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Demographical and Epidemiology Contribution

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Demographical and Epidemiological Contribution to Cancer Incidence in Delhi and Its Trends from 1991-2015

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Abstract

Introduction: Cancer incidences are rising worldwide, and India ranked third globally in cancer incidence as of 2020, according to estimates from GLOBOCAN. The three components that contributed to changes in cancer incidence include cancer-related risk factors, population size, and population structure. The present study aim is to derive the contribution of these factors to cancer incidence and to evaluate their trend from 1991 to 2015. **Methods:** The Data were extracted from the Delhi population-based cancer registry published reports. This longstanding registry covers nearly 100% of the Delhi population. The secular trends of cancer incidence from 1991-2015 were assessed for all sites combined as well as top-five cancer sites among males and females. Joinpoint regression and Riskdiff software were performed to assess the trend among the components of cancer incidence change. **Results:** Both males and females exhibited nearly equal age-standardised incidence rates over 25 years. Albeit, an overall trend in age-standardised rate was not significant for both sexes (0.68% for males and -0.16% for females) when considering all cancer sites combined. Lung, prostate, oral, and gallbladder cancer exhibits a significant rising trend in the age-standardised rates in males while in females only breast and endometrial cancer showed a rising trend. The cancer counts surged by 252% in males and 208.5% in females from 1991 to 2015. The population size component contributed a 180% increase in males and a 170% increase in females, respectively. The site-specific risk changes were more than 100% for the prostate, oral, and gallbladder cancers in males and endometrial cancer in females. The population structure (aging) contributed to rising cancer incidence varying from 35% to 60% in both genders. **Conclusion:** A significant contribution to new cancer cases was observed due to a demographical shift in both population size and structure, in addition to plausible cancer-specific risk factors. This transformation could surge a potential burden on the Delhi healthcare system. Persistent endeavours are essential to expand and enhance the existing cancer care infrastructure to meet the rising demand driven by aging and population growth. Implementing a stringent population policy can help to mitigate the impact of population growth on cancer incidence.

Keywords: Cancer- incidence- Delhi- age-standardised incidence rate- demographical- epidemiology

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Introduction

Globally, cancer stands as the leading cause of mortality claiming, 10.0 million lives and contributing to 19.3 million new cancer cases in 2020 [1]. India, the world's second most populated country, ranked third in cancer incidence in 2020, followed by China and the United States of America [1]. The cancer burden not only escalates the economic load but also impacts disability and potential years of life lost. The projected burden of cancer causes 26.7 million Disability-adjusted life years (DALYs) in India for 2021 and is expected to increase to 29.8 million by 2025. Males experience higher DALYs than females as reported in the latest study [2]. The dominant emerging drivers behind the cancer burden are demographic changes and linked etiological risk factors, like tobacco use, sedentary lifestyle, urbanization, indoor and outdoor pollution, and other environment-related changes, etc. The variation in the trend of cancer due to demographical and epidemiological contribution has not been studied much both globally and in India [3]. Although the studies are conducted to assess the geospatial models to find the regional variations within a city or country [4, 5]. Our extensive search of Indian literature found, one study that assessed the future burden of tobacco-related cancer in Delhi and another study, exploring the trend and prediction of cervical cancer incidence evaluating the impact of demographic and epidemiological changes [6, 7]. Studying the trends of these three components is important not only in India but also for other countries

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undergoing demographic shifts due to an increased expectancy of life at birth and population growth. The life expectancy at birth (LEB) in India increased by nine years from 59.4 years in 1991 to 69 years in 2015 and during the same period, the population increase was 62.0% from 838.6 million in 1991 million to 1,274.4 million in 2015 [8, 9].

Delhi, one of the most densely populated urbanized cities in India has a greater LEB compared to the national average (75.9 vs 69.7 years). Females enjoyed an additional 3.2 years higher LEB compared to males (74.3 yrs. for males and 77.5 yrs. for females) from 2015 through 2019 period [10]. The transition towards the aging population is a worldwide problem, and Delhi is no exception, projections indicate population aged 60 and above will increase by 28.6% in 2016, 63.7% in 2021, and 108.5% in 2026 compared to the 60+ population in 2011 [11, 9]. In 2015, approximately 44.0% of the cancer cases in Delhi were diagnosed in the 60 and above age group. Females exhibit a higher susceptibility to cancer before 60 years, compared to males. We assumed that the aging and population growth contributed to the cancer burden in Delhi, in addition to the etiologic risk factors associated with cancers.

The present study evaluated the temporal trends in cancer incidences of all cancer sites combined and the top five cancer sites ranked by the latest available data (2015) for both males and females in Delhi. The demographic and epidemiology-driven estimates of the trends from 1991 to 2015 in Delhi were extracted using the RiskDiff methodology [12]. This method disentangles the changes into three parts, change due to cancer-specific risk factors which include the well-known associated factors and improvement in diagnostic practice, population structure (aging), and population growth(size). This bifurcation of the changing disease burden into demographic and epidemiology elements allows an understanding of the impact of population transition on cancer burden. The present study results could benefit healthcare planners in building sustainable infrastructure to effectively combat the challenges of cancer burden and also implementing population control strategies.

