Supplementary webappendix: Changes in cause-specific neonatal and 1-59 month child mortality in India from 2000 to 2015: nationally-representative mortality study of 1.3 million homes

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

A. <u>Sub-national estimates of live births and child (under-five) mortality in India, 2000-2015</u>
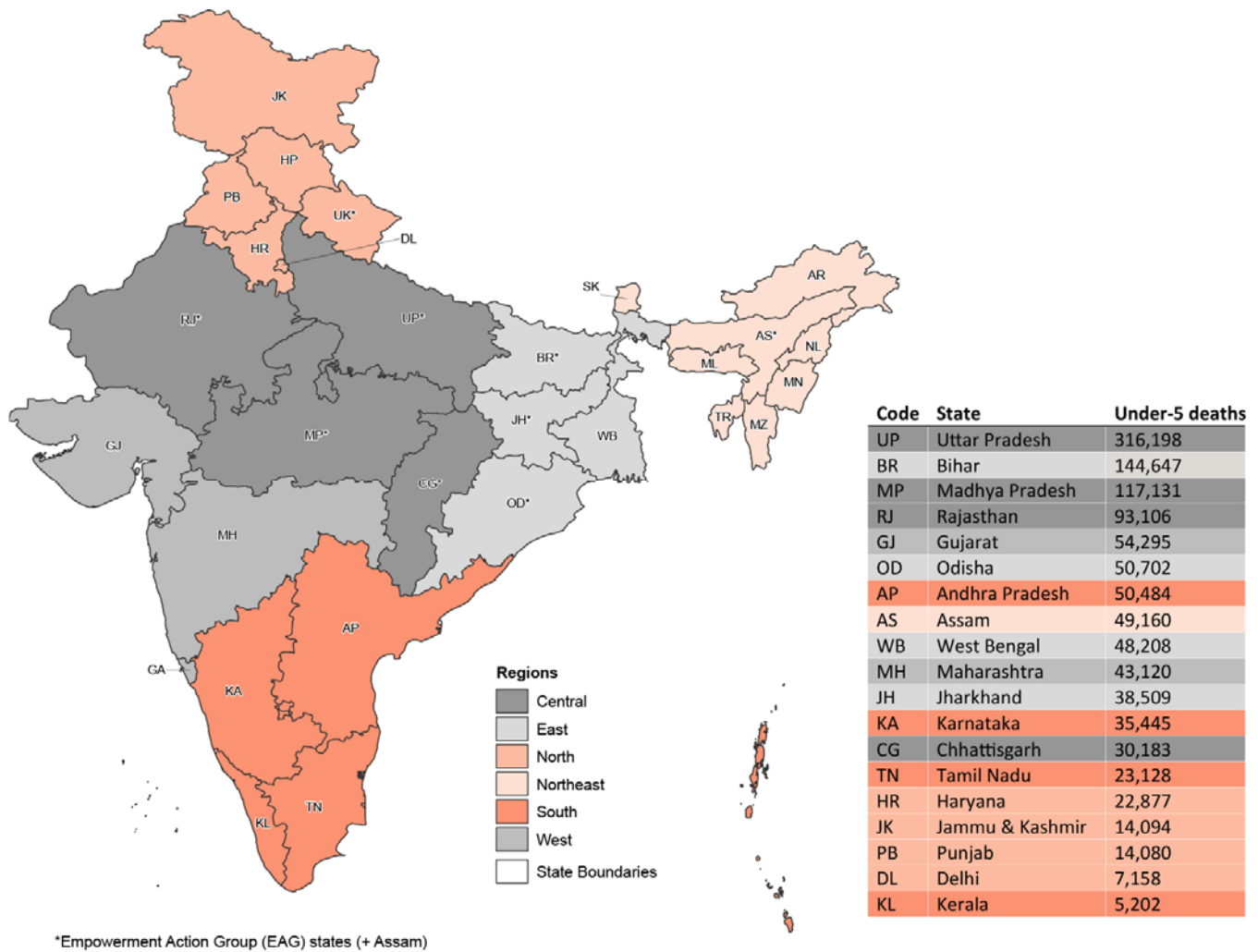The MDS intends to provide temporal trends of cause-specific mortality for 16 years (from 2000 to 2015) based on 2001-2013 verbal autopsy data. We undertook specific procedures to manage the input data quality and smooth the expected noise in annual data. The demographic framework previously published along with causes of neonatal and child mortality estimates for 2005 were based on aggregated 2001-2003 MDS data.[1]

India's SRS has continuously monitored births and deaths vital statistics since 1971 from its nationally representative samples, and the MDS has monitored the causes of death since 2001 within the Sample Registration System (SRS).[2] The United Nations Population Division (UNPD) and the United Nations Inter-agency Group for Child Mortality Estimation's (IGME) national estimates were partitioned for each of India's 35 states and union territories (UT) by using the population data from 1991-2011 Censuses of India and vital statistics from the SRS.[2-4] (appendix figure 1) To obtain a consistent smooth periodic trend, we used SRS data from 1998 onwards to calculate three-year backward moving averages for live births and under-five mortality for 2000 onwards to 2014. For 2014 and 2015 years we used backward moving averages of 2013 to 2014.

SRS vital statistics, sex ratio at birth, proportion of infant deaths that occur in the neonatal period, infant mortality rates, and under-five mortality rates are available for bigger states, which have more than ten million residents.(There are no official SRS estimates for Telangana, a new state established in 2014 as a partition of Andhra Pradesh. SRS vital statistics are not published for smaller states. For these states we used the estimates from an adjacent big state as follows:
- Haryana for Chandigarh
- Uttar Pradesh for Uttaranchal
- Assam for each of Sikkim, Arunachal Pradesh, Nagaland, Manipur, Tripura and Mizoram
- Gujarat for each of Daman-Diu and Dadra & Nagar Haveli
- Maharashtra for Goa
- Kerala for Lakshadweep
- Tamil Nadu for Pondicherry
- Karnataka for A&N Islands

We use SRS rates for our sub-national mortality envelopes (adjusted to the UN estimated national totals) because SRS has been independently judged to have better ascertainment rates than the National Family Health Surveys (NFHS) and District Level Household Surveys (DLHS) in India.[5-7] In contrast to these surveys, the SRS uses a continuous registration method with dual ascertainment of events in contrast to single retrospective review of child births and deaths and provides corresponding death rates for adults. Exceptions were made for states for which SRS data were not available or inconsistent. Specifically, we used estimated values from a fitted regression on pooled data from SRS vital rates, NFHS-3 and DLHS-2 rates for Jharkhand and Chhattisgarh, which became new states in 2001. For Jammu & Kashmir and Delhi, the 2004 SRS rate were used for prior years because SRS did not report reliable rates prior to 2004. Slight differences between current estimates for 2001-2003 in this publication and those from our previously published are due to updates in records.[1]

Code	State	Under-5 deaths
UP	Uttar Pradesh	316,198
BR	Bihar	144,647
MP	Madhya Pradesh	117,131
RJ	Rajasthan	93,106
GJ	Gujarat	54,295
OD	Odisha	50,702
AP	Andhra Pradesh	50,484
AS	Assam	49,160
WB	West Bengal	48,208
MH	Maharashtra	43,120
JH	Jharkhand	38,509
KA	Karnataka	35,445
CG	Chhattisgarh	30,183
TN	Tamil Nadu	23,128
HR	Haryana	22,877
JK	Jammu & Kashmir	14,094
PB	Punjab	14,080
DL	Delhi	7,158
KL	Kerala	5,202

Regions
- Central
- East
- North
- Northeast
- South
- West
- State Boundaries

*Empowerment Action Group (EAG) states (+ Assam)

Appendix Figure 1. States and major regions of India and estimated child (under-five) deaths for big states in 2015.

State-level, gender and urban/rural estimates of live births, neonatal deaths and deaths at ages 1-59 months were calculated for each year from 2000 to 2015. The calculations were adjusted to reflect the UNPD estimates for live births and IGME's estimates for neonatal, infant, and under-five deaths in India for the period 2000-2015 as follows:

1.   Live births
We used census projections of India's population for 1991, 2001, and 2011 to interpolate annual population by five-year age groups and by gender for rural and urban areas of each state yielding 140 strata for 35 states and UT. The annual national population was multiplied by annual SRS crude birth rates multiplied by the SRS sex ratios. The resulting total numbers of live births by gender were then adjusted to reflect the UNPD gender-specific totals for India and then proportionately redistributed for each stratum.

2.   Under-five child deaths
2.1 Infant deaths
We estimated total infant deaths by multiplying annual live birth estimates by the corresponding SRS infant mortality rates.

No SRS infant mortality rate estimates were available for the following small states: Arunachal Pradesh, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Goa, Lakshadweep, Manipur, Meghalaya, Mizoram, Nagaland, Pondicherry, Sikkim, Tripura, Uttarakhand and A & N Islands. Thus, the relevant reference big state's infant mortality rate was applied to the small states as described above in Section A. Urban and rural deaths were determined in proportion to SRS urban and rural deaths. These estimates were finally adjusted to reflect the UN IGME infant mortality estimates for India.

2.2 Neonatal deaths
We calculated total neonatal deaths by multiplying the total infant deaths from step (2.1) by the proportion of neonatal to infant mortality rates (at the state level and by urban/rural area) reported by the SRS. We adjusted these estimates to reflect the IGME neonatal mortality estimates for India. To stratify by gender, weighted male to female death proportions from the MDS were calculated using three yearly backward moving averages. Gender specific death totals in each state were then multiplied by the corresponding urban to rural ratio of SRS neonatal mortality rates.

2.3 Child -under 5 deaths (0-4 years)
SRS mortality estimates for total child deaths do not use live births as a denominator. Therefore, under-five deaths were estimated for each year from 2000 to 2015 using the following steps:
(a)   From the annual census projections of the population of India[2,3] the under-five age population, by gender for each urban and rural area of each state, was extracted and was adjusted to reflect the gender-specific under-five UNPD population estimates for India.[4]
(b)   To calculate the under-five deaths, we multiplied the population of each urban and rural area of each state by the corresponding gender specific SRS crude death rates and then adjusted these to IGME under-five death totals for corresponding years.

