

# Current Perspectives on Cancer Prevention Strategies: Implications for Bangladesh

A project submitted

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Inspiring Excellence

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## **Dedication**

I dedicate my thesis to my parents who have always been my nearest. It is their unconditional love that motivates me to pursue excellence.

## **Certification Statement**

This is to certify that this project titled “Current Perspectives on Cancer Prevention Strategies: Implications for Bangladesh” submitted for the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy from the Department of Pharmacy, BRAC University constitutes my own work under the supervision of Dr. Mohammad ZulfiquerHossain, Associate Professor, Department of Pharmacy, BRAC University and that appropriate credit is given where I have used the language, ideas or writings of another.

Signed,

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Countersigned by the supervisor,

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## **Acknowledgement**

Firstly, I want to give thanks to the Almighty Allah for giving me the strength and guiding me through each step in my endeavor for education as well as my research. Without Allah's blessing I would never be able to complete my project.

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## **Abstract**

Cancer is a very complex disease. Many cancers remain incurable. However, risk of cancer can be reduced through appropriate measures. Good lifestyle choices like having a healthy diet, regular physical activity, reducing alcohol consumption, having a sun protection routine, getting checked once in a month etc. can go a long way in reducing risk of cancer. In a low income country like Bangladesh, cancer is a very expensive disease to treat. In this review, we will discuss current cancer control strategies, we will point out cutting-edge discoveries and we will also highlight implications for policy making in Bangladesh.

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## **List of Acronyms**

IARC: International Agency for Research on cancer

WHO: World Health Organization

HPV: Human Papilloma Virus

HCV: Hepatitis C

CDC: Central of Disease Control and Prevention

HBV: Hepatitis B

## **Chapter 1**

### **Introduction**

## 1.1 Background

One of the most pressing reasons of morbidity and fatality globally as well as in Bangladesh is cancer and even if the current cancer rate remains the same, the quantity of new cancer cases will increase from 12.7 million in 2008 to 21.4 million by 2030 (Lyon, 2011). With the increase in population, the number of adult cancer death is also increasing; 7.6 million people died due to cancer in 2005 (Hussain, 2008). In 2012, it was estimated that the new cancer incidence worldwide was 14.1 million and cancer death incidence was 8.2 million and the number of people living with cancer was 32.6 million (GLOBOCAN, 2012). The casualty rate of cancer rises by gender. Occurrence rate of cancer is almost 25% higher in men than in women (FIGURE:1.1A, 1.2B) (IARC, 2012). Cancer rate is higher in the developed country than developing country.

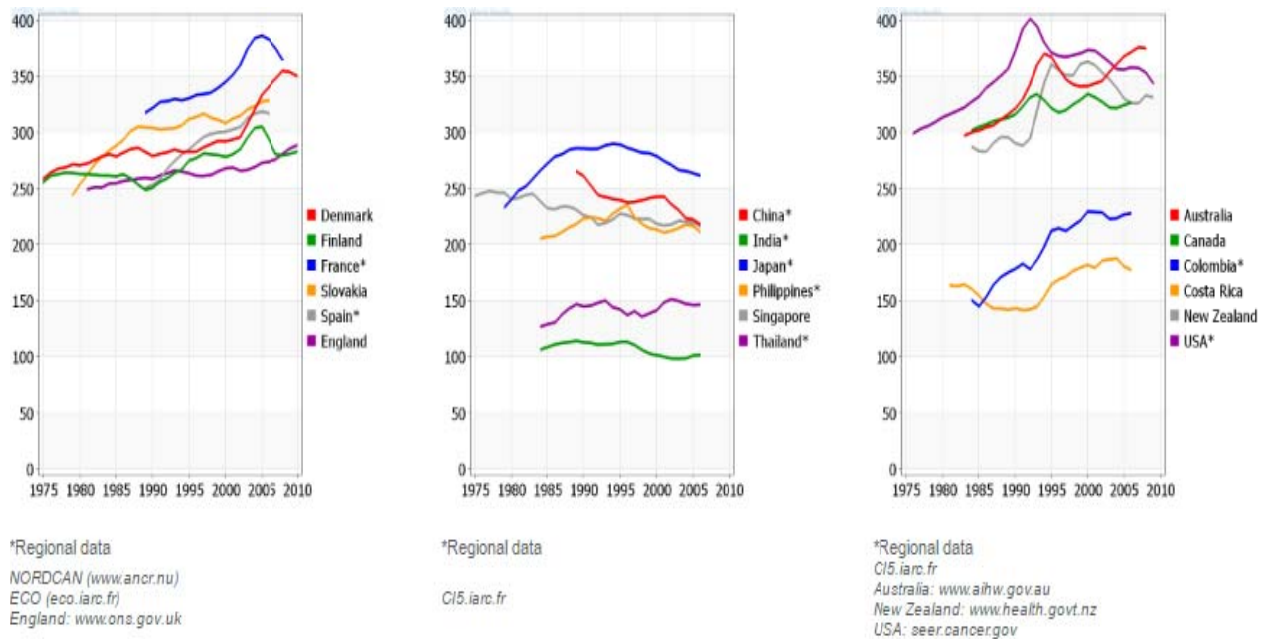


Figure 1.1A: Trends and incident of cancer in selected countries: age standard rate(w)per 100.000 men (IARC, 2012).

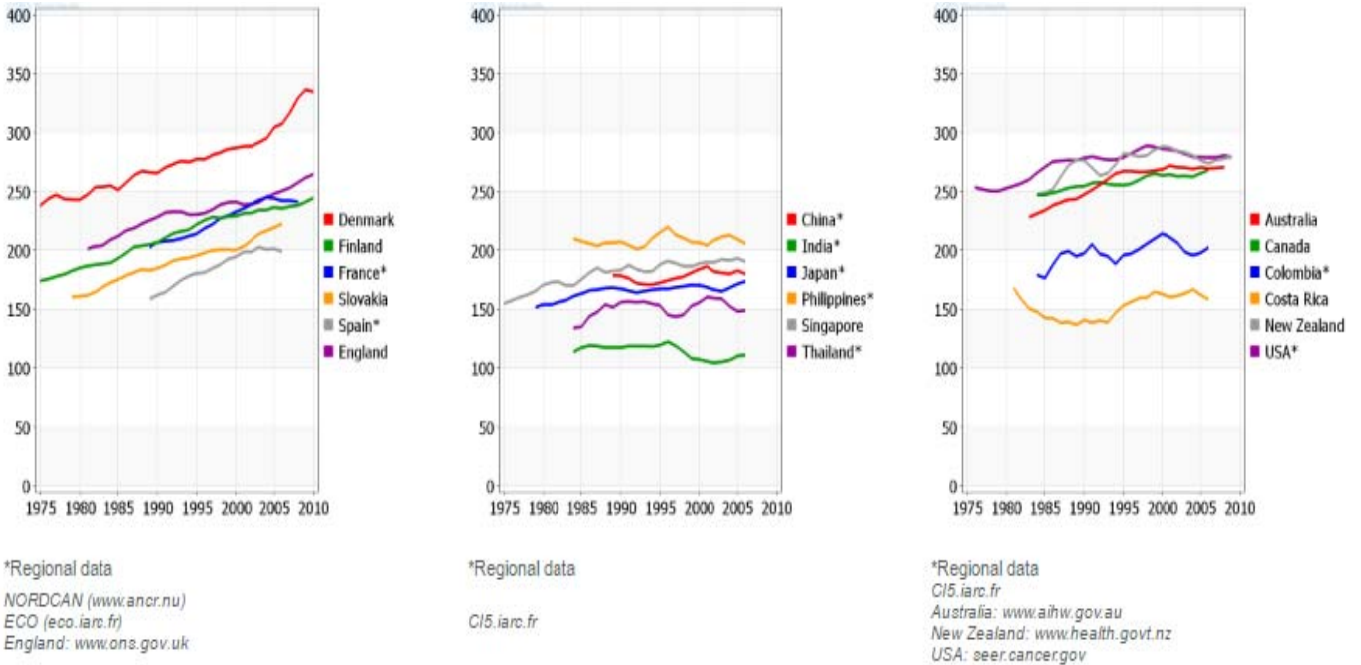


Figure 1.1B: Trends and incident of cancer in selected countries: age standard rate(w)per 100.000 women(IARC, 2012).

Bangladesh is a densely populated country with 153.6 million people and among them there are around 15 lakh people with a cancer diagnosis (SA1, 2013). Although communicable and nutritional diseases are consistent problems for Bangladesh, the non-communicable disease will be an overriding burden. Cancer is the 6<sup>th</sup> driving reason for death in Bangladesh according to the Bangladesh Bureau of Statistics (BBS, 2012). As indicated by IARC (2008), the pre-prominent reasons of death because of disease in Bangladesh differ, relying upon gender (Hussain SA1, 2013). The individuals matured over 30 years will probably experience the side effects of oral, pharynx and laryngeal and lung cancer. A present investigation of WHO demonstrates that there are 49,000 oral, 71,000 pharynx and laryngeal and 196,000 lung cancer cases in Bangladesh (Hussain SA1, 2013). Most common tumors in Bangladesh for men are mouth and oropharynx growth and for ladies are cervix uteri disease and breast disease (Table: 1,2) (HSPR, 2012). In addition, some common cancers include; esophagus cancer, stomach cancer, lymphomas cancer and myeloma.

