

# THE LANCET

## **Supplementary appendix**

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Dikshit R, Gupta PC, Ramasundarahettige C, et al for the Million Death Study Collaborators. Cancer mortality in India: a nationally representative survey. *Lancet* 2012; published online March 28. DOI:10.1016/S0140-6736(12)60358-4.

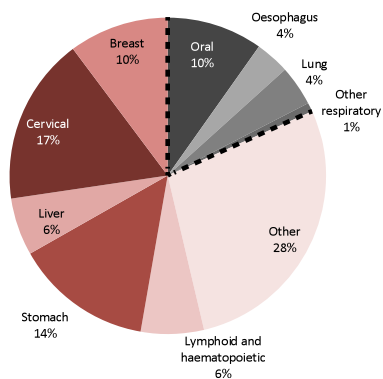
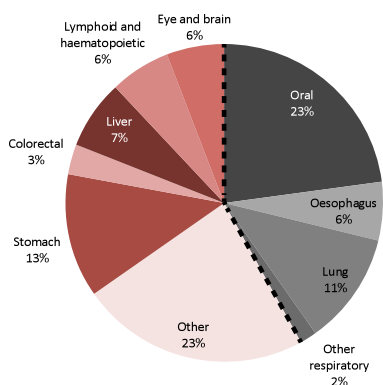
## MEN

## WOMEN

### Total

Cancer deaths in thousands=200, Cumulative Risk=4.7%

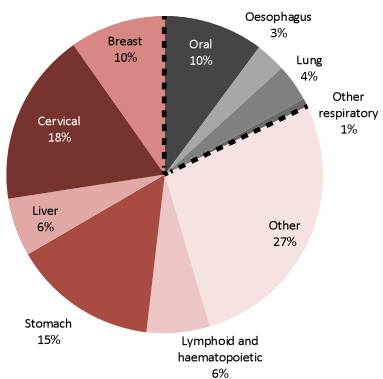
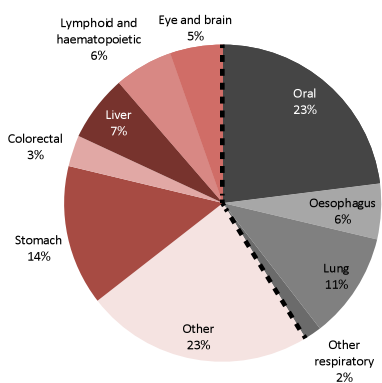
Cancer deaths in thousands=195, Cumulative Risk=4.4%



### Rural

Cancer deaths in thousands=138, Cumulative Risk=4.8%

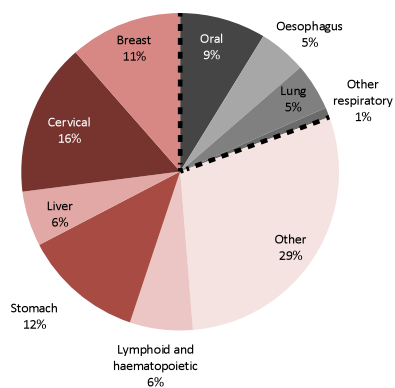
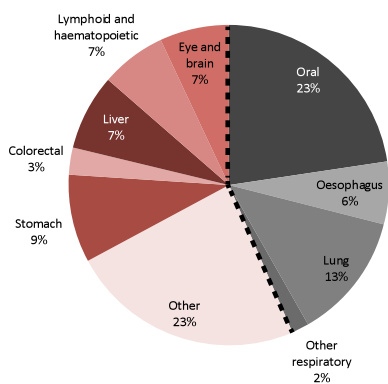
Cancer deaths in thousands=144, Cumulative Risk=4.5%