2.3   Other age groups
(a)   Total deaths between 29 days and one year were calculated by subtracting the neonatal deaths from step (2.2) from the infant deaths from step (2.1).
(b)   Total deaths at ages 1-59 months were calculated by subtracting the neonatal deaths in step (2.2) from the under-five deaths of step (2.3).

3.   Mortality rates
Mortality rates for neonates, for children at ages 1-59 months and for children under-five years were calculated for both genders and for urban and rural areas of each state using the adjusted estimates of total deaths and live births described above. We used simple annual rates of change to compare three six-year periods corresponding to the years prior to the NHM (2000-2005), roll out phase of the NHM programs (2005-2010) and post-NHM implementation (2010-2015):

$$\text{Average annual percent change} = \text{Average}((Y_2-Y_1)/Y_2, (Y_3-Y_2)/Y_2, (Y_4-Y_3)/Y_4, (Y_5-Y_4)/Y_4, (Y_6-Y_5)/Y_5))*100$$

Uncertainty in the underlying demographic estimates
The major source of uncertainty in the regional and gender variation in cause-specific mortality rates in this study is the cause of death proportion. The UN annual estimates of total number of live births and deaths by country are widely accepted and the corresponding uncertainty bounds are also made available by the UNPD and IGME. The SRS does not publish uncertainty bounds for each state by residence type, and without those, sub-national uncertainty estimates cannot be generated.

B. ICD-10 Classification of neonatal deaths and deaths at ages 1-59 months
Three-character International Classification of Diseases (ICD-10)[8] codes were assigned to each child death; inconsistencies in coding (after adjudication) were revised and, if necessary, re-classified with input from the Child Health and Epidemiology Reference Group (CHERG).[9] Two classification systems were developed for the causes of neonatal deaths (appendix box 1) and deaths among children aged 1-59 months (appendix box 2).

Infections during the neonatal period are difficult to classify using verbal autopsy, given the large overlap in symptoms and signs during the neonatal period, and especially during the first 1-2 weeks of life, when most of these deaths occurred. For this reason, neonatal pneumonias, sepsis and CNS infections are combined under a common category 'Neonatal infections'. Similarly, given the difficulty in separating prematurity from low birthweight outside hospital settings, these two conditions are kept together as the category 'Prematurity/ low birthweight'.

Specific rules were used when assigning final cause of death to neonatal tetanus. Deaths coded as tetanus (A33) before the

third day of life were re-classified according to the alternative ICD-10 codes assigned either by the physicians during the coding process or available keywords to either bacterial sepsis of the newborn (P36), central nervous system infections (A80-A89) or birth asphyxia/trauma (P21, P10-P15).

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Box 1: Cause of death classification for neonates

Disease	ICD-10 range
Communicable, perinatal and nutritional conditions	
Prematurity/low birthweight	P01, P05, P07, P22, P25-P28, P52, P61, P77, R04
Birth asphyxia/trauma	P00, P02, P03, P10-P15, P20, P21, P24, P29, P50, P90, P91
Neonatal infections	
Neonatal pneumonia	A37, H65-H68, H70, H71, J00-J22, J32, J36, J85, J86, P23, U04
Meningitis/encephalitis	A39, A81-A89, G00-G09
Sepsis	A20-A28, A32, A38, A40-A44, A46, A48, A49, A68-A70, A74, A75, A77-A79, B95, B96, H10, H60, I30, I32-I33, I39-I41, K65, K67, K81, L00-L04, L08, M00-M01, M60, M86, N10, N30, N34, N41, N49, N61, P35-P39
Tetanus	A33-A35
Other conditions	
Diarrhoea	A00-A09
Poliomyelitis	A80, B91
Measles	B01, B05
Malaria	B50-B54
Other infectious and parasitic diseases	A15-A19, A30-A31, A36, A50-A67, A71, A90-A99, B00, B02-B04, B06-B09, B15-B27, B30, B33-B49, B55-B60, B64-B83, B85-B90, B92, B94, B97, B99, J65, K04, K05, K61, N70-N74, R50, R75, U00, Y95
Nutritional	D50-D53, E00-E02, E40-E46, E50-E56, E59-E61, E63, E64, X53-X54
Other perinatal conditions	P96
Non-communicable diseases	
Congenital	G10-G99, Q00-Q99
Non-communicable	C00-C97, D01-D48, D55-D89, E03-E35, E65-E90, F00-F99, H00-H06, H11-H59, H61-H62, H69, H72-H95, I00-I28, I31, I34-I38, I42-I99, J30, J31, J33-J35, J37-J47, J60, J64, J66-J70, J80-J82, J84, J90-J99, K00-K03, K06-K60, K62-K63, K70-K80, K82-K93, L05, L10-L99, M02-M54, M61-M85, M87-M99, N00-N08, N11-N29, N31-N33, N35-N40, N42-N48, N50-N51, N60, N62-N64, N75-N99, P04, P08, P51, P53-P60, P70-P72, P74-P76, P78, P80-P83, P92-P94, R00, R01, R03, R05, R06, R11-R23,R26, R27, R29-R36, R39-R49, R55, R56, R59, R63, R70-R74, R76-R77, R80-R82, R84-R87, R90, R91
Injuries	S00-S99, T00-T98, V01-V99, W00-W99, X00-X52, X57-X99, Y00-Y91, Y97-Y98
Ill-defined or cause unknown	R02, R07, R09, R10, R25, R51-R54, R57-R58, R60-R62, R64, R68, R69, R78, R79, R83, R89, R92-R99

Box 2: Cause of death classification for deaths at 1-59 months

Disease	ICD-10 range
Communicable, perinatal and nutritional conditions	
Pneumonia	A37, H65-H68, H70, H71, J00-J22, J32, J36, J85, J86, P23, U04
Diarrhoea	A00-A09
Acute bacterial sepsis and severe infections	A20-A28, A32, A38, A40-A44, A46, A48, A49, A68-A70, A74, A75, A77-A79, B95, B96, H10, H60, I30, I32, I33, I39-I41, K65, K67, K81, L00-L04, L08, M00-M01, M60, M86, N10, N30, N34, N41, N49, N61, P36, P38
Measles	B01, B05
Malaria	B50-B54
Meningitis/encephalitis	A39, A81-A89, G00-G09
Other infections	
Tuberculosis	A15-A19, B90, J65
Tetanus	A33-A35
Poliomyelitis	A80, B91
HIV/AIDS	B20-B24, R75
Other infectious and parasitic diseases	A30, A31, A36, A50-A67, A71, A90-A99, B00, B02-B04, B06-B09, B15-B19, B25-B27, B30, B33-B49, B55-B60, B64-B83, B85-B89, B92, B94, B97, B99, K02, K04, K05, K61, N70-N74, P35, P37, P39, U00, Y95
Fever of unknown origin	R50
Nutritional	D50-D53, E00-E02, E40-E46, E50-E56, E59-E61, E63, E64, X53-X54
Perinatal conditions	P00-P04, P05-P07, P10-P15, P20-P22, P24-P29, P50, P52, P61, P77, P90-P91, P96
Non-communicable diseases	
Congenital	Q00-Q07, Q10-18, Q20-Q28, Q30-Q45, Q50-56, Q60-Q87, Q89-Q93, Q95, Q96-Q99
Non-communicable	C00-C97, D01-D48, D55-D89, E03-E35, E65-E90, F00-F99, G10-G99, H00-H06, H11-H59, H61-H62, H69, H72-H95, I00-I28, I31, I34-I38, I42-I99, J30, J31, J33-J35, J37-J47, J60, J64, J66-J70, J80-J82, J84, J90-J99, K00-K01,K03, K06-K60, K62-K63, K70-K80, K82-K93, L05, L10-L99, M02-M54, M61-M85, M87-M99, N00-N08, N11-N29, N31-N33, N35-N40, N42-N48, N50-N51, N60, N62-N64, N75-N99, P04, P08, P51, P53-P60, P70-P72, P74-P76, P78, P80-P83, P92-P94, R00, R01, R03-R05, R06, R11-R23, R26, R27, R29-R49, R55-R56, R59, R63, R70-R74, R76-R77, R80-R82, R84-R87, R90-R91
Injuries	S00-S99, T00-T98, V01-V99, W00-W99, X00-X52, X57-X99, Y00-Y91, Y97-Y98
Ill-defined or cause unknown	R02, R07, R09, R10, R25, R51-R54, R57-R58, R60-R62, R64, R68, R69, R78, R79, R83, R89, R92-R99

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

C. Additional results

Appendix Table 1: Annual study deaths by cause from the Million Death Study, India 2001-2013. A total of 94,309 under-five child deaths with verbal autopsies were coded by physicians.

Causes of death	Year													Total
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Neonatal (age 0-28 days)														
Prematurity/low birthweight	1100	1432	1099	1404	1852	1947	1941	1947	1979	1840	1714	1639	1575	21469
Neonatal infections*	1093	1039	751	891	986	869	780	747	725	723	590	586	572	10352
Birth asphyxia/trauma	681	800	592	764	811	774	697	670	517	503	414	469	400	8092
Non-communicable	190	208	161	288	336	356	347	304	316	267	207	266	241	3487
Congenital	116	139	104	167	227	221	235	220	198	139	123	164	141	2194
Diarrhoea	114	122	101	131	164	160	120	125	143	139	91	107	101	1618
Injuries	14	19	14	22	30	29	27	26	19	35	26	45	24	330
Tetanus	98	98	68	75	106	98	100	60	42	33	15	14	8	815
Other conditions†	16	13	5	32	30	47	37	49	50	26	25	33	24	387
Other perinatal conditions	175	207	179	269	360	344	373	252	200	180	150	167	125	2981
Ill-defined‡	31	67	46	63	38	46	56	52	36	28	23	18	23	527
All causes	**3628**	**4144**	**3120**	**4106**	**4940**	**4891**	**4713**	**4452**	**4225**	**3913**	**3378**	**3508**	**3234**	**52252**
1-59 months														
Pneumonia	1383	1164	885	867	1076	988	946	809	780	660	600	480	410	11048
Diarrhoea	1048	893	775	783	833	730	761	611	608	481	376	331	294	8524
Non-communicable	350	323	275	274	364	339	341	305	314	238	249	189	188	3749
Injuries	304	245	208	228	316	283	272	245	235	266	242	204	174	3222
Other infections§	391	290	249	315	460	448	351	341	320	301	248	221	158	4093
Congenital	94	116	95	130	144	149	169	152	124	105	110	109	107	1604
Nutritional	94	129	119	129	209	220	181	170	158	146	123	88	78	1844
Malaria	263	176	148	146	217	222	183	140	171	153	129	94	58	2100
Meningitis/encephalitis	168	125	148	184	185	154	148	130	126	93	71	60	58	1650
Acute bacterial sepsis and severe infections	109	173	78	82	56	60	51	33	37	35	25	26	19	784
Measles	319	225	214	110	123	130	88	93	73	39	34	25	13	1486
Perinatal conditions¶	89	96	78	131	30	4	8	9	7	2	4	-	-	458
Ill-defined‡	139	149	133	86	127	160	167	117	90	95	99	88	55	1495
All causes	**4751**	**4104**	**3405**	**3465**	**4140**	**3877**	**3666**	**3155**	**3043**	**2614**	**2310**	**1915**	**1612**	**42057**
Under-five all causes	**8379**	**8248**	**6525**	**7571**	**9080**	**8768**	**8379**	**7607**	**7268**	**6527**	**5688**	**5423**	**4846**	**94309**