Table 1.1A: Leading Cancer and the prevalence in last 5years in males.

Cancer type	Prevalence in last 5years (%)
Lung cancer	13.1
Lip and oral cavity cancer	11.9
Other pharynx	8.2
Colo-rectal cancer	6.5
Stomach cancer	4.7
Esophageal cancer	4.1
Non-Hodgkin lymphoma	4.7
Hodgkin lymphoma	2.2
Bladder cancer	3.4
Prostate cancer	2.3
Liver cancer	1.5
Leukemia	0.6

Table 1.1B: Leading cancers and the prevalence in last 5 years in female.

Cancer type	Prevalence in last 5 years (%)
Breast cancer	32.8
Cervical cancer	26.1
Lip and oral cavity cancer	6.5
Ovarian cancer	3.3
Colo-rectal cancer	2.7
Lung cancer	2.0
Esophageal cancer	1.9
Stomach cancer	1.8
Non-Hodgkin lymphoma	1.3
Hodgkin lymphoma	0.8
Liver cancer	0.6

## **1.2 Rational**

Cancer is a very complicated disease with numerous different manifestations and causes. It can affect any part of the body and at any age (Hussain, 2008). Early detection and effective treatment of cancer are possible only in case of a few cancers. Most of the cancers cannot be cured. Prevention is indeed the best possible strategy. Early detection and intervention can also greatly improve the quality of cancer patients. Risk of cancer can greatly be reduced through valid and evidence based approaches. By a healthy diet, regular physical activity, avoiding smoking and alcoholism, using sun protection, protecting us from infections, controlling body weight and performing screening tests regularly, cancer risk can be reduced. Although there are some other steps to reduce the risk of other individual cancer, these eight steps provide the greatest benefit (KY, 2010).

## **1.3 Aim and Objectives:**

Cancer is a severe problem for a low income country like Bangladesh. We have very few dedicated facilities for cancer treatment. The aim of this review article is to help efforts to reduce cancer incidence in Bangladesh. As we discuss and evaluate current cancer control strategies, we will point out cutting-edge discoveries and highlight implications for policy making in Bangladesh. Factors like tobacco smoking, unhealthy diet, alcoholism, environmental pollution, occupational hazard play an important role carcinogenesis. As a developing country, Bangladesh has a lot to do when it comes to chemoprevention. In this review, the risks of cancer and the prevention towards it is described in such a way so that the message of being careful towards one's health becomes clear and easy to follow.



## **Chapter 2**

### **Methodology**

## **Method**

To evaluate and to summarize my review article, I have searched information from PubMed, HINARI, Springer and JSTOR. The Database I have used is BBS (Bangladesh Bureau of Statistics), GLOBOCAN. I have also searched information from national strategy like; CDC (Central of Disease Control and Prevention) and NCI (National Cancer Institute)

## **Chapter 3**

### **Cancer prevention Strategies at Different Levels**

## **2.1 Individual Level Strategies**

The first strategy to reduce the risk of cancer is individual level strategy. At individual level people should make strategy to maintain healthy diet. People should also make strategy to stop smoking and alcoholism. Indoor tanning is another source of cancer which is used to cut off the deficiency of vitamin D. Indoor tanning related cancer can be reduced by consuming food rich in vitamin D. We should raise awareness by not only making others careful but putting up our own healthy lifestyle as an example to others. A person who is independent and careful enough towards life, they will obviously lead a healthy lifestyle as well as get regular checkups hoping the best and thinking of the worst. Other than that, having a good nutritious balance diet along with adequate physical activity will also inspire others to be more careful for the risks associated with cancer as well as other diseases.

## **2.2 Family Level Strategies**

Family level strategy can also be made to reduce the risk of cancer. Family can motivate children to stay fit and to eat healthy. Family can also inspire children to do their own work which is a part of physical activity. This can reduce the risk of cancer.

## **2.3 Community based strategies**

To encourage and support healthy lifestyle, community based strategies can be used whose aim is to change the attitude, knowledge and faith of specific population group. Community based strategy also focus on preventing or reducing the risk factor that is related to cancer and this can occur in number of settings, such as workplace, school etc. In community based strategies infrastructure and management can support to change behaviors like, diet, physical activity and alcohol misuse etc. For example; decrease in total intake of fat consumption and increase in physical activity in children of United States was observed after implementation of school based programs focusing on physical activity and diet (WHO 2005).

## **2.4 National level strategies**

To reduce the risk of chronic disease like cancer, it is important to establish strategies in national level to reduce the risk factors those are related to this fatal disease. Thus, large health gain and

reduction in mortality is observed due to reduction in risk factor (WHO 2005). With input from government and non-government organization, national cancer control strategy of Bangladesh was established and thus the scope of intervention is very wide. For example, National cancers control strategy and plan of action 2009-2015. The goal of Bangladesh national cancer control strategy is to reduce the incident of cancer through primary prevention, to increase awareness among general population, to ensure effective treatment and diagnosis and to improve the effectiveness of cancer control in Bangladesh.

## **2.5 Global Level strategies**

Cancer is pressing cause of death worldwide as well as Bangladesh. Thus, global strategies should be made to encourage international co-operation to promote biomedical technology like; screening test, vaccine etc. Developed countries have more resources and technologies to develop new vaccine or screening tests. On the other hand, developing country does not have that many resources. Global level strategy should also include; protocol for ozone layer, Strategies to protect our climate and to spread knowledge on radiation risk.

## **Chapter4**

### **Individual cancer prevention measures**

## 4.1 Lifestyle changes

### 4.1.1 Smoking

Tobacco smoking not only causes lung cancer but also escalates the risk of many other cancers, such as: neck and head, kidney, bladder, esophagus, cervix, pancreas, colon, stomach, and rectum etc. (Colditz GA, 2004; USPHS, 2010). Death due to tobacco smoking is rising dramatically and the number of deaths each year is under five million, which will rise over the next two generations if it is not controlled (Ezzati M, 2003). Stopping smoking is the best way to prevent cancer and about 150 to 180 million deaths related to smoking could be avoided if half of the adult population stopped smoking by 2020 (Peto, 2009). Smoking-related disease begins to drop within 2 years if anyone quits it and thus preventing young and adults from taking up tobacco provides the greatest health benefit (CDC, 2007; Peto R, 2000; Speizer FE, 1999). Tobacco smoking not only causes liver cancer, it is also responsible for stomach and upper aerodigestive tract which is common in low and middle income countries and spread of their effect may depend on other causes such as; interaction with hepatitis B/C, aflatoxin (V. A. McCormack, 2010).

Table 4.1A: Percentage of cancer due to non-genetic causes (Kathleen Y. Wolin and Graham A. Colditz, 2012).

Factors that causes cancer	Percentage of cancer
Smoking Tobacco	29
Improper diet/ excessive body weight	25
Biological agents/ Virus	8
Lifestyle	5
Genetic factor	5
Factors related to the reproduction	5
Drugs/ other Medical causes	5
Excessive consumption of alcohol	4
Factors related to Environment	4
Radiations; UV etc.	2

### **4.1.2 Physical activity:**

Approximately 85,0000 new cancer cases occur due to obesity every year which can linked to poor survival outcome in cases of cancer survivors and thus physical activity can help in cancer management in obese people(Calle, 2003; Parekh, 2012). The risk of breast, colorectal, ovarian and endometrial cancer can be decreased through physical activity and proper diet can decrease the risk of colorectal cancer as well(Ruiz, 2014; Thomson, 2014). Some strategies can be used to decrease the risk of cancer due to obesity and those strategies include: spreading knowledge about obesity, increasing physical activity, increasing physical education in school level, strategy to make workplace changes that can decrease risk of cancer, strategy to increase healthy food availability, strategy to decrease unhealthy food availability and strategy to decrease screening time(Kathleen Y. Wolin and Graham A Colditz Hank Dart, 2012). Over nutrition can reduce the risk of cancer to a great extend whereas over consumption of calories and weight gain increases the risk of cancer and thus it is healthier to take those foods which include: fruits, vegetables and whole grain and to intake food which are low in fat, red meat and sodium Regular intake of multivitamin can reduce the risk of cancers(WC, 2000; World Cancer Research Fund, 2007). For example; evidence shows that vitamin D can protect against colon cancer and long term intake of folate decrease the risk of colon and breast cancer(Fairfield KM, 2002; Fletcher RH, 2002; Huang HY, 2006).

### **4.1.3 Alcohol**

The "both good and bad" aftermath of alcohol allows it to have a rather neutral role in a person's lifestyle. On one hand studies show that a limited amount of drinking can decrease the amount of heart disease. On the other hand, consuming one drink a day or less than that can contribute in a number of cancers like; breast and colon being the most frequent ones(Preetha Anand, 2008; World Cancer Research Fund, 2007). In both of these cancers, alcohol acts a substance that tends to nullify the action of folic acid and therefore reduces the folic acid level with other probable processes. On the brighter side, evidences show that in taking of folic acid medication can lower the risk of cancers which are related to alcoholism (Giovannucci E, 2003; Gunzerath L, 2004; W. W. Linos E, 2007). Alcoholism also makes an impact on the level of oestrogen in the female



body and therefore leads to breast cancer to some extent. Other considerable ways where alcohol increases the risk is by contributing to cancers of mouth, throat and esophagus. So we should balance the positive and negative outcome of alcoholism. The people who do not drink are not needed to be inspired to drink and the people who drink soberly, they don't need to cut down or stop drinking all at once. Keeping the beneficial sides of moderate drinking in mind, what one should do is make a balance in not being an alcoholic and not stopping it all at once since it will make things rather worse. Another main and important cause for upper aero-digestive tract cancer, liver cancer and breast cancer is alcohol and it was also suggested that taking 10g of ethanol per day will increase the risk of upper aero-digestive tract cancer 2.0%, colorectal cancer 0.7% , liver cancer 0.8% in men and breast cancer 0.8% in women(Baan R, 2007; Bagnardi V, 2001).