Materials and Methods

Incidence Data

The cancer incidence data of the top five cancer sites in both male and female sites, as well as all cancer sites combined, were extracted from the Delhi population-based cancer registry (PBCR) reports from 1991 to 2015. These data were collected at a 5-year age-group interval, according to the International Classification of Disease (ICD) code for males and females diagnosed from 1991 to 2015 from published reports. The recently available report from Delhi PBCR is for the year 2015. This lagging was due to logistic challenges caused by the COVID-19 pandemic and other related issues. This registry was established in 1986 and adheres to the data quality standard set by the International Agency for Research on Cancer (IARC), WHO, and Delhi PBCR data have been accepted for publication in Volumes IX, X, and XII [13]. The Delhi PBCR covers almost 100% of the Delhi population and it stands as the sole registry with full population coverage among 28 PBCRs in India. The top five male cancers incidence were Lung (C33-C34), Prostate (C61), Oral (C00-C06), Urinary Bladder (C67), and Gallbladder (C23-C24), while in females, Breast (C50), Cervix (C53), Gallbladder (C23-C24), Ovary (C56), and Endometrial [Corpus Uteri (C54)]. The ranking of cancer-specific incidence among males and females in Delhi PBCRs is different from the World Cancer ranking as per GLOBOCAN 2020 [1]

Region

According to the 2011 census, Delhi covers an area of 1483 Km^2. The total population of Delhi was 1,67,53,235 with 97.5% of people living in urban areas.

Population Data

The age-wise at-risk population from 1991 to 2011 was determined using the difference distribution method [14] on the Delhi age-wise census data of the years 1991, 2001, and 2011 [11], and the at-risk population from 2012 to 2015 was calculated using the difference distribution method on the age-wise population projection of 2016 obtained from the recently published report of population projection of India [9].

Statistical Analysis

The age-standardised incidence rate (ASIR) per 100,00 was determined by the direct standardisation method using the world population as a reference purposed by the World Health Organization [15] for the 25 calendar periods from 1991-2015(1-year interval). The temporal trend of ASIR from 1991 to 2015 was examined by employing JoinPoint regression software (United States National Cancer Institute; http://surveillance.cancer.gov/joinpoint). The standardised incidence of the top five cancers for both genders and for overall cancer sites was fitted to a log-linear model and identified the significant break (segment) using the Monte Carlo permutation method with 4999 permuted data to detect the statistical significance changes in ASIR with $p<0.05$ [16, 17]. A positive annual percentage change (APC) indicates a rising trend, while a negative APC represents a declining trend. The change in rate within the linear segment of a JoinPoint was presented with annual percentage changes (APCs) and overall change with average annual percent change (AAPC). The APC and AAPC were considered significant when the 95% confidence interval did not include zero. The AAPC provides a summary measure of the trend over a pre-specified fixed period and offers a single number to explain the average APCs over a period of multiple years. It is determined using a weighted average of the APCs from the JoinPoint models, with the weights equal to the length of the APC interval [16, 17].

The decomposition of cancer incidence cases due to changes in the risk which includes disease risk and diagnostic improvement, the change considered due to demographical components are population growth and population structure. The method of decomposition was initially proposed by Bashir and Esteve [18] and

later converted into the computer package (Riskdiff available in R-package) by [12]. This method partitions the demographical and epidemiology components taking two years of data at a time, a reference year, and another comparator year. In the present study, the reference year data corresponds to data from 1991, while the comparator year comprises the data of subsequent years from 1992 to 2015. In other words, demographical and epidemiology changes were compared taking 1991 as a reference with subsequent years till 2015 and assessing the 25-year trend of these components. More detailed information on the methodology and about the Riskdiff computer package can be obtained from [18, 12]. All the statistics analysis was performed using R package version 4.0.1.

Results

Descriptive Information

A total of 3,08,416 new cancer cases (1,59,259 males and 1,49,157 females) were registered in Delhi PBCR from 1991-2015. The crude incidence rate was 88.4 and 97.8 per 100,000 in males and females respectively. The higher rate in females can be attributable to the lower sex ratio in Delhi during the period 1991-2015 (847 females per 1,000 males). The age-standardised rates over the 25 years were 142 and 140 per 100,000 in males and females, respectively. The male-to-female ratio was 1: 0.94. The top five cancers in both males and females contributed nearly 35% and 57% of their respective total cancer cases. The new cancer counts for the top-five cancers per 5-year from 1991 to 2015, divided among the three age categories < 20, 20-59, and >=60 years for both genders and presented in Table 1.

Trends of the top five male and female cancers in Delhi (JoinPoint analysis)

The age-standardised incidence rates for all cancer sites increased by 17%, rising from 129.2 per 100,000 in 1991 to 151.2 per 100,000 in 2015 when both genders combined. Among males, the rate surged by 28.5% , from 123 to 158 per 100,000. In contrast, females experienced an increase of 3.5%, with 140 to 145 per 100,000. The overall non-significant AAPC was observed with a slope of 0.68% and -0.16% per year in males and females

