Demographic Transition in India: Insights Into Population Growth, Composition, and Its Major Drivers FREE

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Summary

Globally, countries have followed demographic transition theory and transitioned from high levels of fertility and mortality to lower levels. These changes have resulted in the improved health and well-being of people in the form of extended longevity and considerable improvements in survival at all ages, specifically among children and through lower fertility, which empowers women. India, the second most populous country after China, covers 2.4% of the global surface area and holds 18% of the world's population. The United Nations 2019 medium variant population estimates revealed that India would surpass China in the year 2030 and would maintain the first rank after 2030. The population of India would peak at 1.65 billion in 2061 and would begin to decline thereafter and reach 1.44 billion in the year 2100. Thus, India's experience will pose significant challenges for the global community, which has expressed its concern about India's rising population size and persistent higher fertility and mortality levels. India is a country of wide socioeconomic and demographic diversity across its states. The four large states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan accounted for 37% of the country's total population in 2011 and continue to exhibit above replacement fertility (that is, the total fertility rate, TFR, of greater than 2.1 children per woman) and higher mortality levels and thus have great potential for future population growth. For example, nationally, the life expectancy at birth in India is below 70 years (lagging by more than 3 years when compared to the world average), but the states of Uttar Pradesh and Rajasthan have an average life expectancy of around 65–66 years.

The spatial distribution of India's population would have a more significant influence on its future political and economic scenario. The population growth rate in Kerala may turn negative around 2036, in Andhra Pradesh (including the newly created state of Telangana) around 2041, and in Karnataka and Tamil Nadu around 2046. Conversely, Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan would have 764 million people in 2061 (45% of the national total) by the time India's population reaches around 1.65 billion. Nationally, the total fertility rate declined from about 6.5 in early 1960 to 2.3 children per woman in 2016, a result of the massive efforts to improve comprehensive maternal and child health programs and nationwide implementation of the national health mission with a greater focus on social determinants of health. However, childhood mortality rates continue to be unacceptably high in Uttar Pradesh, Bihar, Rajasthan, and Madhya Pradesh (for every 1,000 live births, 43 to 55 children die in these states before celebrating their 5th birthday). Intertwined programmatic interventions that focus on female education and child survival are essential to yield desired fertility and mortality in

several states that have experienced higher levels. These changes would be crucial for India to stabilize its population before reaching 1.65 billion. India’s demographic journey through the path of the classical demographic transition suggests that India is very close to achieving replacement fertility.

Keywords: demographic transition, fertility, mortality, India, states, marriage, contraception, family planning, life expectancy, child mortality

Background

India is one of the oldest civilizations and has a vibrant cultural heritage coupled with remarkable diversity. The Mughals ruled the country from 1526 to 1761, and were mainly located north of Vindhyanchal. India was a British colony from 1612 until 1947, when the country attained its independence and became a sovereign nation. The British occupied all of present-day India after defeating Tipu Sultan in Mysuru and Marathas in Maharashtra. The British East India Company governed India and controlled trade throughout the region, except for Goa, which the Portuguese controlled in 1510–1961, and Pondicherry, which the French controlled in 1673–1693 and again in 1699–1962.

India has conducted a regular decadal census since 1881 that measures population size and composition as well as decadal growth at the national and subnational levels (including states, districts, and tehsils). At the dawn of Indian independence, there were about 345 million Indians. The year 1951 witnessed the first census of an independent India, recording a total population of 361 million and a moderate annual exponential growth rate of 1.25% during 1941–1951. From a population growth perspective, the year 1951 became a turning point because it indicated a population explosion since it multiplied threefold by 2001.

According to a United Nations (UN, 2019) report, India constituted 17.7% of the total world population, and was second only to China, whose share was 18.5%. The same estimates revealed that India would not only surpass China in the year 2030 with its share of 17.6% (and China’s would decrease to 17.1%) but it would also maintain the first rank after 2030. The report further indicated that Africa’s share would rise to 25.6% in 2050 and 39.4% in 2100. In contrast, the percentage share of Asia would decline from 59.5% in 2020 to 43.4% in 2100. By 2100, India would attain the first rank as far as the share of a single country is concerned. Nonetheless, its relative share would decline to 16.8% in 2050 and 13.3% in 2100. It is thus essential to examine the dynamics of population growth, its potential, and future drivers of population growth of India.

The rapid population growth caused by a comparatively quick decline in mortality and persisting higher fertility levels has been the cause of concern in most developing counties, including India. The 1961 census of India revealed an annual exponential national growth rate close to 2% during 1951–1961. The concerns were raised about the population growth and its rising size, both nationally and globally. The demographics of India—population size, growth rate, fertility, mortality, and so on—continue to occupy significant space discussions

concerning its impact on various global health and developmental indicators. Alarmed at burgeoning numbers, and a view to accelerating a rapid decline in fertility levels, many developing countries, especially in Southeast Asia, launched official family planning programs in the mid-1960s. In the 1970s and 1980s, most witnessed a strong commitment by leaders to reduce fertility levels. As a result, they experienced one of the fastest transitions in levels of fertility (Pathak & Ram, 1981; Srinivasan & Pathak, 1981). Although India launched an official family planning program in the early 1950s, the real inputs for the program were recorded from the 1960s, when the program became method-mixed and target oriented. Post-independence, upon the advice of several researchers (Chitre, 1964; Gopalaswamy, 1962; Laxmi, 1964), the Indian government implemented its official family planning program in 1952 that promoted sterilization on a large scale. This was considered as the most cost-effective and impactful approach by the government given resource constraints. However, Agarwala (1964) disagreed with this and criticized the program. Recently, Srinivasan (2006) also opined that the continuous focus on sterilization (female) has dominated the Indian national family planning program. In the mid-1960s, government expanded the basket of methods for the clients and included IUD into the program. This, nonetheless failed due to several side effects on the users (Pujari et al., 1967).

The well-known linguistic, economic, and social-cultural diversity of India and its century-old demographic diversity across geographies have expanded, especially since independence. Several states in India, including Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu in the southern region, have moved much faster in achieving the national goal of the replacement fertility. The onset of fertility transition in these southern states occurred when the social and development indicators such as female literacy rates, per capita income, mortality and so on were rather poorer. At the same time, Hindi-speaking states in the northern region, including Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh, continue to experience high levels of fertility as well as mortality. Nationally, fertility levels in India have fallen, and by 2000 Indian women were having an average of about 3.3 children. A significant portion of this decline came from the states in the southern region, where female literacy rates were higher, and women enjoyed greater autonomy than the women in the rest of India. While the southern states of Kerala and Tamil Nadu attained replacement-level fertility long ago, the giant northern states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan continue to reproduce at a prodigious rate (Krishnamoorthy, 1997; Rajan, 1994; Seal & Talwar, 1994). It is important to note that the prevailing social and economic conditions in the southern states at the time of onset of fertility transitions varied considerably. The doctrine of demographic-transition theory advocates indicates that a rise in per capita income, industrialization, and urbanization subsequently leads to reduced levels of fertility and mortality in populations. However, this did not happen in Kerala. Fertility and mortality levels in Kerala were not accompanied by the concurrent improvements in the levels of per capita income, industrialization, and urbanization (Zachariah, 1983).

Until the end of the 20th century, family welfare programs and policies in India focused on lowering fertility rates because the authorities visualized that the persisting higher fertility rates would further add to the built-in growth momentum of its population age composition. The UN’s (1987) population projections revealed that the population momentum alone would add substantially to growing numbers in India. Visaria and Visaria (1994) warned that the ultimate population size of India would be enormous if the country failed to put a brake on the fertility rate and achieved the replacement levels before 2016. It would thus be useful to

elaborate on the demographic transition in India and identify gaps to provide future directions for the program to enable positive changes in matters of population growth, thereby improving the lives and well-being of its people. The national scenario masks the diversity across states. Thus, achieving the goals may be less feasible without any understanding of the issues at the subnational level. This article documents the demographic transition of India at the national and subnational levels and examines various drivers of the transition.

Data

The data for the present research come from several sources. The world population for the past and future years comes from the UN's (2019) *World Population Prospects*. The time-series data for India on population size, growth rates, and age distribution at the national and state levels come from Indian government censuses conducted between 1881 and 2011. The Government of India's National Commission on Population (NCP, 2019) projections provides the numbers for the period 2021–2036. The indicators of fertility (total fertility rates) and mortality (infant mortality rate, under-5 mortality rate, and life expectancy at birth come) are from various rounds of the Indian government's Sample Registration System (SRS). The data for multiple years is available in the annual statistical reports published by the Registrar General of India (2020). The information on contraceptive use and marriage comes from the National Family Health Surveys (International Institute for Population Sciences [IIPS], 1993; IIPS & ICF, 2017; IIPS & ORC-Macro, 2000, 2007). Figures and tables presented throughout the article give detailed data from these sources.

Demographic Transition Theory: A Brief Description

The demographers Warren Thompson (1929) and Adolphe Landry circa 1934 (Landry, 1987), described the classical demography/population transition. However, Frank W. Notestein (1945), an American demographer proposed a precise framework and presented a systematic formulation of the theory in its real sense According to the demographic transition theory, most countries will go through a process of population change from the stage of high birth and death rates (pretransition stage 1) to the last stage of lowest birth and death rates (stage 4). In other words, countries move from the lowest pretransition stage 1 (sometimes negative growth rate) to the highest growth rate (stages 2 and 3) before reaching stage 4, when the growth rate is extremely low (occasionally negative) and the country has attained below-replacement fertility. According to the theory, the demographic transition of a nation can be described with the help of the growth rates if the country has regular censuses over a reasonably long period. In his critical exploration of the demographic transition, Kirk (1996) stated that

> the timing of the decline in countries with Non-European tradition conformed to the forecast by the original authors of the theory, without exception, fall in mortality preceded the decline in the levels of fertility . . . In general, the transition period was shorter in Non-European countries than the countries inhabited by Europeans. (p. 383)

Further, the non-European countries are transitioning with a lower level of socioeconomic development (Cleland & Wilson, 1987).

Several researchers (Kaa, 1987, 2002; Lesthaeghe, 2011, 2014; Lesthaeghe & Surkyn, 2004) have referred to a second demographic transition (SDT). The SDT is a period of continued fertility decline much below-replacement fertility. The most critical factors related to this continued decline are increase in nonmarriage, individual autonomy, self-actualization, rising symmetry in sex roles, advancing female education, and economic independence of women (for details, see Lesthaeghe, 2014). Nevertheless, the postulate of SDT based on the experiences of European countries may not hold in developing countries (Cleland, 2001; Dyson, 2010). The SDT, nevertheless, is much more challenging than the original demographic transition because the countries face declining population sizes, shrinking working population, and graying population. To an extent, replacement migration could help these nations overcome these emerging challenges. Coleman (2006), using the emergence of migrants as the dominant community in some geographies compared to the natives, advocated the concept of the third demographic transition (TDT), which emphasizes the drastic change in population composition. However, the idea of TDT could be a reflection of the adjustment for the shrinking labor force that arises out of SDT, and it does not fit into the purview of demographic transition theory per se.

Results

This section discusses changes in population size, growth and its age-sex composition over time to understand India's population transition. This is followed by a detailed exploration of the crucial factors that led to population transition. For this, we have considered four major drivers of population change that include fertility, mortality, family planning and changes in marriage pattern. Changes in fertility levels have been studied using total fertility rate. The changes in mortality have been studied using three indicators of infant mortality, under-5 mortality and expectation of life at birth. The changes in contraceptive use is examined with the help of contraceptive prevalence rate. Finally, changes in marriage pattern is examined with the help of percentage of women aged 20–24 years who were married before reaching age 18 years and women aged 30–34 years who remained single.

Population Size, Growth, and Age Structure

The UN (2019) estimated a total of 7,795 million people globally in 2020. They suggested that this number would surpass 10 billion by the turn of the 21st century (Table 1). In 2020, about 60% of the people live in Asia and a little over 17% live in Africa. By 2100, Asia would be home to 43% of the global people and Africa to 39%. The share of European countries is estimated to reduce from 9.6% in 2020 to less than 6% in 2100. While a similar pattern is predicted for the countries in Latin America and the Caribbean and the North American regions, the share of Oceania remains unchanged. China's population, was about 19% of the global population in 2020, would reduce to less than 10% by 2100. In India the share would decrease from less than 18% in 2020 to slightly over 13% in 2100.

Table 1. Population Size and Share of the Population of World Regions, China, and India, 2020–2100

	Total Population (Million) and Share (%) as of July 1				
	2020	**2030**	**2050**	**2075**	**2100**
Share of world regions in the world population					
Share of China and India in the world population					
Africa	1,341 (17.2)	1,688 (19.7)	2,489 (25.6)	3,499 (33.1)	4,280 (39.4)
Asia	4,641 (59.5)	4,974 (58.2)	5,290 (54.3)	5,143 (48.6)	4,719 (43.4)
Europe	748 (9.6)	741 (8.7)	710 (7.3)	657 (6.2)	630 (5.8)
Latin America & the Caribbean	654 (8.4)	706 (8.3)	762 (7.8)	750 (7.1)	680 (6.3)
North America	369 (4.7)	391 (4.6)	425 (4.4)	461 (4.4)	491 (4.5)
Oceania	43 (0.6)	48 (0.6)	57 (0.6)	67 (0.6)	75 (0.7)
World	**7,795 (100.0)**	**8,548 (100.0)**	**9,735 (100.0)**	**10,577 (100.0)**	**10,875 (100.0)**
China	1,439 (18.5)	1,464 (17.1)	1,402 (14.4)	1,222 (11.6)	1,065 (9.8)
India	1,380 (17.7)	1,504 (17.6)	1,639 (16.8)	1,609 (15.2)	1,450 (13.3)

Source: UN (2019).

The indirect estimates of crude birth and death rates for India are for the period 1901–1961. After 1971, the SRS, which was established in the late 1960s, started to provide the crude birth rate (CBR) and crude death rate (CDR) for India and bigger states annually. The most recent SRS estimates are available for the year 2017. At the beginning of the 20th century, India had very high levels of crude birth and death rates (48 births/deaths per 1,000 persons; Figure 1), which persisted until 2021. The death rates started to decline around 1930 and reached 16 deaths per 1,000 persons in 1971. The CBR, too, began to fall at a much slower pace. While the CBR was 36 births per 1,000 persons in the early 1970s, the CDR was 16 deaths per 1,000 persons. This declining trend continues, and the gap between the two rates is narrowing over time. The CBR was 20 per 1,000 persons in 2017 as compared to the CDR of 6 per 1,000 persons.