Table 4.1B:Example of changes in alcohol related impact on cancer incidence in specific setting undergoing epidemiological transition(V. A. McCormack1, 2010).

Factor	Setting	Early survey	Recent Survey	Difference(recent-early)
Alcohol	China	3.7	9.6	5.9
	India	1.0	1.2	0.2
	Thailand	12	14.1	2.1
	Indonesia	0.2	0.1	<0
	Egypt	0.8	0.4	<0
	Brazil	4.7	13.6	8.9
	Nigeria	18	21.3	3.3

#### **4.1.4 Protection from sun**

Melanoma is a type of cancer caused due to the exposure of UV rays from the sun or from any other process that involves the exposure of UV ray. Due to the rise in Melanoma rates around the world, sun protection has become one of the major needs of public awareness(E, 2002). Even after all the possible precautions taken, the risk is still increasing(Prevention, 2010). Sunburn and over exposure to the sun increases the possibility of Melanoma, especially it occurs to people having fair complexion (R. B. Cho E, Colditz GA 2005; Han J, 2006; Prevention, 2007). Precautions should be taken to prevent melanoma. For example; sun screen and wearing sun protective clothing, taking all the risks in account. Almost 50% of the melanoma patients are mainly due to not use of sunscreen while they are out and 50-80% percent don't wear clothes that prevents them from the harmful rays and eventually prevent them from cancer(R. B. Cho E, Feskanich D, Colditz GA 2005). However, some studies also show that being in the sun increases the amount of vitamin D level, which is good in respect to the prevention of specific cancers (Coups EJ, 2008; E, 2005; MF, 2007). Another report stated that white people who did not stay for an adequate time on the sun are having a deficiency of vitamin D(Garland CF, 2006). To come to a solution to this issue the population worldwide should try not to go out in the sun in the most intense hours of the day, use sunscreen on a regular basis, wear covered clothes on sunny days etc.

#### **4.1.5 Infection**

Infections play a very important role to cause cancer. Apparently 15 percent of the cancers around the world is because of getting attacked by infections. In the developing countries it's an even worse scenario(K. E. Linos E, Kanzler M, Sainani KL, Lee W, Vittinghoff E, Chren MM, Tang JY 2012). There are different kinds of infection which can lead to a drastic change in the human body leading to cancer eventually. Ten of the most common ones are given in the table below.

Table 4.1C: Infectious agent that causes cancer.

Infectious agents	Related cancer
Hepatitis B	Liver
Hepatitis C	Liver
<i>Helicobacter pylori</i>	Stomach
Human immunodeficiency virus type-1	Kaposi's sarcoma, lymphoma
Human T-cell lymphotropic virus type-1	Leukemia/lymphoma
Human papillomavirus	Cervix, vulva, anus, penis, head and neck
Epstein-Barr virus	Nasopharynx, Hodgkin's disease, non-Hodgkin's lymphoma
Human herpesvirus type-8	Kaposi's sarcoma
Liver flukes	Bile duct
Schistosomes	Bladder

Among these infections Hepatitis B & C, HPV (human papillomavirus), and *Helicobacter pylori* are the most common ones (S, 2000). To avoid getting affected by these infections one should follow some simple steps like by taking safety measures before drawing blood through a needle, by having safer sex and by getting regular checkups for the prevention of HPV, that may require certain tests. These tests should be a must for young girls so that they do not face problems in the

near future(Group, 2009; Markowitz LE, 2007; Scheiman JM, 1999). Boys should also be protected to a certain extent from anal cancer, so we should be vaccinated to prevent HPV(Group, 2009). Vaccination for Hepatitis B can help reduce risks of liver cancer(D, 2005; JJ, 2011).

## **4.2 Screening tests:**

Regular screening or getting tested for cancer is a fairly practiced precaution for cancer. Screening tests had cut down the risks of colorectal cancer up to 25 percent(Chang MH, 2009). Running blood tests like fecal occult blood test can reduce the risk of colorectal cancer up to a quarter(Atkin WS, 2010; Towler BP, 2000). Pap tests and HPV tests also help prevent the forthcoming dangers associated with the formation of a certain kind of cervical cancer. The level of cervical cancer in the US therefore reduced by over 40 percent since 1973(Tomeo CA, 1999). Breast examination are not even though a very promising way to prevent the cancer, it still has some specific usefulness when it comes to fight the cancer(McCrory DC, 1999). Other recent initiatives like the large National lung screening trials are based on mild scanning which are being examined on newly and even former chain smokers(Smith RA, 2010). Studies, however, prove that there is a much effective method of cancer screening still necessary since most of the cancer cases are detected in the late stages(Team, 2011).

## **4.3 Minimizing exposure to risk factors:**

In 2001, 35% of cancer death occurred worldwide due to smoking,consumption of alcohol, obesity and changes in diet; in short changes in lifestyle and also due to urban fume, unsafe sex, air pollution and also for polluted injection(Baan R, 2007; Danaei G, 2005; Key TJ, 2002; smoking, 2004; Vainio H, 2002).

With the increase of population there are broader changes in lifestyle in cooperation with changes in social and family structure, increase of income, urbanization, changes of profession, Open market make it easier to arise new product like; tobacco and alcohol(V. A. McCormack1, 2010). Exposure to Tobacco in its all form such as; smoking, second-hand-smoke and smokeless are most important factor for cancer development specially lungs cancer(V. A. McCormack1, 2010). Cigarette pestilence have four stages according to Lopez et al(Baan R, 2007). In

developed country it can be characterized by increasing and declining smoking prevalence in men and women and pursued by a corresponding tobacco related fatality in cases of men is 20-30 years later but in cases of women is 40-50 years later which is less magnifying.

### 4.3.1 Diet

The mechanism of cancer that occur due to diet is still unknown but some carcinogenic agents , such as nitrates, nitrosamine, pesticides and dioxin are mainly derived from food and they are responsible for cancer(Preetha Anand, 2008). According to Dosil-dial et al, red meat consumption can decrease the rate of lungs cancer but it can increase the threat of several other cancers, such as gastrointestinal tract cancer, bladder cancer, prostate cancer, oral cancer, pancreatic cancer and breast cancer etc. (O. Dosil-Diaz, 2007). During cooking of red meat heterocyclic amines produced and during charcoal cooking of meat some carbon compounds are produced, such as pyrolysates and amino acids which are cancerous agents(Willett, 2000). Food additives and plastic container which are in close contact with food can also cause cancer, such as nitrite preservatives, azo dyes are food additives that increase the threat of cancer and bisphenol from plastic container also increases the risk of prostate and breast cancer(Preetha Anand, 2008). Heavy metals, such as Arsenic can cause bladder, kidney, liver and lung cancer. Foods that contain trans fatty acids, refined sugars and saturated fatty acids are responsible for several cancers.