### Urban

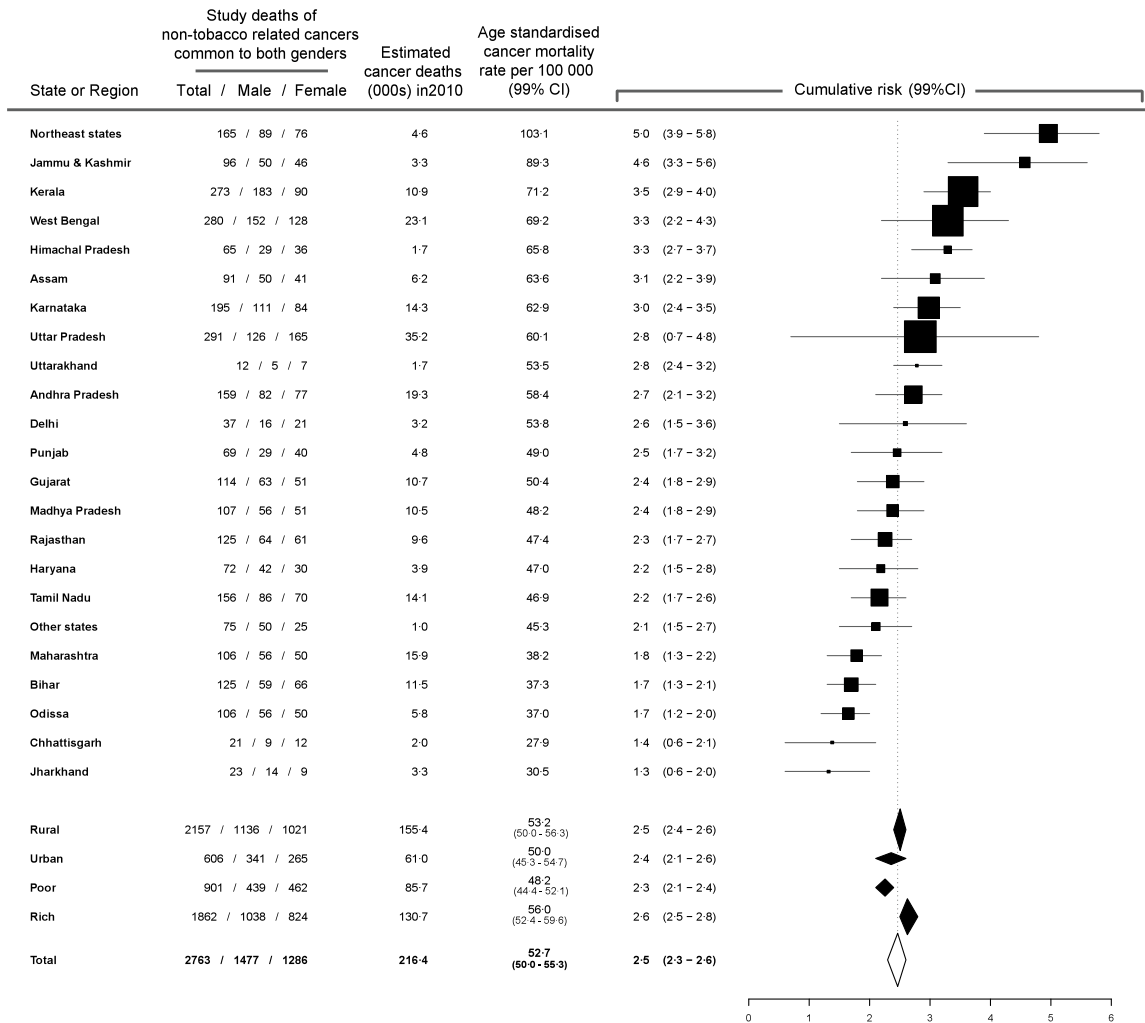
Cancer deaths in thousands=62, Cumulative Risk=4.9%

Cancer deaths in thousands=52, Cumulative Risk=4.2%



**Web figure 1: Causes of cancer mortality at ages 30-69 years in India, by gender and rural or urban residence, 2010**

Rates are standardised to the 2010 world population. The shaded line represents the proportions from cancers strongly related to tobacco use. See main text for definitions of cancer sites.



**Web figure 2: Variation in estimated deaths and cumulative risks from cancers excluding tobacco-related cancers, and gender-specific cancers for adults aged 30-69 years, combined across the states and regions of India.**

See Notes under Figure 1 for definitions of poorer and richer states and for tobacco-related cancers. The correlation of death rates for cancers between men and women was high ( $R^2=0.83$ ).

