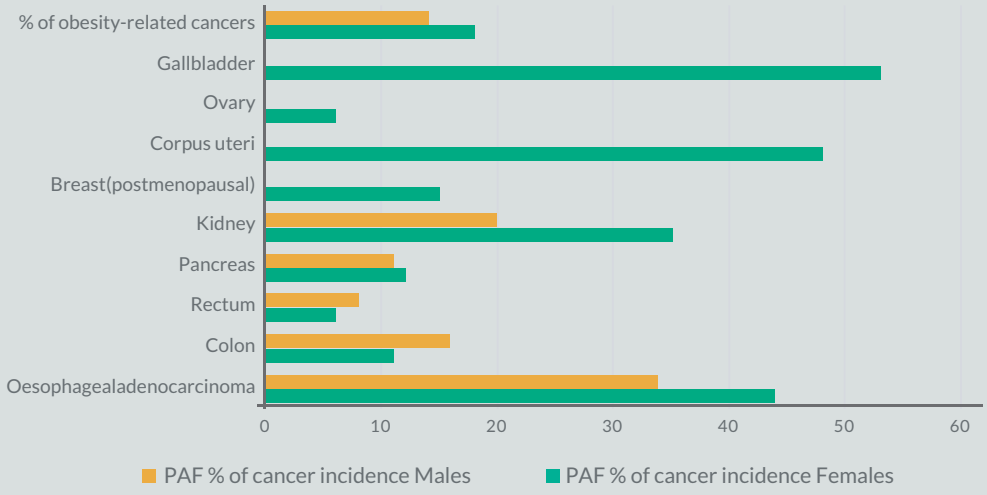


Figure 10: Correlation between prevalence of obesity and cumulative cancer risk among adults in the EMR *(63, 67)*

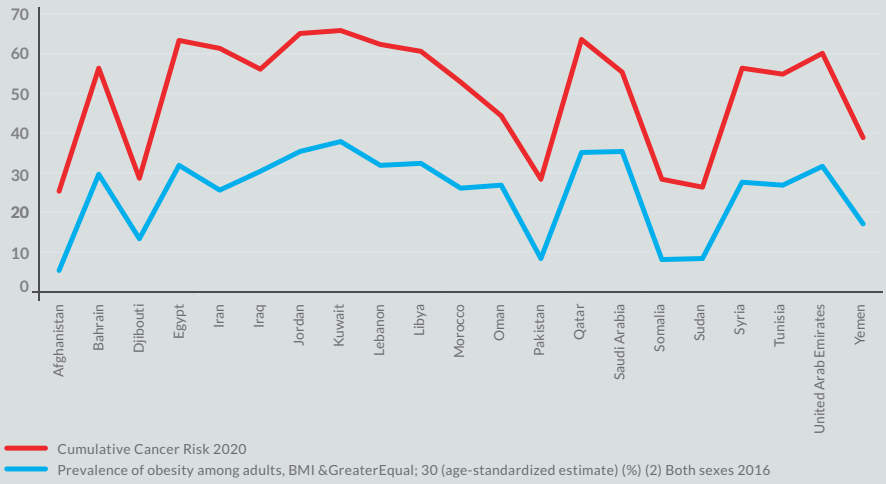


Figure 11: Correlation between prevalence of obesity and probability of death due to cancer in the EMR