Notes: *Neonatal infections are predominantly pneumonia, followed by sepsis and meningitis/encephalitis. †Other conditions for neonatal deaths include polio, measles, malaria, other infectious and parasitic diseases, and nutritional diseases. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. §Other infections for 1-59 months deaths include TB, tetanus, polio, HIV/AIDS, and other infectious and parasitic diseases. ¶Improvement in physician cause assignment reduced the number of deaths at ages 1-59 months misclassified as perinatal.

Appendix Table 2: Annualized mortality rate per 1000 live births in India, 2000-2015.

	Study deaths									Year							
	2001-13	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Live births (M)*		27·9	27·9	27·9	27·8	27·7	27·6	27·5	27·3	27·1	26·8	26·6	26·3	26·1	26·0	25·9	25·8
Neonatal	52252	**45·0**	**43·6**	**42·2**	**40·8**	**39·3**	**38·1**	**37·0**	**36·0**	**35·0**	**33·9**	**32·8**	**31·6**	**30·3**	**29·0**	**27·9**	**27·0**
(90% CI)		(42, 49)	(41, 47)	(39, 46)	(38, 44)	(37, 43)	(35, 41)	(34, 40)	(33, 39)	(32, 38)	(31, 37)	(30, 36)	(29, 35)	(28, 34)	(27, 33)	(25, 32)	(24, 32)
Girls	23208	41·1	39·8	39·6	38·3	37·4	36·8	35·1	34·1	32·5	31·9	31·1	29·5	27·9	26·8	26·2	26·8
Boys	29044	48·5	47·0	44·6	43·0	41·1	39·3	38·7	37·7	37·1	35·8	34·3	33·4	32·5	31·0	29·4	27·1
Rural	29044	49·7	48·1	46·7	45·1	43·7	42·4	41·2	40·3	39·4	38·4	37·2	36·0	34·8	33·4	32·1	31·1
Urban	23208	28·8	28·1	27·1	26·2	24·9	24·2	23·3	22·4	21·2	20·4	19·6	18·6	17·3	16·1	15·5	15·0
Poorer states†	29353	51·9	50·1	48·2	46·6	45·3	44·2	42·8	41·6	40·6	39·5	38·4	37·2	35·9	34·3	32·9	31·8
Richer states	22899	36·0	35·2	34·4	33·1	31·4	30·0	29·0	28·2	27·2	26·1	25·0	23·6	22·5	21·5	20·8	20·1
1-59 months	42057	**45·2**	**43·3**	**41·4**	**39·5**	**37·7**	**35·8**	**34·1**	**32·3**	**30·6**	**28·9**	**27·2**	**25·6**	**23·8**	**22·4**	**20·8**	**19·6**
(90% CI)		(43, 50)	(41, 47)	(39, 45)	(37, 43)	(35, 42)	(33, 40)	(31, 38)	(30, 36)	(28, 34)	(26, 32)	(24, 31)	(22, 29)	(20, 28)	(18, 27)	(16, 26)	(15, 26)
Girls	21841	54·2	52·1	49·0	46·8	43·7	41·2	39·7	38·0	36·6	34·3	32·1	30·5	28·7	26·7	24·3	21·2
Boys	20216	37·0	35·3	34·5	33·0	32·2	31·0	29·0	27·2	25·3	24·1	22·8	21·2	19·4	18·5	17·7	18·1
Rural	20216	49·6	47·6	45·2	42·9	41·0	39·5	38·0	36·0	33·9	31·6	29·6	27·5	25·3	23·6	22·0	20·9
Urban	21841	30·0	28·5	28·5	28·3	26·6	23·8	21·3	20·6	20·5	20·7	20·2	20·2	19·3	18·7	17·3	15·8
Poorer states	25565	56·2	53·9	51·2	48·6	46·0	44·2	42·4	40·1	37·8	35·6	33·8	31·7	29·4	27·6	25·8	24·4
Richer states	16492	31·0	29·6	28·6	27·7	26·6	24·5	22·7	21·6	20·8	19·6	18·1	17·2	16·0	14·9	13·8	12·6
Under-five	94309	**90·1**	**86·9**	**83·6**	**80·3**	**77·0**	**74·0**	**71·1**	**68·3**	**65·6**	**62·8**	**60·0**	**57·2**	**54·2**	**51·4**	**48·8**	**46·6**
(90% CI)		(88, 95)	(85, 91)	(81, 88)	(78, 84)	(75, 81)	(72, 78)	(69, 75)	(66, 72)	(62, 69)	(60, 66)	(57, 63)	(54, 61)	(51, 59)	(48, 57)	(45, 55)	(42, 53)
Girls	45049	95·3	91·9	88·6	85·1	81·1	78·0	74·9	72·0	69·1	66·1	63·2	60·0	56·6	53·5	50·5	48·0
Boys	49260	85·5	82·3	79·0	76·0	73·3	70·4	67·6	64·9	62·4	59·8	57·2	54·6	51·9	49·4	47·2	45·2
Rural	49260	99·3	95·7	91·8	88·0	84·7	81·9	79·2	76·3	73·3	70·0	66·8	63·5	60·1	57·0	54·2	51·9
Urban	45049	58·8	56·7	55·6	54·5	51·6	48·1	44·6	43·0	41·8	41·1	39·8	38·8	36·6	34·8	32·8	30·8
Poorer states	54918	108·1	104·0	99·4	95·2	91·3	88·4	85·2	81·7	78·3	75·2	72·2	68·9	65·2	61·9	58·7	56·2
Richer states	39391	67·1	64·8	63·0	60·8	58·0	54·6	51·8	49·8	47·9	45·7	43·1	40·8	38·5	36·4	34·6	32·7

Notes: *Sub-nationally estimated live births were adjusted to reflect total live births from UNPD estimates. Sub-nationally estimated neonatal, infant and under-five deaths were adjusted to reflect the total death from IGME estimates. The 90% uncertainty bounds for all-cause mortality are as per IGME estimates. †The poorer states are lower income states - Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh - where approximately half of India's population lives.

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

Appendix Table 3: Estimated annualized child deaths (thousands) in India, 2000-2015.

								Year								
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Live births (M)*	27·9	27·9	27·9	27·8	27·7	27·6	27·5	27·3	27·1	26·8	26·6	26·3	26·1	26·0	25·9	25·8
Neonatal	**1,254**	**1,216**	**1,176**	**1,134**	**1,092**	**1,054**	**1,017**	**982**	**946**	**910**	**871**	**831**	**793**	**753**	**722**	**696**
Girls	544·2	527·7	519·3	505·5	491·5	482·6	457·8	440·8	417·6	405·2	391·9	368·3	346·1	329·9	321·6	328·2
Boys	709·4	687·8	656·2	628·5	600·0	571·6	558·8	541·0	528·7	504·4	479·4	462·7	446·5	422·8	400·1	367·7
Rural	1,071·2	1,037·7	1,003·1	966·0	931·3	897·5	865·6	835·2	805·9	774·0	740·1	706·9	677·9	646·7	620·4	598·0
Urban	182·5	177·8	172·5	168·1	160·2	156·6	151·1	146·6	140·4	135·6	131·2	124·2	114·7	106·0	101·3	97·8
Poorer states†	813·5	786·5	759·1	734·5	717·3	700·8	679·6	658·2	637·9	616·4	593·9	572·2	548·7	522·4	500·2	483·0
Richer states	440·1	429·0	416·4	399·5	374·2	353·3	337·1	323·6	308·5	293·2	277·4	258·9	243·9	230·3	221·6	212·9
1-59 months	**1,259·5**	**1,206·4**	**1,152·6**	**1,099·3**	**1,044·9**	**990·3**	**936·7**	**882·0**	**829·2**	**775·4**	**723·8**	**674·8**	**622·2**	**580·9**	**539·0**	**505·1**
Girls	718·4	689·9	652·4	617·2	575·6	539·4	517·9	491·3	469·5	435·9	404·7	381·0	355·6	328·8	298·2	259·9
Boys	541·1	516·5	500·2	482·1	469·3	450·9	418·9	390·7	359·6	339·5	319·1	293·8	266·7	252·1	240·8	245·2
Rural	1,069·6	1,026·0	970·9	917·5	873·5	836·3	798·6	746·6	693·6	637·4	589·1	539·6	494·1	457·9	425·6	401·8
Urban	189·8	180·4	181·7	181·8	171·4	154·0	138·1	135·3	135·5	138·0	134·7	135·2	128·2	123·0	113·4	103·4
Poorer states	880·7	846·6	806·1	765·6	728·4	701·6	673·2	633·3	593·4	555·5	522·5	486·8	449·1	420·9	392·1	371·1
Richer states	378·7	359·8	346·5	333·6	316·5	288·7	263·5	248·6	235·8	219·9	201·3	188·0	173·1	159·9	146·9	134·0
Under-five	**2,513·1**	**2,421·9**	**2,328·1**	**2,233·3**	**2,136·4**	**2,044·5**	**1,953·4**	**1,863·8**	**1,775·5**	**1,685·0**	**1,595·1**	**1,505·9**	**1,414·8**	**1,333·6**	**1,260·8**	**1,201·0**
Girls	1,262·6	1,217·6	1,171·7	1,122·7	1,067·1	1,022·0	975·7	932·1	887·2	841·1	796·6	749·4	701·7	658·7	619·9	588·1
Boys	1,250·5	1,204·3	1,156·4	1,110·6	1,069·3	1,022·5	977·7	931·7	888·3	843·9	798·5	756·5	713·2	674·9	640·9	612·9
Rural	2,140·8	2,063·7	1,973·9	1,883·4	1,804·9	1,733·8	1,664·2	1,581·8	1,499·5	1,411·4	1,329·2	1,246·5	1,171·9	1,104·6	1,046·0	999·8
Urban	372·3	358·2	354·2	349·9	331·5	310·6	289·2	282·0	276·0	273·7	265·9	259·4	242·9	228·9	214·8	201·2
Poorer states	1,694·3	1,633·1	1,565·2	1,500·1	1,445·8	1,402·5	1,352·8	1,291·5	1,231·2	1,172·0	1,116·4	1,059·0	997·8	943·3	892·3	854·1
Richer states	818·9	788·8	762·9	733·2	690·7	642·0	600·6	572·3	544·3	513·1	478·7	446·9	417·0	390·3	368·5	346·9

