

## PROJECTION OF NEW CANCER CASES IN THE STATE OF WEST BENGAL, INDIA - 2020

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### Abstract

It is essential to project cancer incidence for planning cancer control actions, health care and allocation of resources in specific region. Till date no projection of cancer cases according to primary sites and district wise distribution of the cancer cases for the state of West Bengal are available in the literature. In West Bengal only one Population Based Cancer Registry (PBCR) for Kolkata is ongoing cancer registration in West Bengal which is based on urban population only but there is no Population Based Cancer Registry (PBCR) for rural West Bengal Kolkata. PBCR is helpful for the projection of cancer cases in any region. Here the cancer burden for the state of West Bengal had been made to understand the magnitude of cancer problem for the calendar year 2020.

The age, sex, primary site and district-wise cancer incidences were projected on the basis of data along with populations covered by the PBCRs obtained from the report of National Cancer Registry Programme (NCRP) published by National Centre for Disease Informatics and Research (NCDIR), Indian Council of Medical Research (ICMR) for the period 2005-2014.

Thus pooled age-sex specific cancer incidence rates for urban area were obtained by taking weighted averages of 18 PBCRs of India based on exclusively urban population with respective registry populations as weights.

Pooled age sex specific cancer incidence rates for rural area were obtained by taking weighted averages of 15 PBCRs of India based on rural, district and state population with respective registry populations as weights.

The pooled incidence rates were assumed to represent the incidence rates for the state of West Bengal. Populations of this state according to age and sex exposed to the risk of development of cancer in 2020 were obtained from the report of Registrar General of India providing population projections for the state for 2020. Population forecasts were combined with the pooled incidence rates to estimate the projected number of cancer cases by age, sex and site of cancer for 2020. The projections were carried out for the various leading sites as well as for 'all sites' of cancer.

The leading site of cancers, namely those of tobacco related cancers, breast and cervical cancers in women account for over 50 to 60 % of all cancers. Adjustments were made for increasing tobacco habits, exposure to arsenic, Gangetic delta region and also adjustments for increasing trends of lung, prostate, mouth, tongue, and larynx in males and that for breast, cervix uteri, ovary, gall bladder and lung in females were made, the estimates may further increase. The main factors contributing to high burden of cancer over the years are increase in the population size as well as increase in proportion of elderly population, urbanization, Gangetic delta and arsenic exposure.

This projection of cancer incidence will help the policy planners for strengthening and augmenting the existing diagnostic/treatment facilities. Also it will help the researchers to plan their research activities in the field of cancer.

**Keywords:** Projection - Cancer incidence - Magnitude of cancer –District wise– West Bengal

### Introduction

As per the global cancer burden using the GLOBOCAN 2020 estimates of cancer incidence and mortality produced by the International Agency for Research on Cancer (IARC) Globally an estimated 9.3 million new cancer cases (18.1 million excluding non-melanoma skin cancer) and almost 10.0 million cancer deaths (9.9 million excluding non-melanoma skin cancer) occurred in 2020. Female breast cancer had surpassed lung cancer as the most commonly diagnosed cancer, with an estimated 2.3 million new cases (11.7%), followed by lung (11.4%), colorectal (10.0 %), prostate (7.3%), and stomach (5.6%) cancers. Lung cancer remained the leading cause of cancer death, with an estimated 1.8 million deaths (18%), followed by colorectal

(9.4%), liver (8.3%), stomach (7.7%), and female breast (6.9%) cancers.<sup>1</sup>

Cancer incidence will continue to grow worldwide due to increase in life expectancy, increase in the proportion of elderly population and size of population. In India due to absence of any mass screening programme the cancer incidence will increase day by day. West Bengal is being a state of India the scenario of cancer will be more or same as it will be India. Moreover, use of tobacco in both chewing and smoking form among the common people of this state will also be an alarming factor. In addition those about 6 districts of West Bengal are badly affected with arsenic contaminated water and also as per the report of National

Centre for Disease Informatics and Research (NCDIR) the rising trend of gall bladder cancers in the Gangetic region.<sup>2</sup> It is estimated that life expectancy of Indian population will increase from 68 years to 71 years by 2011-2015 to 2021-2025 (MOH and FW, 2011).

Thus changes in age structure, population would face an increase in incidence of cancers among elderly. Due to change in life style and increase in per capita income the environment is at risk of increasing carcinogen and co-carcinogen elements. Due to more busy life insufficient exercise and an unhealthy diet will also be determinants of increasing incidence of cancers.

At present, for India as a whole the magnitude of the cancer incidence projections by site and sex based on scientific methods was available till the year 2016 and 2020.<sup>3-4</sup>

However, no such projections are available for the state of West Bengal. Thus this prediction would help the health policy planners to evolve and implement cancer facilities in this state. In the present study attempts were made to estimate load of cancer incidence at the states as well as district level for all sites, rural-urban differences and sex of the patients.

In West Bengal most of the cancer treating centers are in and around Kolkata which is situated more or less extreme south of this state. Thus proper planning can be made for the transportation of the patients from different districts of West Bengal to Kolkata and also proper planning for more night shelters can be made for the patients who will need only day care treatments.

Above all it will help the researchers to locate different types of cancer patients in different districts of West Bengal.

#### Materials and Methods:

The incidences of cancers are available from the website of NCDIR where the reports of different PBCRs are available. However, most of the PBCRs are based on the urban population. The PBCR, Kolkata is functioning since 1<sup>st</sup> January 1997 and it came under NCDIR since 1<sup>st</sup> January 2005. The report of 33 PBCRs was available at the time of estimation out of which 18 PBCRs are based on exclusively urban population and rest 15 PBCRs of India based on rural, district and state population.

For this reason pooled age sex specific cancer incidence rates for urban area were obtained by taking weighted averages of 18 PBCRs of India based on exclusively urban population with respective registry populations as weights. Pooled age sex specific cancer incidence rates for rural area were obtained by taking weighted averages of 15 PBCRs of India based on rural, district and state population with respective registry populations as weights.

#### Population exposed to risk

Mid-year population for the year 2020 of the state and of the different districts according to age and sex were obtained by population projections based on Census of India 2011 by the

Registrar General of India (Registrar General of India, 2011).

