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Threats of Oncogenic Manifestation: Environmental Synergies

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Abstract

The word "Cancer" continues to evoke the ominous threat of a silent murderer that sneaks up on us without warning. With the knowledge currently available, it is promising to prevent at least one-third of the 10 million cancer cases that occur worldwide each year. Each of us will be impacted by the statistics, whether we are patients, family members, or friends. The majority of the 20 million cancer patients worldwide today reside in the developing countries. In order to reduce the incidence of cancer and the clinical, personal, financial, and social burden that the disease causes, this calls for strong primary prevention efforts to reduce physical, chemical, and biological exposures to carcinogens as well as for the realization of environmental interventions, including in-work settings. The current effort makes an effort to pinpoint important environmental elements, such as occupational risks brought on by potentially carcinogenic chemicals and physical dangers in the air, water, and food. The results of my PhD thesis, "Health Hazards & Care of Cancer Patients: A Sociological Analysis," which examined 110 cancer patients from Thakurpukur, (C.C.W.H & R.I) M.G Road, Kolkata-700063, are the basis for the current study, which is based on a review of the literature and survey data.

Keywords: Environment, Cancer, Risk Factors, Carcinogens, Environmental Policy, Public Health.

Introduction

There are both modifiable and unmodifiable risk factors for cancer. The age, sex, and medical history of a person's family are examples of immutable factors. Cancer-causing environmental variables and lifestyle decisions, including alcohol and cigarette use, nutrition, sun exposure, viral infections, etc., are connected to modifiable ones. There is no way to demonstrate that a risk factor actually caused cancer, even when a person with the risk factor is diagnosed with it. (ACS 2005) The main categories of important cancer risk factors are: environmental, occupational, lifestyle, genetic, viral, immune, psychological, and occupational risk factors. Environmental variables can affect both those who are genetically prone to a disease and those who are not at all genetically sensitive, depending on the condition. There is great promise for cancer control due to the amount of current knowledge regarding the impact of external environmental drivers of cancer. Physical factors include solar radiation, which can cause skin cancer, and ionizing radiation, which can cause cancer of the lung and other organs. Chemical factors include vinyl chloride, which can cause liver cancer, 2-naphthylamine, which can cause bladder cancer, and benzopyrene, which can cause cancers linked to tobacco use. Biological factors include the hepatitis B virus, which can cause liver cancer (which is a cause of cancer of the cervix). The onset of cancer often occurs many years after the initial exposure to the causative factor. Asbestos exposure, for instance, has been linked to the development of mesothelioma decades later. Following exposure to a carcinogen, the development of cancer is typically governed by a dose-response gradient. The likelihood of contracting the disease increases with the amount of exposure.

Material & Methods:

Objectives of the Study:

My primary goals in terms of environmental cancer risk were basically twofold: to evaluate the impact of various occupational and non-occupational factors on cancer patients' prolonged exposure to various carcinogens, to evaluate the level of safety measures adopted by workers in such polluted surroundings.

Database:

I have taken help of both primary and secondary data in bringing out these two broad objectives.

Methodology:

In my survey based research work, "*Health Hazards & Care of Cancer Patients: A Sociological Analysis"*, for the operational convenience as well as owing to the absence of any sample frame of cancer patients in Kolkata, it was decided that the list of cancer patients would be collected from cancer hospitals run by both government as well as non-government organizations dealing exclusively with cancer patients in order to get specialized responses This indicates that sample has been selected on the basis of purpose of the study and convenience of the patients and hospital authority and consequently all elements/members in the population have not got the equal probability of being included into the sample. Therefore the nature of sampling is non-probable in nature or in other words the study is based on non-probability sampling and the type of sampling is purposive sampling as evident from the purpose of the study mentioned earlier. After thorough investigation of the possibilities of different cancer institutions, initially, Cancer Centre Welfare Home and Research Institute, Thakurpukur, (C.C.W.H & R.I) M.G Road, Kolkata-700063 as a private organization and Chittaranjan National Cancer Institute, 37, S.P Mukherjee Road, Kolkata, 700026 as govt. organization were selected. I have interviewed 110 cancer patients from varied Socio- economic and demographic categories. The present study attempts to explore into the sociological framework of a disease trying to spread the intellectual and inquisitive pursuit beyond the medical gaze of the disease with special reference to cancer.

The research endeavour is oriented towards looking into the social forces like beliefs, values, attitudes, socioeconomic conditions, demographic features, life style factors and environmental factors behind the disease as well as the impact of the disease on diverse facets of relations, be it familial, social, professional or spiritual. Regarding environmental predisposition to cancer my basic objectives were primarily two-fold: To assess the role of different occupational and non-occupational activities among cancer patients and their prolonged exposure to different carcinogens.

To gauge safety measures undertaken by workers working in such polluting environments.

