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LIFE TIME RISK FOR DEVELOPMENT OF TEN MAJOR CANCERS IN INDIA AND ITS TRENDS OVER THE YEARS 1982 TO 2000

L. SATYANARAYANA, SMITA ASTHANA

ABSTRACT

BACKGROUND: Understanding cancer magnitude, risk and trends will be of help in cancer control programs. **AIM:** To study trends in cumulative risk up to 64 years of age as lifetime risk of developing major cancers in India during the years 1982 to 2000. **DESIGN:** Retrospective. **SETTING:** Secondary sources of cancer-registration data. **MATERIALS AND METHODS:** Data on age-specific cancer-incidence rates were collected for patients 0-64 years of age of either sex for 10 major cancer sites from the National Cancer Registry Program (NCRP) reports of India from Mumbai, Chennai, Bangalore, Bhopal and Delhi; and Barshi registries for the years 1982 or 1988 to 2000. **STATISTICAL ANALYSIS:** Cumulative risks computed for lifetime development of cancer. Linear trends were studied using simple linear regressions. **RESULTS:** The lifetime risk among females for the 10 cancer sites ranged from 0.02 to 3.3% and from 0.04 to 2.4% for the years 1982 and 2000 respectively; whereas among males, it ranged from 0.04 to 0.89% and from 0.05 to 0.95% respectively. Significant ($P < 0.05$) increasing trends were observed for breast, non-Hodgkin's lymphoma (NHL), gallbladder, thyroid and ovary cancers among females; while declining trends were observed for cervix, mouth, stomach, esophagus and tongue cancers. Among males, significant ($P < 0.05$) increasing trends were observed for NHL and prostate cancer; whereas declining trends were observed for stomach, liver, hypopharynx and tongue cancers. Cancers of mouth and esophagus showed increasing trends ($P < 0.05$) in some regions and declining trends ($P < 0.05$) in some other. **CONCLUSION:** Significant and higher rates of positive trends in lifetime cancer risks for breast cancer among females and for NHL among both sexes were observed.

Key words: Cancer registry, cancer trends, cumulative risk, India, lifetime risk

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INTRODUCTION

The most common cancers diagnosed globally are lung (1.35 million), breast (1.15 million) and colorectal (1 million) cancers. The most prevalent cancer in the world is breast cancer.^[1] India's cancer atlas shows that some parts of India have the world's highest incidence of gallbladder, mouth and lower pharynx cancers.^[2] In India the first three leading cancer sites are breast, cervix and lung. The highest incidence rates observed for these sites in different registries were about 32 per 100,000 for both breast and cervix cancers among females and 12 per 100,000 for lung cancer among males.^[3]

Studies on incidence or risk for development of the disease pattern provide useful summary of disease burden. Several studies reported trends in cancer incidence for various sites.^[4-11] Calculation of cumulative risk as chance or probability of developing lifetime risk of the disease is a useful statistic. Incidence rates are used for computation of cumulative risk of development of cancer as lifetime risk. National Cancer Registry Program (NCRP), reported lifetime cumulative risk percents for all sites for five urban registries and for rural registry of Barshi up to 64 years and 74 years of age for the recent years. The risk for male cancers ranged from 2.6 to 7.27%; and for females, the risk was 3.46 to 8.88%. Cumulative risk can also be converted into one in number of persons at risk, which is another easily understandable statistic. Cumulative risks are used to compute this statistic. The possibility of one in number of persons developing cancer (all cancer sites) as observed in different registries in India for the year 2000 ranged from

14 to 38 among males and 11 to 29 among females up to the age of 64 years.^[3] Earlier, cumulative risk approach was adopted by Mumbai cancer registry for oral cancer^[12] and prostate cancers.^[13] Surveillance Epidemiology and End Results Program (SEER) also reported site-, race- and sex-specific lifetime risk for the years 1999-2001.^[14]

The cumulative risks if computed for different sites in various years for different Indian registries provide useful disease burden summaries. When the risks are computed for various years, the significance in trend should also be evaluated for risks. This communication aims to report cumulative risks and their trends for 10 major cancer sites for the years 1982 to 2000 in different cancer registries in India.

