

India: Towards Universal Health Coverage 2



Reproductive health, and child health and nutrition in India: meeting the challenge

Vinod Kumar Paul, Harshpal Singh Sachdev, Dileep Mavalankar, Prema Ramachandran, Mari Jeeva Sankar, Nita Bhandari, Vishnubhatla Sreenivas, Thiagarajan Sundararaman, Dipti Govil, David Osrin, Betty Kirkwood

India, with a population of more than 1 billion people, has many challenges in improving the health and nutrition of its citizens. Steady declines have been noted in fertility, maternal, infant and child mortalities, and the prevalence of severe manifestations of nutritional deficiencies, but the pace has been slow and falls short of national and Millennium Development Goal targets. The likely explanations include social inequities, disparities in health systems between and within states, and consequences of urbanisation and demographic transition. In 2005, India embarked on the National Rural Health Mission, an extraordinary effort to strengthen the health systems. However, coverage of priority interventions remains insufficient, and the content and quality of existing interventions are suboptimum. Substantial unmet need for contraception remains, adolescent pregnancies are common, and access to safe abortion is inadequate. Increases in the numbers of deliveries in institutions have not been matched by improvements in the quality of intrapartum and neonatal care. Infants and young children do not get the health care they need; access to effective treatment for neonatal illness, diarrhoea, and pneumonia shows little improvement; and the coverage of nutrition programmes is inadequate. Absence of well functioning health systems is indicated by the inadequacies related to planning, financing, human resources, infrastructure, supply systems, governance, information, and monitoring. We provide a case for transformation of health systems through effective stewardship, decentralised planning in districts, a reasoned approach to financing that affects demand for health care, a campaign to create awareness and change health and nutrition behaviour, and revision of programmes for child nutrition on the basis of evidence. This agenda needs political commitment of the highest order and the development of a people's movement.

Published Online
January 12, 2011
DOI:10.1016/S0140-6736(10)61492-4
See Online/Comment
DOI:10.1016/S0140-6736(10)62179-4,
DOI:10.1016/S0140-6736(10)62044-2,
DOI:10.1016/S0140-6736(10)62182-4,
DOI:10.1016/S0140-6736(10)62112-5,
DOI:10.1016/S0140-6736(10)62042-9,
DOI:10.1016/S0140-6736(10)62041-7,
DOI:10.1016/S0140-6736(10)62034-X,
DOI:10.1016/S0140-6736(10)62045-4, and

Introduction

India has a unique opportunity now to improve the health and nutritional status of its people. The country is in a position to invest increasing amounts of resources in social sectors as a result of economic progress. With recognition of the importance of health and nutrition for national development, the prospects for improved and equitable health and nutrition are now better than they have ever been.

Reproductive health, and child health and nutrition are core priorities for any country, more so for India with the world's greatest burden of maternal, newborn, and child deaths. In 2008, 1.8 million children (age <5 years), including 1 million neonates, died,¹ and 68 000 mothers died.² India also has the greatest number of undernourished children, with about 52 million stunted children (age <5 years).³ Progress in reproductive health, and child health and nutrition does not compare favourably with some other countries in Asia that gained independence at about the same time as India (webappendix p 7). India still has a long way to go to reach its declared goals (table 1).³⁻⁶ We review the current situation of reproductive health, and child health and nutrition in India, identify policy and programmatic gaps, and suggest a way forward. To maintain focus on the main themes, we do not cover some equally important and related issues such as child development and micronutrient malnutrition. The description of methods used in this report is provided in the webappendix p 1.

Key messages

- With 1.8 million deaths among children (age <5 years) and 68 000 deaths among mothers every year, and 52 million children who are stunted, India's burden of reproductive health, and child health and nutrition is greater than that in any other country.
- The pace of improvement has been slow and falls short of the national and Millennium Development Goal targets. For instance, the national goal for 2010—ie, an infant mortality rate of less than 30—will not be attained in rural India as a whole, and all except five states, even in 2015. The reason is that the coverage for priority interventions remains insufficient, and the content and quality of existing programmes suboptimum, further complicated by unacceptable inequities.
- The underlying cause of insufficient progress is weak health systems; substantial inadequacies exist in planning, financing, human resources, infrastructure, supply systems, governance, and monitoring.
- Adequate importance has not been given to the first 2 years of a child's life that are critical for prevention of undernutrition and its consequences; the focus of the nutrition programmes has become supplementary nutrition and preschool education for children aged 3–6 years.
- The only way forward is to transform health systems. Effective stewardship, decentralised planning in districts, effective service delivery in communities and health facilities, a reasoned approach to demand-side financing, a sustained campaign to change household behaviours, and creation of centres of excellence for health and nutrition policy research are essential for change.
- Child nutrition programmes need to be changed with focus on the vulnerable first 2 years of life.
- For long-term gains, investments in sexual and reproductive health of young people are essential.

DOI:10.1016/S0140-6736(10)62043-0

This is the second in a **Series** of seven papers on India: towards universal health coverage

All India Institute of Medical Sciences, New Delhi, India (Prof V K Paul MD, M J Sankar DM, V Sreenivas PhD); **Sitarum Bhartia Institute of Science and Research, New Delhi, India** (Prof H S Sachdev MD); **Indian Institute of Management, Ahmedabad, India** (Prof D Mavalankar MD); **Nutrition Foundation of India, New Delhi, India** (P Ramachandran MD); **Society for Applied Studies, New Delhi, India** (N Bhandari PhD); **National Health Systems Resources Centre, New Delhi, India** (T Sundararaman MD); **Institute of Health Management and Research, Jaipur, India** (D Govil PhD); **University College London Centre for International Health and Development, London, UK** (D Osrin PhD); and **London School of Tropical Medicine and Hygiene, London, UK** (Prof B Kirkwood PhD)

Correspondence to: Prof Vinod Kumar Paul, Department of Paediatrics, All India Institute of Medical Sciences, New Delhi 110029, India
vinodkpaul@hotmail.com

See Online for webappendix

Search strategy and selection criteria

Since several global systematic reviews are already available, we restricted our search to India, and reports published in English. We created three groups and used the following terms to search PubMed: "India" (group 1); "maternal", "child", "neonate", "newborn", "infant", "mother", or "pregnancy" (group 2); and "nutrition", "infection", "mortality", "morbidity", or "growth" (group 3). Of 16 695 citations in the past 10 years preceding March, 2009, 2960 publications were judged to be relevant to our report on the basis of the context of the policy and programme. 1965 full-text articles could be traced and were reviewed. Additionally, older publications were reviewed whenever relevant, and new publications after this search were actively tracked and studied.

Burden and underlying disorders

Trends in key indicators

The estimated population of India is 1.16 billion individuals⁷ and is projected to be 1.48 billion people by 2030, surpassing China as the world's most populous nation.⁷ The total fertility rate in 2005–06 was 2.7,³ versus 3.4 in 1998–99.⁸ It is now 2.1 (replacement level) in urban areas, and 3.0 in rural areas.³ In 2005–06, 56% of married women were using contraception³ compared with 41% in 1990–92⁹ and 48% in 1998–99.⁸ The estimated maternal mortality ratio showed a 36% reduction from 398 per 100 000 livebirths in 1997–08 to 254 per 100 000 livebirths in 2004–06 (figure 1).^{5,10,11} However, this decrease is not sufficient to achieve a maternal mortality ratio of less than 100 per 100 000 livebirths to meet national goals or the Millennium Development Goal (MDG) 5 by 2015 (table 1; figure 1).

According to the National Family Health Survey-3 (NFHS 3),³ the mortality rate for children (age <5 years) in India was 74 per 1000 livebirths in 2005–06. The Institute

of Health Metrics and Evaluation⁶ estimated a mortality rate of 62.6 per 1000 livebirths for 2010. At the current rate of progress, India will not be able to achieve the MDG 4 target of 38 per 1000 livebirths by 2015 (figure 1).^{11,12} In 2008, infant mortality rate in India was 53 per 1000 livebirths.⁴ The national goal is to attain a rate of less than 30 per 1000 livebirths by 2010.¹³ Our analyses show that most states, and rural areas as a whole, will not achieve this even by 2015. With the exception of Goa and Kerala, which already have infant mortality rates of fewer than 30 per 1000 livebirths, only Tamil Nadu, West Bengal, and Maharashtra are likely to achieve this target (table 2).^{4,14} In 2008, a neonatal mortality rate of 35 per 1000 livebirths,⁴ meant that more than two-thirds of infant deaths happened in the first 28 days of life.

More than 48% of children (age <5 years) are stunted (height for age <-2 Z score), 43% are underweight (weight for age <-2 Z score), and about 20% have wasting (weight for height <-2 Z score).³ Between 1998–99 and 2005–06, stunting showed a steady but slight reduction in the prevalence of 1% per year. At the current rate of decline, India will not achieve the national goals for child nutrition or the MDG 1 target for child nutrition, which is to reduce the prevalence of underweight among children (age <5 years) to 27% by 2015 (table 1).¹⁵ India consists of 28 states and seven union territories with diverse social, demographic, economic, geographic, and health systems. Wide differentials exist across states in the indicators for reproductive health, and child health and nutrition (webappendix p 8).

Causes of maternal and child mortality

The leading causes of maternal deaths in India are haemorrhage, sepsis, complications of abortion, and hypertensive disorders (figure 2).⁵ More than half of deaths in children (age <5 years) occur in the neonatal period; infections (including sepsis, pneumonia, diarrhoea, and tetanus), prematurity, and birth asphyxia are the three major causes of death in this period (figure 3). The remaining 45% of deaths occur in children aged between 1 month and 59 months, and the major causes are pneumonia and diarrhoea (figure 3).¹

Malnutrition and low birthweight

Undernutrition is the cause of a third¹⁶ to half¹⁷ of deaths among children (age <5 years). Reduction in rates of undernutrition has been slow but steady and is likely to speed up as a result of improvements in socioeconomic status.¹⁸ Transgenerational effects, however, could mean that full-scale change will take decades. Roughly a third of infants (7.8 million) are born with a low birthweight (<2500 g) every year, accounting for 26% of the global burden, the largest for any country.¹⁹ 60% of these infants are born at term after fetal growth restriction.²⁰ The first 2 years of life, particularly the earliest months, are crucial for addressing undernutrition that arises as a result of a combination of low birthweight, suboptimum feeding,

	Status (year)	Goals and targets (year)
Child (age <5 years) mortality rate	74 per 1000 livebirths (2005–06); ³ 69 per 1000 livebirths (2008); ⁴ 63 per 1000 livebirths (2010) ⁵	Millennium Development Goal 4: 38 per 1000 livebirths (2015)
Infant mortality rate	53 per 1000 livebirths (2008) ⁴	National Population Policy (2000) and National Rural Health Mission: <30 per 1000 livebirths (2010); XI Plan: 28 per 1000 livebirths (2012)
Neonatal mortality rate	35 per 1000 livebirths (2008) ⁴	National Plan of Action for Children 2005: 18 per 1000 livebirths (2010)
Maternal mortality ratio	254 per 100 000 livebirths (2004–06) ⁵	National Population Policy (2000) and National Rural Health Mission <100 per 100 000 livebirths (2010); Millennium Development Goal 5 <100 per 100 000 livebirths (2015)
Total fertility rate	2.7 (2005–06) ³	National Rural Health Mission: 2.1 (2012)
Prevalence of underweight among children (age <5 years)	43% (2005–06) ³	National Plan of Action for Children 2005: reduce by half (2010); Millennium Development Goal 1: 27% (2015)

Table 1: Key indicators, and current status and national goals for maternal, newborn, and child health

and infections such as diarrhoea. Early undernutrition predisposes to irreversible effects on educational attainment, adult height, income, and the birthweight of subsequent offspring.