Results/Analysis:

I have taken help of both primary and secondary data in bringing out these two broad objectives. In my study the distribution of population according to exposure to occupational hazards like: a) Industrial Chimney; b) Automobile fumes; c) Chemical effluent; d) Chemical used in work place; e) Chemical effluent in nearby construction; f) Any sort of radiation; g) Radioactive metals; h) Any gas; i) Wood dust, it was seen that only 22% of the population are directly affected by the different sources of pollution in their occupational areas in which maximum (8%) are affected by chemical used in work place. 18 (16.36%) number of people out of 110 are under the effect of occupational pollution hazards. The majority of people (44.44%) is seen to be exposed for 20 years at a stretch where as 11.11% are exposed for about 50 years. Irrespective of all occupations (like agricultural and industrial workers, service men, businessmen, housewife among others) only 5.4% (Personal protection 1.8% + Protection by working area 3.6%) have protection from working area and a major 57.2% don't receive protection either from working area or personally.

Regarding Country and State wise sources of pollution, it has been seen that out of 110

patients, majority have been residing in area which is pollution prone. Out of them, 37.3% reside in Bangladesh, in which 70% is arsenic affected. In Kolkata, 66.6% is affected by automobile fumes. In Hooghly, Midnapore, Birbhum, N. Dinajpur district as well as in Assam 100% people are affected with arsenic and 50% in Jharkhand. In North 24 parganas and Murshidabad, it is seen that 100% are affected by automobile fumes. Therefore, it is seen that overall arsenic contamination is maximum (59.26%) than other chemicals, irrespective of country, state and province.

Ignorance about possible risk factors of chemicals was observed in all respondents. The effect was observed with arsenic topping the list as the major pollutant irrespective of country, state and provincial boundaries, among other pollutants like automobile fumes and other chemicals. The effect was observed cross-nationally through a comparative study with Bangladesh. In all from Bangladesh 10 cases were observed wherein 70% were affected with arsenic. From West Bengal 15 cases were observed throughout 12 districts of Howrah, Nadia, Hooghly, Midnapore, Bankura, Purulia, Burdwan, Birbhum, North Dinajpur, South 24 Parganas, North 24 Parganas, and Murshidabad where also arsenic became the major pollutant. In proper Kolkata however automobile fumes became the major pollutant with no arsenic cases found. Approximately 20 incidents of groundwater arsenic contamination have been reported from all over the world. Of these, four major incidents were in Asia: in Bangladesh (Dhar et. al., 1997 and Biswas et. al., 1998); West Bengal, India (Chowdhury et. al., 1997 and Guha Majumder et. al., 1998); Inner Mongolia, China (Lian et. al., 1994); and Taiwan (Yeh, 1963). The world's two biggest cases of groundwater arsenic contamination and those that affected the greatest number of people were in Bangladesh and West Bengal. The magnitude of the arsenic contamination in Bangladesh surfaced only recently. (Dhar et. al., 1998) A recent report (Pearce, 1998) described the magnitude of the arsenic contamination in Bangladesh; the World Bank's local chief stated that tens of millions of people are at risk for health effects and that 43,000 villages of 68,000 are presently at risk or could be at risk in future.

Traditionally labor-oriented markets are on change towards more automation and mechanization, at the same time general awareness about occupational safety, occupational and environmental hazards were not spread in the society. Due to lack of education, unaware of the hazards of their occupations, general backwardness in sanitation, poor nutrition and climatic proneness of this geographic region to epidemics aggravate their health hazards from work environment. (Vilanilam, 1980) According to Joshi and Smith (2002), Indian doctors and nurses are very poorly trained to deal with occupation health related morbidity. Neither many medical schools were specialized in this faculty nor did offer specialized training. Thereis a big demand and supply equations for Industrial hygienists and occupational professionals and semi-professionals in the market. Even in advanced industrial countries where more and more industries are being established and newer chemicals and processes are being introduced in work places, the fear of increase of occupational cancer risk tends to grow deeper.

It appears that occupational factors are responsible for about 5–10% of all cancers and that environmental factors are responsible for 1–2% of all cancers in industrialized countries. It was observed that many of the patients receiving X-ray therapy developed leukemia, lung cancer, or lymphoma and were likely to develop cancer of the stomach and the oesophagus; while the patients treated with radium therapy showed incidence of bone cancer. The artificial sources of radiation are occupational, therapeutic, diagnostic, and also atomic weapons and reactors. During the asbestos-based industrial activities whether related to mining, milling or manufacturing, asbestos fibers get airborne at the work places. Its prolonged exposure causes progressive pulmonary fibrosis (asbestosis), pleural diseases (pleural plaques and effusion), malignancies as mesothelioma and bronchogenic carcinoma (Rahman et al, 1993).

Also one should not underestimate the importance of contributory or modulatory factors like alcoholism, tobacco-addiction, diet and rural-urban differences. Among the industries in which there is evidence of carcinogenic risk are the following:

agriculture, construction, demolition, shipbuilding, ship breaking, petroleum, metal and rubber.

