A Study on Madras Metropolitan Tumour Registry Breast Cancer patients in Chennai

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***Abstract*- Research on cancer survival is done by many countries in the world and each and every country is fighting against it. The current research is enriched by development and application of innovative analytical approaches in relation to standard methods. The aim of this paper is to study the Madras Metropolitan Tumour Registry especially breast cancer patients. The data consists of 15069 patients with locally advanced breast cancer, during 1982-2012(30 years) taken at the Cancer Institute (WIA), Chennai, India. Different types of graphical representation were plotted and studied. Regression models were fitted for the government and Non-government sources of data.**

***Index Terms*- Breast Cancer, Regression, Statistical Graphs, Tumour Registry**.

I. Introduction

Breast cancer is one of the most common and feared cancers in cancer deaths after lung cancer (Ries et al., 2000). Breast cancer survival data are skewed and consist of complications in the pattern of early events and in the end stage. In general, cancer studies measure the length of survival after diagnosis of cancer and treatment (Rajaeefard et al., 2009). It is common for a proportion of individuals to remain alive and response to treatment (Duncan et al., 1976; Haybittle et al., 1959; Todd et al.,1983; Zahl et al., 1997) at the end of the follow-up period, and only a lower limit on their actual time to event is known. Cancer of the breast is the second most common cancer seen in South Indian women with crude incidence rate (CIR) of 20/100,000 in the Madras Metropolitan Tumour Registry (MMTR). There has been a gradual increase in the CIR for breast cancer over the past several years. As per the MMTR, between the period of 1984-1988 and 1994-1998, there has been a 33% rise in the crude incidence rate (CIR) for breast cancer.

The Cancer Institute (WIA) is the first comprehensive cancer care centre to be established in South India and is the second in India. It comprises a hospital, a research center, a center of preventive oncology and the Dr. Muthulakshmi College of Oncologic Sciences. It is the seat of both demographic and hospital cancer registries. The hospital has 423 beds and more than 50% of the patients are boarded, lodged and treated free of cost. It is an autonomous, non-profit organization recognized as a Regional Cancer Centre by the Ministry of Health & Family Welfare, Government of India, offering state-of-the-art facilities for cancer diagnosis, treatment and research. The Hospital Cancer Registry is functioning at the Cancer Institute (WIA) since its inception in 1954. Data collection on the lines of ICMR started in 1984. New cases are registered using the hospital computer system and interviewed by social investigators for patient identification, demographic and epidemiological details. Lifetime follow-up of all treated patients is practiced. Besides the clinical follow-up of patients who are regular for check-up, an efficient active follow-up system is integrated to the registry functions to get information on the vital status of all treated patients through postal, telephone and house visit enquiries. Thus the registry publishes overall survival figures of top ranking cancers in all its reports as a routine. Complete follow-up information at five years from diagnosis ranges between 80% and 90%. The report is mainly in the form of statistical tables and graphs with the corresponding text giving only the factual description.

Cancer is a group of diseases that cause cells in the body to change and grow out of control. Most types of cancer cells eventually form a lump or mass called a tumor, and are named after the part of the body where the tumor originates. Breast cancer begins in breast tissue, which is made up of glands for milk production, called lobules, and the ducts that connect the lobules to the nipple. The remainder of the breast is made up of fatty, connective, and lymphatic tissue. Most breast cancers are invasive, or infiltrating. These cancers

started in the lobules or ducts of the breast but have broken through the duct or glandular walls to invade the surrounding tissue of the breast.

The seriousness of invasive breast cancer is strongly influenced by the stage of the disease; that is, the extent or spread of the cancer when it is first diagnosed. There are two main staging systems for cancer. The TNM classification of tumors uses information on tumor size and how far it has spread within the breast and nearby organs (T), lymph node involvement (N), and the presence or absence of distant metastases (spread to distant organs) (M).1 Once the T, N, and M are determined, a stage of 0, I, II, III, or IV is assigned, with stage 0 being in situ, stage I being early stage invasive cancer, and stage IV being the most advanced. The TNM staging system is commonly used in clinical settings.