Notes: *Sub-nationally estimated live births were adjusted to reflect total live births from UNPD estimates. Sub-nationally estimated neonatal, infant and under-five deaths were adjusted to reflect the total death from IGME estimates. †The poorer states are lower income states - Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh - where approximately half of India's population lives

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

Appendix Table 4: Annual cause-specific mortality rate per 1000 live births in India, 2000-2015.

Causes of death	Study deaths	2000		2005		2010		2015		Annualized Percent Change[l] 2000-05	2005-10	2010-15
Neonatal												
Prematurity/low birthweight	21,469	12·3	(8·9, 14·6)	12·5	(9·1, 14·9)	14·3	(10·5, 17·0)	14·3	(10·5, 17·0)	0·4	2·8	0·0
Neonatal infections*	10,352	11·9	(6·7, 16·1)	8·1	(4·5, 10·9)	5·7	(3·2, 7·7)	4·0	(2·2, 5·4)	-7·5	-6·7	-6·8
Birth asphyxia/trauma	8,092	9·0	(4·0, 12·4)	6·5	(2·8, 8·8)	3·9	(1·7, 5·4)	2·2	(1·0, 3·0)	-6·5	-9·4	-10·9
Non-communicable	3,487	2·4	(1·2, 3·6)	2·5	(1·2, 3·7)	2·2	(1·1, 3·3)	2·0	(1·0, 2·9)	0·7	-2·2	-2·1
Congenital	2,194	1·8	(1·1, 2·3)	1·7	(1·0, 2·1)	1·4	(0·8, 1·8)	1·1	(0·6, 1·4)	-2·0	-3·3	-5·1
Diarrhoea	1,618	1·6	(1·2, 1·9)	1·4	(1·0, 1·7)	1·3	(0·9, 1·5)	1·1	(0·8, 1·3)	-2·5	-2·0	-3·2
Injuries	330	0·3	(0·1, 0·4)	0·4	(0·2, 0·5)	0·3	(0·2, 0·4)	0·5	(0·3, 0·7)	6·9	-2·6	10·1
Tetanus	815	1·6	(1·0, 3·4)	1·3	(0·8, 2·6)	0·7	(0·5, 1·5)	0·0		-4·9	-10·2	-43·5
Other conditions†	387	0·2	(0·1, 0·7)	0·4	(0·2, 1·2)	0·5	(0·2, 1·4)	0·4	(0·2, 1·3)	13·3	3·4	-0·9
Other perinatal conditions	2,981	3·0	(1·5, 5·3)	2·8	(1·5, 5·0)	1·9	(1·0, 3·4)	1·1	(0·6, 2·0)	-0·8	-7·0	-10·3
Ill-defined‡	527	0·8	(0·4, 1·4)	0·7	(0·4, 1·3)	0·5	(0·3, 0·9)	0·2	(0·1, 0·4)	-1·3	-7·5	-14·7
All causes	**52,252**	**45·0**	**(42, 49)**	**38·1**	**(35, 41)**	**32·8**	**(30, 36)**	**27·0**	**(24, 32)**	**-3·2**	**-3·0**	**-3·8**
1-59 months												
Pneumonia	11,048	11·2	(8·5, 12·7)	8·3	(6·3, 9·4)	6·2	(4·7, 7·1)	4·2	(3·2, 4·8)	-5·8	-5·6	-7·6
Diarrhoea	8,524	9·4	(7·8, 10·6)	7·2	(6·0, 8·1)	5·3	(4·4, 6·0)	3·2	(2·6, 3·6)	-5·3	-5·9	-9·7
Injuries	3,222	2·3	(2·0, 2·4)	2·4	(2·1, 2·5)	2·2	(1·9, 2·3)	2·7	(2·4, 2·8)	1·0	-1·6	4·2
Non-communicable	3749	3·5	(2·0, 5·6)	2·8	(1·6, 4·5)	2·6	(1·4, 4·1)	2·1	(1·2, 3·3)	-4·4	-1·8	-4·0
Other infections§	4,093	3·4	(1·7, 5·8)	3·3	(1·6, 5·6)	2·9	(1·4, 4·8)	2·1	(1·0, 3·4)	-0·5	-3·0	-6·3
Nutritional	1,844	1·5	(0·8, 2·4)	1·8	(1·0, 2·8)	1·7	(0·9, 2·6)	1·1	(0·6, 1·8)	3·4	-1·2	-7·4
Malaria	2,100	2·0	(1·1, 2·7)	1·6	(0·9, 2·2)	1·3	(0·7, 1·8)	1·1	(0·6, 1·5)	-4·3	-3·9	-3·1
Congenital	1,604	1·4	(0·9, 1·6)	1·3	(0·8, 1·5)	1·2	(0·7, 1·4)	1·0	(0·6, 1·2)	-1·0	-1·8	-3·5
Meningitis/encephalitis	1,650	2·1	(0·9, 2·9)	1·9	(0·8, 2·6)	1·2	(0·5, 1·7)	0·8	(0·3, 1·1)	-2·0	-8·5	-7·3
Acute bacterial sepsis and severe infections	784	1·6	(0·5, 2·6)	1·1	(0·3, 1·8)	0·5	(0·2, 0·9)	0·3	(0·1, 0·5)	-7·7	-13·3	-9·7
Measles	1,486	3·3	(2·1, 3·6)	1·7	(1·1, 1·9)	0·9	(0·6, 1·0)	0·3	(0·2, 0·3)	-12·0	-11·0	-21·8
Perinatal conditions¶	458	1·5	(0·5, 2·4)	1·1	(0·4, 1·7)	0·0		0·0		--	--	--
Ill-defined‡	1,495	1·9	(1·1, 3·4)	1·4	(0·9, 2·6)	1·2	(0·7, 2·3)	1·1	(0·7, 2·0)	-5·2	-2·9	-2·1
All causes	**42,057**	**45·2**	**(43, 50)**	**35·8**	**(33, 40)**	**27·2**	**(24, 31)**	**19·6**	**(15, 26)**	**-4·5**	**-5·3**	**-6·4**

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Neonatal infections are predominantly pneumonia, followed by sepsis and meningitis/encephalitis. †Other conditions for neonatal deaths include polio, measles, malaria, other infectious and parasitic diseases, and nutritional diseases. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. §Other infections for 1-59 months deaths include TB, tetanus, polio, HIV/AIDS, and other infectious and parasitic diseases. ¶ Improvement in physician cause assignment reduced the number of deaths at ages 1-59 months misclassified under perinatal conditions. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. [l]The average annual percent change is the average of simple annual rates of changes in mortality.

Appendix Table 5a: Cause-specific neonatal mortality rates per 1000 live births by sex

