ARTICLE

Projecting the educational composition of the population of India: selected state-level perspectives

Anne Goujon[1] and Kirsty McNay[2]

[1]Vienna Institute of Demography, Vienna, Austria; [2]Pauling Centre for Human Sciences, University of Oxford, UK

Abstract: Recent studies in India point to strong progress towards better education for all. However, considerable differences in educational achievement exist at state level. The focus of this paper is to project educational compositions of state-level populations to 2026 for Bihar, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu and Uttar Pradesh. The results represent future scenarios of educational attainment based on a simple 'business as usual' assumption, ie that the progress in school enrolment made during the 1990s continues to 2026. We use the results to comment on the prospective implications of past state-level educational diversity and recent educational progress in the context of future state-level demographic change. The projections' value lies primarily in what they suggest about the adequacy of recent educational progress for the momentum with which education diffuses through a population and for levels of educational achievement in the future.

Keywords: India, Indian States, education, literacy, projection

Introduction

The benefits of education are many and encompass its intrinsic value as well as its role in fostering economic and social change. For India, the latter is illustrated by studies showing that better-educated individuals have higher productivity, lower fertility and lower mortality among their children than uneducated individuals (Planning Commission of India 2002, ch 4). Recent research also recognises that the benefits of education operate beyond the individual level, and that irrespective of one's own education there are positive externalities derived from living in a more educated household or community (McNay et al 2003). At the aggregate level, studies argue that India's recent success as an international player in the information technology sector, and its ability to benefit from growing openness to modern products and methods of production, depend on educational levels (Wood and Calandrino 2000). Drèze and Sen (2002) also emphasise the role of education in fostering participation and empowerment in society. Given these advantages of education, perhaps it is not surprising that evidence suggests a recent surge in educational aspirations across much of India (PROBE Team 1999, p 19). Bhat (2002) calculates that nearly two-thirds of India's fertility decline during the 1990s has been attributable to illiterate women. He argues that women are reducing family size so that they can afford to send their children to school.

Although India's literacy rate is still far from universal, welcome progress during the 1990s has lifted it from 52% of the total population in 1991 to 65% in 2001 (Registrar General of India 2001). As Kingdon et al (2003) point out, this has been the highest absolute increase in any decade since records began in 1881.[1] India's two National Family Health Surveys (NFHS) undertaken in 1992–1993 and 1998–1999 also reveal that headway is being made in younger persons' literacy, reflecting more contemporary advances in education. In the inter-survey period, the literacy rate among 6–19-year-olds increased by 10 percentage points, ie from 67% to 77% (IIPS and Macro International 1995, 2000). NFHS data also show that school attendance rates among 6–14-year-olds have improved from 68% at the time of the first survey to 79% by the second. Encouragingly, both census and NFHS data indicate that during the 1990s gains have been particularly evident for females, closing India's gender gap in education.

However, these all-India data mask considerable differences in educational achievement at the state level. Regional variation in education is just one aspect of India's well known geographical diversity, evident across numerous

Correspondence: Anne Goujon, Vienna Institute of Demography, Prinz Eugen Strasse 8, 1040 Vienna, Austria; tel +43 1 515 81 7719; fax +43 1 515 81 7730; email anne.goujon@oeaw.ac.at

Table 1 Literacy rates among those aged 7 and older by state and sex, 1991 and 2001

	Male			*Female*			*Persons*		
	1991	*2001*	*Increase (%)*	*1991*	*2001*	*Increase (%)*	*1991*	*2001*	*Increase (%)*
Andhra Pradesh	55.1	70.9	15.8	32.7	51.2	18.5	44.1	61.1	17.0
Assam	61.9	71.9	10.0	43.0	56.0	13.0	52.9	64.3	11.4
Bihar	51.4	62.2	10.8	22.0	35.0	13.0	37.5	49.2	11.7
Gujarat	73.1	80.5	7.4	48.6	58.6	10.0	61.3	70.0	8.7
Haryana	69.1	79.3	10.2	40.5	56.3	15.8	55.9	68.6	12.7
Himachal Pradesh	75.4	86.0	10.6	52.1	68.1	16.0	63.9	77.1	13.2
Karnataka	67.3	76.3	9.0	44.3	57.5	13.2	56.0	67.0	11.0
Kerala	93.6	94.2	0.6	86.2	87.9	1.7	89.8	90.9	1.1
Madhya Pradesh	58.5	77.1	18.6	29.4	50.8	21.4	44.7	64.4	19.7
Maharashtra	76.6	86.3	9.7	52.3	67.5	15.2	64.9	77.3	12.4
Orissa	63.1	76.0	12.9	34.7	51.0	16.3	49.1	63.6	14.5
Punjab	65.7	75.6	9.9	50.4	63.6	13.2	58.5	70.0	11.5
Rajasthan	55.0	76.5	21.5	20.4	44.3	23.9	38.6	61.0	22.4
Tamil Nadu	73.8	82.3	8.5	51.3	64.6	13.3	62.7	73.5	10.8
Uttar Pradesh	54.8	70.9	16.1	24.4	43.9	19.5	40.7	58.1	17.4
West Bengal	67.8	77.6	9.8	46.6	60.2	13.6	57.7	69.0	11.3
India	64.1	75.9	11.8	39.3	54.2	14.9	52.2	65.4	13.2

Source: Census of India 2001 (www.censusindia.net/results/provindia1.html).
NOTE: The old boundaries of Bihar, Madhya Pradesh and Uttar Pradesh are used for 2001; ie including Jharkhand, Chhattisgarh and Uttaranchal, respectively.

social, economic and demographic indicators. Tables 1 and 2 use census and NFHS data to summarise the recent state-level experience for two educational variables: literacy rates for the population aged 7 plus and school attendance rates. It is clear that the four large northern states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh are the laggards in terms of educational performance. Other authors agree that the achievement of these lagging states is poor across a range of educational indicators (Tilak 1999). However, the tables also show that a recent process of catch-up has occurred among the lagging states through impressive growth in all three educational variables during the 1990s. For example, the difference between Bihar and Tamil Nadu in school attendance rates among girls aged 6–10 closed by 8 percentage points between the two NFHS surveys (Table 2). Tables 1 and 2 also illustrate Kerala's well documented educational superiority, although they also show that other southern states, particularly Tamil Nadu, are no longer far behind. Himachal Pradesh has also made great educational strides in recent years.