A third of infants have wasting and a fifth are stunted at birth and within the first 6 months of life (figure 4). During the first few months, exclusively breastfed infants generally remain free from infections and are not predisposed to further undernourishment. However, introduction of animal milk between 3 months and 5 months triggers a rise in morbidity due to infections and an increase in the rates of underweight and stunting. Late introduction and inadequate quantity of complementary feeds, and an increase in infections, lead to a further rise in rates of underweight and stunting between the ages of 6 months and 11 months (figure 4). The main reason for a steady increase in the prevalence of undernutrition in the second year of life is the intake of inadequate and low-energy foods. Because of the faltering growth and increase in stunting with increasing age, the prevalence of subnormal body-mass index (BMI) shows a progressive fall from a third in the first 6 months to a sixth by the third year.

By use of the New Delhi Birth Cohort longitudinal database,²¹ we noted that low birthweight increased the odds of underweight, stunting, and wasting in the first 5 years of life, and the effect generally decreased with increasing age (webappendix p 8). At 6 months of age, 28% of underweight and stunting and 22% of wasting were attributable to low birthweight. From the age of 1 year to 5 years, 16–21% of wasting, 8–16% of stunting, and 16–19% of underweight were attributed to low birthweight.

The immediate causes of poor reproductive health, and child health and undernutrition have underlying social, economic, and environmental determinants: literacy, women's status, sociocultural beliefs, caste, taboos, and, above all, income level. Analysis of data from NFHS-3³ showed that illiteracy, low wealth index, rural habitat, and perceived small size at birth were significantly associated with neonatal and infant mortality (webappendix pp 9–10). For low birthweight, maternal age at childbirth of less than 20 years was associated with a roughly 50% excess risk compared with childbirth at older age. Antenatal care seemed to protect strongly against low birthweight. These analyses indicate the importance of delaying childbirth until after 20 years of age, and providing antenatal care and birth spacing as interventions to improved child survival.

The nutritional status of Indian women is inadequate: 33% of married women (aged 15–49 years) are too thin (ie, BMI <18.5 kg/m²), and 11% are too short (ie, height <145 cm).³ In 2004, more than 75% of women were anaemic.²² The reported prevalence of anaemia in pregnant women from large-scale surveys range from 74.3%²² to 96.2%.²³ Added to these burdens are the challenges of the epidemiological transition.

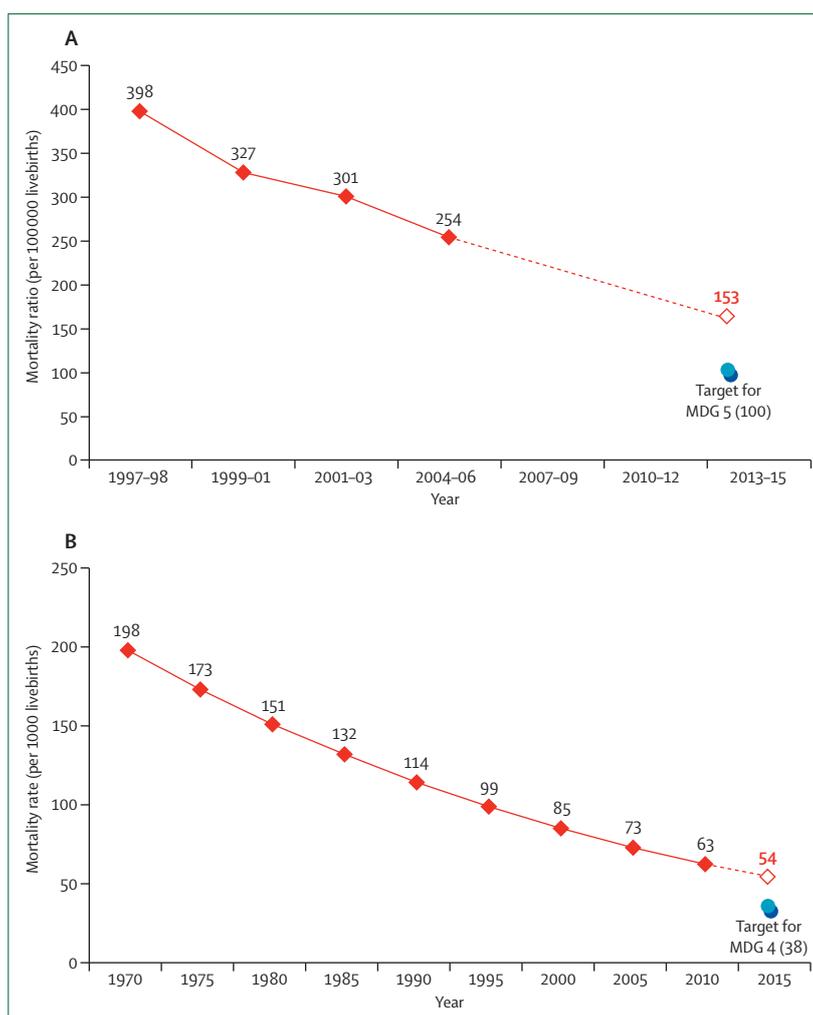


Figure 1: Trends and projections in maternal mortality ratio (A) and child (age <5 years) mortality rate (B) in India

(A) Data from the Registrar General of India;^{5,30} projection to 2015 is based on the average annual rate of reduction from 1997–98 to 2004–06. MDG=Millennium Development Goal. (B) Data from the Institute for Health Metrics and Evaluation;³¹ the projection to 2015 is based on the average annual rate of reduction since 1990.

Overnutrition is emerging as an important public health problem—12.6% of women and 9.3% of men aged 15–49 years have a BMI of 25 kg/m² or more,³ and is more common among people living in urban areas.²⁴ It is associated with a rising prevalence of diabetes mellitus and cardiovascular diseases; an estimated 80 million people are expected to need health care for diabetes mellitus by 2030 in India.^{25–28}

Another challenge is rapid and unplanned urbanisation. Current estimates suggest that 30% of India's population live in towns and cities, and this proportion is projected to increase to 40% (550 million) by 2026.^{29,30} Overall health indicators are generally better in urban than in rural areas, but the aggregate data are not sufficiently informative; the health of individuals who are poor and living in urban areas does not differ substantially from that of the rural population (table 3).³¹

	Actual infant mortality rate (year)			Projected infant mortality rate for 2015*
	1990 [†]	2000 [†]	2008 [†]	
India				
Total	80	68	53	43
Rural	86	74	58	47
Urban	50	43	36	31
States				
Andhra Pradesh	70	65	52	43
Assam	76	75	64	56
Bihar	75	62	56	51
Delhi	43	32	35	38
Goa	21	23	10	5
Gujarat	72	62	50	41
Haryana	69	67	54	45
Himachal Pradesh	68	60	44	34
Karnataka	70	57	45	37
Kerala	17	14	12	10
Madhya Pradesh	111	87	70	58
Maharashtra	58	48	33	24
Meghalaya	54	58	58	58
Orissa	122	95	69	52
Punjab	61	52	41	33
Rajasthan	84	79	63	52
Tamil Nadu	59	51	31	20
Uttar Pradesh	99	83	67	56
West Bengal	63	51	35	25

*Base year was 2000. †Data from the Registrar General of India.

Table 2: Actual and projected infant mortality rates (per 1000 livebirths) in the main states

For data from the Registrar General of India see http://censusindia.gov.in/Vital_Statistics/SRS_Bulletins/SRS_Bulletins_links/Bulletin_2001_Vol_35_No_2.pdf

Scope of current programmes

The main national programmes are the Reproductive and Child Health Programme, National Rural Health Mission (NRHM; panel 1), and the Integrated Child Development Services (panel 2).^{32–37} Janani Suraksha Yojana, a conditional cash transfer scheme to promote deliveries in institutions, is another major initiative that is part of NRHM.^{38,39} Health and nutrition are multidimensional and cross the traditional boundaries between sectors and ministries, requiring improvements in water, sanitation, habitat, connectivity, industry, and food security. Although we recognise that the landscape is intersectoral, in this report we focus mainly on the reproductive health, and child health and nutrition programmes. Policies and programmes for reproductive health and child health include most of the interventions across the life-cycle and service-delivery continuum discussed in *The Lancet* Series about neonatal,⁴⁰ child,⁴¹ and maternal⁴² survival. Inclusion of interventions in a policy or programme document, however, does not mean that they will achieve sufficient coverage for effect, as is the case for India (webappendix p 11).^{23,43} India has not achieved coverage of

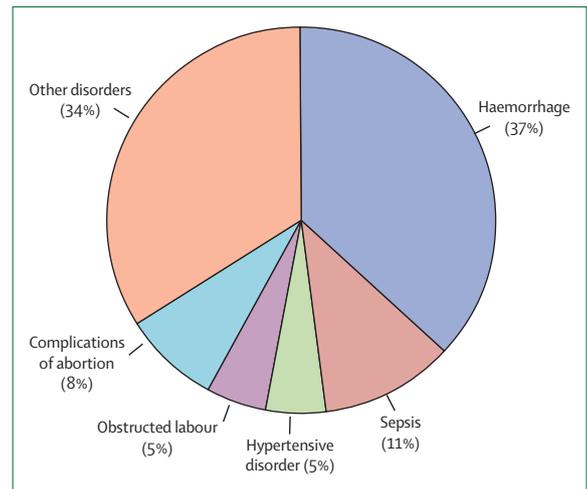


Figure 2: Causes of maternal deaths in India (1997–2003)
Data from the Registrar General of India.⁴⁰

more than 55% for any of the priority interventions for reproductive health, and child health and nutrition. For example, only 46% of infants were exclusively breastfed in the first 6 months of life in 2007–08, and just 24% received solid or semisolid feeds and breastfeeds at 6–9 months.⁴³ A wide variation exists between states (figure 5), and across districts within them (webappendix p 12).⁴³ Improvement of the status of reproductive health, and child health and nutrition requires state-specific and district-specific insights and approaches. The issues about inequities in different socioeconomic strata are discussed by Balarajan and colleagues⁴⁴ in this Series.

Gaps in programmes and strategic directions Child health

In this section, we identify the programmatic gaps in reproductive health, and child health and nutrition. A summary of specific suggestions to address these gaps is presented in webappendix pp 3–5. Integrated Management of Neonatal and Childhood Illnesses, the Indian adaptation of the generic strategy for Integrated Management of Childhood Illness, was introduced in 2005. It includes home visits in the first week of life by anganwadi workers. Postnatal home visits, a strategy that was developed on the basis of the work by Bang and colleagues⁴⁵ in Gadchiroli, have now been recommended by WHO and UNICEF.⁴⁶ The scale-up of Integrated Management of Neonatal and Childhood Illnesses has, however, been tardy. Although training was initiated in 223 districts, only 43 achieved more than 80% coverage for all categories of workers. Nonetheless, by June, 2009, 202 015 providers (>85% of whom were frontline workers—anganwadi workers, auxiliary nurse midwives, and accredited social health activists) had been trained (Mohan P, Unicef India, New Delhi, India, personal communication). For many smaller countries this number would be universal coverage, but in India it is more than ten times fewer than

the number of trainees needed in just the high-burden districts. The reasons for the slow implementation, aside from the numbers required, include lack of capacity for training and supervision, lack of ownership by and convergence with the Integrated Child Development Services, lack of review and monitoring nationally and in states, inability to integrate the referral component, and non-availability of line supervisors.