#### Estimation of load of cancer

The respective age and sex-specific pooled incidence rates by site of 33 registries were multiplied with the corresponding projected age and sex specific population figures to estimate the projected number of cases by age, sex and site of cancer for 2020. The number of new cases of cancer for site "s" ( $N^s$ ) for 2020 was estimated using the relationship  $N^s = \sum n P_x * n I_x$ , where  $n P_x$  represents the projected population in the  $x$  to  $x+n$  age group for a particular year and  $n I_x$  being the pooled incidence rate of cancer by site in the same age group for a particular site.<sup>5</sup> The projections have been carried out for the various selected sites of cancer and tobacco related sites taken together. Estimation of incidence had been done both at the state level as well as for 20 districts of West Bengal.

#### Assumptions:

The projection of number of persons developing cancer had been done with the following assumption: i) rates obtained from these 33 PBCRs represent incidence rate of West Bengal as well as for the various districts of West Bengal and; ii) age-specific cancer incidence rates for the latest available year will remain unchanged till the end of 2020.

#### Results:

According to the projections based on total fertility rates, the total estimated population of West Bengal for the years 2020 (as of 1<sup>st</sup> July 2020) was 9,86,62,146.

The pooled age specific incidence rate of cancer of all sites was calculated based on the incidence rates as per the report of NCDIR for 2020.<sup>2</sup>

**Table 1: Gender wise distribution of expected number of new cancer cases in the districts of West Bengal**

Sl. No	District	Male	Female	Total
1	Darjiling & Kalimpong	1,402	1,437	2,839
2	Jalpaiguri	1,453	1,787	3,240
3	Koch Bihar	919	1,065	1,984
4	Alipur Duar	585	722	1,307
5	Uttar Dinajpur	1,145	1,351	2,496
6	Dakshin Dinajpur	611	704	1,315
7	Malda	1,141	1,584	2,725
8	Murshidabad	2,744	3,185	5,929
9	Birbhum	1,252	1,332	2,584
10	Bardhaman	3,162	3,729	6,891
11	Nadia	2,115	2,216	4,331
12	North 24 Parganas	4,912	5,213	10,125
13	Hugli	2,284	2,909	5,193
14	Bankura	1,151	1,379	2,530
15	Puruliya	964	1,153	2,117
16	Paschim Medinipur & Jhargram	1,789	2,263	4,052
17	Purba Medinipur	1,552	1,827	3,379
18	Haora	2,498	2,681	5,179
19	Kolkata	2,807	2,977	5,784
20	South 24 Parganas	3,003	3,666	6,683
	Total	37,489	43,170	80,663

**Table 2: Gender wise distribution of expected number of new cancer cases in the districts of West Bengal according to place of residence of the patients**

Sl. No	District	Rural			Urban			Total		Grand Total
		Male	Female	Total	Male	Female	Total	Male	Female	
1	Darjiling & Kalimpong	785	628	1,413	617	810	1,427	1,402	1,437	2,839
2	Jalpaiguri	819	933	1,752	634	854	1,488	1,453	1,787	3,240
3	Koch Bihar & Alipur Duar	1,044	1,162	2,206	460	625	1,085	1,504	1,787	3,291
4	Uttar Dinajpur	784	907	1,691	361	444	805	1,145	1,351	2,496
5	Dakshin Dinajpur	461	497	958	150	207	357	611	704	1,315
6	Malda	867	1,102	1,969	274	482	756	1,141	1,584	2,725
7	Murshidabad	1,666	2,015	3,681	1,078	1,170	2,248	2,744	3,185	5,929
8	Birbhum	894	958	1,852	358	374	732	1,252	1,332	2,584
9	Purba & Paschim Barddhaman	1,295	1,638	2,933	1,867	2,091	3,958	3,162	3,729	6,891
10	Nadia	1,152	1,257	2,409	963	959	1,922	2,115	2,216	4,331
11	North 24 Parganas	1,524	1,868	3,392	3,388	3,345	6,733	4,912	5,213	10,125
12	Hugli	984	1,192	2,176	1,300	1,717	3,017	2,284	2,909	5,193
13	Bankura	898	1,073	1,971	253	306	559	1,151	1,379	2,530
14	Puruliya	721	831	1,552	243	322	565	964	1,153	2,117
15	Paschim Medinipur & Jhargram	1,358	1,669	3,027	431	594	1,025	1,789	2,263	4,052
16	Purba Medinipur	1,188	1,364	2,552	364	463	827	1,552	1,827	3,379
17	Haora	672	688	1,360	1,826	1,993	3,819	2,498	2,681	5,179
18	Kolkata	0	0	0	2,807	2,977	5,784	2,807	2,977	5,784
19	South 24 Parganas	1,702	2,147	3,849	1,301	1,513	2,814	3,003	3,660	6,663
	Total	18,814	21,929	40,743	18,675	21,246	39,921	37,489	43,174	80,663

**Note:** Since the age-sex distribution of population of the districts of Kalimpong, Alipurduar, Purba & Paschim Barddhaman and Jhargram are not available in Census-2011. The estimation of population was not possible. The populations of the mentioned districts are being estimated along with parent districts and also all the estimations were made accordingly.

**Table 3: Ten leading site of cancer in male and female**

Male				Female			
Site (ICDO3)	Site of cancer	Number (n=1453)	%	Site (ICDO3)	Site of cancer	Number (n=1453)	%
C33-C34	Lung etc.	4,305	11.5	C50	Breast	7,951	18.4
C03-C06	Mouth	2,974	7.9	C53	Cervix Uteri	6,802	15.8
C61	Prostate	2,201	5.9	C56	Ovary Etc.	2,389	5.5
C15	Oesophagus	1,910	5.1	C23-C24	Gall Bladder etc.	2,354	5.5
C01-C02	Tongue	1,872	5.0	C82-C85	NHL	1,432	3.3
C32	Larynx	1,652	4.4	C33-C34	Lung etc.	1,310	3.0
C16	Stomach	1,584	4.2	C67	Urinary Bladder	1,140	2.6
C22	Liver	1,498	4.0	C03-C06	Mouth	1,084	2.5
C67	Urinary Bladder	1,473	3.9	C15	Oesophagus	1,046	2.4
C82-C85	NHL	1,357	3.6	C16	Stomach	1,004	2.3

Almost half of the population (41.7%) is addicted with tobacco use and incidentally percent of passive smokers are also high in this state. Moreover, additional exposure to arsenic contaminated water causing cancers to related organs which are at high risk of having cancers due to exposure to tobacco and arsenic.