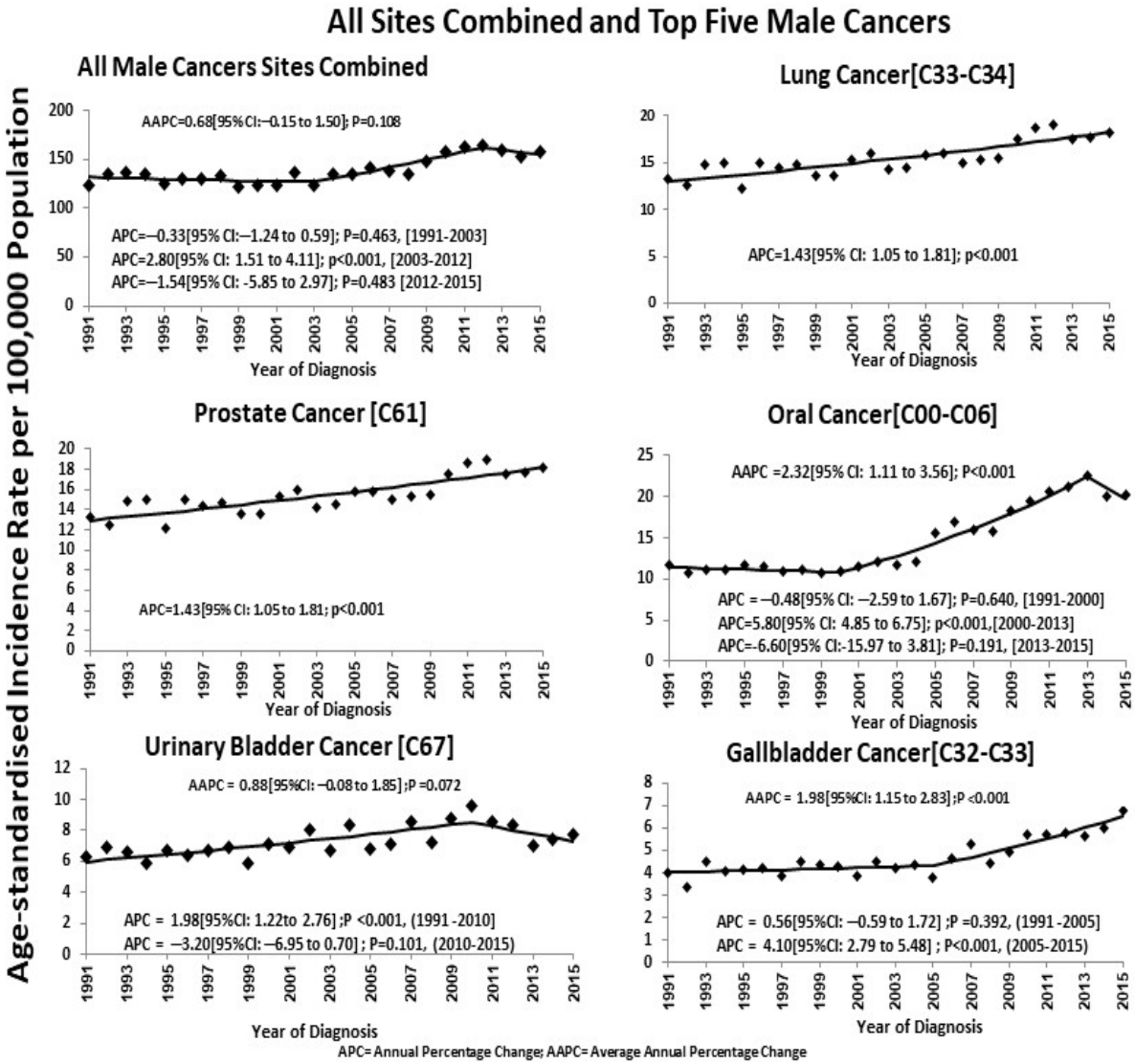

Figure 1. Annual Age-Standardised Incidence Rate for All Sites Combined and Top Five Cancers among Males in Delhi from 1991-2015

Table 1. The Number of Incidence Cases According to Three Age Groups (< 20, 20-59, and ≥60 years) among the Five Top Male and Female Cancers and Overall Cancer in Five 5-Year Periods

5-year Duration	Male [Age in years]					Female [Age in years]				
	Cancer Site	<20	20-59	>=60	Total	Cancer Site	<20	20-59	>=60	Total
1991-1995	Overall	1679	9988	7063	18730	Overall	932	12343	5153	18428
1996-2000		1866	11492	9042	22400		948	14370	6531	21849
2001-2005		2269	14321	11674	28264		1057	16840	8403	26300
2006-2010		2912	18619	16368	37899		1359	21542	11725	34626
2011-2015		3329	24949	23688	51966		1683	28577	17694	47954
1991-1995	Oral Cancer	11	933	601	1545	Breast	22	3032	877	3931
1996-2000	[C00-C06]	12	1155	739	1906	[C50]	6	3893	1318	5217
2001-2005		13	1671	1059	2743		6	4881	1910	6797
2006-2010		26	3066	1703	4795		14	6479	2811	9304
2011-2015		25	4790	2545	7360		1	8885	4401	13287
1991-1995	Lung Cancer	2	914	815	1731	Cervix [C53]	9	2798	868	3675
1996-2000	[C33-C34]	4	1061	1142	2207		6	2736	927	3669
2001-2005		8	1360	1554	2922		2	2768	1148	3918
2006-2010		7	1645	2099	3751		5	3102	1532	4639
2011-2015		0	2233	3228	5461		0	3132	1688	4820
1991-1995	Prostate [C61]	1	155	619	775	Gallbladder	3	648	454	1105
1996-2000		4	169	935	1108	[C23-C24]	0	849	557	1406
2001-2005		4	237	1456	1697		1	940	624	1565
2006-2010		5	315	2233	2553		2	1470	987	2459
2011-2015		3	469	2978	3450		3	2272	1624	3899
1991-1995	Urinary Bladder	5	304	457	766	Ovary [C56]	53	854	264	1171
1996-2000	[C67]	7	363	591	961		54	1106	443	1603
2001-2005		16	534	799	1349		75	1264	536	1875
2006-2010		13	738	1129	1880		92	1750	739	2581
2011-2015		4	805	1427	2236		116	2220	1074	3410
1991-1995	Gallbladder	2	268	252	522	Corpus Uteri [C54]	2	239	126	367
1996-2000	[C23-C24]	0	354	326	680		1	278	204	483
2001-2005		0	468	371	839		2	495	374	871
2006-2010		3	679	583	1265		0	642	494	1136
2011-2015		3	982	941	1926		1	976	923	1900