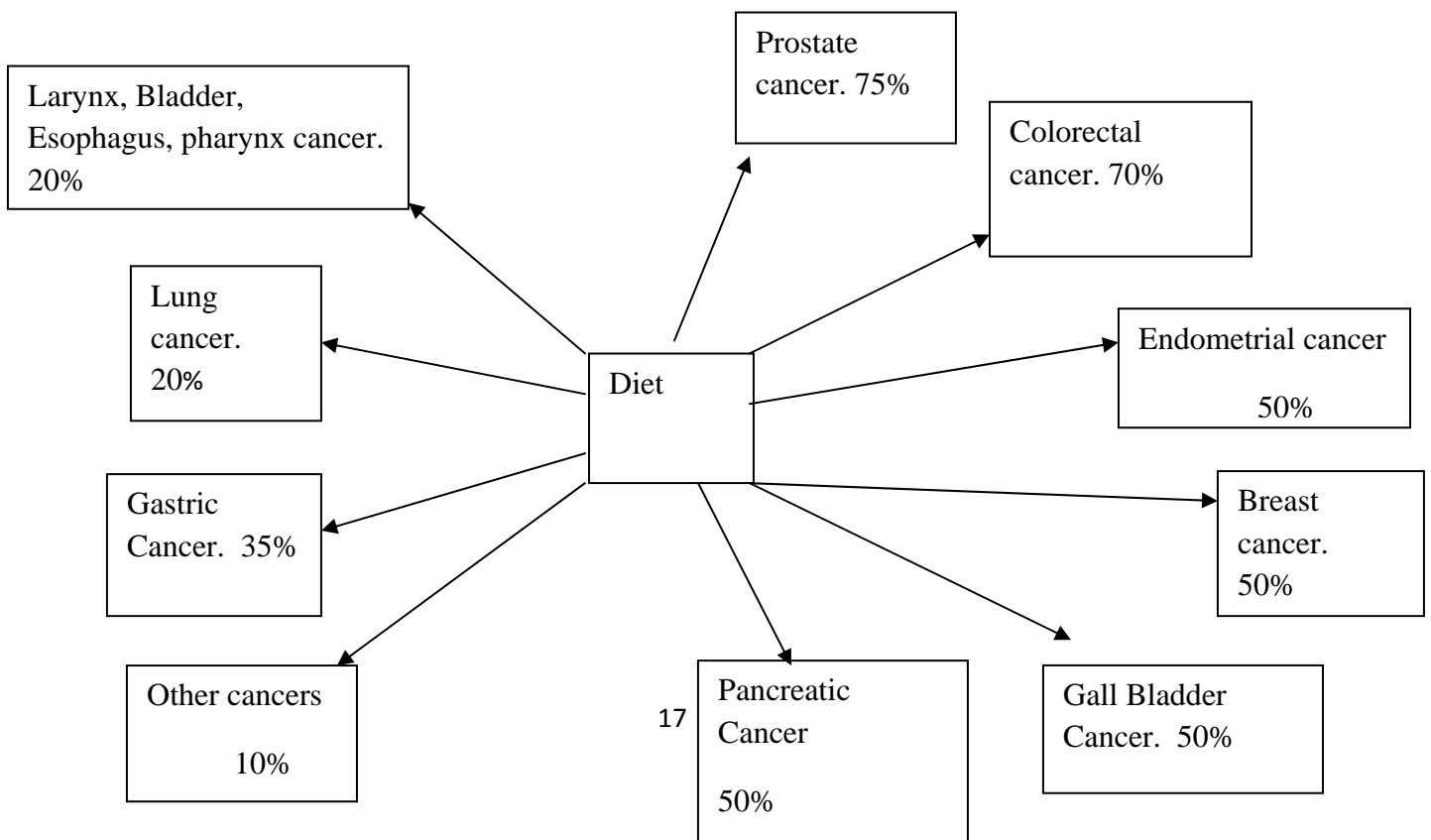


Figure 4.3A: Diet related cancer death rate by Willet (Willett, 2000).

### **4.3.2 Obesity**

Increase in body weight may not be the strong factor for the development of cancer but it has a great influence on total cancer burden and the prevalence of cancer in women is higher than in men in low income countries whose BMI is more than  $30\text{kg/m}^2$  whereas in Europe it is more than  $25\text{kg/m}^2$  (PT, 2004; Renehan AG, 2010). Gradual increase in body weight may lead to some specific kind of cancers. Such as; increase in BMI  $3\text{kg/m}^2$  may elevate the possibility of kidney and colon cancer 14% and also increase the threat of pancreas cancer, non-Hodgkin's lymphoma and leukemia 3% to 5% (V. A. McCormack, 2010). Moreover, in cases women increase in BMI  $3.2\text{kg/m}^2$  may increase the possibility of breast cancer 7.5% in postmenopausal women and increase the possibility of endometrial cancer 35% (V. A. McCormack, 2010). Body weight increases mainly due to improper diet, reduced physical activity and also intake of salt may increase the possibility of stomach cancer and red meat can cause colon cancer (Vainio H, 2002). In many developing countries, overweight mainly due to change in lifestyle and due to westernized diet (A. Drewnowski, 1997). During obesity some neurochemicals and hormones are responsible for cancer, such as, inflammation, insulin like growth factor 1 sex steroid; insulin, adiposity and leptin (S.D. Hursting, 2007). Obesity can activate NF- $\kappa$ B through hyperglycemia and activation of NF- $\kappa$ B produce adiposities, such as tumor necrosis factor, interleukin1 that are responsible for carcinogenesis. Obesity is related to various kind of cancer, like esophageal cancer, gastric cancer, gall bladder cancer, cervical cancer, Non-Hodgkin's lymphoma, pancreatic cancer, uterine cancer, rectal cancer etc. (Preetha Anand, 2008).

Table 4.3A: Example of changes in BMI and related impact on cancer incidence in specific setting undergoing epidemiological transition(V. A. McCormack1, 2010).

Factor	Setting	Early survey	Recent survey	Diffecrence(recent-early)
Excess body weight in men	China	19.8	22.9	3.1
	India	21.5	21.6	0.1
	Latin America	22.1	24.6	0.4
Excess body weight in women	China	20.1	23.3	3.2
	India	21.6	21.8	0.2
	Latin America	24.8	24.8	0.3

### 4.3.3 Infection that causes cancer

Infection is one of the most vital risk factor for cancer and it is responsible 17.8% of cancer worldwide(P. Pisani, 1997). Viruses that are responsible for cancer include: Human papillomavirus, Kaposi's sarcoma associated herpes virus, HBV, Epstein Barr virus, HCV etc.(Preetha Anand, 2008). Among this viruses some are directly mutagenic and other are indirectly mutagenic, such as viral gene E6 and E7 are induced by Human papillomavirus and thus it is directly mutagenic(Song., Pitot., & Lambert, 1999). On the other hand, reactive oxygen

species is generated through chronic inflammation by HBV that is an indirect mutagenic process(B. S. Blumberg, 1975).

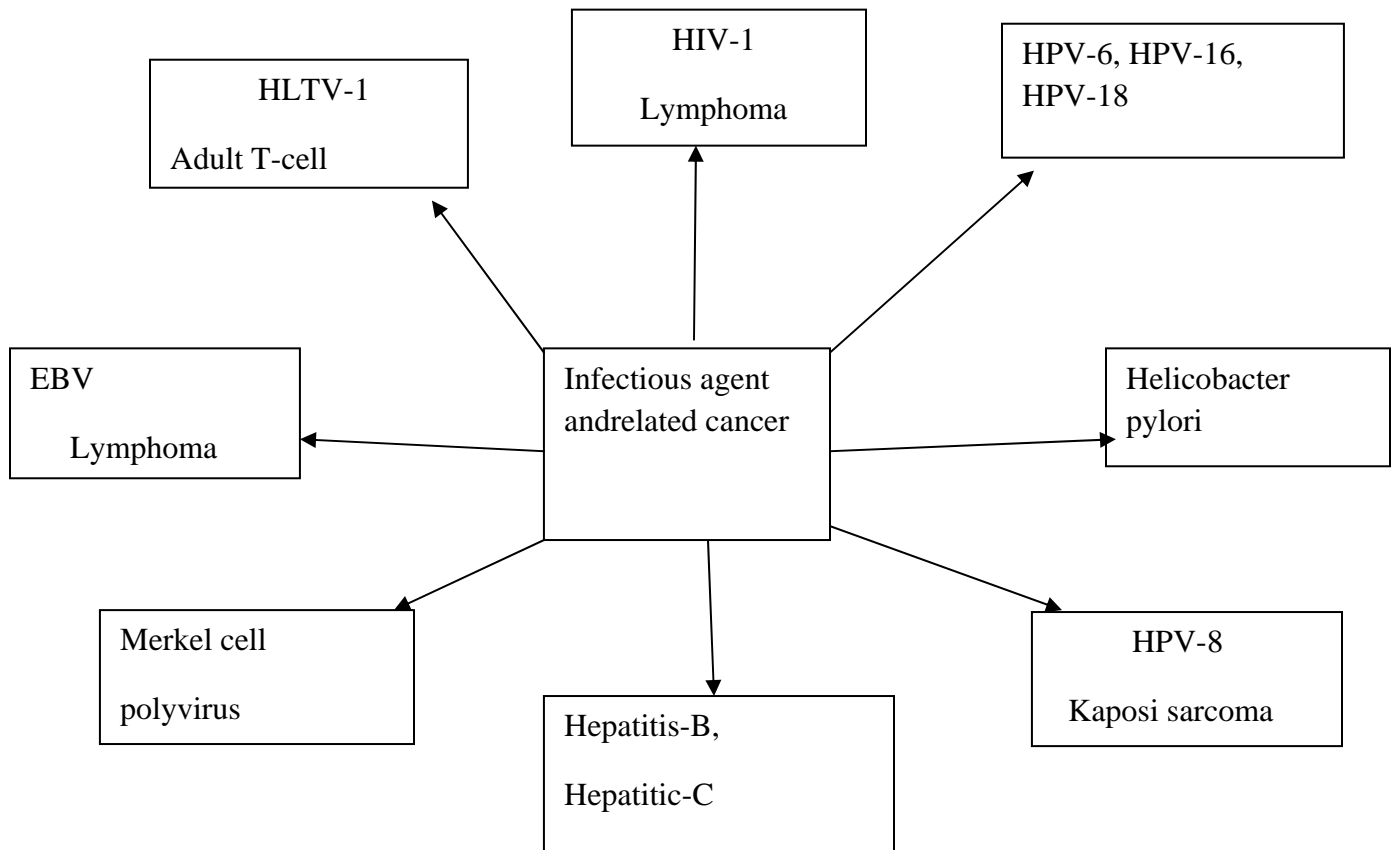


Figure 4.3B: Infectious agent related to cancer(T.M. Hagen, 1994).