The reasons behind India's regional variation in education are considered in detail in Kingdon et al (2003), in which three state-level educational 'models' are described. This discussion is not repeated here. Instead, the focus of this paper is to project educational compositions of state-level populations to 2026. The results represent future scenarios of educational attainment based on a simple 'business as usual' assumption, ie that the progress in school enrolment made during the 1990s continues to 2026. We use the results to comment on the prospective implications of past state-level educational diversity and recent educational progress in the context of future state-level demographic change. The projections' value lies primarily in what they suggest about both the adequacy of recent educational progress and the legacy of longer-term educational policy for the momentum with which education diffuses through a population, and for levels of educational achievement in the future. The state-level analysis also reveals the variation in current and future educational scenarios across the selected states.

Projection method

We apply the demographic methodology of multi-state population projection described in Lutz and Goujon (2001). The multi-state model divides the population by age and sex into 'states', which in our case are four levels of educational attainment. Educational transition rates are then the three corresponding age- and sex-specific movements of the population from lower educational attainment levels to higher levels. We combine the multi-state method with population projection data, including information on age- and sex-specific population, fertility and mortality rates, and total sex-specific net migration rates. These data were recently estimated for the Indian states to 2026 by

Table 2 School attendance rates by state and sex, 1992–1993 and 1998–1999

	Age 6–10			*Age 11–14*		
	1992–1993	*1998–1999*	*Increase (%)*	*1992–1993*	*1998–1999*	*Increase (%)*
Males						
Andhra Pradesh	73.4	88.2	14.8	69.2	71.0	1.8
Assam	75.7	81.8	6.1	71.2	76.3	5.1
Bihar	60.6	69.3	8.7	68.8	72.4	3.6
Gujarat	82.6	86.8	4.2	82.2	79.4	–2.8
Haryana	87.5	92.5	5.0	86.7	89.1	2.4
Himachal Pradesh	94.4	98.9	4.5	93.2	98.2	5.0
Karnataka	79.9	87.7	7.8	71.2	75.2	4.0
Kerala	95.2	97.0	1.8	94.3	96.9	2.6
Madhya Pradesh	66.0	83.1	17.1	73.6	78.5	4.9
Maharashtra	87.5	92.7	5.2	84.4	87.0	2.6
Orissa	77.9	85.4	7.5	75.2	79.7	4.5
Punjab	85.7	94.1	8.4	80.3	89.1	8.8
Rajasthan	72.4	87.7	15.3	77.2	84.3	7.1
Tamil Nadu	92.0	95.8	3.8	78.0	84.8	6.8
Uttar Pradesh	71.1	83.7	12.6	75.4	80.6	5.2
West Bengal	72.5	83.7	11.2	72.5	75.4	2.9
India	75.0	85.2	10.2	76.3	80.2	3.9
Females						
Andhra Pradesh	59.9	82.6	22.7	46.2	54.6	8.4
Assam	67.3	77.9	10.6	63.9	70.8	6.9
Bihar	38.5	55.0	16.5	37.9	52.6	14.7
Gujarat	70.5	80.4	9.9	65.3	63.1	–2.2
Haryana	76.7	89.9	13.2	71.1	80.0	8.9
Himachal Pradesh	89.1	98.9	9.8	85.7	95.5	9.8
Karnataka	71.1	85.2	14.1	54.5	68.0	13.5
Kerala	95.5	98.0	2.5	94.1	96.8	2.7
Madhya Pradesh	55.2	77.1	21.9	54.1	61.1	7.0
Maharashtra	82.2	90.3	8.1	68.3	82.5	14.2
Orissa	65.5	81.2	15.7	56.7	66.1	9.4
Punjab	81.6	94.1	12.5	72.9	84.9	12.0
Rajasthan	42.4	69.6	27.2	37.7	52.7	15.0
Tamil Nadu	87.4	95.6	8.2	84.8	79.6	–5.2
Uttar Pradesh	50.2	73.7	23.5	45.2	62.4	17.2
West Bengal	66.6	82.1	15.5	57.6	68.7	11.1
India	61.3	78.3	17.0	55.3	67.0	11.7
Persons						
Andhra Pradesh	66.6	85.5	18.9	58.0	62.8	4.8
Assam	71.7	79.9	8.2	67.6	73.6	6.0
Bihar	49.9	62.4	12.5	53.8	62.7	8.9
Gujarat	76.7	83.7	7.0	74.3	71.6	–2.7
Haryana	82.4	91.4	9.0	79.8	84.7	4.9
Himachal Pradesh	91.7	98.9	7.2	89.6	96.7	7.1
Karnataka	75.6	86.4	10.8	62.9	71.6	8.7
Kerala	95.3	97.5	2.2	94.2	96.9	2.7
Madhya Pradesh	60.9	80.2	19.3	64.4	69.9	5.5
Maharashtra	84.9	91.6	6.7	76.7	84.9	8.2
Orissa	71.8	83.3	11.5	66.2	73.3	7.1
Punjab	83.8	94.1	10.3	76.8	87.2	10.4
Rajasthan	58.5	79.1	20.6	59.3	69.7	10.4
Tamil Nadu	89.7	95.7	6.0	72.7	82.3	9.6
Uttar Pradesh	61.2	79.0	17.8	61.4	72.3	10.9
West Bengal	69.5	82.9	13.4	65.4	72.2	6.8
India	68.4	81.9	13.5	66.2	73.9	7.7