respectively (Figure 1 and 2). Three Joinpoints breaks (segment) were observed in all sites combined cancers among the males. In the 2003 to 2012 segment, there was a significant positive increase in APC amounting to 2.80% while the other two segments 1991 to 2003 and 2012 to 2015 did not exhibit significant change in APC. In the females, 4 joinpoints were found, among these, two segments APC exhibited a significant trend, a declining trend was observed from 1991 to 2003 with APC = -1.27% and from 2012 to 2015 with APC = -4.89%. From 2003 to 2011 positive insignificant APC was observed (Figure 1).

The trends vary across the cancer sites in males. Except for the urinary bladder cancer (APC=0.88%), all other sites showed a significant rising trend over 25-period; Lung cancer (AAPC=1.43%), prostate cancer (AAPC=2.73%), oral cancer (AAPC=2.32%), and gallbladder cancer (AAPC=1.98%). The respective numbers of joinpoints and their AAPCs with 95% CI for male top-five cancer sites are presented in Figure 1. In females, Breast cancer (AAPC=1.07%) and endometrial cancer (AAPC=3.60%) showed a rising trend whereas cervix cancer demonstrated a downtrend (AAPC= -2.93%). Gallbladder and ovarian cancer represented a flat trend with AAPC=0.49% and AAPC=-0.03%, respectively. Joinpoint breaks and the corresponding APCs for both all sites combined and the top five female cancers were presented in Figure 2. Apportioned the number of new cases into the contribution from the change in risk, and change in population size and age structure combined.

Figures 3 and 4 depict the percentage change trend in incidence by year of diagnosis for both males and females, using taking 1991 as a reference. The trend of percentage change of cancer incidence increased across all sites combined, as well as in the top five cancer sites in males and females respectively. Except for female cervix cancer which showed a decreasing trend. The increasing trend of change appears predominately due to the contribution of demographical components such as Population size and