### 4.3.4 Environment

Environment pollution includes indoor air pollution, outdoor air pollution and also food pollution is included. All of these pollutions are related to various kinds of cancers. All of this pollutions contain some carcinogenic agents that causes cancer, such as pollution related to indoor contain tobacco, smoke, formaldehyde, volatile organic compounds; pollution related to outdoor contain polycyclic aromatic hydrocarbons and food related pollution contains nitrates, pesticides, dioxin etc. (D. Belpomme, 2007). PAH and nitric oxide; both are outdoor air



polluting agent and PAH can enter in our body through breathing by adhering to carbon particles and both of them causes lungs cancer(D. Belpomme, 2007). Increased risk of brain tumor in cases of adult and increased risk of lymphoma and leukemia in cases of children is observed due to excessive exposure to volatile organic compound. Testicular cancer is also occurred due to utero exposure to organic compound(D. Belpomme, 2007). N-nitroso is a mutagenic cancer, which is formed from the nitrates found in drinking water are responsible for lymphoma, leukemia, colorectal cancer and bladder cancer(D. Belpomme, 2007). Measures need to be taken to identify and regulate environmental carcinogens.

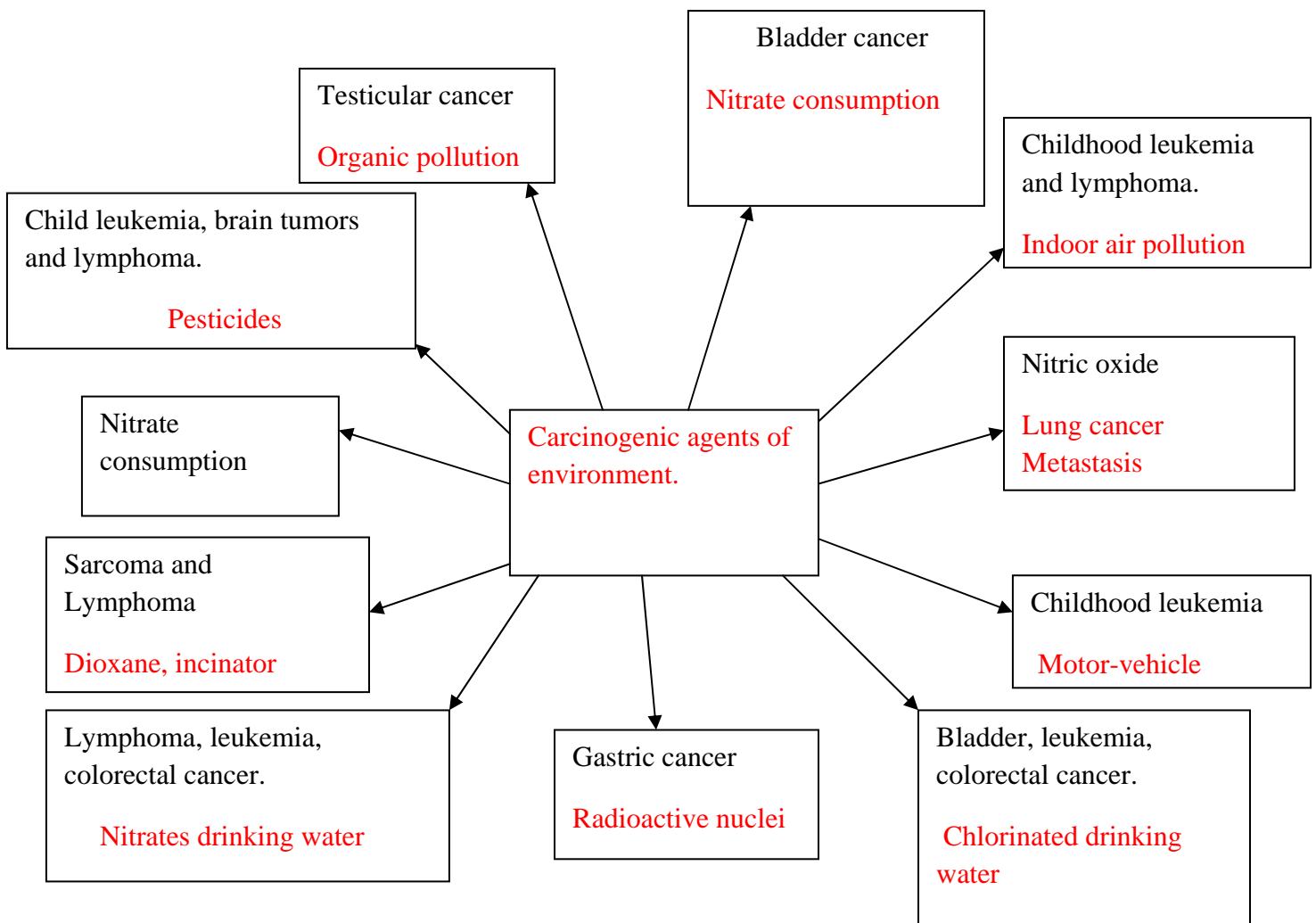


Figure 4.3C: Environmental carcinogenic agents(D. Belpomme, 2007).

### **4.3.5 Radiation**

Another common factor that is related to cancer is radiation and it is responsible for up to 10% of cancer worldwide(D. Belpomme, 2007). Radioactive substances, ultraviolet, ionizing and non-ionizing radiation, pulse electromagnetic field causes skin cancers, lymphoma, leukemia, lungs and breast cancer. Some sources of radiation are radon and radon decay product at home and X-ray in medical use. X-ray causes breast cancer and nuclei from radon, radium, uranium increases the risk of gastric cancer(D. Belpomme, 2007). An example of radiation related cancer was found in Sweden after exposure to radioactive fallout from the Chernobyl nuclear power plant. Ultraviolet ray from sunlight is a non-ionizing radiation and over exposure to UV-ray causes various kinds of skin cancer, such as basal cell carcinoma, squamous cell carcinoma and melanoma(D. Belpomme, 2007).

Due to changes of lifestyle the younger generation may have delay in menarche, less birth and first birth a modest 2years older than the previous generation, all of these changes may increase the possibility of breast cancer 25% and it will worsen at postmenopausal ages. Breast feeding lessen the possibility of breast cancer 4.3% if its continued for 1year and now it is encouraged to lengthened the duration of breast feeding per child in many LMICs(Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, 2002; Lutter CK, 2010).

### **4.4 Chemoprevention:**

Assessable and well defined cancer risk elements explain the importance of chemoprevention and initiatives of cohorts for chemoprevention. The most essential factors in chemoprevention are those which are calculable. These factors are called risk biomarkers. Risk biomarkers can therefore be classified into some groups such as –

- 1) Carcinogen exposure
- 2) Carcinogen effect

### 3) Genetic predisposition

### 4) Intermediate biomarkers of cancer

Apart from their use in classifying cohorts, some risk biomarkers can be regulated by chemoprevention agents. The law of risk biomarkers and serving as dead points are the same except that those cohorts are not regulated by the chemo preventive agents. An initial fact is that biomarkers match the expected biological systems of early carcinogenesis. They should take place in adequate number. The biomarkers then should be surveyed from every angle and should be interacted with cancer incidents. As carcinogenesis is a multipath system, a single biomarker is quite hard to interact with cancer. The drawbacks related to the bookmarks may be interdependent as seen in the colorectal. That is why batteries of biomarker abnormalities may be found more useful. Risk biomarkers are already used in many trials related to chemoprevention. One of them is the phase II trial of oltipraz inhibition of carcinogen-DNA adducts in a Chinese population exposed to aflatoxin B1. Another one is the plan for carrying out a trial for patients having breast cancer. It is explained by both genetic and biomarker abnormalities. Vaccine trials for cervical cancers are also a noteworthy example here. The sexually transmitted HPV (human papillomavirus) defines the major sexually transmitted disease and is apparently known as the capital reason of cancer, 70 percent of which is caused by HPV-16 and HPV-18. The prophylactic HPV vaccine was found before the infection which notably reduced cervical cancer. There was a considerable success in HPV trials after that. Other comparable trials were also tried and showed positive outcome for HPV vaccine based studies.

Cancer can be reversed by using chemo preventive agents and the efficacy of this agents mainly examined by reversing pre-malignant lesion and thus the scientists know how and when to use it(Jemal A, 2008). In accordance with Kraemer and co-workers, patients with Xerodermapigmentosum carcinoma developed 12.1 tumors per year before treatment and after 2 years of treatment with 13-cis-retinoic acid the tumor formation reduced and it was an average of 2.5 per year and irregularity of treatment will increase the possibility of carcinoma(Lung Cancer Incidence Trends Among Men and Women — United States, 2014). Thus this study indicates the long term use of cRNA as discontinuation leads to increase of carcinoma but the use of this agents have been restricted due to their toxic effects and to minimize this problem, biological markers can be used to design chemo preventive studies without any side effect(Jemal A,

2008). There are some approved agents by US Food and drug administration to reduce the risk of cancer in some group of people which are shown in the following table. (4.4A)

#### 4.4.1 Drug

Safe and efficient agents are required for the prevention of cancer that have less side effects after long term administration. Most of the cancer occur in the world occur mainly due to environmental and lifestyle factors which is 90-95% of total cancer. Tamoxifen is one of the chemopreventive drugs that are approved by FDA to prevent breast cancer and it has found that 50% of cancer cases are possible to reduce by using this agent but this drug has some severe toxic effects, such as clotting of blood, disturbances of eye, uterine cancer, stroke and hypercalcemia. On the other hand another FDA approved drug called raloxifene which is used in the treatment of osteoporosis is useful in the treatment of invasive breast cancer, in preventing estrogen-receptor positive and it has less toxic effects but it can cause blood clots and stroke. Raloxifene also have some other less severe side effects, such as flu-like symptoms, joint pain, swelling of legs and feet, hot flashes, leg cramps, sweating etc. (Preetha Anand, 2008).