Use of country liquors are very common among the males in the rural area which may be enforced liver cancer to be in one of the ten leading sites among males.

As usual breast followed by cervix uteri are the two most common primary sites among females.

In overall as per Census 2011 the literacy rate was 77.08% which may lead to cancer in cervix uteri positions 2<sup>nd</sup> after cancer in breast by maintaining good hygienic conditions of female genital organs.

As per the report of NCDIR, ICMR the incidence of gallbladder cancer (Ca-GB) among the women of Gangetic

region is much higher which reflected in the results. In this context it may be noted that the Ganges is the main river of this state which is known as the Bhagirathi and a considerably large part of this state is coming under Gangetic delta region.<sup>2</sup>

Moreover, about 70% of rural women are using biomass as fuel for preparing household products which also causing cancers to respiratory organs.

About 20% of the population of 9 districts of West Bengal is affected with arsenic and fluoride contaminated ground water which is a major exposure for arsenic and fluoride related cancers in both males and females.<sup>6</sup>

The detailed of the cases is provided in the following two tables.

Table 4: Distribution of cancers according the gender in West Bengal

Site of cancer	Male		Female	
	Number	%	Number	%
Lip	101	0.3	167	0.4
Tongue	1,872	5.0	885	2.0
Mouth	2,974	7.9	1,084	2.5
Salivary Gland	233	0.6	174	0.4
Tonsil	209	0.6	96	0.2
Other Oropharynx	99	0.3	40	0.1
Nasopharynx	136	0.4	44	0.1
Hyphopharynx	1,147	3.1	305	0.7
Pharynx Uns	263	0.7	74	0.2
Oesophagus	1,910	5.1	1,046	2.4
Stomach	1,584	4.2	1,004	2.3
Small Intestine	52	0.1	13	0.0
Colon	1,012	2.7	782	1.8
Rectum	1,242	3.3	802	1.9
Anus & Anal Canal	124	0.3	244	0.6
Liver	1,498	4.0	772	1.8
Gall Bladder etc.	1,283	3.4	2,354	5.5
Pancreas	590	1.6	210	0.5
Nose, Sinuses etc.	59	0.2	28	0.1
Larynx	1,652	4.4	261	0.6
Lung etc.	4,305	11.5	1,310	3.0
Other Thoracic Organ	248	0.7	241	0.6
Bone	597	1.6	381	0.9
Melanoma of Skin	962	2.6	602	1.4
Other Skin	568	1.5	550	1.3
Mesothelioma	13	0.0	15	0.0
Kaposi Sarcoma	3	0.0	3	0.0
Connective & Soft Tissue	226	0.6	113	0.3

Table 5: Distribution of caners according to the gender in West Bengal (continued)

Site of cancer	Male		Female	
	Number	%	Number	%
Breast	149	0.4	7,951	18.4
Vulva	0	0.0	163	0.4
Vagina	0	0.0	433	1.0
Cervix Uteri	0	0.0	6,802	15.8
Corpus Uteri	0	0.0	932	2.2
Uterus UNS	0	0.0	231	0.5
Ovary etc.	0	0.0	2,389	5.5
OFG Organ	0	0.0	0	0.0
Placenta	0	0.0	0	0.0
Penis	680	1.8	0	0.0
Prostate	2,201	5.9	0	0.0
Testis	199	0.5	5	0.0
OMG Organ	0	0.0	0	0.0
Kidney etc.	505	1.3	665	1.5
Renal Pelvis	0	0.0	0	0.0
Ureter	10	0.0	3	0.0
Urinary Bladder	1,473	3.9	1,140	2.6
Unspecified Urinary Organ	19	0.1	4	0.0
Eye	64	0.2	257	0.6
Brain, Nervus System	797	2.1	601	1.4
Thyroid	322	0.9	986	2.3
Adrenal Gland	0	0.0	30	0.1
Hodgkin's Disease	350	0.9	300	0.7
NHL	1,357	3.6	1,432	3.3
Malignant Immuno Proliferative	0	0.0	11	0.0
Multiple Myeloma	451	1.2	508	1.2
Lymphoid Leukaemia	461	1.2	451	1.0
Myloid Leukaemia	857	2.3	735	1.7
Leukaemia Unspecified	333	0.9	319	0.7
CMD, Other & Un-Specified (NHL)	0	0.0	0	0.0
Other & Un-Specified	2,299	6.1	3,229	7.5
Total	37,489	100.0	43,174	100.0

Table 6: Five leading sites of cancers in males in different districts of West Bengal

District	Number (%)	Primary Site of cancers				
		Stomach	Lung etc.	Liver	Oesophagus	Mouth
Darjeeling and Kalimpong	No	182	153	111	98	80
	%	13.0	10.9	7.9	7.0	5.7
	Site	Lung etc.	Mouth	Prostate	Oesophagus	Tongue
Jalpaiguri	No	150	115	88	81	71
	%	10.3	7.9	6.1	5.6	4.9
	Site	Lung etc.	Mouth	Prostate	Oesophagus	Tongue
Cooch Behar	No	123	121	83	94	71
	%	17.3	16.0	11.3	12.2	9.5
	Site	Mouth	Lung etc.	Tongue	Hyphopharynx	Prostate
North Dinajpur	No	180	91	78	57	53
	%	15.7	7.9	6.8	5.0	4.6
	Site	Lung etc.	Mouth	Tongue	Liver	Prostate
South Dinajpur	No	92	56	36	30	30
	%	15.1	9.2	5.9	4.9	4.9
	Site	Mouth	Prostate	Tongue	Oesophagus	Stomach
Maldah	No	111	75	63	57	54
	%	9.7	6.6	5.5	5.0	4.7
	Site	Melanoma of skin	Lung etc.	Mouth	Urinary bladder	Prostate
Murshidabad	No	254	221	201	180	143
	%	9.3	8.1	7.3	6.6	5.2
	Site	Oesophagus	Mouth	Lung etc.	Stomach	Liver
Birbhum	No	169	96	84	64	63
	%	13.5	7.7	6.7	5.1	5.0
	Site	Lung etc.	Melanoma of skin	Mouth	Prostate	Urinary bladder
Nadia	No	204	183	154	120	117
	%	9.6	8.7	7.3	5.7	5.5
	Site	Lung etc.	Mouth	Urinary bladder	Tongue	Prostate
North 24 Parganas	No	712	352	252	248	246
	%	14.5	7.2	5.1	5.0	5.0