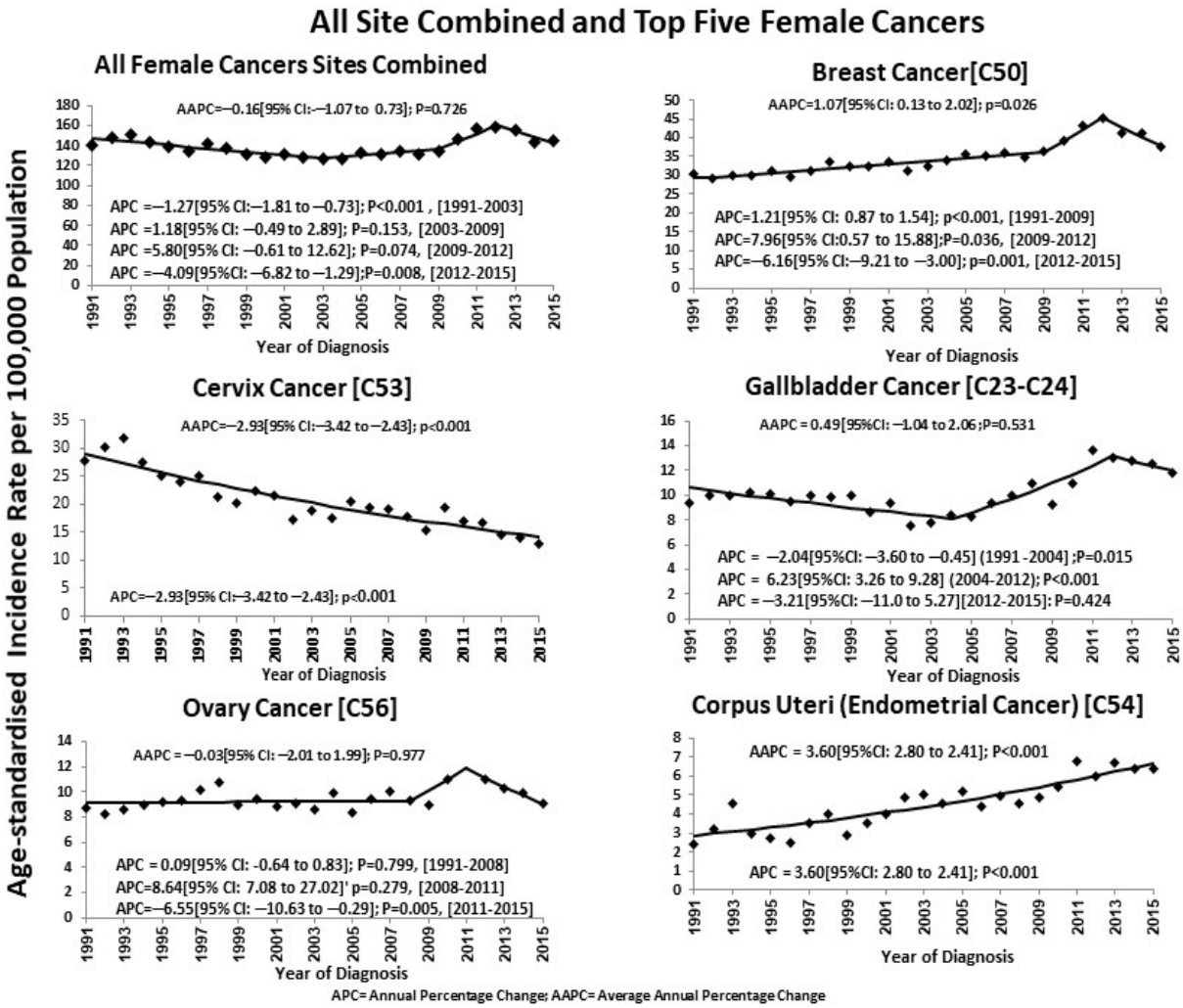

Figure 2. Annual Age-Standardised Incidence Rate for All Sites Combined and Top Five Cancers among Females in Delhi from 1991-2015

population structure. Epidemiological factors had mixed effects, with some cancer sites showing an upward trend while other sites either decreased or remained consistent, especially in female cancers (Figures 3 and 4).

There was a 252.2% increase in new cancer cases among males (36.5% in risk; 180.9% population size; and 34.8% population structure). Among women, an increase of 208.5% (0.12% in risk; 168.4% in population size, and 40.0% in population structure) was recorded. These findings were parallel with AAPCs which exhibited a positive slope for males and a negative slope for females. In females, both ovary and overall cancer sites demonstrated a stable risk trend. The cervix was the only cancer that showed a significant declining trend of risk. Among the males, the trend of risk factors was increasing in all the top five cancer sites as well as for overall cancer. Prostate, gallbladder, and oral cancers contributed to more than 100% increase in risk from 1991 to 2015 (Table 2).

Population growth is a major component contributing to raising the new cancer cases among females and males in Delhi. The population structure (aging) has a positive impact on increasing cancer cases in both genders, although it remains lower than the effect of population growth. The percentage of each of the components, relative to the year 1991 (as reference) was presented in Figures 3 and 4.

Discussion

The present study evaluated the burden of cancer across the top five cancer sites and overall, among the males and females in the Delhi population, by investigating their trends and contributions to cancer changes resulting from demographic transition and cancer risk factors during the period from 1991 to 2015. A flat trend was observed for overall cancer sites in females (AAPC= - 0.16%) and in males (AAPC=0.68%). Despite, a high rise in incidence cases in females by 208% and by 252% in males from 1991 to 2015. During this period, the population growth for females and males was 115.83% and 105.61% respectively [19, 9]. The population growth and population structure are attributed to the rise in cancer cases in both sexes (168.4% growth and 40.0% population structure in females; 181% growth and 34.8% population structure in males). However, the risk component revealed different patterns between males and females. In males, the risk component exhibits a rising trend with a change of 36.5% from 1991 to 2015 for overall cancer sites. However, the

Table 2. Absolute and Relative Bifurcation of Components in the Number of New Cases for Top-Five Cancer and Overall, in Delhi According to Gender in 2015 Compared to year 1991 using the RriskDiff Method [12]

Male			Components of the bifurcation of cancer incidence	Female		
Site Ranked by number of cases in 2015	Change in the number of new cases from 1991			Change in the number of new cases from 1991		Site Ranked by number of cases in 2015
	Absolute	Relative		Relative	Absolute	
Overall	8188	252.17%	Overall	208.50%	6828	Overall
	1185	36.49%	Risk	0.12%	4	
	5873	180.89%	Population size	169.82%	5514	
	1130	34.80%	Population Structure	40.34%	1310	
Oral Cancer [C00-C06]	1306	439.73%	Overall	271.60%	1942	Breast [C50]
	365	122.83%	Risk	26.61%	190.29	
	823	277.23%	Population size	202.82%	1450.17	
	118	39.67%	Population Structure	42.17%	301.52	
Lung [C33-C34]	891	281.96%	Overall	39.09%	258	Cervix [C53]
	127	40.18%	Risk	-78.83%	-520	
	620	196.19%	Population size	75.91%	501	
	144	45.59%	Population Structure	42.00%	277	
Prostate [C61]	691	552.80%	Overall	332.27%	628	Gallbladder [C23-C24]
	202	161.24%	Risk	45.72%	86	
	419	335.31%	Population size	235.93%	446	
	70	56.25%	Population Structure	50.61%	96	
Urinary Bladder [C67]	368	266.67%	Overall	208.92%	445	Ovary [C56]
	41	30.08%	Risk	2.47%	5	
	260	188.34%	Population size	168.61%	359	
	67	48.25%	Population Structure	37.83%	81	
Gallbladder [C23-C24]	377	418.89%	Overall	727.45%	371	Corpus Uteri [C54]
	96	106.83%	Risk	227.52%	116	
	240	266.52%	Population size	451.62%	230	
	41	45.53%	Population Structure	48.31%	25	

risk component exhibits a range of 30% to 161% across the top five cancers. On the other hand, the female risk component remains closer to zero (0.12%). For cancer-specific, cervical cancer demonstrated a drastic decline in risk. However, the other four top female cancers either rose or remained flat in the risk component.