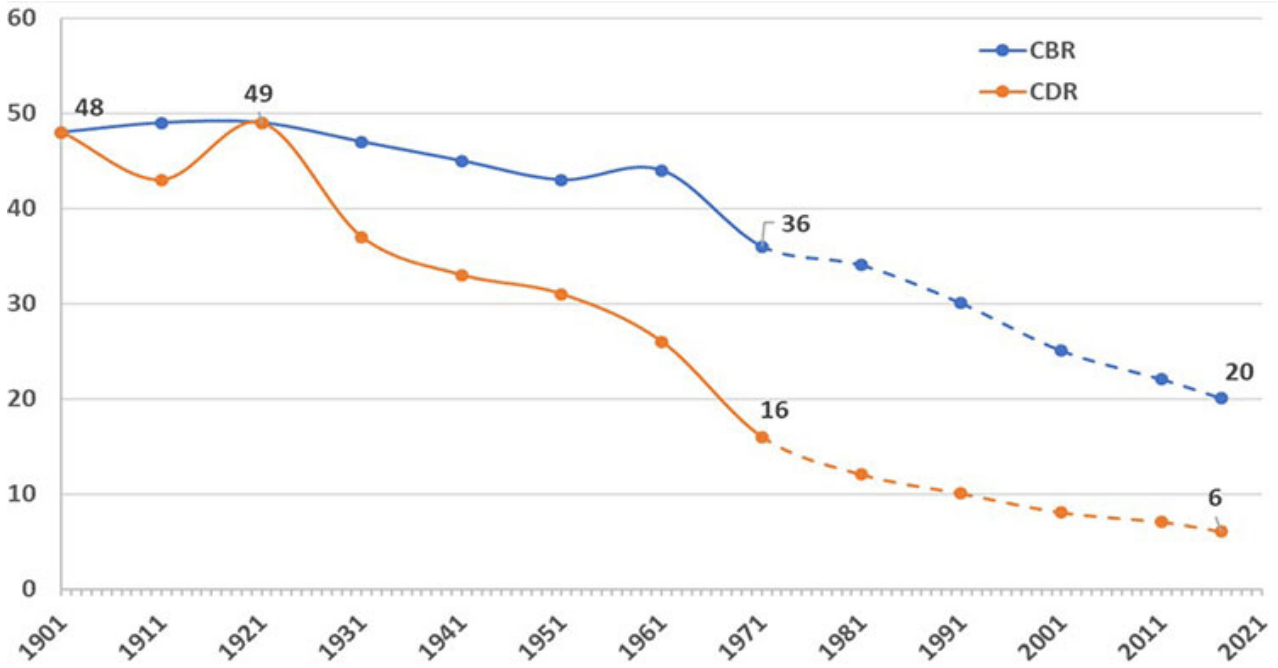

Figure 1. Crude birth rate (CBR) and crude death rate (CDR) for India, 1901–2017.

Source: For the period 1901–1961, data is from Mukherji (1976). For the period 1971–2017, data is from the annual statistical report of the Sample Registration System of India for the respective years.

At the beginning of the 20th century, India had 238 million people. The results of the first census of the new millennium revealed that India had crossed the one billion mark by the end of the 20th century as the 2001 census enumerated a total of 1,029 million Indians (Table 2). The country annually added 16.1 million people in the 1980s and 18.2 million in the 1990s. While the world population increased threefold (from 2 to 6 billion) during the last century, it grew five times in India. The 15th census of India conducted in 2011 enumerated a total of 1,210 million Indians. The population of India grew with a decadal growth rate of about 17.5% during 2001–2011, resulting in an annual exponential growth rate of 1.62% (a decline from 1.96% observed during 1991–2001). Despite a substantial reduction in the growth rate during 2001–2011, India added nearly 181 million people. The UN's 2019 projections indicated a similar addition during 2011–2021, before the country experienced a drastic decline in the subsequent decades.

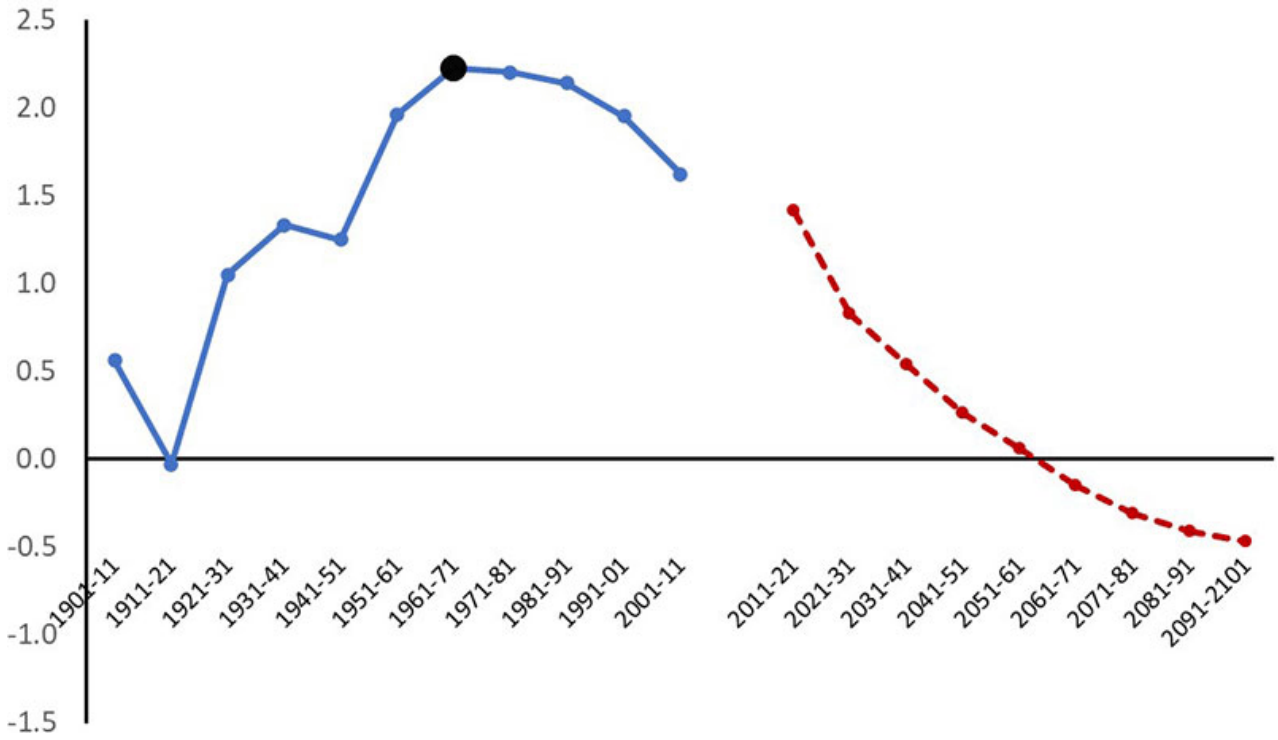

Figure 2. Estimated and observed exponential annual population growth rate (%) during 1901–2011 and 2021–2101, respectively, for India.

Source: UN (2019).

Indian annual population growth peaked at 2.22% during 1961–1971 (Table 1 and Figure 2) and stayed around 2% for the next four decades until 2001. This period may be referred to as the second stage (population explosion stage) of demographic transition for India, during which the country added approximately 590 million people. Between 2001 and 2011 India experienced a substantial decline in its population growth rate (from 1.95% in 1991–2001 to 1.62% in 2001–2011). The UN's 2019 assessment suggested that as far as the population size as concerned, India would surpass China in the next 7–8 years and would continue to increase until the year 2061 when its population size would reach 1,650 million. India may experience a decline in its total population after 2061 and count 1,444 million people in the year 2101. Thus, India would add another 440 million people to its 2011 population size before achieving stabilization. In other words, India is likely to enter the fourth stage (near-zero growth rate) in the next 50 years or so. For India, the third stage of the demographic transition may fall between 2011 and 2051. The momentum inbuilt in the age structure of the population would mostly lead to its growth.

Table 2. Population Size, Intercensal Change (Absolute and Percentage), and Exponential Annual Growth Rate, India, 1901–2001

Census Year	Population (Millions)	Intercensal Population Change/Growth		
		Absolute Change (Millions)	% change	Exponential Annual Growth Rate (%)
Population observed				
Population estimated				
1901	238.4	–	–	–
1911	252.1	13.7	5.7	0.56
1921	251.3	−0.8	−0.3	−0.03
1931	279.0	27.7	11.0	1.05
1941	318.7	39.7	14.2	1.33
1951	361.1	42.4	13.3	1.25
1961	439.2	78.1	21.6	1.96
1971	548.2	109.0	24.8	2.22
1981	683.3	135.1	24.6	2.20
1991	846.4	163.1	23.9	2.14
2001	1,028.7	182.3	21.5	1.95
2011	1,210.2	181.5	17.6	1.62
2021	1,393.0	182.8	15.1	1.41
2031	1,513.7	120.7	8.7	0.83
2041	1,598.3	84.6	5.6	0.54
2051	1,641.2	42.9	2.7	0.26
2061	1,650.3	9.1	0.6	0.06
2071	1,626.4	−23.9	−1.4	−0.15

Census Year	Population (Millions)	Intercensal Population Change/Growth		
		Absolute Change (Millions)	% change	Exponential Annual Growth Rate (%)
Population observed				
Population estimated				
2081	1,576.1	−50.3	−3.1	−0.31
2091	1,512.4	−63.7	−4.0	−0.41
2101	1,443.5	−68.9	−4.6	−0.47

Source: Registrar General of India (n.d.-a); Population estimated from UN (2019).

Examination of the current growth rate in specific states of India, especially for the larger Indian states (in terms of population size), helps to locate growth potentials. Table 3 gives population size for 2001 and 2011, the two recent censuses of India, absolute change and state share in the total national change during 2001–2011, and the exponential population growth rate observed during 2001–2011 for 20 large states of India. The four states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan deserve particular attention. With a population increase of 33.6 million, Uttar Pradesh contributed the most significant growth to the total national change of 182.2 million during 2001–2011, followed by Bihar at 21.1 million and Maharashtra at 15.5 million. Kerala recorded the lowest annual exponential growth rate of 0.48%, followed by Andhra Pradesh (1.04%), Punjab (1.30%), and Odisha (1.31%). Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh together added 446 million (43%) of the total national addition and each state had an annual growth rate of 2% or more. These states are likely to make significant contributions to Indian population growth in the future because the fertility and mortality rates in these states are comparatively high and the decline in these rates has been much slower than that of other states. The most recent projections of the Government of India (NCP, 2019) indicated that by the year 2036 there would be a total of 596 million Indians, and half of them would come from these four states.

Table 3. Population Size, Intercensal Change (Absolute and Percentage), and Exponential Annual Growth Rate for Selected States of India, 2001–2011

State Name	Population (Million)		Change During 2001 – 2011		Exponential Annual Growth Rate (%)
	2001	2011	Absolute Change	State Share (%)[a]	
Uttar Pradesh	166.2	199.8	33.6	18.7	1.84
Maharashtra	96.9	112.4	15.5	8.2	1.48
Bihar	83.0	104.1	21.1	11.5	2.27
West Bengal	80.2	91.3	11.1	6.0	1.30
Andhra Pradesh[b]	76.2	84.6	8.4	4.9	1.04
Madhya Pradesh	60.3	72.6	12.3	7.1	1.85
Tamil Nadu	62.4	72.1	9.7	5.5	1.45
Rajasthan	56.5	68.5	12.0	6.6	1.93
Karnataka	52.9	61.1	8.2	4.4	1.45
Gujarat	50.7	60.4	9.7	4.9	1.76
Odisha	36.8	42.0	5.2	2.7	1.31
Kerala	31.8	33.4	1.6	0.5	0.48
Jharkhand	26.9	33.0	6.1	3.3	2.02
Assam	26.7	31.2	4.5	2.2	1.58
Punjab	24.4	27.7	3.3	2.2	1.30
Chhattisgarh	20.8	25.5	4.7	2.7	2.04
Haryana	21.1	25.4	4.3	2.2	1.81

State Name	Population (Million)		Change During 2001 – 2011		Exponential Annual Growth Rate (%)
	2001	2011	Absolute Change	State Share (%)[a]	
Jammu & Kashmir	10.1	12.5	2.4	1.6	2.12
Uttarakhand	8.5	10.1	1.6	1.1	1.72
Himachal Pradesh	6.1	6.9	0.8	0.5	1.22
Remaining states & Union Territories (UTs)	30.2	36.3	6.1	3.3	1.80
India	**1,028.7**	**1,210.9**	**182.2**	**100.0**	**1.63**

a Sum of states may not match to India due to rounding of the numbers.

b Undivided including Telangana.

Table 4 gives a future population scenario in the 13 large states of India subdivided into three groups based on the attainment of the replacement level of fertility. These 13 states together cover nearly 80% of the national total. Group 1 consists of four states—Rajasthan, Uttar Pradesh, Bihar, and Madhya Pradesh—that have yet to attain replacement fertility. Group 2 and Group 3 consist of the states that have recently reached replacement fertility and a long time ago, respectively. The four large states in Group 1 have enormous potential for growth, and during 2026–2036 their combined growth rate is projected to be close to 1% (0.83%). Bihar is an outlier even within this group, with a growth rate of 1.16% annually. Group 2 states would have a growth rate of around 0.37% and Group 3 of about 0.20%. These findings indicate that a major part of India’s population growth potential lies in the four states of Group 1.

Table 4. Population Size and Year of the Attainment of Replacement Fertility in 13 Large States of India Stratified by Level of Total Fertility Rate, 2011–2036

Groups / States	Population 2011 (million)[a]	Projected Population[b] (million) in the Year					Year Attained Replacement Fertility
		2016	2021	2026	2031	2036	
Group 1: States currently having above replacement-level fertility							
Group 2: States that have attained replacement fertility since 2005							
Group 3: States attained replacement fertility before two decades							
Subtotal all three groups							
Rajasthan	68.5	74.2	79.3	83.6	87.2	90.6	–
Uttar Pradesh[c]	199.8	216.1	230.9	242.9	252.0	259.0	–
Bihar[d]	104.1	114.2	123.1	132.3	141.0	148.6	–
Madhya Pradesh[e]	72.6	78.8	84.5	89.7	94.1	97.8	–
Group 1 total	**445.1**	**483.3**	**517.8**	**548.4**	**574.3**	**595.9**	–
Share of India (%)	**36.8**	**37.5**	**38.0**	**38.5**	**38.9**	**39.2**	–
West Bengal	91.3	95.1	98.1	100.5	102.2	102.9	2005
Punjab	27.7	29.1	30.3	31.3	32.1	32.7	2005
Odisha	42.0	43.1	44.0	44.7	45.0	45.0	2012
Maharashtra	112.4	118.7	124.4	129.3	133.5	136.8	2006
Group 2 total	**273.4**	**286.1**	**296.9**	**305.8**	**312.7**	**317.4**	–
Share of India (%)	**22.6**	**22.2**	**21.8**	**21.5**	**21.2**	**20.9**	–

Groups / States	Population 2011 (million)[a]	Projected Population[b] (million) in the Year					Year Attained Replacement Fertility
		2016	2021	2026	2031	2036	
Group 1: States currently having above replacement-level fertility							
Group 2: States that have attained replacement fertility since 2005							
Group 3: States attained replacement fertility before two decades							
Subtotal all three groups							
Andhra Pradesh	49.6	51.4	52.8	53.7	54.2	54.3	2,004
Karnataka	61.1	64.2	66.8	69.0	70.7	71.9	2,006
Kerala	33.4	34.6	35.5	36.2	36.7	36.9	1,988
Tamil Nadu	72.1	74.6	76.4	77.5	78.1	78.1	1,993
Telangana	35.0	36.5	37.7	38.6	39.2	39.5	2,004
Group 3 total	**251.2**	**261.3**	**269.2**	**275.1**	**278.8**	**280.7**	–
Share of India (%)	**20.7**	**20.3**	**19.8**	**19.3**	**18.9**	**18.5**	–
Absolute population size	**969.7**	**1,030.7**	**1,084.0**	**1,129.3**	**1,165.8**	**1,194.0**	–
Share in national total (%)	**80.1**	**79.9**	**79.6**	**79.3**	**79.0**	**78.6**	–
India	**1,210.9**	**1,290.2**	**1,361.3**	**1,423.4**	**1,475.5**	**1,518.3**	–

a 2011 population data from the census of India.

b Projected population for the period 2016–2036 is from NCP (2019).

c Undivided including Uttarakhand.

d Undivided including Jharkhand.

e Undivided including Chattisgarh.