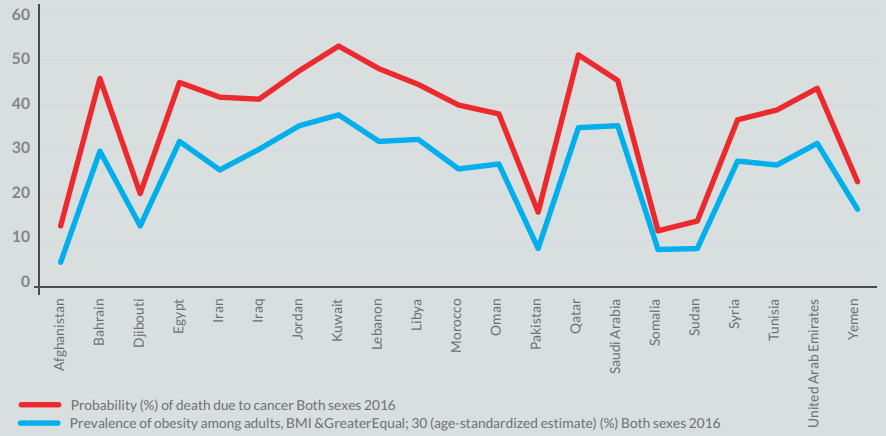
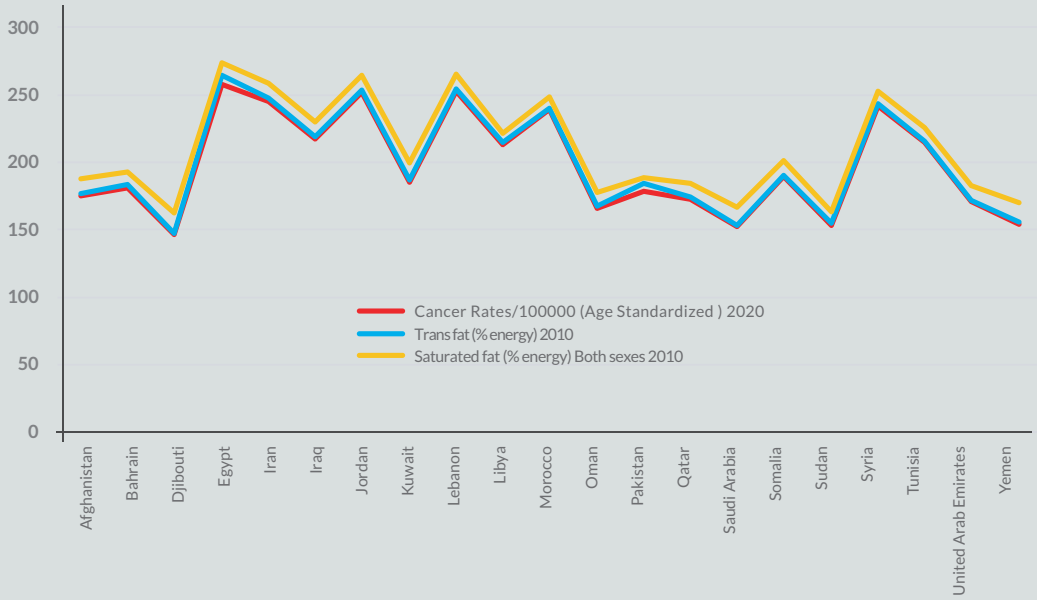


Figure 12: Correlation between cancer rates, trans fat and saturated fat consumption *(67, 76, 92)*



cancer have been confirmed in literature *(69–74)*. The estimated increase in risk of these cancers due to excess BMI ranged from 3–10% per unit increase in BMI *(75)*. Moreover, in 2012, relatively, 3.6% of all cancers (excluding non-melanoma skin cancer) or 13% of all obesity-related cancers could be attributed to excess BMI in adults *(76)*.

EMR countries are facing a rapid rise in NCDs and injuries as a share of the total disease burden as countries transition from traditional to modern health risks. In the EMR, the proportion of obesity-related cancers attributable to excess BMI is 16% while the proportion of all cancers, excluding non-melanoma skin cancers, attributable to excess BMI is 4.5% *(67, 76)* (Figures 5, 6).

The trends of obesity, cancer and death due to cancer coincide in the EMR (Figures 10, 11). The maximum prevalence of cancer attributable to excess body weight has been reported in Kuwait as 7.2%, Jordan 7.2 %, Saudi Arabia 6.8%, Lebanon 5.4%, Libya 5.1% and Qatar 4.9% *(67)* (Table 2).

It has been determined that lowering exposure to cancer risk variables such as diet, nutrition, and physical exercise could prevent approximately 40% of cancer cases *(77)*. Adequate daily intake of fruit and vegetables has been linked to a lower incidence of CVDs *(78)*, Stroke *(79)*, type 2 diabetes *(80)*, and some forms of cancer *(81, 82)*. Intake of industrial TFAs has also been linked to an elevated risk of NCDs and related disorders such ovarian cancer *(83)*. Figure 12 illustrates the coincidence between trans fatty acids intake and cancer rates among EMR countries.

