Levels, Trends and Determinants of Fertility in China: 1973-1987

There is room for further fertility decline, but a more realistic goal might be to strive for replacement level fertility

By Li Bohua*

With the development of its family planning programme, China has achieved great success since the 1970s in slowing the growth of its population. This is evident in the rapid decline in fertility: the total fertility rate (TFR) declined from the 1960s average of 5.68 to 4.0 in the 1970s and to only 2.46 for the first eight years of the 1980s.

However, while the overall development picture is characterized by such advances, there are very large regional differences in China's socio-economic

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development. Because the implementation of the family planning programme is not uniform, changes in the fertility rates of different regions of the country are complex.

This article attempts to give a comprehensive description of changes in the fertility rates of China's 28 provinces, autonomous regions and municipalities (not including Hainan, Xizhang [Tibet] and Taiwan provinces) during the 15-year period from 1973 to 1987 using data from the 1982 One-per-Thousand Fertility Sampling Survey and the 1988 Two-per-Thousand Fertility and Birth Control Sampling Survey. Also, it summarizes some characteristics of fertility changes in these areas, all of which are referred to as "regions" in this article for the sake of convenience.

Changes in fertility are influenced by many factors; in China's case, the current family planning policy has played a decisive role. Nevertheless, no policy exists in isolation since it is conditioned by various aspects of development. This is seen in the changes in fertility in different regions of the country. When the family planning work in these regions is evaluated, it is necessary to consider the fertility rate in light of major factors related to family planning policy, and social, economic and cultural development. Thus, this article establishes a multivariate regression formula for fertility levels and per capita national income, rates of female illiteracy and the proportion of national minorities in the population. This regression equation is useful for comparing actual and expected fertility rates and for evaluating the implementation of the family planning programme in different regions of the country.

Based on changes in the fertility rate in different regions of China from 1973 to 1987, it may be possible for the country to achieve a further decline in fertility, but the magnitude of that decline w-ill be limited in the near future. The reasons for this are quite clear. Family planning work in China is currently faced with a tremendous challenge because a third "baby boom" has already taken place in the country. At present it is perhaps more difficult to make the TFR decline by 0.1 than it was to make it decrease by 1.0 in the early 1970s.

As for policy decisions, it is important to keep the current family planning policy stable. Strict requirements are necessary in order to control population growth. Nevertheless, this does not mean "the stricter the better".

On the other hand, if difficulties are over-emphasized and family planning work slackens, then a "re-rise" in the fertility rate may again take place. Furthermore, in order to maintain more effective control over China's population growth, it is necessary to strengthen family planning legislation. This is not to replace publicity and education, but there is evidence that it is difficult

to achieve continuous fertility decline using only publicity and education as the means to do so.

With regard to the short-term goal of fertility control, we hold that to strive to make fertility decline as soon as possible to a level which is below the replacement level is both necessary and possible. Only in this way can the current continuous growth of China's population be stopped.

Data sources

The fertility rates for the period from 1973 to 1980 are from the 1982 One-per-Thousand Fertility Sampling Survey[1] and those from the period 1981 to 1987 are from the 1988 Two-per-Thousand Fertility and Birth Control Sampling Survey.[2] The 1988 Survey includes data on the Xizhang Autonomous Region, but the 1982 Survey does not. Moreover, at the time the 1982 Survey was taken, what is currently Hainan province was a part of Guangdong province; they were made into two separate provinces in 1988. Consequently, in analysing fertility changes during the period from 1973 to 1987, comparisons are unavailable for Hainan province and Xizhang Autonomous Region, and the data on Guangdong province for the periods 1973-1980 and 1981-1987 have different coverage.

The proportions of national minorities in the population used in this article are from the Third National Population Census.[3] Statistical data on per capita national income are from the State Statistical Bureau[4] and the women's illiteracy rates are from the One-per-Cent Population Changes Sampling Survey[3] conducted by the State Statistical Bureau in 1987.

Findings and analysis

In 1963, TFR reached the highest level since the founding of the People's Republic 14 years previously. In the same year a gradual transition from high to low fertility began.

During the 25 years from 1963 to 1987, the changes in fertility can be divided into three periods. During the first period (1963-1972), the fertility rate fluctuated at a high level, but showed an overall remarkable decline. In the second period (1973-1977), the TFR showed a stable, continuous decline, and in the third period (1978-1987), it fluctuated at a low level, showing only a slight decline.

This article covers only the second and third periods (1973-1987), but in order to enable more comprehensive comparisons and analyses, these periods are divided into phases, with 1973-1977 forming the first phase, 1978-1982, the second phase and 1983-l 987, the third phase.

Changes in fertility rates

Changes in the total fertility rates of the 28 regions from 1973 to 1987 are shown in table 1 (the TFRs are given in thousands of children per thousand women). The changes in TFR were compared by three methods. First, the TFR

Table 1.1: Total fertility rates (TFRs) per thousand in 28 provinces, autonomous regions and municipalities of China

Year	1973	1974	1975	1976	1977	1978	1979	1980
National	4 526	4 160	3 578	3 240	2 846	2 726	2 753	2 260
Beijing	2 601	1 722	1 395	1 452	1 482	1 374	1 461	1 547
Tianjing	2 296	2 066	1 997	2 070	1 718	1 659	1 543	1 413
Hebei	3 848	2 945	2 569	2 518	2 276	2 351	2 266	2 315
Shanxi	4 659	4 168	3 417	3 267	2 702	2 279	2 227	2 249
Inner Mongolia	4 257	4 273	3 048	2 879	2 703	2 550	2 472	2 435
Liaoning	3 413	2 874	2 135	1 953	1 880	2 243	2 092	1 705
Jilin	4 185	3 357	2 501	2 527	2 333	2 458	2 699	1 837
Heilongjiang	4 951	4 105	3 263	2 681	2 458	2 112	2 805	2 194
Shanghai	1 545	1 253	1 120	1 265	1 152	1 197	1 203	824
Jiangsu	2 701	2 524	2 224	2 184	1 989	1 900	1 855	1 381
Zhejiang	3 269	2 907	2 666	2 591	2 356	2 180	2 280	1 776
Anhui	4 862	4 001	3 644	3 399	3 001	3 349	3 403	2 709
Fujian	5 338	4 596	4 216	4 451	4 035	3 499	2 859	2 050
Jiangxi	6 781	6 422	5 825	5 905	5 261	4 771	4 030	3 049
Shandong	3 725	3 309	3 041	2 737	2 343	2 129	2 430	1 737
Henan	4 972	4 883	3 547	3 214	2 985	3 158	3 143	2 327
Hubei	4 015	3 726	3 247	3 051	2 712	2 534	2 930	2 159
Hunan	4 564	4 572	3 970	3 132	2 709	2 455	2 519	2 267
Guangdong	4 848	4 481	3 847	3 796	3 337	3 607	3 765	3 485
Guangxi	5 664	5 586	5 112	4 358	3 987	3 653	3 981	3 841
Sichuan	5 456	5 112	4 438	3 412	2 502	1 879	1 938	1 518
Guizhou	6 662	6 926	6 315	5 120	4 678	3 849	4 116	3 663
Yunnan	5 522	5 351	5 322	5 242	4 995	4 549	3 986	3 198
Shaanxi	4 438	4 168	3 288	3 209	2 617	2 690	2 871	2 158
Gansu	5 804	4 936	3 485	3 027	2 789	3 092	3 499	2 529
Qinghai	5 865	6 096	4 948	5 025	5 110	4 871	5 002	4 156
Ningxia	5 844	5 771	6 190	4 585	4 133	4 347	4 794	4 319
Xinjing	5 496	6 001	4 932	5 263	4 268	4 050	3 788	3 426

Source: 1982 One-per-Thousand Fertility Sampling Survey.

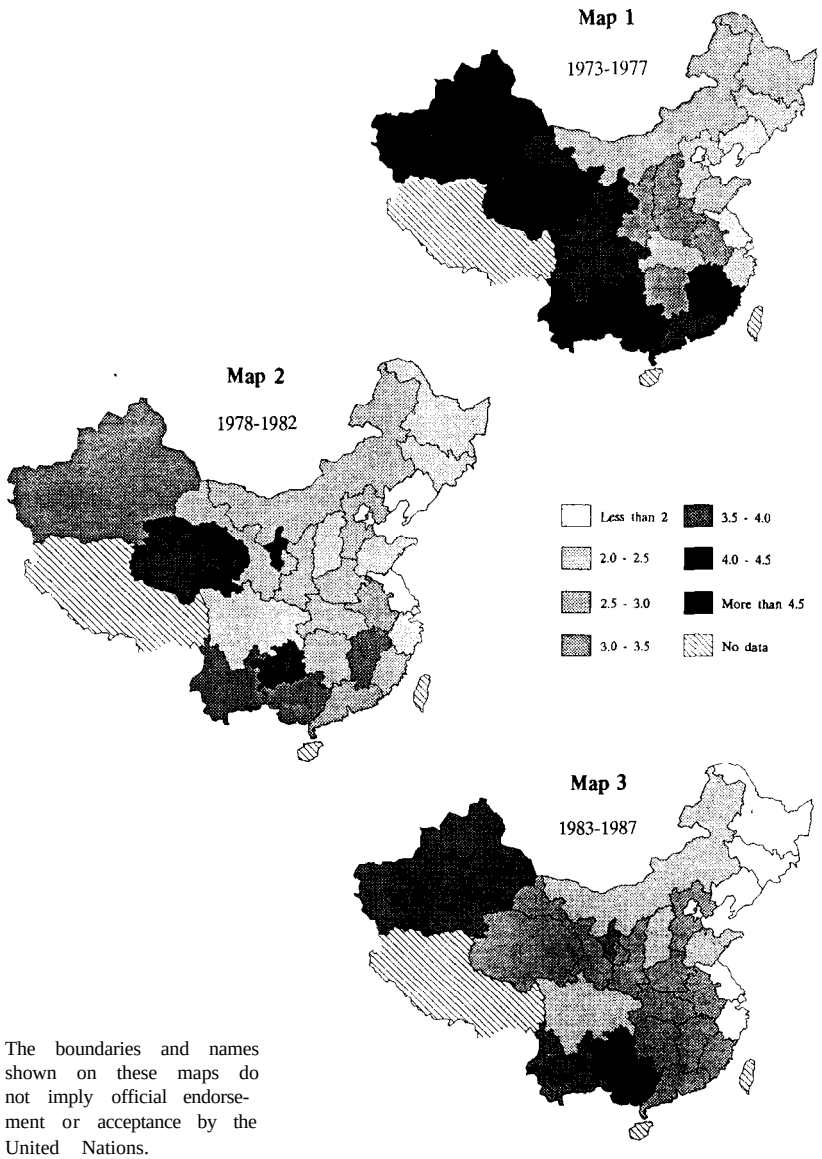
in the 28 regions during different periods of time was studied by comparing changes in the rank order. Second, the difference between the rank order during the previous period and that of the magnitude of TFR decline taking place from the previous to the more recent period was studied in order to determine the relationship between the magnitude of TFR decline and the original TFR level

Table 1.2: Total fertility rates (TFRs) per thousand in 28 provinces, autonomous regions and municipalities of China

Year	1981	1982	1983	1984	1985	1986	1987
National	2 610	2 860	2 420	2 350	2 200	2 420	2 590
Beijing	1 580	1 780	1 470	1 430	1 320	1 490	1 580
Tianjing	1 740	1 850	1 680	1 520	1 510	1 640	1 690
Hebei	2 730	2 960	2 470	2 450	2 360	2 480	2 810
Shanxi	2 370	2 920	2 390	2 630	2 400	2 400	2 460
Inner Mongolia	2 720	2 910	2 330	2 320	2 010	1 970	2 220
Liaoning	1 820	1 900	1 500	1 180	1 340	1 630	1 880
Jilin	1 850	2 100	1 620	1 520	1 520	1 710	1 830
Heilongjiang	2 110	2 390	1 850	1 690	1 620	1 830	1 940
Shanghai	1 280	1 540	1 230	1 100	1 000	1 360	1 480
Jiangsu	2 020	2 140	1 730	1 610	1 580	1 800	2 040
Zhejiang	1 940	2 370	1 880	1 580	1 400	1 550	1 690
Anhui	3 160	3 090	2 760	2 570	2 410	2 390	2 690
Fujian	2 830	3 400	2 960	2 820	2 440	2 320	2 350
Jiangxi	2 750	3 270	2 930	3 160	2 610	2 690	2 900
Shandong	2 200	2 370	2 090	2 100	1 910	2 560	2 680
Henan	2 720	3 050	2 600	2 320	2 110	2 630	3 060
Hubei	2 380	2 690	2 520	2 670	2 500	2 570	2 970
Hunan	2 910	3 500	2 860	2 540	2 360	2 440	2 730
Guangdong	3 170	3 090	2 980	2 890	2 560	2 700	2 760
Guangxi	4 040	3 880	3 550	4 080	3 680	3 480	3 590
Sichuan	2 350	2 850	2 070	1 760	1 940	2 650	2 260
Guizhou	4 250	4 390	3 550	3 870	3 320	3 360	3 690
Yunnan	3 860	4 200	3 440	3 400	3 040	2 970	3 200
Shaanxi	2 320	2 700	2 470	2 600	2 640	2 960	2 970
Gansu	2 750	2 940	2 630	2 760	2 550	2 530	2 610
Qinghai	3 970	4 000	3 040	2 830	2 520	2 610	2 720
Ningxia	3 950	4 420	3 160	3 410	2 770	2 850	3 120
Xinjing	4 180	4 210	4 070	4 200	3 660	3 840	3 750

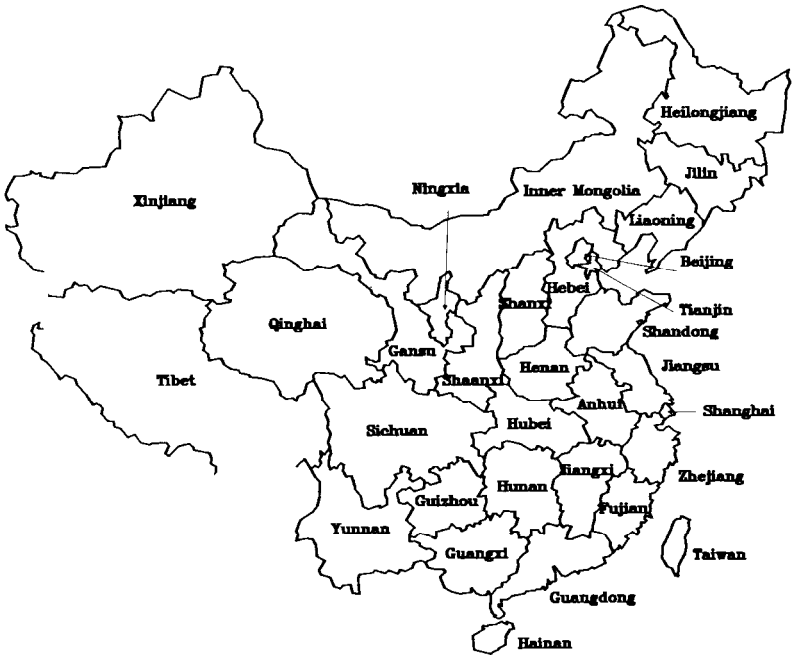
Source: 1988 Two-per-Thousand Fertility and Birth Control Sampling Survey.

Total fertility rates of China, by province: 1973-1977, 1978-1982 and 1983-1987



The boundaries and names shown on these maps do not imply official endorsement or acceptance by the United Nations.