The deviation in cancer burden as a consequence of population growth and population structure is primarily associated with the demographical transition, while the cancer burden attributed to the risk component would likely be related to the diagnostic and preventive practice. The other components of cancer-specific risk are well-known cancer-specific risk factors. For instance, the risk of breast cancer could be increased due to factors such as poor lifestyle, higher age at marriage, low parity, and delay in the age of first childbirth [20, 21]. A sedentary lifestyle and rise in obesity may contribute to the increased incidence of corpus uteri (endometrial) cancer. In contrast, the downtrend in the risk of cervical cancer was attributable to greater awareness about hygiene, access to sanitary products, and increased availability of screening among females. However, cervical cancer is still maintaining the second rank in Delhi PBCR. In India, where the cancer vaccination programs for cervical cancer are in the early stage and available in limited hospitals, the impact of this vaccination program will be evidenced after 10 to 15 years. Endometrial cancer observed the highest change and more than a 7-fold increase observed in 2015 from the year 1991. This exhibited the highest change among the top five cancers both in females and males. Endometrial cancer is highly associated with obesity, a study revealed that women with Body Mass Index (BMI) ranging from 30 to 25 kg/m^2 experienced a 2.6-fold increase. Furthermore, women exceeding BMI>35 kg/m^2 had a 4.6-fold increase in the likelihood of endometrial cancer compared to those with a normal BMI below 25 kg/m2 [22]. In Delhi, based on the National Family Health Survey (NFHS) (1998-99) data, the prevalence of obesity among women aged 15-49 years has shown an upward trend. In NFHS-2 (1988-1999), 9.2% of women were obese, which was the highest compared to other Indian States and Union Territories, and this percentage was increased to 10.2% in NFHS-4 (2015-16) (IIPS, 2000; IIPS, 2017). Every tenth woman in Delhi suffers from obesity as revealed by the NFHS-4 survey. The rise in obesity proportion could be one of the contributing factors to surge in the endometrial cancer incidence [23]. Among 28 PBCRs Delhi holds fourth position in endometrial cancer and all other top three

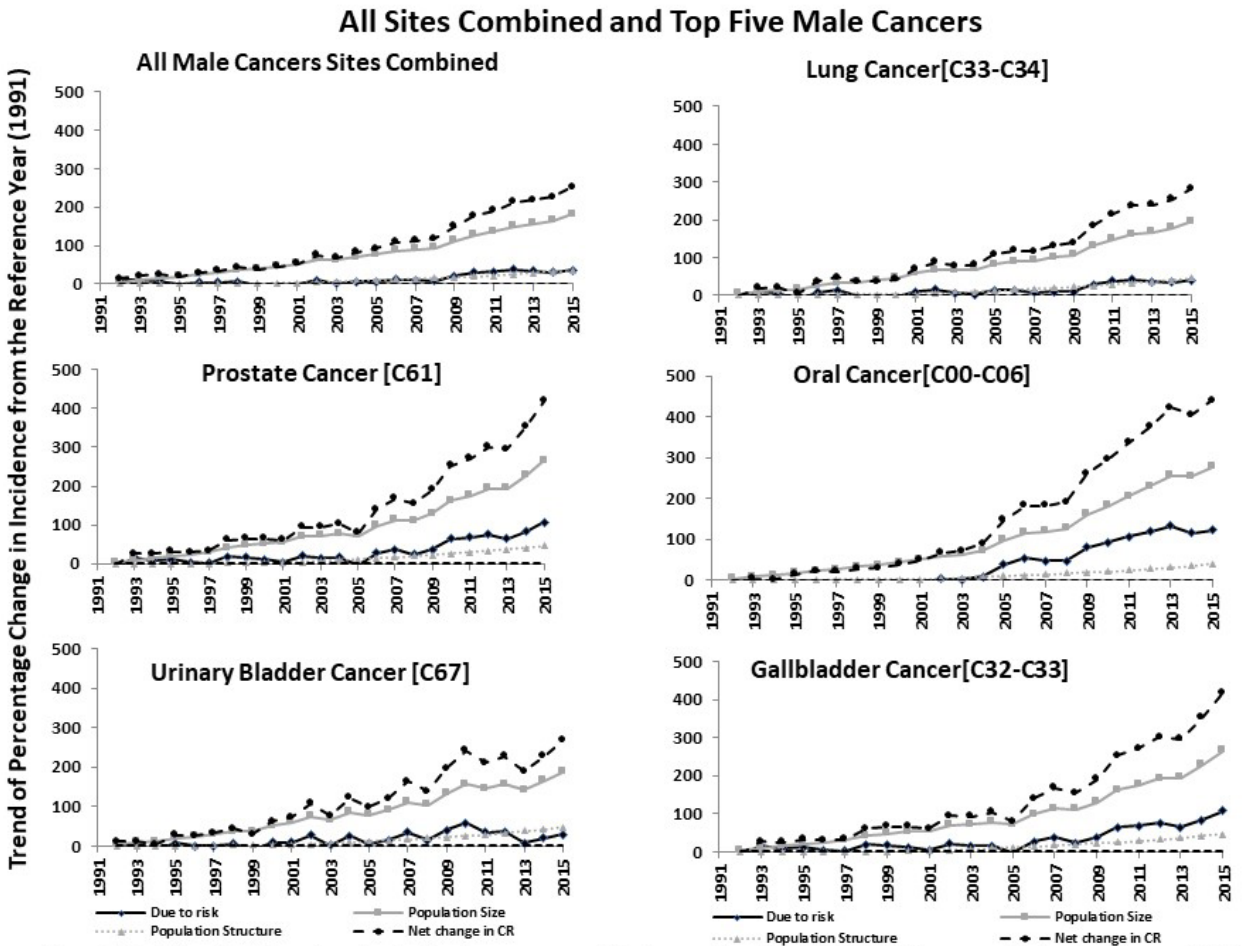

Figure 3. Evolution of Incidence in Males for Top-Five Cancers and All Sites Combined from 1992 to 2015 Compared to the Baseline Year 1991 by Disentangling the Effect due to Risk, Population Size, and Population Structure

PBCRs, exceeding 33% overweight or obese women according to NFHS-4 (2015-2016) [23].