Causes of death		2000		2005		2010		2015		2000-05	2005-10	2010-15
		Mortality rate (lower bound, upper bound)								**Annualized Percent Change§**		
Live births in 000s	**Boys**	14,631		14,529		13,970		13,554				
	Girls	13,254		13,105		12,596		12,239				
Prematurity/low birthweight	Boys	13·3	(9·7, 15·8)	12·7	(9·2, 15·1)	15·1	(11·0, 18·0)	14·3	(10·4, 17·0)	-1·0	3·7	-1·2
	Girls	11·0	(8·0, 13·1)	12·3	(9·0, 14·7)	13·4	(9·8, 16·0)	14·5	(10·6, 17·3)	2·3	1·7	1·7
Neonatal infections*	Boys	12·4	(6·8, 16·8)	8·2	(4·5, 11·2)	5·7	(3·1, 7·8)	4·0	(2·2, 5·5)	-7·8	-7·0	-6·6
	Girls	11·4	(6·5, 15·4)	7·9	(4·5, 10·7)	5·7	(3·2, 7·6)	4·0	(2·3, 5·4)	-7·0	-6·4	-6·8
Birth asphyxia/trauma	Boys	10·2	(4·6, 14·0)	6·8	(3·1, 9·4)	4·4	(2·0, 6·1)	2·4	(1·1, 3·4)	-7·6	-8·3	-11·1
	Girls	7·8	(3·4, 10·6)	6·1	(2·7, 8·2)	3·4	(1·5, 4·6)	1·9	(0·8, 2·6)	-4·9	-10·9	-11·0
Non-communicable	Boys	2·8	(1·4, 4·0)	2·7	(1·3, 3·9)	2·3	(1·2, 3·4)	1·9	(1·0, 2·8)	-0·5	-2·8	-3·4
	Girls	2·1	(1·0, 3·1)	2·3	(1·1, 3·4)	2·2	(1·1, 3·2)	2·1	(1·0, 3·1)	2·1	-1·4	-0·5
Congenital	Boys	2·0	(1·1, 2·5)	1·7	(1·0, 2·2)	1·6	(0·9, 2·0)	1·1	(0·6, 1·4)	-2·5	-2·0	-7·0
	Girls	1·7	(1·0, 2·1)	1·6	(1·0, 2·0)	1·2	(0·7, 1·5)	1·0	(0·6, 1·3)	-1·5	-4·9	-2·7
Diarrhoea	Boys	1·6	(1·1, 1·9)	1·4	(1·0, 1·7)	1·2	(0·9, 1·4)	1·0	(0·7, 1·2)	-2·6	-3·1	-2·5
	Girls	1·6	(1·2, 2·0)	1·5	(1·1, 1·7)	1·4	(1·0, 1·7)	1·1	(0·8, 1·3)	-2·4	-0·8	-3·7
Injuries	Boys	0·2	(0·1, 0·3)	0·3	(0·2, 0·4)	0·4	(0·2, 0·5)	0·5	(0·3, 0·8)	9·0	5·8	7·2
	Girls	0·4	(0·2, 0·5)	0·5	(0·2, 0·6)	0·3	(0·1, 0·3)	0·4	(0·2, 0·6)	1·9	-10·2	11·3
Tetanus	Boys	1·8	(1·1, 3·7)	1·4	(0·9, 2·9)	0·7	(0·4, 1·4)	0·1	(0·1, 0·3)	-4·8	-12·6	-26·9
	Girls	1·5	(0·9, 3·0)	1·1	(0·7, 2·3)	0·8	(0·5, 1·6)	0·0	(0·0, 0·0)	-5·0	-7·1	-66·9
Other conditions†	Boys	0·2	(0·1, 0·7)	0·4	(0·2, 1·1)	0·5	(0·2, 1·4)	0·4	(0·2, 1·1)	12·2	4·9	-4·0
	Girls	0·2	(0·1, 0·6)	0·4	(0·2, 1·3)	0·4	(0·2, 1·4)	0·5	(0·2, 1·7)	17·8	1·9	4·0
Other perinatal conditions	Boys	3·3	(1·7, 5·7)	3·0	(1·6, 5·3)	2·0	(1·0, 3·5)	1·2	(0·6, 2·0)	-0·9	-7·8	-10·1
	Girls	2·7	(1·4, 4·8)	2·5	(1·3, 4·6)	1·9	(1·0, 3·4)	1·1	(0·6, 1·9)	-0·8	-5·8	-10·5
Ill-defined‡	Boys	0·9	(0·5, 1·6)	0·8	(0·4, 1·3)	0·5	(0·2, 0·8)	0·2	(0·1, 0·3)	-2·4	-8·8	-18·1
	Girls	0·7	(0·4, 1·2)	0·7	(0·3, 1·2)	0·5	(0·3, 0·9)	0·3	(0·1, 0·5)	0·2	-5·9	-10·8
All causes	**Boys**	48·5		39·3		34·3		27·1		-4·1	-2·7	-4·6
	Girls	41·1		36·8		31·1		26·8		-2·2	-3·3	-2·9
Neonatal (0-28 days) deaths in 000s	**Boys**	709		572		479		368		-4·2	-3·4	-5·2
	Girls	544		483		392		328		-2·4	-4·1	-3·4

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Neonatal infections are predominantly pneumonia, followed by sepsis and meningitis/encephalitis. †Other conditions for neonatal deaths include polio, measles, malaria, other infectious and parasitic diseases, and nutritional diseases. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. §The average annual percent change is the average of simple annual rates of changes in mortality.

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

Appendix Table 5b: Cause-specific 1-59 month child mortality rates per 1000 live births by sex

Causes of death		Mortality rate (lower bound, upper bound)								Annualized Percent Change[§]		
		2000		2005		2010		2015		2000-05	2005-10	2010-15
Live births in 000s	Boys	14,631		14,529		13,970		13,554				
	Girls	13,254		13,105		12,596		12,239				
Pneumonia	Boys	8·9	(6·8, 10·2)	7·2	(5·5, 8·2)	5·2	(3·9, 5·9)	4·0	(3·0, 4·6)	-4·2	-6·4	-4·9
	Girls	13·6	(10·3, 15·5)	9·5	(7·2, 10·8)	7·4	(5·6, 8·4)	4·4	(3·4, 5·0)	-6·9	-4·9	-9·6
Diarrhoea	Boys	7·1	(5·9, 8·1)	5·9	(4·9, 6·6)	4·2	(3·5, 4·7)	3·0	(2·5, 3·4)	-3·8	-6·6	-6·4
	Girls	11·9	(9·9, 13·4)	8·6	(7·1, 9·7)	6·5	(5·4, 7·4)	3·4	(2·9, 3·9)	-6·2	-5·3	-12·0
Injuries	Boys	2·2	(2·0, 2·3)	2·3	(2·1, 2·4)	2·1	(1·9, 2·2)	2·4	(2·1, 2·5)	0·8	-1·8	2·7
	Girls	2·4	(2·1, 2·5)	2·5	(2·2, 2·6)	2·3	(2·0, 2·4)	2·9	(2·6, 3·1)	0·5	-1·3	5·2
Non-communicable	Boys	3·0	(1·7, 4·7)	2·6	(1·5, 4·1)	2·2	(1·3, 3·5)	2·2	(1·2, 3·4)	-2·5	-3·1	-0·4
	Girls	4·1	(2·3, 6·7)	3·0	(1·7, 4·9)	2·9	(1·6, 4·7)	2·0	(1·1, 3·3)	-6·0	-0·5	-6·8
Other infections*	Boys	3·0	(1·5, 4·8)	3·0	(1·5, 4·9)	2·3	(1·2, 3·8)	1·8	(0·9, 2·9)	0·5	-5·1	-4·6
	Girls	4·0	(1·8, 6·8)	3·7	(1·7, 6·3)	3·5	(1·6, 5·9)	2·3	(1·1, 4·0)	-1·4	-1·2	-7·7
Nutritional	Boys	1·2	(0·6, 1·8)	1·4	(0·7, 2·1)	1·3	(0·7, 1·9)	1·0	(0·5, 1·5)	3·1	-1·7	-4·3
	Girls	1·9	(1·0, 3·1)	2·2	(1·2, 3·6)	2·1	(1·1, 3·4)	1·3	(0·7, 2·0)	3·6	-0·8	-9·6
Malaria	Boys	1·5	(0·8, 2·0)	1·3	(0·7, 1·7)	1·2	(0·6, 1·6)	1·1	(0·6, 1·5)	-3·1	-1·6	-0·7
	Girls	2·5	(1·5, 3·5)	1·9	(1·1, 2·6)	1·4	(0·8, 2·0)	1·1	(0·7, 1·5)	-5·1	-5·6	-4·7
Congenital	Boys	1·5	(0·9, 1·7)	1·3	(0·8, 1·5)	1·0	(0·6, 1·2)	0·9	(0·5, 1·0)	-2·4	-4·4	-2·4
	Girls	1·4	(0·8, 1·6)	1·4	(0·8, 1·6)	1·4	(0·9, 1·6)	1·1	(0·7, 1·3)	0·8	0·6	-4·6
Meningitis/encephalitis	Boys	2·0	(0·8, 2·7)	1·7	(0·7, 2·3)	1·0	(0·4, 1·4)	0·8	(0·4, 1·1)	-3·4	-8·9	-4·4
	Girls	2·3	(0·9, 3·2)	2·2	(0·9, 3·0)	1·4	(0·6, 2·0)	0·8	(0·3, 1·2)	-0·5	-8·2	-9·6
Acute bacterial sepsis and severe infections	Boys	1·1	(0·4, 1·9)	0·8	(0·3, 1·3)	0·5	(0·2, 0·8)	0·2	(0·1, 0·4)	-6·8	-10·3	-14·5
	Girls	2·1	(0·6, 3·4)	1·4	(0·4, 2·2)	0·6	(0·2, 0·9)	0·4	(0·1, 0·6)	-8·3	-15·4	-6·6
Measles	Boys	2·5	(1·6, 2·7)	1·3	(0·9, 1·5)	0·8	(0·5, 0·8)	0·1	(0·0, 0·1)	-11·5	-10·8	-35·1
	Girls	4·1	(2·6, 4·5)	2·1	(1·3, 2·3)	1·2	(0·7, 1·3)	0·4	(0·3, 0·5)	-12·2	-11·2	-16·8
Perinatal conditions†	Boys	1·3	(0·5, 2·1)	0·9	(0·3, 1·5)	0·0	(0·0, 0·0)	-	-	-6·1	-	-
	Girls	1·8	(0·6, 2·8)	1·2	(0·4, 1·9)	0·0	(0·0, 0·0)	-	-	-5·9	-	-
Ill-defined‡	Boys	1·6	(1·0, 3·0)	1·3	(0·8, 2·5)	1·1	(0·7, 2·1)	1·0	(0·6, 1·8)	-4·1	-3·5	-2·3
	Girls	2·1	(1·3, 3·9)	1·5	(0·9, 2·8)	1·3	(0·8, 2·5)	1·2	(0·7, 2·2)	-6·0	-2·2	-1·8
All causes	Boys	37·0		31·0		22·8		18·1		-3·4	-5·9	-4·5
	Girls	54·2		41·2		32·1		21·2		-5·4	-4·8	-7·9
Age 1-59 month child deaths in 000s	Boys	541		451		319		245		-3·6	-6·7	-5·1
	Girls	718		539		405		260		-5·6	-5·6	-8·4

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Other infections for 1-59 months deaths include TB, tetanus, polio, HIV/AIDS, and other infectious and parasitic diseases. †Improvement in physician cause assignment reduced the number of deaths at ages 1-59 months misclassified under perinatal conditions. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. [§]The average annual percent change is the average of simple annual rates of changes in mortality.