Bahrain, one of the high-income Gulf countries, is suffering from an increase in cancer cases *(84, 85)*. Breast, colorectal, lung cancers, non-Hodgkin lymphoma and leukaemia are the five most often diagnosed cancers in Bahrain *(86)*. Obesity, smoking, leading a sedentary lifestyle, and eating a high-fat/low-fibre diet are all major risk factors for colorectal cancer in Bahrain. Almost a third of Bahrain's population is overweight or obese *(87, 88)*.

A systematic evaluation of studies published between 1970 and 2020 in Iran that looked at the epidemiological features of gastric cancer found that poor economic status and food insecurity increased the risk of stomach cancer 2.42- and 2.57-fold, respectively. Furthermore, there was a link between stomach cancer risk and dairy products, processed red meat, fruit juice, legumes, smoked and salty seafood, salt, strong as well as hot tea use. There was also an inverse relationship between the ingestion of fresh fruit, citrus, and garlic and stomach cancer *(89)*.

The intake of fats, protein, and calories was found to have a substantial positive relationship with the incidence of breast cancer in Saudi Arabia. The adjusted odds ratios for cholesterol, polyunsaturated fat, animal protein, saturated fat, and total energy from dietary intake were 1.88 for cholesterol, 2.12 for polyunsaturated fat, 2.25 for animal protein, 2.43 for saturated fat, and 2.69 for total energy from dietary intake for the highest quartile of intake versus the lowest *(90)*.

Diet and healthy eating

According to WHO, the recommended healthy diet is one that consists of fruit, vegetables, legumes (e.g. lentils and beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat and brown rice). An unhealthy diet is a contributing cause to cancer diseases and other NCDs.

In the EMR, the average daily consumption of fruits and vegetables is 280 g per day which is lower than the WHO recommendations (At least 400 g of fruit and vegetables per day) excluding potatoes, sweet potatoes, cassava and other starchy roots *(93)*.

The average consumption of raw sugar in the EMR is 80 g per day, while the recommended amount of sugar is less than 10% of total energy, which is equivalent to 50 g for a person of healthy body weight consuming about 2,000 calories per day. It is recommended that a healthy diet contains less than 5 g of salt (equivalent to about one teaspoon) per day and the sodium intake should be less than 2.3 g daily. In the EMR the average salt daily intake is 9.6 g. For instance, in Bahrain the consumption is very high, and reaches 14 g per day *(94)*.

The American Heart Association recommends aiming for a healthy dietary pattern that contains about 13 g of saturated fat per day (5% to 6% of daily calories), while the trans fatty acids should be limited to be less than 1% of daily calories about 2 g per day. In the EMR the average saturated fats consumption is 10.35% of total energy, while the limit of trans fatty acids has been greatly exceeded in Egypt and Pakistan where average consumption reaches 6.5% and 5.8% from total energy, respectively *(95)*.

WHO regional policies and strategies to address obesity in the EMR

Actions to educate and inform the public about nutrition are widely implemented. More specifically, two thirds of countries have issued food-based dietary guidelines, more than half (56%) provide nutrition and diet counselling and more than a third (39%) have conducted media campaigns. There is much scope for improvement in nutrition labelling – while two thirds (67%) of countries have implemented rules on nutrition labelling, only 41% have issued rules relating to nutrition and health claims and only five countries have introduced simplified front-of-pack labelling *(96)*.

The last decade has seen a step-up in action across the region to scale-up action to tackle unhealthy diets and reduce overweight and obesity. For instance, the Regional Framework

for Action on Obesity Prevention was adopted in 2018. More than half *(97)* of the region's countries have policies relating to trans fatty acids, with seven implementing specific measures to ban or virtually eliminate industrial trans fats. To address the high intakes of salt in the region, 14 countries had fully or partially implemented national salt reduction policies. By 2017, seven countries had adopted policies relating to aspects of marketing food to children, although concrete action in this area is still lacking. The second half of the decade saw several countries introducing taxes – several at a rate of 50% – on carbonated or sugar-sweetened beverages.

While progress has been noted in many EMR countries to improve physical activity and combat the challenges of obesity, EMR countries need to focus their efforts more towards multisectoral and intersectoral collaborations to improve physical activity and lower cancer risk, and obesity-related health problems. ■

Disclaimer

Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy, or views of the International Agency for Research on Cancer/World Health Organization.