Source: NCP (2019).

Population Age-Sex Composition

The population age-sex composition of a country narrates historical experiences, including wars, epidemics, famines, and so on. Population age distribution and the female to male ratio are indicative of fertility and mortality levels and the social status of the women in the populations. Along with the demographic transition in India described earlier, there has been an inevitable change in the age-sex structure—that is, the decline in mortality followed by fertility has resulted in changes to the population's age structure. Several studies have debated and discussed the role of these changes in economic growth. Sex composition (population sex ratio overall and, more important, at birth) reflects the status of women in the society. Globally, the population sex ratio (males per 1,000 females) is favorable to the female gender. An overall sex ratio of 1,030–1,050 females per 1,000 males is standard under the natural conditions. The situation is slightly different in India.

Table 5 gives the sex ratio overall and for children younger than 5 years of age for India for a period of 120 years (1881–2011) along with the absolute change in them. For India, the overall sex ratio was close to normal until around 1931. It started to rise gradually in favor of males after that. The 1991 census of India revealed a higher overall sex ratio nationally: 1,078 males per 1,000 females. However, the scenario is different for the child sex ratio. Female children marginally outnumbered male children until 1941 as the sex ratio was in favor of the female children (960–995 male children per 1,000 female children below age 5). However, the scenario reversed when the 1951 census results were declared as the child sex ratio turned in favor of male children (1,008 male children per 1,000 female children) and has deepened over the years with the widening female-male children gap. The child sex ratio in India increased from 1,022 in 1981 to 1,047 in 1991 and further to 1,071 in 2001 and 1,082 in 2011 male children per 1,000 female children. Nationally, during the periods 1981–1991 and 1991–2001, the child sex ratio increased astonishingly by 25 and 24 units, respectively. The distorted child sex ratio in India as well as in neighboring countries in the region has been a matter of concern and point of debate and investigations among policy makers and researchers. Many have cited widespread gender-based discrimination (neglect) in the form of son preference, lower autonomy to the women, and so on as the leading cause of this distortion. These practices result in sex-selective abortions and gender-specific mortality differentials (Bongaarts, 2013; Bongaarts & Guilmoto, 2015; Guilmoto et al., 2018; Jha et al., 2011; Kashyap, 2019; Ram & Ram, 2018).

Table 5. Sex Ratio (Males per 1,000 Females) of the Total Population and Children Younger Than 5 Years of Age, India, 1881–2011

Year	Overall (All Ages)		Children Younger Than 5 Years	
	Sex Ratio	Intercensal Absolute Change	Sex Ratio	Intercensal Absolute Change
1881	1,038	–	965	–
1891	1,038	0	960	−5
1901	1,029	−9	969	9
1911	1,038	9	967	−2
1921	1,047	9	962	−5
1931	1,053	6	964	2
1941	1,058	5	995	31
1951	1,056	−2	1,008	13
1961	1,063	7	1,008	0
1971	1,075	12	1,021	13
1981	1,070	−5	1,022	1
1991	1,078	8	1,047	25
2001	1,072	−6	1,071	24
2011	1,060	−12	1,082	11

Notes: The sex ratio for the years 1881 and 1891 was calculated using data from Mukherji (1976). The sex ratio for children younger than 5 years of age was calculated using data from a C-series in the respective census of India.

Source: Registrar General of India (n.d.-b).

A few studies have estimated a decrease in girls due to the practice of sex-selective abortions in India and found that these practices are not universal across geographies. Instead, they vary considerably in subregions of India (Jha et al., 2011; Ram & Ram, 2018). Table 6 presents the sex ratio for selected states in India for the period 1991–2011 and the change in it. Regardless of the year, Kerala is the only state that has an overall sex ratio lower than 1,000 (i.e., females exceeding the male population). In addition, the male-female gap has widened over the past two decades by almost 43 units. Punjab and Haryana have the most skewed overall sex ratio, varying between 1,117 and 1,162 males per 1,000 females. The overall sex ratio has been in favor of males in the remaining states. However, the gaps in sex ratio seemingly have bridged over time. While the decline was sharp in the states of Uttar Pradesh, West Bengal, and Assam, it has remained mostly similar in Madhya Pradesh and Maharashtra. Similar to the overall sex ratio, Haryana and Punjab had a highly skewed child sex ratio, varying between 1,128 and 1,144, respectively, in 1991 and 1,190 and 1,169 in 2011. In 2011, Gujarat (1,110), Rajasthan (1,120), and Maharashtra (1,117) also showed a child sex ratio skewed in favor of male children. Other states also showed a considerable deficit of female children. Haryana topped the list as the child sex ratio increased by 62 units in favor of males during 1991–2011. The corresponding increase was by 59 units in Maharashtra, 50 units in Rajasthan, 44 units in Gujarat, 42 units in Madhya Pradesh, and 30–39 units in Andhra Pradesh, Bihar, Odisha, and Uttar Pradesh. Kerala was the only state where the child sex ratio improved in favor of female children by 16 units between the 1991 and 2011 censuses.

Table 6. Sex Ratio (Males per 1,000 Females) of the Total Population and Children Younger Than 5 Years of Age for India and Selected States, 1991–2011

State	Overall (All Ages)			Absolute Change: 1991–2011	Children Younger Than 5 YEARS			Absolute Change: 1991–2011
	1991	2001	2011		1991	2001	2011	
Andhra Pradesh[a]	1,029	1,022	1,007	−22	1,023	1,042	1,061	38
Assam	1,084	1,070	1,044	−40	1,023	1,047	1,036	13
Bihar	1,098	1,088	1,089	−9	1,025	1,090	1,063	38
Gujarat	1,070	1,086	1,088	18	1,066	1,164	1,110	44
Haryana	1,156	1,162	1,138	−18	1,128	1,236	1,190	62
Karnataka	1,042	1,037	1,028	−14	1,040	1,063	1,048	8
Kerala	965	945	922	−43	1,051	1,028	1,035	−16
Madhya Pradesh	1,074	1,088	1,074	0	1,036	1,080	1,077	41
Maharashtra	1,071	1,084	1,076	5	1,058	1,115	1,117	59
Odisha	1,030	1,028	1,022	−8	1,028	1,060	1,058	30
Punjab	1,134	1,142	1,117	−17	1,144	1,286	1,169	25
Rajasthan	1,099	1,086	1,077	−22	1,070	1,123	1,120	50
Tamil Nadu	1,027	1,013	1,004	−23	1,052	1,047	1,059	7
Uttar Pradesh	1,138	1,114	1,096	−42	1,059	1,113	1,098	39
West Bengal	1,090	1,071	1,053	−37	1,029	1,043	1,043	14

Note: Sex ratio from respective censuses of India (Table C-6 of 1991 and C-14 of 2001 and 2011).

a Undivided including Telangana.

Almost half of the districts in the country in 2011 had a deficit of girl children. The practice of neglect of the female child resulting in sex-selective abortion and excess female mortality is universal (Guilmoto et al., 2018; Ram & Ram, 2018). A more recent analysis for India by Kashyap (2019) indicated the dominance of prenatal factors (sex-selective abortion) compared to excess female mortality (postnatal factor). Table 7 presents the sex ratio at birth (SRB) for India and selected states. The data suggest that the SRB is favorable to male children for India nationally and subnationally. Punjab and Haryana, followed by Rajasthan, Uttar Pradesh, Gujarat, and Bihar, had a highly disturbing SRB in 1999. For every 100 female births, Punjab and Haryana recorded 125 to 126 male births each, the other states recorded 112 to 118 male births. The male-female imbalance at birth has continued over time, although with a sign toward bridging the gaps. At the national level, the SRB has mostly remained unchanged at 112 male children for every 100 female children. Nonetheless, the imbalance has widened in Andhra Pradesh, Assam, and Haryana, suggesting that the efforts to address this have failed to yield desirable results. The study by Jha et al. (2011) demonstrated that the practices are more prevalent among affluent and educated people.

Table 7. Sex Ratio at Birth (Male Births Per 1,000 Female Births) and Absolute Change in Sex Ratio at Birth in India and Selected States, 1999–2016

State	Sex Ratio at Birth in the Year					Absolute Change: 1999–2016
	1999	2004	2009	2013	2016	
Andhra Pradesh[a]	104	109	109	109	109	−5
Assam	102	110	108	109	109	−7
Bihar[b]	112	116	110	110	111	1
Gujarat	118	118	111	110	117	1
Haryana	125	121	118	115	120	5
Karnataka	106	109	106	105	108	−2
Kerala	108	110	104	103	105	3
Madhya Pradesh[c]	110	110	109	108	109	1
Maharashtra	110	115	112	112	114	−4
Orissa	108	107	107	105	107	1
Punjab	126	125	120	115	113	13
Rajasthan	114	119	114	112	117	−3
Tamil Nadu	107	106	108	109	110	−3
Uttar Pradesh[d]	115	116	115	115	114	1
West Bengal	105	108	107	105	106	−1
India	**111**	**114**	**110**	**110**	**112**	**−1**

a Undivided including Telangana for the years 1999, 2004, 2009, and 2013.

b Undivided including Jharkhand for the year 1999.

c Undivided including Chhattisgarh for the year 1999.

d Undivided including Uttarakhand for the years 1999, 2004, and 2009.

Source: Sex ratio from the annual statistical report of the Sample Registration System of India.

Table 8 presents age distribution by sex and dependency ratios (child, old age, and overall) for the period 1981–2011 (census of India) and 2036 for India (NCP, 2019). Figures 3A and 3B present age-sex population pyramids. The results in Table 8 suggest a visible change in the age structure over the decades. Nationally, the share of children below age 15 in the total population declined to from about 40% in 1981 to 31% in 2011. The NCP (2019) projections indicated that the share would decrease to 20% by 2036. The percentage of people aged 60 years and older increased to 9% in 2011 and is estimated to reach 15% in 2036 (over 227 million). The changes in the dependency ratios for children and older people also confirm a transition in the age structure. While the child dependency ratio in India declined from 73% in 1981 and to 51% in 2011, the dependency ratio for older people increased marginally from 12% to 14%. The official population projections suggest that in 2036 the child dependency ratio would further decline to 30% and the dependency ratio for older people would increase to 23% nationally. In 2001, India had about 587 million people in the working ages, between 15 and 59 years. Those aged 15–34 years accounted for nearly 60% (349 million). The number of people in the working ages of 15–59 years and 15–34 years increased to 733 million and 425 million, respectively, in the year 2011. Population projections suggest that in 2036, while the number of people of working age would increase to almost 989 million, young labor would reach 464 million. Such changes would impact future economic development and would call on the government to initiate innovative strategies to take care of the older population. Besides, a sharp rise in the labor force demands generation of more employment.

Table 8. Share of the Male and Female Population Out of the Total Population by Age Groups and Dependency Ratios (for Children, Older People, and Overall), India, 1981–2011 and 2036

Age Group (in Years)	Share of the Population (%) Out of a Total Population of India for the Year									
	1981[a]		1991[a]		2001[a]		2011[a]		Projected 2036[b]	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Fem
Children below 15 years of age										
Working-age population										
Older population (aged 60 years or older)										
Dependency ratio[c] (both sexes)										
0–4	6.4	6.2	6.3	6.0	5.6	5.2	4.9	4.5	3.3	3.0
5–9	7.3	6.8	6.9	6.5	6.5	6.0	5.5	5.0	3.5	3.1
10–14	6.8	6.1	6.2	5.6	6.4	5.8	5.8	5.3	3.7	3.3
Subtotal (male + female): <15	**39.6**		**37.5**		**35.4**		**30.9**		**19.8**	
15–19	5.1	4.5	5.1	4.4	5.3	4.5	5.3	4.7	3.9	3.5
20–24	4.4	4.3	4.5	4.4	4.5	4.2	4.8	4.5	4.0	3.6
25–29	3.9	3.8	4.1	4.2	4.1	4.1	4.3	4.2	4.0	3.7
30–34	3.2	3.1	3.6	3.4	3.6	3.6	3.7	3.6	4.2	3.9
35–39	3.0	2.9	3.3	3.0	3.5	3.4	3.6	3.5	4.3	3.9
40–44	2.7	2.4	2.7	2.4	2.9	2.5	3.1	2.9	4.0	3.7
45–49	2.3	2.1	2.3	2.1	2.4	2.2	2.7	2.5	3.5	3.4
50–54	2.1	1.7	2.0	1.7	1.9	1.6	2.1	1.9	3.1	3.1
55–59	1.3	1.2	1.3	1.3	1.3	1.4	1.6	1.6	2.6	2.8

Age Group (in Years)	Share of the Population (%) Out of a Total Population of India for the Year									
	1981[a]		1991[a]		2001[a]		2011[a]		Projected 2036[b]	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Fem
Children below 15 years of age										
Working-age population										
Older population (aged 60 years or older)										
Dependency ratio[c] (both sexes)										
Subtotal (male + female): 15–59	**53.9**		**55.7**		**57.1**		**60.5**		**65.1**	
	3.3	3.2	3.5	3.3	3.7	3.8	4.2	4.4	7.1	7.9
Subtotal (male + female): ≥60	**6.5**		**6.8**		**7.5**		**8.6**		**15.0**	
All age population (million)	**683.3 (100.0)**		**846.4 (100.0)**		**1,028.7 (100.0)**		**1,210.2 (100.0)**		**1,518.3 (100.0)**	
Child (<15 years)	73.3		67.2		62.1		51.0		30.4	
Old age (≥60 years)	12.0		12.2		13.1		14.2		23.1	
Overall (<15 + ≥60 years)	85.3		79.4		75.2		65.2		53.5	

a Population is taken from the censuses of India 1981, 1991, 2001, and 2011.

b Projected population for 2036 is from NCP (2019).

c Dependency ratio from author calculations. The child dependency ratio is defined as the number of children below 15 years of age per 100 persons in the working ages of 15–59 years. The old-age dependency ratio is defined as the number of persons aged 60 years or older per 100 persons in the working ages of 15–59 years. The overall dependency ratio is defined as the number of children below 15 years of age and persons aged 60 years or older per 100 persons in the working ages of 15–59 years.