Age (yrs.)	Population
0 - 4	96 000
5 - 9	100 000
10 - 14	90 000
15 - 19	9000
20 - 24	8000
25 - 29	8000
30 - 34	6000
35 - 39	6000
40 - 44	6000
45 - 49	6000
50 - 54	5000
55 - 59	4000
60 - 64	4000
65 - 69	3000
70+	4000

**Web table 1: World standard population, ref 18.**

	Million Death Study		Indian population-based cancer registries	
	Cancer deaths	(%)	Cancer deaths	(%)
<b>Male</b>				
Lip, oral cavity and pharynx	543	(34•6)	1614	(27•9)
Stomach	361	(23•0)	772	(13•3)
Larynx, trachea and lung	314	(20•0)	1779	(30•7)
Liver	177	(11•3)	533	(9•2)
Lymphoid and haematopoietic	173	(11•0)	1088	(18•8)
Total	1568	(100)	5786	(100)
<b>Female</b>				
Cervical	391	(28•2)	1297	(31•6)
Stomach	338	(24•4)	392	(9•5)
Breast	240	(17•3)	1880	(45•8)
Lip, oral cavity and pharynx	238	(17•2)	536	(13•1)
Ill-defined digestive	179	(12•9)	-	-
Total	1386	(100)	4105	(100)

**Web table 2.1: Comparison of top 5 cancer sites in MDS and Indian population-based cancer registries, for ages 30-69 years.**

Note: Spearman's rank correlation coefficient for all cancers: males,  $r_s=0.76$ ,  $p<0.0028$ ; females,  $r_s=0.56$ ,  $p=0.0463$

	Million Death Study(Urban)¶		Indian population-based cancer registries	
	Cancer deaths	(%)	Cancer deaths	(%)
<b>Male</b>				
Lip, oral cavity and pharynx	31	(19•7)	1464	(17•1)
Stomach	18	(11•5)	664	(7•8)
Larynx, trachea and lung	22	(14•0)	1481	(17•3)
Liver	5	(3•2)	500	(5•8)
Lymphoid and haematopoietic	9	(5•7)	863	(10•1)
Other cancers	72	(45•9)	3586	(41•9)
Total male cancers	157	(100)	8558	(100)
<b>Female</b>				
Cervical and uterine	32	(20•0)	1192	(15•6)
Stomach	21	(13•1)	344	(4•5)
Breast	26	(16•3)	1715	(22•4)
Lip, oral cavity and pharynx	8	(5•0)	501	(6•5)
Ill-defined digestive	4	(2•5)	-	-
Other cancers	69	(43•1)	3908	(51•0)
Total female cancers	160	(100)	7660	(100)

**Web table 2.2: Comparison of top 5 cancer sites in MDS (urban) and Indian population-based cancer registries.**

¶ - Includes all cancer deaths, ages 30 to 69, in urban areas of Karnataka, Kerala, Maharashtra and Tamil Nadu.

Cancer sites	Cancer mortality rate per 100 000		
	Indian population-based cancer registries (direct)*	Indian population-based cancer registries (estimated)**	Million Death Study (all urban areas)
	<b>Males</b>		
C00-C14 (Oral, pharynx, lip)	7•67	21•65	22•8
C16 (Stomach)	2•68	7•76	8•7
C32-34 (Lung/trachea)	7•99	15•53	13•8
	<b>Females</b>		
C00-C14 (Oral, pharynx, lip)	4•18	9•11	7•7
C16 (Stomach)	2•55	4•85	11•4
C50 (Breast)	14•18	28•66	9•8
C53 (Cervix)	5•97	13•70	11•4

**Web table 2.3: Calculation of cancer mortality rate in Indian population-based cancer registries by two different methods, and comparison to Million Death Study, for ages 30-69.**

\* Calculated by using number of recorded deaths in age group 30-69 for each cancer category, for Chennai and Mumbai combined.

\*\* Estimated by using formula  $M=I*(1-S)$ , where M is mortality rate, I is incidence rate, and S is 5 year relative survival, for Mumbai & Chennai combined. This method is similar to that used in GLOBOCAN estimates.

Note: Relative survival for laryngeal cancer could not be recorded in the Chennai registry. Overall, these results suggest good agreement with the urban cancer mortality rates seen in the MDS in Table 2. For women, good agreement was seen for cervix but not for stomach or breast cancer mortality in the MDS in Table 2. However, the rates for breast cancer for Mumbai and Chennai will be much higher in these metros compared to many other small towns, which are included under the label “urban” in MDS study. The MDS is representative of urban areas while urban areas in registries are limited to the metros of large cities.