MATERIALS AND METHODS

The data for this study were obtained from NCRP, India's population-based reports.^[3,15-17] The NCRP brings out a comprehensive annual report containing various data summaries, such as incidence rates and mortality rates. The availability of data in different cities of the country depends on the year a particular registry came into network of NCRP and/ or initiation of the registry in a particular area. Data for the years 1982 to 2000 were available for Mumbai, Chennai and Bangalore; while data for Bhopal, Delhi and Barshi (rural registry) were available from the year 1988. Though Mumbai cancer registry was established in 1963, it came into NCRP network in 1982 only. The main resources for registration of incidence of cases and the type of population covered in various registries were described in the NCRP reports.^[3] Cancers in 10 major sites

among males and females are considered for computation of lifetime risk. We used ranking of cancer incidence rates of the year 2000 as given in NCRP report^[3] for selection of the 10 sites from different registries for the years 1982 to 2000. International classification of diseases (ICD) coding used was as per ICD 10. Age-specific annual cancer incidence rates for either sex in different registries for 10 sites for ages in the range of 0-64 years were used for computations. The 10 sites for females were breast (C50), cervix (C53), tongue (C01-02), mouth (C03-06), esophagus (C15), stomach (C-16), gall bladder (C23-24), ovary (C56), thyroid (C73), NHL (C82-85, C96); and for males, these were lungs (C33-34), hypopharynx (C12-13), liver (C22), larynx (C32), tongue (01-02), mouth (C03-06), esophagus (C15), stomach (C-16), prostate (C61), NHL (C82-85, C96). For summarization as cumulative risk and one in number of persons developing cancer, the formula used was:

Cumulative risk = $100 \times [1 - \exp(-\text{cum. rate}/100)]$,
where cumulative rate = $[5 \times \Sigma(\text{ASpR}) \times 100] / 100,000$ and ASpR is age-specific incidence rate. One in number of persons

at risk of developing cancer is calculated as 100/cumulative risk. The cumulative risk is the probability that an individual will be diagnosed with cancer during a certain age period in the absence of any competing cause of death and assuming that the current trends prevail over the time period.^[3]

The trend among risks of developing cancer in different registries for each site was studied using linear regression analysis. Significance of the trend coefficients was assessed at 1% probability.

RESULTS

Cumulative risks were computed for 10 major sites in six registries for the years 1982-2000. Percent risks were computed for each site and gender for different years. The cumulative risk among females ranged from 0.02 to 3.3% and from 0.04 to 2.4% for the years 1982 and 2000 respectively. The risk among males ranged from 0.04 to 0.89% and from 0.05 to 0.95% for the years 1982 and 2000 respectively. Trend evaluation of cumulative risks for each site of cancer was done. Statistically significant trends

Table 1: Significant trends in cumulative risks of 10 major cancers among females for various cancer registries in India during 1982–2000

Registry	Positive (increasing) trends				Negative (decreasing) trends			
	Site	Trend coeff	P value	R-square	Site	Trend	P value	R-square
Bangalore	Breast	0.036	0.01	53	Cervix	-0.065	0.009	55
	NHL	0.006	0.013	50	Mouth	-0.023	0.02	45
Barshi					Stomach	-0.008	0.089	56
Bhopal	NHL	0.02	0.052	69	esophagus	-0.03	0.067	63
Chennai	Breast	0.032	0.01	53	Cervix	-0.098	<0.001	89
	NHL	0.006	<0.001	87	Mouth	-0.015	<0.001	87
					Stomach	-0.007	0.01	54
Delhi	Gall bladder	0.018	0.082	58	Cervix	-0.066	0.034	76
	NHL	0.003	0.092	56	esophagus	-0.009	0.034	76
	Thyroid	0.005	0.054	68	Stomach	-0.007	0.025	81
Mumbai	Breast	0.028	0.001	75	Cervix	-0.018	0.004	63
	Ovary	0.006	0.051	32	esophagus	-0.011	0.004	62
	Gall bladder	0.004	0.02	45	Stomach	-0.008	0.009	55
	NHL	0.007	0.001	74	Tongue	-0.002	0.055	31

Blank row for Barshi indicates no significant trend observed for any site

in cumulative risks are presented in Tables 1 and 2. Risk percents for various years in each site for every registry were converted into one in number of persons at risk of developing cancer. These risks as cumulative risk and one in number of persons at risk of developing cancer are presented in Tables 3-6 for the years 1982 or 1988 to 2000. The observations on lifetime risks and their trends in different sites for each registry are given as follows.