Another chemo preventive agent that are used in prevention of prostate cancer finasteride and this drug is able to decrease 25% of cancer incidence and the side effects that are related to this drug are: impotence, lower sexual desire, erectile dysfunction and gynecomastia. For the prevention of familial adenomatous polyposis a COX-2 inhibitor is required and one of the FDA approved COX-2 is celecoxib and this drug has less side effects. As drugs that had approved by FDA for cancer prevention have some serious side effects and thus indicates the use of safe and efficacious agent that have less side effects (Preetha Anand, 2008).

Table 4.4A: FDA approved agents for treatment and prevention of cancer in indicated group.

Agent	Targeted group	FDA indication
HPV vaccine	Girls and women whose age within 9-26years.	prevention of cervical, vulvar, vaginal, and cancer caused by HPV type 16, 18, 31, 45, 52, 1 and 58

		Prevention of genetic warts caused by HPV types 6 and 11
HPV vaccine	Boys and men whose age within 9-15 years.	Prevention of anal cancer caused by 16,18,31,33,45,52 and 58  prevention of genital wart caused by HPV 6 and 11
HPV vaccine	Female whose age is within 9-25years	Prevention of diseases caused by oncogenic HPV types 16 and 18.  Prevention of cervical cancer and cervical intraepithelial neoplasia.
Tamoxifen	Women with DCIS after breast surgery and radiation	Reduce the risk of invasive breast cancer
Raloxifene	Postmenopausal women at high risk for invasive breast cancer	Reduce the risk of invasive breast cancer
Photodynamic therapy with photofrin	Males and females with high grade dysplasia in Barrett esophagus.	Removal of high grade dysplasia in patient who do not undergo esophagectomy.

Celecoxib	Males and Females age more than 18 years with familial adenomatous polyposis.	Reduction in the number of adenomatous colorectal polyps.
Valrubicin	Males and Females with BCG refractory CIS	Intravesical use in the treatment and prophylaxis of CIS of urinary bladder.
Fluorouracil	Males and Females with multiple actinic or solar keratoses	Topical treatment of multiple actinic
Imiquimod	Immunocompetent adults	Topical treatment of clinically typical nonhyperkeratotic, nonhypertrophic actinic keratoses on the face or scalp
Ingenolmebutate	Males and females with actinic keratoses on the face and scalp and extremities.	Topical treatment of actinic keratoses
Masoprocol	Males and females with actinic keratoses	Topical treatment of actinic keratoses

PDT with 5-aminolevulinic acid	Males and females with actinic keratoses on the face and scalp.	Topical treatment of minimally to moderately thick actinic keratoses of the face or scalp
Diclofenac sodium	Males and females with actinic keratoses	Topical treatment of actinic keratoses

There are also some interventions that are used to reduce the risk of cancer through prevention of infections and diseases. These interventions can be shown in the following table as follow:

Table 4.4B: Type specific interventions to reduce the risk of cancer.

Organism that causes infection	Related cancer	Intervention
Hepatitis B virus	Hepatocellular carcinoma	Hepatitis B vaccine.
Hepatitis C virus	Hepatocellular carcinoma	Interferon therapy, nucleoside analogues
Human immunodeficiency virus	Kaposi sarcoma and non-Hodgkin lymphoma	Antiretroviral therapies

<i>Helicobacter pylori</i>	Gastric/stomach cancer	Antibiotics, “triple/quadruple therapy”
Schistosomiasis	Bladder cancer	Antischistosomal, praziquantel and metrifonate

Carcinogenesis can be defined as divergence of differentiation and the natural history of carcinogenesis provide an approach to the control of the disease and thus one can consider pharmacological intervention to reverse or restrict the disease. In some circumstances it is possible to reverse the differentiation with a hormone like agent that is essentially non-cytotoxic and other approaches are to block their expansion through non-toxic agents and or to induce an apoptotic state in cells that would programmed to die. Chemopreventive agents are developed based on these mechanisms that are under experiment or in clinical use and it are possible to develop more new and better agent on mechanistic basis. For example, cyclooxygenase; an enzyme that formed from arachidonic acid for the formation of prostaglandins which is an early and central event in colon cancer and thus it can be used as an important target for drug development for this cancer although the mechanism by which COX-2 promotes tumor formation is still unknown. Thus for clinical chemoprevention it is important to inhibit COX-2 by using such drugs that are free of side effects. For the development of whole new class of pharmacological agents for colon cancer it is important to identify an agent that selectively target COX-2 and this applicable for other classes of cancer as well. The recent selective safer COX-2 inhibitor is MF-triglyceride which is a major new development with potentially far reaching human colon cancer.

Again, in cases of mammary carcinogenesis estrogen is the promoting factor and antagonism of this factor is an important experimental and clinical approach for the prevention of this cancer without causing any harmful effect on brain, the bone and the cardiovascular system. Thus, it is



important to design an agent that gives estrogen agonist action where it is necessary and estrogen antagonist action where estrogen may develop carcinogenesis; such as, breast and uterus etc. an estrogen analog called tamoxifen can suppress the mammary cancer but it may increase the endometrial carcinoma and for this reason a new generation of drug had been developed that is benzothiophene estrogen analog raloxifene. This agent does not cause endometrial cancer and is highly effective for the prevention of breast cancer also for the prevention of osteoporosis.

#### **4.4.2 Natural chemopreventive agents**

About 30-35% of cancer death occurs due to obesity, metabolic syndrome and it has proved that some fresh fruits and vegetables and also grain have the ability to prevent cancer. Vegetables, fruits, spices and grains contain more than 25,000 phytochemicals agents that act as cancer preventive agent whose mechanisms have extensively been examined and these phytochemicals are safe and have target multiple cell signaling pathways (B. B. Aggarwal, 2006). Carotenoids, vitamins, resveratrol, silymarin, indole-3-carbinol, quercetin and sulphoraphane are some major chemopreventive agents found in fruits, vegetables or in spices whose mechanisms are discussed below.

##### **Lycopene and other carotenoids**

One of the most important carotenoid that can be used as anticancer agent is lycopene and this agent is mainly found in grape fruit, pink guava, watermelon, apricots and tomato. Lycopene shows its anticancer activity through interference with cell proliferation, up regulation of detoxification systems, modulation of signal transduction pathway and inhibition of cell cycle progression. There are other carotenoid agents that help in the prevention of cancer, such as alpha-carotene, beta-carotene, fucoxanthin, phytocene and capsanthin etc. (H. Nishino, 2002).

##### **Indole-3-carbinol**

Cauliflower, broccoli, brussels sprout and cabbage contain anti-cancerous agent which is flavonoid indole-3-carbinol which is metabolized to various products such as, dimer 3,3'-diindolylmethane and this product exerts different kind of biological and biochemical effects. These agents metabolize carcinogenesis through inducing phase-1 and phase-2 enzymes and also

metabolize estrogen. They are also responsible for treating recurrent respiratory papillomatosis(Rogan, 2006).

#### Reserveratrol

Breast, prostate, stomach, colon and pancreas cancer can be prevented by reserveratrol which is found in peanuts, berries and in grapes and this agent shows its inhibitory action through activation of ceramid tubulin polymerization, mitochondrial and adenylyl cyclase pathways, apoptosis induction, through arrest of cell cycle, up and down regulation of p21, p53, Bax and survivin, cyclin E, cyclin D1 respectively. Reserveratrol is also responsible for caspases activation, apoptosis of protein, nitric oxide synthesis suppression, transcription factor suppression, cyclooxygenase-2 inhibition and responsible for invasion, metastasis. Structural analog of reserveratrol is a potential chemopreventive as well as therapeutic agent(K. B. Harikumar, 2008).

#### Silymarin, silybin, taxifolin, silychristin, silydianin

Silybum marianum is the source of silymarin and it is mainly act as antioxidant and hepatoprotective agent and an emerging anti-cancer agent. Silymarin shows anti-inflammatory effect through suppression of lipoxygenase, COX-2, inducible NO synthase and act against numerous carcinogenic agent, such as 7,12-dimethylbenz(a)anthracene, phorbol 12-myristate 13-acetate, UV light and others. It shows activity against tumors in prostate and in ovary through down regulation of MDR protein and by other mechanisms(R. Agarwal, 2006).

#### Quercetin

Fruits, vegetables and beverages contain a dietary flavonoids called quercetin which act as antioxidant, anti-proliferative, anti-inflammatory, apoptotic agents and can NF-kB activation and thus it can prevent lung and colon cancer. It can also inhibit lymphocyte tyrosine kinase activity and it has showed in a study that increased level of quercetin after a meal of onion is responsible for increased resistance to strand breakage in lymphocyte breakage and thus it reduce the some metabolites that are related to cancer in the urine(Russo, 2007).

Table 4.4C: Chemopreventive agents that are found in teas and spices.

Chemo preventive agents	Spices
Catechins	Green tea
Curcumin	Turmeric
diallyldisulfide	Garlic
Thymoquinone	Black cumin
Capsaicin	Red chili
Gingerol	Ginger
Anethole	Licorice
Diosgenin	Fenugreek

#### Catechins

Green tea and black tea contains catechins and it is used as chemo preventive agents for hepatic malignancies, cervical and prostate without inducing any major side effects. Studies shows that green tea can be used both as chemo preventive agent and also for treatment and a person with solid tumors can consume 900 mL of green tea three times daily (L. Chen, 2007).