Discussions:

The wealth of current knowledge about the influence of external environmental determinants of cancer provides significant potential for cancer control. These external factors can be categorized as follows: *physical*, for example, solar radiation (which can give rise to skin cancer), and ionizing radiation (which induces cancer of the lung and certain other organs); *chemical*, for example, vinyl chloride (which can cause liver cancer), 2-naphthylamine, (which can cause cancer of the bladder), and benzopyrene (which can cause tobacco-related cancers); *biological*, for example, hepatitis B virus (which is a cause of liver cancer), and human papilloma virus (which is a cause of cancer of the cervix). Cancer typically arises many years after initial contact with the etiological agent. For example, exposure to asbestos can result in the development of mesothelioma several decades later. A dose-response gradient generally governs the development of cancer following exposure to a carcinogen. The greater the extent of exposure, the more likely it is that the disease will occur.

Particulate pollutants in air are present in sizes varying from 0.001 to 10,000 (micron) in diameter. Within this range, the particles of the size 0.25 -10 micron in diameter reach tracheal tube and those less than l micron reach alveoli (The functional part of the lungs) and may enter blood circulation. Polycyclic hydrocarbons are the major component (60percent) of the particulate matter. These substances which have been found experimentally and epidemiologically to be carcinogenic, are generated from the combustion of petroleum, gasoline, and diesel fuel in the heat and power generation, refuse burning, coke production and motor vehicle emission. The International Agency for Research in Cancer (a WHO organisation) has identified 42 polycyclic aromatic hydrocarbons occurring in the environment. Some of these are anthracene, benzofluranthene, benzophenanthrene, dibenzanthracene, benzopyrene, chrysene and coronene (In the urban cities in Germany, benzopyrene concentration gose upto 333 ng/m^3 in air in winter). Besides these major sources, hydrocarbons are introduced in air by tobacco smoking and burning *chullah* (country stove). Water absorbs elements and salts from the reservoir rock. It is contaminated by objectionable chemicals discharged from chemical factories, agricultural fields and sewage effluents. Among heavy metals, lead, chromium, copper, iron and manganese are present in drinking water and they are not welcome. Arsenic and selenium are also toxic to the biological system. It appears that occupational factors are responsible for about 5–10% of all cancers and that environmental factors are responsible for 1–2% of all cancers in industrialized countries. (National Cancer Control Programmes: Policies and Managerial Guidelines, W.H.O 2002). Among the industries in which there is evidence of carcinogenic risk are the following: agriculture, construction, demolition, shipbuilding, ship breaking, petroleum, metal and rubber. (Totman, 1979)

Behera (1995) emphasized that the problem of indoor air pollution far outweighs the ambient air pollution. There are four principal sources of pollutants of indoor air: (i) combustion, (ii) building material, (iii) the ground under the building, and (iv) bioaerosols. In developed countries the most important indoor air pollutants are radon, asbestos, volatile organic compounds, pesticides, heavy metals, animal dander, mites, moulds and environmental tobacco smoke. However, in developing countries the most important indoor air pollutants are the combustion products of unprocessed solid biomass fuels used by the poor urban and rural folk for cooking and heating. Approximately half the world's population and up to 90% of rural households in developing countries still rely on unprocessed biomass fuels such as wood, dung and crop residues. (World Resources Institute, 1998-99)

Pesticides like DDT and DDD are chlorinated hydrocarbons. Their degradative product, dichlorostilbene is a co-carcinogen. The pesticide aerosols: settle in the soil and are taken up by plants or crops and may enter the body through food. Some of the hydrocarbons are not carcinogens by themselves. They are

required to be converted into an active carcinogenic form called epoxides. When hydrocarbons enter the body, epoxides are formed in the liver. In heavily industrialised cities the level of hydrocarbons may reach 20 to 360 microg/100m^3. Radon is a naturally occurring radioactive gas which is a disintegration product of radium present in the earth's crust. It emits particles which cause lung cancer. Radon is present in the open air as well as inside houses. Its concentration inside houses is much higher than outside. (Rao, 1996)

Conclusion:

Traditionally labor-oriented markets are on change towards more automation and mechanization, at the same time general awareness about occupational safety, occupational and environmental hazards were not spread in the society. Due to lack of education, unaware of the hazards of their occupations, general backwardness in sanitation, poor nutrition and climatic proneness of this geographic region to epidemics aggravate their health hazards from work environment. (Vilanilam, 1980) According to Joshi and Smith (2002), there is a big demand and supply equations for Industrial hygienists and occupational professionals and semi-professionals in the market. Even in advanced industrial countries where more and more industries are being established and newer chemicals and processes are being introduced in work places, the fear of increase of occupational cancer risk tends to grow deeper.

Development of an effective strategy for the prevention of occupationally- induced cancers requires detailed knowledge of which exposures carry significant risk. The impetus for identifying occupationally-induced cancers has come from: increased competence in recognizing and demonstrating occupational hazards and the growing diversity of industrial processes and the concomitant exposure of workers to physical and chemical carcinogens.

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