Bangalore: Breast cancer, which ranks number one among female cancers, was found to have an increasing trend ($P = 0.01$). The cancers of uterine cervix and mouth cancer were found to be on decline, while cancers of other sites did

not show any statistically significant change. The data suggest that 1 in every 47 women in the year 2000 as against 1 in 64 in the year 1982 was at risk of developing breast cancer. The chance of developing cervical cancer was 1 in 55, while that of mouth cancer was 1 in 248 among women.

Among males, mouth cancer showed decline ($P = 0.024$), while cancers of other sites did not show any significant change. There was a chance of 1 in 578 men developing mouth cancer in the year 2000 as against 1 in 323 in the year 1982.

Chennai: Cervix cancer is the most prominent

Table 2: Significant trends in cumulative risks of 10 major cancers among males for various cancer registries in India during 1982–2000

Registry	Positive (increasing) trends				Negative (decreasing) trends			
	Site	Trend coeff	P value	R-square	Site	Trend	P value	R-square
Bangalore	-	-	-	-	Mouth	-0.009	0.024	43
Barshi	-	-	-	-	Larynx	-0.008	0.08	59
Bhopal	NHL	0.02	0.052	69	Stomach	-0.01	0.022	82
Chennai	esophagus	0.009	0.013	50	-	-	-	-
	Prostate	0.003	0.085	24	-	-	-	-
	NHL	0.01	0.001	72	-	-	-	-
Delhi	Mouth	0.003	0.089	56	Liver	-0.004	0.013	88
Mumbai	NHL	0.01	<0.001	80	Hypopharynx	-0.017	0.015	49
	-	-	-	-	sophagus	-0.015	0.001	76
	-	-	-	-	Stomach	-0.006	0.009	55
	-	-	-	-	Larynx	-0.008	0.013	51
	-	-	-	-	Tongue	-0.008	<0.001	90

Blank row for Bangalore Barshi and Chennai indicates no significant trend observed for any site

Table 3: Cumulative risk percent for development of cancer among females (0–64 years) for 10 major cancer sites in India (1982 and 2000)

Sites (ICD 10)	Bangalore		Chennai		Mumbai	
	1982	2000	1982	2000	1982	2000
Breast (C50)	1.56 (64)	2.13 (47) [†]	1.51 (66)	2.22 (45) [†]	1.64 (61)	2.12 (47) [†]
Cervix (C53)	3.33 (30)	1.81 (55) [†]	4.0 (25)	2.63 (38) [†]	1.64 (61)	1.25 (80) [†]
Tongue (C01-02)	0.10 (1021)	0.04 (2440)	0.17 (594)	0.12 (848)	0.19 (513)	0.13 (715)
Mouth (C03-06)	1.10 (91)	0.42 (238) [†]	0.69 (145)	0.47 (215) [†]	0.32 (308)	0.29 (337)
esophagus (C15)	0.52 (189)	0.44 (227)	0.29 (342)	0.50 (198)	0.45 (220)	0.29 (344) [†]
Stomach (C-16)	0.45 (221)	0.44 (227)	0.53 (190)	0.38 (266) [†]	0.36 (281)	0.14 (674) [†]
Gall Bladder (C23-24)	-	0.06 (1653)	0.02 (4652)	0.08 (1291)	0.08 (1243)	0.14 (695) [*]
Ovary (C56)	0.47 (213)	0.35 (287)	0.25 (393)	0.48 (207)	0.43 (230)	0.53 (187)
Thyroid (C73)	0.22 (462)	0.17 (575)	0.10 (967)	0.17 (587)	0.11 (897)	0.10 (962)
NHL (C82-85,C96)	0.12 (939)	0.17 (596) [*]	0.06 (1563)	0.16 (620) [†]	0.06 (1627)	0.21 (456) [†]