#### Curcumin

Turmeric is the source of curcumin and it causes inhibition of inflammation and cancer through inhibition of NF-kB and NF-kB related expression of gene in cancerous cell. It is also useful in Crohn's disease, ulcerative proctitis, in cases of topical pancreatitis with the combination of piperine. One of the study shows that curcumin and quercetin can inhibit adenomatous polyposis and both of them was able to decrease the polyp number 60.4% and size 50.9% within 6 months with less toxic effect (P. Anand, 2008).

#### Eugenol

Eugenol is mainly derived from cloves. Eugenol helps to act against the rapid increase of melanoma cells (Ghosh, 2005). Eugenol treatment hinders the growth of tumor, causes a decrease

in the size of tumor. Whereas animals in other groups faced death due to the spreading of cancer, people receiving the eugenol treatment didn't face any risk of spreading of cancer. A certain study in 1994 showed that eugenol generated a kind of skin tumor in mice(K. Sukumaran, 1994).

#### Anethole

The major component of the spice fennel is Anethole. This component has a fairly helpful role when it comes to chemoprevention. A study carried out in 1994 showed the effectiveness of anethole against Ehrlichascitescancer in mice (M. M. al-Harbi, 1995).

#### Vitamins

Even though it is a debatable matter, but vitamins are said to have some sort of chemo preventive activity in them. The most common form of vitamins in one's diet is in the fruits and vegetables. Most of the vitamins are found in fruits and vegetables except for vitamin D. Without having any toxic effect in them, Vitamins said to have chemo preventive activity to some extent. Vitamin C has a rather important role when it comes to reducing the risks of cancer and hinders the eventual death caused by it. It is also found that vitamin C can reduce the risk of different kind of cancer (K. W. Lee, 2003). On the other hand vitamin D has a role in the cell growth, apoptosis, and a wide range of cellular mechanisms that works in the middle of the development of cancer(B. A. Ingraham, 2008). Vitamin E which is widely found in eggs, liver and dark green vegetables work against bowel cancer. It also works as a component which reduces the damage caused by ozone.

#### Whole-grain foods

Whole-grain foods play one of the most important roles in a human's basic balanced diet and are also an important element in order to fight or help reduce the risks of certain cancer. The main wholegrain foods are actually the most common ones; wheat, maize and rice. Other wholegrain foods are namely barley, sorghum, millet, rye, and oats. Grains are considered as a basic source of energy in most of the cultures but in modern countries it is rather eaten as refined-grain products(Henley S J, 2010). Whole grain can be used in chemoprevention because it contains antioxidants. The level of antioxidants in grains are although less than berries but it's in abundance compared to many fruits and vegetable(Richardson., 2000). The numbers and types of cancer which by using wholegrain in our balanced diet can be reduced are actually many(D. R.

Jacobs, 1998; L. Chatenoud, 1998). Studies therefore showed that the addition of wholegrain food in one's diet reduced the risks of several cancers by 30 percent-70 percent(L. Marquart, 2003). One of the main elements of wholegrain is insoluble fiber. Insoluble fiber helps decrease the risk of bowel cancer(M. Eastwood, 2005). On the other hand, insoluble fiber are also fermented to produce short chain fatty acids namely butyrate which plays a very essential role to reduce the tumor growth(A. McIntyre, 1993). The intake of whole grain also reduces the risk of breast and colon cancer to some extent(J. L. Slavin, 2001). Studies even show that grains also contain biologically active compounds that help in chemoprevention. As an instance, we have isoflavones that are non-steroidal diphenolic compounds that are found in leguminous plants(K. S. Ahn). Detailed studies show that a food plan rich on soy isoflavones is one of the most important and most beneficial for the lower seen mortality due to prostate cancer in Asia. Based on studies mainly over Japanese and American or European subjects, keeping a check on the diet and urinary excretion level due to certain isoflavones, it is found that they(isoflavones) are the reason for a rather reduced cancer risk. Specific isoflavones also prevent cell development or the formation of cancers in the stomach,bladder, lung, prostate, and blood (F. H. Sarkar, 2006).

#### **4.4.3 Vaccine**

Vaccine is used not only for the prevention of infectious disease but also can be used for the prevention or treatment of cancer. Hepatocellular carcinoma occur due to hepatitis-B virus and this can be prevented through the use of hepatitis-B vaccine that can treat hepatitis and liver cancer(A., 2011).

##### Licensed Cancer Vaccine

A small number of products are used in different countries but not many of them (Goldman, 2009). These products have several uses but mainly in cellular products. An example of this is sipuleucel-T which was recently licensed for the treatment of advanced prostate cancer(Kantoff, 2010) .This process consists of collecting cells containing antigens from a patient and then the cell is stimulated with tumor antigen which is grown and then inserted into the patient. This is a very expensive way to treat the patients in comparison with the off-the-shelf vaccine and is a more difficult process. A plasmid DNA vaccine is a newly licensed vaccine for dog melanoma(Bergman, 2003).

## 4.5 Early detection of Cancer

Cancer is an unrestrained hereditary disease; which is generated through the mutation of genes and spread from one part of the body to another; recognition of changes that occur during gene mutation can contribute us with signs which can help in advance finding of cancer. Depending on the rising knowledge of the hereditary changes that occurs in tumor cell we can detect cancer cell earlier and this is essential because advance finding helps in fruitful cure of disease(D., 2016). Hereditary conversion of genes in carcinogenic cell and microsatellite which is diversification of DNA repeat sequences can also be used to predict the progression of tumor cell and uncertainty in microsatellite exhibit diversified genes which represents the Cancer cell(D., 2016). Diversification of broad range of gene occurs due to inactivation of anti-oncogene which can be recognized through RNA-dependent technique that can detect changes that occur during regulation of gene expression and can generate expanding signs which are the possible marker of tumor cell(Smith, 1997). A ribonucleoprotein known as telomerase are also used as sign, because it is active in more than 90% of neoplasm cell but not active in prevalent cell.

In addition to mutated DNA and RNA, physical symptoms, secreted protein, cell death or spreading and serum concentration of molecules like cholesterol or glucose can also be used as biomarkers for detection of cancer at an early stage. Panels of protein not only help in the advance finding but also help in the complete therapy of cancer and its monitoring(James F. Ruslinga & F., 2010). For definite detection of cancer and its monitoring, collections of protein biomarkers are more reliable than single biomarker and this biomarker can be measured in serum and in tissue(Ebert, Korc, Malfertheiner, & Rocken, 2006; Weston & Hood, 2004; Xiao, Prieto, Conrads, Veenstra, & Issaq, 2005). According to American cancer society, prostate specific antigen is the only protein biomarker for the early detection of cancer and PSA serum concentration 4 to 10ngm/L indicates the high possibility of cancer(James F. Ruslinga & F., 2010).

Detection of cancer at an advance stage should be effective and test should fill five primary specifications: Investigation should be free from errors with appropriate cut off level defined, this should be done at that stage where disease is curable, the investigation must differentiate the harmful and harmless lesion and this test must be accepted by large number or population

because of its reasonable price. Lastly, the investigation must be finely adjusted for optimal measurement and it should be reproducible (James F. Ruslinga & F., 2010).

Bio-electric detection of cancer: early detection of cancer helps to select treatment for that particular cancer and search for new method for cancer is a never ending search and many attempts have been taken to detect cancer at an early stage. An electro-dynamics theory of life had been evolved by Burr and Northrop by accumulating some data from experiments on growth and regeneration in nervous system. According to this theory cancer should produce changes in the electric pattern of that organism.

#### **4.6 Public Awareness:**

Cancer is the sixth cause of death in Bangladesh. The number of cancer patients in Bangladesh is 13 to 15 lakh and two lakh people newly diagnosed with cancer in every year. The incidence of cancer will increase if the awareness is not increased. To increase the awareness among the people of Bangladesh, the knowledge of early detection and prevention is necessary but the general population does not have the virtual knowledge of early detection and prevention. The major organizations have assessed nine signs which are used to warn the population about cancer and the knowledge of these signs are necessary which include: alteration in bowel or bladder habits, lump in the breast or elsewhere, bleeding unusually, unhealed sore, cough or hoarseness, obvious change in a wart, loss of weight unexpectedly, swallowing difficulty and digestion problem.

It was found that the level of education is an important factor for awareness. The more educated people are more concerned about the health issues than the uneducated or low educated people. Thus increasing the level of education will increase the awareness among people.

According to a study, women are more aware of their health than men because of their responsibility to their families and children. For example, due to responsibility to their children and for their family health many women participate in mass health programs (Kathleen Y. Wolin and Graham A. Colditz Hank Dart, 2012). People who have family history of cancer are more likely to be aware of cancer and thus family history of health is an important factor in cases of cancer awareness.

Education level in Bangladesh is not that high and the level of knowledge about warning sign are also low. So it's important to increase the knowledge of warning signs rapidly.

Social media can be an important tool for dissemination of information among the people of Bangladesh as most of the people use it as a mean of communication. By creating pages about early detection, warning signs, treatment awareness can be increased. Some short films about cancer incident can also touch people's heart and thus awareness will increase.