China by names of provinces



during the previous period. Third, the magnitude of TFR decline taking place from the previous to the more recent period in those regions was compared so as to study the increase or decrease in TFR.

A comparison between the average TFRs of the first and thud phases (maps 1 and 3) shows that, while no change took place in the rank order in four regions (namely, Beijing, Shanghai, Anhui and Gansu), the rank order in 11 regions (namely, Hubei, Shaanxi, Hebei, Guangxi, Xinjiang, Jiangsu, Guangdong, Shandong, Tianjin, Hunan and Yunnan), rose with three of them showing a significant rise (9, 7 and 6 for Hubei, Shaanxi and Hebei, respectively). The remaining 13 regions showed a decline in rank order, with Sichuan province showing a remarkable decline (a decrease of 11).

Thus the mutual relationship between the fertility levels of the different

regions was by no means unchanged. Only a small number of them experienced no change in rank order between the first and third phases. In other words, some of them became relatively more "advanced", while others became relatively more "backward".

When the fertility rates of the different regions in the second phase are compared with those in the first phase, the following features of change can be found:

a) Fertility rates declined in all 28 regions;

b) The magnitude of the decline generally had an evident association with the previous fertility level, the correlation coefficient being 0.79;

c) Individual comparison of the 28 regions, based on the difference between the rank order of the previous fertility rate and the rank order of the magnitudes of decline, revealed three types of relationship. First, 14 regions showed a negative value, indicating a relatively larger magnitude of decline compared with the previous level. Outstanding examples are Sichuan, Shanxi and Heilongjiang, with the difference between the two orders being -7, -8 and -9, respectively. Second, seven regions showed a positive value, indicating a relatively smaller magnitude of decline compared with the previous level. Examples are Guangdong, Ningxia, Qmghai and Anhui, with the difference between the two orders being 12, 11, 10 and 7, respectively. Third, another seven regions showed no value difference, indicating that the magnitude declined correspondingly compared with the previous level.

When the fertility rates of the various regions in the third phase are compared with those in the second phase, more complicated changes can be found:

a) Of the 28 regions, there was a continuous decline in 22 of them, while the other six, namely, Shaanxi, Hubei, Shandong, Shanxi, Sichuan and Shanghai, showed a rise in fertility; the TFR for Shaanxi, Hubei and Shandong increased by 180.2, 107.4 and 94.8, respectively;

b) The magnitude of fertility decline retained an association with the previous fertility level, the correlation coefficient being 0.64; however, the association was weak compared with that during the previous two phases; and

c) When individual comparisons were made of the 28 regions, the above-mentioned 22 (not including the six regions with a rise in the fertility rate) can be divided into three types based on the difference between the order of precedence of the previous fertility level and the order

of precedence in the magnitude of decline. First, 12 regions showed negative values, the difference between the two orders being - 13, -12, -12, -11, -8, -7 and -6 in Jilin, Zhejiang, Liaoning, Heilongjiang, Beijing, Jiangsu and Tianjin, respectively. Second, eight regions showed positive values, the difference between the two orders being 16, 10 and 6 in Xinjiang, Guangxi and Guizhou, respectively. Third, two regions, i.e. Qinghai and Ningxia, showed no difference, the values being zero.

A comprehensive examination of the data listed in table 1 shows that the spatial distribution of fertility fluctuations had no regularity while their time distribution had a tendency to concentrate.

For the sake of convenience, when the time distribution of fertility fluctuations are examined in terms of their tendency to concentrate, they are compared by phases, with the phase from 1978 to 1982 being further divided into two subphases, namely, from 1978 to 1980 and from 1981 to 1982, and the phase from 1983 to 1987 similarly divided into two subphases, from 1983 to 1985 and from 1986 to 1987.

When the two subphases of the 1978-1982 phase are studied, 17 regions show a rise in TFR while 11 of them show a continuous decline. Of the 17 regions, Sichuan, Hunan and Hebei show marked rises in their mean TFR, the increases being 822, 791 and 534, respectively, whereas Henan, Zhejiang and Yunnan show less marked rises in their mean TFR, with the increases being 9, 76 and 119, respectively.

As for the two subphases in the 1983-1987 phase, fertility rose in 13 regions, declined in 14 regions and did not change in one region, i.e. Zhejiang. Out of the 13 regions showing a rise in fertility, the rises in mean TFR were more marked in Shandong and Sichuan, with the increases being 587 and 532, respectively, while in Tianjin and Beijing the rises were less marked, being 95 and 128, respectively.

In summarising the fertility fluctuations taking place in the 28 regions during the second and third phases, it is found that the rise in fertility during both phases took place in eight regions, namely, Beijing, Tianjin, Hebei, Jiangsu, Shanghai, Shandong, Henan and Sichuan, whereas the decline in fertility during both phases took place in six regions, namely, Anhui, Jiangxi, Giangdong, Gansu, Qinghai and Ningxia. As for the 14 other regions, a decline in fertility took place during one phase while a rise in fertility, or maintenance of the previous level of fertility, took place during the other phase.

When the previous fertility levels of the regions where a rise in fertility took place in both phases are compared with those of the regions where a

decline in fertility took place during those phases, it is found that the previous fertility levels in the former regions were all relatively low (with the exception of Henan where the order of precedence was 18 during 1978-1980, the other seven regions' orders being equal to or below 10; and their orders of precedence during 1983-1985 being equal to or below 13). By contrast, the previous fertility levels of the regions where the decline in fertility took place during both phases were all relatively high (their orders of precedence during 1978-1980 being equal to or above 20, and during 1983-1985 being equal to or above 17).

However, the previous fertility level was not necessarily associated with the rise or decline in later fertility. In other words, the rise in fertility did not take place in all the regions with a previously low fertility level, nor did a further fertility decline take place in all the regions with a previously high fertility level. This is because during a certain period of time. a rise or decline in the fertility rate is influenced by other factors in addition to the previous fertility level, particularly by the family planning work being conducted in the region at that time.

Generally, the regions with a previously relatively high fertility level were more sensitive to family planning work so that their fertility rates were more likely to show a tendency to decline. Nevertheless, if the role of family planning has not been brought into full play in a particular region, the fertility rate may show a rise. By contrast, in regions with a previously relatively low fertility rate, family planning work will usually be found to have played a considerable role, and any slight slackening of those factors which promote fertility decline will result in a rise in fertility under such conditions. However, if family planning is brought into full play, there subsequently may be a continuous decline in the fertility rate. For example, in Guangxi, Guizhou and Yunnan during 1978-1980, their mean TFRs were 3,825, 3,876 and 3,911, respectively; during 1981-1982, the mean TFR of these three regions rose to some extent. During 1983-1985, the mean TFR of these regions dropped to 3,770, 3,580 and 3,293, respectively; however during 1986-1987, the mean TFR of the same regions still showed a tendency to decline.

It is evident that the former rise in fertility was due to a lack of full implementation of the family planning programme, while the later decline in fertility was a result of improved family planning work.

Actual and expected mean TFR

The per capita national income (1986), women's illiteracy rate (1987) and the proportion of national minority population (1982) of the 28 regions are listed in table 2.

Taking the mean TFR of the 28 regions during 1986-1987 as the dependent variable (y) and the figures listed in table 2 as the independent variables, i.e. per capita national income (x_1), women's illiteracy rate (x_2) and proportion of national minorities in the population (x_3), the following regression formula can be derived:

Table 2: Population and socioeconomic indicators for 28 provinces, autonomous regions and municipalities

	Per capita income (yuan) (1986)	Women's illiteracy rate (%) (1987)	Proportion of national minorities in the population (%) (1982)
Beijing	2 130	10.8	3.5
Tianjing	2 040	23.1	2.1
Hebei	673	35.3	1.6
Shanxi	682	27.8	0.3
Inner Mongolia	630	31.l	15.5
Liaoning	1 299	18.9	8.1
Jilin	823	23.4	8.1
Heilongjiang	997	25.4	4.9
Shanghai	3 471	22.6	0.4
Jiangsu	1 064	40.9	0.2
Zhejiang	1 042	35.0	0.4
Anhui	599	54.1	0.5
Fujian	672	49.0	1.0
Jiangxi	543	45.7	0.1
Shandong	770	42.1	0.5
Henan	540	42.6	1.1
Hubei	805	36.1	3.7
Hunan	603	29.7	4.1
Guangdong	897	32.1	1.8
Guangxi	450	35.2	38.3
Sichuan	515	36.4	3.7
Guizhou	406	56.8	26.0
Yunnan	453	57.4	31.7
Shaanxi	531	39.2	0.5
Gansu	570	59.4	7.9
Qinghai	698	66.7	39.4
Ningxia	616	47.3	31.9
Xinjing	740	25.1	59.6

$$y = 2505.4 - 0.469939x_1 + 5.42744x_2 + 18.5786x_3$$

The F test value of the regression formula was significant at the 0.001 level and the compound correlation coefficient was R = 0.83. The high correlation is striking because the fertility rate had already declined to a low level. A strong relationship of fertility to economic, cultural and other factors would be expected if fertility were high, but not necessarily so if fertility were low.

The values of the standardized coefficients of x_1, x_2 and x_3 were 0.49, 0.11 and 0.47, respectively. Per capita national income had the largest impact on fertility, about the same as the proportion of national minority population. Women's illiteracy had the smallest impact.

Using the above regression formula, the expected mean TFR of the 28 regions during 1986-1987 can be calculated (table 3). The expected TFR is the TFR which a province would have if fertility were completely determined by the above three socioeconomic variables.

Out of the 28 regions, during 1986-1987, nine regions, namely Beijing, Tianjin, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu and Zhejiang, had an actual mean TFR which was below the replacement level. Six regions, namely Fujian, Sichuan, Yunnan, Gansu, Qinghai and Ningxia, had an actual mean TFR which was above the replacement level but lower than the expected mean TFR. Six other regions, namely Hebei, Shanxi, Anhui, Jiangxi, Shandong and Hunan, had an actual mean TFR which was above the replacement level and higher than the expected mean TFR, with the difference between the two mean TFRs being less than 300. The remaining seven regions, namely Henan, Hubei, Guangdong, Guangxi, Guizhou, Shaanxi and Xinjiang, had an actual mean TFR which was above the replacement level, but higher than the expected mean TFR, with the difference between the actual and expected mean TFRs of more than 300.

Conclusions

It may be concluded that the regions in the above-described first and second categories developed their family planning work successfully; while those regions in the third category have enjoyed moderate success, the regions in the fourth category were not very successful.

By comparing the mean fertility rates during 1983-1987 with those during 1973-1977, it is found that the change in fertility of the different regions was neither "parallel" nor "proportional". When compared with the past, some regions became more "advanced" whereas others became more "back-

Table 3: Actual mean total fertility rate (TFR) and expected mean TFR in 28 provinces, autonomous regions and municipalities of China (1986-1987)

	Actual mean TFR	Expected mean TFR
Beijing	1 535	1 676.7
Tianjing	1 665	1 711.3
Hebei	2 645	2 410.8
Shanxi	2 430	2 340.5
Inner Mongolia	2 095	2 667.1
Liaoning	1 755	2 148.8
Jilin	1 770	2 396.5
Heilongjiang	1 885	2 266.7
Shanghai	1 420	1 004.7
Jiangsu	1 920	2 230.9
Zhejiang	1 620	2 213.2
Anhui	2 540	2 527.1
Fujian	2 335	2 473.8
Jiangxi	2 795	2 499.7
Shandong	2 620	2 382.2
Henan	2 845	2 502.6
Hubei	2 770	2 391.9
Hunan	2 585	2 458.8
Guangdong	2 730	2 290.7
Guangxi	3 535	3 196.0
Sichuan	2 455	2 529.1
Guizhou	3 525	3 106.0
Yunnan	3 085	3 193.3
Shaanxi	2 965	2 477.1
Gansu	2 570	2 707.4
Qinghai	2 665	3 271.9
Ningxia	2 985	3 065.8
Xinjing	3 795	3 400.8

ward". Sichuan province serves as a representative of the former while Hubei, Shaanxi and Hebei are examples of the latter.

Comparisons of the magnitude of fertility decline between the different phases show that in seven regions, namely, Heilongjiang, Jilin, Zhejiang, Liaoning, Jiangsu, Tianjin and Inner Mongolia, the magnitude of fertility decline

during the two periods was relatively significant compared with their previous fertility rates, while three regions, Guangxi, Hebei and Guizhou, showed a relatively insignificant magnitude of fertility decline during the two periods compared with their previous fertility rates.

During 1973-1987, the fertility decline in all regions showed fluctuations. It is understandable that when the fertility rate is relatively high, the probability of a declining trend continuing is greater, but if the fertility rate is already relatively low, there is a greater probability that it will rise again rather than continue to decline. However, population policy factors and successful family planning work can obviously make an impact on fertility rates.

As shown by the findings of this study, there are 13 regions with a fertility rate above the replacement level and higher actual than expected fertility levels. Thus, although there is potential for a further decline in fertility in those regions, China's family planning programme faces very difficult challenges in realizing that potential.

Out of the 28 regions, the expected mean TFRs during 19861987 were higher in five of them, namely Jiangxi, Guangdong, Guangxi, Guizhou and Xinjiang, than the lowest actual fertility levels during 1973-1987. Hence, there exists a probability of further decline in fertility in China. Historically, however, although China's fertility was close to the replacement level in 1980 and 1985, the decline in fertility was not constant, and a rise subsequently took place. Moreover, with regard to the four categories of regions classified in this article, despite the possibility of a further decline in fertility in the first two categories of regions, the magnitude of decline will not be very remarkable, although there is a considerable "potential" for fertility decline in the last two categories. However, owing to the relatively backward family planning work in those regions, the fertility there probably will not show a rapid and significant decline.

Based on a comprehensive consideration of the above-mentioned findings, a realistic goal for China might be to strive to reach the replacement level of fertility as soon as possible and maintain it at that level.

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Family Planning Needs and Costs: Nepal, 1985-2000

Contraceptive prevalence will need to increase four-fold to reach a total fertility rate of 2.5

By Shyam Thapa and Amy 0. Tsui*

In the early 1980s the Government of Nepal set a demographic target of reducing the current fertility rate of about six children per woman of child-bearing age to 2.5 by the end of the century. To achieve this target, increasing attention has been given to implementing family planning programmes both in the public and private sectors. The key questions are: What level of family planning practice will be required to reach this national target? Through what compositions of contraceptive method use can the fertility target be achieved? What might this effort cost?

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This report contains the results of an analysis aimed at answering those three questions. The analysis uses a methodology for contraceptive target-setting developed by Bongaarts (1984) and microcomputer software prepared jointly with Stover (1986).

Nepal's population policy and goals

Family planning had been included as part of the general development policy of Nepal since the mid-1960s. However, it was only in the mid-1970s that the Government explicitly articulated its policy with respect to population. One of the foremost policies called for a reduction in the population growth rate by direct and indirect means.

In 1983, the Government reassessed the overall demographic situation and set a target of reducing the total fertility rate (TFR) from about 6 per woman in 1985 to 2.5 in the year 2000, stating that:

> "The magnitude of the population problems makes it imperative that fertility targets be set with a view to achieving minimum possible growth in the future" (National Commission on Population, 1983, p. 3).

A national population strategy with the following major thrusts has been adopted to achieve the target (National Commission on Population, 1983, p. 4):

Accord high priority to fulfilment of current substantial unmet demand for family planning services;

Integrate population programmes in all projects relating to environment, forestry, agriculture and rural development;

- Emphasize programmes that help to increase the status of women, female education and employment;
- Effective mobilization of local panchayats (village councils), class organizations and NGOs (non-governmental organizations), in view of the enormously important role of local communities in all population and fertility reduction programmes; and
- Control the steadily increasing immigration into the country.