Table 3 Summary of base line indices and population projection assumptions, selected states, 2001–2006 and 2021–2026

	Total fertility rate		*Life expectancy at birth*				*Net migration rate*
			Male		*Female*		
	2001–2006	*2021–2026*	*2001–2006*	*2021–2026*	*2001–2006*	*2021–2026*	*2001–2026*
Bihar	3.81	2.11	64.3	69.2	63.3	70.4	–1.10
Kerala	1.80	1.80	71.3	71.8	76.8	78.8	–0.64
Madhya Pradesh	3.53	1.88	58.0	64.1	58.5	65.7	0.64
Maharashtra	2.21	1.80[a]	65.3	66.9	68.6	72.0	1.24
Rajasthan	3.58	1.80	62.3	67.8	64.1	71.2	–0.38
Tamil Nadu	1.80	1.80	65.1	68.0	68.3	72.8	–0.45
Uttar Pradesh	4.25	2.32	61.8	68.0	61.4	68.8	–1.32

Source: Dyson (2003).
[a] TFR (total fertility rate) = 1.8 is already reached in 2011–2016.

Dyson (2003). Dyson's projection data refer to the five periods 2001–2006, 2006–2011, 2011–2016, 2016–2021 and 2021–2026. So, unlike Lutz and Goujon (2001), we do not primarily use the multi-state method to produce a new set of population projections that take account of the effects of the changing educational composition of the population on fertility and life expectancy.[2] Rather, we assume that all educational groups have the same fertility, mortality and migration behaviour, and we focus on projecting possible future scenarios of educational attainment given Dyson's population projections.[3] A summary of Dyson's population projection assumptions is provided in Table 3.

Data and education projection assumptions

The projections of the educational composition of the population require data on population by age, sex and education for each Indian state for our starting year, 2001. We use 2001 census data on population by age and sex, but unfortunately at the time of undertaking this research, 2001 census data on state-level educational attainment have not been released.[4] Instead, we use equivalent data for age groups between 5 and 49 years from the second National Family Health Survey (NFHS-2) conducted during 1998–1999.[5] For age groups 50 and beyond, for which there are no NFHS-2 data, we incorporate educational attainment data from the 1991 census. In using these data, we take account of population ageing between 1991 and 2001, and we assume that the proportions of each 2001 age group with a given level of educational attainment are the same as those in the 1991 census.[6] Each state's age- and sex-specific 2001 population is subdivided into four levels of educational attainment according to census categories: 'illiterate', 'primary and below', 'junior' and 'secondary and above'.[7] We assume that all children in the 0–4 age group are illiterate.

We then estimate the three age- and sex-specific educational transition rates. These are the age-specific probabilities for young males and females to move from the category of illiterate to the category of primary and below, from primary and below to junior, and from junior to secondary and above. For each transition, we again use NFHS data and assume that the rate of increase in school attendance rates (ISARs) observed between NFHS-1 (1992–

Table 4 Summary of education projection assumptions, selected states, 2001–2026

	Percentage increase in 5-year period in:					
	Transition from illiterate to primary and below		*Transition from primary and below to junior*		*Transition from junior to secondary and higher*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Bihar	11.8	34.6	4.3	31.4	21.5	71.1
Kerala	1.6	2.2	2.3	2.4	19.7	29.4
Madhya Pradesh	21.2	32.1	5.5	10.7	17.3	43.6
Maharashtra	4.9	8.2	2.6	17.1	15.3	43.9
Rajasthan	17.3	51.1	7.6	32.2	26.3	78.9
Tamil Nadu	3.4	7.8	7.2	15	28.3	51.7
Uttar Pradesh	14.6	37.7	5.7	30.8	27.5	61.7

Source: Authors' calculations.
NOTE: See section 'Data and education projection assumptions' and notes 9, 10 and 11 for details.

1993) and NFHS-2 (1998–1999) for age groups 6–10, 11–14 and 15–17 continues linearly through the projection period. This assumption provides us with the 'business as usual' scenario, yielding 'medium variant' type educational projections.[8] A summary of the education projection assumptions is provided in Table 4. We apply the ISARs for males and females aged 6–10 to the transition from illiterate to primary and below, for males and females aged 11–14 to the transition from primary and below to junior, and for males and females aged 15–17 to the transition from junior to secondary and above. We noted above that during the 1990s notable progress was made in school attendance rates, so that use of these data may impart some optimism into our projections. We assume that the rates of increase in school attendance experienced during the 1990s continue to 2026 for transitions from illiterate to primary and below, and from primary and below to junior.[9] However, this assumption seems inappropriate for the transition from junior to secondary and above, because it means that the proportions of the population moving into the highest educational level appear unrealistically large by 2026. Our solution is to apply the ISARs for this transition for less than the entire projection period and then hold these transition rates constant, ie assume that no further improvements are made over time in the proportions of a cohort that acquires the highest educational level.[10] For most states during the 1990s, the ISARs for females have been higher than for males, as shown in Table 2. If continued to 2026, the differences lead to large gaps in levels of educational attainment in favour of females. As this result seems unlikely, we apply the ISARs for males and females separately until the proportions of males and females moving to the next educational level equalise. We then apply the ISARs of males for both sexes.[11]

