https://doi.org/10.4082/kjfm.22.0167 • Korean J Fam Med 2023;44:76-86

KJFM
Korean Journal of Family Medicine

eISSN: 2092-6715

■ Review Article

Risk-Reducing Measures for Cancer Prevention

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Cancer, or malignancy, continues to be one of the most serious health problems in the world, leading to death and disability. Unlike in previous years, where new cases of cancer were predominant in developed nations, the number of cases of cancer and the resultant deaths are increasing in low- and middle-income countries. This is partially attributable to the current trend of adopting a Western lifestyle, substantial urbanization, and the rise in infections, such as the human papillomavirus (HPV) and hepatitis B virus (HBV), which together account for over 30% of cancer cases in underdeveloped and developing nations. The deleterious impact of cancer, as cases multiply worldwide, is multi-dimensional. Cancer exerts serious physical, psychological, and monetary burdens, not only on cancer patients but also on their family members, close friends, health care systems, and society at large. Importantly, over half of all cancer types can be prevented globally by mitigating the risk and causative factors as well as prompt adherence to scientifically recommended prevention measures. This review provides various scientifically based and people-centered strategies that every individual could adopt to reduce their risk of developing cancer in the future. It is recommended that, for these cancer prevention strategies to be effective, there should be a strong political will from the governments of individual countries to enact specific laws and implement policies that will significantly reduce sedentary lifestyles and unhealthy eating among the general public. Likewise, HPV and HBV vaccines, as well as cancer screenings, should be made available, affordable, and accessible on a timely basis for those who are eligible to take them. Finally, intensified campaigns and numerous informative and educational programs that promote cancer prevention should be initiated globally.

Keywords: Neoplasms; Prevention and Control; Healthy Lifestyle; Screening; Breast Feeding; Infections

Received: August 25, 2022, Accepted: December 30, 2022
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INTRODUCTION

Cancer, or malignancy, is a collection of numerous diseases that involves an abnormal growth of cells, with the potential to spread or attack other healthy cells in the body.[1] It is typically observed to be a chronic health problem. More than 100 types of cancer have been documented to affect humans, and some of the indicative symptoms of the disease include, but are not limited to, unusual bleeding, persistent coughs, unintended loss of weight, lumps, and rapid changes in feces discharge.[1] These signs and symptoms are not exclusive to cancer alone and they might have other underlying causes.[1] The severity and complexity of cancer are usually ranked from 0 to 4 and the higher this figure, the more likely it is that the cancer has spread to other parts of the body.[1]

Smoking of tobacco alone accounts for approximately 20% of deaths from cancer, while around 10% of cancer causes are due to unhealthy diet, being overweight, excessive consumption of alcohol, and low levels of physical activity.[2] Other risk factors for cancer include specific pathogenic infections, regular exposure to radiation, and environmental pollutants.[1,3] For instance, in underdeveloped and developing nations, hepatitis B virus (HBV), hepatitis C virus (HCV), Epstein-Barr virus (EBV), *Helicobacter pylori*, human immunodeficiency virus (HIV), and human papillomavirus (HPV) account for around 30% of all cancers by initiating an abnormal alteration of healthy cells in the body. Finally, hereditary and genetic abnormalities cause around 5%–10% of all cancers worldwide.[3]

Globally, cancer continues to rank as the leading cause of mortality for non-communicable diseases, with over 10 million direct deaths recorded in 2020 alone (about one in every six deaths).[1] Breast, lung, rectum, colon, and prostate malignancies are the most frequently occurring cancers among all other types of cancer worldwide.[1] The deleterious impact of cancer, which is increasing worldwide, is multi-dimensional. It exerts serious physical, mental, and monetary burdens, not only on the patients, but also on family members, close friends, society, and the healthcare system. Thus, by mitigating the risk and causative factors, as well as prompt adherence to scientifically recommended prevention measures, approximately 30%–50% of all types of cancer can be prevented globally.[1] To this end, this review aims to provide detailed and scientific information on various lifestyle modification methods that can be used globally to prevent cancer.

METHODS

This review aimed to provide various scientifically proven lifestyle modification-centered methods for the prevention of cancer. Primarily, PubMed, Google, Elsevier, and Google Scholar were used as search engines for peer-reviewed sources of grey literature, as well as various health organization websites, and other reputable online sources (i.e., National Cancer Institute, World Health Organization, American Cancer Society, World Cancer Research Fund International, and Centers for Disease Control and Prevention), making use of the keywords "cancer," "prevalence of cancer," and "prevention of cancer." To ensure the recency of the literature, studies that have been published in the last 5 years were included in the review, with extremely few exceptions. The word "cancer" in the literature search was used as a generic name to refer to all types of cancers and was not specific to one particular type. Also, when "breast cancer" is used in this manuscript, it typically indicates that of the female gender, except when stated otherwise. The literature search took place between September 2021 and August 2022, and mainly included randomized controlled trials and meta-analytical studies, although other types of studies such as systematic and narrative reviews were also included due to the nature of the present study. After the imputation of the search terms into various databases and search engines, thousands of results were recorded; however, they were streamlined into manageable numbers using the title, as well as the aims and objectives of this study as guidelines. Furthermore, additional and specific searches were conducted on each of the returned results for the "prevention of cancer," which have been discussed under each of the subheadings. After the inclusion and exclusion criteria were applied, around 72 documents in total were deemed appropriate for this review and reported in a narrative and concise way as follows.