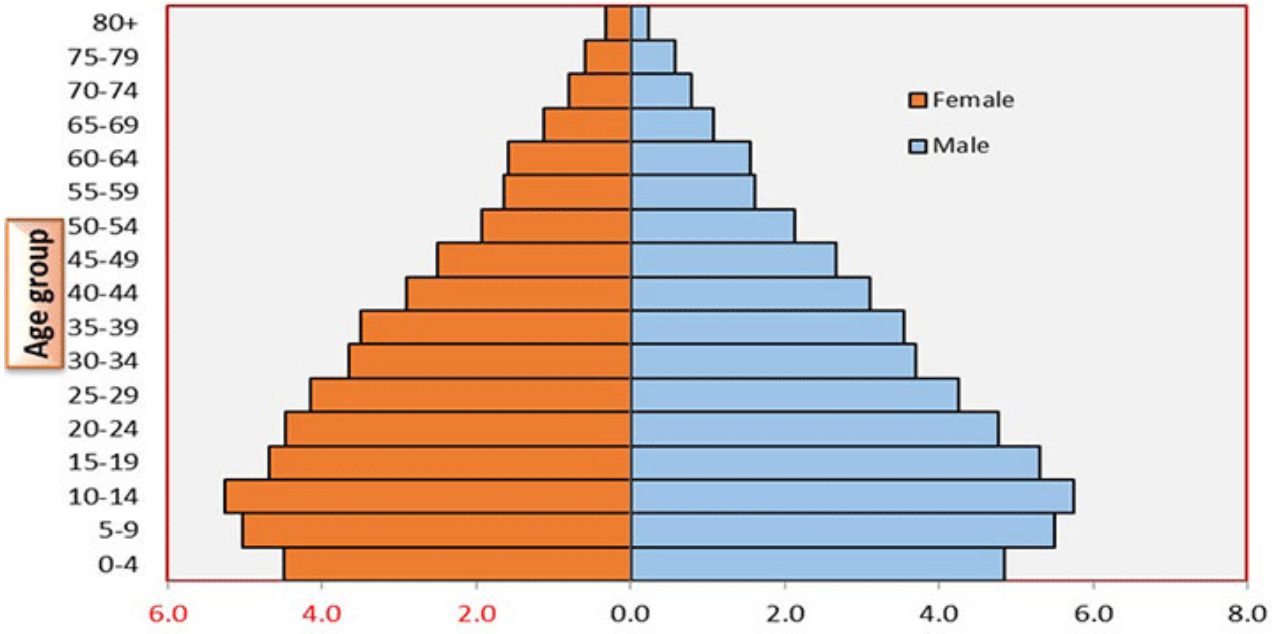

Figure 3A. Age-sex population pyramids of India, 1991.

Data from the census of India, 1991.

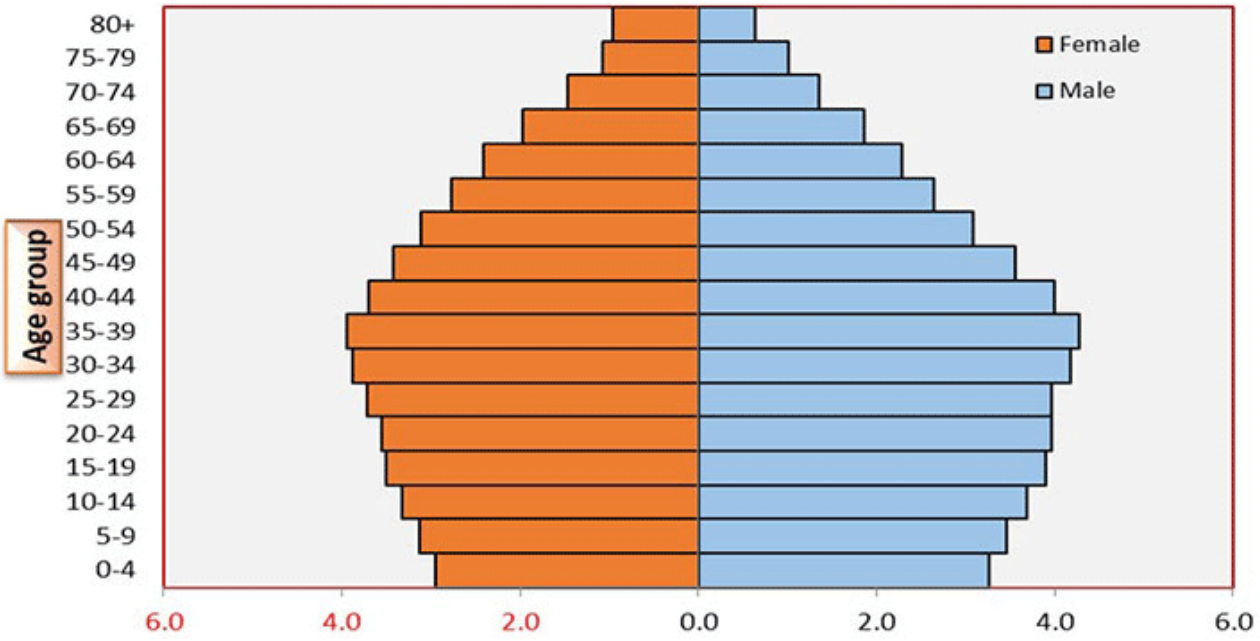

Figure 3B. Age-sex population pyramids of India, 2036.

Source: NCP (2019).

Major Drivers of Population Growth

Three drivers impact the population growth rate and are responsible for demographic transition: fertility, mortality, and international migration. Generally speaking, international migration has a limited role, as its volume is small. Thus, it is mainly the changes in fertility

and mortality levels in a population that lead to demographic transition. This section discusses fertility and mortality transition in India and specific programmatic interventions responsible for the change in the fertility and mortality levels. India lacks good quality civil registration data on births and deaths (Ram et al., 2020; Yadav & Ram, 2019). Until the early 1970s, the estimated fertility and mortality for India and its states came from indirect methods that used census data stratified by age and sex. In the early 1970s, the Registrar General of India launched an annual nationwide system of collecting data on fertility and mortality (known as the sample registration system; SRS), which provides invaluable data for India and its states, especially for the bigger states. For the most part, the present research used fertility and mortality data from the SRS.

Fertility

Figure 4 presents the total fertility rate (TFR) for India spanning over nearly 150 years (Ram et al., 1995). The TFR gives the number of children a woman would have at the end of the reproductive period, assuming that she experiences the prevailing age patterns of fertility. The data suggests that the TFR in India virtually remained unchanged at around 6.3 children per woman from 1871–1881 until 1951–1961 (standard deviation = 0.27). There has been little fluctuation in the TFR, which is mainly attributed to the variations in the quality of age-sex data in different censuses (Mukherji, 1976). Coale's (1986) proposition of survival strategy postulates that a TFR of less than six for the expectation of life at birth (e^{o}_{o}) of 20–25 years could lead to a zero or negative population growth. Thus, under a high mortality regime, maintaining a TFR of 6 and above was an excellent strategy to ensure moderate positive population growth. The decline in the TFR during the period 1896–1901 might have been the result of the famines of 1896–1997 and 1899–1901, which were among the worst ever experienced in history and affected substantial sections of the population (Dyson, 1991).

The fertility transition in India most likely began during the late 1960s. Since the inception of fertility transition, the TFR in India declined by 19% to about 1.1 fewer children per woman during the first decade (1966–1971 to 1976–1981). The 1960s witnessed a substantial change in the family planning program in India, which became target-oriented and included the introduction of intrauterine devices to the official program in 1965. The initial inherent demand for family planning and a persistently higher level of fertility may have been the reason for a relatively faster fertility decline during the first decade following the onset of the demographic transition. In the next decade (1976–1981 to 1986–1991), although the decrease in fertility continued, its pace slowed down. The decline in TFR slowed down notably in the subsequent decade of 1976–1981 to 1986–1991 when the reduction was only about 15%. The coercive approach adopted during the emergency period (1975–1977) was mainly responsible for this reduction in several states, more specifically in the larger Hindi-speaking states of Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh. This in turn accelerated the decline in TFR. Between 1986–1991 and 1996–2001, the TFR declined by 19% (from about 4 children to 3.2 children per woman). During 1996–2001, the TFR in India declined by about 14%. The mid-1990s saw a paradigm shift in the national family planning program as the country revamped the program from a target-oriented to target-free regime. This paradigm shift resulted in an initial decline/stagnation in the family planning performance in the country.

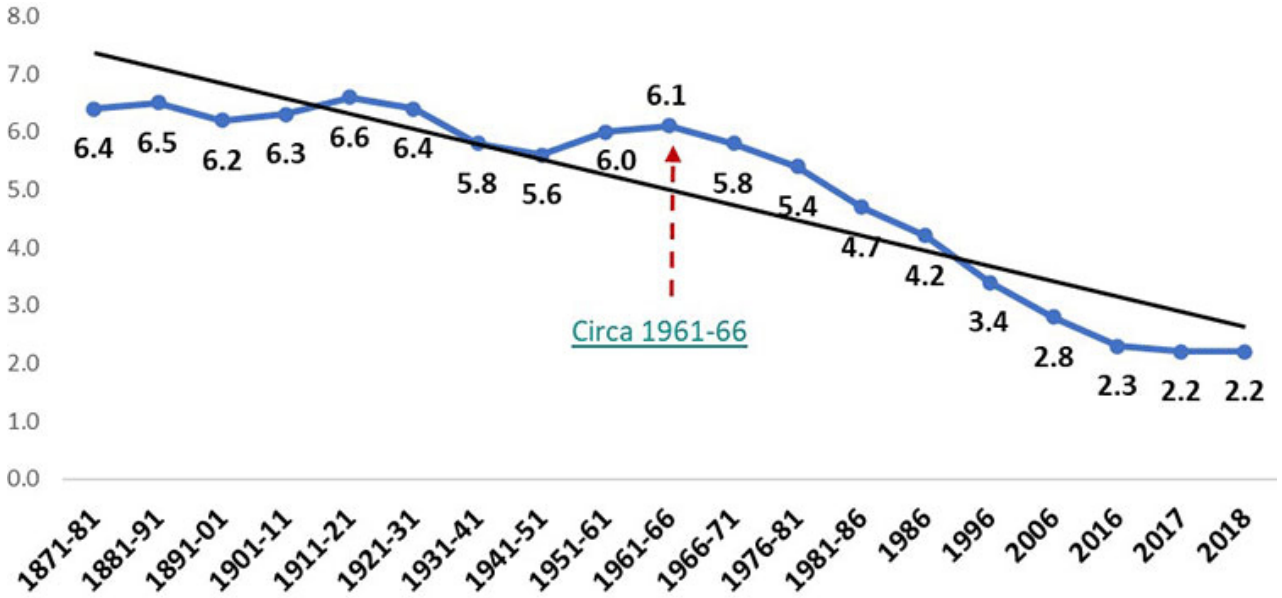

Figure 4. Total fertility rate, India, 1871–2018.

Source: Up to 1971, data from Ram, Namboodiri, and Ram (1995). For post 1971, data from annual statistical reports of the Sample Registration System for respective years.

Nationally, the TFR almost halved in the 30 years between 1986 and 2016 from 4.2 to 2.3 children per woman (Table 9). Many states in India showed a similar trend. Rural India also experienced a decline in the TFR from 4.5 in 1986 to 2.5 in 2016. However, urban India had already achieved replacement fertility in 2006. Of the states included in this analysis, eight states have already attained replacement or below-replacement fertility. The lagging states are Bihar Madhya Pradesh, Rajasthan, and Uttar Pradesh, where TFR continues to be close to 3 children per woman. As noted, these are the states that are or could be center for India population growth in the coming years. The urban areas in several states attained replacement or below-replacement fertility in 2016: the urban areas had a TFR of as low as 1.3 children per woman in West Bengal, 1.4 in Odisha, 1.5 in Andhra Pradesh, and 1.6 in Karnataka and Tamil Nadu. Further, the rural areas of Andhra Pradesh, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu, and West Bengal had a TFR that varied between 1.7 and 1.9 children per woman in 2016.

Table 9. Total Fertility Rate for Combined, Rural, and Urban Areas and the Ratio of Rural to Urban Rate for India and Selected States, 1986–2016

Country/States	Total Fertility Rate				Change (%) 1986–2016
	1986	1996	2006	2016	
Combined areas					
Rural areas					
Urban areas					
Ratio: Rural to urban					
Andhra Pradesh[a]	3.8	2.5	2.0	1.7	−55.3
Assam	4.0	3.2	2.7	2.3	−42.5
Bihar[b]	5.2	4.5	4.2	3.3	−36.5
Gujarat	3.8	3.0	2.7	2.2	−42.1
Haryana	4.4	3.5	2.7	2.3	−47.7
Karnataka	3.5	2.6	2.1	1.8	−48.6
Kerala	2.3	1.8	1.7	1.8	−21.7
Madhya Pradesh[c]	4.9	4.1	3.5	2.8	−42.9
Maharashtra	3.6	2.8	2.1	1.8	−50.0
Orissa	4.2	3.1	2.5	2.0	−52.4
Punjab	3.4	2.8	2.1	1.7	−50.0
Rajasthan	5.0	4.2	3.5	2.7	−46.0
Tamil Nadu	2.7	2.1	1.7	1.6	−40.7
Uttar Pradesh[d]	5.4	4.9	4.2	3.1	−42.6
West Bengal	3.6	2.6	2.0	1.6	−55.6
India	**4.2**	**3.4**	**2.8**	**2.3**	**−55.3**

Country/States	Total Fertility Rate				Change (%) 1986–2016
	1986	1996	2006	2016	
Combined areas					
Rural areas					
Urban areas					
Ratio: Rural to urban					
Andhra Pradesh[a]	4.1	2.7	2.1	1.7	−58.5
Assam	4.2	3.4	3.0	2.4	−42.9
Bihar[b]	5.3	4.6	4.3	3.4	−35.8
Gujarat	4.0	3.2	3.0	2.5	−37.5
Haryana	4.8	3.8	2.9	2.4	−50.0
Karnataka	3.7	2.8	2.3	1.9	−48.6
Kerala	2.3	1.8	1.7	1.8	−21.7
Madhya Pradesh[c]	5.4	4.4	3.9	3.1	−42.6
Maharashtra	4.0	3.2	2.3	1.9	−52.5
Orissa	4.3	3.3	2.6	2.1	−51.2
Punjab	3.6	3.0	2.1	1.7	−52.8
Rajasthan	5.3	4.5	3.8	2.8	−47.2
Tamil Nadu	2.8	2.2	1.8	1.7	−39.3
Uttar Pradesh[d]	5.8	5.1	4.4	3.4	−41.4
West Bengal	4.2	2.9	2.2	1.7	−59.5
India	**4.5**	**3.7**	**3.1**	**2.5**	**−44.4**
Andhra Pradesh[a]	3.1	2.1	1.6	1.5	−51.6
Assam	2.5	2.1	1.6	1.6	−36.0