In males, the highest increase of 550% occurred in Prostate cancer count in 2015 compared to 1991 and contributed 161% towards the cancer-specific risk factors which was highest among the top-five cancer sites. This surge may be probably attributable to the availability of screening programs, lifestyle changes, and an increase in LEB. Oral cancer counts witnessed a rise of 440% in 2015 compared to 1991 and this is mainly associated with tobacco consumption and can be prevented. Delhi contributed nearly 39.1% to tobacco-related cancers [6]. Smokeless tobacco consumption stands out as the major cause of over 60% of oral cancers in India as well as in the World of tobacco [24]. It is a big challenge to reduce tobacco consumption in India because of cultural factors and administrative barriers. However, the Indian government made mandatory visualization of oral cancer images on every tobacco product packing to increase awareness about tobacco-related cancers and to curb the sale of tobacco products to individuals under the age of 18 years. Lung cancer incidence is nearly 6 to 10-fold higher in smokers than non-smokers, in addition to other contributing etiological factors [25-28]. However, nowadays lung cancer is being observed in non-smokers, as well, although research in this non-smoker population remains limited [27, 28]. Indoor and outdoor pollution may be one of the risk factors for non-smokers. Delhi has been consistently observing a high pollution level for the last decade and may be one of the potential contributors to increasing Lung cancer cases among the non-smoker population in the future.

Both genders showed an upward trend in gallbladder cancer, the females have experienced a higher cancer case compared to males. However, in the last decade, the trend showed a greater rate of increase in males than females [29]. Over the 25-year period, male gallbladder cancer has surged from 24th to 5th position while in females it moved from rank 5th to 3rd position. Several risk factors contribute to Gallbladder cancer namely obesity, smoking, alcohol, dietary habits, lifestyle, residing near the Ganga belt, and heavy metals apart from other biological reasons [30-32]. The possible attributable factors for rising gallbladder cancer in Delhi include High obesity, poor lifestyle, Ganga and Yamuna river water as the primary source of drinking water, the presence of heavy metals in the Yamuna river water [33], and migration of major workforce in Delhi from Ganga river belt states namely - Uttaranchal, Bihar, and Uttar Pradesh [11].

Previous studies conducted in the United States [34], Europe [7], and Hong Kong [3] aimed to evaluate the impact of demographical change on cancer incidence. The