Results

We present our results as multi-state age pyramids for 2001 and 2026 with females in five-year age groups on the right and males on the left, and variation in shading representing different levels of educational attainment (Figure 1). We choose a selection of Indian states to portray both the regional variation in recent educational attainment shown in Table 1 and in current and future demographic conditions. Our selected states are Bihar, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu and Uttar Pradesh. Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh are

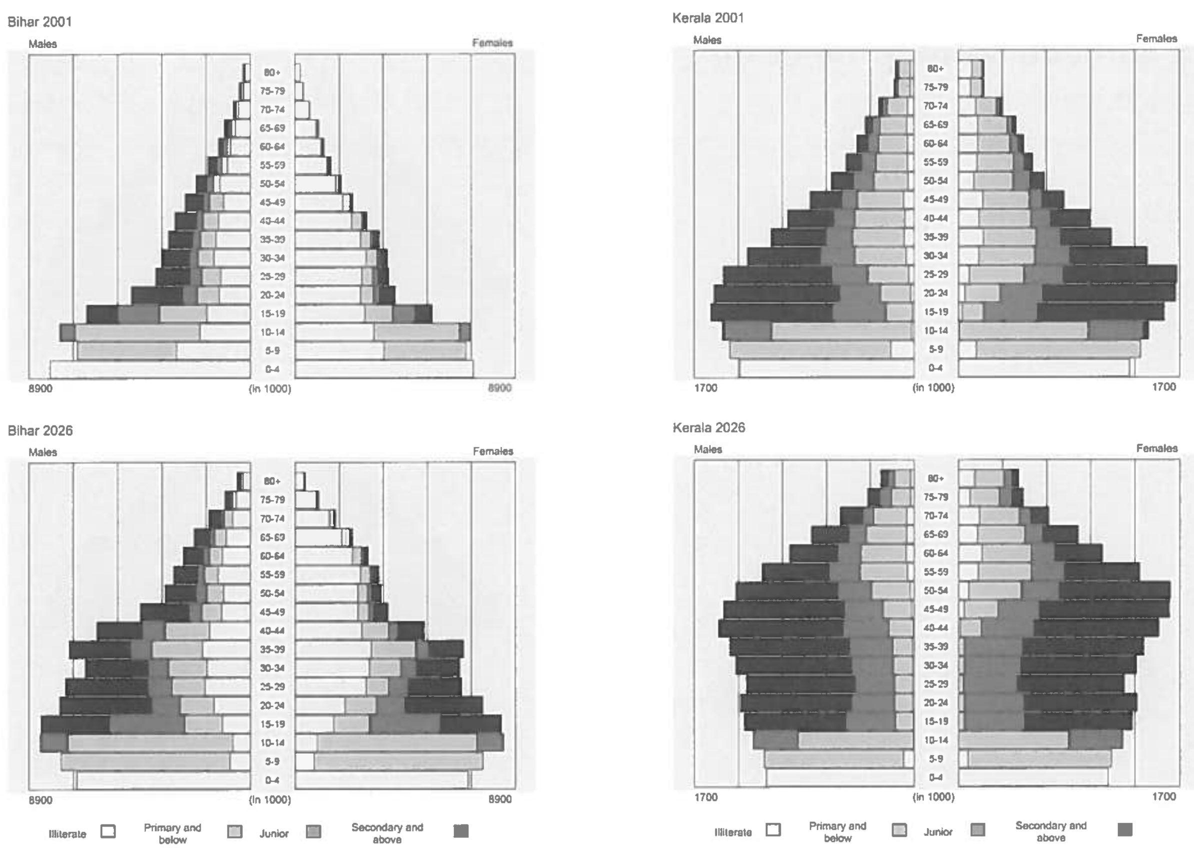

Figure 1 Multi-state age pyramids for selected Indian states, 2001 and 2026 (*continued overleaf*)