Cumulative risk percents presented in the table are corrected to two decimal places. Figures in parenthesis () indicate one in number of persons at risk of developing cancer. * $P < 0.05$, [†] $P < 0.01$

Table 4: Cumulative risk percent for development of cancer among females (0–64 years) for 10 major cancer sites in India (1988 and 2000)

Sites (ICD 10)	Delhi		Bhopal		Barshi	
	1988	2000	1988	2000	1988	2000
Breast (C50)	2.17 (46)	2.44 (41)	1.67 (60)	2.04 (49)	0.75 (133)	0.46 (216)
Cervix (C53)	2.27 (44)	1.69 (59)*	1.92 (52)	1.96 (51)	1.92 (52)	1.61 (62)
Tongue (C01-02)	0.22 (452)	0.12 (820)	0.02 (6061)	0.13 (776)	0.08 (1251)	0.31 (764)
Mouth (C03-06)	0.17 (562)	0.13 (752)	0.32 (313)	0.37 (269)	0.06 (1667)	0.06 (1539)
Esophagus (C15)	0.32 (308)	0.23 (443)*	0.70 (142)	0.29 (341)	0.08 (1251)	0.22 (448)
Stomach (C-16)	0.20 (488)	0.10 (967)*	0.05 (1695)	0.08 (1283)	0.06 (1667)	-
Gall Bladder (C23-24)	0.35 (283)	0.58 (173)	0.32 (310)	0.44 (226)	0.08 (1251)	-
Ovary (C56)	0.66 (151)	0.65 (154)	0.35 (285)	0.43 (230)	0.11 (893)	0.04 (2632)
Thyroid (C73)	0.16 (644)	0.20 (489)	0.02 (3774)	0.12 (817)	-	0.02 (4082)
NHL (C82-85, C96)	0.16 (642)	0.17 (508)	0.11 (931)	0.25 (398)	-	0.10 (1026)

Cumulative risk percents presented in the table are corrected to two decimal places. Figures in parenthesis () indicate one in number of persons at risk of developing cancer. -- No case was reported in the registry. * $P < 0.05$, † $P < 0.01$

Table 5: Cumulative risk percent for development of cancer among males (0–64 years) for 10 major cancer sites in India (1982 and 2000)

Sites (ICD 10)	Bangalore		Chennai		Mumbai	
	1982	2000	1982	2000	1982	2000
Tongue (C 01-02)	0.35 (283)	0.27 (375)	0.31 (326)	0.37 (272)	0.48 (209)	0.33 (303)†
Mouth (C03-06)	0.31 (323)	0.17 (579)*	0.46 (216)	0.17 (213)	0.43 (230)	0.45 (220)
Hypopharynx (C12-13)	0.37 (273)	0.26 (390)	0.31 (320)	0.33 (300)	0.54 (186)	0.22 (451)*
Esophagus (C15)	0.59 (170)	0.47 (215)	0.55 (183)	0.72 (138)*	0.69 (145)	0.34 (293)†
Stomach (C-16)	0.75 (134)	0.53 (187)	0.85 (118)	0.95 (105)	0.37 (273)	0.27 (376)†
Liver (C22)	0.21 (469)	0.23 (434)	0.12 (820)	0.23 (427)	0.24 (425)	0.20 (496)
Larynx (C32)	0.32 (311)	0.26 (390)	0.28 (351)	0.33 (299)	0.48 (209)	0.42 (236)*
Lungs (C33-34)	0.33 (299)	0.51 (195)	0.46 (218)	0.71 (140)	0.84 (119)	0.47 (213)
Prostate (C61)	0.10 (1042)	0.17 (589)	0.10 (991)	0.11 (922)	0.17 (601)	0.14 (712)
NHL (C82-85, C96)	0.25 (393)	0.22 (449)	0.15 (654)	0.32 (313)†	0.11 (931)	0.27 (376)†

Cumulative risk percents presented in the table are corrected to two decimal places. Figures in parenthesis () indicate one in number of persons at risk of developing cancer. * $P < 0.05$, † $P < 0.01$