References

1. Bray F, Jemal A, Torre LA, Forman D, Vineis P. Long-Term Realism and Cost-Effectiveness: Primary Prevention in Combatting Cancer and Associated Inequalities Worldwide. *J Natl Cancer Inst* 2015 107(12): djv273.
2. Prevention. (Cancer control: knowledge into action: WHO guide for effective programmes; module 2.) World Health Organization 2007.
3. IARC, Reducing social inequalities in cancer: evidence and priorities for research / edited by S. Vaccarella, J. Lortet-Tieulent, R. Saracci, D.I. Conway, K. Straif, C.P. Wild.2019.
4. Romero Y, Trapani D, Johnson S, Tittenbrun Z, Given L, Hohman K, Stevens L, Torode J, Boniol M, Ilbawi A. National cancer control plans: a global analysis. *The Lancet Oncology.* 2018 19 (18):30681-8. DOI:https://doi.org/10.1016/S1470-2045(18)30681-8
5. From Burden to "Best Buys": Reducing the Economic Impact of Non-Communicable Diseases in Low- and Middle-Income Countries Bloom DE edt al 2011 World Economic Forum
6. Freedman ND, MJ T. Tobacco products: Massive and still growing causes of cancer worldwide. In: Wild CP, Weiderpass E, BW S, editors. World Cancer Report: Cancer Research for Cancer Prevention Lyon, France: International Agency for Research on Cancer. Lyon, France: International Agency for Research on Cancer; 2020. p. 50-9.
7. Kulhanova I, Znaor A, Shield KD, Arnold M, Vignat J, Charafeddine M, et al. Proportion of cancers attributable to major lifestyle and environmental risk factors in the Eastern Mediterranean region. *Int J Cancer.* 2020;146(3):646-56.
8. Charafeddine MA, Olson SH, Mukherji D, Temraz SN, Abou-Alfa GK, Shamseddine AI. Proportion of cancer in a Middle eastern country attributable to established risk factors. *BMC Cancer.* 2017;17(1):337.
9. Drope J, Schluger N, Cahn Z, Drope J, Hamill S, Islami F, et al. The Tobacco Atlas. 6th ed. Atlanta, USA: *American Cancer Society and Vital Strategies*; 2018.
10. *WHO global report on trends in prevalence of tobacco use 2000-2025*, fourth edition. Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.
11. Bath Uo. Eastern Mediterranean Region 2020 [Available from: https://tobaccotactics.org/wiki/eastern-mediterranean-region/.
12. Hamadeh RR, Lee J, Abu-Rmeileh NME, Darawad M, Mostafa A, Kheirallah KA, et al. Gender differences in waterpipe tobacco smoking among university students in four Eastern Mediterranean countries. *Tob Induc Dis.* 2020;18:100.
13. WHO. WHO Framework Convention on Tobacco Control. Control and prevention of waterpipe tobacco products 2016 [Available from: https://www.who.int/fctc/cop/cop7/FCTC_COP_7_10_EN.pdf.
14. Khattab A, Javaid A, Iraqi G, Alzaabi A, Ben Kheder A, Koniski ML, et al. Smoking habits in the Middle East and North Africa: results of the BREATHE study. *Respir Med.* 2012;106 Suppl 2:S16-24.
15. Nakkash R, Khader Y, Chalak A, et al. Prevalence of cigarette and waterpipe tobacco smoking among adults in three Eastern Mediterranean countries: a cross-sectional household survey. *BMJ Open* 2022;12:e055201. doi:10.1136/ bmjopen-2021-055201
16. Al-Mandhari A, Hammerich A, El-Awa F, Bettcher D, Mandil A. Full implementation of the WHO Framework Convention on Tobacco Control in the Eastern Mediterranean Region is the responsibility of all. *East Mediterr Health J.* 2020;26(1):4-5.
17. Abu-Rmeileh NME, Khader YS, Abdul Rahim H, et al. Tobacco control in the Eastern Mediterranean region: implementation progress and persisting challenges *Tobacco Control* 2022;31:150-152.