Age in years	Estimated cancer death rate per 100,000 (99% CI)				Cumulative risk (%) (99% CI)**			
	Male		Female		Male		Female	
0 - 14*	5•5	(4•3 - 6•6)	3•2	(2•2 - 4•2)	0•08	(0•06 - 0•10)	0•05	(0•04 - 0•06)
15 - 19	6•2	(5•9 - 6•4)	6•9	(6•6 - 7•2)	0•11	(0•07 - 0•15)	0•08	(0•05 - 0•11)
20 - 24	7•8	(7•5 - 8•1)	8•1	(7•8 - 8•4)	0•15	(0•10 - 0•20)	0•12	(0•08 - 0•16)
25 - 29	11•7	(11•3 - 12•1)	9•7	(9•3 - 10•1)	0•21	(0•15 - 0•27)	0•17	(0•12 - 0•22)
30 - 34	22•0	(21•4 - 22•5)	20•6	(20•0 - 21•1)	0•32	(0•25 - 0•39)	0•27	(0•21 - 0•33)
35 - 39	27•3	(26•6 - 27•9)	35•1	(34•4 - 35•9)	0•46	(0•36 - 0•56)	0•45	(0•36 - 0•54)
40 - 44	37•0	(36•2 - 37•8)	52•6	(51•6 - 53•6)	0•64	(0•52 - 0•76)	0•71	(0•59 - 0•83)
45 - 49	59•5	(58•4 - 60•6)	89•7	(88•3 - 91•1)	0•94	(0•79 - 1•09)	1•16	(0•99 - 1•33)
50 - 54	119•6	(117•9 - 121•3)	114•6	(112•9 - 116•3)	1•54	(1•34 - 1•74)	1•73	(1•49 - 1•97)
55 - 59	167•2	(165•0 - 169•3)	162•3	(160•1 - 164•4)	2•37	(2•08 - 2•66)	2•54	(2•22 - 2•86)
60 - 64	229•1	(226•1 - 232•2)	184•6	(181•9 - 187•4)	3•52	(3•10 - 3•94)	3•47	(3•01 - 3•93)
65 - 69	282•3	(278•3 - 286•3)	218•9	(215•5 - 222•3)	4•93	(4•37 - 5•49)	4•56	(3•99 - 5•13)
70 - 74	342•9	(337•6 - 348•2)	209•5	(205•6 - 213•3)	6•64	(5•79 - 7•49)	5•61	(4•70 - 6•52)
75+	436•5	(430•7 - 442•3)	312•1	(307•6 - 316•6)				
All ages*	58•5	(56•0 - 61•0)	51•6	(49•3 - 53•9)	6•64	(6•36 - 6•92)	5•61	(5•36 - 5•86)
30 - 69*	97•6	(92•5 - 102•7)	95•1	(90•1 - 100•2)	4•72	(4•48 - 4•96)	4•39	(4•16 - 4•62)
Rural*	95•6	(89•6 - 101•7)	96•6	(90•7 - 102•6)	4•63	(4•36 - 4•90)	4•46	(4•20 - 4•72)
Urban*	102•4	(92•7 - 112•1)	91•2	(81•9 - 100•5)	4•94	(4•42 - 5•46)	4•21	(3•73 - 4•69)
Poorer states*	83•3	(76•2 - 90•5)	87•1	(79•8 - 94•3)	3•30	(3•03 - 3•64)	3•50	(3•17 - 3•80)
Richer states*	108•5	(101•3 - 115•8)	101•2	(94•3 - 108•1)	4•30	(4•08 - 4•60)	4•00	(3•79 - 4•31)

**Web table 3: Estimated cancer death rate, cumulative risk and their confidence intervals for male and female.**

\* - Age standardized cancer death rate, with rates standardized to the world population;

\*\* Cumulative risk for "All ages" was calculated by summing the risk from 0 to 74 years, yielding the probability of death from cancer if there were no other causes of death.