THE GLOBAL PREVALENCE OF CANCER

Globally, cancer remains the leading cause of deaths under non-communicable diseases, with over 10 million direct deaths recorded in 2020 alone (about one in every six deaths), while in the same year, 2.26 million, 2.21 million, 1.93 million, 1.41 million, 1.20 million, and 1.09 million new cases of breast, lung, colon and rectum, prostate, skin, and stomach cancers, respectively, were recorded in both genders.[1] Combined with other cancer types, excluding skin cancer, over 18 million new cancer incidents were confirmed in 2020 in both genders globally, with a combined age-standardized estimate of 190 per 100,000, while this estimate was lower for women (178.1 per 100,000) compared to men (206.9 per 100,000).[4]

Globally, lung cancer (15.4%) was the most newly diagnosed cancer type in men in 2020, together with prostate, colon, and rectum cancers, which accounted for around 41.9% of all cancers diagnosed in men, with the exclusion of skin cancer.[4] In women, global estimates revealed breast cancer (25.8%) to be the most newly diagnosed cancer type in 2020, together with colon, rectum, and lung cancers which accounted for 44.5% of the total cancers, with the exclusion of skin cancer.[4] As per the causes of cancer deaths in 2020, lung cancer is in the lead with 1.80 million deaths, followed by colorectal, liver, stomach, and breast cancers with 916,000, 830,000, 769,000, and 685,000 deaths, respectively.[1] With variations in countries, cervical cancer is the most rampant in the world, affecting around 23 nations, while around 400,000 new cases of cancer are diagnosed in children worldwide every year.[1]

Age-standardized estimates from individual countries in 2020 ranked Denmark as the country with the highest cancer incidence for both males and females, followed by Ireland, Belgium, Hungary,

https://doi.org/10.4082/kjfm.22.0167

France, the Netherlands, Australia, Norway, France, and Slovenia, while for men alone, Hungary ranks the highest in cases of cancer incidence, trailed by Latvia, France, Lithuania, Slovakia, Slovenia, Estonia, and Ireland.[5] For women, Denmark recorded the highest cases of cancer, followed by Belgium, Ireland, and the Netherlands.[5] These findings indicate higher cases of cancer are recorded in the European continent compared to other regions of the world.[5] In addition, the country with the highest mortality rate due to cancer for both males and females was Mongolia, followed by Serbia, Hungary, Montenegro, and Slovakia, while in men alone, Mongolia, Hungary, Slovakia, Serbia, Montenegro, Moldova, Belarus, Croatia, Poland, Lithuania, Romania, Armenia, Latvia, Turkey, Bosnia and Herzegovina, Estonia, Uruguay, China, and Russia had the highest number of cancer deaths.[5] For women, Zimbabwe had the highest cancer mortality rates, trailed by Mongolia, Samoa, Malawi, Serbia, and Papua New Guinea.[5]

Importantly, deaths due to cancer tend to be lower in developed countries than in underdeveloped and developing nations, mostly due to advanced medical care systems. For example, approximately 16.9 million patients survived cancer in the United States in 2019, while this number is estimated to reach 22.2 million by 2030.[6] Cancer continues to cause a heavy burden on budgetary health allocations of individual countries in the world. For instance, over $150.8 billion was spent on the management and treatment of cancer patients in the United States in 2018, while this figure is expected to increase in the future due to the aging population, higher number of cancer cases, and wider coverage of novel cancer treatments.[6] Future projections indicate that an additional 27.5 million cases of cancer will be recorded by 2040 globally, while deaths due to cancer are likely to increase by 16.3 million in the same period due to the aging population and some evidently increasing risk factors, such as the use of tobacco products, and the normalization of sedentary behaviors.[7]

EVIDENCE-BASED MEASURES FOR THE PREVENTION OF CANCER

Numerous factors predispose and increase an individual's risk of developing cancer. Some of these risk factors can be mitigated, consequently reducing the risk of developing cancer in the future. Highlighted below are some of the various scientifically proven methods that can significantly prevent all types of cancer.

AVOIDING ALL FORMS OF SMOKING

Tobacco alone contains over 7,000 chemicals, of which around 250 are identified to be dangerous to humans and 69 have been proven to be carcinogenic.[7] Over the years, various studies have shown that smoking increases the chances of an individual developing cancers of the mouth, lung, throat, larynx, kidney, esophagus, bladder, pancreas, cervix, liver, blood, stomach, colon, and rectum in the future.[8-10] In addition, apart from direct smoking, passive or secondhand smokers also face similar deleterious effects as active smokers.[11] For instance, findings from a specific meta-analytical study revealed that second hand smoking was significantly associated with a higher risk of a female developing cervical cancer in the future.[11] Furthermore, apart from the identified cancers, smoking also increases the risk of other numerous chronic diseases and health problems such as stroke, heart disease, diabetes, aortic aneurysm, difficulty in getting pregnant, osteoporosis, chronic obstructive pulmonary disease, arthritis, and age-related eye problems.[12]

Smoking cessation has numerous benefits in the prevention of cancer and other smoking-associated diseases in non-smokers and people who quit smoking at all ages. For instance, an individual's chances of lung cancer is reduced by 30%–50% when the habit of smoking is stopped after 10 years, and the risk of developing mouth or esophageal cancer is reduced by over 50% within 5 years of cessation.[13,14] People should be encouraged to stop all forms of smoking around the world, and policies that will hinder the public from easy access to all tobacco products should be encouraged and implemented.[10] In addition, counseling smokers about smoking cessation is imperative, while the use of drugs and treatments such as sustained-release bupropion hydrochloride and nicotine replacement agents (nicotine gum, nicotine inhaler, nicotine nasal spray, and transdermal nicotine patches) are also effective for smoking cessation.[15]