Table 7: Five leading sites of cancers in males in different districts of West Bengal (continued)

South 24 Parganas	Site	Lung etc.	Mouth	Prostate	Oesophagus	Tongue
	No	304	241	183	171	147
	%	10.1	8.0	6.1	5.7	4.9
Kolkata	Site	Lung etc.	Prostate	Mouth	Tongue	Larynx
	No.	529	232	194	154	151
	%	18.8	8.3	6.9	5.5	5.4
Purba Bardhaman	Site	Lung etc.	Mouth	Prostate	Tongue	Larynx
	No.	408	248	216	163	159
	%	12.9	7.8	6.8	5.2	5.0
Hugli	Site	Lung etc.	Mouth	Prostate	Tongue	Oesophagus
	No.	281	174	150	114	111
	%	12.3	7.6	6.6	5.0	4.9
Howrah	Site	Lung etc.	Prostate	Mouth	Other & un-specified	Tongue
	No.	475	179	175	138	126
	%	19.0	7.2	7.0	5.0	5.0
Purba Medinipur	Site	Mouth	Lung etc.	Oesophagus	Liver	Prostate
	No.	139	118	112	92	88
	%	9.0	7.6	7.2	5.9	5.7
Paschim Medinipur and Jhargram	Site	Mouth	Lung etc.	Oesophagus	Liver	Prostate
	No.	161	137	129	106	103
	%	9.0	7.7	7.2	5.9	5.8
Bankura	Site	Lung etc.	Mouth	Oesophagus	Liver	Prostate
	No.	114	96	79	75	59
	%	9.9	8.4	6.9	6.5	5.1
Purulia	Site	Mouth	Lung etc.	Oesophagus	Liver	Prostate
	No.	80	70	63	63	52
	%	8.3	7.3	6.5	6.5	5.4

Table 8: Five leading sites of cancers in females in different districts of West Bengal

District	Site	Cervix uteri	Breast	Stomach	Liver	Ovary etc.
Darjeeling and Kalimpong	Number	360	164	140	99	72
	%	25.1	11.4	9.7	6.9	5.0
Jalpaiguri	Site	Breast	Cervix uteri	Ovary etc.	NHL	Gall bladder
	Number	339	306	91	77	63
	%	19.0	17.1	5.1	4.3	3.5
Cooch Behar and Alipurduar	Site	Cervix uteri	Ovary etc.	Lung etc.	NHL	Oesophagus
	Number	352	88	72	62	52
	%	38.3	9.9	8.1	7.2	5.7
North Dinajpur	Site	Cervix uteri	Breast	Ovary etc.	Gall bladder etc.	Mouth
	Number	247	222	100	89	74
	%	18.8	16.9	7.6	6.8	5.6
South Dinajpur	Site	Cervix uteri	Breast	Gall bladder etc.	Ovary etc.	Lung etc.
	Number	138	128	46	43	27
	%	19.6	18.2	6.5	6.1	3.8
Maldah	Site	Cervix uteri	Breast	Gall bladder etc.	Ovary etc.	Other skin
	Number	329	301	78	76	57
	%	20.8	19.0	4.9	4.8	3.6
Murshidabad	Site	Breast	Cervix uteri	Gall bladder etc.	Melanoma of skin	Ovary etc.
	Number	580	577	179	165	151
	%	18.2	18.1	5.6	5.2	4.7
Birbhum	Site	Cervix uteri	Breast	Ovary etc.	Oesophagus	NHL
	Number	291	264	67	42	42
	%	21.8	19.8	5.0	3.2	3.2
Nadia	Site	Breast	Cervix uteri	Gall bladder etc.	Ovary etc.	Melanoma of skin
	Number	455	354	181	122	91
	%	20.5	16.0	8.2	5.5	4.1
North 24 Parganas	Site	Breast	Cervix uteri	Gall bladder etc.	Ovary etc.	Urinary bladder
	Number	1144	714	378	350	309
	%	21.9	13.7	7.3	6.7	5.9

Table 9: Five leading sites of cancers in females in different districts of West Bengal (continued)

South 24 Parganas	Site	Breast	Cervix uteri	Gall bladder etc.	Ovary etc.	Lung etc.
	Number	703	646	200	187	159
	%	19.2	17.7	5.5	5.1	4.3
Kolkata	Site	Breast	Cervix uteri	Ovary etc.	Gall bladder etc.	Lung etc.
	Number	652	259	191	189	183
	%	21.9	8.7	6.4	6.3	6.1
Purba Bardhaman	Site	Breast	Cervix uteri	Gall bladder etc.	Ovary etc.	Lung etc.
	Number	754	582	221	209	122
	%	20.2	15.6	5.9	5.6	3.3
Hugli	Site	Breast	Cervix uteri	Gall bladder etc.	Ovary etc.	NHL
	Number	538	421	198	149	144
	%	18.5	14.5	6.8	5.1	5.0
Howrah	Site	Breast	Cervix uteri	Gall bladder etc.	NHL	Ovary etc.
	Number	567	334	214	190	166
	%	21.1	12.5	8.0	7.1	6.2
Purba Medinipur	Site	Cervix uteri	Breast	Ovary etc.	Oesophagus	NHL
	Number	419	375	95	60	57
	%	22.9	20.5	5.2	3.3	3.1
Paschim Medinipur and Jhargram	Site	Cervix uteri	Breast	Ovary etc.	Liver	Oesophagus
	Number	496	446	112	74	71
	%	21.9	19.7	4.9	3.3	3.1
Bankura	Site	Cervix uteri	Breast	Thyroid	Ovary etc.	Other thoracic organ
	Number	303	257	76	64	52
	%	22.0	18.6	5.5	4.6	3.8
Purulia	Site	Cervix uteri	Breast	Ovary etc.	Gall bladder etc.	Lung etc.
	Number	243	220	56	45	37
	%	21.1	19.1	4.9	3.9	3.2