Country/States	Total Fertility Rate				Change (%) 1986–2016
	1986	1996	2006	2016	
Combined areas					
Rural areas					
Urban areas					
Ratio: Rural to urban					
Andhra Pradesh[a]	1.3	1.3	1.3	1.1	−14.3
Assam	1.7	1.6	1.9	1.5	−10.7
Bihar[b]	1.3	1.4	1.4	1.4	7.8
Gujarat	1.2	1.2	1.3	1.3	8.6
Haryana	1.5	1.4	1.2	1.2	−17.5
Karnataka	1.3	1.3	1.4	1.2	−6.9
Kerala	1.0	1.0	1.0	1.0	−4.3
Madhya Pradesh[c]	1.5	1.8	1.6	1.5	−4.3
Maharashtra	1.3	1.3	1.3	1.2	−10.9
Orissa	1.4	1.4	1.5	1.5	8.1
Punjab	1.2	1.4	1.1	1.1	−8.5
Rajasthan	1.4	1.5	1.4	1.2	−12.7
Tamil Nadu	1.2	1.2	1.1	1.1	−8.9
Uttar Pradesh[d]	1.5	1.4	1.4	1.4	−2.3
West Bengal	1.8	1.6	1.7	1.3	−28.4
India	**1.5**	**1.5**	**1.6**	**1.4**	**−4.3**
Bihar[b]	4.2	3.2	3.0	2.5	−40.5
Gujarat	3.3	2.6	2.3	1.9	−42.4

Country/States	Total Fertility Rate				Change (%) 1986–2016
	1986	1996	2006	2016	
Combined areas					
Rural areas					
Urban areas					
Ratio: Rural to urban					
Haryana	3.3	2.7	2.4	2.0	−39.4
Karnataka	2.9	2.1	1.7	1.6	−44.8
Kerala	2.2	1.8	1.7	1.8	−18.2
Madhya Pradesh[c]	3.5	2.5	2.4	2.1	−40.0
Maharashtra	3.0	2.4	1.8	1.6	−46.7
Orissa	3.1	2.3	1.7	1.4	−54.8
Punjab	3.1	2.2	1.9	1.6	−48.4
Rajasthan	3.8	3.0	2.7	2.3	−39.5
Tamil Nadu	2.4	1.8	1.6	1.6	−33.3
Uttar Pradesh[d]	4.0	3.7	3.2	2.4	−40.0
West Bengal	2.3	1.8	1.3	1.3	−43.5
India	**3.1**	**2.4**	**2.0**	**1.8**	**−41.9**

a Undivided including Telangana for the years 1986, 1996, and 2006.

b Undivided including Jharkhand for the years 1986 and 1996.

c Undivided including Chhattisgarh for the years 1986 and 1996.

d Undivided including Uttarakhand for the years 1986, 1996, and 2006.

Source: Total fertility rate from the annual statistical report of the Sample Registration System of India.

Improved child survival and concurrent expansion of female education have led to fertility decline in developing countries like India (Davis, 1963; Dyson, 2010). We have already discussed geographic diversity in the TFR and transition. In Table 10, we present the levels of TFR by education for India and selected states. In 1992–1993, the TFR for India was 4.3 per woman for women who had completed fewer than 5 years of schooling (including nonliterate) compared to 3.3 for those who had 10 or more years of schooling; a difference of one child. By 2015–2016, the TFR declined to 2.9 per woman and 1.8 for the respective groups. Over time there is no convergence in the level of fertility in lower and higher education groups as TFR declined by 45.5% among those who had 10 or more years of schooling compared to 32.6% among those who had fewer than 5 years of schooling. Nationally, around 22% of women aged 15–49 had completed 10 or more years of schooling in 1992–1993. The share of these women increased to about 60% in 2015–2016. Although TFR is higher for less educated people in India, their share in total women aged 15–49 has been reducing rapidly due to the expansion of education. The rise in education has a significant impact on delay in age at marriage.

A similar trend is observed at the state level as well. In 2015–2016, with the exception of Bihar (TFR = 2.3), women who had 10 or more years of schooling had reached the replacement level of fertility. The lowest being in Punjab (TFR = 1.4) and the highest in Uttar Pradesh (TFR = 2.0). Women with 5–9 years of schooling in many states except Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh either reached replacement or below-replacement level fertility or are very close to achieving it. The four larger states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh) have lower child survival and limited outreach of female education. In 2015–2016, Kerala had 95% of women aged 15–49 with 10 or more years of schooling, which was 44% in Bihar (including Jharkhand), 46% in Rajasthan, 52% in Madhya Pradesh (including Chhattisgarh), and 53% in Uttar Pradesh (including Uttarakhand).

Table 10. Total Fertility Rate by the Educational Status of the Women, India and Selected States, 1992–2016

State/India	1992–1993			1998–1999			2005–2006			2015–2(
	<5 Years	5–9 Years	≥10 Years	<5 Years	5–9 Years	≥10 Years	<5 Years	5–9 Years	≥10 Years	<5 Years
Andhra Pradesh[a]	3.1	2.6	2.8	1.8	1.9	2.5	2.0	1.8	1.8	1.8
Assam	5.2	3.7	3.5	2.7	2.3	2.1	3.2	2.1	1.3	1.8
Bihar[b]	4.5	4.0	3.0	3.4	2.7	2.8	4.5	3.2	2.4	2.3
Gujarat	4.1	2.9	2.8	3.1	2.6	2.3	3.2	2.4	1.7	1.5
Haryana	4.9	3.4	3.6	3.1	2.7	2.7	3.3	2.5	2.3	1.6
Karnataka	3.9	3.4	2.8	2.1	2.1	2.4	2.3	2.1	2.1	1.8
Kerala	2.9	3.0	2.7	2.3	2.4	2.5	2.2	2.1	2.0	1.6
Madhya Pradesh[c]	4.4	3.7	2.9	3.2	2.7	2.5	3.7	2.8	1.9	1.9
Maharashtra	3.7	3.5	2.8	2.6	2.5	2.6	2.6	2.3	1.8	1.7
Orissa	3.7	4.0	2.5	2.8	2.7	2.4	2.9	2.0	1.9	1.7
Punjab	3.7	3.5	3.0	3.3	2.8	2.4	2.8	2.1	1.6	1.4
Rajasthan	4.1	3.0	3.1	3.7	2.6	2.5	3.7	2.5	1.8	1.8
Tamil Nadu	3.4	2.7	2.6	2.3	2.5	2.5	2.0	2.0	1.8	1.7
Uttar Pradesh[d]	5.7	4.5	3.1	4.1	3.2	3.0	4.5	3.3	2.4	2.0
West Bengal	3.9	3.0	2.3	2.4	1.9	1.9	2.8	1.9	1.4	1.6
India	**4.3**	**3.5**	**3.3**	**3.0**	**2.5**	**2.6**	**3.4**	**2.4**	**1.9**	**1.8**

a Undivided including Telangana (1992–1993, 1998–1999, and 2005–2006).

b Undivided including Jharkhand (1992–1993 and 1998–1999).

c Undivided including Chhattisgarh (1992–1993 and 1998–1999).

d Undivided including Uttarakhand (1992–1003 and 1998–1999).

Source: International Institute for Population Sciences (1993); International Institute for Population Sciences & ICF (2017); International Institute for Population Sciences & ORC-Macro (2000); International Institute for Population Sciences & ORC-Macro (2007).

Mortality

The mortality data has information on three key indicators: infant mortality rate (IMR), under-5 mortality rate (U5MR), and expectation of life at birth (LEB; e^{o}_{o}). The data comes from the SRS for India and covers about 25 years (1990–2016). The year 1990 is chosen as a base since it benchmarks the Millennium Development Goals (MDG) base year, and the year 2016 benchmarks the base year of the recently declared Sustainable Development Goals (SDGs). The MDG goal for U5MR for India was to attain a U5MR of 42 deaths of children aged below 5 years per 1,000 live births by the year 2015. The corresponding goal for the IMR was 37 infant deaths per 1,000 live births. Under the SDG, the goals are 21 and 15, respectively, for the year 2030.

At the beginning of the 20th century, in India, a newborn baby had an average life expectancy of 21–23 years (Davis, 1951; Mukherji, 1976). The SRS life table available for the period 2013–2017 revealed that a newborn baby in India would live an average of more than 69 years, which is considerably lower than in other countries globally and in the South Asian region. Nonetheless, this is a significant improvement from just about 20 years to close to 70 years, and an essential aspect of this improvement relates to IMR. At the national level, the IMR was 80 infant deaths per 1,000 live births in 1990, which declined to 68 in 2000 (12 points in 10 years; see Table 11). The first decade of the 21st century unfolded a significant decline in the IMR for India— 47 infant deaths per 1,000 live births in 2010 and 34 per 1,000 in 2016. Mortality decline in India and its states may have been due to improvements in access to health services and also an incremental increase in access to improved drinking water and sanitation. Similar to the global evidence (Fink et al., 2011), the National Family Health Survey (NFHS) data for 1992–1993 and 2015–2016 revealed a quantum jump in access to sanitation facilities (IIPS, 1993; IIPS & ICF, 2017).

The acceleration, especially after 2005, may be due to the *Janani Suraksha Yojana* program implemented under the National Health Mission (erstwhile known as the National Rural Health Mission). The program provided a cash incentive of Rs. 1400 to women who delivered their babies in a health facility (Stephen et al., 2010). However, compliance varies considerably across India’s states. In the year 1990, Kerala had the lowest IMR (17 infant deaths per 1,000 live births), whereas it was higher in Odisha (122), followed by Madhya Pradesh (111) and Uttar Pradesh (99). By 2016, IMR declined significantly in all states. While Kerala continued to occupy the first place with the lowest IMR, Madhya Pradesh replaced Odisha with an IMR of 47 deaths per 1,000 live births. The states, on the whole, have succeeded in reducing the IMR; however, the usual lagging states of Assam, Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh, and Odisha continue to have higher IMRs.

Table 11. Infant Mortality Rate and Percentage Change in the Rate in India and Selected States, 1990–2016

Country/ State	Infant Mortality Rate in the Year							Change (%) During:		
	1990	1995	2000	2005	2010	2015	2016	1990–2005	2005–2016	1990–2016
Andhra Pradesh[a]	70	67	65	57	46	37	34	18.6	40.4	51.4
Assam	76	77	65	57	58	47	44	25.0	22.8	42.1
Bihar[b]	75	73	62	61	48	42	38	18.7	37.7	49.3
Gujarat	72	62	62	54	44	33	30	25.0	44.4	58.3
Haryana	69	69	67	60	48	36	33	13.0	45.0	52.2
Karnataka	70	62	57	50	38	28	24	28.6	52.0	65.7
Kerala	17	15	14	14	13	12	10	17.6	28.6	41.2
Madhya Pradesh[c]	111	99	88	76	62	50	47	31.5	38.2	57.7
Maharashtra	58	55	48	36	28	21	19	37.9	47.2	67.2
Orissa	122	103	95	75	61	46	44	38.5	41.3	63.9
Punjab	61	54	52	44	34	23	21	27.9	52.3	65.6
Rajasthan	79	85	80	67	55	43	41	15.2	38.8	48.1
Tamil Nadu	59	54	51	37	24	19	17	37.3	54.1	71.2
Uttar Pradesh[d]	99	86	83	73	61	46	43	26.3	41.1	56.6
West Bengal	63	58	51	38	31	26	25	39.7	34.2	60.3
India	**80**	**74**	**68**	**58**	**47**	**37**	**34**	**27.5**	**41.4**	**57.5**

a Undivided including Telangana for the years 1990, 1995, 2005, and 2010

b Undivided including Jharkhand for the years 1990 and 1995.

c Undivided including Chhattisgarh for the years 1990 and 1995.

d Undivided including Uttarakhand for the years 1990 and 1995.

Source: Infant mortality rates from the annual statistical report of the Sample Registration System of India.

Table 12 presents the gender-specific U5MRs for India and states for 1990–2016. An average of 114 children per 1,000 live births died in India in 1990 before celebrating their 5th birthday, which declined to 39 in 2016; a two-thirds decline in 26 years. During the same period, the U5MR declined from 119 to 37 for male children and from 132 to 41 for female children. Similar to IMR, the U5MR fell relatively faster in the last 16 years in India (2000–2016) when compared with the corresponding change during 1990–2000. Once again, there are vast differences across states of India in U5MR as well; the lagging states continue to have significantly higher levels of childhood mortality. In 2016 Kerala had the lowest U5MR (11), and the Madhya Pradesh had the highest (55), followed by Assam (52) and Odisha (50). The improvement in child survival in India brought a sense of security for the families to go for smaller families and contributed to the lowering of the TFR. An important point to note here is that regardless of the period studied, the U5MR in India has exceeded for female children compared to the male children. Surprisingly, most states have revealed a gender gap in childhood mortality. A study by Ram et al. (2013, 2014) documented wide disparities in the levels of under-5 mortalities in districts of India.