18. Prevention. CfDCa. Electronic nicotine delivery systems. Key facts. : CDC; 2016 [Available from: https://www.cdc.gov/tobacco/stateandcommunity/pdfs/ends-key-factsoct-2016.pdf.
19. Makri OE, Pallikari A, Kagkelaris K, Mastronikolis SN, Karanasios G, Symeonidis C, et al. The Acute Effects of Electronic Cigarette Vaping and Tobacco Cigarette Smoking on Choroidal Thickness in Young, Healthy, Habitual, Dual Smokers. Toxics. 2020;8(4).
20. Walley SC, Jenssen BP, Section on Tobacco C. Electronic Nicotine Delivery Systems. *Pediatrics.* 2015;136(5):1018-26.
21. Afifi R, Saravanan M, El Salibi N, Nakkash R, Rady A, Sherman S, et al. Evidence from the Lebanon Global School-based Student Health Survey on midwakh tobacco smoking in school students: a harbinger of the next global tobacco pandemic? *East Mediterr Health J.*2020;26(1):116-21.
22. Jawad M, Al-Houqani M, Ali R, El Sayed Y, El Shahawy O, Weitzman M, et al. Prevalence, attitudes, behaviours and policy evaluation of midwakh smoking among young people in the United Arab Emirates: Cross-sectional analysis of the Global Youth Tobacco Survey. *PLoS One.* 2019;14(4):e0215899.
23. Al-Houqani M, Ali R, Hajat C. Tobacco smoking using Midwakh is an emerging health problem--evidence from a large cross-sectional survey in the United Arab Emirates. *PLoS One.* 2012;7(6):e39189.
24. Nakkash R, Lee K. The tobacco industry's thwarting of marketing restrictions and health warnings in Lebanon. *Tob Control.* 2009;18(4):310-6.
25. Heydari G. Quantitative comparison of WHO tobacco control measures: lessons from the Eastern Mediterranean Region. East Mediterr Health J. 2020;26(1):9-17.
26. Hassounah S, Rawaf D, Khoja T, Rawaf S, Hussein MS, Qidwai W, et al. Tobacco control efforts in the Gulf Cooperation Council countries: achievements and challenges. *East Mediterr Health J.* 2014;20(8):508-13.
27. Awaisu A, Hagi A, Ashour MA, Kheir N. Pictorial health warnings on cigarette packages in Qatar: preimplementation awareness and perceptions of ever-smokers versus neversmokers. *Nicotine Tob Res.* 2013;15(10):1765-72.
28. WHO. Tobacco Free Initiative. WHO Framework Convention on Tobacco Control 2020 [Available from: http://www.emro.who.int/tfi/who-fctc/index.html.
29. Diseases. UNITFotPaCoN. The Investment Case for Noncommunicable Disease Prevention and Control In the Kingdom of Saudi Arabia : Return on Investment Analysis
30. WHO report on the global tobacco epidemic 2021: addressing new and emerging products. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.
31. COVID-19 and beyond: banning the use of tobacco and e-cigarettes in public places. World Health Organization Regional Office for the Eastern Mediterranean; 2021. License: CC BY-NC-SA 3.0 IGO.
32. Scollo, M., Hippolyte, D., & Miller, C. 12A.3 Evidence about the effects of health warnings. In Scollo, MM and Winstanley, MH [editors]. Tobacco in Australia: Facts and issues. Melbourne: Cancer Council Victoria; 2019. Available from: https://www.tobaccoinaustralia.org.au/chapter-12-tobacco-products/attachment-12-1-health-warnings/12a-3-evidence-about-effects-of-health-warnings
33. Guidelines for implementation of Article 11 of WHO FCTC. Packaging and labelling of tobacco products. 2013. https://fctc.who.int/publications/m/item/packaging-and-labelling-of-tobacco-products
34. Raupach T, Brown J, Herbec A, Brose L, West R. A systematic review of studies assessing the association between adherence to smoking cessation medication and treatment success. *Addiction.* 2014;109(1):35-43.