Awareness of cancer can also be increased by doing some campaign in the villages and slums about the warning signs and early detection. Some advertise in national television can also help us to increase awareness among general population.

#### **4.7 Success Story: Lowering Lungs Cancer Incidence in the U.S**

Central of disease control and prevention used data from National program of cancer registries and National cancer institute's surveillance to monitor the lungs cancer incidence in men and women depending on their age (Henley, 2014). It was found that lungs cancer incidence decreased in men in all age groups except those whose age is less than 35 years and also lungs cancer decreased more in men than the women. From 2005 to 2009, 485,027 women were reported in United States, among them the incidence of lungs cancer was higher in women aged more than 75 years and 569,366 men reported, among them those aged less than or equal to 35 or aged between 35-44 are more likely to affected by the incidence of lungs cancer. The incidence of lungs cancer in men have decreased in the census region and 23 states and women lungs cancer incidence decreased in south and west U.S census region and seven states due to strong tobacco control (Henley, 2014). Due to 10% increase in tobacco price, the use of tobacco among youth decreased 1-14% and among adult it decreased 1-4.5% in U.S and thus in 2010 a higher proportion of adult quit smoking. Tobacco control is a winnable battle according to Central of disease control and prevention. Although United states have succeed in decreasing lungs cancer through tobacco control but continued attention and support is required to prevent tobacco use and to control its use in order to decrease the incidence of cancer.



## **4.8 Role of global and national organizations**

Cancer is increasingly becoming an important factor in Global burden and the number of cancer patients are increasing in such a way that each person is touched either as a patient or a family member or a friend. Although scientific knowledge and experience required for the treatment and prevention of malignant disease like cancer, existing knowledge can also help to prevent cancer to a broad extent. World Health Organization took one of the most important challenge of this era that is cancer control and prevention and the role of this organization to improve quality of life of the cancer patients and their family and to reduce the morbidity and mortality of cancer patients.

To fight against cancer there are some important sectors such as; governmental sector, non-governmental sector, private sector and professional organizations and the role of this sectors are to reduce morbidity and mortality within national cancer control program or strategy.

Cancer can be preventable by means of controlling tobacco and alcohol use, early detection, moderating diet, immunizing Hepatitis-B and by proper treatment if enough resource is available. The role of National cancer control program is to increase awareness about cancer and to reduce morbidity and mortality by improving quality of life of patients and their family. To improve the quality of life and to reduce morbidity and mortality, it is important to know what kind of cancer the patient is suffering, burden of cancer, prevention, early detection processes,

Diagnosis and treatment and palliative care for that patient and through all this means national cancer control program maintain the degree of cancer control.

For effective and efficient cancer control program there must be some quality management approach and such approach maintain some principles. Such as; to continuously guide the process so that the health and quality of life covered by the program, to focus on the need of the people, to take decision systematically, to take systemic and comprehensive approach, to maintain leadership as well as partnership and to increase innovation and creativity to the maximum level.

After management planning, it is important to implement national cancer control program step by step and to optimize existing resources, to organize activities with systemic resources, to

educate people about cancer and to train them and finally to monitor and to evaluate the whole program.

#### **4.9 National cancer control strategy of Bangladesh:**

Cancer is the sixth leading cause of death in Bangladesh and it includes over a hundred diseases with different causes. With the existing knowledge it can be prevented if enough resources is available. Many government and non-government organizations are involved in order to reduce morbidity and mortality due to cancer in Bangladesh and to involve in prevention, detection, treatment and care. With the technical help of WHO, Bangladesh government had formed national cancer control strategy and plan of action. National cancer control strategy is the most effective way of reducing cancer in Bangladesh and the purpose of this strategy is to reduce differences in cases of treatment and to reduce incidence of cancer in Bangladesh. The vision of this strategy in Bangladesh is to reduce incidence of cancer by informing people about health promoting and cancer preventing behaviors and by informing people about early detection and screening. National cancer control strategy also has some goals which include: decrease cancer incident through prevention, proper screening and early detection of cancer, to ensure the quality of life of cancer patient and their families, proper diagnosis and treatment of the patient, to ensure palliative care, to ensure proper service to the patient and to evaluate the strategy and to improve usefulness through different research and surveillance.

The key component for any cancer control program is to prevent cancer and for this the main focus is to avoid those risk factors that cause cancer. For example, smoking, chewing leaf betel etc. For prevention of cancer, changes of personal habit are also important. According to national cancer control and plan of action some factors and personal habits are describes as follow:

Tobacco: According to WHO, there are almost twenty million Bangladeshis including five million women are using tobacco in different forms and about 57,000 people die due to disease related to tobacco. Four hundred and thirty eight chemicals in tobacco can cause cancer among four thousand chemicals and it is the most modifiable factors for cancer. Smoking of tobacco can cause lungs, larynx, oesophagus cancer and chewing of tobacco is most serious risk factor and it can cause oral cavity cancer. Nonsmoker can also affected by tobacco through passive smoking which is a unique form of smoking. Thus Bangladesh government has banned tobacco smoking

in public places and it is important to ban tobacco import and tobacco industry in Bangladesh to protect the health of the people of Bangladesh. Health professionals can also play an important role by informing and teaching about severe side effect of tobacco. WHO Framework Convention on Tobacco Control (FCTC) treaty was adopted by 192 members of WHO and Bangladesh was the first country to support it. The FCTC sets guidelines which encourage the tobacco users to quit it and to restrain non-user from taking it.

Sexual and reproductive factors: Uterine cervix and breast cancer occur mainly due sexual behavior factor. Including human papilloma virus, sexual hygiene, multiple sex partners and young age sex are related to uterine cervix and cervical cancer. Thus sex related education should be provided to the people who are not aware of this factor and also about the warning signs of this cancer so that cancer can be detected at an early age.

Diet: Diet is another important factor in cases of cancer as 35% of cancer in Bangladesh occurs due to unhealthy diet. Excessive intake of alcohol and preserved food causes oral cavity, pharynx, larynx, oesophagus, liver and breast cancer and also excessive intake of fat may also lead to cancer. The risk of cancer can be decreased through intake of vitamin A, vitamin C, fruits and vegetables. To reduce the risk of cancer, it is also important to maintain the body mass index in range of 18.5 to 25 kg/m<sup>2</sup>.

Physical activity: Physical activity is important for a healthy life and it can be any kind of activity such as; jogging, cycling, swimming etc. physical activity can maintain the fitness of body and also reduce the risk of obesity and other diseases that may cause cancer.

Occupation: Workers who are involved in manufacture asbestos, rubber tires and textile are in high risk of cancer. Moreover, workers who are involved in pharmaceutical plants are at high risk of bladder cancer. Thus it is important to migrate the workers and to limit their exposure to the carcinogenic substances.

Infection: Some cancers are related to infection and about 15% of cancer occurs due to infections. Through eliminating the source of infection, preventing transmission and by improving host immunity through vaccination and other treatments risk related to cancer can be reduced.

Another approach of national cancer control strategy and plan of action is to detect cancer at an early stage by means of various tests so that it would be easy to treat those diseases. According to the strategy there are many kinds of treatment. Such as; surgery, radiotherapy, chemotherapy and by other means. National cancer control strategy also contains the palliative care for cancer patients and their families. This care is provided through prevention and by relieving suffering by early detection and providing proper treatment. Cancer control strategy has also provided information regarding rehabilitation of cancer patients and their family to provide social, emotional, nutritional, informational, psychological, sexual, spiritual and practical needs throughout the spectrum of the cancer experience.

Although National cancer control strategy and plan of action has provided all the information's related to cancer, there are also some other ways to improve the condition of cancer in this country. Bangladesh is highly populated country and economic condition of this country is not much good. Thus it is very difficult for most of the people of Bangladesh to get three major treatment of cancer which involves surgery, radiotherapy and chemotherapy. For this reason many people of this country die without treatment. It can be reduced if we establish fund in every government and non-government health care system by informing people about the condition of people. Our government can also help by establishing some cancer treatment center in every district. People of Bangladesh need to be informed about the warning signs of cancer through social media and by some campaign. People can also be informed about warning signs and early detection through some educational advertisement in national television.

## **Chapter 4**

## **Conclusion**

On the basis of this review, it can be said cancer is people's primary fear. If we can raise awareness to take the necessary precautions listed and described above, then the idea of inevitable death due to this disease can have a probable and possible cure. As described taking a few simple steps in our daily lives can keep cancer at bay to some extent. Regular screening and being more careful towards life can help us with an early detection which can later be fought against. Raising awareness towards it can make a whole lot of difference. It's never late to save our life. We can pass our thoughts and findings to the people worldwide by social media and even by making small cancer awareness groups. With time, people worldwide will then be more and more confident of surviving this brutal disease.

In Bangladesh, cancer is a dreadful thing to face for a person. Bangladesh is known as a developing country which makes the people here more ignorant of the idea of cancer. The word cancer to them has only one meaning and that's death. To make things change in Bangladesh the people should find a way to get rid of this negative thought they have on this. Initially the solution to this problem is only one. And that is "not fearing cancer" and working against it. Make more research centers, raise awareness on all means and take necessary measures when it comes to early detection. Leading a healthy lifestyle and having a positive perception about it can make things better on a different level. We can't forget the fact that cancer is a very brutal disease but by carrying out whatever steps that have been listed above, we can at least reduce the risks of it and make a positive comeback out of it.

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