Both the districts of **Darjeeling and Kalimpong** are having population with similar to Seven Sisters States of North East and Sikkim. Moreover, a large number of peoples from Nepal and Bhutan permanently settled down here. Thus the cultural, personal habits and food habits of the districts are more or less similar to the north-east states. Thus the pattern of cancers resemble with that of the north states and that of Sikkim. Having cold weather throughout the year people use to smoke and drink. Common people are engaged as laborer in the tea gardens who are having habit of smoking and drinking of alcohol. Among males cancer in stomach on the top may be due to common food habits of Sikkim and other north eastern states. Liver cancer may be due to drinking of alcohol. Comparatively a less proportion of area of the districts is in the urban area. Moreover, women are the labourer of the tea gardens where scarcity of water at the slope of the hills for sanitation and illiteracy among the women labourer may lead to poor hygienic condition of genital organs which enforced cancer in cervix uteri to be on the top among the ten leading sites of cancers. Among females habit of smoking and drinking of alcohol are comparatively higher than that of other districts of West Bengal which reflected in the ten leading cancers among females.

**Jalpaiguri** is famous for its location as it is the 'Gateway' to north eastern states and international borders through surface transport. Thus it is famous for business as a result of that people from different places and adjoining district of Darjeeling have settled down permanently. This mixture of population leads to varieties of food habits and personal habits which have been reflected in the occurrence of cancers. Among males cancer in lung and other respiratory organs followed by oral cavity are on the top may be due to habit of both smoke and smokeless tobacco habit of the people. This mixture of population has been reflected in the occurrence of female cancers as the breast and cervix uteri are the two leading primary sites.

**Alipur Duar** is being constituted from the part of **Jalpaiguri** the food habits and personal habits which have been reflected in the occurrence of cancers have been reflected in the occurrence of cancer. Among males cancer in lung and other respiratory organs followed by oral cavity are on the top may be due to habit of both smoke and smokeless tobacco habit of the people.

**Cooch Bihar** is adjacent to Assam and Bangladesh. Thus chewing of betel nuts along with tobacco is very common among the personal habits of common people. which have been reflected in the occurrence of cancers. Among males cancers in mouth followed by oesophagus are on the top which may be due to habit of both betel nut and smokeless tobacco habit of the people. A few urban areas are in the district as result of that the district is socio-economically backward as compared to other districts. This has been depicted in the ten leading site of cancer among females enforcing cancer in cervix uteri is on the top among the cancers in females.

The specialty of this district of **North Dinajpur** is surrounded by with several districts with different kinds of personal habit and also Bangladesh and Bihar touch the majority part of eastern and western border of this district respectively. However, due to the restrictions at the international border the life style of the people of this district significantly affected by personal habit of both males and females. As a result of that mouth cancer is very much on the top of the ten leading site due to chewing of smokeless tobacco. As usual the cancer in cervix uteri is on the top of the ten leading site among females. Effect of smokeless tobacco has been reflected on the ten leading site of cancer among the females.

In **South Dinajpur** effect of tobacco habit has been predominantly reflected in the occurrence of cancers among males enforcing cancer in respiratory organs on the top of ten leading sites in males. Most of the areas of this district are in rural area. Thus cancer in cervix uteri is the leading site in females. Also being adjacent to Gangetic delta region gall bladder cancer in females in this district is also one of the ten leading sites in females.

**Malda** is bordering with Jharkhand, Bihar and Bangladesh. Moreover, this district is badly affected with arsenic contaminated drinking water and it also situated at the another "Triveni Sangam" of India i.e. the Ganges, the Bhagirathi and Padma of Bangladesh. However, the main stream is the Ganges which is divided into two parts the Bhagirathi towards later on the Hooghly River passing through the southern part of West Bengal and another part the Padma is through Bangladesh. Thus affect of arsenic, chewing tobacco (as popular in both Jharkhand and Bihar) and belt of gall bladder cancer being at the bank of the Ganges have been reflected in the occurrence of cancers. Among males cancers in mouth is on the top which may be due to habit of smokeless tobacco habit of the people. Also cancer in urinary bladder caused by exposure to arsenic is within ten leading cancers. Prostate cancer leads the second top may be due to higher proportion of old age population in the district. Due to poor socio-economic condition cervical cancer is on the top of ten leading cancers. Effect of arsenic is reflected on the occurrence of cancer in urinary bladder and effect of being in the nearer to the Ganges is reflected on the occurrence of gall bladder.

**Murshidabad** is bordering with Jharkhand and Bangladesh. Moreover, this district is badly affected with arsenic contaminated drinking water and it also situated at the another "Triveni Sangam" of India i.e. the Ganges, the Bhagirathi and Padma of Bangladesh. The Bhagirathi is causing damage destruction of it banks due to its zigzag flow washing the human habitation. Thus affect of arsenic is very prominent in this district and chewing tobacco (as popular in Jharkhand) and belt of gall bladder cancer being at the bank of the Ganges have been reflected in the occurrence of cancers. Among males cancers melanoma of skin is the top which may be due to effect of arsenic. Lung and mouth cancers are also leading cancers caused by both

habit of tobacco use and exposure to arsenic. In overall skin cancers are found to be in majority of people due to badly affected with arsenic contaminated water. Both breast and cervix are more or equal in proportion among females. Effect of being in the Gangetic delta region cancer in gall bladder is leading cancer in females. Skin cancers are found to be in ten leading cancers due to badly affected with arsenic contaminated water.

**Birbhum** is being attached to Santal Parganas Country Liquor may enforce oesophagus to be on the top of ten leading site of cancers in males. Use of tobacco in the form both chewing and smoking is reflected in 2<sup>nd</sup> and 3<sup>rd</sup> leading primary site as mouth and lung. Due to poor socio-economic status of majority of population cancer cervix is on the top of ten leading cancers. Use of both forms of tobacco among females is reflected including lung and mouth in the ten leading sites of cancer.

**Nadia** is having combined effect of arsenic affected drinking water, the effect of the Gangetic delta and habit of tobacco use which have been reflected in leading site of cancer in males. Lung and other respiratory organs are being the top of the ten leading site of cancer followed by melanoma of skin. Also gall bladder cancer is one of the ten leading sites of cancer. Breast is the leading site of cancer in females followed by cervix uteri. Also gall bladder and melanoma of skin are in the ten leading site of cancer in females.