Table 6: Cumulative risk percent for development of cancer among males (0–64 years) for 10 major cancer sites in India (1988 and 2000)

Sites (ICD 10)	Delhi		Bhopal		Barshi	
	1988	2000	1988	2000	1988	2000
Tongue (C 01-02)	0.42 (237)	0.36 (276)	0.72 (139)	0.67 (150)	0.29 (338)	0.11 (870)
Mouth (C03-06)	0.23 (443)	0.27 (370)	0.45 (223)	0.64 (156)	0.57 (175)	0.10 (957)
Hypopharynx (C12-13)	0.21 (481)	0.11 (889)	0.33 (299)	0.46 (216)	0.18 (569)	0.11 (878)
Esophagus (C15)	0.41 (243)	0.39 (256)	0.43 (234)	0.63 (159)	0.22 (452)	0.33 (306)
Stomach (C-16)	0.26 (386)	0.22 (449)	0.32 (312)	0.21 (468)	-	0.11 (878)
Liver (C22)	0.17 (580)	0.12 (859)	0.12 (817)	0.18 (544)	-	0.21 (473)
Larynx (C32)	0.58 (171)	0.54 (185)	0.53 (190)	0.32 (315)	0.10 (1021)	0.05 (2128)
Lungs (C33-34)	0.73 (137)	0.72 (139)	0.89 (112)	0.84 (119)	0.04 (2223)	0.20 (498)
Prostate (C61)	0.16 (614)	0.15 (648)	0.17 (575)	0.27 (373)	0.08 (1191)	0.06 (1755)
NHL (C82-85, C96)	0.33 (303)	0.34 (296)	0.04 (2353)	0.28 (352)	-	0.16 (626)

Cumulative risk percents presented in the table are corrected to two decimal places. Figures in parenthesis () indicate one in number of persons at risk of developing cancer. No case was reported in the registry. * $P < 0.05$, † $P < 0.01$

one among female cancers in this registry. Decreasing trends were observed in cervix cancer ($P < 0.001$), in mouth cancer ($P < 0.001$) and in stomach cancer ($P = 0.01$), while there

was an increasing trend for breast cancer ($P = 0.01$). The other sites studied other than the above did not show any significant change. The chance of developing cancer of cervix was

1 in 38; for mouth, 1 in 215; and for stomach, 1 in 266 among females.

Among males significant increasing trends were observed for esophagus ($P = 0.013$) and for prostate cancer ($P = 0.085$). The risks for these cancers for the year 2000 were 1 in 138 and 1 in 922 for esophagus and prostate cancers respectively.

Mumbai: Female breast and cervical cancers are the most prevalent cancers in this registry. Among males, lung and esophagus cancer sites are in top ranks. Among females, cervix, tongue, esophagus and stomach cancers showed decreasing trends; while breast, gallbladder, ovary cancers and NHL showed increasing trend. From the data of the year 2000, the lifetime risks for these cancers were as follows: for cervix 1 in 80; for tongue, 1 in 715; for esophagus, 1 in 344; for stomach, 1 in 674; for breast, 1 in 47; for gallbladder, 1 in 695; for ovary, 1 in 187; and for NHL, 1 in 456 women.

The cancers of hypopharynx, esophagus, stomach and larynx among males were on decline, while NHL showed increasing trend [Table 1]; the risks for these cancers were 1 in 451, 293, 376, 236 and 376 men – for hypopharynx, esophagus, stomach, larynx and NHL respectively for the year 2000.

Delhi: Breast cancer ranks foremost among females and lung cancer among males in this registry. Evaluation of trends in 10 major sites studied for the years 1988 to 2000 showed that cervix, esophagus and stomach cancers were on decline; while gallbladder, thyroid cancers and NHL showed significant increasing trends

among females. The statistics of one in number of persons developing particular cancer were computed: cervix, 1 in 59; esophagus, 1 in 443; stomach, 1 in 967; gallbladder, 1 in 173; thyroid, 1 in 490; and NHL, 1 in 508.