The Government of Nepal has thus made a strong commitment to controlling population growth. Many of the anticipated achievements in other sectors of the society will depend on the extent to which this target is attained.

Organizational support and service delivery

The Population Policy Coordination Board was established in 1975, under the National Planning Commission, as the Government's first effort towards giving organizational structure to the national population policy. It became the National Commission on Population (NCP) in 1978 under the chairmanship of the Prime Minister. In 1982 it was reorganized as an independent, politically strong support system for population and family planning activities. Policy making and co-ordination of policy implementation, which are central responsibilities of NCP, are pursued by various internal divisions and subdivisions. NCP remains under the chairmanship of the Prime Minister and maintains its own secretariat with representation from various governmental and non-governmental organizations.

Family planning services are provided primarily through four channels (Thapa, 1989). The two largest are semi-autonomous agencies of the Ministry of Health: namely, the Family Planning/Maternal and Child Health Project (FP/MCH) and the Integrated Community Health Services Development Project (ICHSDP).

The FP/MCH Project provides services through 200 or more clinics and about 1,600 panchayar-based health workers. ICHSDP provides services through 1,492 village health workers and 348 community health leaders, who are supported by auxiliary health workers located at 744 ICHSDP health posts. Another service organization is the private and voluntary Family Planning Association of Nepal, with central offices in Kathmandu and 18 branch offices.

In addition, the Contraceptive Retail Sales Project was organized in 1978; in 1983 it was renamed as the Nepal Contraceptive Retail Sales Company, with the function of distributing contraceptive pills and condoms through more than 9,000 outlets in 73 districts of the country. This range of service-providing agencies will play a major role in implementing and achieving the national fertility target in the short- and long-term.

Future family planning needs

As noted above, NCP has set a specific goal for fertility, i.e., to achieve a TFR of 2.5 by the year 2000. The scheduled change is for the TFR of 5.8 in 1985 to reduce to 4.0 by 1990 and to fall to 2.5 by 2000.

Another scenario of fertility decline put forth in a recent round of population assessments by the United Nations (1986) estimates that the TFR will be 4.61 in the year 2000, according to the medium variant. The course of TFR change is from 6.05 in 1985 to 5.63 in 1990, to 5.18 in 1995 and then

to 4.61 in 2000. For the purpose of our analysis, we have taken the base TFR to be 6.05.

Two aspects of contraceptive practice are additionally important to consider for projecting the contraceptive prevalence level needed to achieve the targeted fertility rate. The first is the level of use-effectiveness, determined by the contraceptive method mix, and the second is contraceptive continuation. Four assumptions have been developed on the basis of these factors and the fertility targets for estimating future family planning needs:

Projection	TFR		Method mix	Discon-tinuation
	1985	2000		
I-A	6.05	2.5[a]	Constant	High
I-B	6.05	2.5[a]	Changing	Moderate
II-A	6.05	4.61[b]	Constant	High
II-B	6.05	4.61[b]	Changing	Moderate

Notes: [a] National Commission on Population (1983), [b] United Nations (1986).

Table 1 gives the method mix derived from the 1986 Nepal Fertility and Family Planning (NFFP) Survey data which are assumed to have held for 1985. From this survey of over 5,000 currently married women between the ages of 15 and 50, contraceptive prevalence was estimated to be 15.1 per cent

Table 1: Two assumptions of contraceptive method distribution for Nepal, 1985-2000: constant and changing

Method	Assumption A		Assumption B	
	1985	2000	1985	2000
Total	100.0	100.0	100.0	100.0
Pill	5.9	5.9	5.9	20.0
IUD	0.7	0.7	0.7	25.0
Injection	3.3	3.3	3.3	3.0
Female sterilization	44.7	44.7	44.7	21.0
Male sterilization	40.8	40.8	40.8	19.0
Condom	3.9	3.9	3.9	8.0
Other	0.7	0.7	0.7	4.0

Note: For details on constant and changing contraceptive method mix, see the text.

(Ministry of Health, 1987). The distribution of users across methods reflects a strong orientation towards delivery of contraceptive sterilization services in the various programmes. Approximately 85 per cent of current users are sterilization acceptors, almost equally divided between male and female methods.

Assumption B in table 1 gives a hypothesized change in method mix, wherein temporary family planning methods ascend and sterilization declines in prominence. Gains are projected for the pill, IUD and condom methods in particular. This mix is more or less typical of those observed in other developing countries with active family planning programmes; however, the mix is typical in that few other least developed countries(LDCs) approach the vasectomy prevalence seen either at the present or future hypothesized level. Because of the cumulative retention of the number of persons sterilized in cross-sectional survey rates of contraceptive use, it is difficult to imagine the share of male sterilization falling much below what is assumed here, unless they age out quickly.

Two schedules of annual discontinuation rates, by method, assumed as high and moderate in the projections are:

Method	High	Moderate
Pill	.57	.35
IUD	.60	.15
Female sterilization	.02	.01
Male sterilization	.02	.01
Injection	.05	.05
Condom	.93	.75
Other	.50	.60

With the exception of the rate for "other" methods, the *high* schedule is taken from a World Bank (1983) study report. The *moderate* schedule is a hypothetical one, based on the experience of other LDCs.

The results of the projections are summarized in tables 2 and 3. The estimated size of the female population in the reproductive age group at each five-year interval is taken from projections based on the fertility scenarios. The 1985 proportion of women aged 15 to 49 years currently married (85 per cent) is based on the 1981 census and is assumed to remain constant throughout the projection period. Table 2 illustrates the dramatic growth in the numbers of married women in the child-bearing age group, which is a consequence of past rapid population growth. The fertility assumptions over the next 15 years have little impact on these projected female populations since the majority of

Table 2: Projected number of women of reproductive age and contraceptive prevalence, Nepal, 1985-2000

Indicator	1985	1990	1995	2000
Total fertility rate				
Projection I-A, B	6.05	4.00	3.25	2.50
Projection Il-A, B	6.05	5.63	5.18	4.61
Women 15-49 years (thousands)				
Projection I-A, B	3 659	4 150	4 719	5 338
Projection Il-A, B	3 659	4 165	4 750	5 393
Women 15-49 years in marital union (thousands)				
Projection I-A, B	3 110	3 528	4 011	4 537
Projection Il-A, B	3 110	3 540	4 038	4 584
Percentage of married women of reproductive age currently using contraception				
Projection I-A	15.1	42.0	51.9	61.8
Projection I-B	15.1	42.5	53.0	63.8
Projection II-A	15.1	20.6	26.5	34.0
Projection II-B	15.1	21.0	27.5	35.9
Number of contraceptive users (thousands)				
Projection I-A	469.6	1 483.1	2 081.9	2 802.2
Projection I-B	469.6	1 499.2	2 127.2	2 895.7
Projection II-A	469.6	730.0	1 071.3	1 559.8
Projection II-B	469.6	743.1	1 110.4	1 646.8

the women eligible for child-bearing have been born. Projection I calls for 5.338 million women aged 15 to 49 years compared with 5.393 million women in Projection II.

The future course of fertility, on the other hand, implies significant increases in contraceptive prevalence. Current use levels will need to rise four-fold, i.e. from 15 to 62 per cent, in order to achieve a TFR of 2.5, as specified by the National Population Commission, given no change in method mix and high contraceptive discontinuation. A changing method mix and moderate discontinuation – Projection I-B – requires the prevalence to rise to 64 per cent, which is still very similar to Projection 1-A. These estimates imply that the force of fertility reduction will push the projected prevalence level upward to a much greater extent than modiftkations in method mix or improvements in continuation rates.

If the United Nations fertility scenario is achieved, which by comparison

Table 3: Projected family planning use by projection type, Nepal, 1985-2000

Year	I-A		I-B		II-A		II-B	
	Using (per cent)	Users (thousands)	Using (per cent)	Users (thousands)	Using (per cent)	Users (thousands)	Using (per cent)	Users (thousands)
1985	15.1	469.6	15.1	469.6	15.1	469.6	15.1	469.6
1986	20.5	652.9	20.5	654.3	16.2	516.9	16.3	578.7
1987	25.9	845.5	26.0	849.2	17.3	566.5	17.4	570.5
1988	31.3	1 047.9	31.5	1 054.7	18.4	618.5	18.6	625.1
1989	36.7	1 260.3	37.0	1 271.3	19.5	673.0	19.8	682.6
1990	42.0	1 483.1	42.5	499.2	20.6	730.0	21.0	743.1
1991	44.0	1 593.1	44.6	1 613.9	21.8	792.5	22.3	809.6
1992	46.0	1 708.0	46.7	734.2	23.0	857.8	23.6	879.5
1993	48.0	1 827.9	48.8	1 859.9	24.2	926.1	24.9	953.0
1994	49.9	1 952.6	50.9	991.2	25.4	997.3	26.2	1 029.9
1995	51.9	2 081.9	53.0	2 127.7	26.5	1 071.3	27.5	1 110.4
1996	53.9	2 216.0	55.2	2 269.7	28.0	1 161.5	29.2	1 208.3
1997	55.8	2 355.3	57.3	2 417.8	29.5	1 255.4	30.8	1 310.8
1998	57.8	2 499.7	59.5	2 571.6	31.0	1 353.2	32.5	1 418.1
1999	59.8	2 648.7	61.6	2 731.0	32.5	1 454.6	34.2	1 530.1
2000	61.8	2 802.2	63.8	2 895.7	34.0	1 559.8	35.9	1 646.8

appears to be a more realistic proposition, then the needed level of contraceptive use will be 34 per cent (36 per cent with changes in method mix and continuation levels), i.e. double the present figure. The growth in the number of contraceptive users, shown for every five years in table 2 and each year in table 3, represents the combined impact of required increases in prevalence rates and inevitable growth in the size of the child-bearing population of women.

To achieve the NPC fertility target of 2.5, the number of users will need to increase from roughly half a million to 2.8 or 2.9 million over the 15-year period. A TFR reduction from 6.05 to 4.61 calls for about 1.6 million users in the year 2000, or 1.3 million fewer than implied by Projection I. The six-fold increse in the number of contraceptive users needed to achieve the NPC target is as much the outcome of an ambitious fertility reduction goal as it is the increase in the number of reproductive aged women in a conjugal union, since reaching a TFR of 4.61 already implies a three-fold increase in contraceptive use.

Table 4. Percentage of women currently in maritial union aged 15 to 39 using contraceptives, by method and project, Nepal, 1985-2000

Method	1985[a]	2000[a]	1985[b]	2000[b]
Projection I-A				
Pill	0.9	2.5	3.1	3.6
IUD	0.1	0.3	0.4	0.4
Injection	0.5	1.4	1.7	2.0
Female sterilization	6.7	18.8	23.2	21.6
Male sterilization	6.2	11.2	21.2	25.2
Condom	0.6	1.6	2.0	2.4
Other	0.1	0.3	0.4	0.4
Projection I-B				
Pill	0.9	4.5	8.1	12.8
IUD	0.1	4.4	10.7	19.1
Injection	0.5	1.6	2.4	3.2
Female sterilization	6.1	15.6	15.3	13.4
Male sterilization	6.2	14.3	13.9	12.1
Condom	0.6	1.5	1.8	1.9
Other	0.1	0.5	0.8	1.3
Projection II-A				
Pill	0.9	1.2	1.6	2.0
IUD	0.1	0.1	0.2	0.2
Injection	0.5	0.7	0.7	1.1
Female sterilization	6.7	9.2	11.9	15.2
MaIe sterilization	6.2	8.4	10.8	13.9
Condom	0.6	0.8	1.0	1.3
Other	0.1	0.1	0.2	0.2
Projection II-B				
Pill	0.9	2.2	4.2	1.2
IUD	0.1	1.8	4.6	9.0
Injection	0.5	0.7	0.9	1.1
Female sterilization	6.1	1.7	7.9	7.5
Male sterilization	6.2	7.0	1.2	6.8
Condom	0.6	1.1	1.8	2.9
Other	0.1	0.4	0.8	1.4

Notes: [a] Constant method mix; [b] Changing method mix.

Table 4 shows the percentage of women in marital union who will be using each method of contraception at five-year intervals between 1985 and 2000, following the method mix assumptions shown in table 1. If no change in method mix is assumed, a 53 per cent use of sterilization (28 per cent female, 25 per cent male) is needed to achieve a TFR of 2.5 compared with 29 per cent for a TFR of 4.6. Observe, however, that it is also possible to achieve the low TFR target with an alternative method mix, i.e. pill use in the year 2000 at 13 per cent, IUD use at 19 per cent and sterilization at 12 to 13 per cent.

The general picture that emerges is of a very sizeable increase in the demand for each contraceptive method. This phenomenon is caused by (a) the large cohorts of women who will be entering the reproductive age group because they were born during Nepal's period of high fertility and (b) either a major increase in the prevalence rate of contraceptive use (Projection I) or a modest increase (Projection II). These users will unquestionably place heavy burdens on existing delivery systems as well as the resource requirements necessary to expand them.

Projected costs

The projected number of users of each method can be translated into annual supply requirements over the period 1985 to 2000 as shown in table 5.

As implied by Projection I-A, the number of pill cycles to be distributed would need to increase from 360,100 to 2,148,900 between 1985 and 2000, while the number of condom units would increase from 1.83 million to 10.93 million. Projection II-A calls for distribution of 1.196 million pill cycles by the year 2000, since the fertility target is lower. Gains in pill share from a changed method mix (Projection II-B) will require 4.282 million pill cycles to be distributed annually in the year 2000. If average costs for supplying each method are available, a cost projection can be obtained by multiplying them against these supply requirements and factoring in other servicing costs, e.g. medical examination fees.

To place a different financial perspective on understanding future family planning needs, the cost per user has been estimated based on reported expenditures for 1984/85 (Central Bureau of Statistics, 1987: table 14.1) and the calculated number of 1985 users shown in table 1. The cost per user was about $US5.85 in 1985.

As a rough approach to estimating future costs for Nepal, the reported family planning expenditures and use over time were examined in two countries, namely India and Thailand, which circa 1985 had method mixes similar to those under assumptions A and B shown in table 1. Since the Indian programme is also heavily oriented towards sterilization delivery and since the cost per user was found to be relatively stable, as shown in table 6, one projection scenario of constant costs is proposed.

Thailand's recorded rise in contraceptive prevalence over the 1970-1985 period, from 15 to 62 per cent, nearly parallels the projected rise for Nepal (Projection I). Thus, we pursue a second scenario speculating that the financial implications of required change to organized delivery of birth control in Nepal will resemble those for Thailand. Current annual cost per user in Thailand is

Table 5: Annual contraceptive supply requirements, Nepal, 1985-2000 by projection type (thousands*)

Method	1985[a]	2000[a]	1985[b]	2000[b]
Projection I-A				
Pill	360.1	1 137.5	1 596.8	2 148.9
IUD	3.3	7.6	9.9	12.5
Injection	62.0	195.8	274.8	370.0
Female sterilization	79.5	93.4	83.3	98.8
Male sterilization	74.4	89.7	82.3	98.0
Condom	1 830.0	5 784.1	8 119.3	10,930.0
Projection I-B				
Pill	360.1	2 066.0	4 231.9	7 528.3
IUD	3.3	73.3	141.7	226.9
Injection	62.0	231.9	377.3	579.2
Female sterilization	79.5	55.7	22.8	9.6
Male sterilization	74.4	54.2	24.4	12.2
Condom	1 830.0	5 397.3	7 021.2	8 690.0
Projection II-A				
Pill	360.1	559.9	821.7	1 196.0
IUD	3.3	3.6	5.2	7.0
Injection	62.0	96.4	141.4	206.0
Female sterilization	27.7	35.2	49.2	63.3
Male sterilization	26.8	34.3	48.1	62.1
Condom	1 830.0	2 847.0	4 178.2	5 670.0
Projection II-B				
Pill	360.1	1 024.0	2 208.7	4 282.2
IUD	3.3	28.6	64.4	111.3
Injection	62.0	95.1	137.7	197.6
Female sterilization	19.4	18.8	16.5	10.7
Male sterilization	19.2	18.8	16.9	11.6
Condom	1 830.0	3 913.6	7 366.0	13,170.0

Notes: * Pill requirements are given in terms of thousands of cycles; IUD and injections in terms of thousands of insertions/injections; sterilization (male and female) in terms of thousands of procedures; condoms in terms of thousands of units.
[a] Constant method mix; [b] Changing method mix.