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

Appendix Table 6a: Cause-specific neonatal mortality rates per 1000 live births by poorer/richer states

Causes of death		Mortality rate (lower bound, upper bound)								Annualized Percent Change[§]		
		2000		2005		2010		2015		2000-05	2005-10	2010-15
Live births in 000s	Poorer	15,676		15,865		15,469		15,190				
	Richer	12,209		11,769		11,097		10,604				
Prematurity/low birthweight	Poorer	11·3	(8·3, 13·5)	13·3	(9·7, 15·8)	16·5	(12·1, 19·7)	17·8	(13·0, 21·1)	3·2	4·5	1·5
	Richer	13·5	(9·7, 15·9)	11·5	(8·2, 13·5)	11·2	(8·1, 13·3)	9·5	(6·8, 11·2)	-3·2	-0·4	-3·3
Neonatal infections*	Poorer	16·5	(9·7, 21·8)	10·9	(6·4, 14·4)	7·6	(4·5, 10·0)	5·1	(3·0, 6·7)	-7·9	-6·9	-7·6
	Richer	6·1	(3·0, 8·7)	4·3	(2·1, 6·1)	3·0	(1·5, 4·3)	2·4	(1·2, 3·4)	-6·7	-6·5	-4·4
Birth asphyxia/trauma	Poorer	10·1	(4·2, 13·9)	7·0	(2·9, 9·6)	4·0	(1·6, 5·4)	1·8	(0·7, 2·5)	-7·1	-10·7	-14·4
	Richer	7·4	(3·6, 10·2)	5·7	(2·7, 7·8)	3·9	(1·9, 5·3)	2·8	(1·4, 3·9)	-5·1	-7·4	-6·1
Non-communicable	Poorer	2·6	(1·2, 3·8)	2·6	(1·2, 3·8)	2·6	(1·2, 3·8)	2·4	(1·1, 3·5)	0·6	-0·3	-1·3
	Richer	2·4	(1·3, 3·4)	2·4	(1·3, 3·5)	1·8	(1·0, 2·6)	1·4	(0·8, 2·1)	0·4	-5·3	-4·4
Congenital	Poorer	1·7	(0·9, 2·3)	1·5	(0·8, 2·0)	1·0	(0·6, 1·4)	0·6	(0·3, 0·8)	-3·1	-6·4	-9·7
	Richer	2·0	(1·2, 2·4)	1·9	(1·2, 2·4)	1·9	(1·2, 2·3)	1·8	(1·1, 2·2)	-0·4	-0·3	-1·3
Diarrhoea	Poorer	2·0	(1·5, 2·4)	1·8	(1·4, 2·2)	1·7	(1·3, 2·0)	1·5	(1·1, 1·8)	-2·2	-1·3	-2·1
	Richer	1·1	(0·8, 1·4)	0·8	(0·6, 1·0)	0·7	(0·5, 0·8)	0·4	(0·3, 0·5)	-5·1	-4·5	-9·8
Injuries	Poorer	0·3	(0·2, 0·5)	0·4	(0·2, 0·5)	0·3	(0·2, 0·5)	0·7	(0·3, 0·9)	3·4	-2·1	16·0
	Richer	0·2	(0·1, 0·3)	0·3	(0·2, 0·5)	0·3	(0·2, 0·4)	0·3	(0·1, 0·4)	15·8	-2·6	-2·7
Tetanus	Poorer	2·8	(1·8, 5·6)	2·0	(1·3, 4·1)	1·2	(0·8, 2·4)	-		-6·0	-10·0	-60·1
	Richer	0·2	(0·1, 0·5)	0·3	(0·1, 0·6)	0·1	(0·0, 0·2)	0·1	(0·0, 0·3)	5·5	-14·6	1·9
Other conditions†	Poorer	0·1	(0·0, 0·3)	0·4	(0·2, 1·4)	0·6	(0·2, 1·9)	0·5	(0·2, 1·7)	37·4	6·1	-1·9
	Richer	0·4	(0·2, 1·1)	0·4	(0·2, 0·9)	0·3	(0·1, 0·8)	0·3	(0·1, 0·9)	-0·8	-2·1	0·9
Other perinatal conditions	Poorer	3·6	(1·8, 6·3)	3·4	(1·7, 6·0)	2·3	(1·2, 4·1)	1·3	(0·7, 2·4)	-0·4	-7·1	-10·3
	Richer	2·2	(1·2, 3·9)	2·0	(1·1, 3·6)	1·4	(0·7, 2·5)	0·8	(0·4, 1·5)	-1·9	-6·9	-10·0
Ill-defined‡	Poorer	0·9	(0·5, 1·6)	0·8	(0·4, 1·5)	0·5	(0·3, 1·0)	0·2	(0·1, 0·3)	-0·1	-8·2	-20·4
	Richer	0·7	(0·4, 1·2)	0·5	(0·3, 1·0)	0·4	(0·2, 0·7)	0·3	(0·2, 0·5)	-3·3	-5·9	-6·4
All causes	**Poorer**	51·9		44·2		38·4		31·8		-3·2	-2·8	-3·7
	Richer	36·0		30·0		25·0		20·1		-3·6	-3·6	-4·3
Neonatal (0-28 days) deaths in 000s	**Poorer**	814		701		594		483		-2·9	-3·3	-4·1
	Richer	440		353		277		213		-4·3	-4·7	-5·1

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Neonatal infections are predominantly pneumonia, followed by sepsis and meningitis/encephalitis. †Other conditions for neonatal deaths include polio, measles, malaria, other infectious and parasitic diseases, and nutritional diseases. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. §The average annual percent change is the average of simple annual rates of changes in mortality.

Appendix Table 6b: Cause-specific 1-59 month child mortality rates per 1000 live births by poorer/richer states

Causes of death		Mortality rate (lower bound, upper bound)								Annualized Percent Change§		
		2000		2005		2010		2015		2000-05	2005-10	2010-15
Live births in 000s	Poorer	15,676		15,865		15,469		15,190				
	Other	12,209		11,769		11,097		10,604				
Pneumonia	Poorer	15.4	(12·2, 17·6)	11·0	(8·7, 12·6)	8·1	(6·4, 9·3)	5·4	(4·3, 6·1)	-6·5	-5·9	-7·8
	Other	5.7	(4·1, 6·4)	4·5	(3·3, 5·2)	3·5	(2·5, 4·0)	2·4	(1·7, 2·8)	-4·3	-4·9	-7·3
Diarrhoea	Poorer	12.7	(10·5, 14·1)	9·8	(8·2, 10·9)	7·3	(6·1, 8·1)	4·5	(3·8, 5·0)	-4·9	-5·8	-9·2
	Other	5.2	(4·3, 6·1)	3·6	(2·9, 4·2)	2·5	(2·1, 2·9)	1·3	(1·1, 1·5)	-7·2	-6·7	-12·6
Injuries	Poorer	2.3	(2·0, 2·5)	2·4	(2·1, 2·5)	2·4	(2·1, 2·6)	3·4	(3·0, 3·6)	0·6	0·4	6·8
	Other	2.3	(2·1, 2·4)	2·3	(2·1, 2·4)	1·8	(1·7, 1·9)	1·6	(1·5, 1·7)	0·9	-4·8	-2·4
Non-communicable	Poorer	3.5	(1·9, 5·5)	3·0	(1·6, 4·8)	2·8	(1·5, 4·5)	2·4	(1·3, 3·8)	-2·6	-1·7	-2·9
	Other	3.6	(2·1, 5·7)	2·5	(1·5, 3·9)	2·3	(1·3, 3·5)	1·7	(1·0, 2·6)	-6·7	-2·0	-5·9
Other infections*	Poorer	4.4	(2·1, 7·5)	4·1	(1·9, 7·0)	3·6	(1·7, 6·1)	2·4	(1·1, 4·1)	-1·1	-2·6	-7·5
	Other	2.2	(1·1, 3·6)	2·3	(1·1, 3·7)	1·8	(0·9, 3·0)	1·6	(0·7, 2·5)	0·5	-4·2	-3·2
Nutritional	Poorer	2.2	(1·2, 3·3)	2·5	(1·4, 3·8)	2·1	(1·2, 3·2)	1·4	(0·8, 2·1)	3·7	-3·4	-7·2
	Other	0.6	(0·3, 0·9)	0·8	(0·4, 1·3)	1·1	(0·5, 1·8)	0·8	(0·4, 1·4)	7·2	6·7	-4·4
Malaria	Poorer	2.8	(1·6, 3·9)	1·9	(1·1, 2·7)	1·8	(1·0, 2·4)	1·4	(0·8, 2·0)	-6·9	-2·0	-3·9
	Other	1.0	(0·6, 1·3)	1·1	(0·7, 1·5)	0·7	(0·4, 0·9)	0·6	(0·4, 0·8)	3·7	-9·5	-1·6
Congenital	Poorer	1.1	(0·6, 1·3)	1·0	(0·5, 1·1)	0·9	(0·5, 1·1)	0·7	(0·4, 0·8)	-2·2	-0·8	-5·5
	Other	1.8	(1·2, 2·1)	1·9	(1·2, 2·1)	1·6	(1·0, 1·8)	1·5	(0·9, 1·7)	0·4	-2·5	-2·0
Meningitis/encephalitis	Poorer	2.1	(0·9, 2·9)	2·2	(0·9, 2·9)	1·4	(0·6, 1·9)	1·1	(0·5, 1·5)	1·0	-8·0	-5·0
	Other	2.1	(0·9, 3·0)	1·6	(0·6, 2·2)	0·9	(0·4, 1·3)	0·5	(0·2, 0·6)	-5·9	-9·8	-13·4
Acute bacterial sepsis and severe infections	Poorer	1.9	(0·7, 3·2)	1·3	(0·4, 2·1)	0·5	(0·2, 0·9)	0·3	(0·1, 0·5)	-7·5	-15·4	-9·1
	Other	1.2	(0·3, 1·9)	0·8	(0·2, 1·2)	0·5	(0·1, 0·8)	0·3	(0·1, 0·4)	-8·2	-9·3	-10·7
Measles	Poorer	4.2	(2·8, 4·5)	2·3	(1·5, 2·5)	1·3	(0·8, 1·3)	0·4	(0·3, 0·4)	-11·1	-11·2	-19·5
	Other	2.2	(1·3, 2·4)	0·9	(0·6, 1·0)	0·5	(0·3, 0·6)	0·0	(0·0, 0·0)	-14·7	-10·8	-33·9
Perinatal conditions†	Poorer	1.6	(0·5, 2·6)	1·0	(0·3, 1·7)	0·0	(0·0, 0·0)	-	-	-7·2	-	-
	Other	1.5	(0·6, 2·2)	1·1	(0·4, 1·6)	0·0	(0·0, 0·0)	-	-	-4·6	-	-
Ill-defined‡	Poorer	2.0	(1·2, 3·7)	1·6	(1·0, 3·0)	1·5	(0·9, 2·7)	1·3	(0·8, 2·4)	-4·2	-1·5	-1·8
	Other	1.7	(1·0, 3·2)	1·2	(0·7, 2·2)	0·9	(0·5, 1·6)	0·7	(0·5, 1·4)	-7·0	-6·0	-2·7
All causes	Poorer	56.2		44·2		33·8		24·4		-4·7	-5·2	-6·3
	Other	31.0		24·5		18·1		12·6		-4·6	-5·8	-7·0
Age 1-59 month child deaths in 000s	Poorer	881		702		522		371		-4·4	-5·7	-6·6
	Other	379		289		201		134		-5·3	-6·9	-7·8

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Other infections for 1-59 months deaths include TB, tetanus, polio, HIV/AIDS, and other infectious and parasitic diseases. †Improvement in physician cause assignment reduced the number of deaths at ages 1-59 months misclassified under perinatal conditions. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. §The average annual percent change is the average of simple annual rates of changes in mortality.