While Integrated Management of Neonatal and Childhood Illnesses was becoming established, programme managers overlooked the need to continue pushing for increased population coverage of pre-existing interventions, especially for diarrhoea and acute

respiratory infections in districts and blocks where rollout of the Integrated Management of Neonatal and Childhood Illnesses was not planned immediately. Little progress has occurred in their coverage. For instance, in 2007–08,⁴³ 34% of children received oral rehydration solution for diarrhoea compared with 30% in 2002–04.²³

Facility-based care of infants and children has also not been given enough attention. Consequently, when the number of deliveries in institutions increased as a result of Janani Suraksha Yojana, the availability and quality of newborn care was inadequate.⁴⁷ UNICEF's facility-based newborn-care programme to operationalise special-care newborn units in district hospitals and stabilisation units

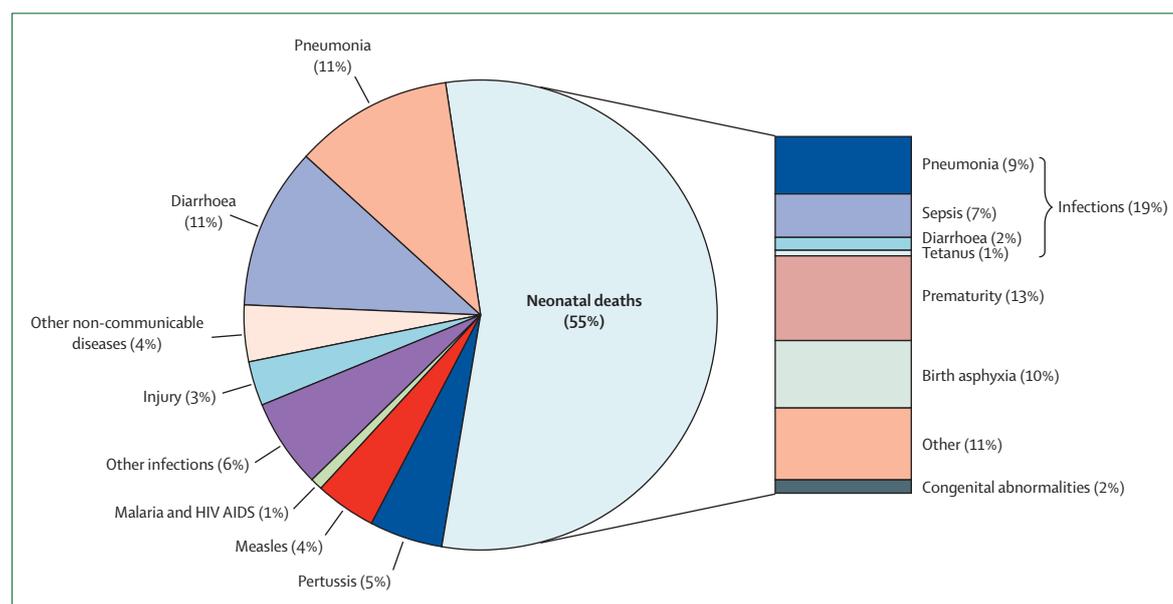


Figure 3: Causes of deaths among children (age <5 years) in India (2008)

Data from Black and colleagues.¹

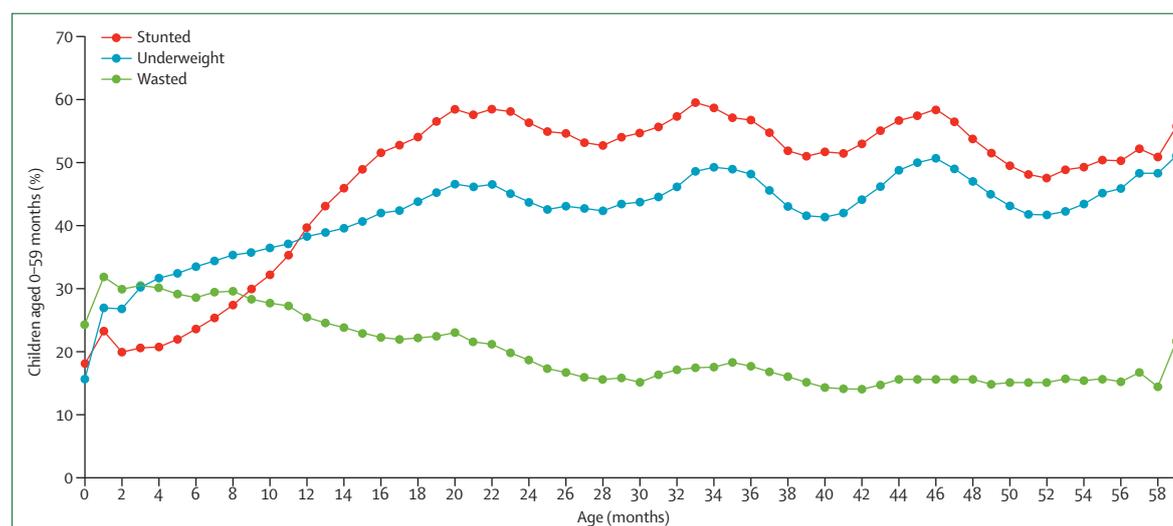


Figure 4: Prevalence of stunting, underweight, and wasting in children (age <5 years)

Reproduced with permission from International Institute for Population Sciences.³

	Urban			Rural overall
	Poor	Non-poor	Overall	
Neonatal mortality rate (per 1000 livebirths)	34.9	25.5	28.7	42.5
Infant mortality rate (per 1000 livebirths)	54.6	35.5	41.7	62.1
Child (age <5 years) mortality rate (per 1000 livebirths)	72.7	41.8	51.9	81.9
Total fertility rate (children per woman)	2.8	1.84	2.06	2.98
Deliveries in institutions	44.0%	78.5%	67.4%	28.9%
Children completely immunised	39.9%	65.4%	57.6%	38.6%
Children (age 0–5 months) exclusively breastfed	44.7%	38.6%	40.7%	48.6%
Children (age <3 years) who are underweight	47.1%	26.2%	32.7%	45.6%
Children with diarrhoea in the past 2 weeks given oral rehydration solution	24.9%	36.3%	32.6%	23.8%
Permanent sterilisation methods used	41.1%	38.2%	38.9%	38.1%
Total unmet need for contraception	14.1%	8.3%	10.0%	14.6%

Data from the Urban Health Resource Centre.³¹

Table 3: Key indicators of maternal, newborn, and child health in urban areas (2005–06)

in subdistrict facilities, with technical support from the National Neonatology Forum, needs to be expanded by state governments. Inpatient care of sick children should be linked to these newborn-focused efforts.

Because treatment of pneumonia, diarrhoea, and neonatal infections is important, ways to ensure early identification of sick infants and children, provide primary treatment in the community, and refer the children to facilities, if indicated, are urgently needed. Results of studies have shown a care-seeking bias against girls. For every two male neonates, only one female neonate is admitted to a health facility (district hospital or a tertiary-care institution).^{48–50} Financial incentives for care seeking might need to be considered, particularly for female infants and children. Ideally, neonates with sepsis should be treated in health facilities. However, most are not taken to such facilities, and auxiliary nurse midwives urgently need to be trained and empowered to administer intramuscular injections of gentamicin and oral antibiotics, either on an ambulatory basis or at home. Additionally, physicians practising ayurveda, unani, siddha, and homoeopathy might be involved in this task. Another important option is to involve the private sector in the care of sick neonates and children.

Evidence shows that community health workers can be effective in substantially reducing the number of child deaths, especially through case management.⁵¹ Experience from India, both from research^{45,52} and in the programme setting,⁵³ justifies encouragement of home-based and community-based care of neonates and children. With the introduction of one accredited social health activist (a school-educated local female health worker) per 1000 population, under the NRHM, there is great potential to strengthen care of neonates and children in the community. An opportunity exists to introduce the home-based newborn-care model,⁴⁵ especially in areas

where access to health facilities and care seeking are inadequate. After an avoidable delay of years, training of accredited social health activists for such a role has been started; however, completion of training is likely to take 3–5 years in the high priority districts. Training must be followed by effective supervision, supplies, and payment to accredited social health activists for the strategy to be effective and sustainable. The role of these health workers in promoting immunisation and providing treatment for diarrhoea and acute respiratory infections also needs to be further strengthened.

The proportion of infants aged 12–23 months who were fully vaccinated (BCG, measles, diphtheria, pertussis, and tetanus, poliomyelitis) increased to 54% in 2007–08,⁴³ from 46% in 2002–04.²³ This increase in uptake happened after a phase of stagnation in the preceding decade. However, India still lags behind the rest of the world in immunisation coverage—the global average for diphtheria, pertussis, and tetanus is 81%⁵⁴ compared with 64% in India.⁴³ Existing immunisation services have not ensured reliable, regular supply and distribution of vaccines, despite India being a major producer of vaccines. The situation is made worse by operational deficiencies such as defunct cold chain equipment, vacant staff positions, weak surveillance of vaccine-preventable diseases (other than poliomyelitis), erratic implementation of a fixed-day, fixed-place strategy, and lack of active targeting of potential non-acceptors. Community participation in routine immunisation is inadequate, communication activities to encourage behaviour change have not been prioritised, and communities view polio vaccine as the only important vaccine.⁵⁵ Some states have tried innovative approaches to increase coverage, including deploying alternative vaccinators. Other examples are Muskaan ek abhiyan, an incentive-based scheme in Bihar with programme monitoring at the highest administrative department, and Shishu Samrakshak Maah in Chhattisgarh, which provides immunisation with other child health interventions. The perception among public health activists is that the weight of international recommendations, the opinion of professionals from the private sector, and lobbying by industry, rather than scientific evidence and context of the programme, tend to affect the introduction of vaccines. A judicial intervention in response to a civil society plea in this respect has led to a comprehensive review of vaccine policy recently.

Maternal health

Under the NHRM, the Government of India has taken steps to improve maternal health. The three key efforts are encouraging delivery in institutions through incentives from Janani Suraksha Yojana, supporting the development of services for emergency obstetric care, and training auxiliary nurse midwives and nurses for 2–3 weeks to gain competencies as skilled birth attendants. Janani Suraksha Yojana provides a cash incentive to women who give birth in health centres or government

Panel 1: India's reproductive and child health programmes

Until the advent of the National Rural Health Mission (NRHM) in 2005, India's programmes for maternal and child health and family planning were fragmented and inconsistent, and mostly vertical—family planning in the 1960s and early 1970s, immunisation in the 1970s and 1980s, and diarrhoeal disease in the late 1980s and early 1990s. The country did not take a comprehensive view of the needs of the communities, outreach programmes, and facilities. Inadequate health systems (human resources, infrastructure, supplies, monitoring), with low political visibility of health and low health spending, were never adequate to support the action that was needed to improve the health of women and children. Hence, India often missed most of the goals.

In 1992, India launched the Child Survival and Safe Motherhood (CSSM) Programme by bringing together interventions for child survival (immunisation, control of diarrhoeal disease, acute respiratory infections, vitamin A, essential newborn care) and maternal health (antenatal care, deliveries in institutions, emergency obstetric care). In 1997, the programme for family planning and the CSSM Programme were merged to create the Reproductive and Child Health Programme. The focus on reproductive and child health shifted to births in institutions and emergency obstetric care as the key strategy for reduction of the maternal mortality rate.