$US23.40, and this amount is used as an estimate for Nepal in the year 2000, linearly interpolating the cost for 1990 and 1995 at $USll.70 and $USl7.50, respectively.

The results of these calculations are given in table 7. The total annual

Table 6: Estimated family planning expenditures and users in India and Thailand, 1970-l 985

Year	India			Thailand		
	Expen-ditures (thousands of ($US)	Users (thousands)	cost per user ($US)	Expen-ditures (thousands of ($UIS)	Users (thousands)	cost per user ($US)
1970	75,756	10,475	7.23	900	803	1.12
1975	111,750	25,371	4.40	9 350	1 677	5.60
1980	183,000	24,901	7.35	26,000	2 171	12.00
1985	269,600	41,556	6.49	116,000	4 948	23.40

Sources: Expenditure data = Ross *et al.* (1988); users data = estimated from contraceptive prevalence rate and population of married women in the reproductive age groups.

cost of contraception will rise precipitously in the next 15 years from a current amount of $US2.74 million to $US16.39 million, or five-fold, to achieve the NPC fertility target. This is in spite of annual costs per user remaining constant at $US5.85. If the lower fertility level is attained, an expenditure of $US9.12 million, a two-fold increase, would still be required. To follow the Thai model of service expansion implies that family planning expenditures would need to rise 24-fold to $US67.76 million in 2000 to reach the NPC target, or to $US38.54 million, a 13-fold increase, to reach the United Nations estimate.

Table 7: Summary of projected contraceptive cost, Nepal, 1985-2000 (thousands of $US)

Projection	1985	1990	1995	2000	1985-2000 percentage increase
Constant user cost[a]					
Projection I-A	2 735.5	8 676.1	12,179.l	16,392.9	499
Projection II-A	2 735.5	4 270.5	6 267.1	9 124.8	234
Increased user cost[b]					
Projection I-B	2 735.5	17,540.6	37,234.8	67,759.4	2 377
Projection II-B	2 735.5	8 694.3	19,432.0	38,535.l	1 309

Notes: [a] Cost constant at $US5.85 per user;
[b] Cost increases linearly over interval to $US11.70 in 1990, $US17.50 in 1995, and to $US23.40 in 2000.

The earlier message of necessary service expansion is clearly confirmed with these cost projections. The challenge to the Government of Nepal will be to develop effective financing strategies to accommodate the projected needs in contraception. Will these costs be the total or predominant responsibility of the public sector, or will cost recovery measures through lesser subsidization of retail costs of contraception be needed? An important issue will be the "tailoring" of the subsidies to acceptable levels without compromising the adoption of contraceptive practices and without incurring undue costs to underprivileged users.

In assessing family planning needs and costs, an important policy and programmatic issue that needs to be considered is the effect of changing contraceptive technologies (Gillespie *et al,* 1989). The costs for already available but improved products or newly developed contraceptives could affect the scenario considerably. IUDs and subdermal implants are cases in point.

The newer generation of IUDs (TCu-T, TCu-7, MLCu-250, or MLCu-375) are considerably more expensive than the older inert IUDs (Lippes loop). But beyond cost, the newer type of IUDs have been shown to be more effective in preventing pregnancies and also have lower expulsion rates than the conventional types (Sivin and Stern, 1979; Sung *et al,* 198.5). At issue is whether the new types of IUDs should be preferred to the conventional types, even though they are more expensive. Alternatively, should cost be the more important determining factor for a resource-poor country such as Nepal? While there are no fixed answers to these questions, some programmatic and logistical issues should be taken into account in making the decisions. The newer IUDs need to be removed every five years; in contrast, the conventional types may be safely left in *situ* until menopause. This aspect may be an important consideration from the accessibility point of view. In this respect, the newer types may not necessarily be the most appropriate products. On the other hand, if the explusion rate is known to be a major problem or if the pregnancy rates are high, it may be more prudent to consider introducing the new products.

The subdermal implant is an example of a newly developed contraceptive. The implant is relatively expensive contraceptive; it may cost $US25-35 per user to provide a set of implants. Because of this, some programmes may find it too costly to provide them on a large scale. Yet in terms of ease and convenience of use, high efficacy and high acceptability, the implants may be an attractive contraceptive to an otherwise underserved group of people (Thapa *et al.,* 1990). Hence, the cost consideration may be partly off-set by the need to provide contraceptives to eligible couples. The calculus in costing the role of new technologies is made complex by the possibility that their introduction may raise overall contraceptive demand as well as affect supply. Gillespie *et al.* (1989) suggest that, of the total financing costs, commodity costs tend to be less than those of service delivery.

These issues underscore an important point: trade-offs in contraceptive technology and service delivery capabilities are imminent and thus need to be considered in the planning and decision-making processes. The accumulated experience of providers and the availability of resources are key inputs to this process, as are results from well-designed and executed studies.

Conclusion and implications

Nepal's target of achieving a TFR of 2.5 by the year 2000 is an ambitious one; the target is 54 per cent lower than what is considered by the United Nations to be a plausible course for fertility reduction. Regardless of its plausibility though, the results presented in this article suggest the enormity of the challenge that Nepal faces.

Even to achieve the United Nations target of a TFR of 4.6, the level of current contraceptive use will need to increase two-fold, and accordingly, the number of users will need to increase three-fold (from about 470,000 to 1.6 million). If the TFR is to be reduced to 2.5, the corresponding figures involve five-fold and six-fold increases, respectively.

Other findings that have important programmatic and policy implications are that:

- Increased effort may be given to the promotion and use of modern reversible contraceptive methods and lesser emphasis placed on sterilization without necessarily affecting the overall demographic impact, i.e. the fertility level. Another strong rationale for putting more emphasis on providing services for non-permanent birth control methods is that there may be significant unmet demand for contraception to achieve birth-spacing.

- The current continuation rates for reversible methods remain at low levels. Special effort should be taken to improve continuation rates, since they bear directly upon programmatic requirements of acceptor levels to achieve targeted use levels.

- Even if the cost per user remains constant into the future, the projected total cost for achieving the lower fertility target is $US16.4 million annually, nearly a 500 per cent increase over family planning costs in 1985.

- Assuming that the cost per user for future delivery of family planning services rises with the necessary expansion of the infrastructure, the present estimates call for as much as a 24-fold increase, or $US68 million in the year 2000 to achieve a TFR of 2.5.

Many of the anticipated achievements in other sectors of society will depend to a large extent on future family planning programme performance directed at meeting the demographic target. The results presented in this article suggest that the fertility target may need to be re-evaluated, that existing programme strategies of service delivery need to be reviewed for their method orientations, others developed and expanded, and that sufficient resources will need to be marshalled if the national goal of fertility reduction is to be achieved.

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Women's Work and Family Size in Rural Thailand

Reproduction does not prevent rural women from working, but it does have an impact on women's economic activities

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One of the potential benefits of family planning programmes in developing countries is that limiting family size can increase women's ability to participate in productive activities, which in turn can contribute to the economic well-being of the family. This argument is based on the assumption that reproductive

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and productive activities compete for a woman's limited time and hence women with a small number of children to rear are able to engage more in economic activities than those with larger numbers of children. Thus, the prevalence of small families should be desirable to both the families and the Government. Despite this, however, little is known about the impact of reduced family size on women's participation in the labour force.

It is important to recognize at the outset that the relationship between reproduction and women's labour force participation is a complicated issue. Any relationship potentially involves a complex set of forces that make it difficult to isolate the pure effects of any single factor. Whether or not a woman works is likely to depend not only on the number of children she has but also on a variety of other factors including the age of the children, availability of child-care help, substitute labour in the family, availability of jobs, wage levels, type of employment, and social and cultural norms (Cochrane *et al.* n.d.). Moreover, the nature of the relationship between reproduction and women's work is likely to vary with the economic setting. Where modern-sector employment prevails, for example, work and child-rearing may compete directly because employment is typically non-familial and the work place is often located some distance from the residence.

Under such circumstances, having children, especially a large number of children, may deter some women from engaging in economic activities while others may in turn be deterred from child-bearing because they do not wish to disrupt their careers in order to rear children. In contrast, in more traditional agrarian settings where work centres around the family farm, reproduction and women's work may be relatively compatible and thus have little effect on each other.

When considering the impact of rearing children on women's work, several potential dimensions can be distinguished. First, child-bearing and child-rearing may totally *prevent* a woman from working for the entire duration of the period during which she is rearing children. Second, child-bearing and the initial demands of caring for a newborn infant may temporarily *interrupt* the continuation of her economic activity to which she will return once the demands of child care become less intensive. Third, although the woman may continue or resume working, child care may *interfere* with the execution of her economic activities, lowering her productivity by reducing the intensity of work or the amount of time that she can devote to it. Fourth, reproduction may *influence* the *type of work* a woman does, causing her to shift from jobs that are less compatible to those that are more compatible with rearing children.

While the first three of these dimensions act to reduce the extent of

women's employment as a result of reproduction, two additional dimensions operating in the opposite direction are also possible. Having children to support, and particularly having large families, may increase the need for the woman to be active economically and thereby either prompt entry into the labour force or lead a woman to intensify the extent of her economic activity.

In rural Thailand, as clearly documented in our survey (see below), it is the norm for women to work both prior to marriage and during each segment of their child-bearing span. Thus, economic activity is virtually universal during a woman's reproductive years regardless of the stage of family building or the eventual achieved family size. Under these circumstances, there is Little tendency for reproduction to prevent or prompt economic activity. In addition, there is no evidence in our study that women intensify economic activity because of having children. Thus, our analysis concentrates on the extent to which the birth of each child and the accumulative effect of child-bearing in terms of family size interrupts, interferes with, or influences the type of economic activity of women in the sample.

Thailand provides an interesting setting for examining the impact of reduced family size on women's employment. Since the early 1970s, a rapid and substantial fertility decline associated with an active family planning programme has occurred in both urban and rural areas (Knodel, Chamratrithirong and Debavalya, 1987). At the same time, there has been considerable socio-economic change including an expansion of non-agricultural employment and increasing levels of education among members of younger cohorts.

Study design

In an effort to examine the consequences of family size on women's employment, quantitative and qualitative data from a research project particularly designed to investigate major aspects of the consequences of reduced family size in Thailand are drawn upon.[1] The goal of the project is to examine the perceived and objective consequences of the number of children a rural Thai couple has for their socio-economic well-being. The project combines a survey component to provide quantitative data with focus group discussions to provide qualitative data.[2]

The fieldwork was carried out in two purposively selected sites. One site consisted of two adjacent districts in the northern province of Lamphun, an area where rapid and substantial fertility decline has been evident since the early 1960s. The second site consisted of two neighbouring districts in Suphanburi province in the central region, where fertility decline began later and has proceeded at a slower pace.

The survey covered 612 currently married couples whose family size was likely to be complete and whose reproductive experience corresponded with the period of fertility decline. The couples were purposively selected to represent both small and large families defined, respectively, as having one or two surviving children, or having four or more surviving children. Only those couples whose first child war born during the period from 1962 to 1974 were eligible for the survey. This ensured that their reproductive activities overlapped with the period when modem contraceptive methods first became available and that sufficient time had passed for some of the consequences of different family sizes to have emerged.

An equal number of small and large families were selected within each sample village thus ensuring that both types of families were geographically distributed in a similar manner and lived in a similar social and economic environment. In addition, both types of families within a sample village were matched as far as possible with respect to such characteristics as age of the oldest child and thus the time period when they started family building. All couples were Buddhists, spoke a major Thai dialect, had no adopted children and no living children from past marriages. Additionally, couples with small families were limited to those who had not had any children who died after the age of six months.[3]

Information about women's work was obtained through a set of survey questions which asked each woman whether she engaged in any productive activities during different segments of her reproductive span starting from the time prior to marriage, then from marriage to the first birth, during each birth interval and after the birth of the last child. For women who worked outside the home, a series of questions were asked to obtain more information on the type of employment (farm or non-farm, family enterprise or wage labour, seasonal or non-seasonal, full-day or part-day), type of payment and place of work. These were followed by questions on whether or not the respondents were unable to work for one month or more as a result of each child-birth and if so, for how long. For segments prior to the "last" birth, the interview allowed for the reporting of two simultaneous jobs: a main activity and a secondary activity. For the period following the last birth, up to five jobs, undertaken either simultaneously or sequentially, could be reported.

At or near the end of the survey fieldwork, focus group discussions were conducted in each site. Participants were selected from the respondents interviewed in the survey. Each focus group consisted of seven to nine participants and was homogeneous with respect to whether the participants had small or large families. Only one spouse was chosen from a particular couple. Altogether 12 focus group discussions were held in each of the two research

sites, three such discussions with participants having small families and three with participants having large families. The guidelines for discussion about the impact of family size on women's employment focused on such issues as whether or not most married women in the research areas worked outside the home, the type of the work they did, whether children (particularly young children) prevent or interfere with the mothers' work, and if so, in what ways. The focus group method enables considerable flexibility for probing into details of issues emerging during the discussions. At the same time, the use of a common set of guidelines gives a uniform structure to the discussions and enables broad comparisons to be made between groups. The discussions were tape-recorded and fully transcribed for analysis.

As a result of the project's design, small and large families are only moderately different with respect to most demographic characteristics (other than family size). The vast majority of both small- and large-family couples expected no more children (95 and 97 per cent, respectively) and thus can be considered to have completed child-bearing. The average age of the couples' children is also relatively similar (close to 17) although the average age of the oldest child is somewhat higher and the average age of the youngest child is somewhat lower in large families than in small families. Couples with large families tend to be married somewhat longer on average than those with small families (23 years compared with 21 years).

Small-family couples tended to be characterized by somewhat better socio-economic background than those with large families. They had slightly more education (measured as years of schooling) and tended to possess fewer modern consumer goods in the household. The couples also differed with regard to their primary source of income. Although the majority of both groups depended on farming (mainly growing rice but also some other cash crops), a relatively larger proportion of the small-family group did so compared with those with large families. In contrast, more large-family couples were involved in wage labour than those with small families. These differences could potentially have some bearing on the economic activities of women.

Reproduction and work

Table 1 summarizes the employment status of the women in the sample during different segments of the family-building process. During each segment, from the time prior to marriage to the time after the birth of the last child, the percentage of those who engaged in any productive activities is very high. This is true regardless of the number of living children that the women have. In fact, all women (100 per cent) worked for wages at least during one segment since marriage.

Table 1: Percentage of women who worked before marriage, from marriage to birth of first child, between births and after birth of last child, by family size

Time segment	Number of living children			
	1-2	4	5	6+
Before marriage	99	99	99	100
Marriage to 1st birth	97	97	100	98
1st to 2nd birth	93	95	97	83
2nd to 3rd birth	–	96	97	93
3rd to 4th birth	–	96	98	93
4th to 5th birth	–	–	98	93
5th to 6th birth	–	–	–	96
After last birth	100	98	97	91
Number of women	306*	169	92	44

Note: * Of this number, 26 had only one child.