Table 12. Gender-Specific Under-5 Mortality Rate and Percentage Change, India and Selected States, 1990–2016

Country/ State	Under-5 Mortality Rate in the Year							Change During (%)		
	1990	1995	2000	2005	2010	2015	2016	1990–2005	2005–2016	1990–2016
Both sexes combined										
Male children										
Female children										
Andhra Pradesh[a]	89	83	73	66	49	39	37	25.8	43.9	58.4
Assam	115	109	90	85	84	62	52	26.1	38.8	54.8
Bihar[b]	111	112	88	76	66	48	43	31.5	43.4	61.3
Gujarat	104	83	82	68	57	39	33	34.6	51.5	68.3
Haryana	92	94	83	68	56	43	37	26.1	45.6	59.8
Karnataka	94	81	70	57	47	31	29	39.4	49.1	69.1
Kerala	23	20	18	18	15	13	11	21.7	38.9	52.2
Madhya Pradesh[c]	161	139	115	102	84	62	55	36.6	46.1	65.8
Maharashtra	79	73	56	44	33	24	21	44.3	52.3	73.4
Orissa	165	141	116	97	80	56	50	41.2	48.5	69.7
Punjab	82	69	60	54	43	27	24	34.1	55.6	70.7
Rajasthan	119	120	108	88	69	50	45	26.1	48.9	62.2
Tamil Nadu	78	68	57	43	28	20	19	44.9	55.8	75.6
Uttar Pradesh[d]	148	126	117	102	82	51	47	31.1	53.9	68.2
West Bengal	93	85	67	50	38	30	27	46.2	46.0	71.0
India	114	105	89	77	61	43	39	32.5	49.4	65.8

Country/ State	Under-5 Mortality Rate in the Year							Change During (%)		
	1990	1995	2000	2005	2010	2015	2016	1990–2005	2005–2016	1990–2016
Both sexes combined										
Male children										
Female children										
Andhra Pradesh[a]	97	84	74	70	46	37	36	27.8	48.6	62.9
Assam	143	117	105	92	79	58	48	35.7	47.8	66.4
Bihar[b]	117	110	84	75	60	43	35	35.9	53.3	70.1
Gujarat	110	88	77	71	52	38	34	35.5	52.1	69.1
Haryana	93	89	78	69	51	41	34	25.8	50.7	63.4
Karnataka	110	81	76	61	43	31	26	44.5	57.4	76.4
Kerala	30	19	18	16	14	12	10	46.7	37.5	66.7
Madhya Pradesh[c]	177	150	123	109	79	63	58	38.4	46.8	67.2
Maharashtra	83	69	55	40	31	21	20	51.8	50.0	75.9
Orissa	154	135	114	97	76	56	49	37.0	49.5	68.2
Punjab	76	64	60	52	38	27	24	31.6	53.8	68.4
Rajasthan	144	116	104	93	60	44	42	35.4	54.8	70.8
Tamil Nadu	84	58	53	47	26	20	19	44.0	59.6	77.4
Uttar Pradesh[d]	155	123	110	99	71	49	46	36.1	53.5	70.3
West Bengal	97	85	70	51	37	28	27	47.4	47.1	72.2
India	119	102	87	75	55	40	37	37.0	50.7	68.9

Country/ State	Under-5 Mortality Rate in the Year							Change During (%)		
	1990	1995	2000	2005	2010	2015	2016	1990–2005	2005–2016	1990–2016
Both sexes combined										
Male children										
Female children										
Andhra Pradesh[a]	96	75	73	67	51	42	38	30.2	43.3	60.4
Assam	140	123	110	91	87	66	57	35.0	37.4	59.3
Bihar[b]	139	128	98	85	68	54	51	38.8	40.0	63.3
Gujarat	123	101	86	79	60	41	33	35.8	58.2	73.2
Haryana	115	117	107	87	59	46	42	24.3	51.7	63.5
Karnataka	105	83	72	62	47	32	31	41.0	50.0	70.5
Kerala	25	17	15	15	16	14	12	40.0	20.0	52.0
Madhya Pradesh[c]	194	158	140	118	85	61	52	39.2	55.9	73.2
Maharashtra	80	68	60	46	35	26	23	42.5	50.0	71.3
Orissa	159	131	114	98	79	55	51	38.4	48.0	67.9
Punjab	92	84	82	64	48	26	25	30.4	60.9	72.8
Rajasthan	172	133	118	103	79	56	49	40.1	52.4	71.5
Tamil Nadu	90	62	55	44	28	21	19	51.1	56.8	78.9
Uttar Pradesh[d]	189	142	131	119	87	53	49	37.0	58.8	74.1
West Bengal	97	86	63	49	38	31	28	49.5	42.9	71.1
India	132	113	96	82	64	45	41	37.9	50.0	68.9

a Undivided including Telangana for the years 1990, 1995, 2005, and 2010.

b Undivided including Jharkhand for the years 1990, 1995, 2005, and 2010.

c Undivided including Chhattisgarh for the years 1990, 1995, 2005, and 2010.

d Undivided including Uttarakhand for the years 1990, 1995, 2005, and 2010.

Source: Author calculations based on data from SRS Based Life Tables for 1988–1992, 1993–1997, 1998–2002, and 2003–2007. Data for 2015 and 2016 from the annual statistical report of the Sample Registration System of India for the respective years.

We now examine levels of life expectancy at birth (LEB). Table 13 presents the relevant data for India and its states for both sexes combined as well as separately. The LEB for India was nearly 49 years during 1970–1975, which increased to about 58 years in 1986–1990, an increase of 9 years in 16 years resulting in an annual improvement of approximately 0.6 years. By 1996–2000, the LEB in India increased to 62 years and further to 69 years in 2013–2017. Up until the 1980s, nationally, Indian males lived longer than the Indian females (Ram & Ram, 1997). Data on gender-specific LEB since 1993 indicates that in India, females now live longer than males, and the gap was by 2 years in 2013–2017. The gender gap indeed widened in the mid-1990s when male LEB was at 60.4 years and females at 61.8 years. But at the same time, gender gaps in mortality have also widened for adolescents (to the female disadvantage), an anomaly indicating the downside of using only LEB for exploring gender disparity.

Table 13. Gender-Specific Life Expectancy at Birth and Changes in the Life Expectancy, India and Selected States, 1986–2017

Country/ State	Both Sexes				Change (%)	Males			
	1986–1990	1996–2000	2006–2010	2013–2017	1986/1990 to 2013/2017	1986–1990	1996–2000	2006–2010	2013–2017
Andhra Pradesh[a]	59.1	62.7	65.8	69.7	−17.9	58.2	61.1	63.5	68.3
Assam	53.6	57.4	61.9	66.2	−23.5	53.6	57.3	61.0	65.4
Bihar[b]	54.9	60.5	65.8	68.9	−25.5	55.7	61.1	65.5	69.2
Gujarat	57.7	64.4	66.8	69.7	−20.8	57.0	63.0	64.9	67.6
Haryana	62.2	64.4	67.0	69.7	−12.1	62.2	64.1	64.9	67.6
Karnataka	61.1	64.5	67.2	69.2	−13.3	60.4	62.6	64.9	67.7
Kerala	69.5	71.6	74.2	75.2	−8.2	66.8	68.7	71.5	72.5
Madhya Pradesh[c]	53.0	57.1	62.4	66.0	−24.5	53.7	56.6	61.1	64.2
Maharashtra	62.6	65.9	69.9	72.5	−15.8	61.2	64.2	67.9	71.2
Orissa	54.4	58.3	63.0	68.4	−25.7	54.6	57.8	62.2	67.1
Punjab	65.2	66.5	69.3	72.4	−11.0	64.7	65.5	67.4	71.0
Rajasthan	55.2	62.1	66.5	68.5	−24.1	55.2	61.0	64.7	66.3
Tamil Nadu	60.5	64.8	68.9	71.7	−18.5	60.0	63.5	67.1	69.9
Uttar Pradesh[d]	53.4	59.2	62.7	65.0	−21.7	54.2	59.6	61.8	64.3
West Bengal	60.8	64.3	69.0	71.2	−17.1	60.2	63.0	67.4	70.4
INDIA	59.1	62.7	65.8	69.7	−17.9	57.7	61.2	64.6	67.8

[$$] authors calculation using SRS gender-specific life tables.

a Undivided including Telangana.

b Undivided including Jharkhand for 1986–1990 and 1996–2000.

c Undivided including Chhattisgarh for 1986–1990 and 1996–2000.

d Undivided including Uttarakhand for 1986–1990, 1996–2000, and 2006–2010

Source: From Life tables of the Sample Registration System (SRS) of India.

Family Planning and Unmet Need

India acquired the status of being the first nation globally to launch an official family planning program in 1952. However, the real push to the program came through in the 1960s when the program adopted a target-specific approach. The federal authorities in India assigned targets to the states, which were allocated to districts and further to the individual health workers at the lowest level of service provision. These targets became extremely volatile over the years, and the authorities announced disincentives and incentives to the users and the service providers based on performance (Pachauri, 2014). This period was accompanied by the emergency period (1975–1977) in India, when the program became extremely coercive. This act of the government damaged the program to a great extent and impacted the northern Hindi-speaking belt where fertility levels were higher. Although the success in fertility reduction in India is not comparable to that of other Asian countries, its achievements are by no means modest. In the initial phase, the program success was mostly monitored and evaluated using service statistics with the help of the number of acceptors and births averted as a result of family planning acceptance. Family planning surveys conducted in the 1970s and 1980s (ORG, 1972, 1982, 1990) complemented monitoring and evaluating efforts. After 1990, India launched nationwide surveys (see IIPS, 1993; IIPS & ICF, 2017; IIPS & ORC-Macro 2000, 2007). Tables 14, 15, and 16 give selected family planning indicators for India.

There has been a continuous rise in the percentage of married women using modern contraception in India. For example, just over 10% of married Indian women in 1970 used modern contraception (ORG, 1972). This percentage increased to 42.8% in 1998–1999 and to 48.5% in 2005–2006 (Table 14). India's contraceptive prevalence rates (CPRs) are presented for the period between 1992–1993 to 2015–2016 in Table 13. At the national level, overall CPR has increased from a little over 36% in the early 1990s to close to 48% in 2015–2016, which translates to an increase of 12 units over the 23 years (an annual increase of 1.4%). The 2017 NFHS indicated that modern method CPR had marginally decreased from 48.5% in 2005–2006 to 47.8% in 2015–2016 (IIPS & ICF, 2017; IIPS & ORC-Macro, 2007). The decline in CPR of the modern method is substantial in many states, including Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, and Tamil Nadu. This has raised debates among policy makers and researchers because these states have concurrently exhibited a significant decline in TFR levels. There is some research evidence that has indicated doubt about the estimated CPR for the period 2015–2016. A study by Jayachandran and Stover (2018) expressed concern over the quality of contraceptive data collected in the 2017 NFHS. The modern limiting method CPR showed an increase of five units (from 31% to a little over 36%) and there was a twofold rise in the modern spacing method CPR (from about 6% to over 11%) during the same period. Interestingly, CPR for traditional methods also increased, from 4% to almost 6% (IIPS & ICF, 2017).

The levels of CPR, as well as the pace of change in it, varied considerably across Indian states included in the analysis. Generally, the states in the southern and western regions revealed higher levels of CPR compared to those in the northern and eastern regions of India. While the CPR rose over time, Gujarat and Kerala had a marginal decline in the overall CPR. Assam, Odisha, and West Bengal (all three in the eastern region) and Uttar Pradesh in the northern part had higher CPR of the traditional method (abstinence and withdrawal/rhythm) compared

to the remaining states. While the CPR for traditional methods declined in Assam and West Bengal, it increased from 1%–2% in 1992–1993 to over 12%–14% in 2015–2016 in Odisha and Uttar Pradesh. The use of traditional methods is higher among women who live in urban areas, who were more educated and resided in economically better-off households. The patterns of CPR are somewhat similar for the modern limiting and spacing methods across states, as seen for all methods combined. Nonetheless, a few states, such as Assam, Haryana, Odisha, Uttar Pradesh, and West Bengal, have shown a tremendous rise in the CPR for modern spacing methods.

Table 14. Contraceptive Prevalence Rate for Modem Limiting, Modern Spacing Methods and Traditional Methods of Family Planning and Percentage Change in Them, India and Selected States, 1992–2016

Country/ State	1992–1993	1998–1999	2005–2006	2015–2016	Change (%): 1992–2016	1992–1993	1998–1999	2005–2006	2015–2016	C (9 1 2
	Modern methods only (Overall)					Traditional methods only				
	Modern methods only (limiting)					Modern methods only (spacing)				
Andhra Pradesh[a]	47.0	58.9	67.0	69.4	47.7	0.4	1.8	0.6	0.6	5
Assam	19.9	26.6	27.0	37.0	85.9	23.1	16.7	29.5	15.4	-3
Bihar[b]	21.6	22.4	28.9	23.3	7.9	1.5	1.6	5.2	0.8	–4
Gujarat	46.9	53.3	56.5	43.1	–8.1	2.4	5.6	10.1	3.8	5
Haryana	44.3	53.2	58.3	59.4	34.1	5.3	8.9	5.0	4.5	–1
Karnataka	47.3	56.5	62.5	51.3	8.5	1.8	1.7	1.1	0.5	–7
Kerala	54.4	56.1	57.9	50.3	–7.5	8.9	7.6	10.7	2.8	–6
Madhya Pradesh[c]	35.5	42.6	52.8	49.6	39.7	1.0	1.4	3.2	1.9	9
Maharashtra	52.5	59.9	64.9	62.5	19.0	1.2	1.0	1.9	2.3	9
Orissa	34.6	40.3	44.7	45.4	31.2	1.6	5.6	6.1	12.1	6
Punjab	51.3	53.8	56.1	66.3	29.2	7.4	12.4	7.2	9.5	2
Rajasthan	30.9	38.1	44.4	53.5	73.1	0.8	1.9	2.8	6.2	6
Tamil Nadu	45.2	50.3	60.0	52.6	16.4	4.6	1.8	1.4	0.6	–8
Uttar Pradesh[d]	18.5	22.0	29.3	31.7	71.4	1.3	5.7	14.3	13.9	9
West Bengal	37.3	47.3	49.9	57.0	52.8	20.1	18.5	21.3	14.2	–2
India	**36.3**	**42.8**	**48.5**	**47.8**	**31.7**	**4.3**	**5.0**	**7.8**	**5.9**	**3**

Country/ State	1992–1993	1998–1999	2005–2006	2015–2016	Change (%): 1992–2016	1992–1993	1998–1999	2005–2006	2015–2016	C (' 1 2
	Modern methods only (Overall)					Traditional methods only				
	Modern methods only (limiting)					Modern methods only (spacing)				
Andhra Pradesh[a]	45.2	52.2	65.8	63.5	40.5	1.8	4.3	1.2	1.2	–3
Assam	14.6	16.8	13.2	9.6	–34.2	5.3	9.9	13.8	27.4	4
Bihar[b]	18.6	20.1	24.4	20.7	11.3	2.9	2.2	4.5	2.5	–1
Gujarat	41.0	45.3	43.5	33.7	–17.8	5.9	8.1	12.9	9.4	5
Haryana	34.7	40.8	38.9	38.6	11.2	9.6	12.4	19.4	20.6	1
Karnataka	42.5	52.2	57.6	48.6	14.4	4.8	4.4	5.0	2.6	–4
Kerala	48.3	51.0	49.7	45.9	–5.0	6.1	5.1	8.2	4.4	–2
Madhya Pradesh[c]	31.5	38.0	45.5	42.7	35.6	4.0	4.6	7.2	6.8	7
Maharashtra	46.1	52.2	53.2	51.1	10.8	6.4	7.7	11.7	11.4	7
Orissa	31.6	35.6	34.1	28.4	–10.1	3.0	4.7	10.5	16.8	4
Punjab	34.0	30.9	32.0	38.1	12.1	17.3	23.0	24.0	28.3	6
Rajasthan	27.7	32.3	35.0	40.9	47.7	3.3	5.8	9.4	12.5	2
Tamil Nadu	39.5	45.9	55.4	49.4	25.1	5.7	4.3	4.6	3.1	–4
Uttar Pradesh[d]	13.1	15.6	17.4	17.4	32.8	5.5	6.4	11.8	14.2	1
West Bengal	30.6	33.8	32.9	29.4	–3.9	6.7	13.5	17.0	27.4	3
India	**30.8**	**36.0**	**38.3**	**36.3**	**17.9**	**5.5**	**6.8**	**10.2**	**11.4**	**1**

a Undivided including Telangana (1992–1993).

b Undivided including Jharkhand (1992–1993 and 1998–1999).

c Undivided including Chhattisgarh (1992–1993).

d Undivided including Uttarakhand (1992–1993 and 1998–1999).

Source: International Institute for Population Sciences (1993); International Institute for Population Sciences & ICF (2017); International Institute for Population Sciences & ORC-Macro (2000); International Institute for Population Sciences & ORC-Macro (2007).