35. Hawari FI, Bader RK. Advancing Tobacco Dependence Treatment Services in the Eastern Mediterranean Region: International collaboration for training and capacitybuilding. *Sultan Qaboos Univ Med J.* 2014;14(4):e442-7.
36. Stead LF, Buitrago D, Preciado N, Sanchez G, Hartmann-Boyce J, Lancaster T. Physician advice for smoking cessation. *Cochrane Database Syst Rev.* 2013(5):CD000165.
37. Al Mulla A, Hassan-Yassoub N, Fu D, El-Awa F, Alebshehy R, Ismail M, et al. Smoking cessation services in the Eastern Mediterranean Region: highlights and findings from the WHO Report on the Global Tobacco Epidemic 2019. *East Mediterr Health J.* 2020;26(1):110-5.
38. Hamadeh RR, Ahmed J, Al-Kawari M, Bucheeri S. Quit tobacco clinics in Bahrain: smoking cessation rates and patient satisfaction. *Tob Induc Dis.* 2017;15:7.
39. WHO technical manual on tobacco tax policy and administration. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.
40. Batmanghelidj E, Heydari G. Sanctions, Smuggling, and the Cigarette: The Granting of Iran Office of Foreign Asset Control's Licenses to Big Tobacco. *Int J Prev Med.* 2014;5(2):138-44.
41. El-Awa FMS, El Naga RA, Labib S, Latif NA. Tobacco advertising, promotion and sponsorship in entertainment media: a phenomenon requiring stronger controls in the Eastern Mediterranean Region. *East Mediterr Health J.* 2018;24(1):72-6.
42. CDC. Tobacco Use in Top-Grossing Movies — United States, 2010–2016 Atlanta, USA: Centers for Disease Control and Prevention; 2017 [Available from: https://www.cdc.gov/mmwr/volumes/66/wr/mm6626a1.htm.
43. Maziak W, Nakkash R, Bahelah R, Husseini A, Fanous N, Eissenberg T. Tobacco in the Arab world: old and new epidemics amidst policy paralysis. *Health Policy Plan.* 2014;29(6):784-94.
44. Regional consultation on novel tobacco products: health effects, research needs and provisional recommended actions for regulators. *East Mediterr Health J.* 2020;26(1): 129-30.
45. Hamadeh RR, Borgan SM, Sibai AM. Cancer Research in the Arab World: A review of publications from seven countries between 2000-2013. *Sultan Qaboos Univ Med J.* 2017;17(2):e147-e54.
46. Alcohol Consumption and Ethyl Carbamate : IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 96. Available from https://publications.iarc.fr/114. (Last accessed on 7 July 2020).
47. World Health Organization (WHO) Global Status Report on Alcohol and Health. 2018. Available from: https://www.who.int/substance_abuse/publications/global_alcohol_report/en/. (Last accessed on 10 July 2020).
48. World Health Organization. Global Information System on Alcohol and Health. Geneva, Switzerland: World Health Organization, 2015.
49. Jürgen Rehm, et.al,. The relation between different dimensions of alcohol consumption and burden of disease: 2010 an overview. Addiction. April. 2010. https://doi.org/10.1111/j.1360-0443.2010.02899.
50. Lim, Vos & Flaxman, 2012, et.al.: A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, Volume 380, Issue 9859, 15 December 2012–4 January 2013, Pages 2224-2260
51. Bagnardi et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose–response meta-analysis. *British Journal of Cancer*, volume 112, 03 February 2015, pages580–593.
52. Kulhánová I, et.al. Proportion of cancers attributable to major lifestyle and environmental risk factors in the Eastern Mediterranean region. *Int J Cancer* ; 2020 Feb 1;146(3):646-656.