Qualitative data from focus group discussions confirm our survey results. Participants in all groups reported that it was usual for women in their villages to work after marriage and between and after the birth of their children. Indeed, work seems to be almost as common for women as it is for men. The women work "just like their husbands." The difference (or disadvantage, according to some participants) is that women have to stop working at childbirth and during at least part of the time when they are taking care of young children. Other than this, women and men are similar in their economic activity. Virtually all women work whether they are from rich or poor families and whether they have a small or large number of children. Thus, our findings, both from the survey and from focus group discussions, confirm the universality of economic activity among rural Thai women.

Interruption of work

In a situation whether virtually all women work during their reproductive years as in the case in rural Thailand, interruption of economic activities in connection with child-bearing typically lasts for a relatively short duration following the birth of each child, As shown in table 2, women are prevented from being engaged in economic activities on average for about three months following the birth of a child (the median values range from 2 to 3.7 months). There are only minor differences in work interruption with respect to family size and the order of the birth. After this period of rest, most women are able to return to productive work, but probably with less than full intensity (see

Table 2: Median number of months the mother is not economically active in her main occupation following the birth of a child, by order of birth and family size

Order of birth	Small family		Large family	
	Median	N	Median	N
After 1st birth	3.5	302	2.9	306
After 2nd birth	3.4	281	2.9	302
After 3rd birth	2.1	45	3.0	303
After 4th birth	–	10	2.8	306
After 5th birth	–	2	3.7	162
After 6th birth	–	2	2.0	73

Notes: Includes women who were not economically active during the entire reproductive segment. Since family size refers to the number of living children, some women in the small family category had more than two births. Results based on fewer than 20 cases are not shown.

below). The relatively short duration of the economically inactive period after the birth of each child is confirmed by focus group participants.

> *"A month or two after child-birth they (mothers) work."*
> (Large family group, Central)

> *"We stopped working during the* yu fai[4] *period for one month."*
> (Small family group, North)

There is, of course, some variation among women in the duration of economic inactivity following child-birth. While for many it lasts only a few months, others wait longer before they resume working. A few women even cease working during the entire interval to the next birth. Nevertheless, the interruptive effect of having children is largely limited to a period of rest during the few months following child-birth and thus for most women is rather short.

It should be noted that table 2 does not directly indicate the effect of family size; rather it shows the effect of each birth on women's employment. However, it is implicit from these results that, if a woman is prevented from economic activities for some period of time for each birth, a larger number of births (i.e. large family size) will result in a longer cumulative inactive period for that mother than for women who have fewer births.

A focus group discussion in rural Thailand helps to generate useful information about the impact of child-bearing on women's economic activities. (Photo by Napaporn Havanon)

Indeed, calculation of the median cumulative length of time that women were economically inactive following child-bearing throughout the period from the first birth to 12 months after the last birth reveals a substantial difference associated with family size.[5] The median length of economic inactivity during the entire reproductive span as so defined is 19.3 months for women with large families as compared with 9.1 months for women with small families.

Interference with work

Beyond the short duration of economic inactivity following child-birth, the added responsibility of child care typically interferes with work rather than totally preventing women from undertaking their economic activities. Focus group participants frequently reported that mothers of young children do work, but that the need to care for their children often was a source of interference with their work. In general, the focus group participants believe that the extent to which child-rearing interferes with the mother's work depends on the age of the child and, to a limited extent, the availability of child-care help.

The breast-feeding period is the time when interference in the mothers' work is the greatest. This period of maximum inconvenience lasts until the child weans which typically takes more than a year. A recent national survey indicates that the median duration that a child is breast-fed in rural Thailand is 16 months (Knodel, Chayovan and Wongboonsin, 1990). Comments by focus group participants about the difficulties of working when a child is very young often were linked to the fact that the child was still being breast-fed.

> *"It's not convenient [to go to work if children are very small]. We have to breast-feed them."* (Participant 1)
>
> *"If we still breast-feed them we, we can 't leave them."* (Participant 2)
>
> *"During the period of breast-feeding, we have to be with the child all year long. We can leave them only when they area year old"* (Participant 1)
>
> (Large family group, Central)

Although many mothers breast-feeding their children can and do work, they still need to breast-feed them at the same time they are attending to their economic pursuits thus distracting the mother from her work. Only when the child is sleeping can the mother fully concentrate on work.

Discussion among the focus group participants indicates that it is not uncommon to take a very young child to the work place (usually the ricepaddy), but that this is not without considerable inconvenience.

"We lead a d[fficult life in rural areas. We have to carry the baby with us [to the rice fields]. We make a hut to protect (the child)." (Participant 1)

"We make a cradle out of a sarong (ankle-longth skirt cloth)." (Participant 2)

"Babies delay the work." (Participant 3)

"Mothers are not as efficient as possible." (Participant 4)

"Sometimes they hold to us and we can't reap the rice stalks." (Participant 5)

"Some babies sleep for just a few hours. When they are awake, they don 't let mothers work. They cry." (Participant 3)

(Large family group, Central)

"When the child is still very young (not weaned), the mother can work only when (the child) is sleeping."

(Small family group, North)

"If the child is easy to care for, that helps because he'll sleep quite long. Sometimes he'll get up to be fed just once every three hours. But if it's a difficult child, he'll be crying before we have finished transplanting two bunches of sprouts and we have to go tend to him. Then, when he sleeps, we resume."

(Large family group, Central)

"[We are] very busy! While the mother works, the child needs help. Now food, now drink. Mother has to frequently leave her work to take care of the child. She can't work fully."

(Large family group, North)

In general, focus group participants agreed that after the child is weaned, the mother is considerably freer to engage in economic activities. Yet, there are different views as to how old the child must be before the mother can enjoy more freedom to work. Although constraints on women's work are reduced substantially after the child is weaned, the problem of interference is not completely eliminated. If a mother takes a young child with her to work away from home, she still has to worry about the child and is periodically distracted from her work by the child's needs. The period for which all agree that mothers will be free to engage in economic activities is when the child has gone to school.

"If we don't keep an eye on them, they may disappear in the hay-stack or the rice-field".

(Small family group, Central)

Working mothers in rural Thailand have to adjust their schedule to suit the needs of their children, especially when they are breast-feeding. For some, it means taking their children into the fields with them so that they are available to them throughout the day. (Photo by Napaporn Havanon)

"When the kids go to school, we can go to the rice-field without any problem. We hire teachers to take care of our children".

(Large family group, Central)

There are also other ways to cope with child-rearing so that the mother can engage in economic activities. It is commonly argued that other family members can serve as substitutes for child care and thereby reduce the extent of interference in women's work activities (e.g. Standing, 1983).

Discussions among focus group participants indicate that this is also the case in rural Thailand. Some focus group participants pointed out that the availability of grown children, grandparents and, to some extent, other relatives of the couple can help to alleviate the problem of interference. However, there are a number of constraints on the extent to which couples can rely on substitute child care. For example, the close maternal involvement required when the mother is still breast-feeding, makes child-care substitution by other family mernbers more difficult when the child is very young.

According to focus group participants, older children are considered dependable as providers of care for younger siblings only after they reach the age of 10 or so. Given that children in Thailand remain in school at least until age 12 or 13, the extent of help provided by older siblings with respect to child care is likely to be minimal. By the time the oldest sibling finishes schooling, the youngest is usually past the age when intensive care is needed.

While focus group participants share the opinion that they can ask for child-care help from grandparents and other relatives, they. hesitate to do so on more than an occasional basis. It was not uncommon for participants to express reservations about imposing on others for help with taking care of children.

"Can't you have your parents help [take care of infants]?" (Moderator)

"We breast-feed them." (Participant 1)

"They can help when the child is two or three." (Participant 2)

"After weaning." (Participant 1)

"After they are weaned, our parents can help." (Participant 2)

(Large family group, Central)

"Asking our parents to take care of our children is unfair. They raised us in the past; now they are asked to look after our children. That's a pity. It's alright to have them help occasionally."

(Large family group, North)

In recent years, kindergarten or preschool classes have become available in some rural schools, relieving mothers of their need to be with their children during the day. Such services increase the availability of mothers for work.

Children aged three to four years old are usually accepted by such schools. Nonetheless, since parents have to pay school fees as well as provide lunch money for their children, it is difficult for low-income parents to take advantage of these facilities. However, in the case of the focus group participants, kindergarten or pre-school classes rarely existed at the time when they were rearing their children. Therefore, most did not enjoy daytime freedom from child care until the children began primary education at the age of six or seven. Possibly for this reason, one of the participants referred to an old saying: "Having one child makes you poor for seven years".

The discussion based on the focus group data points to the fact that, in a situation where all women work such as that of rural Thailand, interference due to children may have a substantial effect on women's labour force participation.

Although children do not prevent women from working, the interference caused by child-care needs could reduce the mothers' productivity to the point where the family's well-being is affected. Moreover, the cumulative effect of interference over the reproductive span would be greater for women with large families than for those with small families.

Even though a precise estimate of this effect cannot be provided from the present study, it seems reasonable to suggest that family size is related to the cumulative duration of time that children interfere with women's economic activity. Focus group participants seem to concur.

"It takes four or five years to care for five babies but it takes only two or three years to care for just two of them. With five of them, you can't get rid of them easily."

(Small family group, North)

"Suppose we have two children, the wives will spend at most a year or two looking after them. If there are four or five, it means four to five years before the wives can go out to work."

(Small family group, Central)

Some focus group participants indicated that husbands may need to stay home on occasion to care for the child so that the mother can go out to work. More commonly, however, participants mentioned that during the period that child care interferes with the wife's work, the husband's workload tends to increase since the husband often has to substitute his labour for the work that his wife would otherwise do.

Some male participants mentioned that in addition to hard work in the field, they had to do some household work because their wives were tied up with the children. Thus, during the period of intensive child care, particularly from birth to the weaning of the child, husbands are under pressure to compensate for the wife's reduced economic role.

> *"It is certainly hard work for the husband because he has to work more while his wife can help but a little."*
>
> (Large family group, Central)

> *"With young children around, both mother and father are busy. The father has to work harder since the mother can hardly work. In addition, the father has to help in taking care of the children."*
>
> (Small family group, North)

> *"We (husband and wife) used to work together. After having a baby, the husband has to work alone, he must work twice as much as he used to do".*
>
> (Small family group, Central)

Effect on type of work

In order to explore the effect of family size on the types of work women do, table 3 compares women with small and with large families in terms of the characteristics of their main economic activity. Two selected segments of their reproductive spans are examined: between marriage and first birth and after last birth. The first segment has been selected to represent the time when reproduction and family size would have no effect on either group of women while the latter segment should reflect any effects of child-bearing as well as family size.

Table 3 reveals that tile women in both groups are generally similar with respect to most aspects of the type of work they do. In those few aspects where differences are observed, they are relatively minor. Thus, the survey results suggest that there is little effect from child-bearing or family size on the dimensions of work measured. In both of the reproductive segments examined, women with small families are generally similar to those.with large

Table 3: Selected characteristics of women's work between marriage and birth of first child and after birth of last child, by family size (per cent)

	Between marriage and birth of first child			After birth of last child		
	Small family	Large family	All families	Small family	Large family	All families
Of all wives:						
Economically active	97	98	98	100	97	98
Of economically active wives:						
Doing more than one economic activity	79	78	77	91	87	89
Type of main economic activity						
Growing rice	71	61	66	64	59	62
Growing other crops	10	13	11	12	15	13
Wage labour	9	17	13	11	19	15
Other	10	8	9	13	7	10
Total*	100	100	100	100	100	100
Working in family enterprise for main activity	84	78	81	83	79	81
Place of main economic activity						
Home	3	4	4	8	5	6
Village area	78	75	76	74	76	75
Outside village	13	13	13	12	9	11
Combination of above	6	8	7	6	9	8
Total*	100	100	100	100	100	100
Working in seasonal main economic activity	90	89	89	86	91	89
Working on a daily basis	94	94	94	92	90	91
Working full days	97	98	97	95	94	95

Note: * Total of distribution may not add to 100 per cent because of rounding.

families with regard to the following characteristics: place of work, seasonal nature of work, whether or not they worked in a family enterprise, and whether they worked on a daily basis and whether they worked full days.

The difference in the percentage of those who engaged in more than one economic activity before the first birth (77 per cent) and after the last birth (89 per cent) undoubtedly reflects differences in exposure time to work since the length of the two segments is not equal. The segment after the last birth is far longer, extending from the last birth to the time of the survey.[6]

Consequently, women are exposed to a longer period during which job changes could occur than during the segment between marriage and first birth. Since the main and the secondary activities can be sequential, women have greater opportunity to participate in more than one activity during this longer segment. Thus, it is not possible to attribute the difference observed to the effect of reproduction.

Although some difference is evident in the type of main economic activities between women with small and women with large families, the fact that a similar pattern of differences exists both between marriage and the birth of the first child and after the birth of the last child suggests that family size produces no effect. Rather, the differences are likely to stem from the different economic backgrounds of the women in the two groups.

Women who have a small number of children come from better off families judging from the fact that a larger proportion of them engaged in growing rice and a smaller proportion depended on wage labour compared with women in the large family group. Indeed, this difference in family background between small family couples and large family couples is clearly noted in an analysis of family size and wealth accumulation drawing upon the same data set as the one used in this study (Havanon, Knodel and Sittitrai, 1990).

Given that family size would potentially affect the type of economic activities of the women, it is worth considering why so little difference is evident between women with small and with large families at our research sites. While a full explanation of this cannot be reached within the scope of our survey and focus group data, one possible reason for the lack of difference may be the limited types of employment opportunities in the two areas where the research was conducted.

Information from focus group discussions and the survey indicate that

family farming (growing rice and other crops) is the major economic activity of most women in the sample. This work is supplemented by wage labour (mainly agricultural), and to a limited extent by handicraft (cloth weaving and embroidery in the North), and small trade (e.g. running a shop in the village or selling vegetables in the market). There is little variation between the regions and across the sample villages. In view of these limited opportunities, women do not have a wide choice in the type of work they can do.

> *"Around here, there (are no other jobs], only working in a field or on a farm."*
>
> (Small family group, Central)

> *"If we had a lot of children and there was a clothing factory near here, we could take some clothes to sew at our own house. But in reality, we have no such factory here."*
>
> (Small family group, North)

While qualitative data from focus group discussions do not contradict the survey findings presented above, they shed some additional light on the issue by indicating that child-rearing itself, especially when the child is young, rather than family size affects the type of work the mother does. Most participants in the discussions were aware that mothers with very young children (not yet weaned) cannot do wage work which requires full and continuous participation of the worker. They were also well aware that it is difficult for breast-feeding mothers to engage regularly in economic activities away from home unless it is possible to bring children with them to the work place. Women expressed these concerns regardless of their family size.

> *"With very young children mothers cannot do wage work".*
>
> (Large family group, North)

> *"A mother [with a young child can] tie onions. If her child is still small, she has to take it along with her. She cannot leave it at home. The baby must be able to sit by itself so that we can take it with us. We'll take a mat and put the baby on it."*
>
> (Small family group, North)

> *"[With young children] if the work is to be done at home, it is possible, but for work in the field, it's a problem".*
>
> (Small family group, Central)

Evidently the effect of child rearing on type of work is shared by women with small and large families alike. Considering the limited availability of employment and women's readiness and willingness to work, it is reasonable to

conclude that family size in itself has little impact on the type and characteristics of economic activities of the women in the research areas. This is not to deny, however, that the rearing of young children exerts an influence on some aspects of women's work activities.