Bhopal: Breast cancer among females and lung cancer among males stand as the most prominent cancer in this registry. Trends for 10 major cancer sites were evaluated for the period 1988 to 2000 in this registry. Unlike other registries, Bhopal did not show any significant change in breast and cervix cancer among females. The risk for development of the cancer of esophagus among females was 1 in 341. However, this cancer among females was on decline ($P = 0.067$). The calculated risk for developing cancers during lifetime among males was 1 in 468 and 1 in 352 persons for stomach and NHL respectively. Among males, stomach cancer was on decline ($P = 0.022$); while NHL showed increasing trend ($P = 0.052$).

Barshi: This is a rural registry, while all the other five registries studied were urban based. On evaluation of trends, stomach ($P = 0.089$) among females and larynx ($P = 0.08$) among males showed significant decline. For the year 2000, no case of stomach cancer was reported among females in this registry. The chance of developing cancer among males was found to be 1 in 2,128.

DISCUSSION

The cumulative risks for various major cancer sites have been computed, and their trends were studied during the years 1982–2000 during various population-based cancer registries

in India. Increasing trends were observed among females for breast, gallbladder, thyroid cancers and NHL. The cancers of esophagus, prostate and mouth and NHL among males were rising. The reports of National Cancer Registry Program, Indian Council of Medical Research (ICMR), which compile data, were used. Though the population covered by these registries under NCRP is small as compared to the vastness of India, nevertheless, these data can give a fair idea of the cancer problem in the country.^[3]

The 10 major sites considered for the present study were chosen from six registries according to rankings for each site in both sexes based on age-adjusted incidence rates as reported in the recent NCRP report.^[3] All cancer registries from which data were obtained follow uniform data collection procedures and reliability measures. There may be variability in terms of indices of reliability. Mortality incidence ratio, an important index of reliability, for the years 2001–2003 in these six registries for males ranged from 12.0% in Delhi to 78.5% in Barshi; and for females, it ranged from 9.3% in Delhi to 73.0% in Barshi.^[18] The mortality incidence ratios for Delhi were observed to be low. This may be due to lack of completeness of mortality data in the Delhi registry. There may be some data of the registry that may not match with mortality information of civil registration system. The Barshi registry has small geographical area, with a better completeness in data regarding mortality. Among the other registries, Mumbai is the oldest, and completeness of mortality information appears to be good. Chennai and Bangalore registries are the other two old registries for which the completeness is fairly good. A good proportion of cases in various

registries are microscopically verified. These microscopically verified cases for males ranged from 77.4% in Chennai to 87.3% in Bhopal; and for females, such cases ranged from 81.5% in Delhi to 89.4% in Bhopal. Case registration based on only death certificate was under 10% in different registries. In addition, the initial years of different registries might have suffered from quality assurance, which would have likely influenced the trends during the study period. This is a limitation in the present study, due to a possible bias in trend assessment.

It is well known that incidence rates are informative, and annual percent change in incidence would give a better picture. The risk statistics based on incidence is not a replacement of incidence rate itself. The cumulative risk as one in number of persons developing cancer is an easily understandable statistics for public health messages for the respective governments and for the use by policy makers. As the trend analysis of risk will not affect the age structure pattern, we use it for comparison in various registry areas in the country. However, this is a limitation for global comparison of Indian trends in cumulative risk.

The cancer sites, as well as the occurrence of NHL, that were found to have increasing trends among females were breast, gallbladder, thyroid and ovary in various registries. The decline in trends was observed for cervix, esophagus, stomach, mouth and tongue in female cancers [Table 1]. Among males, NHL, esophagus, prostate and mouth showed increasing trends [Table 2]. Rate of increase for breast cancer risk was very high compared to other sites. Increasing trend in cumulative risk for breast cancer was observed in Bangalore,