2005 was a watershed year for the health sector in India. The government launched the NRHM. This mission included increased investment in public health, improvements in health systems, focus on communities, decentralisation, and demand-side

(Continues on next column)

(Continued from previous column)

interventions to improve the effectiveness of the programmes. The programme for reproductive and child health was integrated into the NRHM. Although the NRHM has a wide scope, its prime focus is on reduction of maternal and child mortality rates. Key strategies include deployment of more than 750 000 new health workers—accredited social health activists), and 47 000 additional auxiliary nurse midwives and 27 000 new nurses; integration of disease control programmes in the communities or population; setting up of 450 000 village health and sanitation committees (made up of local elected representatives, an anganwadi worker, accredited social health activists, local school teacher, and representatives of self-health groups); strengthened primary health-care infrastructure (civil work, equipment, and supplies); ensuring quality to meet Indian public health standards; provision of unconditional grants at subcentres for autonomous action for health locally; strengthened programme management capacity by deployment of management professionals in states and districts; funds provided directly to the districts from the centre; and establishment of 29 000 patient-welfare committees at facilities for local decision making and use of funds.^{32,33} A total of 1031 mobile medical units are operational and emergency transport system has been made operational in 12 states with 2919 ambulances.³³

An assessment of NRHM by an international advisory panel showed that the demand for public health facilities has gone up. NRHM strategies have had a positive effect on antenatal care, institutional deliveries, and immunisation. However, the effect on infant mortality rate has not been impressive. The NRHM has not succeeded in removing the regional imbalance in health infrastructure in the subcentres and primary health centres.³⁴

hospitals. If a woman delivers in a facility, she is entitled to receive INR1400 (US\$35), and the health worker (accredited social health activist) who accompanies her to the facility receives INR600 (\$15) for transportation expenses and as an incentive. In urban areas and high-performing states, the incentives are low and are restricted to women living below the poverty line. In just 5 years, beneficiaries of Janani Suraksha Yojana have increased 13 times, from 0.74 million in 2005–06 to nearly 10 million in 2009–10,³³ thus representing almost 40% of the 26 million women who deliver in India every year. Budgetary allocation for Janani Suraksha Yojana increased from \$8.5 million to \$275 million in 2008–09. From the point of view of delivery in public sector health facilities, cash incentives seem to stimulate demand and enhance use. In just 1 year, for instance, the states of Rajasthan³⁶ and Madhya Pradesh³⁷ showed an increase in deliveries in government facilities by 36% and 53%, respectively. Janani Suraksha Yojana has helped to overcome financial constraints that prevented women from going to the hospitals for delivery.

After 2–3 years of implementation of Janani Suraksha Yojana, high odds of births in facilities were reported

among users of the scheme and a reduction of about four perinatal and two neonatal deaths per 1000 livebirths.³⁸ The findings of the study confirmed substantial use of Janani Suraksha Yojana by individuals who were poor, as had been shown in other less robust assessments.^{56,57} An increase of 8.0%, from 29.8% to 37.8% in deliveries in rural institutions between 2002–04²³ and 2007–08⁴³ is generally attributed to Janani Suraksha Yojana.

Although the experience with Janani Suraksha Yojana shows that India can embark on bold, big initiatives for maternal, newborn, and child health, there are major concerns and challenges.³⁹ Most mothers and babies are discharged within hours of delivery because hospitals lack amenities and families want to return home after receiving the cash incentive.^{56–58} Therefore, there is not enough time for newborn-care counselling, establishment of breastfeeding, stabilisation of post-partum mothers, and detection of danger signs in mothers and infants. Deliveries might be made by unskilled support staff rather than by skilled nurses or doctors, and best practices such as partography, neonatal resuscitation, and kangaroo

mother care are not followed. The system of referral in emergency departments is inadequate. Payments to families and accredited social health activists are delayed in some places,^{58,59} and instances of corruption have also been reported.⁵⁹ Another serious issue is the effect of Janani Suraksha Yojana on other initiatives for maternal, newborn, and child health. Since the management capacity of the health system has not been optimally augmented for Janani Suraksha Yojana, its magnitude, high political visibility, and a huge number of transactions result in the neglect of other vital programmes. Janani Suraksha Yojana is a unique initiative and its full effect and implications have yet to emerge. The challenge is to strengthen, streamline, and deepen its implementation, and to increase the equity quotient and ensure continued independent monitoring and assessment.³⁹

NRHM has also triggered innovative approaches in states. Tamil Nadu, for example, has operationalised strategically located primary health centres for basic emergency obstetric care and referral services, developed subdistrict hospitals for emergency obstetric and neonatal care, and instituted an audit of maternal deaths.⁶⁰ The delivery rate in institutions is now 98%.³ Importantly, maternal care has shifted from large to small hospitals, and from the private to the public sector.

Gujarat has shown that public-private partnerships can increase access to delivery in institutions and emergency obstetric care. The Government of Gujarat by recognising the shortage of obstetricians in the public system in rural areas, and at the same time their presence in the private sector in nearby towns, developed an innovative partnership. The Chiranjeevi scheme provides childbirth and services for emergency obstetric care in private hospitals under the care of qualified private obstetricians, free of cost to families but paid for by the government. More than 800 obstetricians have joined the scheme and have undertaken more than 300 000 deliveries for clients who are poor, with acceptable rates of caesarean section. At about \$46 per delivery, the government has negotiated a low average rate of payment per delivery, including caesarean sections.⁶¹ The model is being replicated in other states. Referral services, specifically emergency ambulance services, have also improved in 12 states through public-private partnership. The services are free of cost and highly popular. In Assam, outreach services are being delivered to isolated islands of the Brahmaputra river by use of innovative boat clinics.

Most states have a shortage of anaesthetists and obstetricians. Only 31% of community health centres have obstetricians, surgeons, and paediatricians.⁶² The Government of India has developed in-service courses in emergency obstetric care (16 weeks' duration) and life-saving skills in obstetric anaesthesia (18 weeks' duration) for general medical officers with the aim of deploying them in district hospitals and community health centres. Although in the right direction, the scale-up of such multiskilled approaches is unlikely to close the gap in

human resources soon. Postnatal care continues to be insufficient, with only 51% of women receiving any in 2007–08.⁴³ Since home deliveries are likely to remain a reality for some time, and mothers often leave hospital within a day of delivery in an institution, postnatal care needs to be provided at home. Accredited social health activists should provide such care to neonates and mothers by making home visits.

Family planning and sexual health

In principle, reproductive health is not about population control but a matter of rights, informed choice, good health, and wellbeing. Most of the increase in the population will occur among communities that are poor, and the challenge to ensuring that health, education, employment, and amenities are provided to a large population is formidable. India rejected the coercive family planning policies that were implemented in China, and it has no reason to go back to a regime of targets. Rather, the focus should be on how to address the unmet need for contraception and ensure access to adolescent, maternal, and child care. To improve reproductive health in the long term, engagement with young people is essential (panel 3).^{3,63–67}

Despite the fact that the emphasis of the programme for reproductive and child health is on client choice and use of non-terminal methods, female sterilisation accounts for about two-thirds of the prevalence rate for contraception, a proportion that has not changed since 1990–92.^{3,9} The unmet need for contraception, both for birth spacing and termination, is substantial. Indeed, 13% of married women reported that they were not using contraception even though they wished to delay further pregnancies or stop further childbearing altogether.³ The unmet need for contraception among young married women is high (27% and 21% for women aged 15–19 years and 20–24 years, respectively). Difficulties in obtaining contraception include a lack of awareness of non-terminal methods (notably among young women⁶⁸), little communication with couples, and an imbalance in gender relations that make access to contraception difficult for women. At the same time, deficiencies exist in the programmes—health-care providers do not always inform women about the options available or counsel clients about potential side-effects of the different methods; not all physicians at peripheral health centres are trained in the methods of sterilisation, and not all paramedical staff have appropriate skills in inserting intrauterine devices.⁶⁹

Prevention of unsafe abortion

Despite the liberalisation of abortion services since the early 1970s, access to safe abortion remains restricted, particularly in rural areas. Of the estimated 6·7 million abortions per year, only 1 million are thought to be provided by certified cadres at authorised centres.⁷⁰ The typical woman seeking an abortion is married and aged 20–29 years, but a large number are young and unmarried,

Panel 2: Integrated Child Development Services (ICDS)

Services provided by this programme include supplementary nutrition, non-formal education, immunisation, health check-ups, referral services, and nutrition and health education. These are provided at a centre called the Anganwadi (a courtyard play centre) that is located within the village itself. The anganwadi worker, a woman selected from the local community, is the key functionary. She, with assistance from a helper, is responsible for the population of an average village (about 1000 people).

The anganwadi worker surveys all the families in the community and identifies children younger than 6 years, and pregnant and lactating women. Eligible individuals are given supplementary feeding support for 300 days per year. On average, the daily supplement is expected to provide 500 calories and 12–15 g of protein to children, and 600 calories and 18–20 g of protein to pregnant or lactating women. Children who are severely malnourished are given an additional 300 calories and 8–10 g of protein on the basis of medical advice. The anganwadi worker also monitors and plots the growth of children who attend the Anganwadi centre by weighing them periodically and plotting the data on weight-for-age growth cards. Additionally, she is entrusted with the responsibility of nutrition and health education of women aged 15–45 years.

Launched in 1975, the programme has gradually increased from 33 projects to 7073 projects in 2009, catering to about 87.3 million beneficiaries through a network of about 1 million Anganwadi centres.³⁵ The allocation of funds for the scheme has steadily increased over the years from INR26 012.8 million in the 8th Five Year Plan (1992–97) to INR440 000 million in the 11th Five Year Plan (2007–12).³⁶

(Continues on next column)

(Continued from previous column)

The effect of the ICDS programme has been the subject of intense scrutiny in the past two decades, the findings of which are not encouraging. The programme has not been able to achieve the necessary results despite three decades of existence. Results of studies have shown little or no association between the presence of an ICDS centre and the nutritional status of children.³⁷ Focus on children younger than 3 years is inadequate, thus missing the critical window of opportunity to avert an avoidable undernutrition. About 20% of children younger than 6 years live in areas that do not have an anganwadi centre (National Family Health Survey-3).³ Even in those areas that do, almost three-quarters of children did not receive any supplementary food from an anganwadi centre in the 12 months before the survey. A similar proportion of women did not receive supplementary food from an Anganwadi centre during their previous pregnancy.

Although ICDS might not have succeeded in substantially reducing the burden of undernutrition, the presence of an anganwadi worker and a physical site for health and nutrition activities (Anganwadi centre) in villages and poor urban areas offers a great opportunity to improve nutritional status and provide health-care services for mothers and children.

gestational age of 7 weeks or less was legalised in 2002,⁷³ and, to make them more accessible, rules and regulations were further amended so that abortions can now be undertaken by certified providers in unregistered facilities, as long as they have access to a registered facility for backup.⁷⁴ Although impressive, these efforts remain insufficient to meet the needs of women seeking abortion services.

Selective abortion

often seeking abortion in the second trimester.⁷¹ Many factors affect access to safe abortion services. The distribution of registered abortion facilities and certified providers is uneven across and within states. Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh together have 40% of the population but less than 17% of all approved abortion facilities.⁷² Moreover, most abortion facilities are located in urban areas, whereas more than 70% of Indian women live in rural areas. Aside from the inaccessibility of facilities, other obstacles include a lack of trained providers, perceived poor-quality care, little awareness that women are legally entitled to abortion, cost, and for young and unmarried women there is the fear of disclosure.

The Government of India has made concerted efforts to increase access to abortion services. For example, the National Population Policy¹³ recommended expanding the provision of abortion to the primary health centres. Certification procedures have been rationalised, training of medical officers in manual vacuum aspiration has been expanded, non-surgical abortion (using drugs) at

In India, men and women across all wealth strata, education groups, castes, tribes, religions, and states have a preference for sons. For example, 81% of ever-married women and 74% of ever-married men wanted at least one son, and a quarter of men and women wanted more sons than daughters.³ The high prevalence of sex-selective abortion after prenatal diagnostic testing is a cause for concern. Although the government tried to address this practice by introducing a law in 1994, it has not been able to prevent many such abortions.⁷⁵ Prevalences of sex-selective abortions that were reported in community-based studies ranged from 3% to 17%.^{76–79} Indirect estimates derived from data reported by NFHS-2 indicate that, among women who received ultrasound or amniocentesis during antenatal check-ups, 6.4% of female fetuses were assumed to have been aborted.⁸⁰ The child sex ratio recorded in the 2001 census was 927 girls per 1000 boys (age 0–6 years), worse than the estimated 945 girls per 1000 boys in the 1991 census.^{29,81} Sex ratios are very low in Punjab, Haryana, Delhi, Gujarat, and Rajasthan (793, 820, 865, 878, and 909 girls, respectively,

per 1000 boys). Some states are now showing a trend towards improvement.