References

53. WHO NCD Data Finder (last accessed on 11 July 2020).
54. WHO, Global Strategy to Reduce the Harmful Use of Alcohol. Geneva, Switzerland: WHO; 2010. Available at http://www.who.int/entity/substance_abuse/alcstrategyaftereb.pdf. Accessed July 10, 2020.
55. WHO, Tackling NCDs, 'Best buys' and other recommended interventions for the prevention and control of noncommunicable diseases: WHO 2017. Available at https://apps.who.int/iris/bitstream/handle/10665/259232/WHO-NMH-NVI-17.9-eng.pdf. Accessed July 10.2020 .
56. WHO Global Recommendations on physcal activity for health , WHO 2010. Available at file:///Users/saif1980/Downloads/9789241599979_eng%20(1).pdf. Accessed on 10 July 2020.
57. WHO Global action plan on physical activity 2018-2030. WHO 2018. Availble at file:///Users/saif1980/Downloads/9789241514187-eng%20(1).pdf. Accessed on 13 July 2020
58. Harriss DJ, Atkinson G, Batterham A, et al. Lifestyle factors and colorectal cancer risk (2): a systematic review and meta- analysis of associations with leisure-time physical activity. *Colorectal Dis Sep* 2009; 11(7): 689e701.
59. Moore SC, Gierach GL, Schatzkin A, Matthews CE. Physical activity, sedentary behaviours, and the prevention of endome-trial cancer. *Br J Cancer Sep* 28 2010; 103(7): 933e938.
60. Monninkhof EM, Elias SG, Vlems FA, et al. Physical activity and breast cancer: a systematic review. *Epidemiology* Jan 2007; 18(1): 137e157.
61. Mabry RM, Reeves MM, Eakin EG, Owen N. Evidence of physical activity participation among men and women in the countries of the Gulf cooperation council: a review. *Obes Rev* Jun 2010; 11(6): 457e464.
62. WHO NCD Data Finder. Available at https://apps.apple.com/ro/app/who-ncd-data-finder/id1250210033 . Accessed on 8 July 2020.
663. World Health Organization. Global Health Observatory. Indicators. www.who.int. Available online at: https://www.who.int/data/gho/data/ indicators (accessed August 31, 2021).
64. Institute for Health Metrics and Evaluation. Institute for Health Metrics and Evaluation (2018). Available online at: http://www.healthdata.org (accessed August 30, 2021).
65. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* (2021) 71:209–49. doi: 10.3322/caac.21660
66. Arafa MA, Rabah DM, Farhat KH. Rising cancer rates in the Arab World: now is the time for action. *East Mediterr Health J.* (2020) 26:638– 40. doi: 10.26719/emhj.20.073
67. Global Cancer Observatory. Global Cancer Observatory. Iarc.fr (2018). Available online at: https://gco.iarc.fr/ (accessed October 16, 2021).
68. World Health Organization. Noncommunicable Diseases Country Profiles (2018).
69. Continuous Update Project Report. World Cancer Research Fund / American Institute for Cancer Research; 2010. *Food, Nutrition, Physical activity, and the Prevention of Breast Cancer.*
70. Continuous Update Project Report. World Cancer Research Fund / American Institute for Cancer Research; 2011. *Food, Nutrition, Physical activity, and the Prevention of Colorectal Cancer.*
71. Continuous Update Project Report. World Cancer Research Fund / American Institute for Cancer Research; 2012. *Food, Nutrition, Physical activity, and the Prevention of Pancreatic Cancer.*
72. Continuous Update Project Report. World Cancer Research Fund / American Institute for Cancer Research; 2013. *Food, Nutrition, Physical activity, and the Prevention of Endometrial Cancer.*
73. Continuous Update Project Report. World Cancer Research Fund / American Institute for Cancer Research; 2014. Food, *Nutrition, Physical activity, and the Prevention of Ovarian Cancer.*
74. Food, nutrition, physical activity and the prevention of cancer: a global perspective: a project of World Cancer Research Fund International. American Institute for Cancer Research. World Cancer Research Fund; Washington, D.C.: 2007.
75. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet.* 2008; 371(9612):569–78. [PubMed: 18280327]
76. Arnold M, Pandeya N, Byrnes G, Renehan AG, Stevens GA, Ezzati M, et al. (2015). Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *Lancet Oncol.* 16(1):36–46. PMID: 25467404 (free full text available)