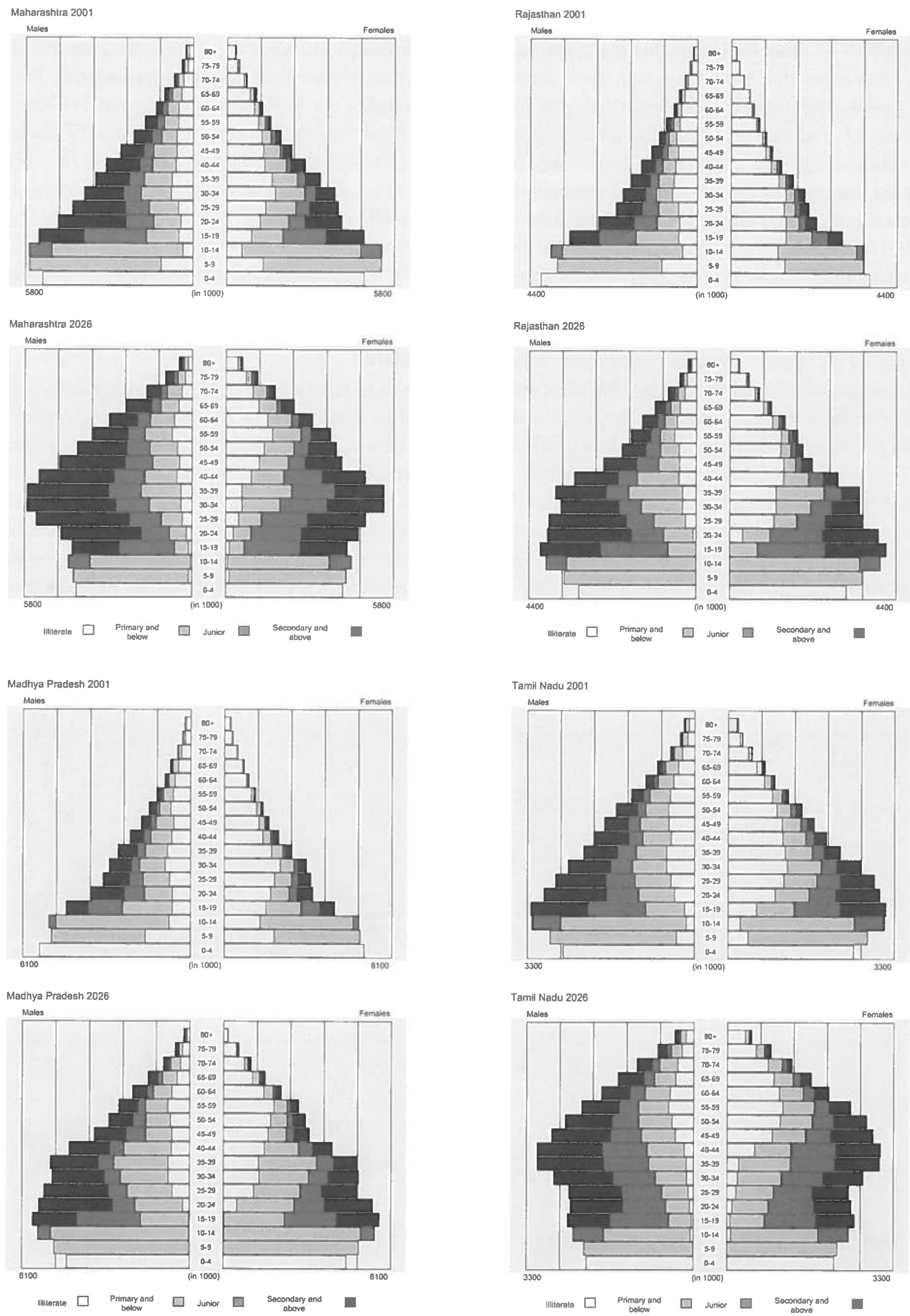

Figure 1 *continued*

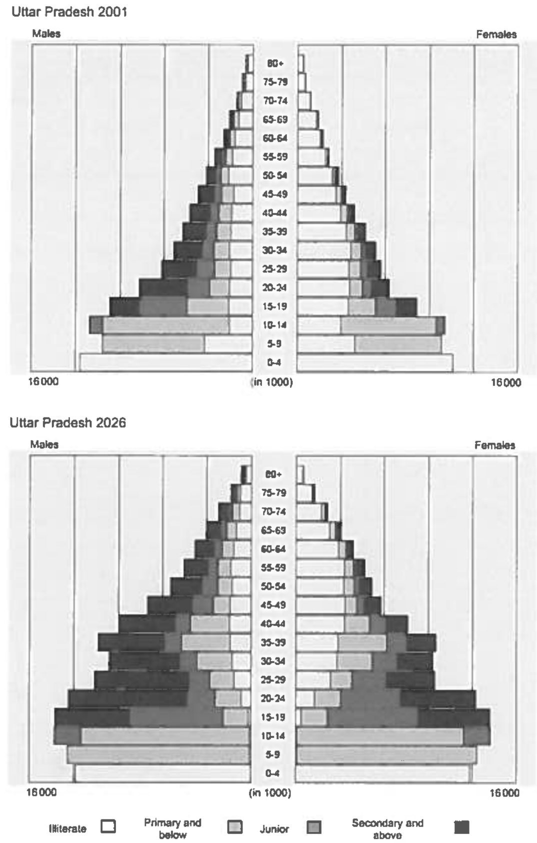

Figure 1 *continued*

the four large northern educational laggards. Demographically, these states have higher fertility and mortality rates than India as a whole and most of the southern and eastern states, and much of their demographic transition is still to occur during the projection period to 2026. In contrast, Kerala is the most educationally and demographically advanced state, with fertility already below replacement level in 2001. Tamil Nadu and Maharashtra are intermediate states, although in terms of the demographic transition, Tamil Nadu is now not far behind Kerala.[12]

Before we consider the projected changes in the educational composition of the states' populations, an examination of the projected changes in their age distributions is informative. The pyramids show that Uttar Pradesh is the only state where the 2026 preschool population aged 0–4 is larger than the equivalent 2001 population. In addition, the school-age population in the age groups 5–9, 10–14 and 15–19 is also expected to increase between 2001 and 2026. Growth in the school-age population aged 5–19 between 2001 and 2026 is also projected for Bihar and Madhya Pradesh, and growth in the school-age population aged 10–19 is projected for Rajasthan. In contrast, our projections show Kerala, Maharashtra and Tamil Nadu all experiencing contractions in the size of their populations aged 0–19. These contrasts reflect differences in the timing of the onset and the pace of state-level fertility transitions with the slower demographic performers set to confront growth in their young populations between 2001 and 2026. Such growth will be accompanied by the challenge of getting these increasing numbers of children into school, a challenge that therefore also still lies ahead. For the demographically more advanced states, the task of schooling every child is made easier because the size of the school-age population will shrink. Kerala and Tamil Nadu will also see contractions in their younger working-age populations, while all the other states will experience growth in every five-year age group comprising the working-age population aged 20–64. Kerala and Tamil Nadu will see the most evident increase in the size of the elderly population aged 65 and above.