Tables 15 and 16 provide data on the future demand for family planning as assessed using the information on unmet need for family planning over 25 years. Nationally, the unmet need for family planning declined by nearly 37% in two and a half decades; the unmet need of almost 20% in 1992–1993 to about 13% in 2015–2016 (Table 15). The unmet need for modern spacing methods had halved in the country from nearly 12% to 6% during the same period. However, the unmet need for family planning seemingly has remained unchanged since 2010, as the decline was by only one percentage point (from 14% to 13% for all methods and from 6.1% to 5.6% for spacing methods). Gujarat and Kerala were the only states where the total unmet need for family planning increased over time. In the remaining states, the change in the total unmet need has followed the national pattern. While the total unmet need remained nearly unchanged in Haryana, Karnataka, Madhya Pradesh, Maharashtra, and Tamil Nadu, it increased only marginally in Andhra Pradesh, Assam, and Wes Bengal. The unmet need doubled in Gujarat and increased substantially in Kerala.

In contrast, the unmet need declined in Bihar, Odisha, Rajasthan, and Uttar Pradesh during the same period. In case of unmet need for spacing methods, the data indicated substantial decline over the period for all states except Kerala, where unmet need for spacing methods rose from 6% to 8% in the last decade. A on-going investigation of NFHS data by Ram et al. (in press) showed that unmet need increased mainly due to the rise in the unmet need among the nonusers.

Table 15. Total Unmet Need for Family Planning, Unmet Need for Spacing, and Percentage Change, India and Selected States, 1992–2016

Country/ State	Total Unmet Need: Limiting and Spacing Methods				Change (%) 1992–2016	Unmet Need for Spacing Methods Only				C (' 1 2
	1992–1993	1998–1999	2005–2006	2015–2016		1992–1993	1998–1999	2005–2006	2015–2016	
Andhra Pradesh[a]	11.8	7.8	4.8	5.8	−50.8	7.9	5.1	2.8	3.4	–5
Assam	22.7	17.1	12.3	14.1	−37.9	11.8	6.9	3.6	5.8	–5
Bihar[b]	25.9	25.4	24.0	20.5	−20.8	15.8	12.6	10.6	9.3	–4
Gujarat	13.3	8.8	8.3	17.0	27.8	8.1	5	3.9	6.6	–1
Haryana	16.6	7.6	9.5	9.3	−44.0	9.3	2.9	3.0	3.8	–5
Karnataka	18.8	11.6	10.1	10.4	−44.7	12.6	8.2	5.6	6.0	–5
Kerala	12.1	11.8	9.8	13.7	13.2	8.1	6.9	6.1	8.3	2
Madhya Pradesh[c]	22.4	16.6	11.8	11.9	−46.9	15.1	8.8	5.4	5.6	–6
Maharashtra	14.8	13	10.0	9.7	−34.5	8.8	8	5.3	4.3	–5
Orissa	24.3	15.7	16.1	13.6	−44.0	14.8	8.7	6.5	4.7	–6
Punjab	13.2	7.4	9.0	6.2	−53.0	6.8	2.8	2.8	2.3	–6
Rajasthan	21.2	17.9	15.7	12.3	−42.0	12.7	8.7	7.3	5.7	–5
Tamil Nadu	14.8	13	10.3	10.1	−31.8	8.5	6.6	4.1	4.8	–4
Uttar Pradesh[d]	30.7	25.6	22.6	17.9	−41.7	17.8	11.7	8.8	6.7	–6
West Bengal	17.4	12.1	9.5	7.5	−56.9	9.5	6.2	4.3	3.0	–6
India	**20.3**	**16.1**	**13.9**	**12.9**	**−36.5**	**12.2**	**8.3**	**6.1**	**5.6**	**-5**

a Undivided including Telangana (1992–1993, 1998–1999, and 2005–2006).

b Undivided including Jharkhand (1992–1993 and 1998–1999).

c Undivided including Chhattisgarh (1992–1993 and 1998–1999).

d Undivided including Uttarakhand (1992–1993 and 1998–1999).

Source: International Institute for Population Sciences (1993); International Institute for Population Sciences & ICF (2017); International Institute for Population Sciences & ORC-Macro (2000); International Institute for Population Sciences & ORC-Macro (2007).

There are 46 million married women aged 15–49 in India who have expressed an unmet need for modern contraception, of whom 14 million prefer limiting methods and 18 million prefer spacing methods. The remaining 14 million couples, who used traditional methods, are considered to have an unmet need for modern methods of contraception in the NFHS for 2015–2016 (IIPS & ICF, 2017). It is important to note that all of the nonusers having unmet need will not convert into the users for various reasons as unmet need is highly unlikely to attain a zero value. The current unmet need of 18.7% may best reduce to 4%–5%, as observed in some states (as well as other countries in the neighborhood). In other words, 35 million couples actually can be converted to users. Nonuse of contraception could be due to sterility (primary and secondary), which varies considerably across India's states, especially after age 30 (Ram, 2010). In other words, the potential pool of available users will include fewer people, around 28–30 million. Table 16 presents the share of current users and couples with unmet needs in the states of India in the national totals. The 14 states included consist of 88% of all users in India, and nearly 84% of the couples with unmet need belonged to these 14 states. Almost 47% of the couples with unmet need come from Bihar (13%), Madhya Pradesh (5%), Rajasthan (7%), and Uttar Pradesh (21%). This share is likely to rise because the demand for contraception in other states has almost reached a saturation point. The geographic allocation of unmet need creates a challenging situation because program strength and social development in these states are inadequate and of poor quality.

Table 16. State Share of the Users of Modern Methods of Family Planning and State Share of Couples Having Total Unmet Need for Family Planning (Limiting and Spacing Combined) in the National Totals, 1992–2016

Country/ State	State Share of Modern Method Users				State Share of Couples With Unmet Need			
	1992–1993	1998–1999	2005–2006	2015–2016	1992–1993	1998–1999	2005–2006	2015–2016
Andhra Pradesh[a]	11.4	11.6	10.9	9.8	5.2	4.1	2.7	3.3
Assam	1.4	1.6	1.4	2.0	3.0	2.7	2.2	2.8
Bihar[b]	5.1	4.3	4.9	3.9	11.0	13.0	13.8	13.1
Gujarat	6.4	6.4	6.0	4.7	3.3	2.8	3.1	3.2
Haryana	2.3	2.5	2.5	2.6	1.6	1.0	1.4	1.5
Karnataka	6.8	6.9	6.8	5.7	4.9	3.8	3.8	4.2
Kerala	4.9	4.3	3.8	3.0	2.0	2.4	2.2	2.2
Madhya Pradesh[c]	7.8	7.2	6.9	5.8	8.9	7.5	5.5	5.2
Maharashtra	13.7	13.1	12.6	12.5	7.0	7.6	6.7	7.4
Orissa	3.5	3.3	3.2	3.2	4.5	3.5	4.0	4.2
Punjab	3.2	2.9	2.6	3.1	1.5	1.1	1.5	1.6
Rajasthan	4.6	4.9	5.2	6.6	5.8	6.2	6.3	7.3
Tamil Nadu	8.4	7.7	8.0	7.1	5.0	5.3	4.8	5.0
Uttar Pradesh[d]	8.2	7.9	9.5	9.8	24.8	24.6	24.2	20.7
West Bengal	8.2	8.9	8.4	10.0	6.9	6.1	5.5	5.2
Subtotal	**96.0**	**93.5**	**92.7**	**89.9**	**95.5**	**91.7**	**87.7**	**86.7**

Country/ State	State Share of Modern Method Users				State Share of Couples With Unmet Need			
	1992–1993	1998–1999	2005–2006	2015–2016	1992–1993	1998–1999	2005–2006	2015–2016
Remaining states/Union Territories (UTs)	4.0	6.5	7.3	10.1	4.5	8.3	12.3	13.3
India	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

a Undivided including Telangana (1992–1993, 1998–1999, and 2005–2006).

b Undivided including Jharkhand (1992–1993 and 1998–1999).

c Undivided including Chhattisgarh (1992–1993 and 1998–1999).

d Undivided including Uttarakhand (1992–1993 and 1998–1999).

Source: International Institute for Population Sciences (1993); International Institute for Population Sciences & ICF (2017); International Institute for Population Sciences & ORC-Macro (2000); International Institute for Population Sciences & ORC-Macro (2007).

Marriage

A very dark side of Indian culture has been the practice of child marriage, which was rampant in the 20th century. The Hindu scripture advocated marriage for a girl before puberty (onset of menstruation). However, girls who married early remained in the parental home until “Gauna” (Kapadia, 1966), which was generally performed at the age when the girl attains physical maturity (onset of menstruation). The Sarda Act enacted in 1929, followed by the Child Marriage Restraint Act of 1978 in India, defined the minimum legal age for marriage as 18 years for girls and 21 years for boys. Early marriage has a multidimensional effect on the lives of the females in India throughout their life course, from deprivation of education, skill development, health care access, and so on. At the macro level, the marriage pattern of a population has a significant effect on fertility and mortality (especially child mortality) levels. Marriage is one of the proximate determinants of fertility besides family planning use. The female age at marriage in India is rising, but rather slowly. The singulate mean age at marriage in India was 15.9 years in 1961, which increased to 18.3 years in 1981 and 20.8 years in 2011, an increase of about five years in five decades. In the 1990s, nearly half of the women aged 20–24 in India were married before age 18 years. This percentage reduced to about 45% in 2005–2006.

The institution of marriage in India almost remained universal. Close to 97% of the Indian women aged 30–34 years in 2011 were married (Table 17). The percentage of these women varied marginally across states. Only two states (Kerala and Odisha) had 5% of the women aged 30–34 years who were single. The percentage of single women aged 30–34 years was 4% in Karnataka and West Bengal. Data from the 2015–2016 survey indicated that about one-quarter of women aged 20–24 years were married before they were 18 years (in absolute terms, 14.5 million women married below age 18). There is a great deal of variation across the states. Around 42% of women aged 20–24 years were married before age 18 in West Bengal, followed by 40% in Bihar, 31–33% in Rajasthan, Madhya Pradesh and Andhra Pradesh, and 23–26% in Gujarat, Karnataka, and Maharashtra.

Table 17. Percentage of Women Ages 20–24 Married Before Age 18 and Percentage of Single Women Ages 30–34, India and Selected States, 2015–2016

Country/ State	Women Married Before 18 Years			% Single Women Ages 30–34 Years
	Percent	Number (in Thousands)	% Share in State in National Total	
Andhra Pradesh	33.6	761.7	5.2	2.6
Assam	33.1	499.1	3.4	7.5
Bihar	39.7	1,763.9	12.1	1.1
Gujarat	24.0	684.8	4.7	2.9
Haryana	18.7	236.2	1.6	1.5
Karnataka	23.6	669.9	4.6	4.1
Kerala	7.8	100.9	0.7	5.0
Madhya Pradesh	31.1	1,088.8	7.5	1.9
Maharashtra	25.9	1,351.9	9.3	3.8
Orissa	21.7	424.7	2.9	5.3
Punjab	7.5	95.9	0.7	3.4
Rajasthan	31.5	1,080.8	7.4	0.9
Tamil Nadu	16.3	495.6	3.4	3.9
Uttar Pradesh	19.3	1,965.3	13.5	2.1
West Bengal	41.8	1,812.9	12.5	4.3
Subtotal	–	13,032.5	89.7	–
Rest of India	18.7	1,503.9	10.3	–
India	**25.3**	**14,536.4**	**100.0**	**3.3**

Source: Authors' calculation based on data from NCP (2019) and IIPS and ICF (2017). Percent of single women data from Census of India, 2011.

Concluding Remarks

Although India holds a national treasure in its decadal censuses that have been continuously reported since 1881, the country has failed to develop and strengthen its civil registration system for births and deaths. A significant constraint faced by Indian policy makers is a lack of data with regard to its socioeconomic and demographic scenario, including fertility and mortality. This shortcoming became apparent in several policies and programs that lacked evidence-based decisions to improve the health and well-being of the population. These experiences motivated the authorities in India, and nearly two decades after the country attained independence, the Government of India initiated the sample registration system SRS in an effort to replace the civil registration system and fill the data void. In the early 1990s, the government's focus on health and well-being led to the publication of the first National Family Health Survey in 2017. The data from these surveys has helped policy makers and researchers to gain insight into the demographic changes in India, nationally and subnationally.

India is the second-most populous country in the world. The international community has expressed concerns about the rising population size and high growth rate in India, which has received unprecedented attention in almost all platforms. Between 1961 and 2001, India's population grew at an average rate of about 2%, and the size of the population in absolute terms exceeded one billion in 2001. During 2001–2011, the population growth slowed down substantially. However, India continued to add an average of 18 million people annually to its already large base, leading to a total national population of 1.21 billion in 2011. An assessment by the UN (2019) indicated that India's population would peak at 1.65 billion in 2061 and would begin to decline after that and reach 1.44 billion in the year 2100. The four large states in India (Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan) continue to reveal high levels of fertility and mortality (especially during early childhood), and have great potential for future population growth. The spatial distribution of India's population will have a significant influence on its future political and economic scenario. Kerala state may experience a negative population growth rate around 2036. The undivided Andhra Pradesh (including the newly created state of Telangana) may experience the same around 2041 and Karnataka and Tamil Nadu around 2046. Four states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan would have 764 million people in 2061 (45% of the national total) by the time India's population reaches around 1.65 billion (Verma, 2018).

Changes in fertility and mortality are the two most important demographic factors contributing to population growth in India. The total fertility rate (TFR) in India declined from about 6.5 children per woman in the early 1960s to 2.3 children per woman in 2016 (a reduction of 4.2 children per woman in fewer than six decades). India is concerned about relatively high TFR in Bihar (3.3 children per woman), Uttar Pradesh (3.1 children per woman), Madhya Pradesh (2.8 children per woman), and Rajasthan (2.7 children per woman). The states have exhibited a higher unmet need for contraception and a weak public health-care delivery system. Childhood mortality in India has declined substantially, especially after the 1990s (114 in 1990 to 39 children deaths per 1,000 live births in 2016). This remarkable improvement is the result of massive efforts to improve comprehensive maternal and child health programs and nationwide implementation of the national health mission. The latter focused attention on improving the maternal and child health indicators in the country.

Despite this, childhood mortality continues to be unacceptably high in Uttar Pradesh (47 children deaths per 1,000 live births), Bihar (43 children deaths per 1,000 live births), Rajasthan (45 children deaths per 1,000 live births), and Madhya Pradesh (55 children deaths per 1,000 live births). Besides, more considerable attention to improving access to public health-care services would promote contraception use immensely by way of reducing unmet needs and, in turn, reduce child mortality.