	Study cancer deaths, 2001- 03				All India, 2010					
	Rural	Urban	Total	Two coders agreed	Age standardized cancer mortality rate per 100,000 (99% CI)					
					Rural	Urban	Total			
<b>Male</b>										
Lip, oral cavity and pharynx	411	132	543	335	21.8	(18.9 - 24.8)	22.8	(18.3 - 27.3)	22.1	(19.7 - 24.6)
Stomach	296	65	361	213	13.9	(11.6 - 16.3)	8.7	(5.8 - 11.5)	12.5	(10.6 - 14.3)
Larynx, trachea and lung	238	76	314	173	10.7	(8.6 - 12.8)	13.8	(10.1 - 17.5)	11.6	(9.8 - 13.4)
Liver	127	50	177	141	6.4	(4.8 - 7.9)	7.9	(5.2 - 10.6)	6.8	(5.4 - 8.1)
Oesophagus	116	37	153	76	5.7	(4.1 - 7.2)	6.9	(4.3 - 9.5)	6.0	(4.7 - 7.3)
Ill-define digestive	112	33	145	34	5.8	(4.3 - 7.3)	6.3	(3.8 - 8.8)	5.9	(4.6 - 7.2)
Lymphoid and haematopoietic	132	41	173	141	5.6	(4.2 - 7.0)	6.3	(3.9 - 8.7)	5.8	(4.6 - 7.0)
Eye and brain	118	37	155	127	4.6	(3.4 - 5.8)	7.5	(4.8 - 10.2)	5.3	(4.2 - 6.5)
Other cancers	73	18	91	26	3.6	(2.4 - 4.7)	2.9	(1.2 - 4.6)	3.4	(2.4 - 4.4)
Bone	58	19	77	49	3.2	(2.0 - 4.3)	3.2	(1.4 - 5.0)	3.2	(2.2 - 4.1)
Colorectal	55	22	77	43	2.9	(1.9 - 4.0)	2.8	(1.3 - 4.3)	2.9	(2.0 - 3.7)
Other digestive organs	33	14	47	29	1.7	(0.9 - 2.5)	2.7	(1.2 - 4.2)	2.0	(1.3 - 2.7)
Urinary tract	42	12	54	39	2.0	(1.2 - 2.9)	1.8	(0.5 - 3.1)	2.0	(1.3 - 2.7)
Ill-defined, secondary and unspecified sites	158	48	206	89	7.7	(6.0 - 9.4)	8.8	(6.0 - 11.7)	8.1	(6.6 - 9.5)
Sub total of tobacco related cancer†	800	255	1055	588	39.9	(35.9 - 43.9)	45.0	(38.5 - 51.5)	41.4	(38.0 - 44.8)
Sub total of infection related cancer‡	423	115	538	354	20.3	(17.5 - 23.1)	16.6	(12.7 - 20.5)	19.2	(17.0 - 21.5)
Total male	1964	604	2573	1515	95.6	(89.6 - 101.7)	102.4	(92.7 - 112.1)	97.6	(92.5 - 102.7)
<b>Female</b>										
Cervical & uterine	317	74	391	324	16.6	(14.2 - 19.1)	14.7	(10.7 - 18.7)	16.0	(13.9 - 18.1)
Stomach	282	56	338	186	14.3	(12.0 - 16.6)	11.4	(7.9 - 14.8)	13.5	(11.6 - 15.5)
Breast	178	62	240	203	9.2	(7.4 - 11.0)	9.8	(6.8 - 12.8)	9.4	(7.8 - 10.9)
Lip, oral cavity and pharynx	196	42	238	159	9.9	(8.0 - 11.8)	7.7	(5.0 - 10.4)	9.4	(7.8 - 10.9)
Ill-define digestive	156	23	179	43	8.8	(7.0 - 10.6)	3.6	(2.0 - 5.3)	7.4	(6.0 - 8.8)
Lymphoid and haematopoietic	133	38	171	138	6.3	(4.7 - 7.8)	5.9	(3.5 - 8.3)	6.1	(4.8 - 7.4)
Other cancers	114	39	153	84	5.4	(4.0 - 6.8)	7.9	(5.1 - 10.7)	6.0	(4.8 - 7.3)
Liver	112	33	145	116	5.7	(4.3 - 7.2)	5.1	(2.9 - 7.2)	5.6	(4.4 - 6.8)
Eye and brain	76	32	108	80	3.7	(2.5 - 4.8)	6.2	(3.8 - 8.5)	4.4	(3.3 - 5.4)
Larynx, trachea and lung	80	27	107	64	3.8	(2.6 - 5.0)	4.0	(2.2 - 5.8)	3.9	(2.9 - 4.9)