ADHERENCE TO REGULAR PHYSICAL ACTIVITY

Physical activity has been established to prevent numerous cancer types such as colon, kidney, esophagus, breast, stomach, endometrial, and bladder cancer.[16] Although physical activity may increase the risk of melanoma, a specific skin cancer, this should not discourage the frequent practice and adherence to regular physical activity due to its overall health benefits.[16] The risk of physical activity-associated skin cancer could be mitigated through various methods that prevent direct skin exposure to the sun.[16] In addition, adherence to a routine physical activity plan prior to and after a cancer is confirmed and diagnosed is beneficial for the disease outcome, that is, it will boost survival rates in people with confirmed cases of colon and breast cancers, with the beneficial effect more evident in post-diagnosis physical activity as compared to pre-diagnosis physical activity.[16,17]

Adherence to a routine physical activity is not only beneficial for the prevention and control of cancer, but also helpful in the prevention of other numerous chronic diseases such as obesity, overweight, diabetes, and heart disease.[18] Individuals whose jobs are sedentary in nature must integrate physical activity into their day-day activities. As per the recommendations from the World Health Organization (WHO), adults must be active every day and engage in not less than 150 minutes of minimal physical activity or an equivalent of not less than 75 minutes of high-impact physical activity weekly, while children should participate in minimal-impact physical activities for not less than 1 hour daily in a week.[18] The prompt adherence to these recommendations could help in a 7% reduction of specific cancers (colorectal and breast cancers).[18] For additional beneficial results in the prevention of

cancer and the improvement of overall health, the higher the level of participation in physical activities, the better and higher the beneficial effects.[18]

Importantly, sensitization programs and physical activity-promoting messages should be increased in every part of the world, especially in countries experiencing higher cases of cancer and other associated chronic diseases. Adherence to physical activity plans is beneficial to people without cancer and those who survived the disease.[16] All types of physical activities are beneficial to health and include minimal-impact activities such as walking, swimming, doing or engaging in various home chores, dancing, cycling, and gardening, and high-impact activities such as fast cycling and swimming, running at a longer stretch, aerobics, and engagement in team sports.[19] Importantly, participation in any form of physical activity should be to the level and health status of the participants to avoid health complications.[19]

ADEQUATE CONSUMPTION OF HEALTHY DIETS

The regular consumption of a healthy diet is one of the most important measures to have overall good health, as well as prevent the risk of having cancer in the future.[20] Findings from a systematic and meta-analytical study revealed that regular adherence to a Mediterranean food regimen reduced the risk of developing esophageal, colorectal, liver, lung, bladder, and stomach cancers in the future, as well as significantly reduced the risk of death and serious health outcomes in people who survived cancers.[21] This is possible through the modification and reduction of chemical enzymes and other growth hormones that increase the risk and development of cancer cells in the body.[22]

In addition, various futuristic studies have revealed that food regimens that incorporate higher consumption of natural fruits, leafy vegetables, and legumes, and reduced consumption of beef (processed or red meats) and domestic salt are associated with reduced chances of death and development of cancer in the future, as well as improved holistic survival rates of patients with colorectal and breast cancers.[23,24] Likewise, adequate consumption of leafy vegetables and natural fruits offers beneficial effects against the development of cancers in the respiratory and digestive tracts, while convincing evidence also indicates the protective role of adequate consumption of dietary fiber on cancers of the colon and rectum.[23,24] Moreover, processed or red beef promotes the development of colon and rectum cancers, while the intake of drinks that are sweetened with sugar and other additives increases the development of cancer of the pancreas.[23,24] A high-calorie diet regimen, which includes sugar-sweetened and fatty foods, may result in excess calories in the body, consequently increasing the risk of obesity, overweight, type 2 diabetes, and cardiovascular diseases, thereby favoring the development of cancer.[23,24]

These evidences strongly support the overall health benefits of a healthy dietary regime. For the prevention of cancer, it is advised that people consume adequate legumes, natural grains such as rye, brown rice, oats, wheat, and barley, and various leafy vegetables and natural fruits, while limiting all forms of high-calorie diets, such as sugary and fatty foods, carbonated drinks, red and processed beef, and all types of foods and drinks that contain high salts.[23] There is no conclusive evidence on the protective role of dietary or nutrient supplements such as minerals, all types of vitamins, folic acid, and garlic in the prevention of cancer, heart disease, and obesity,[25] except for calcium, which has some levels of protection against colorectal cancer.[26] In fact, findings from an experimental study revealed that excess intake or use of beta-carotene nutrients might increase the development of lung cancer, especially in people who smoke regardless of the type of cigarette used.[27]

ABSTINENCE OR REDUCTION IN THE CONSUMPTION OF ALCOHOL

Chronic intake of alcohol is the third-ranked factor of death and disease in Europe and is established to increase the risk of development of liver, breast, colorectal, and upper aerodigestive tract cancers via numerous biological pathways, regardless of the levels of intake or the type of alcohol consumed, while the risk of developing these cancers increases with increasing levels of alcohol consumption.[28,29] In addition, the use of alcohol is attributable to 10% and 3% of all cases of cancer in men and women, respectively, in Europe.[28,29] Similarly, alcohol consumption increases the risk of other chronic non-communicable diseases such as type 2 diabetes, obesity, and heart diseases, all of which increase the risk of developing cancer, as well as deaths from cancer.[30]