Focusing on future changes in the educational composition of the states' populations, our pyramids show that we expect educational progress in all states. Below, we describe the educational trends underlying the pyramids by outlining our findings at the level of the states' total populations, summarised in Table 5. We then comment in more detail on the age-specific patterns revealed by the pyramids. For the populations as a whole, our projections show considerable progress in the educationally lagging states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh. We project that person illiteracy in these states will fall from around 50% or more in 2001 to between 26% in Madhya Pradesh and 38% in Bihar by 2026. However, in absolute terms, the size of the illiterate populations will not start to fall until between 2016 and 2021 in Bihar and between 2006 and 2011 in Madhya Pradesh, Rajasthan and Uttar Pradesh. The lag between the onset of declines in illiteracy rates and the declines in the absolute sizes of the illiterate populations reflects faster population growth than educational improvement during the periods of lag. In the more advanced states, illiteracy rates also decline between 2001 and 2026, reaching levels ranging from 10% in Kerala and 22% in Tamil Nadu. In 2026, the gender gap in illiteracy that currently disadvantages females persists in all states, although it is greatly reduced everywhere.

Corresponding to the declines in illiteracy, our projections show increases in the population proportions having some level of education. At the beginning of the projection period, the proportions with a maximum of primary education increase, reflecting educational transitions from illiteracy to primary education. However,

Table 5 Educational composition of the population by state and sex, 2001 and 2026

	2001				*2026*			
	Illiterate (%)	*Primary and below (%)*	*Junior (%)*	*Secondary and above (%)*	*Illiterate (%)*	*Primary and below (%)*	*Junior (%)*	*Secondary and above (%)*
Male								
Bihar	46.5	27.5	9.4	16.5	30.0	31.0	12.7	26.7
Kerala	14.5	37.6	16.9	31.0	8.7	26.3	19.9	45.1
Madhya Pradesh	38.9	37.7	9.8	14.4	19.2	41.3	13.5	26.0
Maharashtra	26.4	35.1	15.3	23.3	15.1	28.3	18.6	38.0
Rajasthan	38.5	34.5	11.5	15.5	17.9	35.2	17.0	30.0
Tamil Nadu	26.6	35.9	15.2	22.3	15.6	30.3	23.3	30.8
Uttar Pradesh	39.0	30.9	12.2	17.9	20.0	32.3	14.9	32.7
Female								
Bihar	70.5	20.1	4.3	5.0	46.0	28.0	9.7	16.4
Kerala	19.4	36.9	15.5	28.2	10.9	24.2	22.2	42.7
Madhya Pradesh	61.2	27.4	4.8	6.5	32.7	40.0	11.9	15.4
Maharashtra	44.5	32.8	9.8	12.9	25.4	30.0	20.4	24.2
Rajasthan	67.3	22.9	4.6	5.2	37.8	29.9	16.6	15.7
Tamil Nadu	45.1	30.6	11.6	12.7	27.4	32.0	20.7	19.9
Uttar Pradesh	63.5	24.1	5.2	7.2	34.5	31.5	16.1	17.9
Persons								
Bihar	58.1	24.0	7.0	11.0	37.7	29.5	11.2	21.6
Kerala	17.0	37.3	16.2	29.6	9.8	25.2	21.1	43.9
Madhya Pradesh	49.3	32.7	7.4	10.6	25.9	40.6	12.7	20.8
Maharashtra	35.1	34.0	12.6	18.3	20.2	29.1	19.5	31.2
Rajasthan	52.3	29.0	8.2	10.5	27.7	32.6	16.8	22.9
Tamil Nadu	35.8	33.2	13.4	17.5	21.6	31.1	21.9	25.3
Uttar Pradesh	50.6	27.7	8.9	12.8	27.1	31.9	15.5	25.5

Source: Authors' calculations.

NOTE: The illiteracy rates in this table do not correspond to those in Table 1 because they are calculated for the total population, including 0–6-year-olds, and because they are estimates based on the methods described in the text. The boundaries for Bihar, Madhya Pradesh and Uttar Pradesh for both 2001 and 2026 are the old ones (see note to Table 1).

towards the end of the projection period, population shares with only primary and below education start to fall, reflecting transitions to higher up the educational scale. By 2026, the projections reflect a variation of between around 30%–40% of the states' populations with only primary education or below. They also illustrate that the gender gap disadvantaging females at this stage of education almost disappears by 2026.

Among all the states, the proportion of the population with the two highest educational levels – junior, and secondary and above – increases notably from 2001 onwards. At both dates Kerala stands out as having significantly higher proportions of its population with junior and above education – 46% in 2001 and 65% in 2026. Compare these proportions with those for Bihar and Madhya Pradesh – 18% in 2001 and 33% in 2026 – still an increase of 15 percentage points during the projection period. Although the populations with these levels of education are predominantly male in all states, there is a clear positive relationship between the female proportions and overall advancement to these levels. This is consistent with Wils and Goujon's (1997) proposition that educational improvement tends to reach male populations first and then spreads to female populations.

We now turn to the age-specific patterns of educational composition illustrated by our pyramids. Starting with the school-age cohorts, the pyramids clearly show the effects of continuing to 2026 the progress that characterised the 1990s in the form of smaller proportions of 5–19-year-olds without formal education by the end of the projection period. By 2026, illiteracy among 5–19-year-olds remains most conspicuous in Bihar, although even in this state there is considerable improvement. For example, among 10–14-year-olds, our calculations estimate that the illiteracy rate falls from 26% in 2001 to 8% in 2026 for boys and from 45% to 11% for girls. Among the other educationally lagging states, the pyramids reveal that if the progress of the 1990s continues until 2026, illiteracy will be almost completely confined to age groups above 5–19 years. Indeed, assuming that the rates of improvement in school attendance made during the 1990s continue to 2026, means that among 5–9-year-olds these latter three states overtake Kerala by that time as they have lower illiteracy rates in this age group.[13] In all states, the absolute size of the illiterate populations aged 5–19 years falls by the end of the projection period.