In **North 24-Parganas** apart from the tobacco related cancers arsenic related cancers and gall bladder cancer were found to be in the ten leading cancers in males.

Being adjacent to Kolkata the district is having many urban areas which is reflected in ten leading cancers enforcing breast is on the top. Arsenic related cancers and gall bladder cancer were found to be in the ten leading cancers in females.

**South-24 Parganas** is being adjacent to Kolkata the pattern of incidence of cancers resembles with Kolkata wherein lung and mouth are on the top of ten leading sites of cancer. Some parts are affected with arsenic contaminated ground water leads to urinary bladder cancer among the ten leading sites. As like other urban cancers breast is the leading site in females. Being in the end of the Gangetic delta gall bladder was also found to be among the leading cancers. Melanoma of skin may be also among the leading sites due to arsenic.

In **Kolkata** air pollution along with habit of smoking enforced lung cancer to be on the top of ten leading cancers and cancers of other respiratory organs are also among the ten leading cancers. As it is situated in the Gangetic delta region gall bladder cancer is also positioned among ten leading cancers. Affect of arsenic contaminated water reflected as the urinary bladder was also among ten leading cancers in males. Like other urban areas breast topped among the ten leading cancers and cancers of lung and other respiratory organs are also among the ten leading cancers which may be due to increasing air pollution. As it is situated in the Gangetic delta region gall bladder cancer is

also positioned among ten leading cancers. Affect of arsenic contaminated water reflected as the urinary bladder was also among ten leading cancers in females.

Most of the industrial belts of West Bengal are situated in these districts of **Purba and Paschim Bardhaman** and also numbers of coal mine are also situated in this district. Smoking is rampant among the labourers and air pollution caused lung cancer on the top of ten leading cancers. Also being adjacent to Jharkhand chewing of tobacco is rampant in this district which causes mouth cancers being 2<sup>nd</sup> leading cancers among males. Number of urban areas with modern life style caused breast cancer is the leading cancers in females. Effect of air pollution also reflected as the lung is also among the ten leading cancers in females.

In **Hugli** Habit of smoking and chewing tobacco products has been reflected in the ten leading cancers as lung is on the top followed by mouth cancers. Being situated on the bank of Hooghly river (the Ganges) gall bladder cancer is also among the ten leading cancers. Number of urban areas of the district with modern life style caused breast cancer is the leading cancers in females. Effect of air pollution also reflected as the lung is also among the ten leading cancers in females. Being situated on the bank of Hooghly river (the Ganges) gall bladder cancer is also among the ten leading cancers

In **Howrah** Habit of smoking and chewing tobacco products has been reflected in the ten leading cancers as lung is on the top followed by mouth cancers. Being situated on the bank of Hooghly river (the Ganges) gall bladder cancer is also among the ten leading cancers. Number of urban areas of the district with modern life style caused breast cancer is the leading cancers in females. Numbers of industrial belts are situated in this district. Effect of air pollution also reflected as the lung is also among the ten leading cancers in females. Being situated on the bank of Hooghly river (the Ganges) gall bladder cancer is also among the ten leading cancers

In **Purba Medinipur** Chewing pan (mixture of betel nut, betel leaf, zarda (tobacco) and calcium) is very famous in this district. Apart from this Khaini and Gutkha are also common personal habits along with smoking of common people. Fisherman use to go to Bay of Bengal along with these products and country liquors which enforced tobacco related cancers on the top of ten leading cancers and liver cancer may be due to drinking of country liquors. Cancer of oesophagus resembles with cancer of oesophagus like other coastal areas of Bay of Bengal like Chennai. Effect of chewing pan with tobacco products also reflected mouth cancer in ten leading cancers. Like other rural areas cervix is on the top of ten leading site. As it is situated in the bank of Hooghly River (The Ganges), gall bladder cancer ranked 6<sup>th</sup> in the top ten.

The life style of the people of **Paschim Medinipur and Jhargram** is more or less similar to the people of Purba Medinipur. Moreover, these districts are adjacent to Odisha and Jharkhand. So chewing of Khaini and Gutkha are



rampant along with pan. Drinking of country liquor and Heria (traditional liquor among the tribal) are also common among the people of poor socio-economic status who are mainly labourers. Bidi smoking is also found to be one of the most common habit among the labourers. Thus ten leading cancers are more or similar to Purba Medinipuri enforced tobacco related cancers on the top of ten leading cancers and liver cancer may be due to drinking of country liquors. In overall the socio-economic condition of these districts is moderate to poor enforced cervix cancer to be on the top of ten leading cancers. Bidi smoking is found to be common among the women from labour class. Thus lung cancers are also in the ten leading cancers.

In **Bankura** Habit of tobacco in term of smoking and chewing was reflected in ten leading site of cancers. Lung cancer is on the top of ten leading followed by mouth cancer. Drinking of country liquor and traditional liquor lead to liver cancer to be among the ten leading cancer.

**Puruliya**, Jharkhand is bordering this district. Thus habit of tobacco in term of chewing and smoking reflected in ten leading site of cancers. Mouth cancer is on the top of ten leading followed by lung cancer. Drinking of country liquor and traditional liquor lead to liver cancer to be among the ten leading cancer.

Like other districts of Medinipur Division in overall the socio-economic condition of these districts is moderate to poor enforced cervix cancer to be on the top of ten leading cancers.

#### Discussion:

West Bengal is on the eastern bottleneck of India, stretching from the Himalayas in the north to the Bay of Bengal in the south. It lies between 85 degree 50 minutes and 89 degree 50 minutes east longitude, and 21 degrees 25 minutes and 27 degrees 13 minutes north latitude.

It is a part of the ethno-linguistic Bengal region of the Indian subcontinent, to its northeast lies the states of Assam and Sikkim and the country Bhutan, and to its southwest, the state of Odisha, to the west it borders the state of Jharkhand and Bihar, and to the northwest, Nepal. Bangladesh is situated in the east of this state.

The main river in West Bengal is the Ganges, which divides into two branches. One branch enters Bangladesh as the Padma, while the other flows through West Bengal as the Bhagirathi River and Hooghly River. The Farakka barrage over the Ganges feeds the Hooghly branch of the river by a feeder canal. This river has divided the southern part of West Bengal into two halves.