With respect to the deleterious impact of alcohol consumption on health, as well as its promoting role in the development of cancer and other chronic non-communicable diseases, it is recommended that all intake of alcohol should be reduced to the barest minimum; a total stoppage to all forms of alcohol consumption is beneficial for the prevention of cancer.[28,31] Although various regulatory health bodies in many countries usually recommend the daily consumption of alcohol in healthy individuals not to exceed two drinks and one drink for men and women, respectively, there are no scientific findings and bases that support this as a safe level of alcohol consumption, while all types of alcoholic beverages, either wines, beers, or spirits, all exert similar risk effects for the development of cancer.[32]

MAINTAINING A HEALTHY WEIGHT

There is a continuous rise in the trend of cancers attributable to obesity and overweight worldwide. For instance, 55% and 24% of cancer cases in women and men, respectively, are caused by obesity and overweight.[33] Likewise, being overweight and obese increases the risk of cancer in not less than 13 locations in the body, which include, but are not limited to, the esophagus, kidney, pancreas, uterus, liver, stomach, bone marrow, colon and rectum, breast, thyroid, ovary, gallbladder, and the brain.[33,34] This is due to different underlying mechanisms such as the role of sex hormones, adipocytokines, and the insulin/insulin-like growth factor 1 system.[33] There are variations in obesity-in-

https://doi.org/10.4082/kjfm.22.0167

duced cancers as per sex, with estimates revealing higher cases of uterine, breast, and ovarian cancers in women, while in cancer types that pertain to both sexes, a higher rate in men, especially cancer of the esophagus.[33]

Unhealthy weight is a major risk factor for the development of various cardiovascular diseases, type 2 diabetes, and other numerous chronic non-communicable diseases, all of which increase cancer morbidity and mortality.[35] The various measures that will always ensure a healthy weight, with a body mass index within the range of 18.5–24.9 kg/m^2 are necessary and imperative for overall health.[33,34,36] Some of these measures include the consumption of a healthy diet, low intake of alcohol, adherence to routine physical activity, and shunning all forms of sedentary lifestyles.[33,35,36]

PREVENTION OF ULTRAVIOLET RADIATION

Direct exposure to the sun, tanning equipment, and sun lamps increases the risk of serious skin damage and melanoma, an aggressive type of skin malignancy.[37] Irregular exposure to the sun, any equipment or materials emitting ultraviolet radiation greatly heightens this risk.[37,38] The incidence of melanoma is increasing in every part of the world, especially in young individuals as well as the older population, and is the 5th most common type of malignancy seen in men, and 6th most commonly seen in women.[37,38] Melanoma could only be properly diagnosed by an expert, dermatologist, or specialist medical personnel, as a wrong and late diagnosis might promote the spread of the disease, which is deleterious to health, and also increases the chances of death.[37,38] Various measures have been proven to greatly reduce the individual risk of developing melanoma, which includes ensuring and adhering to all measures that minimize contact with sun and ultraviolet radiation.[38]

In addition, regular skin examination, wearing body-fitted clothing materials, following a healthy diet regimen, avoiding sun beds, and using sunscreen, a hat, and sunglasses to serve as protection for the skin surrounding the eyes when in outdoor places are all helpful in the prevention of melanoma.[39] Sunscreen with a sun protection factor of 15 is recommended for use, however, a sun protection factor exceeding 15, for instance, 30 confers even greater benefits for melanoma prevention.[39] Importantly, using sunscreen as a mitigation measure for a longer stay in the sun is counterproductive.[40] Adhering to all safety measures and precautions in the use of radiation-generating materials and devices, both in hospital settings and various workplaces is important to reduce the risk of skin cancer.[1,41]

PREVENTION OF POLLUTANTS

There is convincing evidence from both human and *in-vitro* studies suggesting that outdoor air pollution, specifically particulate matter (PM), which is abundant in outdoor environments and air, is mostly generated by heavy industrial machines, power-generating equipment, vehicles, and emissions from domestic burnings, increases the risk of morbidity and mortality of lung malignancy.[42] Global estimates indicated that over 100,000 deaths from lung malignancy every year are a result of air pollution of PM.[42] Likewise, ambient air pollution might also increase the risk of developing breast and bladder cancers in the future, and might also reduce the rate of survival after a cancer diagnosis.[42] In addition, radon, a radioactive gaseous pollutant, is greatly abundant in residential places, is mostly neglected by medical personnel as a risk factor, increases the risk of lung cancer, especially in individuals who do not smoke, and also poses a risk for lung cancer in people who smoke as well.[43]

Also, exposure to cadmium, a naturally occurring harmful pollutant that is mostly obtained from industrial and agricultural products, and is usually ingested by humans through contaminated edible items, such as water and food, as well as via smoking of cigarettes, and the inhalation of contaminated air has been shown to increase the risk of numerous cancers, such as kidney, breast, pancreas, lung, nasopharynx, and prostate cancer, as well as increases the risk of developing osteoporosis in the future.[44] Cadmium has a longer life span, usually between 25 to 30 years, and mostly accumulates in animals and plants.[44]