II. Materials and Method

Breast cancer is the most common cancer affecting women. Though hereditary factor contributes up to 5% to 10 % of breast cancer, early spohaneously, early puberty, delayed first child, late menopause, having no/less number of children, hormone replacement therapy, obesity etc. are some of the factors which increase one's risk of getting breast cancer. Breast feeding, healthy diet and physical activity are some of the factors which reduce the risk. Though breast cancer cannot be prevented, screening helps in early detection and thus provides a cure and a prolonged duration of life. Screening for breast cancer includes Mammogram/MRI-Breast, Clinical Breast Examination (CBE), and Self-Breast Examination (SBE). Main Sources of Registration of Incident Cases of Cancer available at Chennai as listed below in table 1.

Table 1

Name of the Institution	**Name of the Institution**
Cancer Institute (WIA) Chennai-600020	Sri Ramachandara Medical and Research Centre-600116
Government General Hospital Chennai-600003	Govt Kilpauk Medical college and Hospital Chennai-600010
Dr Rai Memorial Cancer Centre Chennai-600018	Periperal Hospital Anna Nagar Chennai-600078
Government Royapettah Hospital Chennai-600014	Southern Railway Hospital Chennai-600023
Government Stanley Hospital Chennai-600001	Jeevodaya Chennai-600068
Apollo Hospital Chennai-600006	V H S Chennai-600113
Govt Womens and Childrens Hospital Chennai-600008	Sundaram Medical Foundation Chennai-600040
Corporation of Chennai Chennai-600003	Government Institute of Child Health Chennai-600008
St.Issabels Hospital Chennai-600004	

Cancer is not a notifiable disease in India. Therefore registration of cases is done by active method. The registry continues to enjoy good cooperation from all health care facilities in and around Chennai with greater than 225 sources of registration till date: government and private hospitals, nursing homes, clinics, consultants, pathology laboratories, imaging centers and hospices. The Social Scientists of the registry visit the collaborating hospitals regularly and collect data on cancer by interviewing the cases wherever possible and/or from medical records. The following table2 provides Breast cancer patients of government hospitals and non- government hospitals from 1982 to 2012(30 years in 6 blocks).

Table 2
MMTR Breast cancer total cases by year (1982-2012)

Year	Govt Sources	Non-Govt Sources	Total	Year	Govt Sources	Non-Govt Sources	Total
1982	143	91	234	**1997**	164	290	454
1983	135	86	221	**1998**	162	274	436
1984	154	85	239	**1999**	199	280	488
1985	139	104	243	**2000**	210	271	481
1986	157	111	268	**2001**	206	349	555
1987	161	112	273	**2002**	273	321	594
1988	145	167	312	**2003**	240	398	638
1989	174	144	318	**2004**	262	428	690
1990	152	155	307	**2005**	269	457	726
1991	158	149	307	**2006**	272	436	708
1992	143	166	309	**2007**	270	444	714
1993	173	168	341	**2008**	240	474	714
1994	144	218	362	**2009**	234	527	761
1995	136	232	368	**2010**	276	547	823
1996	164	234	398	**2011**	271	598	969
				2012	270	648	918
				Total	**6096**	**8973**	**15069**

The Breast cancer patients from the above table2 clearly indicates that the patients are increasing year by year and also the patients are more screened in non – government hospitals rather in government hospitals.

Breast cancer is the commonest cancer in women in Chennai. Breast cancer accounts for 26.8% of all cancers in women in Chennai. Common age groups for breast cancer in Chennai, a few decades back, almost 65% to 70% of women suffering from breast cancer were above 50 years, only 30% to 35% women were below fifty years of age. It is also confirming the other sources (Shanta et al. 2004) and their prediction based on the total cancer burden is predicted to increase by 32% by 2012–2016 compared with 2002–2006, with 19% due to changes in cancer risk and a further 13% due to the impact of demographic changes in Tamil Nadu, Chennai (Madras). Predicted rates of all cancers combined, especially cancers of the female breast showed an increasing trend.