Discussion

Couples at our research sites view women's work as an economic necessity. Devoting time exclusively to child-rearing, without contributing to the economic activities of the household, is not perceived as a real alternative for most mothers. Few couples in our sample could be considered wealthy. For those who were quite poor and lived barely above the subsistence level, the wife's economic contributions were a matter of survival. Many others, although they were relatively better off, shared a widespread sense of economic hardship stemming from rising material aspirations and increased desires to educate and provide welI for their children. In this context of a perceived necessity for both the husband and wife to work, couples relied on a number of mechanisms which, in varying combinations and degrees, permitted them to cope with the pressure of child-rearing on the economic activities of the mother. As the focus group discussions made clear, each had its limitations.

Grandparents or close relatives could provide day care, especially if they were co-resident or lived nearby. Older children who were not in school could also help to care for younger siblings. In some cases, child care could be hired in the village or children could be left at nursery school or kindergarten. Primary schools served the function of providing care once children reached the age of six or seven. Women could modify their work schedule and husbands could share some of the burden of child-rearing and housework. Mothers could bring the child to the fields or work place and watch over the child while working. Most of these mechanisms, however, could be turned to by couples with small and large families alike. Hence, only modest effects of family size on women's work are evident.

A general conclusion that can be drawn from this study is that reproduction does not prevent rural Thai women from working, but does have some impact on women's work through temporarily interrupting economic activity and through young children interfering with their work after economic activity is resumed. To the extent that interruption and interference cumulate with each birth, it can be said that family size also has an impact. Thus, as far as rural Thailand is concerned, the relevant question regarding the relationship between family size and women's employment is not whether women work during their reproductive years but rather how much they can work and how productive is their work.

Evidence that couples at our research sites generally perceive family size as affecting women's work and, in particular, that having a large family detracts more from economic activities than having a small family is provided by responses to an opinion question on this issue that was included in the survey. Women with small families were asked if they thought they would have worked more or less than they actually did if they had had four or five children. Those with large families were asked if they thought they would have worked more or less than they actually did if they had had only two children.

The results indicate that there is overwhelming consensus that more work can be done if family size is kept small. Among women with small families, 95 per cent replied that they would have worked less if they had had four or five children while 90 per cent of women with large families said they would have been able to work more if they had had only two children.

These perceptions expressed by the survey respondents fit well with the more detailed discussions of the focus group participants. It seems reasonable to assume that the responses indicating that large families permit women to work less probably reflect an awareness that having additional children implies additional periods of interruption in work following child-birth and additional periods of interference while children are still young. They also suggest that the respondents do not feel that the various mechanisms that they use to cope with the competing demands of child-rearing and economic activities of the mother completely solve the problem.

The extent to which our findings, based on two. rural sites in Thailand, can be generalized is an empirical question. The impact of child-bearing and family size on women's economic activity is likely to be contingent on the socio-economic and cultural setting. Thus, even within Thailand, women in urban areas, where the structure of economic activities is quite different, or women belonging to ethnic and religious minorities with different cultural values, will not necessarily share the experiences of those at our study sites. Nevertheless, there are undoubtedly large segments of the rural population in developing countries where women's participation in economic activities are the rule and where conditions surrounding child-rearing and women's work are not so very different from the situation in rural Thailand.

Policy implications

Results of our research make clear that rural Thai women need to be engaged in income-earning activities which contribute to the economic well-being of their households. At the same time, they have the primary responsibility for child-rearing, particularly when the child is young. These combined responsibilities create considerable strains for working mothers.

Over the last two decades, the promotion and provision of the means for family planning by the Thai Government have permitted women to limit their family size to the number of children they wish to have. This has facilitated a reduction in the cumulated duration of time during which women are under the joint strain of work and child-care. Government policy has also promoted the country's economic development. Of particular relevance for the current study has been the extensive commercialization and diversification of agriculture that has been taking place. One result has been an expansion of the variety of income-earning activities available for rural women. For example, wage labour is currently demanded in the production of various cash crops throughout the year. Nevertheless, the types of women's employment that do not compete with child-rearing are still limited at the research sites.

Several policy recommendations are implicit in our findings. First, family planning services should continue to be promoted and kept easily accessible to rural Thai women. Second, in addition to the usual wage labour associated with agro-industrial enterprises, consideration needs to be given to the development and expansion of types of employment that are more compatible with child-rearing, especially jobs that can be done at home for rural women. Third, programmes need to be implemented to reduce the strain between work

The promotion of jobs in rural areas should take into consideration the needs of women to be at home with children not yet old enough for school.

outside the home and child-rearing so that women can more fully benefit from the economic development that is underway. Perhaps the most obvious example of such programmes would be the expansion of nursery centres and kindergartens in rural communities which can serve the function of child-care, alleviating the strains on working mothers while providing an educational headstart for the children.

In implementing such a programme, the actual circumstances of women's work in the rural setting needs to be taken into account. For example, where many women are engaged in agricultural wage labour, they often must start work very early in the morning, before nursery centres or kindergarten would normally open. Thus, provision for child-care during these early hours should be combined with the expansion of the preschool facilities. This could involve hiring local woman to tend to the children for the two- or three-hour gap before the facilities formally open and when the mothers leave for the fields.

It is also important that child-care service, including preschool centres, be made available at a low cost since pay is generally quite low for agricultural labour, especially for women. In practice, this will probably mean that these costs will need to be subsidized by the local or national Government, at least for those mothers in the lowest economic strata.

Some tension between the need for women in third world rural settings such as Thailand to engage in economic activities and their responsibilities for child care as mothers of young children is inevitable. Informed private and governmental programmes, however, can contribute to the improvement of the situation by helping couples limit the number of children they have to their desired family size, by promoting a wider range of types of employment, and by helping provide alternative means of child care during the hours that women work outside the household.

Footnotes

1. The project, entitled the Socio-economic Consequences of Fertility Decline for the Thai Family (SEC), was conducted by the Institute of Population Studies, Chula-Iongkorn University. Fieldwork was carried out during the first half of 1988.

2. A focus group consists of a small number of participants recruited from a specified target population to discuss topics relevant to a particular research study. As such it serves as a tool for collecting qualitative data. The discussion is typically guided by a trained moderator using predetermined guidelines specifying the topics to be covered. As a field method, it has the advantage of being flexible and thus allowing plenty of leeway to follow up unanticipated topics germane to the theme of the discussion. In addition, it enables interaction among participants which helps to verify information

and elicit personal attitudes and views (Goldman and McDonald, 1987; Knodel, Pramualratana and Havanon, 1988).

3. See Knodel, Podhisita and Sittitrai (1.988) for the exact specification of the eligibility criteria and their rationale as well as a complete reproduction of the questionnaire and the logic behind the key questions.

4. The Thai words *yu fai* mean the time immediately after giving birth during which the mother lies by a fire or over hot bricks for variable periods of time, typically one or two weeks; in certain localities, this practice lasts up to a month. It is a traditional practice believed to help dry up the mother's womb and cleanse her blood, thus restoring the woman's health. The practice was widespread in rural aeas of all regions of Thailand in the past, but currently is disappearing.

5. If, after the last birth, a woman stopped working longer than 12 months, her inactive period is taken as 12 months. In other segments, however, the actual duration (in months) of economic inactivity is taken. If during any segment prior to the last birth a women did not work at all, the length of the entire segment is considered as economically inadtive. Note that, since we are referring to the median of the cumulative amount of time inactive, it is not simply equal to the sum of the medians associated with each birth order within each specific category of total numbers of births.

6. The mean age of the youngest surviving children (most of whom were the last born) is 15.1 years for couples with small families and 10.3 years for those with large families.

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Effect of Famine on Child Survival in Matlab, Bangladesh*

Famine is defined as widespread food shortage leading to a significant rise in regional mortality (Blix, 1971). Historically, major causes of famine have been natural calamities. However, in modern times, when a natural disaster causes insufficient production of food, political and social factors play an important role in determining whether famine becomes widespread and who is affected (Alamgir, 1980; Langsten, 1985; Sen, 1980).

The 1974 famine in Bangladesh was one of the most severe of modern times. More than 1.5 million excess deaths reportedly occurred as a consequence (Alamgir, 1980; Sen, 1980).

Studies have found that the effect of famine on mortality depends on the socio-economic status of families and the demographic characteristics of individuals. The effect of famine is especially severe among the poor (Razzaque, 1985; Sen, 1980) and among the very young and the elderly (Chen and Chowdry, 1977; Chen, Huq and D'Souza, 1981; Razzaque, 1985 and 1989). D'Souza and Chen (1980) have documented that, among children under 14 years of age, during the Bangladesh famine of 1974, females suffered higher mortality than males.

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The excess mortality associated with famine usually continues for a time following the famine. A short while after that period, the death rate can fall below the pre-famine level (Bongaarts and Cain, 1981; Watkins and Menken, 1985). The sustained effect of famine on mortality is generally attributed to such factors as malnutrition, spread of infectious disease associated with generally lower resistance to disease, unsanitary conditions associated with floods, shortage of medical supplies and disruption of the infrastructure. The lower-than-usual level of mortality in the period following the period of sustained higher mortality may be due to premature death (including intrauterine mortality) of the more frail members of the population during famine, which results in a healthier surviving population.

Razzaque and his colleagues (1990) found that mortality was higher up to the second year of life for the children born during famine, compared with the non-famine cohort, whereas mortality in the cohort conceived during the famine was higher only for the first year. Thereafter, the children born during the famine and the children conceived during the famine experienced lower mortality compared with the children conceived after the famine.

The period of famine is also associated with a higher-than-usual rate of out-migration (Razzaque, 1985). Families whose survival is in danger apparently are more likely than others to move away from the area affected by famine. Accordingly, the level of mortality in the famine area is affected by the level of out-migration.

This paper examines how the level of child mortality and rate of out-migration, and their covariates were affected during the 1974 famine and the periods immediately following the famine in Bangladesh.

Data

The data are from Matlab, a rural area of Bangladesh, where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) has maintained its Demographic Surveillance System since 1966. The Matlab field research area is in the low-lying deltaic plain situated 70 kilometres south-east of Dhaka.

The population covered by the surveillance was 276,000 in 228 villages at the time of the 1974 census. The population density in that area exceeds 2,000 persons per square mile.

Farming is the dominant occupation of the study population, and fishing is the second most common occupation. The average educational level is low, and sanitation in the villages is poor (Razzaque, 1989). The nutritional status of the children under age 5 is very poor. About 56 per cent of the children

weigh less than 70 per cent of the normal weight for their age group as measured by National Child Health Survey growth curves (Bhuiya, 1983).

The Demographic Surveillance System maintains continuous registration of births, deaths, migrations, marriages and divorces, and it conducts cross-sectional censuses as well. Details on field operations have been reported elsewhere (Cholera Research Laboratory, 1978; Razzaque, 1985).

For our study, children under three years of age as of 1 July 1974 and children born between July 1974 and June 1977 were selected. The basic data consisting of dates of birth, death and out-migration are extracted from the Demographic Surveillance System, and are believed to be accurate.

Characteristics of families were extracted from the census of May 1974 and merged with the basic demographic data. Some community variables have also been added to the data set. Using these data, mortality and out-migration are analyzed in the three-year period from July 1974 through June 1977.

Methods

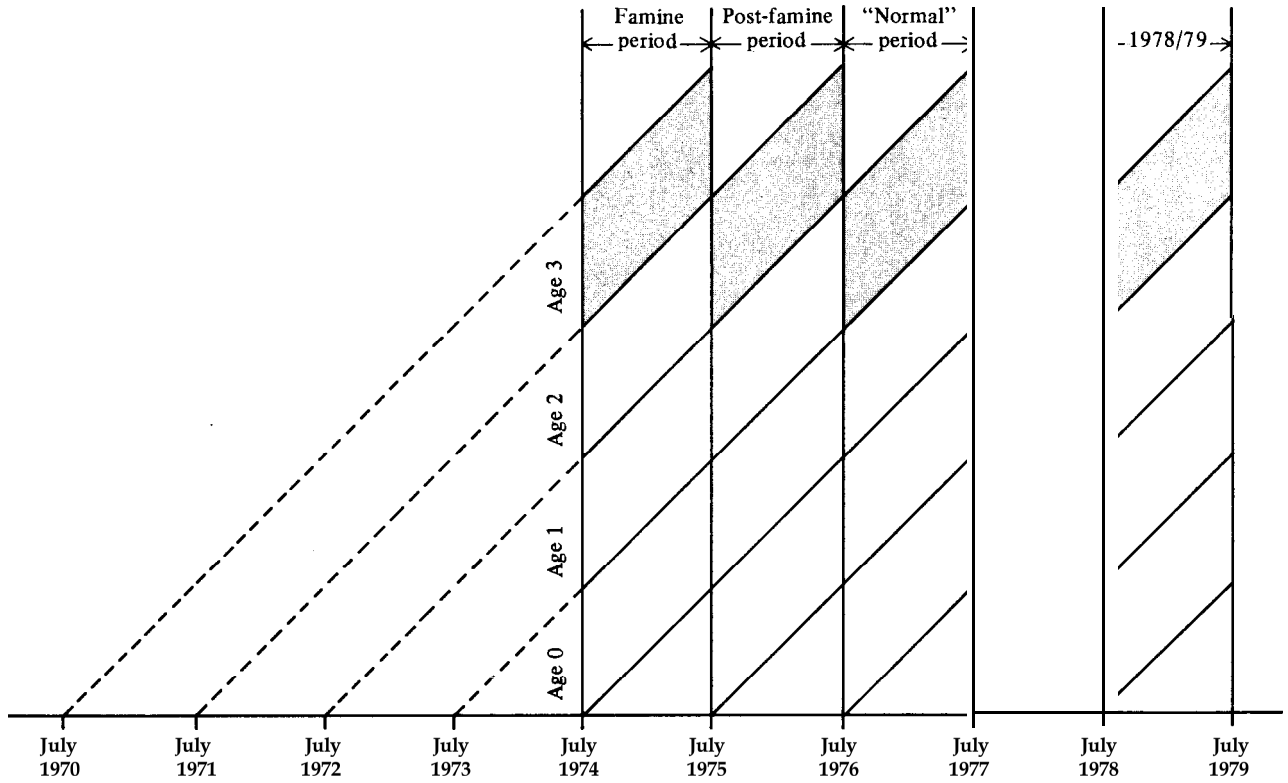
The three-year period is divided into three sub-periods: the famine period from July 1974 to June 1975; the post-famine period from July 1975 to June 1976; and a "normal" period from July 1976 to June 1977. Figure 1 shows a Lexis diagram of population and events covered by the study.

The analysis consists of a series of multivariate models, one model for each single year of age. For each model, three cohorts of children who were surviving at the beginning of each of the one-year periods have been selected. The dependent variable is the status of children at the end of the one-year period. The status is categorized as one of the three possible outcomes: death during the year, out-migration during the year, or survival. Using the multinomial logit model (Maddala, 1983; Choe, 1989), we estimate the age-specific probabilities of death, out-migration and survival, and the effects of covariates for children aged 0, 1, 2 and 3 at the beginning of each of the three sub-periods. For purposes of comparison, age-specific probabilities of dying are also calculated for the period July 1978 to June 1979.

For example, to estimate the effects of the famine and other covariates on three possible outcomes, namely, death, out-migration and survival, from age 3 to age 4, three birth cohorts who were aged 3 at the beginning of the three sub-periods are analyzed (see figure 1).