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Appendix Table 7a: Cause-specific neonatal mortality rates per 1000 live births by rural/urban

Causes of death		Mortality rate (lower bound, upper bound)								Annualized Percent Change[§]		
		2000		2005		2010		2015		2000-05	2005-10	2010-15
Live births in 000s	Rural	21,550		21,172		19,886		19,253				
	Urban	6,334		6,462		6,680		6,540				
Prematurity/low birthweight	Rural	13·2	(9·5, 15·8)	14·0	(10·1, 16·6)	16·6	(11·9, 19·7)	17·0	(12·3, 20·3)	1·1	3·5	0·6
	Urban	8·8	(6·6, 10·3)	8·0	(6·0, 9·4)	7·9	(5·9, 9·3)	6·6	(5·0, 7·7)	-1·9	-0·2	-3·4
Neonatal infections*	Rural	13·9	(7·8, 18·8)	9·5	(5·3, 12·8)	6·8	(3·8, 9·1)	4·6	(2·6, 6·3)	-7·4	-6·5	-7·2
	Urban	5·2	(2·8, 7·2)	3·6	(2·0, 5·0)	2·6	(1·4, 3·6)	2·2	(1·2, 3·0)	-6·9	-6·4	-3·3
Birth asphyxia/trauma	Rural	9·9	(4·3, 13·5)	7·2	(3·1, 9·8)	4·4	(1·9, 6·0)	2·4	(1·1, 3·4)	-6·2	-9·4	-10·8
	Urban	6·0	(2·8, 8·1)	4·1	(1·9, 5·5)	2·6	(1·2, 3·5)	1·5	(0·7, 2·1)	-7·4	-8·5	-10·0
Non-communicable	Rural	2·5	(1·2, 3·7)	2·6	(1·3, 3·9)	2·4	(1·2, 3·6)	2·3	(1·1, 3·3)	1·0	-1·6	-1·4
	Urban	2·0	(1·0, 2·9)	2·0	(1·0, 2·8)	1·6	(0·8, 2·3)	1·2	(0·6, 1·7)	0·0	-4·2	-5·6
Congenital	Rural	1·7	(1·0, 2·2)	1·5	(0·9, 2·0)	1·3	(0·8, 1·7)	0·9	(0·6, 1·2)	-2·3	-2·7	-6·6
	Urban	2·1	(1·3, 2·5)	1·8	(1·1, 2·2)	1·5	(0·9, 1·8)	1·2	(0·7, 1·5)	-2·4	-4·0	-3·2
Diarrhoea	Rural	1·8	(1·4, 2·2)	1·6	(1·2, 1·9)	1·5	(1·1, 1·8)	1·3	(1·0, 1·6)	-2·9	-1·2	-1·9
	Urban	0·8	(0·6, 1·0)	0·8	(0·6, 1·0)	0·6	(0·4, 0·7)	0·2	(0·2, 0·3)	-0·1	-5·5	-15·9
Injuries	Rural	0·3	(0·1, 0·4)	0·4	(0·2, 0·6)	0·3	(0·2, 0·4)	0·6	(0·3, 0·8)	9·7	-6·7	14·6
	Urban	0·2	(0·1, 0·2)	0·2	(0·1, 0·2)	0·3	(0·1, 0·4)	0·3	(0·1, 0·4)	1·4	11·9	1·1
Tetanus	Rural	2·0	(1·3, 4·2)	1·5	(0·9, 3·1)	0·8	(0·5, 1·7)	0·0		-5·6	-11·0	-58·4
	Urban	0·5	(0·3, 0·7)	0·6	(0·3, 0·9)	0·5	(0·3, 0·7)	0·2	(0·1, 0·3)	5·7	-4·0	-14·6
Other conditions†	Rural	0·2	(0·1, 0·7)	0·4	(0·2, 1·2)	0·5	(0·2, 1·7)	0·4	(0·2, 1·4)	10·6	6·7	-3·5
	Urban	0·5	(0·2, 1·2)	0·5	(0·2, 1·2)	0·3	(0·1, 0·7)	0·4	(0·2, 0·9)	0·2	-9·5	5·3
Other perinatal conditions	Rural	3·2	(1·7, 5·7)	3·0	(1·6, 5·4)	2·1	(1·1, 3·7)	1·1	(0·6, 2·0)	-0·7	-7·0	-11·2
	Urban	2·1	(1·1, 3·6)	2·0	(1·1, 3·4)	1·4	(0·8, 2·4)	1·0	(0·5, 1·7)	-1·1	-6·2	-7·4
Ill-defined‡	Rural	0·8	(0·4, 1·5)	0·7	(0·3, 1·2)	0·5	(0·3, 0·9)	0·3	(0·1, 0·4)	-3·6	-5·3	-11·6
	Urban	0·7	(0·4, 1·1)	0·8	(0·4, 1·2)	0·4	(0·2, 0·7)	0·1	(0·1, 0·2)	5·6	-12·1	-21·7
All causes	Rural	49·7		42·4		37·2		31·1		-3·1	-2·6	-3·6
	Urban	28·8		24·2		19·6		15·0		-3·4	-4·1	-5·3
Neonatal (0-28 days) deaths in 000s	Rural	1,071		898		740		598		-3·5	-3·8	-4·2
	Urban	182		157		131		98		-3·0	-3·5	-5·7

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Neonatal infections are predominantly pneumonia, followed by sepsis and meningitis/encephalitis. †Other conditions for neonatal deaths include polio, measles, malaria, other infectious and parasitic diseases, and nutritional diseases. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time. For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. [§]The average annual percent change is the average of simple annual rates of changes in mortality.

webappendix: Changes in cause-specific in neonatal and 1-59 month child mortality in India from 2000 to 2015

Appendix Table 7b: Cause-specific 1-59 month child mortality rates per 1000 live births by rural/urban

Causes of death		Mortality rate (lower bound, upper bound)								Annualized Percent Change§		
		2000		2005		2010		2015		2000-05	2005-10	2010-15
Live births in 000s	Rural	21,550		21,172		19,886		19,253				
	Urban	6,334		6,462		6,680		6,540				
Pneumonia	Rural	13·0	(9·9, 14·9)	9·6	(7·3, 11·0)	7·0	(5·3, 8·0)	4·5	(3·4, 5·2)	-5·9	-6·1	-8·3
	Urban	5·5	(4·3, 6·2)	4·3	(3·3, 4·8)	4·0	(3·1, 4·5)	3·1	(2·4, 3·5)	-4·9	-1·2	-4·8
Diarrhoea	Rural	10·7	(8·9, 12·1)	8·3	(6·9, 9·4)	6·0	(5·0, 6·8)	3·5	(2·9, 4·0)	-4·9	-6·2	-10·1
	Urban	5·2	(4·3, 5·7)	3·9	(3·2, 4·3)	3·1	(2·6, 3·4)	2·3	(1·9, 2·6)	-5·6	-4·1	-5·4
Injuries	Rural	2·4	(2·2, 2·6)	2·4	(2·2, 2·5)	2·3	(2·1, 2·5)	2·8	(2·5, 3·0)	-0·3	-0·3	3·7
	Urban	1·6	(1·4, 1·7)	2·1	(1·8, 2·3)	1·7	(1·4, 1·8)	2·3	(2·0, 2·4)	6·4	-4·7	6·8
Non-communicable	Rural	3·7	(2·1, 5·9)	2·9	(1·6, 4·7)	2·6	(1·5, 4·2)	2·0	(1·1, 3·3)	-4·3	-2·4	-4·8
	Urban	2·8	(1·6, 4·4)	2·3	(1·3, 3·6)	2·4	(1·4, 3·8)	2·2	(1·3, 3·4)	-3·8	1·0	-2·0
Other infections*	Rural	3·9	(1·9, 6·5)	3·7	(1·8, 6·3)	3·1	(1·5, 5·2)	2·2	(1·0, 3·7)	-0·7	-3·5	-6·6
	Urban	2·0	(1·0, 3·1)	2·1	(1·0, 3·4)	2·1	(1·0, 3·4)	1·6	(0·8, 2·6)	1·6	0·1	-5·5
Nutritional	Rural	1·7	(0·9, 2·6)	2·0	(1·1, 3·1)	1·8	(1·0, 2·8)	1·2	(0·6, 1·8)	4·2	-1·9	-7·8
	Urban	1·0	(0·5, 1·4)	1·1	(0·6, 1·6)	1·4	(0·7, 1·9)	1·1	(0·6, 1·5)	2·3	3·9	-4·0
Malaria	Rural	2·3	(1·3, 3·2)	1·9	(1·1, 2·6)	1·5	(0·9, 2·0)	1·2	(0·7, 1·7)	-4·0	-4·4	-3·3
	Urban	0·8	(0·4, 1·1)	0·7	(0·4, 0·9)	0·8	(0·4, 1·1)	0·7	(0·4, 1·0)	-2·4	3·7	-2·0
Congenital	Rural	1·2	(0·7, 1·4)	1·2	(0·7, 1·3)	1·1	(0·7, 1·3)	0·9	(0·5, 1·0)	-0·8	-0·2	-4·7
	Urban	2·0	(1·3, 2·2)	1·7	(1·1, 1·8)	1·4	(0·9, 1·5)	1·3	(0·8, 1·4)	-3·5	-3·2	-2·0
Meningitis/encephalitis	Rural	2·1	(0·9, 2·9)	1·9	(0·8, 2·7)	1·3	(0·5, 1·8)	1·0	(0·4, 1·4)	-1·7	-7·5	-4·6
	Urban	1·9	(0·8, 2·6)	1·6	(0·7, 2·2)	1·0	(0·4, 1·3)	0·3	(0·1, 0·4)	-3·0	-10·2	-21·4
Acute bacterial sepsis and severe infections	Rural	1·7	(0·5, 2·9)	1·1	(0·3, 1·9)	0·5	(0·2, 0·9)	0·3	(0·1, 0·5)	-7·6	-13·3	-9·8
	Urban	1·1	(0·3, 1·6)	0·8	(0·2, 1·1)	0·5	(0·1, 0·6)	0·2	(0·1, 0·3)	-7·2	-9·9	-12·2
Measles	Rural	3·6	(2·3, 3·8)	1·9	(1·2, 2·1)	1·0	(0·6, 1·1)	0·3	(0·2, 0·3)	-11·3	-12·3	-19·4
	Urban	2·3	(1·6, 2·5)	1·0	(0·7, 1·1)	0·8	(0·5, 0·8)	0·2	(0·1, 0·2)	-14·0	-5·5	-26·5
Perinatal conditions†	Rural	1·5	(0·6, 2·4)	1·1	(0·4, 1·7)	0·0	(0·0, 0·1)	-	-	-4·9	-	-
	Urban	2·0	(0·5, 2·9)	1·1	(0·2, 1·6)	0·0	(0·0, 0·0)	-	-	-11·1	-	-
Ill-defined‡	Rural	1·9	(1·1, 3·6)	1·5	(0·9, 2·9)	1·2	(0·7, 2·4)	1·1	(0·7, 2·2)	-4·6	-3·7	-1·3
	Urban	1·7	(1·0, 2·7)	1·1	(0·7, 1·8)	1·1	(0·7, 1·8)	0·8	(0·5, 1·3)	-8·0	0·1	-6·3
All causes	Rural	49·6		39·5		29·6		20·9		-4·5	-5·6	-6·8
	Urban	30·0		23·8		20·2		15·8		-4·4	-3·2	-4·7
Age 1-59 month child deaths in 000s	Rural	1,070		836		589		402		-4·8	-6·8	-7·4
	Urban	190		154		135		103		-4·0	-2·6	-5·1