In addition, regular exposure and contact with specific chemicals and environmental substances, such as benzene, aflatoxins, wood dust, thorium, benzidine, aristolochic acids, indoor and outdoor tobacco smoke, beryllium, repairable crystalline silica, nickel compounds, hexavalent chromium compounds, 1,3-butadiene, vinyl chloride, coal tar, coal-tar pitch, formaldehyde, trichloroethylene, butanol, asbestos, erionite, soot, acetone, materials containing sulfuric acid, arsenic, minimally treated or untreated mineral oils, coke-oven emissions, ethylene oxide, and emissions and fumes from domestic use of coal, all increase the risk of various cancers in the future, regardless of the age, gender, and location of an individual. These chemical substances can be found in the air, edible items such as food and water, daily household items, and working tools and materials, and hence, might be difficult to avoid during daily activities.[45]

Minimizing the exposure and devising various measures that would reduce contact with these chemicals and their products both in indoor and outdoor settings, such as education centers, workplaces, and residential places, are important for reducing the risk of cancer.[1,46] Some of the measures include adequately checking through the chemical components of products and items before purchase and usage, making use of safer and alternative products, increased education and sensitization programs of the public on carcinogen and their products, and making use of various methods that would ensure adequate ventilation in homes and workplaces, as well as help in the purification of inhaled air. In addition, the use of air purifiers and various air filtration methods at residential places and highly industrialized workplaces, as well as the use of appropriate respiratory hygiene materials such as nose masks in highly polluted areas are recommended.[46] Likewise, adopting a holistic strategy that involves reducing air pollution from various sources will be beneficial to ensuring cleaner and healthier air.[46] These methods offer double beneficial effects in the reduction of cancer, and also help in the prevention of other health problems asso-

ciated with air pollution, such as premature delivery, various breathing problems, allergies, cardiovascular health conditions, and deaths.[1,46] There is also an urgent need to intensify various sensitization programs to improve public awareness of various pollutants that increase the risk of cancer, as well as measures that could be taken to prevent them globally.[42,43]

PROMOTION OF EXCLUSIVE BREASTFEEDING

Total breastfeeding, especially for a longer period of time, offers protection against the development of breast cancer in the future, as evident in a meta-analysis study by Zhou et al.[47] Likewise, longer exclusive breastfeeding has been established to reduce the occurrence of endometrial malignancy, as well as ovarian cancer.[48-50] Apart from the protective functions in the prevention of breast, ovarian, and endometrial cancers, which longer and exclusive breastfeeding confers on women, various health benefits, which include but are not limited to the prevention of obesity and overweight, are also derived by infants who are adequately and regularly breastfed, thereby reducing their chances of developing numerous cancers in which risk factors are being overweight and obesity.[51]

The recommendations by the WHO, except in specific circumstances such as nursing women with HIV/acquired immunodeficiency syndrome, is that total breastfeeding of infants should be for a period of not less than 6 months, then continued for 2 years or more, and supplemented with other additional vital foods.[51] Hence, nursing mothers should be encouraged in practicing the exclusive method of breastfeeding, while policies to encourage this is required globally.[51] Various sensitization and education programs that promote exclusive breastfeeding should be intensified around the world, as well as the enactment and implementation of policies that will encourage exclusive breastfeeding by women in various countries.[51] Likewise, family support is needed during the breastfeeding periods, for example, husbands should encourage and be supportive of their partners when breastfeeding their infants.[50]

INFECTION PREVENTION AND CONTROL

Various viral and bacterial infections have been shown to increase an individual's risk of developing cancer. Some examples include EBV (nasopharyngeal and stomach cancers, Hodgkin lymphoma, and Burkitt lymphoma), HBV and HCV (liver cancer and non-Hodgkin lymphoma), HIV-associated cancers (Kaposi sarcoma, nasopharyngeal, cervical, anal, lung, liver, skin cancers, and Hodgkin disease), HPV (vaginal, penile, cervical, anal, oropharyngeal, and vulvar cancers), human herpes virus 8 (Kaposi sarcoma, lymphoma, and cancer of the blood), human T-lymphotrophic virus-1 (lymphocytic leukemia and non-Hodgkin lymphoma), Merkel cell polyomavirus (skin cancer), and Simian virus 40 (lung, brain, abdominal, bone cancers, and lymphomas).[52] Individuals with herpes, chlamydia, syphilis, and gonorrhea also have an increased risk of cervical cancer in the future.[52]

Most of these infections are spread among individuals, mostly via the sharing of sharp objects or needles, unsafe sexual intercourse, during the child delivery process, transfusion of infected blood, and contamination via contact with infected materials. All individuals must ensure adherence to infection prevention measures such as adequate personal hygiene, the practice of safe sexual intercourse, routine testing, and avoiding the sharing of personal belongings, especially sharp materials, while healthcare personnel should ensure adequate screening of blood before transfusion and ensure safety measures during childbirth.[52] Furthermore, disinfection and proper cleaning of regularly touched items and materials should always be done by using highly effective disinfectants such as electrolyzed hypochlorous (HOCI) water or hydrogen peroxide (H_2O_2). These measures are necessary for the prevention of infections to reduce the risk of developing cancer, especially in underdeveloped and developing nations where infections are the highest cause of cancer.[52]