However, presently, breast cancer is more common in the younger age group and 49% of all women suffering from breast cancer in Chennai are below 50 years of age. A significant number of patients are below 30 years. The reason is not that few decades back, it was not detected earlier and now it is being detected earlier. The reason is that there has been a very genuine rise in the incidence of breast cancer in younger women. The breast cancer

is increasing even in the older population; it is just that the increase in younger population is more than that in the older population; maybe because of the predominant young population in India

III. Statistical Applications

In 1982 - 83, breast cancer accounted for about 20%of all cancers in women in Chennai. Presently, breast cancer accounts for 32% of all cancers in women in Chennai.

In the battle of the female cancers, breast cancer has overtaken cervix as the top cancer among women in Chennai. Statistics from the Madras Metropolitan Tumour Registry at the Adyar Cancer Institute's hospital registry indicate that a subtle change has taken place that has had breast cancer incidence growing at a much higher rate than cervical cancer. A comparative study between the incidence of the two conditions in 1982-87 and 2009-2010 makes this clear: In 1982-87, the incidence of Cervical Cancer in the Registry was 44.3 per 1,00,000 population. Comparatively, the breast cancer incidence was 19.1. In 2009 – 2010, the cervical cancer incidence had dropped to 19.3, while that of breast cancer rose to 35.8 per 1,00,000. As it is evident from the figure1below, there has been a significant rise in the number of breast cancer cases as compared to earlier. For the data above in table 2, multiple regression model was fitted using SPSS software and outcome are exhibited in the following table3.

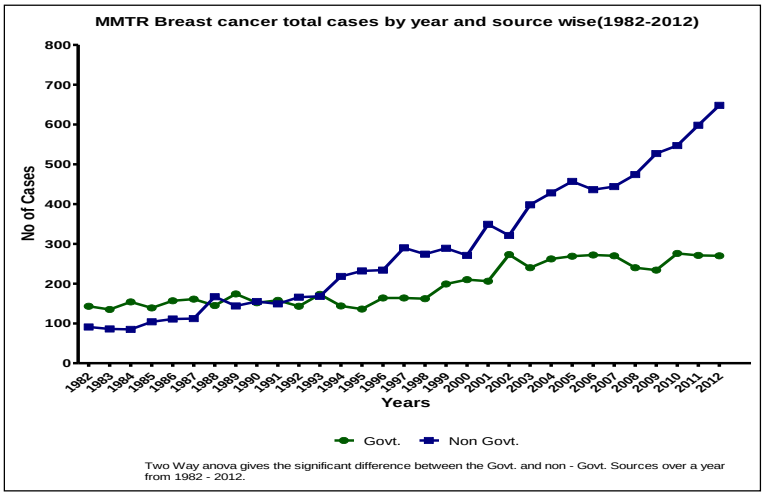
Table 3

Model	Unstandardized		Sig.
	B	Std. Error	Std. Error
Constant	1979.315	1.972	.000
Govt Sources	.020	.016	.228
Non-Govt Sources	.048	.005	.000

Due to the increase in number of Breast cancer patients, the value of the regression coefficient is very high, and the regression coefficient for government and Non-government sources are very small, this indicates that the breast cancer prevails high in Chennai.

The MMTR Breast cancer cases reported by every year and sources between government and nongovernment over a period between 1992 and 2012 are shown in the line graph shown below. The lines are parallel after a small period between 1988 and 1993 onwards. This graph also proves that there are differences in reporting MMTR breast cancer cases between these two sources(government and Non-government) and in fact nongovernmental sources significantly surpass the governmental sources.

Figure 1



The graph (Fig 1) above shows the incidence of breast cancer in Chennai from 1982- 2012.From the Descriptive Statistics table4 , it can be seen that, overall, the average cancer cases reported by government sources and nongovernmental sources with corresponding standard deviation, respective block years. This pattern is more obvious when looking at the plot. Since the lines representing the government sources in the plot are not parallel to nongovernmental sources, this implies there is an interaction effect between cases reporting sources and Block years. It was identified from the graph1 that the lines would be approximately parallel if there were no interaction. So, the reporting cases of MMTR breast cancer changes with block years and sources, and vice versa.