However, despite the progress at these ages, the pyramids clearly show that in most states a sizeable proportion of 15–19-years-olds remain without completed elementary education in 2026. For example, in Madhya Pradesh, 31% of boys and 39% of girls in this age group will be without it. Even in Tamil Nadu, an educationally advanced state, our assumptions mean that 19% of boys and 29% of girls will be in this situation. These are sobering calculations. They indicate the likely scenario of school-age educational attainments in 2026 if the trends in the 1990s continue and efforts to improve schooling are not stepped up further. On a more positive note, the pyramids show considerable narrowing of gender differences in school-age educational attainment by 2026.

The pyramids also show the continuation of considerable amounts of illiteracy and low-level education among most states' working-age populations by 2026. This is especially true of the female and older working-age groups, and indicates the slowness with which recent educational investments will benefit adult populations. For example, our calculations show that in Rajasthan in 2026, 64% of the female population aged 20–64 will be without completed elementary education; indeed, we estimate that 43% of this age group will still be illiterate. But, more positively, these figures compare to equivalent ones for 2001 of 87% and 76%, respectively. Our projections indicate that 41% of the male working-age population in Rajasthan in 2026 will be without completed elementary education, and 14% will be illiterate. Conversely, in Kerala, by 2026, the majority of all male and female five-year age groups making up the 20–64 years population will have junior or above levels of education. In Tamil Nadu and Maharashtra, this will be the case for the younger working-age groups, as it was for Kerala in 2001. But despite the presence of significant proportions of illiterate and poorly educated persons among the working-age populations in many states in 2026, the pyramids show that in absolute terms, between 2001 and 2026 the populations with at least junior education grow faster than the less educated populations. The absolute size of the working-age populations who are illiterate or have only primary level education grows in Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh. However, they shrink in Kerala, Tamil Nadu and Maharashtra, demonstrating the long-term benefits of both fertility decline and investment in education.

Finally, as in 2001, many states' populations aged 65 and older will still be predominantly illiterate or poorly educated in 2026, reflecting the fact that this group missed out on educational investment in its youth. The poor educational status of the elderly is most notable among females. Even in Kerala, the majority of women in this age group are either illiterate or have a maximum of only primary education.

Conclusions

Our projections and pyramids convey a mixed message. Although they depict considerable educational progress between 2001 and 2026 in all selected states, they also reveal that the legacy of many states' past neglect of education and gender equity is still clearly visible in the form of illiteracy and low-level education in 2026. Our assumption that the progress made during the 1990s holds until 2026 is not sufficient to remove this legacy. The results indicate the inertia with which investments in education permeate through the population. Even in 2026, in the vast majority of age groups, states have not reached the educational levels evident in 2001 Kerala, with its superior history of investment in human capital. The projections suggest that our 1990s 'business as usual' scenario is inadequate to achieve the United Nations Millennium Development Goal relating to education; that is, to ensure that by 2015 all children complete primary stage education (UN 2002a). In 2026, we still see evident illiteracy among young adults aged 20–29, who in 2015 would have been in age groups in which primary schooling should have been completed. Efforts to step up the rate of educational progress beyond what was achieved during the 1990s are required. We now plan to undertake further research to investigate the extent to which progress will have to be stepped up to achieve the Millennium Development Goal in the Indian states, and the feasibility of doing so.

The results also have age-specific implications. They demonstrate that there is much scope for school-age cohorts to enjoy immediate benefits from near-term schooling improvements, in the form of higher educational levels. The pyramids also indicate the scope for improvement in educational standards offered by educational campaigns for young adults who have already completed their school-age years. As well as enhancing current educational levels, adult education campaigns are increasingly important for the future because, as the pyramids show, as these cohorts age they will form a significantly larger proportion of the 2026 working-age group than do the equivalent cohorts in 2001. Therefore, unless these adults are educated today, an increasing proportion of future working-age populations will remain uneducated for some time to come.[14]

Also, the implications of the projection results go beyond India's borders. We project that in 2026, more than half of the working-age population will have at least a junior secondary education across the seven states selected for the analysis (which represent together more than half of the Indian population in 2001). This scenario will be happening in a world of rapid ageing of the OECD populations, especially in Western Europe and the Pacific-Asian region. For example, more than one third of the Japanese population will be aged 60 years and older in 2020 (UN 2002b). The implications are of course important in terms of potential migration to those economically wealthy and ageing regions where the young, educated and abundant labour force of India may be in demand.

Acknowledgements

Anne Goujon's work was undertaken at the International Institute for Applied Systems Analysis and at the Vienna Institute of Demography. Kirsty McNay's work was undertaken while she was a senior research fellow at the London School of Economics on a project entitled 'The Future of India. Population, Environment, and Human Development', funded by the Wellcome Trust, Grant nr GA053660. We are grateful for the insightful comments and suggestions made by Robert Cassen, Tim Dyson, Geeta Kingdon and Wolfgang Lutz during the preparation of this paper. The comments from anonymous referees and Natalie Jackson, the editor, further strengthened the paper.

Notes

1 As Kingdon et al (2003) note, literacy data across different sources, including the Indian Census 2001, the National Family Health Survey II, 1998–1999 and the National Sample Survey, 1997, is consistent, suggesting that the progress during the 1990s has been real.