Early age at childbirth

The median maternal age at first delivery in India is 19·9 years; about 30% of girls give birth before the age of 20 years, and account for 21% of all deliveries.³ We have estimated that the risks of neonatal mortality and low birthweight are increased by almost 50% if maternal age at childbirth is less than 20 years (webappendix pp 9–10). Early childbearing is also associated with excess maternal mortality. In a national study done by the Indian Council of Medical Research at ten institutions, maternal mortality among adolescents was 645 per 100 000 livebirths compared with 342 per 100 000 livebirths in women aged 20–34 years.⁸²

Child nutrition

India's inability to improve child nutrition arises from the present policy that lacks an evidence base for effectiveness. The National Plan of Action for Children 2005 committed India to reducing malnutrition and low birthweight in children (age <5 years) by half from 2005 to 2010.⁸³ This reduction was impossible in view of the evidence that changes in fetal and child growth are not biologically amenable to quick improvements. Although the first 2 years of life, particularly the earliest weeks and months, are important for prevention of undernutrition and the serious and long-term consequences associated with it, this age group has not received sufficient focus.¹⁵ Panel 2 shows that the focus of the Integrated Child Development Services is provision of supplementary nutrition and education for children aged 3–6 years. In a time and motion study, anganwadi workers spent 40% of their time on education of this age group, 36% on provision of supplementary nutrition, 16% on record keeping, and 9% on the rest of their activities.⁸⁴ Little time was left to work with infants or for activities such as home visits, growth promotion, health and nutrition education, and community mobilisation.

This lack of attention to young children is one of the conceptual inadequacies of the Integrated Child Development Services. Other deficiencies include a lack of home visits to newborn infants, thereby missing a chance to support breastfeeding, one of the most potentially effective interventions for child health; a lack of emphasis on feeding low-birthweight infants, a high-risk group; inadequate efforts to help vulnerable groups (girls, low castes, tribal populations, poor families); a focus on food supplements at the expense of education to improve feeding practices; poor content and quality of take-home supplements for young children; inadequate convergence between health and nutrition programmes and systems; and an approach to the management of severe acute malnutrition that is not sufficiently robust. These inadequacies in design need to be addressed before progress can be made in nutrition.

Although severe acute malnutrition in children has gradually declined in prevalence, it has not really been addressed systematically. The emphasis has been on inpatient rehabilitation, but recognition of the need to implement community and domiciliary approaches is increasing.^{85,86} Progress has been hampered by the lack of treatment regimens that have undergone rigorous assessment and uncertainty about the usefulness of ready-to-use therapeutic foods. Most stakeholders do not judge severe acute malnutrition to be a medical emergency. The way forward is to undertake controlled research to compare feasible regimens, including locally manufactured, culturally acceptable, ready-to-use therapeutic foods.^{87,88} Webappendix p 5 shows the suggested strategic directions for policy and programmes for child nutrition.

Poor implementation of strategies for reproductive and child health is due to weak health systems. We present suggestions to address these gaps in webappendix pp 6–7.

Weak health systems

Governance

Technical leadership in India and its states is weak. Bureaucrats with little experience in public health make decisions about reproductive and child health, whereas technical advisors are relegated to the fourth level of the central hierarchy. Nationally, for the entire maternal or child health programme, there are five or six senior technical professionals. This problem was recognised early, but little improvement has occurred.⁸⁹ Expert technical committees are established for specific tasks, but not for sustained guidance. Weak technical leadership means that crucial aspects of programmes might get little attention (eg, inadequate push for programmes for diarrhoea, acute respiratory infections, and adolescent health). Guidelines and strategies are delayed and programmes are often implemented with a lack of commitment. International agencies are often relied on for technical advice by governments and these agencies have their own agendas.

In states, governance of the health and nutrition sector is much weaker and frequent changes occur at the top hierarchy. For instance, in the first 4 years since the launch of NRHM, Uttar Pradesh, Uttarakhand, Chhattisgarh, Bihar, and Rajasthan have had seven, six, five, four, and four secretaries of health, respectively. New incumbents at times undermine, reduce, or discard initiatives taken by their predecessors, breaking continuity and demoralising downstream implementers. Tensions exist between NRHM mission directorates (headed by non-doctor administrators) and health directorates (headed by physician administrators). In the districts, the NRHM health societies, the overarching financial and administrative bodies, are supervised by district magistrates rather than district health chiefs, but accountability for delivery of health outcomes is perceived

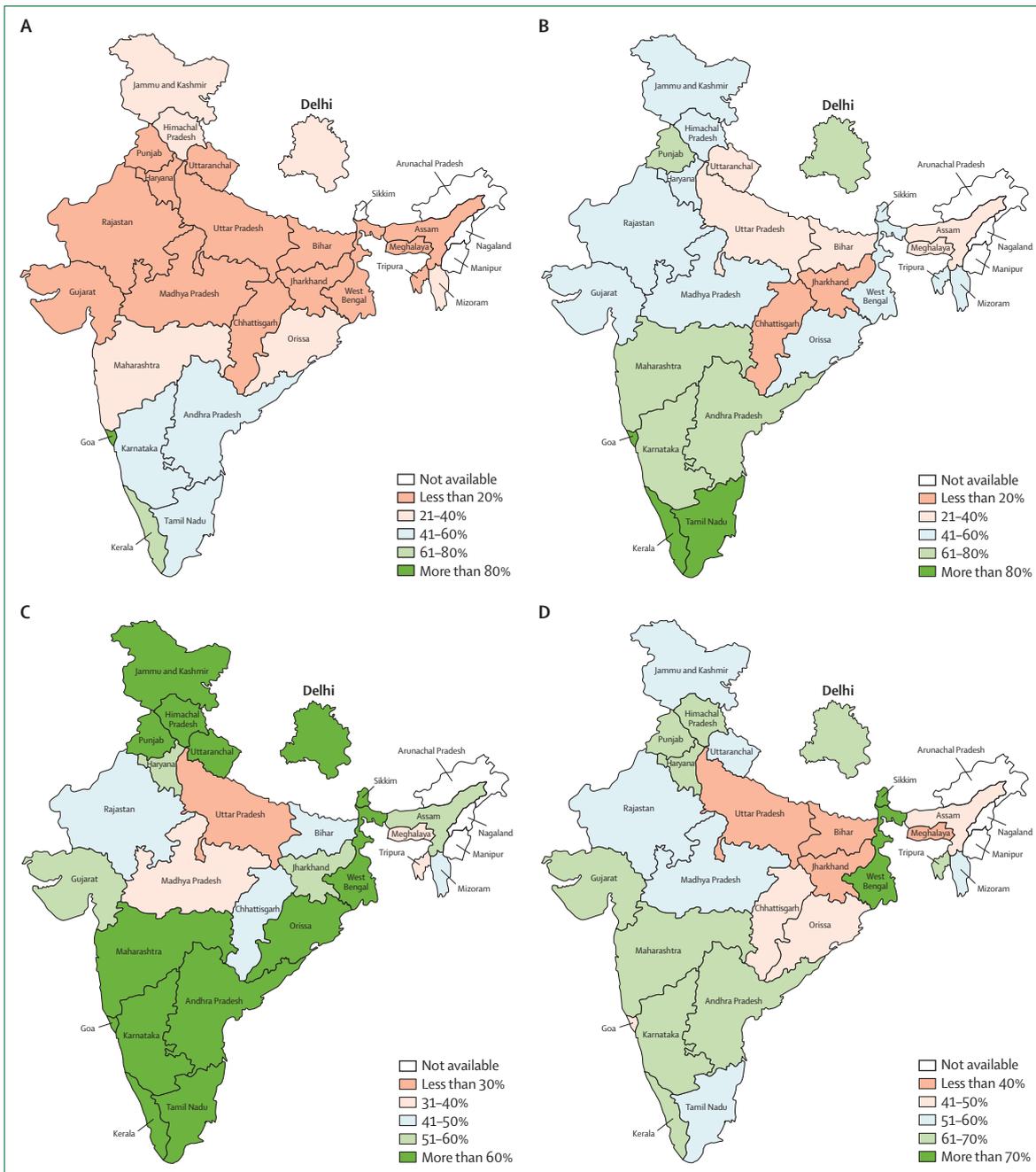


Figure 5: Coverage of key interventions for reproductive and child health in different states of India (2007-08)

(A) Women given complete antenatal check-ups. (B) Women who delivered in institutions. (C) Children (aged 12-23 months) given complete immunisation. (D) Use of any method for family planning. Reproduced with permission from International Institute for Population Sciences.⁴³

to be the responsibility of health departments. These issues need to be addressed to ensure a motivated district health leadership to deliver effective, efficient, and responsive frontline health care.

Planning

The Government of India allocates funds to states every year on the basis of their yearly plans for programme

implementation under the NRHM. These plans are a declaration of the vision, intent, action, and resource needs of each state to meet its commitments to the health goals.⁹⁰ A review of the yearly plans of different states shows that they emphasise politically visible schemes (such as Janani Suraksha Yojana, health campaigns, and special-care baby units), ignoring critical interventions such as those for diarrhoea, acute

Panel 3: Reproductive health issues for young people in India

With a huge population that is young, investments in the health of young people are crucial for the country's productivity and development. Young women and men, both in and out of school, have to be reached to educate them about good reproductive and sexual health, and to lay a foundation for healthy lifestyles.

Women in India continue to get married at a young age: 18% of women aged 20–24 years were married by the time they were 15 years old and almost 47% before the minimum legal age (18 years) for marriage. Early marriage is followed by early pregnancy. The National Family Health Survey³ reports that 28% of women aged 20–49 years had given birth by the time they were 18 years old, and 24% of those aged 18 years had already begun childbearing (had a livebirth or were pregnant with their first child).

Early childbearing poses a risk to both the mother and infant. Young women who marry early are much worse off than are those who marry late: they are more likely to have pregnancy-related complications and less likely to seek timely care;⁶³ they are less likely to deliver their first child in an institution, more likely to experience violence within marriage, and more likely to have loss of pregnancy.⁶⁴ For young women, early marriage might also pose substantial risks of acquiring infection from their husbands.⁶⁵

(Continues on next column)

respiratory infections, nutrition, and postnatal care. Holistic understanding of strategies is insufficient. For example, the Integrated Management of Neonatal and Childhood Illnesses is seen in terms of training activities only, overlooking the need for health-system support and community action. Key interventions are undertargeted, leading to inadequate coverage of, for example, emergency obstetric care. Components such as immunisation stimulate detailed planning and realistic budgeting, whereas others such as family planning and control of acute respiratory infections do not because of lack of planning framework. Planning in districts is recognised as an important step towards effective public health action, and the NRHM milestones aim to implement 100% of the district health action plans by 2012. However, high-quality district planning remains an aspiration rather than a reality.

Finance

Although reproductive and child health has been a priority (45–47% of health sector budget has been allocated to family welfare in 5-year plans since 1985), India has long been investing less than 1% of its gross domestic product on health. The programme for reproductive and child health has injected additional funding since 2005, but the resources available to the NRHM are still inadequate to ensure acceptable health care.

(Continued from previous column)

Premarital sexual relations are increasingly noted—15% of young men and 4% of young women aged 15–24 years had had premarital sexual relations according to the results of the Youth in India: Situation and Needs study,⁶⁶ a subnational study done in Andhra Pradesh, Bihar, Jharkhand, Maharashtra, Rajasthan, and Tamil Nadu. Moreover, the individuals involved in sexual relations were largely uninformed (eg, just two-fifths and three-fifths of sexually experienced young men and women were aware that a woman can get pregnant during first sexual intercourse). Most young people did not use a condom, and, often, the sexual relations were unwanted or forced.