The state of West Bengal situated in eastern part of India with its substantial geographical variation represents a wide-spectrum of geographic signatures. Geographically the state can be divided into 8 regions which are 1-Darjeeling Himalayan hill region, 2-Terai region ("Moist land"), 3-North Bengal plains (The region between the Mahananda and the Ganges), 4-Rarh region (This region is believed to be created from the soil from the Deccan plateau), 5-Coastal

plain, 6-Sunderbans (The Sunderbans delta is the largest mangrove forest in the world), 7-Western plateau and high lands, 8-Ganges delta.

Thus, considering the geographical diversity of the state showed prominent differences in the incidence of cancers in West Bengal due to several natural risk factors and life styles of the people.

For estimation of cancer cases in any place life styles, age composition of the population, total population size, personal habits and natural exposure are determinants of cancer magnitude. In West Bengal use of tobacco products is rampant among common people. Moreover, At least 9 districts in the state suffer from arsenic contamination of groundwater, and as of 2017 an estimated 1.04 crore people were afflicted by arsenic poisoning.

International Agency of Research on Cancer (IARC), WHO classifies arsenic and inorganic arsenic compounds as "carcinogenic to humans." This is based on sufficient evidence in humans that these compounds can cause lung cancer, bladder cancer and skin cancers. Also it may cause kidney cancer, liver cancer and prostate cancer.

IARC classifies the organic arsenic compounds dimethylarsinic acid (DMA, also known as cacodylic acid) and monomethylarsonic acid (MMA) as "possibly carcinogenic to humans."

Moreover, pollution of the Ganges from indiscriminate waste dumped into the river is a major problem. The reports of cancer registries of National Centre for Disease Informatics and Research (NCDIR), Indian Council of Medical Research (ICMR) showed that the inhabitants of the Gangetic region are more prone to have Gall Bladder Cancer (Ca-GB) as compared to other regions. Also the females of this are more prone to have Ca-GB as compared to males. But the aetiologies of Ca-GB are of the Gangetic Region is unknown.

With the help of cancer registries several models have been attempted in the developed countries to predict the cancer cases. However, ecological data help the precision of the estimates to be more accurate.

Founder Director of Chittaranjan National Cancer Research Centre, Calcutta, India presently Chittaranjan National Cancer Institute (CNCI), Dr. Subodh Mitra along with Mr. Ajit Das Gupta of Indian Statistical Institute, Calcutta estimated the Prevalence of Cancer in India in which was the first attempt to estimate the prevalence of cancer in India and it was estimated that approximately 6,00,000 for the prevalence of cancer in India in 1954-55.<sup>7</sup>

Mitra et al. estimated the cancer cases for India for 29 states and 7 union territories. Thus approximately the estimated number of cancer cases in West Bengal was 16,667 which was much lower than that of estimated incidences of 80,663 in 2020.

In her 8-year (2003-2010) multi-centre based study Chatterjee reported that the incidence of cancer during 2003-2006 was moderate in West Bengal which maximum peak in 2010. According to five leading cancer were breast,

cervix, stomach, lung and esophagus. Also the incidence of cancer was higher in urban areas as compared to rural area.<sup>8</sup>

Chatterjee could not provide the estimated total number of cancers in West Bengal and also the five leading sites deferred from the estimated five leading site as per this study.

Saha et al. conducted a study over a period of five years (2006–2010) regarding gastric cancer in West Bengal. The patients were from the Gangetic areas of West Bengal. According to them out of 23,851 patients who were underwent Upper GI endoscopy 462 (1.9%) were found to be with gastric cancer with the ratio of male and female as 2.7:1.0. Antrum was the commonest site whereas ulceropro-liferative type was commonest type. *H. pylori* positivity was 80.89% in adenocarcinoma cases.<sup>9</sup>

The study by Saha et al. was a cross sectional study based on some areas of Gangetic West Bengal. As per this study 4.2% of males and 2.3% of females were having stomach cancer which was higher than the study by Saha et al.(1.9%).

Marimuthu et al. reported the cancer prevalence in eight districts of West Bengal. The districts under consideration were Kolkata, North 24-Parganas, South-24 Parganas, Howrah, Hooghly, Naida, Burdwan and Bankura. They analyzed different tumors of 9034 cancer cases registered over five years. As per their findings liver cancer was predominant among males and cancer of the cervix uteri was most prevalent among females and the results revealed that cancer incidence increased during their study period.<sup>10</sup> In this study lung was predominant in males and cancer of breast in females.

Carcinoma of the breast was the second most common cancer in females in present study after gastrointestinal cancers. Study done by Ghosh et al. showed increasing trend in incidence of breast cancer in females of West Bengal.<sup>11</sup> In this study breast was predominant in females followed by cervix.

Aggarwal et al. reported that out of 2181 biopsies received in the department 200 (9.2%) patients were diagnosed as having cancer with ratio of male and female ratio of 1.3:1.0. The cancers in gastrointestinal tract was the commonest cancer in both males and females and was found in 104 (52%) patients (60 males and 44 females) with predominant involvement of stomach followed by rectum, oesophagus and colon. After gastrointestinal malignancies, breast cancer was the leading cancer in female and bladder cancer was the leading cancer in males.<sup>12</sup> Lung was predominant in males and cancer of breast in females as per study.

As per the report of Global Burden of Disease Study 1990–2016 the incidence rate per 100,000 in West Bengal was 63.9 in 1990 and was 85.4 in 2016.<sup>13</sup>

Maiti et al. mentioned that the diversity in patterns of incidence of major cancers across three medical college hospitals in the state of West Bengal in India. The data were collected from the period between 2001 and 2005. As per

the results a striking variation of incidence of major cancers was observed in the urban, semi-urban and rural parts of West Bengal.<sup>14</sup>

As per Maiti et al. lung cancers were increasing rapidly in Kolkata and West Bengal, whereas head and neck cancer had shown a declining trend. Also proportion of gastro-intestinal cancers was increasing in West Bengal. Also breast cancers were the commonest cancer of females of West Bengal in contrast to rest of India except Mumbai. Incidence of cancer of cervix had grossly declined in the city of Kolkata, but not in rural Bengal.<sup>15</sup> The findings of this study also revealed that lung was predominant in males and cancer of breast in females which was indicated by Maiti et al.

