

Global Cancer Incidence and Etiology: Drivers, Disparities, and Prevention Insights from the Arab Region with Libya as a Case Study

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Abstract

The continuous escalation in the number of cases of cancer across the globe represents a complicated public health problem as a result of the combined impact of demographic shifts, behavior changes, environmental contamination, and socioeconomic inequalities. Such an increase does not merely result from enhanced diagnostic techniques but represents a true increase in cancer risk in populations. The problem is compounded by the differential impacts observed between low- and middle-income countries, including those in the Arab region, as a consequence of intersecting factors and underdeveloped health infrastructure. The purpose of this review is to discuss the multiple causative factors behind the increasing burden of cancer on a global scale, analyze the unique situation in the Arab region in terms of cancer epidemiology and prevention, evaluate current and prospective prevention options, and identify success factors for community-based interventions.

Keywords. Cancer Incidence, Etiology, Prevention, Arab Region, Libya.

Introduction

Cancer has become an enormous global problem in terms of increased incidence and mortality rates [1]. Such a situation has been observed globally and especially in poorer areas. In low-income regions, more than half of all cancer cases and mortalities were recorded in 2012, with expectations for further growth by 2025 [2]. In terms of the worldwide disease burden, the number of newly diagnosed cases is expected to grow from 19.3 to 28.4 million cases per year by 2040 [3]. Despite a relatively low incidence of all types of cancer in Arab states in comparison to global numbers, the trend shows increasing tendencies, as well as certain types' incidence higher than in other parts of the world: such cancers include non-Hodgkin and Hodgkin lymphoma, bladder, breast, and liver cancers [4]. Furthermore, Arab states suffer from a high mortality-to-incidence ratio, which indicates some diagnostic or treatment problems. These facts create the necessity for a careful analysis of both global and local circumstances that lead to such trends. [4]. Specifically, this paper will analyze the interplay of global risk factors, such as lifestyle changes mirroring Western patterns, and region-specific determinants in shaping cancer epidemiology in Libya and the broader Arab world.

Global Risk Factors Behind the Epidemic

Meta-analysis has identified several related risk factors contributing to the cancer burden. First of all, the non-modifiable factor that needs consideration is the aging of the world's population. Longer life expectancy leads to an inevitable increase in cancer risks through the accumulation of cellular mutations and genotypic instability. With the anticipated doubling of the population aged over 60 years expected by 2050, especially in under-resourced countries, there exists a serious concern. However, it should be noted that increased age-standardized incidence rates prove that aging alone cannot account for the growing global numbers of cancer cases. Preventable modifiable risk behaviors represent major determinants of this phenomenon. Tobacco smoking accounts for 15.1% of attributable cases and 25% of cancer deaths [5, 6], while alcohol consumption increases the risk of different forms of cancer even at lower levels of exposure [3, 4]. Obesity, responsible for nearly 3.9% of cancer globally, causes metabolic disorders and systemic inflammatory response [7, 8]. Western-style dietary habits and increased consumption of processed food, red meat, and sugary products further aggravate obesity-associated risks, especially in younger populations [9, 10]. Environmental and occupational carcinogens, such as PM2.5 and diesel exhaust (group 1 carcinogens) or asbestos exposure, add additional risks of cancer types, such as lung or bladder cancers [11–13]. Infectious agents (HBV/HCV, H. pylori, HPV) account for approximately 15-20% of global cancers, disproportionately affecting regions with limited prevention access [14, 15]. One worrying trend is the 79.1% global increase in early-onset cancers (detection before the age of 50) from 1990-2019, caused by childhood obesity, poor nutrition in early life, and exposure to harmful environmental factors during critical periods of development [16–18]. Deeply entrenched socioeconomic inequalities further affect low-to-middle-income countries (LMICs) that must contend with their chronic infection-linked cancers alongside emerging non-communicable malignancies due to a lack of prevention, screening, and early detection methods [19, 20]. Despite a small portion (5-10%) of cancers being due to genetic mutations, genetic predisposition mainly

affects one's sensitivity to the environment through gene-environment interactions and alters personal susceptibility to carcinogens [14, 21, 22].