Unmet need for birth spacing was high among young women—25% and 15% among those aged 15–19 years and 20–24 years, respectively. Although overall 82% of demand for contraception was achieved among all women, just 32% and 61% were achieved among women aged 15–19 years and 20–24 years, respectively.³

Results of several facility-based studies have shown that 1–30% of women who seek abortions are young and unmarried.⁶⁷ The programme for reproductive health and child health includes the framework of services targeted at adolescent reproductive and sexual health services for the young people.

Human resources

Action for reproductive and child health requires community health workers, nurses, and midwives, doctors, public health managers, and ancillary cadres. The overall number of health professionals in India is 1.9 (doctors 0.6; nurses and midwives 1.3) per 1000 population.⁹¹ The public health system has 1.35 health professionals per 1000, with more doctors than nurses and midwives.⁹² The Joint Learning Initiative has estimated that 2.5 skilled professionals per 1000 are needed to attain 80% coverage by skilled attendants.⁹³ There has been a drive to increase workforce deployment throughout the health system. National norms and milestones have been developed and a decision taken to assign a second auxiliary nurse midwife to every subcentre. However, in 2007–08, a second auxiliary nurse midwife was reported to be present in only 1%, 2%, 3%, 8%, and 22% of subcentres in West Bengal, Karnataka, Uttar Pradesh, Madhya Pradesh, and Rajasthan, respectively.⁴³

One notable achievement of NRHM has been the deployment of more than 750 000 accredited social health activists in villages since 2005.³³ Accredited social health activists are being recognised as change agents, especially by encouraging deliveries in institutions under Janani Suraksha Yojana.⁴⁷ However, they still need to be deployed in other key activities of reproductive and child health in households and communities. Accredited social health activists should make at least three home visits to provide

postnatal care to neonates and mothers within 7 days of delivery. They need to be provided with the skills to address their clients' unmet need for contraception by providing improved counselling skills and supplies. They should be permitted to use oral antibiotics to treat non-severe pneumonia and local infections in children. Suitable incentives to undertake such tasks will be necessary. Chhattisgarh and Assam have created effective support and mentoring systems for accredited social health activists that are worth emulating by other states.

The enormous in-service training load is a major bottleneck for the scale up of strategies for reproductive and child health.⁹⁴ District training centres and institutes for health and family welfare—logical training hubs—are inadequately staffed and supported in most states. As a result, training depends on ad-hoc efforts of professional bodies and support from a select few national centres. The long-term objective of building state and district capacities to meet current and future training needs does not attract adequate attention, commitment, and resources. Scant attention is paid to programme-relevant knowledge, skills, and attitudes in preservice education of doctors, nurses, auxiliary nurse midwives, and other cadres that are relevant to the needs of the programme. Recent exceptions include the introduction of the Integrated Management of Neonatal and Childhood Illnesses to the undergraduate medical curriculum in some states, and of neonatal nursing to the nursing curriculum in Gujarat. Although medical colleges are often asked to assist in the training effort, the model is outsourcing rather than sustained partnership, and efforts are seldom made to build institutional capacity.

Infrastructure

In 2003, only 32% of 9688 primary health centres and 63% of 1625 community health centres were judged to have adequate infrastructure.⁹⁵ Public health infrastructure has undoubtedly improved since the launch of the NRHM. For instance, in 2007–08, operating theatres were functioning in more than 65·2% of community health centres, and 68·8% of district hospitals had fully operational blood banks.⁹⁶ The maintenance of buildings and equipment has improved as a result of the provision of unconditional funds provided at the discretion of local authorities. Yet, only 46% of subcentres had labour rooms, 27·9% of primary health centres had neonatal equipment, and only 18·7% of community health centres offered caesarean sections. Of 146 036 functional subcentres, only 54% have their own buildings, and according to government estimates, at least 40% need new buildings.⁹⁷ The infrastructure of public health systems still needs further development.

Supply systems

Traditionally, supply systems in public health departments have been weak. For instance, there is a 37% shortage of cold boxes for vaccine transportation,⁹⁸ and delays and shortages have occurred in the

procurement of vaccines and drug kits. In 2007–08, only 65·3% of subcentres and 69·6% of primary health centres were thought to have adequate supplies ($\geq 60\%$ of essential drugs).⁴³ Tamil Nadu has an exemplary drug supply system, but it is an exception.

Information and monitoring systems

Although many surveys have been done and many routine data sources exist, India lacks reliable, usable information. Definitions and classification systems vary between sources, and reports are often released after much delay, preventing their use in programme implementation. The first report about the causes of child deaths based on verbal autopsies for 2001–03 became available in 2009.⁹⁹ Comprehensive district health profiles and information about private providers are inadequate. Information moves up through the system and feedback to frontline workers is inconsistent. Facility-based medical audits and community social audits are few, and equity-based indicators of inputs and outputs are not mainstreamed. The NRHM is attempting to redress this lack through improvements in monitoring and assessment, and the system now tracks a much reduced and rationalised list of indicators.

Paralysis by polio

India has invested enormous political will and resources in its efforts to eradicate poliomyelitis at the cost of other priorities in reproductive health and child health. The budget for Pulse Polio alone is more than INR12 billion per year, more than 10% of the yearly health expenditure on all reproductive and child health.¹⁰⁰ The eradication programme has hampered progress in reproductive health and child health, including routine immunisation. In Uttar Pradesh and Bihar, the last states in India where poliomyelitis is still prevalent, as many as 100–140 days, (almost half the number of working days) are devoted to the Pulse Polio campaign by peripheral staff such as auxiliary nurse midwives. Therefore, progress has been slow in almost all respects of child survival in these states.

Urban reproductive health and child health

No systematic effort has been made to address reproductive health and child health, and inadequate nutrition among the individuals living in urban areas who are poor. Unlike rural areas, most urban areas do not have a dedicated government health-care structure, and rapid increase in the urban population in the previous decades has put pressure on already inadequate primary health-care facilities. Individuals seeking treatment in the private sector—concentrated in urban areas—incur high out-of-pocket expenditures. The National Urban Health Mission, a proposed extension of the NRHM, seeks to address the health-care needs of the rapidly growing urban population, with a focus on disadvantaged, vulnerable people. The emphasis is on building local capacity and engaging communities in

delivery of health care, and on building public-private partnerships to enhance quality of care; an example of such a partnership is discussed in webappendix p 2.

Way forward

Transformation of health systems

In India, inadequate progress in reproductive health and child health is due largely to underdeveloped, under-resourced, and underperforming health systems. A health system with weak foundations cannot support the interventions and strategies needed to attain the goals presented in policy documents. The results are inadequate coverage of most interventions and behaviours, and widespread inequities. However, an unprecedented effort has been made to reform the health sector through NRHM, and the changes are becoming noticeable. Much more needs to be done to achieve long-promised outcomes and to start addressing other priorities for the health of women (infertility, cancer, mental health), children (disability, obesity), and adolescents.

To achieve equitable and sustained improvements across health services and outcomes, efforts would be required for systems strengthening in essential components: policy, financing, human resources, supply systems, service provision and management, and information and management systems.¹⁰¹ By use of this framework, we have identified inadequacies in the public health system from the perspective of reproductive health and child health (webappendix pp 10–11). Transformation of the health systems, and not mere tinkering, is imperative because of the chronic dysfunctional state in all domains.

Provide effective stewardship

Stewardship rests with the government and relates to oversight of all facets of health systems, and action and a guarantee of equity. A crucial constituent is policy formulation and programme design. For reproductive health and child health, these processes have been inconsistent, fragmented, and often ad hoc. Phase 2 (2005–10) of the programme for reproductive health and child health was designed before the rollout of NRHM, but no systematic attempt was made to reposition it until 2008, when an exercise was initiated to develop a newborn and child health policy. However, the draft policy that was developed through an intense consultative process, and ready since 2009, has not yet been implemented—a missed opportunity. An empowered technical board is urgently needed for reproductive health and child health that is tasked to provide continued stewardship for the programme, working closely with the government. The board might have component subcommittees (eg, for child health, maternal health, and adolescent health), and subgroups for crosscutting health-systems issues (eg, human resources, community mobilisation, service delivery). It should be well resourced and be objective. Such boards could be replicated in all states, where

technical expertise is weak and the opinion of the bureaucracy almost absolute.

Planning and implementation in districts and blocks

India is a huge nation with inequities not only between states but also across the 643 districts. Each district is a distinct civil administrative unit with defined structures, including those for health and nutrition. The average population size of a district is about 1.8 million, larger than at least 50 of the world's countries. The decentralised district-based planning envisaged in the NRHM needs to be rolled out throughout the country by 2012. Methods for situation analysis and planning need to be disseminated, and the capacity developed to use them. The National Health Systems Resource Centre has provided useful support to fill this gap. The time has come for development and implementation of one plan that encompasses the activities of both the NRHM and the Integrated Child Development Services to ensure convergence.

Since districts are so large, decentralised governance needs to go a step further. A district is typically divided into eight to ten blocks (smaller administrative units with populations of about 180 000 per unit) and each block is similar to a district in many countries. Each block would have about 180 anganwadi workers and accredited social health activists, 72 auxiliary nurse midwives, and 36 male health workers. About 30 000 eligible couples will need counselling for family planning, 540 pregnant women will need antenatal care, skilled assistance at birth and postnatal care, 4800 neonates will each need three postnatal visits in the first week of life, and the same number of children will each need counselling for complementary feeding and nine immunisations in the first year of life. With so many actors, beneficiaries, activities and transactions, coordination for implementation and monitoring of the programmes for reproductive health, and child health and nutrition should shift from districts to blocks, within the action territory and close to the people. A new initiative to introduce plans that are based on local needs and context in about 250 high-burden districts is a welcome step.

Centres of excellence for policy research

Health and nutrition policies need to be based on biological, epidemiological, and operational evidence that is applied in the appropriate sociocultural contexts and programmes. However, interventions based on poor-quality evidence are allowed to continue, thus wasting resources. Conversely, policy delays might prevent the use of effective evidence-based interventions in programmes for years. Policy makers face conflicting opinions—at times motivated by vested interests—and are often unable to make decisions. Policy research, a familiar process in strategic, economic, and social sectors, has not been nurtured in health and nutrition. Development of centres of excellence for policy research in maternal health, newborn health, child health, reproductive health, nutrition, and health systems is urgently needed. These centres might be part of existing

institutions, started from scratch, or virtual interdisciplinary networks, but they will require commitment of resources. Their main objectives will be evidence analysis, development and dissemination of policy briefs, and promotion of programme-relevant research. An immediate task for such a think-tank would be to organise a comprehensive review of programme implementation for reproductive health and child health to develop the evidence base for action for the XII Plan (2012–17).

Incentives

Conditional cash transfers through implementation of Janani Suraksha Yojana for institutional deliveries have created demand and increased use of health facilities. Questions about quality, effect, sustainability, equity, and long-term effects on health systems will only be answered in due course. On the basis of national and international experience, we see a potential benefit for reproductive health, and child health and nutrition with conditional cash transfers and other incentives that encourage demand for health care. Strategies should, however, be designed to take into account best practices and evidence, and they should promote equity. Rigorous monitoring and assessment should be built in and the initiatives should not be allowed to imply political generosity.

Policies and programmes for child nutrition

A new policy for child nutrition based on biological and epidemiological evidence is overdue, but the discussion about nutrition in India has been clouded by controversies that have hampered efforts to reform policy. Creation of multisectoral nutritional programmes has often been difficult because of the divergent views of the various stakeholders. Rampant and unremitting child undernutrition is restricting future human potential and intellectual capital. A National Child Nutrition Mission that is similar to NRHM and the Sarva Shiksha Abhiyan is imperative to substantially improve the nutritional status of children in India. The National Child Nutrition Mission should be part of the continuum of other social sector programmes aimed at poverty alleviation, food and nutrition security, education, water and sanitation, and universal health care. We favour an outright focus on child nutrition in the medium term rather than a general nutrition initiative for adults and children in which the child nutrition agenda might be weakened. India needs to aim at prioritisation of action for its future human capital.