Oesophagus	63	25	88	52	2.9	(1.9 - 4.0)	4.8	(2.7 - 6.9)	3.4	(2.5 - 4.3)
Colorectal	51	11	62	36	2.8	(1.8 - 3.9)	2.5	(0.9 - 4.1)	2.7	(1.8 - 3.6)
Other digestive organs	33	12	45	26	1.6	(0.9 - 2.4)	1.2	(0.2 - 2.2)	1.5	(0.9 - 2.1)
Ill-defined, secondary and unspecified sites	116	34	150	65	5.6	(4.1 - 7.0)	6.3	(3.8 - 8.9)	5.8	(4.5 - 7.0)
Sub total of tobacco related cancer†	357	100	457	283	17.5	(15.0 - 20.1)	17.6	(13.6 - 21.5)	17.6	(15.4 - 19.7)
Sub total of infection related cancer‡	711	163	874	626	36.7	(33.0 - 40.4)	31.2	(25.5 - 36.8)	35.1	(32.0 - 38.2)
Total female	1907	508	2415	1576	96.6	(90.7 - 102.6)	91.2	(81.9 - 100.5)	95.1	(90.1 - 100.2)

**Web table 4: Site specific age standardized cancer mortality rates for rural/ urban India, 2010.**

† Tobacco related cancer includes oral, lung, oesophagus and other respiratory cancers, ‡ Infectious related cancer includes stomach, liver and (for females) cervical. \* Age-standardised cancer mortality rates and their standard errors use the method of IARC, based on the cancer mortality rate, world population weights, and the number of deaths observed.

## **MILLION DEATH STUDY COLLOBORATORS**

### **Indian Academic Partners (in alphabetical order):**

1. Department of Community Medicine Gujarat Medical College, Ahmedabad: DV Bala, P Seth KN Trivedi
2. Department of Community Medicine Kolkatta Medical College, Kolkatta: SK Roy
3. Department of Community Medicine Regional Institute of Medical Sciences, Imphal: L Usharani
4. Department of Community Medicine S.C.B. Medical College Cuttack, Orissa: Dr. B Mohapatra
5. Department of Community Medicine SMS Medical College Jaipur: AK Bharadwaj, R Gupta
6. Epidemiological Research Center, Chennai: V Gajalakshmi, CV Kanimozhi
7. Gandhi Medical College, Bhopal: RP Dikshit, S Sorangi
8. Healix-Seskarhia Institute of Public Health, Navi Mumbai: PC Gupta, MS Pednekar, S Sreevidya
9. Indian Institute of Health & Family Welfare, Hyderabad: P Bhatia
10. St. John's Academy of Health Sciences, Bangalore: A Kurpad, P Mony, M Vaz, R Jotkar, S Rao-Seshadri, S Srinivasan, A Shet, AS Shet, D Xavier, S Rathi
11. King George Medical College, Lucknow: S Awasthi
12. Najafgarh Rural Health Training Centre Ministry of Health Government of India, New Delhi: N Dhingra, J Sudhir, I Rawat (until 2007)
13. Regional Medical Research Center, ICMR Institute, Bhubaneswar: AS Karketta, SK Dar
14. School of Preventative Oncology, Patna: DN Sinha
15. School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh: N Kaur, R Kumar, JS Thakur
16. Tata Memorial Cancer Hospital, Mumbai: RA Badwe, RP Dikshit, M Mallath

### **Lead Partners:**

1. Office of the Registrar-General India, RK Puram, New Delhi India: C Chandramouli (Registrar General of India [RGI]), RC Sethi, B Mishra, S Jain (until 2008), DK Dey (until 2009), AK Saxena, MS Thapa, N Kumar, JK Banthia and DK Sikri (former RGIs)
2. Million Death Study Coordinating, Centre for Global Health Research (CGHR), Li Ka Shing Knowledge Institute, St. Michael's Hospital, Dalla Lana School of Public Health, University of Toronto, Canada: P Jha (Principal Investigator), S Gambhir, R Jotkar, R Kamadod, B Pezzack, S Rao-Seshadri, P Rodriguez, P Sati, J Sudhir, C Ramasundarahettige, W Suraweera

### **Affiliated Partners:**

1. Indian Council of Medical Research, New Delhi India: VM Katoch (Director General or DG from 2008), NK Ganguly (DG to 2008), L Kant, B Bhattacharya, B Shah, DK Shukla
2. World Health Organisation, Geneva and SEARO Office, New Delhi: T Boerma, A Fric, S Habayeb (former WHO Representative-India), S Khanum, CD Mathers, DN Sinha, N Singh, P Singh (Deputy Regional Director)
3. Clinical Trial Service Unit and Epidemiological Studies Unit (CTSU), University of Oxford, England: N Bhala, J Boreham, R Peto, G Whitlock