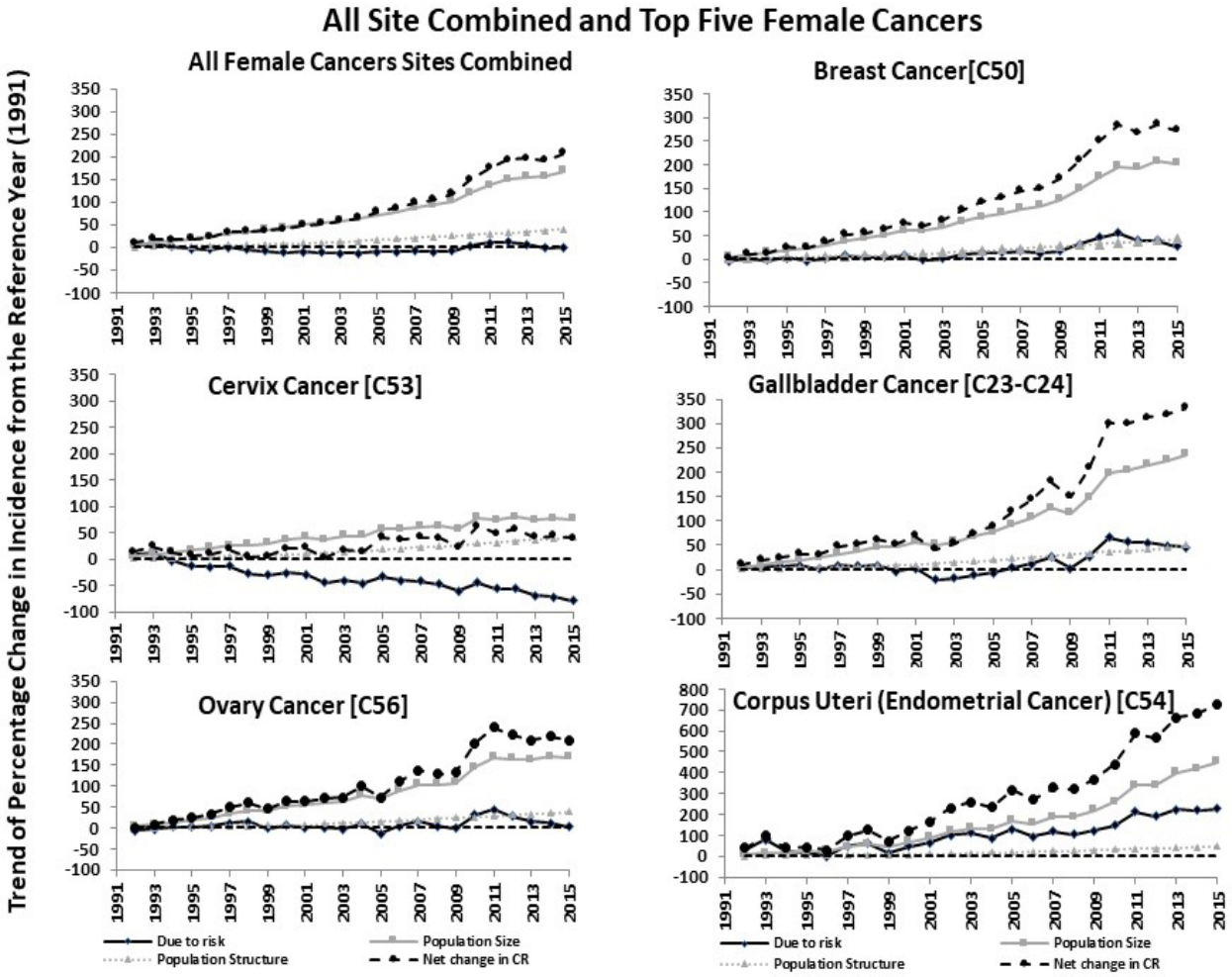

Figure 4. Evolution of Incidence in Females for Top-Five Cancers and All Sites Combined from 1992 to 2015 Compared to Baseline Year 1991 by Disentangling the Effect due to Risk, Population Size and Population Structure

present study corroborated the findings of these earlier studies [34, 35, 3]. For instance, the incidence projection in the United States indicates a 67% increase among the 65 and older from 2010 to 2030. In contrast, young adults are expected to increase by 11% [34]. Hong Kong Study examined the demographic and epidemiology trends in cancer incidence and found a 96% increase in male cancers from 1983 to 2017. This increase was attributable to -48.8% risk; 119.4% structure changes(aging), and 25.4% population growth. Among the females, the rise of cancer was more pronounced with a 156.5% increase, bifurcation of these three attributable factors include -4.5% risk; 95% aging, and 66.1% growth] [3]. Hong Kong study emphasized that population structure was a major component for rising cancer incidence but the present study suggested that population size emerges as the predominant component. This may be a consequence of a higher fertility rate, absence of population control policies, lower literacy rate, and cultural barriers. Population control is a bigger challenge in India because of cultural diversity, lack of comprehensive population control policy, varying literacy levels, religious factors, etc. Now India surpassed China in population count and become the world's most populous country.

In Nordic countries, there was a 49% increase in cancer incidence observed between 1993-1997 to 2018-2022 of this increase, 45% was attributable to demographic changes while only 4% was assignable to changes in cancer risk [35]. A study on tobacco-related cancers in Delhi [29] revealed a 100% rise in cancer incidence from 2008-2012 to 2018-2022 out of this 46% change was driven by risk factors and 54% resulted from alteration in population size and structure. A recent study on cervical cancer revealed that by 2030, there will be an 11.58% rise in the cervical cancer count compared to the average incidence cases of 2010-2014 in Delhi. Population growth will contribute 33.84%, and population aging will account for 38.87% of this increase, while there was a substantial decrease in cervical cancer-related risk factors [7].

Strength and Limitation

The findings of any research significantly rely on the quality of the data. Delhi PBCR adheres to the international standard for collecting the data and its data is accepted for publication in the IARC reports. The coverage of the Delhi PBCRs is nearly 100% and on average 85% of cancer cases were diagnosed through microscopic verification. Two international indicators of data quality are high morphological verification and low death certificate-only (DCO) cases. On average the

morphological verification was nearly 85.0% and the DCO average was closer to 7.0% during this 25-period. However, the caveat is that the Delhi PBCRs have the latest available data until 2015. Information about the staging at diagnosis is not accessible, and thus staging contribution could not be assessed.

In conclusion, significant growth in new cancer cases was observed due to demographic changes in structure as well as population growth in Delhi, in addition to the contribution of cancer-related risk factors in both genders. With the improvement in LEB and advancement of treatment modalities, the prevalence of cancer is expected to increase, consequently, this will surge the burden on the healthcare system. Thus, Delhi and India need continued efforts to enhance the health care system for cancer patients and to reduce the modifiable risk factors by promoting the awareness of preventive measures. The need of the hour is to immediately frame and strictly implement a uniform population policy to reduce the future impact of population growth not only on cancer but also on other diseases.

Author Contribution Statement

RKM, NM, SVS Deo, and SM contributed to conceptualizing the study. RKM extracts the data and analyses it. All four authors contributed to interpreting the results, writing the draft, editing, and finalising the manuscript.

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Institutional Review Board Statement

This study does not involve identifiable individual-based human data and previously published reports of PBCR were used to extract the data. Thus, ethical approval is not required for this study.

Availability of data

The most of data was extracted from the hardcopy (published reports) and available in the Delhi Cancer Registry in the form of monographs, but some of the data are present on the website (https://ncdirindia.org/ncrp/All_Reports/PBCR_Annexures/Default.aspx).

Conflict of Interest

There is no conflict of interest among the authors.

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