The National Child Nutrition Mission should focus on children in the age group 0–2 years. Nutrition of pregnant and lactating women should be included in this mission, but the main focus should be indicators of child nutrition. The focus on 0–2 years could be achieved by deployment of a second anganwadi worker, actively targeted interventions, and benefits and services for the poorest populations. The rationale for a second anganwadi worker is that she is essential for targeting young children effectively, beginning with home visits in the early neonatal period to support

breastfeeding and nutrition of low-birthweight infants.^{37,102}

The tasks of the second anganwadi worker should include counselling about breastfeeding, extra care for low-birthweight babies, growth monitoring, and provision of supplementary nutrition to children aged 6 months to 2 years and pregnant and lactating women. The other anganwadi worker can continue to focus on children aged 2–6 years. The food supplied as part of the supplementary nutrition component of the programme for the children aged 6 months to 2 years should be different from that for the older children. This supplement, also offered as a take-home ration for children who cannot visit the anganwadi worker, should consist of locally available, acceptable, child-specific, nutritious foods. Success will also depend on decentralised district-based planning, implementation and monitoring, and community empowerment and ownership. The mission can be initiated in areas where rates of undernutrition are exceptionally high.

Investment in youth

The sexual and reproductive health of young people is pivotal to address India's ability to achieve the health MDGs. Reproductive health of young people has profound implications for maternal health, child survival, and the nation's ability to combat HIV/AIDS. Progress in delaying marriage is evident but far too gradual, and early childbearing remains a reality. Most young women have little autonomy to make decisions about health, including contraception, care surrounding pregnancy, and postnatal care. The content and coverage of initiatives for adolescent health should be strengthened. Innovative ways to provide counselling to young people about sexual and reproductive health, services, and supplies are urgently needed.

Healthy behaviours

Despite tremendous improvements in interpersonal and mass communications, India has not harnessed their potential to create awareness of health and nutrition issues, change norms and practices, and persuade individuals, families and communities to make positive behaviour changes. Through culturally appropriate behaviour-change communication, delivered through several complementary channels, health and nutrition messages need to reach every household repeatedly. Key themes should include family planning, safe abortion, safe practices for sexual intercourse, antenatal care, diet and supplements in pregnancy, birth and emergency preparedness, deliveries in institutions, breastfeeding, immunisation, complementary feeding, hygiene, and care seeking. For the health of young women and their children, and the wellbeing of the family and society, we call for a national campaign to delay childbearing till the maternal age is greater than 20 years. We call on the chief ministers of states to institute incentives for this social change. The health and nutrition awareness campaigns for 2011–15 should surpass any previous campaign in terms of coverage, intensity, innovation, partnerships,

Panel 4: Priority actions for reproductive health, and child health and nutrition**In 2011**

- 1 A public commitment by the Prime Minister of India to achieve the national and Millennium Development Goal targets for reproductive health, and child health and nutrition, and pledge to review progress with state chief ministers on a yearly basis
- 2 A comprehensive Newborn and Child Health Policy and Strategy based on the existing draft
- 3 A new evidence-based, innovative, and wide-ranging National Child Nutrition Mission
- 4 A national movement in partnership with the states to encourage women to delay childbearing till after the age of 20 years
- 5 A national programme to involve Panchayat Raj institutions in reproductive health and child health and nutrition
- 6 Centres for policy research in family planning, maternal health, newborn and child health and nutrition

By 2015

- 1 All administrative blocks plan, implement, and monitor the programmes for reproductive and child health, and nutrition
- 2 The lowest population wealth quintile attains a less than 10% unmet need for family planning, 80% of deliveries in institutions, 90% of children with complete immunisation, 80% coverage of three contacts by accredited social health activists with infants in the first week of life, 75% of infants receive exclusive breastfeeding in the first 6 months, and 75% of children aged 6–9 months receive complementary food in addition to being breastfed
- 3 The proportion of deliveries among mothers younger than 20 years of age is reduced to less than 10%; sex education is taught in schools in all states

By 2020

- 1 Infant mortality rate is less than 20 per 1000 livebirths in 90% of districts
- 2 Maternal mortality ratio is less than 100 per 10 000 livebirths in all states
- 3 Less than 5% of children younger than 5 years have wasting
- 4 Total fertility rate is 2.1 per woman or less in all states

and effect. The huge footprint of mobile telephony offers a great and unique support for transmitting health-related information.

Panchayats

If health is of the people and for the people, the people have to be at the centre of health action. Panchayats are citizens' councils in villages, elected by the people, with women forming a third of their membership. They are linked to block and district councils, which together form the Panchayat Raj institutions. These institutions can have a decisive role in the programmes for reproductive health, and child health and nutrition through community participation and oversight, as envisaged in the NRHM.³⁴ Their potential roles could include microplanning, supervision of health and nutrition functionaries, mentoring health workers such as the accredited social health activists and anganwadi workers, community mobilisation, promotion of healthy community behaviours, help with service delivery and referral, identification of poor and marginalised individuals who need to be targeted in the programmes, and handling health funds. Female Panchayat members can have an important role in

reproductive health, and child health and nutrition by working with adolescent girls and women, and would be powerful allies for campaigns and promotion of childbearing at an older maternal age. Guidelines and methods need to be developed to engage Panchayat Raj institutions in a systematic and sustained manner. Mechanisms should be developed to ensure that the health department, Integrated Child Development Services, and Panchayat Raj institutions work together in the blocks.

Political commitment

Meeting the challenge of reproductive health, and child health and nutrition is essential for India's quest for human development. We call for a reaffirmation of the highest political commitment and game-changing initiatives to address this priority (panel 4). In addition to developments in allied sectors such as water, sanitation, and education, and development of infrastructure, communications, science, and technology, a transformed health and nutrition sector will enhance the lives of children, adolescents, and women in India.

Contributors

DG did the secondary analyses of the NFHS data. All other authors contributed to the conceptualisation, contents, and writing of the report.

Conflicts of interest

DO was originally a reviewer of this report and was requested to join as a co-author after the first draft; he has received payment for employment from the University College London Institute of Child Health, grants from a Wellcome Trust Fellowship, and payment for visiting lectures at the London School of Hygiene and Tropical Medicine. The other authors declare that they have no conflicts of interest.

Acknowledgments

The *Lancet* Series on India: Towards Universal Health Coverage was supported by grants from the John T and Catherine D MacArthur Foundation and the David and Lucile Packard Foundation to the Public Health Foundation of India. DO is supported by Wellcome Trust Fellowship (grant number 081052). We thank Shireen J Jejeebhoy for major inputs for sections about reproductive health and Rajiv Bahl for child health; S K Bhargava for providing access to the data for the New Delhi Birth Cohort; Pavitra Mohan for highly valuable comments about the report; Armida Fernandez, Thomas Cherian, Jose Martines, and Satish Gupta for suggestions and inputs; and Manju Saksena for assistance with the research.

References

- 1 Black RE, Cousens S, Johnson HL, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet* 2010; **375**: 1969–87.
- 2 Hogan MC, Foreman KJ, Naghavi M, et al. Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet* 2010; **375**: 1609–23.
- 3 IIPS and Macro International. National Family Health Survey (NFHS-3), 2005–06: India: volume I. Mumbai: International Institute for Population Sciences and Macro International, 2007.
- 4 Registrar General of India. Sample Registration System (SRS) statistical report 2008. New Delhi: Registrar General of India, 2009.
- 5 Registrar General of India. Special bulletin on maternal mortality 2004–06. New Delhi: Registrar General of India, 2009.
- 6 Rajaratnam JK, Marcus JR, Flaxman AD, et al. Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards Millennium Development Goal 4. *Lancet* 2010; **375**: 1988–2008.
- 7 Jansankhya Sthirtha Kosh and Ministry of Health and Family Welfare. India: partnership for population stabilization. Delhi: Jansankhya Sthirtha Kosh and Ministry of Health and Family Welfare, 2009.

- 8 IIPS. National Family Health Survey (NFHS-2) 1998–99. Mumbai: International Institute of Population Sciences, 2000.
- 9 IIPS. National Family Health Survey (NFHS-1) 1992–93. Mumbai: Indian Institute of Population Sciences, 1995.
- 10 Registrar General of India. Maternal mortality in India: 1997–2003. Trends, causes and risk factors. New Delhi: Registrar General of India, 2006.
- 11 IHME. Child mortality (global). <http://www.healthmetricsandevaluation.org/resources/datasets/2010/mortality/results/child/child.html> (accessed Aug 1, 2010).
- 12 Bhutta ZA, Chopra M, Axelson H, et al. Countdown to 2015 decade report (2000–10): taking stock of maternal, newborn, and child survival. *Lancet* 2010; **375**: 2032–44.
- 13 MoHFW. National population policy 2000. New Delhi: Ministry of Health and Family Welfare, Government of India, 2000.
- 14 Registrar General of India. Compendium of India's fertility and mortality indicators, 1971–1997 (based on the Sample Registration System). New Delhi: Registrar General of India, 1999.
- 15 World Bank. India's undernourished children—a call for reform and action. World Bank: Washington DC, 2006.
- 16 Black RE, Allen LH, Bhutta ZA, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 2008; **371**: 243–60.
- 17 Jones G, Schultink W, Babbille M. Child survival in India. *Indian J Pediatr* 2006; **73**: 479–87.
- 18 Sachdev HPS. Recent transitions in anthropometric profile of Indian children: clinical and public health implications. *NFI Bull* 2003; **24**: 6–8.
- 19 UNICEF and WHO. Low birthweight: country, regional and global estimates. New York: United Nations Children's Fund, 2004.
- 20 National Neonatal Perinatal Database. Report for the year 2002–03. http://www.newbornwhocc.org/pdf/nmpd_report_2002-03.PDF (accessed Nov 10, 2010).
- 21 Bhargava SK, Sachdev HS, Fall CH, et al. Relation of serial changes in childhood body-mass index to impaired glucose tolerance in young adulthood. *N Engl J Med* 2004; **350**: 865–75.
- 22 National Nutrition Monitoring Bureau (NNMB). NNMB Micronutrient survey. Hyderabad: National Institute of Nutrition, 2002.
- 23 IIPS. District Level Household Survey (DLHS-2), 2002–04: India. Mumbai: International Institute for population Sciences, 2006.
- 24 Sachdev HP. Nutritional transition in the backdrop of early life origin of adult diseases: a challenge for the future. *Indian J Med Res* 2004; **119**: iii–v.
- 25 Ghaffar A, Reddy KS, Singhi M. Burden of non-communicable diseases in South Asia. *BMJ* 2004; **328**: 807–10.
- 26 Prabhakaran D, Shah P, Chaturvedi V, Ramakrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of northern India. *Natl Med J India* 2005; **18**: 59–65.
- 27 Ramachandran A, Snehalatha C, Kapur A, et al. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia* 2001; **44**: 1094–101.
- 28 Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004; **27**: 1047–53.
- 29 Registrar General of India. Census of India 2001. <http://www.censusindia.net> (accessed Aug 1, 2010).
- 30 Registrar General of India. Population projection 2001–26. http://www.censusindia.gov.in/Census_Data_2001/Projected_Population/Projected_Population.pdf (accessed Sep 29, 2009).
- 31 Urban Health Resource Centre. Key indicators for urban poor in India from NFHS-3 and NFHS-2. <http://uhrc.in/downloads/Factsheet-India.pdf> (accessed Nov 10, 2010).
- 32 Ministry of Health and Family Welfare, Government of India. 2009. NRHM—the progress so far. http://www.mohfw.nic.in/NRHM/Documents/NRHM_The_Progress_so_far.pdf (accessed Nov 27, 2009).
- 33 MoHFW. Five years of National Rural Health Mission. Bringing good health care closer to every village, every family. *The Indian Express* (New Delhi), April 12, 2010: 5.
- 34 Bajpai N, Sachs JD, Dholakia RH. Improving access, service delivery and efficiency of the public health system in rural India: mid-term evaluation of the National Rural Health Mission. New York: Center on Globalization and Sustainable Development, The Earth Institute at Columbia University, 2009.
- 35 Ministry of Women and Child Development. Integrated Child Development Services. Monthly progress report. <http://wcd.nic.in/icdsimg/sanoprAWCs300909.pdf> and <http://wcd.nic.in/icdsimg/mpr2009.pdf> (accessed on Nov 27, 2009).
- 36 Ministry of Women and Child Development, Government of India. Integrated Child Development Services scheme. <http://wcd.nic.in/icds.htm> (accessed Nov 1, 2010).
- 37 Ministry of Women and Child Development, Government of India and World Bank. Strengthening ICDS for reduction of child malnutrition. New Delhi: Ministry of Women and Child Development, Government of India and the World Bank, 2006.
- 38 Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *Lancet* 2010; **375**: 2009–23.
- 39 Paul VK. India: conditional cash transfers for in-facility deliveries. *Lancet* 2010; **375**: 1943–44.
- 40 Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L. Evidence-based, cost-effective interventions: how many newborn babies can we save? *Lancet* 2005; **365**: 977–88.
- 41 Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS, and the Bellagio Child Survival Study Group. How many child deaths can we prevent this year? *Lancet* 2003; **362**: 65–71.
- 42 Campbell OM, Graham WJ, on behalf of The Lancet Maternal Survival Series steering group. Strategies for reducing maternal mortality: getting on with what works. *Lancet* 2006; **368**: 1284–99.
- 43 IIPS. District Level Household Survey (DLHS-3), India 2007–08: fact sheet. Mumbai: International Institute for Population Sciences, 2008.
- 44 Balarajan Y, Selvaraj S, Subramanian SV. Health care and equity in India. *Lancet* 2011; published online Jan 12. DOI:10.1016/S0140-6736(10)61894-6.
- 45 Bang AT, Bang RA, Baitule SB, Reddy MH, Deshmukh MD. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet* 1999; **354**: 1955–61.
- 46 WHO and UNICEF. Home visits for the newborn child: a strategy to improve survival. Geneva: World Health Organization, 2009.
- 47 NRHM. Key findings. Second common review mission (CRM). New Delhi: National Rural Health Mission, 2008.
- 48 Investigators of the National Neonatal Perinatal Database (NNPD), National Neonatology Forum. Morbidity and mortality among outborn neonates at 10 tertiary care institutions in India during the year 2000. *J Trop Pediatr* 2004; **50**: 170–4.
- 49 Sharma BB, Paul V K, Deorari A K, Padmalatha P, Raina G. Profile of sick neonates at a remote district hospital in Himachal Pradesh. XVIII Annual Convention of National Neonatology Forum, Vellore, India, 1998.
- 50 Mohan P. Improving newborn care in Dausa district. MPhil thesis, University of North Carolina, 1999.
- 51 Haines A, Sanders D, Lehmann U, et al. Achieving child survival goals: potential contribution of community health workers. *Lancet* 2007; **369**: 2121–31.
- 52 Kumar V, Mohanty S, Kumar A, et al. Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: a cluster-randomised controlled trial. *Lancet* 2008; **372**: 1151–62.
- 53 Sundararaman T. Community health-workers: scaling up programmes. *Lancet* 2007; **369**: 2058–59.
- 54 UNICEF. The state of the world's children 2009. New York: United Nations Children's Fund, 2009.
- 55 Agarwal RK. Routine immunization, India's Achilles heel. *Indian Pediatr* 2008; **45**: 625–28.
- 56 UNFPA and Centre for Operations Research and Training (CORT). Assessment of ASHA and Janani Suraksha Yojana in Rajasthan. 2007. <http://www.cortindia.com/RP/RP-2007-0302.pdf> (accessed May 20, 2010).