77. IbrahimAS, KhaledHM,Mikhail NN, Baraka H, Kamel H. Cancer incidence in Egypt: results of the national population-based cancer registry program. *J Cancer Epidemiol.* (2014) 2014:437971. doi: 10.1155/2014/437971
78. Bazzano LA, He J, Ogden LG, Loria CM, Vupputuri S, Myers L, et al. Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *Am J Clin Nutr.* (2002) 76:93–9. doi: 10.1093/ajcn/76.1.93
79. Carter P, Gray LJ, Troughton J, Khunti K, Davies MJ. Fruit and vegetable intake and incidence of type 2 diabetes mellitus: systematic review and meta-analysis. *BMJ.* (2010) 341:c4229. doi: 10.1136/bmj.c4229
80. Maynard M, Gunnell D, Emmett P, Frankel S, Davey Smith G. Fruit, vegetables, and antioxidants in childhood and risk of adult cancer: the Boyd Orr cohort. *J Epidemiol Community Health.* (2003) 57:218– 25. doi: 10.1136/jech.57.3.218
81. Papas MA, Giovannucci E, Platz EA. Fiber from fruit and colorectal neoplasia. *Cancer Epidemiol Biomarkers Prev.* (2004) 13:1267–70.
82. Nishida C, Uauy R, Kumanyika S, Shetty P. The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: process, product and policy implications. *Public Health Nutr.* (2004) 7:245 -50. doi: 10.1079/phn2003592
83. Micha R, Mozaffarian D. Trans fatty acids: effects on cardiometabolic health and implications for policy. *Prostaglandins Leukot Essent Fatty Acids.* (2008) 79:147–52. doi: 10.1016/j.plefa.2008.09.008
84. Hamadeh RR, Abulfatih NM, Fekri MA, Al-Mehza HE. Epidemiology of breast cancer among bahraini women: data from the Bahrain Cancer Registry. *Sultan Qaboos Univ Med J.* (2014) 14:e176–e82.
85. Nasaif HA, Al Qallaf SM. Knowledge of colorectal cancer symptoms and risk factors in the Kingdom of Bahrain: a cross- sectional study. *Asian Pac J Cancer Prev.* (2018) 19:2299–304. doi: 10.22034/APJCP.2018.19. 8.2299
86. Cancer Today. gco.iarc.fr. Available online at: https://gco.iarc.fr/today/data/ factsheets/populations/48-bahrain-fact-sheets.pdf (accessed August 30, 2021).
87. Countries - The World Factbook. www.cia.gov. Available online at: https://www.cia.gov/the-world-factbook/countries/Bahrain (accessed July 20, 2021).
88. Kingdom of Bahrain Ministry of Health. National Non-communicable Disease Risk Factors Survey 2007. Report of theNationalNon-Communicable Diseases STEPwise Survey (2009). Available online at: http://www.who.int/ ncds/surveillance/steps/2007_STEPS_Survey_Bahrain.pdf (accessed July 20, 2021).
89. Kalan Farmanfarma K, Mahdavifar N, Hassanipour S, Salehiniya H. Epidemiologic study of gastric cancer in Iran: a systematic review. *Clin Exp Gastroenterol.* (2020) 13:511–42. doi: 10.2147/CEG.S256627
90. Diet High in Trans Fatty Acids - Level 3 Risk. Institute for HealthMetrics and Evaluation (2020). Available online at http://www.healthdata.org/results/ gbd_summaries/2019/diet-high-in-trans-fatty-acids-level-3-risk (cited November 2, 2021).
91. https://rho.emro.who.int/ThemeViz/TermID/146.
92. Micha R, Khatibzadeh S, Shi P, Fahimi S, Lim S, Andrews KG, et al. Global, regional, and national consumption levels of dietary fats and oils in 1990 and 2010: A systematic analysis including 266 country-specific nutrition surveys. *BMJ.* (2014) 348:g2272. doi: 10.1136/bmj.g2272
93. Healthy diet in EMR: https://applications.emro.who.int/docs/EMROPUB_2019_en_23536.pdf?ua=1
94. Policy statement and recommended actions for lowering sugar intake and reducing prevalence of type 2 diabetes and obesity in the Eastern Mediterranean Region http://www.emro.who.int/nutrition/strategy/policy-statement-and-recommended-actions-for-lowering-sugar-intake-and-reducing-prevalence-of-type-2-diabetes-and-obesity-in-the-eastern-mediterranean-region.html.
95. Promoting healthy diet: reducing levels of salt, sugars and saturated fats in the food supply http://www.emro.who.int/dsaf/emropub_2011_1274.pdf?ua=1
96. Strategy on Nutrition for the Eastern Mediterranean Region ; 2020-2030 http://applications.emro.who.int/docs/9789290222996-eng.pdf?ua=1
97. Framework of Action on obesity Prevention in EMR: http://applications.emro.who.int/docs/EMROPUB_2019_en_22319.pdf?ua=1