Likewise, certain vaccines have been developed to help prevent various infection-caused cancers. For instance, taking the HPV vaccine is effective and offers over 90% protection against the development of all cancers that are caused by HPV in the future.[53] Three HPV vaccines that are available and presently authorized for use are: bivalent (HPV16, 18), quadrivalent (HPV6, 11, 16, 18), and nonvalent (HPV6, 11, 16, 18, 31, 33, 45, 52, 58).[53] The current recommendation is for everyone between the ages of 9 to 12 to get the HPV vaccine before having any sexual intercourse to reduce their risk of HPV-causing cancers in the future.[54] In addition, people who are between the ages of 13 to 26 could still get the HPV vaccine, but it is highly effective when taken at a younger age.[54] The HPV vaccine is not recommended for people who are above the age of 26 years.[54]

Additionally, vaccines to prevent HBV infection are available. The current recommendation in the United States is for all individuals, including children, and people who have not passed the age of 59 years to take the vaccine.[55] It is also recommended for people who are above the age of 59 years and at a high risk of HBV infection.[55] This category of people includes those living with HIV, men who engage in sexual intercourse with other men, people who inject drugs, all individuals who are at high risk of exposure such as medical personnel and social workers, all individuals in confined places or homes such as prisoners and so forth.[55] Importantly, all effective vaccines against HPV and HBV should be made available in abundance via numerous partnerships with local, state, national, and international organizations in underdeveloped and developing regions of the world where cancer-causing infections are rampant.

ENSURING REGULAR HEALTH AND CANCER SCREENING

Ensuring regular health care, inclusive of routine cancer screening tests, is a major way to prevent future cases of cancer.[56] The purpose of a regular cancer examination is to identify possible cancers on a timely basis, before exhibiting any signs and symptoms and when it can be

treated with ease and success. Numerous effective cancer screening tests help in the detection of probable cancers before they fully develop. Some of the most available and highly reliable methods in the detection of early cancers include, but are not limited to, breast malignancy screening and routine breast examination, cervical malignancy screening which includes Pap and HPV tests, colorectal malignancy screening which includes high-level stool examination, colonoscopy, and sigmoidoscopy, and lung malignancy screening which includes computers-operated tomography.[56] Other cancer diagnostic methods include multi-cancer early detection screening, skin examination, alpha-fetoprotein serum test, virtual colonoscopy, breast magnetic resonance imaging, prostate-specific antigen test, cancer antigen 125 serum test, and transvaginal ultrasound.[57]

Importantly, people with a history of cancer, those in a family with a history of cancer, and those with specific genetic mutation problems, are highly vulnerable to industrial chemicals, highly vulnerable to HPV and HBV, use or smoke tobacco, have blood clotting problems, and people at old age should be prioritized for cancer screening globally. In addition, these categories of people should be screened frequently and at a younger age than others.[58] Likewise, every individual should seek from their medical providers when a cancer test is needed, the appropriate and most affordable test to take, the time frame to have them, and when to stop taking them.[58] This information will help the individual to be prepared physically, emotionally, and financially for the tests. Likewise, sensitization and various education programs that promote cancer screening, with information on where the test centers could be accessed, need to commence and intensify in underdeveloped and developing countries of the world. The earlier the probable cancer is detected, the higher the chance and rate of survival.[59,60]

ADEQUATE AND UNINTERRUPTED SLEEP PATTERN

Inadequate, longer, disrupted, and altered sleep patterns, which cause disruptions and alterations in the body's circadian rhythm that controls numerous functions in the body, have been proven to increase the risk of cancers of the colon, prostate, breast, and ovaries.[61-63] For instance, findings from a study on the duration of sleep and risk of malignancy among Mexican-Americans revealed that a short sleep duration of <6 hours at night increased the risk of all cancer types by 1.37 folds among the participants,[64] while a longer sleep duration of >9 hours at a stretch increased the risk of cancers among people who are overweight.[64] Likewise, findings from another similar study indicate that a sleep duration of >7 hours increases the risk of breast cancer.[65]

Melatonin, a hormone related to serotonin, is secreted by the pineal gland and stimulates color change in the skin. It is also actively involved in the sleep and wake pattern; reproductive cycles in humans are usually diminished through long-term exposure to high artificial light during late-night working hours, which increases the risk of cancer, especially breast cancer.[66] Sleep alteration, disturbances, and other sleep problems are common in patients after a cancer diagnosis, which is associated with severe outcomes of the disease.[67] This is usually due to the numerous physiological and biological changes in the body due to cancer, and various treatments such as radiation therapy, surgery, hormonal therapy, and chemotherapy initiated to tackle the disease.[67]

The normal duration of sleep in an individual varies due to different factors such as the physiological and health components of an individual.[68] Thus, sleep recommendation is usually on an individual-to-individual basis, and it is imperative to adopt and adapt to an individual's given sleep recommendations by medical personnel which incorporates the time of sleep and measures to ensure sleep quality.[68] Generally, for healthy individuals, it is recommended that newborns between 0–3 months get 14–17 hours of sleep daily, infants between 4–12 months get 12–16 hours of sleep daily (naps included), toddlers between 1–2 years get 11–14 hours of sleep daily (naps included), preschoolers between 3–5 years get 10–13 hours of sleep daily (naps included), school-aged individuals between 6–12 years get 9–12 hours of sleep daily, teenagers between 13–18 years get 8–10 hours of sleep daily, and adults between 18–60 years, 61–64 years, and 65 years and above should get 8–10 hours, 7–9 hours, and 7–8 hours of sleep daily, respectively.[69-71]