- 57 UNFPA and Centre for Operations Research and Training (CORT). Assessment of ASHA and Janani Suraksha Yojana in Madhya Pradesh. <http://www.cortindia.com/RP/RP-2007-0301.pdf> (accessed May 20, 2010).
- 58 Ministry of Health and Family Welfare, Government of India. 3rd common review mission report (November 2009). New Delhi: National Rural Health Mission, 2010. http://www.mohfw.nic.in/NRHM/CRM/CRM_files/Third_CRM.htm (accessed May 24, 2010).
- 59 Malini S, Tripathi RM, Khattar P, et al. A rapid appraisal on functioning of Janani Suraksha Yojana in South Orissa. *Health Popul Perspect Issues* 2008; **31**: 126–31.
- 60 Padmanaban P, Raman PS, Mavalankar DV. Innovations and challenges in reducing maternal mortality in Tamilnadu, India. *J Health Popul Nutr* 2009; **27**: 202–19.
- 61 Mavalankar D, Singh A, Bhat R, Desai A, Patel SR. Indian public–private partnership for skilled birth-attendance. *Lancet* 2008; **371**: 631–32.
- 62 MoHFW. Statistics Division. Bulletin of rural health statistics in India 2007. New Delhi: Ministry of Health and Family Welfare, 2007.
- 63 Santhya KG. Understanding pregnancy-related morbidity and mortality among young women in Rajasthan. New Delhi: Population Council, 2009.
- 64 Santhya KG, Ram U, Acharya R, Jejeebhoy SJ, Ram F, Singh A. Associations between early marriage and young women's marital and reproductive health outcomes: evidence from India. *Int Perspect Sex Reprod Health* 2010; **36**: 132–39.
- 65 Santhya KG, Jejeebhoy S. Sexual and reproductive health needs of married adolescent girls. *Econ Polit Wkly* 2003; **38**: 4370–77.
- 66 Santhya KG, Acharya R, Jejeebhoy SJ, Ram U. Timing of first sex before marriage and its correlates: evidence from India. Culture, health and sexuality, 2010.
- 67 Ganatra B. What we know, what we need to know: review of current evidence on induced abortion in India. In: Ramasubban R, Jejeebhoy S, eds. Women's reproductive health in India. New Delhi: Rawat Publications, 2000.
- 68 Youth in India: situation and needs 2006–07, Maharashtra. Mumbai: International Institute for Population Sciences and Population Council, 2009.
- 69 Santhya KG. Contraceptive use dynamics. In: Jejeebhoy S, ed. Looking back, looking forward: a profile of sexual and reproductive health in India. New Delhi: Rawat Publications, 2005.
- 70 Chhabra R, Nuna C. Abortion in India: an overview. New Delhi: Ford Foundation, 1994.
- 71 Kalyanwala S, Zavier AJ, Jejeebhoy S, Kumar R. Abortion experiences of unmarried young women in India: evidence from a facility-based study in Bihar and Jharkhand. *Int Perspect Sex Reprod Health* 2010; **36**: 62–71.
- 72 Barge S, Khan ME, Rajagopal S, Kumar N, Kumber S. Availability and quality of MTP services in Gujarat, Maharashtra, Tamil Nadu and Uttar Pradesh. International Workshop on Abortion Facilities and Post-Abortion Care in the Context of RCH Programme; New Delhi, India; 1998.
- 73 Drugs Controller General, India. 2006. Number of permission and date of issue MF-7059/06.
- 74 Government of India. The medical termination of pregnancy rules (amendment). New Delhi: Government of India, 2003.
- 75 Oomman N, Ganatra BR. Sex selection: the systematic elimination of girls. *Reprod Health Matters* 2002; **10**: 184–88.
- 76 Khanna SK. Traditions and reproductive technology in an urbanizing north Indian village. *Soc Sci Med* 1997; **44**: 171–80.
- 77 Malhotra A, Parasuraman S, Nyblade L, et al. Realizing reproductive choices and rights: abortion and contraception in India. Washington DC, USA: International Centre for Research on Women, 2003.
- 78 Elul B, Barge S, Verma S, et al. Unintended pregnancy and abortion: a community-based study in Rajasthan—summary report. New Delhi: Population Council, 2003.
- 79 Ganatra BR, Hirve SS, Rao VN. Sex-selective abortions: evidence from a community-based study in western India. *Asia Pac Popul J* 2000; **16**: 109–24.
- 80 Arnold F, Kishor S, Roy TK. Sex selective abortions in India. *Popul Dev Rev* 2002; **28**: 759–86.
- 81 UNFPA, Office of the Registrar General and Census Commissioner, and Ministry of Health and Family Welfare, Government of India. 2003. Missing: mapping the adverse child sex ratio in India. New Delhi: UN Population Fund, Office of the Registrar General and Census Commissioner, and Ministry of Health and Family Welfare, Government of India, 2005.
- 82 Krishna UR. The status of women and safe motherhood. *J Indian Med Assoc* 1995; **93**: 34–35.
- 83 Ministry of Human Resource Development. Department of Women and Child Development. National Plan of Action for Children 2005. New Delhi: Ministry of Human Resource Development, 2005.
- 84 NCEAR. Concurrent Evaluation of Integrated Child Development Services. New Delhi: National Council of Applied Economic Research, 2001.
- 85 Bhatnagar S, Lodha R, Choudhury P, et al. IAP guidelines 2006 on hospital based management of severely malnourished children (adapted from the WHO Guidelines). *Indian Pediatr* 2007; **44**: 443–61.
- 86 Kapil U. Ready to use therapeutic food (RUTF) in the management of severe acute malnutrition in India. *Indian Pediatr* 2009; **46**: 381–82.
- 87 Kapil U, Sachdev HPS. Management of children with severe acute malnutrition: A national priority. *Indian Pediatr* 2010; **47**: 651–53.
- 88 Sachdev HPS, Kapil U, Vir S. Consensus statement: National Consensus workshop on management of SAM children through medical nutrition therapy. *Indian Pediatr* 2010; **47**: 661–65.
- 89 Mavalankar DV, Rosenfield A. Maternal mortality in resource-poor settings: policy barriers to care. *Am J Public Health* 2005; **95**: 200–03.
- 90 National Health Systems Resource Center (NHSRC). Child Health in the State PIPs 2008–09: Mapping Technical Assistance Needs. New Delhi, 2008.
- 91 WHO. World health statistics 2009. Geneva: World Health Organization, 2009.
- 92 Rao M, Rao KD, Shiva Kumar AK, Chatterjee M, Sundararaman T. Human resources for health in India. *Lancet* 2011; published online Jan 12. DOI:10.1016/S0140-6736(10)61888-0.
- 93 WHO. The world health report 2006. Geneva: World Health Organization, 2006.
- 94 MoHFW. National Training Strategy for In-service Training under National Rural Health Mission. New Delhi: Ministry of Health and Family Welfare, Government of India, 2008.
- 95 IIPS. India facility survey. Mumbai: International Institute for Population Sciences, 2005. http://www.rchiips.org/pdf/rch2/National_Facility_Report_RCH-II.pdf (accessed Nov 15, 2010).
- 96 IIPS. District Level Household Survey (DLHS-3) 2007–08. Mumbai: International Institute for Population Sciences, 2010.
- 97 MoHFW. Statistics Division. Bulletin of Rural Health Statistics. New Delhi: Ministry of Health and Family Welfare, Government of India, 2008: 26–28.
- 98 MoHFW. National Cold Chain Assessment. New Delhi: Ministry of Health and Family Welfare, Government of India (National Rural Health Mission) and UNICEF, 2008.
- 99 Registrar General of India. Report on causes of death in India 2001–03. New Delhi: Registrar General of India, 2009.
- 100 MoHFW. Central Bureau of Health Intelligence. National Health Profile 2008. New Delhi: Ministry of Health and Family Welfare, 2008.
- 101 WHO. The world health report 2000. health systems: improving performance. Geneva: World Health Organization, 2000.
- 102 Working group on Children under six. Strategies for children under six. *Econ Pol Weekly* 2007; **42**: 87–101.