The birth cohort of July 1970 to June 1971 (for convenience, this cohort is called the 1970 birth cohort) was aged 3 at the beginning of the famine period. The 1971 birth cohort was aged 3 at the beginning of the post-famine

Figure 1: Lexis diagram depicting age-specific probabilities of dying and out-migration for children aged 3 for famine, post-famine, "normal" and 1978/79 periods



period, and the 1972 birth cohort was aged 3 at the beginning of the "normal" period .

These three birth cohorts are analyzed together to estimate the effects of famine as well as other covariates of the mortality and out-migration for the three-year-old.

Each period is defined as a 12-month period so that the analysis would not be affected by the seasonality of births and deaths. Demographic events in Matlab show very clear seasonality associated with farming activities. Births are concentrated in December and January, reflecting high marriage and conception rates during the spring following the major winter harvest (Becker, 1981a, 1981b).

Figure 2, which plots the number of births by month for the period July 1970 to June 1977, shows this seasonality of births, which was disrupted somewhat during the famine.

Figure 2: Number of births by month of birth: July 1970 to June 1977, Matlab, Bangladesh

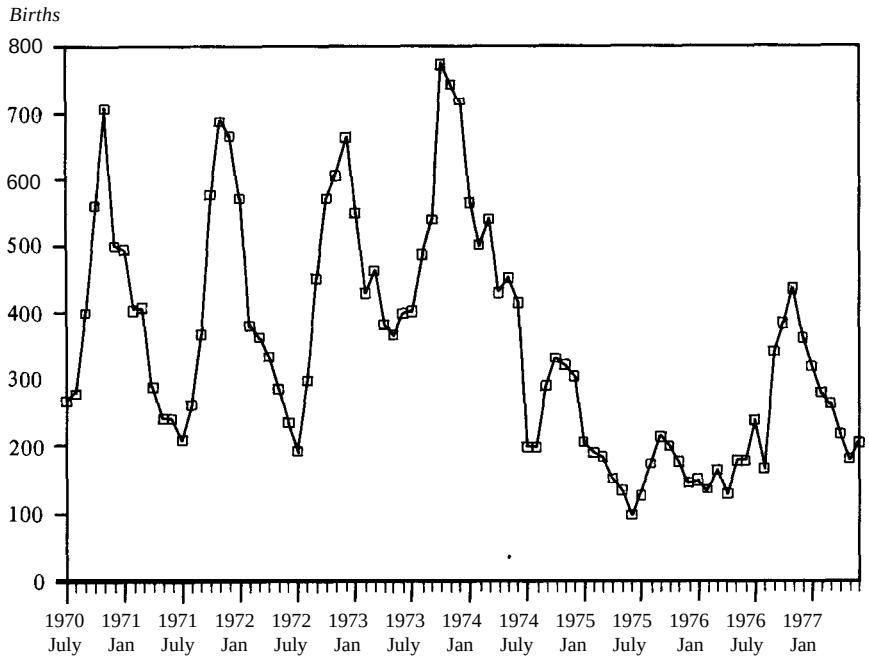
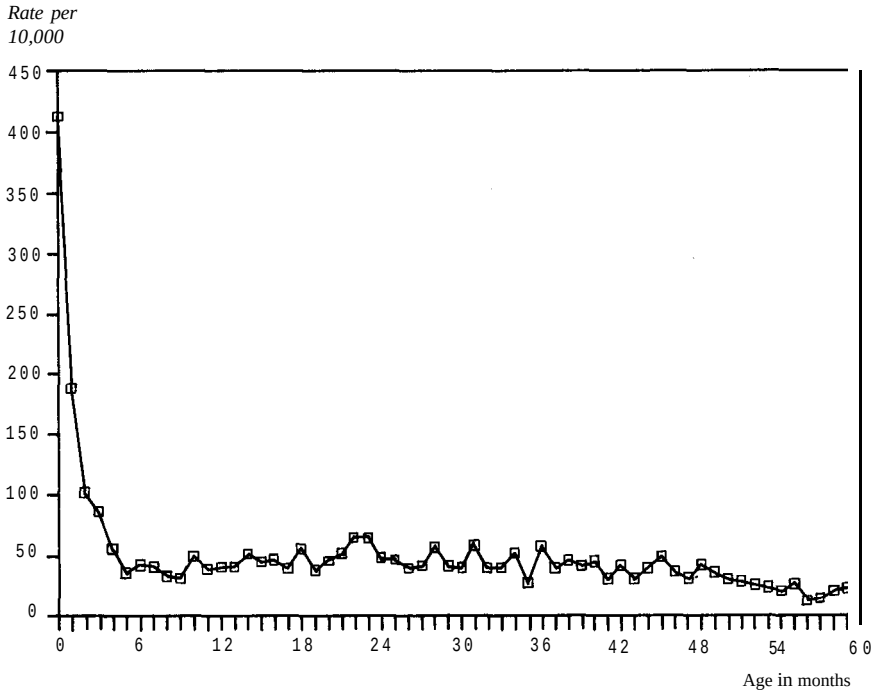


Figure 3: Monthly age-specific death rates: July 1974 toJune 1977, Matlab, Bangladesh



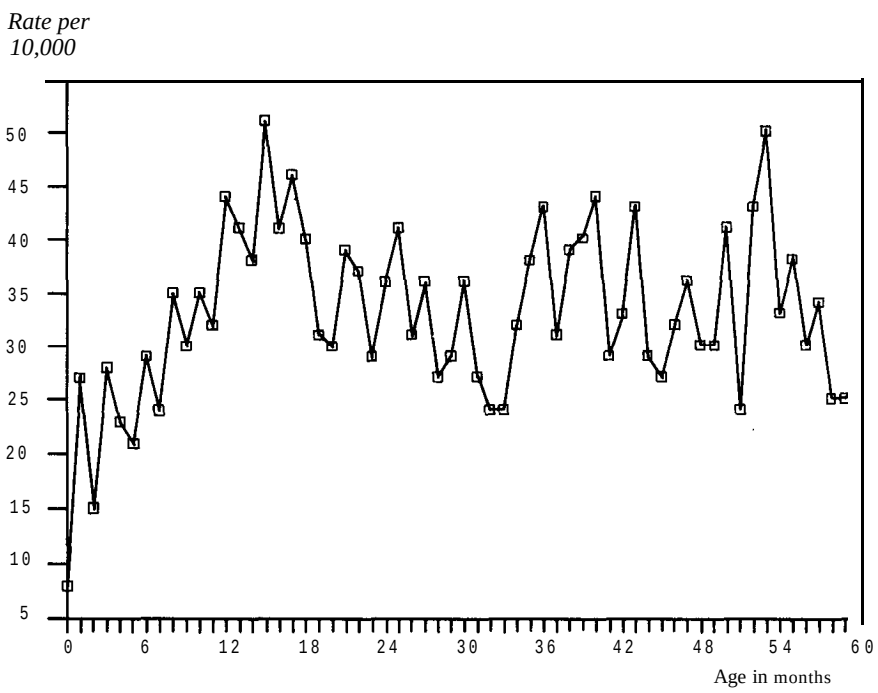
Figures 3 and 4 show overall age-specific death rates and out-migration rates. With regard to the quality of data, there is no evidence of data heaping or other severe problems.

Covariates of mortality and out-migration

The model includes two dummy variables indicating the famine period (1970 birth cohort) and the post-famine period (1971 birth cohort). The effects of the famine and post-famine periods are estimated through these dummy variables.

The model also includes other covariates we believe to be associated with mortality and out-migration rates, and the interaction terms between the dummy variable indicating the famine period and other covariates. Not included are the interaction terms between the dummy variable indicating the post-famine period and other covariates because we do not believe that

Figure 4: Monthly age-specific out-migration rates: July 1974 to June 1977, Matlab, Bangladesh



the effects of other covariates differed significantly during the post-famine period compared with the "normal" period. The covariates of mortality and out-migration consist of community characteristics, socio-economic conditions of the family, and the age and sex of children.

Socio-politica! characteristics of the community are represented by a dummy variable indicating whether any resident in the same village was a member of a local union council. Members of local union councils are responsible for informing the people of the time of arrival of relief food. Therefore, if a village resident is a member of the union council, the residents of the village may be informed of the coming relief sooner than the residents of other villages.

Three covariates describing family characteristics are included in the model: living standard, education and mother's religion. Living standard is measured by the number of items owned by a family from among the following:

radio, watch, hurricane lamp, quilt and remittances. The number of such items is recoded under two categories, 0 for one or none, and 1 for two or more items. The mortality and out-migration rate is hypothesized to be higher among families not owning many household items.

The level of education of the family is also included in the model. A higher level of education attained by any member of the family should improve the level of health of each member of the household through better information, adoption of modem technologies and utilization of services such as health centres. The educational level of the family is coded as 1 if any member of the family had some formal education; if not, then it is recorded as 0. It is hypothesized that children from a family with more education had lower mortality and a lower rate of out-migration. The mother's religion is used as an indicator of whether the family belongs to the majority religious group (Muslim). It is hypothesized that the families of the minority group (Hindu) had higher mortality and migration rates.

As individual characteristics, a dummy variable indicating whether the child is male (value 1) or female (value 0) is included in the model. In Bangladesh, female children are found to receive nutrition and health care that are inferior to that of male children (D'Souza and Chen, 1980). Table 1 shows the list of covariates with descriptive statistics.

Results

After trial runs, the interaction between the variables indicating political representation of the community and famine was found to be not significant statistically for all ages. Therefore, it was dropped from the final models.

Table 1: Descriptive statistics of covariates of mortality and out-migration for children aged 0-3, Matlab, Bangladesh

Covariates	Proportions
Community has political representation	0.693
Household has two or more household items	0.406
Someone in family has formal education	0.743
Religion is Muslim	0.869
Sex of child is male	0.516
Number of children	52,045

Note: The characteristics are as of the time of the 1974 census.

Table 2: Estimated multinomial logit regression coefficients of probabilities of death, out-migration and survival by age of children, Matlab, Bangladesh

Covariates	Age 0	Age 1	Age 2	Age 3
P (death)/P (survival)				
Famine period	1.092*	0.952*	0.658	0.239
Post-famine period	0.641*	0.493*	0.818*	1.301*
Community	-0.068	-0.221*	-0.138	-0.243
Living standard	-0.36	-0.305*	-0.255	-0.284
Education of family	-0.16	-0.14	-0.305*	-0.877*
Muslim religion	-0.004	0.282	0.634*	-0.274
Sex is male	-0.168	-0.356*	-0.359*	-0.352*
Famine x living standard	-0.003	-0.281	-0.08	-0.476
Famine x education	-0.31	-0.213	-0.032	0.21
Famine x Muslim	-0.104	-0.144	0.466	0.936*
Famine x male	-0.267	-0.399*	-0.326	-0.234
P (out-migration)/P (survival)				
Famine period	2.776*	2.435*	2.666*	2.764*
Post-famine period	0.258	0.439*	0.337*	0.299
Community	-0.182	-0.084	-0.148	-0.106
Living standard	0.412	-0.012	0.209	-0.059
Education of family	-0.164	-0.183	0.018	-0.439*
Muslim religion	0.43	0.325	0.454	0.938*
Sex is male	-0.035	-0.122	0.196	0.019
Famine x living standard	-0.957*	-0.41	-0.318	-0.346
Famine x education	-0.464	-0.678*	-0.566*	-0.2 1
Famine x Muslim	-1.628*	-1.395*	-1.397*	-1.885*
Famine x male	-0.028	0.304	0.103	-0.004
P (death)/P (out-migration)				
Famine period	-1.684*	-1.483*	-2.009*	-2.525*
Post-famine period	0.383	0.054	0.481*	1.002*
Community	0.114	-0.137	0.01	-0.137
Living standard	-0.772*	-0.293	-0.464*	-0.226
Education of family	0.003	0.043	-0.323	-0.437
Muslim religion	-0.434	-0.044	0.18	-1.212*
Sex is male	-0.133	-0.234	-0.554*	-0.371
Famine x living standard	0.954*	0.128	0.238	-0.129
Famine x education	0.155	0.465	0.534	0.42

Table 2 *(continued)*

Covariates	Age 0	Age 1	Age 2	Age 3
Famine x Muslim	1.524*	1.251*	1.863*	2.821*
Famine x male	-0.239	-0.703*	-0.428	-0.23

Notes: Community is coded as 1 if the child's community has a resident who is a member of the union council; if not, it is coded as 0. Living standard is coded as 1 if child's family owns two or more itmes: radio, watch, hurricane lamp, quilt, or remittances; if not, it is coded as 0. Education of family is coded as 1 if anyone in the family has formal education; if not, it is coded as 0.

Table 2 shows the estimated multinomial logit regression coefficients. The top panel shows the estimated coefficients associated with the probability of dying versus the probability of surviving. The second panel shows the estimated coefficients associated with the probability of out-migration versus the probability of surviving, and the bottom panel shows the estimated coefficients associated with the probability of dying versus the probability of out-migration. The column headed by "age 0" gives coefficients for those who were age 0 at the beginning of the observation, and so on for the other ages.

The results of the multinomial logit regression are also presented in terms of expected probabilities of dying and out-migration for a population with specific characteristics. For example, to see the effect of the famine and post-famine periods on child survival after adjustments are made for other factors, the expected probabilities of dying and out-migration are computed from the estimated model, by substituting the mean values of all covariates except the dummy variables indicating the famine and post-famine periods. For these dummy variables, appropriate combinations of ones and zeroes are used to indicate the famine, post-famine, and "normal" periods. Tables 3 through 7 show expected probabilities computed in this manner. The results are discussed in detail in the following paragraphs.

Effect of famine

Table 3 shows the estimated probabilities of dying and out-migration during three one-year periods: namely, the famine period, post-famine period and "normal" period, by age of children at the beginning of each period. The table is augmented by the implied level of infant mortality rate, a more familiar indicator of mortality, in the top panel.

These infant mortality rates are estimated in the following way. For the infants born during a one-year period, the probability of surviving to the

Table 3: Estimated probabilities of dying and out-migration by age of children in completed years and period

Age	Period	Probability of dying*	Probability of out-migration	Infant mortality†
0	Famine	532	752	3 238
	Post-famine	372	66	1 238
	Normal	200	52	970
1	Famine	437	730	
	Post-famine	300	108	
	Normal	186	70	
2	Famine	272	1 019	
	Post-famine	351	109	
	Normal	158	79	
3	Famine	112	985	
	Post-famine	347	90	
	Normal	97	68	

Notes: * Probability of dying in 12 months for children of specified age in completed years (per 10,000). Using complete life table notations, this probability is equal to 10,000 L(x+l)/L(x).

† Per 10,000 live births. From West regional model life table with matching probability of surviving to the end of the year for infants born during one-year period. See text for details of the procedure.

end of the period ($L_0/1_0$ in life-table notation) is estimated by the same multinomial logit model. Then a West model life table (Coale and Demeny, 1983) with the matching survival probability is found. From the model life tables, the infant mortality rate (q_0 in the life table) is obtained.

Compared with the "normal" period, mortality was substantially higher during the famine as well as the post-famine period for all the ages considered. For children of ages 0 and 1, mortality was highest during the famine, but for children of ages 2 and 3, mortality was highest during the post-famine period. This is not surprising because at ages 2 and 3, most children have been weaned. Their mortality is influenced more by nutrition and sanitary conditions as well as health care when they become ill than by the biological factors the children are born with.

Sanitary and health-care conditions during the post-famine period may have been as bad as or worse than during the famine itself. Moreover, these children were probably weaned during the famine and received inferior nutrition which would have weakened their 'resistance to infectious diseases

prevalent during the post-famine period. Compared with these children, the older children, i.e. those of ages 2 and 3 at the beginning of the famine, were probably weaned before the famine began and thus had the opportunity to grow and build resistance to hardship before the famine.