The required duration of sleep, as well as good sleep quality, is beneficial for general health.[72] Indicative indicators of unhealthy sleep quality include feelings and a sense of tiredness despite having a substantial amount of sleep, waking up at intervals and intermittent sleep at night, and other manifestations of sleep problems such as snoring for longer duration and difficulty in breathing when sleeping.[72] Better sleep patterns and habits are imperative for health and sleep quality, as well as undergoing rapid treatment for any sleep problems.[72] Likewise, various relaxation and rest methods, and cognitive behavioral interventions can promote healthy sleep.[72] Also, adherence to routine physical activity, reduction in the intake of caffeine, and regular consumption of a healthy diet are beneficial for healthy sleep.[72]

CONCLUSION

From this strength-based review, it is scientifically concluded that avoiding all forms of smoking, adhering to regular physical activity, adequately consuming healthy diets, abstaining or reducing alcohol consumption, maintaining a healthy weight, avoiding ultraviolet radiation, avoiding pollutants, promoting an exclusive form of breastfeeding, preventing and controlling infection, ensuring regular health and cancer screening, and having an adequate and uninterrupted sleep pattern will greatly help in reducing the risk of developing cancer of any type in the future. A summary of each of the components of these findings is presented in Table 1. These findings are in line with the results from numerous other cancer prevention studies showing that healthy lifestyle components, when implemented and strictly followed, are effective in the prevention of cancer and reduction of cancer deaths.

For cancer prevention strategies to be effective, it is recommended

Table 1. Summaries of the preventive measures that reduce the risk of cancer

Preventive options	Key findings
1. Avoiding all forms of smoking	Tobacco alone contains over 7,000 chemicals, of which around 250 are identified to be dangerous to humans and 69 have been proven to be carcinogenic.[7] Smoking increases the chances of an individual having cancers of the mouth, lung, throat, larynx, kidney, esophagus, bladder, pancreas, cervix, liver, blood, stomach, and cancers of the colon and rectum region in the future, as well as other numerous chronic diseases.[8-12] An individual's chances of lung cancer are reduced by 30%–50% when there is a cessation of smoking after 10 years, and the risk of developing mouth or esophagus cancers is reduced by over 50% within 5 years of cessation.[13,14] Policies and programs that will hinder the public from easy access to all tobacco products should be encouraged and implemented globally.[10,15]
2. Adherence to regular physical activity	Physical activity is highly effective in the prevention of numerous cancer types such as colon, kidney, esophagus, breast, stomach, endometrial, and bladder cancer, and also helps in the survival outcomes of the disease, as well as the prevention of numerous chronic diseases.[16-18] The World Health Organization recommends that adults must be active every day and engage in not less than 150 minutes of minimal physical activity or an equivalent of not less than 75 minutes of high-impact physical activity weekly, while children should participate in minimal-impact physical activities for not less than 1 hour daily in a week.[18] Prompt adherence to these recommendations could help in a 7% reduction of specific cancers (colorectal and breast cancers), although the higher the level of participation in physical activities, the better.[18] All types of physical activities are beneficial to health.[19]
3. Adequate consumption of healthy diets	Regular adherence to a Mediterranean food regimen reduces the risk of developing esophagus, colorectal, liver, lung, bladder, and stomach cancers in the future, as well reduced significantly the risk of cancer deaths, and serious health outcomes in people that survived cancers.[21-24] No conclusive evidence on the protective role of dietary or nutrients supplements such as minerals, all types of vitamins, folic acid, and garlic in the prevention of cancer, heart disease, and obesity, except for calcium with some levels of protection against colorectal cancer,[26] while excess intake or use of beta-carotene nutrients might promote the development of lung cancer, especially in people who smoke regardless of the type of cigarette used.[27]
4. Abstinence or reduction in the consumption of alcohol	Chronic intake of alcohol increases the risk of development of liver, breast, colorectal, and upper aerodigestive tract cancers regardless of the levels of intake or the type of alcohol consumed, while the risks of developing these cancers and other chronic diseases increase with increasing levels of alcohol consumption.[28-30] The intake of alcohol is attributable to 10% and 3% of all cases of cancer in men and women, respectively, in Europe.[28,29] All consumption of alcohol should be reduced to the barest minimum; a total stoppage of all forms of alcohol consumption is beneficial for the prevention of cancer.[28,31,32]
5. Maintaining a healthy weight	Around 55% and 24% of cancer in women and men, respectively, are caused by obesity and overweight.[33] Being overweight or obese increases the risk of cancer in not less than thirteen locations in the body.[33,34] Unhealthy weight is a major risk factor for the development of various cardiovascular diseases, type 2 diabetes, and other numerous chronic non-communicable diseases, which all increases cancer morbidity and mortality.[35] Various measures that ensure a healthy weight with a body mass index in the range of 18.5–24.9 kg/m^2 are necessary and imperative. These include the consumption of a healthy diet, low intake of alcohol, adherence to routine physical activity, and shunning all forms of sedentary lifestyle.[33,35,36]
6. Prevention of ultraviolet radiation	Direct exposure to the sun, tanning equipment, and sun lamps increases the risk of serious skin damage, and melanoma, an aggressive skin malignancy. Even an irregular exposure to the sun, any equipment or materials emitting ultraviolet radiation greatly heightens this risk.[37,38] Regular skin examination, wearing body-fitted clothing materials, following a healthy diet regimen, avoiding sun beds, and using sunscreen, a hat, and sunglasses to serve as protection for the skin surrounding the eyes when in outdoor locations are all helpful in the prevention of melanoma. A sunscreen with a sun protection factor of 15 is recommended, however, a sun protection factor of 30 confers even greater benefits for melanoma prevention.[39] Adherence to all safety measures and precautions in the use of radiation-generating materials and devices, both in hospital settings and in various workplaces is important to reduce the risk of skin cancer.[1,41]
7. Prevention of pollutants	Outdoor air pollution, specifically PM, increases the risk of morbidity and mortality of lung and bladder malignancies, while global estimates indicated that over 100,000 deaths of lung malignancies every year are a result of air pollution of PM.[42] Radon increases the risk of lung cancer in both smokers and non-smokers,[43] while, exposure to cadmium has been shown to increase the risk of numerous cancers, as well as the risk of developing osteoporosis in the future.[44] Minimizing exposure to air pollutants is important to reduce the risk of cancer while adopting a holistic strategy, which involves reducing air pollution at its various sources, will be beneficial to ensuring cleaner and healthier air globally.[1,45]
8. Promotion of exclusive breast feeding	Total breastfeeding, especially for a longer period of time, offers protection against the development of breast, endometrial, and ovarian cancer in the future.[46-49] Various health benefits, which include the prevention of obesity and being overweight, are also derived by infants who are adequately breastfed, consequently reducing their chances of developing cancer in the future.[50] Total breastfeeding of infants should be for a period of not less than 6 months, then continued for 2 years or more, and supplemented with other additional vital foods.[50] Nursing mothers should be encouraged in practicing the exclusive method of breastfeeding, and policies, sensitization, and education programs that encourage this are necessary globally.[50]
9. Infection prevention and control	Various viral and bacterial infections have been established to increase an individual's risk of developing cancers.[51] Most of these infections are spread among individuals via the sharing of sharp objects or needles, unsafe sexual intercourse, during the child delivery process, transfusion of infected blood, and through other means.[51] Taking the HPV vaccine confers over 90% protection against the development of all cancers that are caused by HPV in the future.[52] It is recommended for everyone between the age of 9 to 12 years to get the HPV vaccine before having any sexual intercourse to reduce their risk of HPV-causing cancers in the future. Also, people who are between the ages of 13 to 26 years could get the HPV vaccine, but it is highly effective when taken at a younger age. The vaccine is not recommended for people who are above the age of 26 years.[53] A vaccine to prevent HBV infection is available, and the recommendation in the United States is for all individuals, including children, and people who have not passed the age of 59 years to take the vaccine.[54] HBV vaccine is also recommended for people who are above the age of 59 years, and those at higher risk of HBV infection.[54] All the effective vaccines against HPV and HBV should be made accessible in underdeveloped and developing regions of the world where cancer-causing infections are rampant.