Notes: ICD-10 codes for each cause are listed in appendix pp 6-7. *Other infections for 1-59 months deaths include TB, tetanus, polio, HIV/AIDS, and other infectious and parasitic diseases. †Improvement in physician cause assignment reduced the number of deaths at ages 1-59 months misclassified under perinatal conditions. ‡Ill-defined conditions include all ICD-10 'R' codes that have not been assigned to defined cause groups. Ill-defined causes averaged 1% in neonatal death and 4% in child death, and decreased in proportion over time.

For 2003-2013, causes of deaths are calculated using 3-yearly backward moving averages of death proportions from Million Death Study, then adjusted to IGME death totals. For 2000-02 and 2014-15, we extrapolated predicted values from a cubic spline polynomial fitted on 2003 to 2013 death rates. We calculated rates by dividing estimated deaths by UNPD live birth estimates for India. For cause-specific rates, lower bounds reflect the rates when two independent physicians had immediate agreement, and the upper bounds reflect the rates when either physician assigned the cause of death. We normalized both rates across all years. §The average annual percent change is the average of simple annual rates of changes in mortality.

Appendix Table 8: Change in rank of COD and estimated deaths (thousands) for neonates and 1-59 month child deaths in India from 2000 to 2005 to 2015

Estimated deaths (2000)		Estimated deaths (2005)		Estimated deaths (2015)	
Neonates		**Neonates**		**Neonates**	
1. Prematurity/low birthweight	342	1. Prematurity/low birthweight	345	1. Prematurity/low birthweight	370
2. Neonatal infections	333	2. Neonatal infections	223	2. Neonatal infections	103
3. Birth asphyxia/trauma	252	3. Birth asphyxia/trauma	178	3. Birth asphyxia/trauma	57
4. Non-communicable	68	4. Non-communicable	70	4. Non-communicable	52
5. Congenital	51	5. Congenital	46	5. Congenital	28
6. Tetanus	46	6. Diarrhoea	37	6. Diarrhoea	27
7. Diarrhoea	44	7. Tetanus	35	7. Injuries	13
8. Injuries	7	8. Injuries	10	8. Tetanus	0·6
All other defined causes	89	All other defined causes	89	All other defined causes	41
Ill-defined	22	Ill-defined	20	Ill-defined	6
All causes	1254	**All causes**	1054	**All causes**	696
1-59 months		**1-59 months**		**1-59 months**	
1. Pneumonia	311	1. Pneumonia	229	1. Pneumonia	108
2. Diarrhoea	262	2. Diarrhoea	198	2. Diarrhoea	82
3. Non-communicable	98	3. Other infections	92	3. Injuries	69
4. Other infections	96	4. Non-communicable	78	4. Non-communicable	54
5. Measles	92	5. Injuries	66	5. Other infections	53
6. Injuries	63	6. Meningitis/encephalitis	53	6. Nutritional	29
7. Meningitis/encephalitis	59	7. Nutritional	49	7. Malaria	28
8. Malaria	55	8. Measles	47	8. Congenital	26
9. Acute bacterial sepsis and severe infections	44	9. Malaria	44	9. Meningitis/encephalitis	22
10. Nutritional	43	10. Congenital	37	10. Acute bacterial sepsis and severe infections	8
11. Congenital	40	11. Acute bacterial sepsis and severe infections	29	11. Measles	7
All other defined causes	43	All other defined causes	29	All other defined causes	--
Ill-defined	52	Ill-defined	39	Ill-defined	20
All causes	1259	**All causes**	990	**All causes**	505

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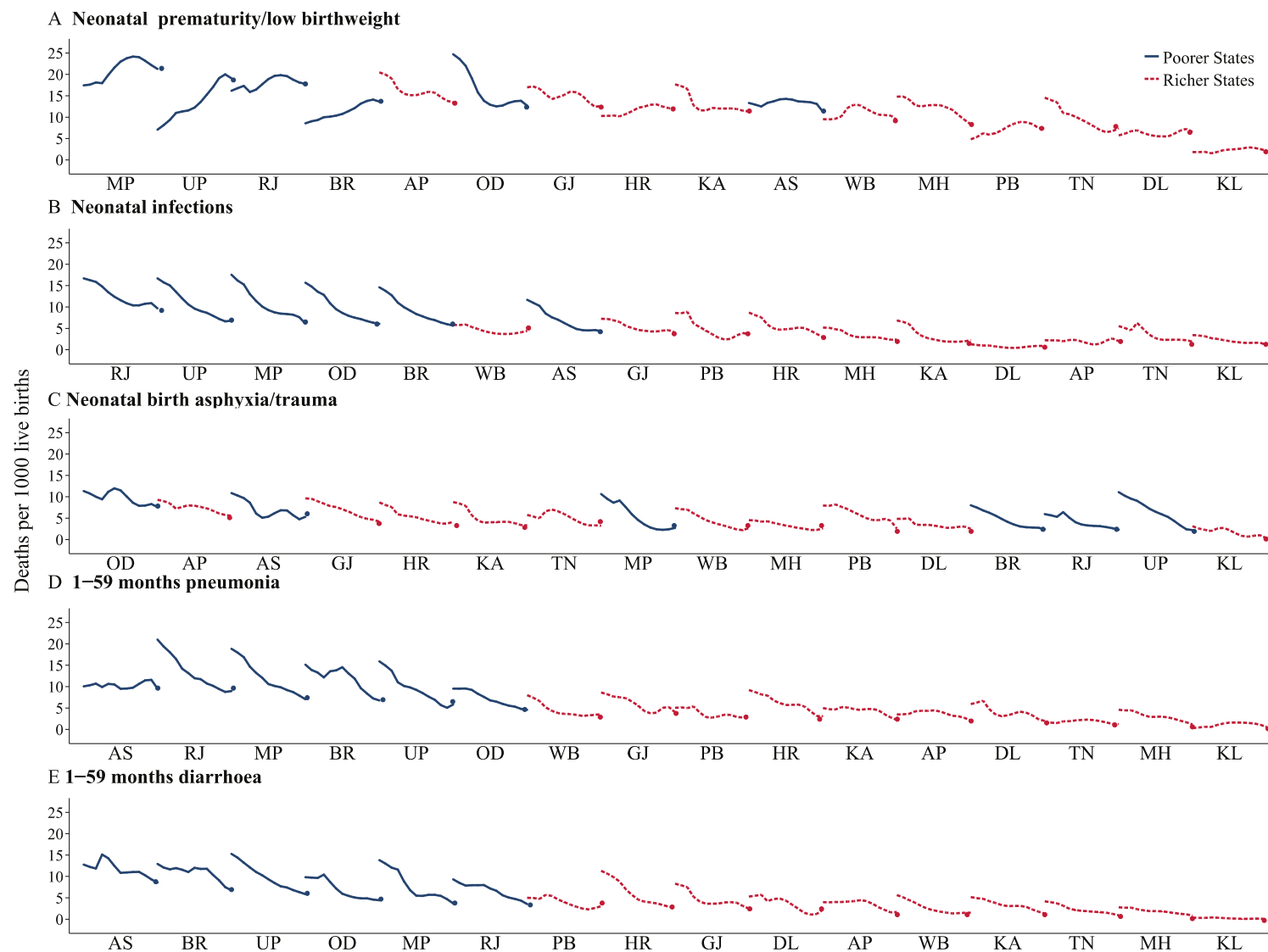
Appendix Figure 2: Cause-specific child mortality rates for top five causes of death in richer and poorer states in India, 2001-2013. States are ordered by decreasing 2013 cause-specific mortality rate. Richer states include Andhra Pradesh (AP), Delhi (DL), Gujarat (GJ), Haryana (HR), Karnataka (KA), Kerala (KL), Maharashtra (MH), Punjab (PB), Tamil Nadu (TN), and West Bengal (WB). Poorer states include Assam (AS), Bihar (BR), Madhya Pradesh (MP), Odisha (OD), Rajasthan (RJ), and Uttar Pradesh (UP). Each horizontal axis shows the 2001-13 trends in mortality rates.