Cancer in the Arab Region: A Dual Burden

Arab nations reflect the juxtaposition of old-fashioned and new cancer hazards, producing an exclusive dual burden of disease. Arab countries experience chronic infection-related cancers (due to HBV/HCV, H. pylori, and HPV, especially in areas without vaccinations and screenings) along with an alarming increase in non-communicable cancers due to smoking, lack of physical exercise, obesity, and unhealthy westernized diets comprising highly processed foods and sugar content [23–25]. The incidence of obesity is rapidly rising in the Arab world, greatly increasing the risk of developing certain types of cancers, including breast and colorectal cancers [23, 25]. Old-fashioned cultural practices can provide some degree of protection from cancer; for example, following the traditional Mediterranean diet, which consists of legumes, olive oil, and spices such as turmeric and garlic (known for their beneficial bioactive properties) [26, 27], engaging in Ramadan fasting (which might help adjust one's metabolism and minimize oxidative stress) [28, 29], and avoiding the consumption of alcohol, which has been proven to have adverse effects on people's health [30, 31]. Still, the ongoing process of globalization and urbanization makes it challenging to maintain old-fashioned habits. Significant disparities between different regions within the Arab world should be noted. Wealthy GCC countries utilize available resources more effectively to organize and implement structured prevention programs, including vaccinations against HPV, promotion of the Mediterranean diet, physical activities, and other health-preserving measures. Nevertheless, some problems, such as the inability to enforce smoking restrictions, remain unsolved. On the other hand, poorer or politically unstable countries (such as Libya and Yemen) face numerous obstacles, including a scarcity of medical care, insufficient infrastructure, and inadequate funding for prevention and screening [23, 32, 33].

Libya's Cancer Burden: A Microcosm of Regional Challenges and Systemic Risk Factors

The rising prevalence of cancers in Libya is symptomatic of larger public health problems across the Arab states, attributed to the interaction of a wide range of modifiable and non-modifiable risk factors that emerged with changes in socioeconomic circumstances and demographics. Epidemiologically, the distribution of risk factors presents pronounced geographical variations. Breast cancer remains the most common type of cancer. However, there are substantial differences between various geographic regions, with breast cancer accounting for 47.8% of all cancers in the South and 24.26% in the East [34–36]. Other types of cancers include colorectal and lung cancer, where the latter is the most common cancer in Libyan males, the second most common type of cancer in eastern regions [37], and strongly associated with past tobacco use in western regions [38]. In addition, around 2.4 million women are exposed to cervical cancer risks owing to low HPV vaccination rates and inadequate screening programs [39, 40, 41]. Some infectious organisms, such as H. pylori, add to these health concerns through their contributions to gastric cancer in eastern regions, as well as liver cancer, which is caused by hepatitis B and C viruses in rural areas [35, 41]. The above-mentioned trends in the epidemiology are directly associated with the fast-paced changes observed in lifestyle and the environment. Urbanization has contributed to a Westernization of diet, resulting in an increased intake of red meat, fried food, and processed products. Combined with sedentary lifestyles, such dietary practices have led to a higher prevalence of obesity and metabolic problems, thus contributing to the development of colorectal and other types of gastrointestinal malignancies, especially in the West [42, 43, 44]. At the same time, environmental exposure is another factor that adds to the cancer problem. Industrial pollution, including toxic metals and chemicals used in oil production, and the lack of waste management facilities are considered possible causes of cancer clusters in specific geographic locations [45–47, 44, 48, 49].

Furthermore, the occurrence of cancer in Libya is exacerbated by serious systemic and sociocultural challenges. The post-conflict era has destabilized the health sector in terms of governance, inadequate financing, and resource scarcity, particularly skilled labor, medical equipment, and crucial vaccines [37, 48]. This fragmentation has led to the lack of national screening campaigns, and important interventions such as HPV vaccination have been continuously delayed [34, 35, 37, 50]. The country faces economic instability due to its dependence on unstable oil reserves, which causes resources to be redirected from prevention to emergency management. In addition to these systemic challenges, sociocultural problems like cancer stigma, low health literacy, and mistrust in the healthcare sector further discourage individuals from taking up screening procedures, and as a result, they experience negative consequences for their health status [34, 35, 50]. Additionally, rural-urban health inequities remain pronounced in Libya, particularly among vulnerable groups affected by vaccine-preventable infections and advanced cancers [35, 41].

Any successful cancer management strategy in Libya is fundamentally obstructed by the lack of proper epidemiologic capacity. There is no functioning national cancer registry, and there is also a scarcity of data in general; such data, however, is outdated and insufficient for cancer tracking and resource allocation [35, 50]. Lack of epidemiological capacity in Libya reflects a wider trend within the region: only 57% of Arab

nations have functioning cancer registries, thus confirming the fact that Libya is an example of the broader cancer problem in the Middle East/North Africa region [51]. Consequently, the solution of the problem of the growing cancer burden in Libya should include many measures, among which are health care reform, ensuring equal access to preventive programs and vaccinations, environmental assessment, and education.