(Continued on next page)

Table 1. Continued

Preventive options	Key findings
10. Ensuring regular health and cancer screening	Ensuring regular health care, inclusive of routine cancer screening and tests is one of the major ways to prevent future cases of cancer.[55,56] People with a previous history of cancer, in a family with a history of cancer, or have specific gene mutations, are highly vulnerable to industrial chemicals, HPV, HBV, or tobacco smoke, have blood clots problems for no specific reasons, and should be prioritized for cancer screening at old age. Also, these categories of people should be screened frequently, and at a younger age compared to others.[57] The earlier a probable cancer is detected, the higher the chances and rate of survival.[58,59]
11. Adequate and uninterrupted sleep pattern	Inadequate and irregular sleep patterns have been proven to increase the risk of cancers of the colon, prostate, breast, and ovaries.[61-63] A short sleep duration of <6 hours at night increases the risk of all cancer types by 1.37 folds,[64] while a longer sleep duration of >9 hours at a stretch increases the risk of cancers among individuals who are overweight.[64] Likewise, a sleep duration of >7 hours increases the risk of breast cancer.[65] Melatonin is usually diminished in the body through long-term exposure to high artificial light during late-night working hours increasing the risk of cancer, especially cancer of the breast.[66] Numerous sleep problems due to various treatments imitated to treat cancer are common in patients after a cancer diagnosis, and this is associated with severe outcomes of the disease.[67] For all healthy individuals, it is recommended that everyone gets enough sleep on a daily basis, and sleep recommendations should be individualized.[68-72] Better sleep patterns and habits are imperative for health and sleep quality, as well as undergoing rapid treatment for any sleep problems.[72] Also, various relaxation and rest methods, and cognitive behavioral interventions can promote healthy sleep, and adherence to routine physical activity, reduction in the intake of caffeine, and regular consumption of a healthy diet are beneficial for healthy sleep.[72]

PM, particulate matter; HPV, human papillomavirus; HBV, hepatitis B virus.

that there be a strong political will on the part of the governments of various countries of the world to enact specific laws and implement policies that will greatly reduce sedentary lifestyles and unhealthy eating among the public. Such measures include, but are not limited to, higher taxation on unhealthy food products, banning cigarette products, increasing the consent age for alcohol consumption, and so forth. Likewise, as in the case of underdeveloped and developing countries, the majority of which are caused by vaccine-preventable infections, HPV and HBV vaccines should be made available, affordable, and accessible on a timely basis for those eligible to take the vaccines. In addition, there should be intensified campaigns and numerous educational programs that promote cancer prevention globally.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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