Table 4
Descriptive Statistics

source	Blockyear	Mean	Std. Deviation	Number of years
Govt	1982-1986	145.60	9.529	5
	1987-1991	158.00	10.840	5
	1992-1996	152.00	15.700	5
	1997-2001	188.20	23.350	5
	2002-2006	263.20	13.664	5
	2007-2012	260.17	18.181	6
	Total	196.65	52.781	31
NonGovt	1982-1986	95.40	11.546	5
	1987-1991	145.40	20.550	5
	1992-1996	203.60	33.982	5
	1997-2001	294.60	31.596	5
	2002-2006	408.00	53.042	5
	2007-2012	539.67	75.917	6
	Total	289.45	165.916	31
Total	1982-1986	120.50	28.277	10
	1987-1991	151.70	16.853	10
	1992-1996	177.80	36.911	10
	1997-2001	241.40	61.893	10
	2002-2006	335.60	84.603	10
	2007-2012	399.92	155.163	12
	Total	243.05	130.755	

The above table4 is very useful because it provides the mean and standard deviation for each combination of the group of variables (government and nongovernmental sources) which is sometimes referred to as each "cell" of the design. In addition, the table4 provides "Total" rows, which allows means and standard deviations for each group. The actual results, whether either of the two independent variables (government sources and nongovernmental sources) and their interaction are statistically significant which is given in the below table5.

Table 5
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	985611.088[a]	11	89601.008	78.178	.000	.945
Intercept	3490442.012	1	3490442.012	3045.454	.000	.984
Source(Govt/NonGovt)	115662.964	1	115662.964	100.917	.000	.669
Blockyear	657176.938	5	131435.388	114.679	.000	.920
source * Blockyear	194932.069	5	38986.414	34.016	.000	.773
Error	57305.767	50	1146.115			
Total	4705413.000	62				
Corrected Total	1042916.855	61				

a. R Squared = .945 (Adjusted R Squared = .933)

The above table5 is highlighted on the rows of the sources of cancer cases as (Sources: Govt / NonGovt"), the corresponding reporting years for cases of MMTR breast cancer as "Block Year" and the interaction between these independent variables as (Sources: Govt / NonGovt) Block Year rows. These rows inform us whether our independent variables (the "Sources: Govt / NonGovt" and "Block Year" rows) and their interaction (the "Sources: Govt / NonGovt * Block Year " row) have a statistically significant effect on the dependent variable, "reported cases".

It is important to first, look at the (" Sources: Govt / NonGovt * Block Year ") interaction as this will determine how it can interpret results. It is being noticed from the above table under "Sig." column that it has a statistically significant interaction at the $p = .000$ level. It possibly reflects the same scenario for " Sources: Govt / NonGovt " and "Block Year" results.

We can see from the table5 above that there was statistically significant difference in mean reported cases of cancer between two sources like Govt and non-govt organizations ($p = 0.000$), but there were statistically significant differences between the periods of block years ($p < .000$).

From the below table6 we can find the mean, standard error and confidence interval for each block year for the govt and nongovt sources of data.