Prevention Strategies: Implementation and Barriers

Arab countries employ various cancer prevention strategies, though implementation efficacy varies drastically, with Libya facing pronounced barriers. Regional strategies include tobacco control measures aligned with the WHO FCTC (public bans, taxation, warnings), though enforcement is inconsistent, particularly in LMICs [52]. GCC states have integrated HPV vaccination into national programs, yet regional cervical cancer screening adherence remains critically low (~18.2%) [53] due to stigma, access barriers, and low awareness [23]. Public health campaigns promoting traditional diets and physical activity exist (e.g., the UAE's walkable city initiatives) [54]. Infection control efforts include HBV vaccination and H. pylori eradication programs, though coverage is uneven. Environmental regulations, while introduced in some GCC nations, suffer from weak enforcement elsewhere.

Table 1. Cancer Epidemiology and Prevention Challenges in Select Arab Contexts

Region/Country	Leading Cancers	Dominant Risk Factors	Key Prevention Challenges
Libya	Breast (regional variation), Colorectal, Lung	Westernized diet, Obesity, Smoking, HBV/HCV, H. pylori	Fragmented healthcare, Weak governance, Poor screening/vaccination, Environmental pollution, Data gaps
GCC (e.g., UAE)	Breast, Colorectal, Thyroid	Obesity, Sedentary lifestyle, Westernized diet	Tobacco control enforcement, Maintaining traditional diets amidst affluence
Levant (e.g., Jordan)	Breast, Lung, Colorectal	Smoking, Obesity, Urbanization	Cultural stigma, Resource limitations for screening, Rural access
North Africa (e.g., Egypt)	Liver (HCV), Breast, Bladder	HBV/HCV, Schistosomiasis, Smoking, Emerging obesity	High infection burden, Resource constraints, Environmental exposures

Key Success Factors for Community-Based Interventions

A review of successful community-based initiatives highlights the key success factors vital for lowering cancer prevalence in resource-limited settings such as Libya, starting with cultural adaptation and full community participation. Programs should be congruent with prevailing culture and social values, incorporating influential stakeholders such as clergy members and women workers in the process to ensure trust-building and reduce stigma [55, 56]. Such community-oriented approaches are most effective when incorporated into existing systems, harnessing the potential of schools and basic healthcare facilities, together with shifting tasks to community health workers [57, 58]. In addition to structural alignment, success requires direct contact with individuals using peer educators and cancer survivors, supplemented by education and navigation services [55]. Moreover, interventions that can be expanded should include multi-sector collaboration and diverse sources of financing, complemented by appropriate policies and advocacy efforts to create an enabling environment through governmental legislation. However, ultimately, the applicability and effectiveness of these interventions will depend on evidence-based application, using local data to guide interventions and adjust strategies to changing circumstances.

Evidence from other LMICs offers adaptable models

Other countries that are similar to Libya have found ways to deal with these problems. For example, Zambia has used a cheap way to screen for cervical cancer [59], and Rwanda has had success with a program to vaccinate girls against HPV [60]. Bhutan has also had success with a program to reduce smoking [61]. Jordan has used campaigns that are tailored to the culture to get more women to get screened for breast cancer. South Korea has reduced the number of colon cancer cases by changing the way people eat and by providing screening for people who are at high risk. Gujarat, India, has also reduced the number of cancer cases caused by pollution by working with the community and private companies [62]. These examples show that it is possible to make a difference in the fight against cancer in countries that face many challenges.

Conclusion

The escalating global cancer burden is an undeniable consequence of complex, interacting forces: demographic aging, pervasive modifiable risks (tobacco, diet, obesity, alcohol), environmental carcinogens,

infectious agents, and entrenched socioeconomic inequities. The Arab region, exemplified by Libya, faces a particularly acute challenge characterized by a dual burden of traditional and modern cancer risks, amplified by resource constraints, governance fragility, and critical data deficits. While the drivers are multifaceted, a significant proportion of cancers are preventable. Success hinges on implementing contextually relevant, multi-pronged strategies grounded in evidence. Lessons from successful community-based interventions globally demonstrate that overcoming barriers in settings like Libya requires: culturally sensitive approaches embedded within existing community structures and healthcare systems; robust policy frameworks; strategic multi-sectoral partnerships; sustained investment; and a commitment to data-driven, adaptive programming. Prioritizing cost-effective, evidence-based interventions, such as scaling up HPV vaccination using Rwanda's model, implementing low-tech screening like Zambia's VIA, enforcing rigorous tobacco control inspired by Bhutan, and tackling environmental risks through partnerships, as in Gujarat, is imperative. Addressing the rising tide of cancer in Libya and similar contexts demands urgent, coordinated, and contextually grounded action that prioritizes equity, prevention, and community empowerment.

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