A total of 2058 cancer cases of northern part of West Bengal were studied by Ghosh et al. with duration of the 3-year period. As per the results the major types of cancers were oro-pharynx (16.1%), breast (15.4%), cervix (13.2%), lung (12.7%), gall bladder (6.5%) and stomach cancer (6.4%). As per the study increasing proportions was observed for breast and gall bladder cancers. The proportion of gallbladder cancer cases in 2010, 2011, and 2012 were 3.8%, 7.3% and 7.8%, respectively. Among 134 gall bladder cancer cases, 93.3% were females, 85.1% alcoholics, 57.4% had a history of fatty liver, 94% had adeno- / adenosquamous carcinomas and 65.7% were metastatic in nature. They had concluded that an increasing trend was observed in gall bladder cancer cases.<sup>16</sup> This study suggested that lung and oral cancers were predominant in males of northern parts of West Bengal expect in Darjeeling and Kalimpong wherein stomach was the leading site. In females Cervix uteri was the leading site except in Jalpaiguri where breast was found to be leading site.

As per Press Information Bureau Government of India, Ministry of Health and Family Welfare on March 9, 2018 the Estimated Incidence of cancer cases in West Bengal were 99,339; 1,03,532 and 1,07,906 in 2014, 2015 and 2016 respectively. However, this study deviated from this estimation which was much lower with the tally as 80,663.

Indian Council of Medical Research –National Centre for Disease Informatics and Research –National Cancer Registry Programme Investigator Group led by Mathur et al. mentioned that the projected incidence of patients with cancer in India among males was 679,421 (94.1 per 100,000) and among females 712,758 (103.6 per 100,000) for the year 2020. The projected 5 leading site of cancers for males were lung, mouth, prostate, tongue, and stomach which constituted 36% of all male cancers and for females these were breast, cervix uteri, ovary, corpus uteri, and lung constituted with 53% of all female cancers in 2020. Tobacco-related cancers estimated to contribute 27.1% of cases this year. Cancer cases in the country are likely to increase to 15.6 lakhs by 2025 — a 12% increase from current estimated cases — based on current trends, according to the National Cancer Registry Programme

Report 2020.<sup>2</sup> The leading sites in males and females as this study also resembled with the study by Mathur et al.

The first report of Population Based Cancer Registry (PBCR), Calcutta for 1998-99 by Sen et al.<sup>17</sup> reported that most frequently reported malignancies in males were lung cancer (16.3%), followed by cancers of the oral cavity (7.1%), pharynx (5.7%) and larynx (5.7%). In females, the most frequently reported malignancies were breast (22.7%) followed by uterine cervix (17.5%), gallbladder (6.4%) and ovary (5.8%) which indicated more or less findings by this study with slight variation as prostate with the second site in males and more or less similar indication for females.

#### **Conclusion:**

Estimation of cancer cases is very important for policy planners, clinicians, researchers and in overall it will be helpful for cancer control programme. According to this study most of the cancers occurred in West Bengal are preventable as well as curable at early stage.

In this study estimated number of cases of is available for different district of West Bengal. Thus the district wise policies of creating awareness and screening programme to reduce cancer burden in the state of West Bengal can also be introduced.

The state of West Bengal is having vast diversity of atmospheric condition, cultures, food habits, personal habits and other life styles which is a key factor of different types of cancers in different districts of West Bengal. There are 23 districts in West Bengal. Moreover the Basin of Hooghly River (the Bhagirathi, the Ganges) is having highest incidence of gall bladder cancers. Chewing of tobacco and smoking are rampant among common people. Effect of arsenic contaminated drinking water is reflected in the occurrence of cancers.

Among males almost half of the population (41.7%) is addicted with tobacco use and incidentally percent of passive smokers are also high in this state. Moreover, additional exposure to arsenic contaminated water causing cancers to related organs which are at high risk of having cancers due to exposure to tobacco and arsenic.

Use of country liquors are very common among the males in the rural area which may be enforced liver cancer to be in one of the ten leading sites among males.

According to the Census 2011 (Census of India, 2011), West Bengal remains one of the highly urbanized states of the country with currently 32% of the state's population residing in urban areas and it ranks fourth highest urbanised states in the country

Breast followed by cervix uteri are the two most common primary sites among females. In overall as per Census 2011 the literacy rate was 77.08% which may lead to cancer in cervix uteri positions 2<sup>nd</sup> after cancer in breast by maintaining good hygienic conditions of female genital organs. As per the report of NCDIR, ICMR the incidence of gallbladder cancer (Ca-GB) among the women of Gangetic region is much higher which reflected in the results. In this

context it may be noted that the Ganges is the main river of this state which is known as the Bhagirathi and a considerably large part of this state is coming under Gangetic delta region.

Moreover, about 68% of rural women are using biomass as fuel for preparing household products which also causing cancers to respiratory organs. Moreover, air pollution in urban areas shows increasing trend of cancers to respiratory organs.

About 20% of the population of 9 districts of West Bengal is affected with arsenic and fluoride contaminated ground water which is a major exposure for arsenic and fluoride related cancers in both males and females.

Among the common people the sentence "Cancer has no answer" is very popular this is not true in practical. Most of the cancers are curable at an early stage. Thus more awareness programme as well as screening programme can prevent deaths to due to cancers. Moreover, common people can save the expenditure of treatments by reporting at an early stage.

In this study estimated number of cancer cases according to primary site for the districts of West Bengal has been provided which will help to introduce preventive measures and screening programme of cancers in the districts.

#### **Recommendation:**

Though most of the cancers are curable at an early stage, most of the cancer patients attend any cancer treating centres at advanced stages of their cancers resulting to poor outcomes. In West Bengal there is only Population Based Cancer Registry (PBCR), Kolkata is running with the fund from NCDIR, ICMR.

However, establishment of State Cancer Registry will be very helpful to access cancer cases in any state which will help to provide to formulate cancer control programme for the state. In rural West Bengal there is no PBCR. Thus any scenario of cancer cases in rural areas is completely unknown. Moreover, establishment of PBCR in the Gangetic Delta region and PBCR in arsenic affected regions will help to find etiology of increasing number of gall bladder caners in Gangetic Delta region. Also establishment of PBCR in arsenic affected regions will help to access the cancers related to arsenic exposures with control strategies.

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