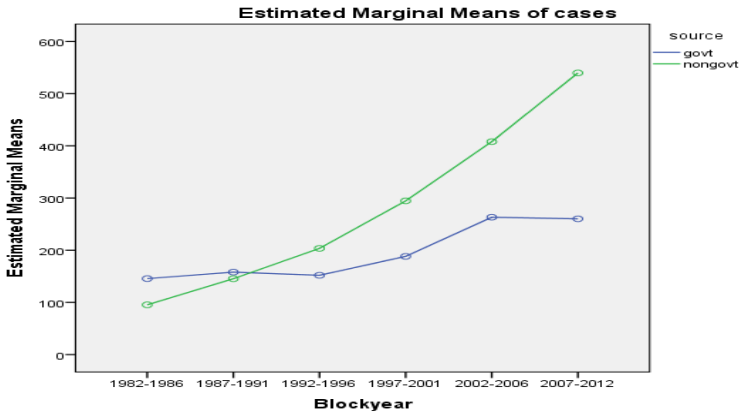
Table 6
Source * Block year

Dependent Variable: cases

Source	Block year	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Govt	1982-1986	145.600	15.140	115.190	176.010
	1987-1991	158.000	15.140	127.590	188.410
	1992-1996	152.000	15.140	121.590	182.410
	1997-2001	188.200	15.140	157.790	218.610
	2002-2006	263.200	15.140	232.790	293.610
	2007-2012	260.167	13.821	232.406	287.927
nongovt	1982-1986	95.400	15.140	64.990	125.810
	1987-1991	145.400	15.140	114.990	175.810
	1992-1996	203.600	15.140	173.190	234.010
	1997-2001	294.600	15.140	264.190	325.010
	2002-2006	408.000	15.140	377.590	438.410
	2007-2012	539.667	13.821	511.906	567.427

The plot of the mean of the "reported cases score" for each sources and its combination of Govt and NonGovt are plotted in a line graph, as shown below:

Figure 2



Although this graph (Fig 2) is sufficient to present the reports, it does tend to provide a good graphical illustration for the results obtained from the table6. An interaction effect can usually be seen as a set of non-parallel lines. This graph clearly shows the differences on their reporting cases of cancer over a period of years in blocks and also that the lines do not appear to be parallel but the lines actually intersect at 1987-1991 then, significantly dominating by nongovernmental organizations. This might be the cause for the interaction to be statistically significant, which also confirms the reality as well as the trend which is plotted in the fig1.

In statistics, the multiple comparisons, multiplicity or multiple testing problem occurs when one considers a set of statistical inferences simultaneously or infers a subset of parameters selected based on the observed values. It is also known as the look-elsewhere effect. "Multiple comparisons" arise when a statistical analysis encompasses a number of formal comparisons, with the presumption that attention will focus on the strongest differences among all comparisons that are made. The purpose of most multiple-comparisons procedures is to control the "overall significance level" for some set of inferences performed as a follow-up to ANOVA. The following table7 shows the multiple comparisons (Bonferroni) done between the govt and nongovt sources of the data.

Table 7

Multiple Comparisons (Bonferroni)

(I) source	(J) source	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
combined	govt	289.45*	10.146	.000	264.61	314.30
	nongovt	196.65*	10.146	.000	171.80	221.49
govt	combined	-289.45*	10.146	.000	-314.30	-264.61
	nongovt	-92.81*	10.146	.000	-117.65	-67.96
nongovt	combined	-196.65*	10.146	.000	-221.49	-171.80
	govt	92.81*	10.146	.000	67.96	117.65

Based on observed means.

The error term is Mean Square(Error) = 1595.581.

*. The mean difference is significant at the .05 level.

From the above table7 it s clear that there is statistically significant difference in mean reported cases of cancer between two sources like Govt and non-govt organizations when multiple comparisons are made (p = 0.000),so it is evident that more number of cancer cases are reported in nongovt sources rather than govt sources.

IV. DISCUSSION

The effective delivery of cancer-related services requires reliable predictions of the future cancer burden. Such statistics help ensure rational allocation of resources to develop the infrastructure for cancer control and care. As discussed in the land mark papers Engeland et al. (1993) and Parkin et al. (2005), age-standardized rates using the world standard population were computed to describe the observed and future trends. The predicted changes in the average annual numbers of cases were further partitioned into two components: those due to changes in cancer risk (rates) and those due to changes in demographics such as population growth and ageing.

This study has used empirically evaluated methods to predict the future cancer burden in

Chennai. Changes in socioeconomic factors among women, even in rural areas, with respect to education, age at first childbirth and parity suggest that the risk of breast cancer may continue to increase (Shanta et al. 2004). Also adding with this, breast and cervical cancers together constitute almost half of the total cancer burden among women in Chennai. Hence, organizing intervention programmes at the population level aimed at controlling both these cancers would significantly reduce the overall cancer burden among women in Chennai. The predicted trends are similar in both sources like private and government registry also confirmed statistically.

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