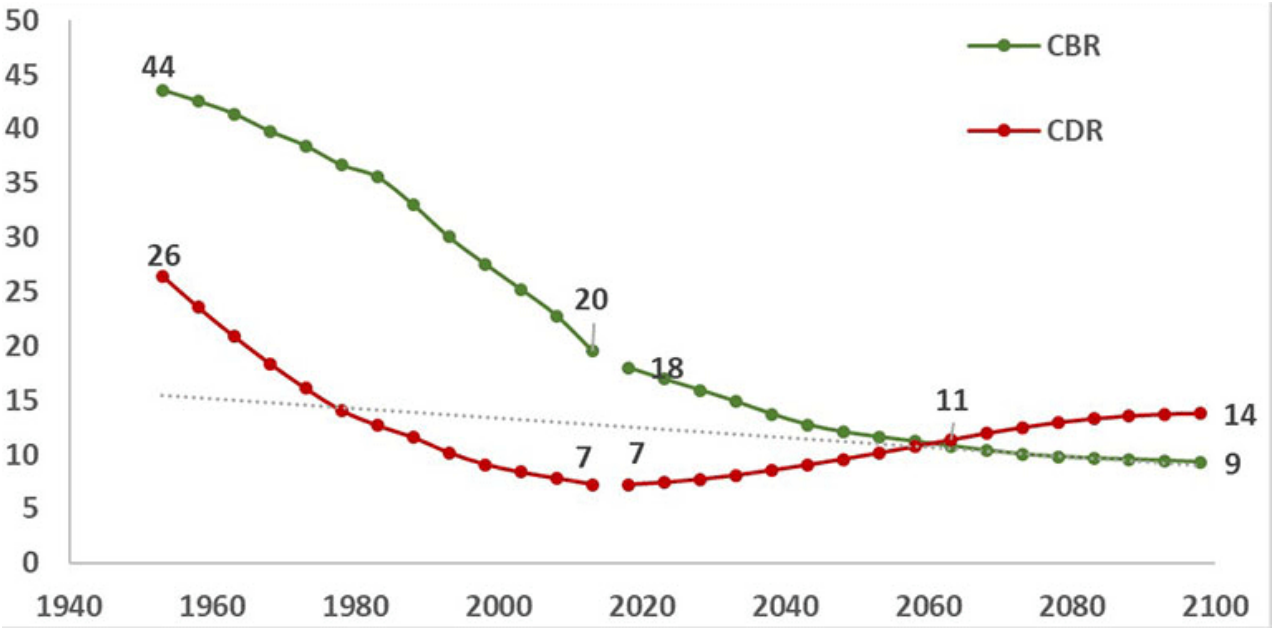

Figure 5. Future prospects of the demographic transition for India, 1950–2100.

Source: Crude birth rate (CBR) and crude death rate (CDR) for India are taken from UN (2019).

A great deal of scientific evidence suggests that the intertwined programmatic interventions focusing on female education and child survival are essential. Such efforts, notably in the four large states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan, would go a long way to reduce unmet need for contraception and enhance contraception use giving a big push to reducing fertility in the future. This would be crucial for India to stabilize its population before reaching 1.65 billion. India's demographic journey through the path of the classical demographic transition suggests that the country is very close to achieving replacement fertility. Figure 5 outlines the future path of India's transition according to the UN's (2019) assessment. Although India may achieve replacement level fertility very soon (around 2023), the population will continue to grow until 2060 due to population momentum. Only after this, India may experience a negative growth rate; that is, the crude death rate will exceed the crude birth rate.

Further Reading

Caldwell, J. (1980). Mass education as a determinant of the timing of fertility decline. *Population and Development Review*, *6*(2), 225–255.

Cleland, J., & Rodriguez, G. (1988). The effect of parental education on marital fertility in developing countries. *Population Studies*, *42*, 419–442.

Cochrane, S. H. (1979). *Fertility and education: What do we really know?* Johns Hopkins University Press.

Dreze, J., & Murthi, M. (2001). Fertility, education, and development: Evidence from India. *Population and Development Review*, *27*(1), 33–63.

Lutz, W., & Kebede, E. (2016). Education and health: Redrawing the Preston curve. *Population and Development Review*, *44*(2), 343–361.

Pamuk, E. R., Fuchs, R., & Lutz, W. (2011). Comparing relative effects of education and economic resources on infant mortality in developing countries. *Population and Development Review*, *37*(4), 637–664.

Preston, S. H. (1975). The changing relation between mortality and level of economic development <https://www.jstor.org/stable/2173509>. *Population Studies*, *29*(2), 231–248.

Preston, S. H. (1980). Causes and consequences of mortality declines in less developed countries during the twentieth century. In R. A. Easterlin (Ed.), *Population and economic change in developing countries* (pp. 289–360). University of Chicago Press.

Samir, K. C., Wurzer, M., Speringer, M., & Lutz, W. (2018). Future population and human capital in heterogeneous India <http://www.pnas.org/cgi/doi/10.1073/pnas.1722359115>. *Proceedings of the National Academy of Sciences*, *115*(33), 8328–8333.

References

Agarwala, S. N. (1964). Sterilisation as a population control device and its economics. *The Economic Weekly*, 1091–1094.

Bongaarts, J. (2013). The implementation of preferences for male offspring. *Population and Development Review*, *39*(2), 185–208.

Bongaarts, J., & Guilmoto, C. Z. (2015). How many more missing women? Excess female mortality and prenatal sex selection, 1970–2050. *Population and Development Review*, *41*(2), 241–269.

Chitre, K. T. (1964). Sterilization as a method of family limitation and its implementation in the family planning programme. *Maharashtra Medical Journal*, *11*(2), 288.

Cleland, J. (2001). The effects of improved survival on fertility: A reassessment. *Population and Development Review*, *27*(Suppl.), 60–92.

Cleland, J., & Wilson, C. (1987). Demand theories of fertility decline: An iconoclastic view. *Population Studies*, *41*(1), 5–30.

Coale, A. J. (1986). The decline of fertility in Europe since the 18th century as a chapter in demographic history. In A. J. Coale & S. C. Watkins (Eds.), *The decline of fertility in Europe* (pp. 1–31). Princeton University Press.

Coleman, D. (2006). Immigration and ethnic change in low fertility countries: A third demographic transition. *Population and Development Review*, *32*(3), 401–446.

Davis, K. (1951). *The population of India and Pakistan*. Princeton University Press.

Davis, K. (1963). The theory of change and response in modern demographic history. *Population Index*, *29*(4), 345–366.

Dyson, T. (1991). On the demography of South Asian famines, Part 1. *Population Studies*, *45*(1), 5–25.

Dyson, T. (2010). *Population and development: The demographic transition*. Zed Books.

Fink, G., Gunther, I., & Hill, K. (2011). The effect of water and sanitation on child health: Evidence from the demographic and health surveys 1986–2007. *International Journal of Epidemiology*, *40*, 1196–1204.

Gopalaswamy, R. A. (1962). Family planning: Outlook for government action in India. In Cycle V. Kise (Ed.), *Research in family planning* (p. 78). Princeton University Press.

Guilmoto, C. Z., Saikia, N., Tamrakar, V., & Bora, J. K. (2018). Excess under-5 female mortality across India: A spatial analysis using 2011 census data. *Lancet Global Health*, *6*, e650–e658.

International Institute for Population Sciences. (1993). *National family health survey (NFHS-1), 1992–93: India*. International Institute for Population Sciences.

International Institute for Population Sciences & ICF. (2017). *National family health survey (NFHS-4), 2015–16: India*. International Institute for Population Sciences.

International Institute for Population Sciences & ORC-Macro. (2000). *National family health survey (NFHS-2), 1998–1999: India*. International Institute for Population Sciences.

International Institute for Population Sciences & ORC-Macro. (2007). *National family health survey (NFHS-3), 2005–2006: India*. International Institute for Population Sciences.

Jayachandran, A. A., & Stover, J. (2018). *What factors explain the fertility transition in India?* Health Finance and Governance Project.

Jha, P., Kesler, M. A., Kumar, R., Ram, F., Ram, U., Aleksandrowicz, L., Bassani, D. G., Chandra, S., & Banthia, J. K. (2011). Trends in selective abortions of girls in India: Analysis of nationally representative birth histories from 1990 to 2005 and census data from 1991 to 2011. *Lancet*, *377*, 1921–1928.

Kaa, D. J., van de. (1987). Europe’s second demographic transition. *Population Bulletin*, *42*(1), 1–59.

Kaa, D. J., van de. (2002, January). *The idea of a second demographic transitions in industrialized countries* [Paper presentation]. Sixth Welfare Policy Seminar of the National Institute of Population and Social Security, Tokyo, Japan.

Kapadia, K. M. (1966). *Marriage and family in India*. Oxford University Press.

Kashyap, R. (2019). Is prenatal sex selection associated with lower female child mortality? <https://doi.org/10.1080/00324728.2018.1442583> *Population Studies*, *73*(1), 57–78.

Kirk, D. (1996). Demographic transition theory. *Population Studies*, *50*(3), 361–387.

Krishnamoorthy, S. (1997). *India towards population and development goals, UNFPA for United Nations system in India*. Oxford University Press.

Landry, A. (1987). Adolphe Landry on the demographic transition revolution <https://doi.org/10.2307/1973031>. *Population and Development Review*, *13*(4), 731–740.

Laxmi, P. (1964). Family planning programme in madras state: The role of sterilisation as a method of family planning. *Maharashtra Medical Journal*, *11*(2), 271–272.

Lesthaeghe, R. J. (2011). The "second demographic transition": A conceptual map for the understanding of late modern demographic developments in fertility and family formation <http://nbn-resolving.de/urn:nbn:de:0168-ssoar-342259>. *Historical Social Research*, *36*(2), 179–218.

Lesthaeghe, R. J. (2014). *The second demographic transition: A concise overview of its development*. Royal Flemish Academy of Arts and Sciences.

Lesthaeghe, R. J., & Surkyn, J. (2004). *When history moves on: The foundations and diffusion of a second demographic transition*. Free University of Brussels.

Mukherji, S. B. (1976). *The age distribution of the Indian population: A reconstruction for the states and territories, 1881–1961*. East West Population Institute.

National Commission on Population. (2019). *Population projections for India and states 2011–2036* <https://nhm.gov.in/New_Updates_2018/Report_Population_Projection_2019.pdf>. Ministry of Health and Family Welfare, Technical Group on Population Projections.

Notestein, F. W. (1945). Population: The long view. In T. Schultz (Ed.), *Food for the world* (pp. 36–57). University of Chicago Press.

Operation Research Group. (1972). *Family planning practices in India: First all India survey*. Operation Research Group.

Operation Research Group. (1982). *Family planning practices in India: Second all India survey*. Operation Research Group.

Operation Research Group. (1990). *Family planning practices in India: Third all India survey*. Operation Research Group.

Pachauri, S. (2014). Priority strategies for India's family planning programme <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4345745/>. *Indian Journal of Medical Research*, *140*(Suppl. 1), S137–S146.

Pathak, K. B., & Ram, F. (1981). Recent trends in the fertility of Asian Countries: A comparative analysis. In K. Srinivasan & S. Mukerji (Eds.), *Dynamics of population and family welfare* (pp. 118–151). Himalaya Publishing House.

Pujari, S. B., Joshi, S. K., Bhatt, R. V., & Patel, B. C. (1967, November 26–28). *Complication following use of LIPPEs-loop* [Paper presentation]. 14th All-India Obstetric and Gynaecological Congress, Nagpur, India.

Rajan, S. L. (1994). Heading towards a billion. *Economic and Political Weekly*, *17*(24), 3201–3205.

Ram, F., Namboodiri, K., & Ram, U. (1995). *Fertility transition in India*. International Institute for Population Sciences.

Ram, F., & Ram, U. (1997). Fertility transition in Uttar Pradesh and its neighboring states. In K. Gupta & A. Pandey (Eds.), *Population and development in Uttar Pradesh* (pp. 199–216). BR Publishing Corporation.

Ram, F., Verma, A., Khan, N., & Acharya, R. (2020). *Assessment of death registration in India and selected states, 2000–16* [Unpublished report]. Population Council.

Ram, F., Kumar, A., Saggurti, N., & Jain, A. (in press). *New estimates on demand for contraception in India and its states*. Population Council.

Ram, U. (2010). Levels and patterns of permanent childlessness in India and its states. *Demography India*, *39*(1), 81–101.

Ram, U., Jha, P., Ram, F., & Kumar, R. (2014). Absolute and relative declines in child mortality in India's districts during 2001–12. *Lancet Global Health*, *2*, e21.

Ram, U., Jha, P., Ram, F., Kumar, K., Awasthi, S., Shet, A., Pader, J., Nansukusa, S., & Kumar, R. (2013). Neonatal, 1–59 month, and under-5 mortality in 597 Indian districts, 2001 to 2012 <https://doi.org/10.1016/S2214-109X(13)70073-1>. *Lancet Global Health*, *2*, e21.

Ram, U., & Ram, F. (2018). To be born and to be alive: The struggle of girl children in subregions of India. *Lancet Global Health*, *6*, e594–e595.

Registrar General of India (n.d.-a). *Provisional population totals, size, growth rate and distribution of population, census of India 2011* <https://censusindia.gov.in/2011-prov-results/data_files/india/final_ppt_2011_chapter3.pdf>.

Registrar General of India (n.d.-b). *Provisional Population Totals, Gender Composition of the Population, Census of India 2011* <https://censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter5.pdf>.

Registrar General of India (2020). *Sample registration system statistical report for various years*. Government of India.

Seal, K. C., & Talwar, P. P. (1994). The billion-plus population: Another dimension. *Economic and Political Weekly*, *29*(36), 2344–2347.

Srinivasan, K. (2006). Population policies and family planning in India: A review and recommendations. *Social Change*, *37*(1), 125–136.

Srinivasan, K., & Pathak, K. B. (1981, December). *The nature of stable high fertility and the determinants of its destabilization: Process in selected countries of Asia*. International Population Conference of the IUSSP, Manila.

Stephen, S. L., Dandona, L., Hoisington, J. A., James, S. L., Hogan, M. C., & Gakidou, E. (2010). India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: An impact evaluation <https://doi.org/10.1016/S0140-6736(10)60744-1>. *Lancet*, *375*(9730), 2009–2023.

Thompson, W. S. (1929). Population <https://doi.org/10.1086%2F214874>. *American Journal of Sociology*, *34*(6), 959–975.

United Nations. (1987, September). *Global trends and prospects of the age structure of population: Different paths to aging*. Proceedings of the UN International Symposium on Population, Structure and Development, Tokyo.

United Nations. (2019). *World population prospectsI <https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf>*. United Nations Department of Economic and Social Affairs.

Verma, R. K. (2018). *Convergence to population stability in India: A state-wise assessment of demographic potential and demographic dividend* (Unpublished doctoral dissertation, International Institute for Population Sciences (IIPS)).

Visaria, P., & Visaria, L. (1994). Demographic transition, accelerating fertility decline in 1980 <https://www.jstor.org/stable/4402166>. *Economic and Political Weekly*, *29*(51–52), 3281–3292.

Yadav, A. K., & Ram, F. (2019). There is a glaring gender bias in death registrations in India. *Economic and Political Weekly*, *54*(51), 2349–8846.

Zachariah, K. C. (1983). Anomaly of fertility decline in Kerala (Report No. 1, RPO 677–670). World Bank.

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