2 Nevertheless, we did conduct projections incorporating the fertility differentials by education given by the second NFHS. These differentials add some dynamic to the demographic system because the relative weights of the four education categories vary with increases in levels of education, and this variation influences the total fertility rate. As the weight of more educated groups increases in the population, so does the proportion of the population adopting the lower fertility rates of these groups. Population numbers therefore fall quite significantly via this mechanism. In all other respects, including the educational composition of the population, the projections incorporating the fertility differentials by education are identical to the ones presented in this article. They are not presented here, but are available from the authors upon request.

3 The projections are implemented using the PDE Population Projections Software, which can be downloaded free of charge from the website of the International Institute for Applied Systems Analysis (IIASA): http://www.iiasa.ac.at/Research/POP/models/index.html. The software requires absolute age-specific net migration data. Dyson's migration rate estimates are not age-specific. We therefore use model migration schedules by Rogers and Castro (1981) to determine the age patterns of migrants from total net migration figures calculated from Dyson's data.

4 The age distributions of the 2001 census population data are not smoothed. We therefore make appropriate small adjustments to the distributions to smooth them.

5 Adjustments had to be made for the age groups between 20 and 49 because NFHS-2 data are only available for 10-year rather than our required 5-year age groups.

6 For instance, the proportions by educational attainment of the age group 50–54 in the 1991 census are applied to the age group 60–64 in the 2001 census.

7 Primary education in India typically refers to the first five years of schooling (corresponding to ages 6–10); junior education refers to the next three years of schooling (corresponding to ages 11–14); elementary education refers to primary and junior schooling combined (ages 6–14); and secondary education refers to the last four years of schooling before university entrance (corresponding to ages 15–18).

8 Comparing the projections based on this assumption with others using alternative assumptions will provide an interesting comparative perspective and is a topic of further work.

9 We calculate the average annual growth rates in attendance between the two NFHS surveys undertaken in 1992–1993 and 1998–1999, adapt these rates to apply to five-year periods (because Dyson's projection data refer to five-year periods) and assume that attendance continues to grow at these rates during 2001–2006, 2006–2011, 2011–2016, 2016–2021 and 2021–2026.

10 The ISARs are applied until 2011–2016 for Madhya Pradesh, Maharashtra, Rajasthan and West Bengal, and then held constant. For Bihar, Kerala, Uttar Pradesh and Tamil Nadu the transition rates are held constant at 2001–2006 levels.

11 In 2001, Kerala was the only state where females already had higher attendance rates than males. We maintain this difference throughout the projection period.

12 Given its promising educational performance during the 1990s, it would have been useful to include Himachal Pradesh in our selection. However, we were unable to do so because population projection input data are unavailable for this state. Although other states outside our selection are also of potential interest, our choice of states encompasses the broad range of educational and demographic experience across India.

13 The result reflects the continuation to 2026 of the faster rates of progress in primary stage enrolment made during the 1990s among the educationally lagging states compared to Kerala, already at almost universal enrolment during the 1990s and with much less scope for further improvement. But it is important to emphasise that even with this assumption, Bihar does not catch up with Kerala.

14 We thank Michael Lipton for sharing this point with us.

References

Bhat PNM. 2002. Returning a favor; reciprocity between female education and fertility in India. *World Dev*, 30:1791–803.

Drèze J, Sen A. 2002. India: development and participation. Oxford and Delhi: Oxford Univ Pr.

Dyson T. 2003. India's population – the future. In Dyson T, Cassen RH, Visaria L, eds. Twenty-first century India: population, environment, and human development. Delhi and London: Oxford Univ Pr. Forthcoming.

IIPS and Macro International. 1995. National Family Health Survey (NFHS-1), 1992–93: India and state reports. Bombay: International Institute for Population Sciences.

IIPS and Macro International. 2000. National Family Health Survey (NFHS-2), 1998–99: India and state reports. Mumbai: International Institute for Population Sciences.

Kingdon G, Cassen RH, McNay K et al. 2003. Education and literacy. In Dyson T, Cassen RH, Visaria L, eds. Twenty-first century India: population, environment, and human development. Delhi and London: Oxford Univ Pr. Forthcoming.

Lutz W, Goujon A. 2001. The world's changing human capital stock: Multi-state population projections by educational attainment. *Popul Dev Rev*, 27:323–39.

McNay K, Arokiasamy P, Cassen RH. 2003. Why are uneducated women in India using contraception? A multilevel analysis. *Popul Stud*, 57:21–40.

Planning Commission of India. 2002. India: national human development report 2001. New Delhi: Government of India.

PROBE Team. 1999. Public report on basic education in India. New Delhi: Oxford Univ Pr.

Registrar General of India. 2001. Provisional population totals. Census of India 2001, paper 1 of 2001 [online]. Accessed 4 Aug 2003. URL: http://www.censusindia.net/results/provindia3.html

Rogers A, Castro LJ. 1981. Model migration schedules. IIASA research report nr RR-81-030. Laxenburg: International Institute for Applied Systems Analysis.

Tilak JBG. 1999. Investment in human capital in India: an inter-state analysis of stock and flow of human capital. *J Indian Sch Polit Econ*, X1:39–73.

[UN] United Nations. 2002a. UN Millennium Development Goals (MDG) [online]. Accessed 4 Aug 2003. URL: http://www.un.org/millenniumgoals/index.shtml

[UN] United Nations. 2002b. World population prospects: the 2002 revision. Population database [online]. Accessed 4 Aug 2003. URL: http://www.un.org/esa/population/unpop.htm

Wils A, Goujon A. 1997. Diffusion of education in six world regions, 1960–90. *Popul Dev Rev*, 24:357–68.

Wood A, Calandrino ME. 2000. When other giant awakens: trade and human resources in India. *Econ Polit Wkly*, 35:4677–94.