Chennai and Mumbai areas. Lifetime risk for developing breast cancer was highest, with 1 in 45 women likely to develop the disease. The risk was more or less of the same magnitude in all these registries. A study on trends in age-specific incidence rates^[7] for breast cancer for most urban populations in India showed steep increase for the years 1982–1996. The rising trends in breast cancer might be associated with a shift towards more westernized life style among the urban population.^[10] The chance of developing breast cancer was higher in Delhi compared to other registries, with the risk of 1 in 40 women likely to develop the disease in her lifetime. In SEER areas, the risk for breast cancer was 1 in 8 females for all races.^[14] Next to breast cancer was cancer of the cervix, which was high in magnitude, with 1 in 60 women on an average with chance of developing cancer, in different registries. The chance for cervix cancer in SEER areas was 1 in 130 women for all races.^[14] Time trend analysis^[6] of cervical cancer incidence for a segment of 8 years from 1988 to 1995 in Delhi did not reveal any significant decrease or increase. Our study for the duration up to the year 2000 observed that cervical cancer was declining in Bangalore, Chennai, Delhi and Mumbai registries in India [Table 1]. Awareness of importance of hygiene, improvement in socioeconomic status, reproductive and child health care (RCH) may be the reasons for the observed decline.

Infection of human papillomaviruses (HPVs) has been considered as the principal etiological agent for the development of cervical cancer. Hybrid Capture (HCII) has been demonstrated as an accurate predictor for the presence of HPV infection.^[19] Low-cost screening procedures, such as aided visual examination

techniques, for early detection of cervical cancer are presently recommended for low-resource settings as alternative to cytology screening.^[20] If adopted, low-cost screening at the country level could bring major changes in the enormity of the disease even if the cytological screening programs are absent.

Among males, lung cancer occupies the third position in most of the Indian registries, with 1 in 180 males at risk of developing this cancer in his lifetime. No significant changes in trends were observed for lung cancer over the years in Indian registries. SEER reported the risk for lung cancer as 1 in 13 for males and 1 in 18 for females (in all races).^[14] Mouth cancer showed declining trends in Bangalore in both the sexes. Chennai also observed significant declining trends for this cancer site in females, whereas Delhi showed an increasing trend in mouth cancer among males. This might be due high tobacco usage in this region. Sunny *et al.* reported that 1 out of every 57 men and 1 in every 95 women in Mumbai will develop any oral cancer at some point in time in their lifetime.^[12] In most of Europe and Australia, NHL is on the rise in both the sexes.^[10] The present study showed increasing trends in NHL in some registries for both the sexes [Tables 1 and 2]. In Chennai, NHL showed 2.0- and 2.7-fold (significant) increase in risk during the 18-year period in females and males respectively. Bhopal observed maximum rate of increase in NHL in both the sexes. The increase in risk for this cancer was 2.3-fold for females and 7-fold for males. This high increase could be due to long-term chemical exposure in the well-known gas tragedy in Bhopal. Similar changes of increase in risk among females in Bhopal were observed – 6-fold for thyroid cancer and

6.5-fold for tongue cancer. Gallbladder showed increasing trend among females in Delhi and Mumbai. Most registries demonstrated declining trend in esophageal cancer among females. Among males, Chennai showed an increasing trend and Mumbai showed a declining trend for esophageal cancer.

Mumbai registry analysis of age-adjusted incidence trends of prostate cancer during the period 1986 to 2000 also showed no statistically significant changes. The same registry reported that 1 out of 59 men was at risk of developing prostate cancer at some point in time in his lifetime, and there was 99% chance of contracting the disease after the age of 50 years.^[13] The present study projects a borderline significance for this cancer in Chennai registry only. Other registries did not show any increase or decrease in trend during the period 1982–2000 [Table 2]. One important reason could be that the age group considered in the study was up to 64 years only. Maximum load of incident cases of this cancer was reported for ages above 50 years.^[13] Other reason may be the nonexistence of prostate-specific antigen (PSA) screening in India. Contrary to this, increasing trend of this cancer was observed in westernized countries due to increasing diagnostic activity through PSA screening.^[21] As per the present study, prostate cancer reported highest risk in Bhopal, with 1 in 373 men likely to develop the disease; and lowest in Chennai [Tables 5 and 6]. Barshi, the rural registry, showed that 1 in 1,755 men was likely to develop cancer in his lifetime (up to 64 years).

Trend evaluation of cumulative risks showed changes in magnitude of cancer risk in different

registries. Significant and higher rates of positive trends in lifetime risk of breast cancer for females and of NHL for both sexes were observed. This might help in the planning of preventive, diagnostic management and control of the disease.

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