It may be seen that the increase in the probability of out-migration is greater than the increase in mortality during the famine, especially for older children. It may be concluded that, when children are old enough, they may avoid excess mortality partly by moving away from the area affected by the famine.

Designating the period July 1976 to July 1977 as the "normal" period needs to be interpreted with caution. This period, which immediately followed the famine and post-famine periods, may show a somewhat lower level of mortality than such periods as the pre-famine period (Bongaarts and Cain, 1981).

Unfortunately, our data do not allow direct calculation of mortality during the pre-famine period. However, it is possible to compute mortality during the period from July 1978 to June 1979. The probabilities of dying, corresponding to the third column of table 3 were 346 for children of age 0, 288 for age 1, 2 10 for age 2, and 140 for age 3. Mortality during the 1978/79 period was lower than that during the famine and post-famine periods but higher than that during the "normal" period, especially among older children.

Children who survived the famine and the immediate post-famine period had lower mortality during the subsequent period, probably because the more frail members had already died and only the healthier members of that cohort survived.

This result is consistent with the findings by Razzaque *et al*. (1990), who examined infant and child mortality of cohorts of children born during the famine, conceived during the famine, and conceived after the famine in the same Matlab area. They found that the children born or conceived during the famine experienced higher mortality than did children conceived after the famine during the first year or two, but that afterwards their mortality was lower than that of the cohort conceived after the famine.

Community representation

Community representation, indicated by whether a resident of the same community was a member of the union council proved not to be statistically significant during the "normal" time as well as during the famine and post-famine periods. Only 1 of the 12 coefficients associated with this variable was statistically significant (table 2).

This finding is contrary to our expectation. We expected that, because union council members were responsible for informing people when relief supplies would be distributed, having a village resident in the union council would speed the communication, leading to faster access to relief and lower mortality. However, our data do not support the hypothesis that political representation of a community improves the survival chances of its residents during a famine.

Living standard

Table 4 shows that, in general, children in families who owned more household items had lower mortality than children in families who owned fewer items, but the differences are statistically significant only for age 1 (table 2).

Families who owned fewer items seem to have been affected by famine more than families who own more, but these differential effects are not statistically significant. Furthermore, children in families with more possessions had lower ratios of mortality to out-migration rate than did children in families with fewer possessions, the difference being statistically significant for children ages 0 and 2.

For children of age 0, the effect of the famine on mortality was greater than its effect on migration. Among the poor, families with very young children were perhaps less mobile than other families and as a result suffered higher mortality.

Education

In general, higher education was associated with lower mortality, the relationship being larger and statistically more significant for older children (table 5). This is consistent with our hypothesis that a higher level of education of a family improves the survival of its members because of their ability to utilize resources better.

Better utilization of resources is likely to improve the survival of older children more than the younger children because, at older ages, mortality is affected by environmental factors to a larger extent than at younger ages.

The effect of famine on mortality did not depend on education very much, but the educational differences in the effect of famine on out-migration was statistically significant for families with children of ages 1 or 2. Among families with more education, the out-migration rate did not increase as much during the famine as it did among families with less education. Perhaps the

Table 4: Estimated probabilities of dying and out-migration by age of children in completed years, number of household items owned and period

Age	Number of household items owned	Period	Probability (x10,000) of:	
			Dying	Out-migration
0	Fewer than 2	Famine	609	793
		Post-famine	429	71
		Normal	231	56
	2 or more	Famine	447	485
		Post-famine	302	108
		Normal	162	85
1	Fewer than 2	Famine	511	772
		Post-famine	353	115
		Normal	219	75
	2 or more	Famine	299	533
		Post-famine	263	115
		Normal	163	75
2	Fewer than 2	Famine	306	975
		Post-famine	392	104
		Normal	177	76
	2 or more	Famine	223	892
		Post-famine	305	128
		Normal	138	94
3	Fewer than 2	Famine	132	1 046
		Post-famine	412	96
		Normal	116	73
	2 or more	Famine	65	728
		Post-famine	313	91
		Normal	87	69

Note: The probabilities are estimated from the multinomial logit model, fiiing the educational level of family, mother's religion, sex of child, and community representation at their mean values.

Table 5: Estimated probabilities of dying and out-migration by age of children in completed years, education of family and period

Age	Education of family	Period	Probability (x 10,000) of:	
			Dying	Out-migration
0	Low	Famine	659	1000
		Post-famine	474	91
		Normal	256	72
	High	Famine	443	574
		Post-famine	408	78
		Normal	219	62
1	Low	Famine	497	982
		Post-famine	350	149
		Normal	218	98
	High	Famine	376	447
		Post-famine	306	125
		Normal	190	a2
2	Low	Famine	337	1 127
		Post-famine	438	121
		Normal	199	89
	High	Famine	255	691
		Post-famine	327	125
		Normal	147	91
3	Low	Famine	193	1 364
		Post-famine	611	127
		Normal	175	100
	High	Famine	107	770
		Post-famine	265	85
		Normal	74	65

Note: The probabilities are estimated from the multinomial logit model, fixing the number of household items owned, mother's religion, sex of child and community representation at their mean values.

Table 6: Estimated probabilities of dying and out-migration by age of children in completed years, religion of mother and period

Age	Religion	Period	Probability (x10,000) of:	
			Dying	Out-migration
0	Hindu	Famine	537	1 181
		Post-famine	392	109
		Normal	211	86
	Muslim	Famine	528	391
		Post-famine	388	167
		Normal	209	132
1	Hindu	Famine	356	888
		Post-famine	247	133
		Normal	153	87
	Muslim	Famine	432	322
		Post-famine	323	181
		Normal	201	119
2	Hindu	Famine	140	1 025
		Post-famine	181	110
		Normal	81	79
	Muslim	Famine	436	413
		Post-famine	333	169
		Normal	151	123
3	Hindu	Famine	110	774
		Post-famine	335	69
		Normal	94	53
	Muslim	Famine	222	312
		Post-famine	254	177
		Normal	71	134

Note: The probabilities are estimated from the multinomial logit model, fixing the number of household items owned, educational level of family, sex of child, and community representation at their mean values.

families consisting of members with no formal education were engaged in less stable occupations and were more likely to move during a famine.

Religion

The relationship between religion and mortality is not clear (table 6). However, there is a clear relationship between religion and out-migration during the famine. Minority Hindus had much higher out-migration rates during the famine than did Muslims, although the out-migration rate at other times was not very different. In fact, religion shows a greater effect of change on out-migration during the famine than any other covariate considered. It may be that Hindus, being a minority, had less attachment to the community and were more willing to move out of the affected area during hard times.

Female mortality was higher than male mortality at all ages (table 7). Further, the increase in mortality during the famine period was higher for females compared with males at all ages. The sex differentials of mortality are statistically significant for all ages except age 0, while the interaction between sex and famine was significant for age 1.

These findings are as expected because mortality at very young ages depends more on biological factors; the sex differential for nutrition and child care would not result in differential mortality at very young ages.

At older ages, female children suffered higher mortality and the effect of famine was greater on female children. This result is consistent with findings from other studies that examined sex differentials of child mortality in Bangladesh (Bairagi, 1986; Chen, Huq and D'Souza, 1981; D'Souza and Chen, 1980).

Interestingly, the effect of sex on probability of out-migration was not statistically significant for any age, at any period. Most of the time, migration is a family event, affecting all members of the family. In contrast, mortality is an individual event and individual characteristics within a family, such as sex, can be an important factor.

Discussion

We examined age-specific mortality and out-migration rates during the famine, post-famine, and "normal" periods, and found that the famine affected both mortality and out-migration. When migration is not considered as a possible demographic response to the famine, assuming that mortality is the same among out-migrants and non-migrants, the estimated covariates

Table 7: Estimated probabilities of dying and out-migration by age in completed years, sex and period

Age	Sex	Period	Probability (x10,000) of: Dying	Out-migration
0	Male	Famine	415	736
		Post-famine	373	66
		Normal	200	52
	Female	Famine	624	763
		Post-famine	438	68
		Normal	236	54
1	Male	Famine	268	877
		Post-famine	275	96
		Normal	170	63
	Female	Famine	562	720
		Post-famine	387	107
		Normal	241	70
2	Male	Famine	173	1 207
		Post-famine	312	118
		Normal	141	86
	Female	Famine	347	909
		Post-famine	441	96
		Normal	200	70
3	Male	Famine	78	993
		Post-famine	306	91
		Normal	85	69
	Female	Famine	139	974
		Post-famine	426	88
		Normal	120	68

Note: The probabilities are estimated from the multinomial logit model, fixing the number of household items owned, educational level of family, mother's religion and community representation at their mean values.

are quite different (Razzaque, 1988) especially for socio-economic variables such as education, living standard and religion. We conclude that a study of mortality during famine should be done taking out-migration into consideration.

The effect of famine on mortality and out-migration varies considerably across different age groups. While older children suffered higher excess mortality during the famine, children aged one or two at the beginning of the famine seem to have suffered higher mortality extending to the period beyond that considered as famine by the average population.

We also found that, after this sustained higher mortality, children exhibited a lower level of mortality compared with the usual level of mortality for their age. We explain this as the consequence of premature deaths among more frail members of the population during hard times, leaving a healthier surviving population some time after the famine.

Socio-economic covariates, such as living standard, education and religion, affected both mortality and out-migration, but in somewhat different ways, especially during the famine. The effects of education and religion changed more during the famine compared with their effects during the "normal" period.

Female children suffered higher mortality, especially during older childhood. Although the sex differential of mortality increased during the famine, the additional disadvantage of female children during famine is statistically significant only for one age group (age 1) among the four age groups (0 to 3) considered.

It should be noted also that detailed analysis of age-specific mortality and out-migration rate has become possible only by using the high-quality data collected by the Demographic Surveillance System (DSS) in Matlab, and merging the information collected through the DSS system and other sources of data such as the population census.

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The Population Dilemma*

Because humankind is on the threshold of the twenty-first century, there is considerable speculation about what the future will look like. It is evident that not only will the population continue to grow rapidly in the future, but technological innovations and inventions will also multiply rapidly. Indeed, it appears as if population and technology rely on one another for their sustenance and growth.

Technology has helped humankind to produce more food, provide better health care, better communication, faster modes of travel, better consumer durables, greater amenities and, by and large, better quality of life for millions of people around the world.

However, at the same time, there has been a marked trend towards the marginalization of poor and uneducated people and a widening of the technological gap between developed and developing countries. These have been intertwined with problems associated with the effects of rapid population growth, uneven population distribution, environmental degradation and, more generally, the threat of unsustainable development in the long run.

Here, then, is the crux of the population and development dilemma – the golden promise of technology for continued human progress, on the one hand, and the perilous threat of unsustainable development resulting from the worsening nexus between population, resources and technology, on the other.

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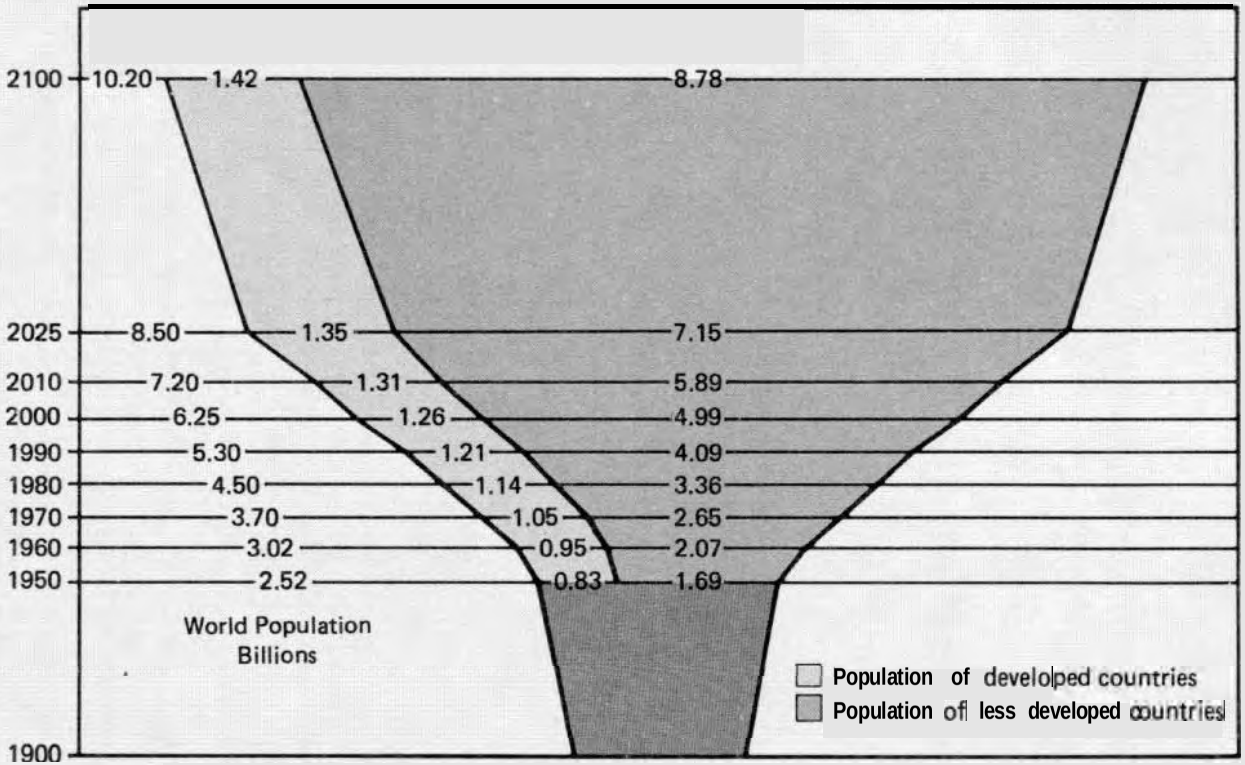
* By Tatsuro Kunugi, Deputy Executive Director, United Nations Population Fund. This note is adapted from an article that appeared in the 8 January 1990 issue of the *Asahi Evening News.*

Growth of world population



Source: Meeting the Population Challenge, (New York, UNFPA, 1990), p 5.

How to bring these elements into harmony so as to achieve a long lasting, sustainable development is an issue that deserves the most serious attention of the international community during the last, crucial decade of this century.

Mounting pressures

The world population, which has doubled since 1950, is currently estimated at 5.25 billion people. It is increasing at a rate of 1.73 per cent a year – i.e., over 90 million people every year or nearly a quarter of a million persons every day.

The United Nations estimates that the world population will likely reach 9.5 billion by the middle of the next century, but only if the rates of human reproduction continue to decline in the coming decades as expected. Should these rates not decline, however, the earth's population may soar to as high as 12 billion people by the year 2050.

The fact that well over 90 per cent of the population increase is taking place in developing countries adds a special dimension to the problem of achieving sustainable development.

Furthermore, rapid population growth in poorer countries is resulting in mass migrations from rural areas to urban centres. Urban populations in developing countries will double between 1990 and the year 2000, creating numerous large cities, including 16 of the world's 20 largest "mega-cities" - all with populations larger than 10 million.

By the year 2000 it is estimated that 75 per cent of Latin America's population, along with 42 per cent of Africa's and 37 per cent of Asia's, will be urbanized. This will create grave internal tensions for countries and severe hardships for urban migrants. It will also create pressure for international migration, particularly from developing countries to developed countries. And such mass movement could simultaneously pose a serious threat to international security unless its catalysts can be reduced.

In addition, around the middle of the next century, there could be hundreds of millions of "environmental refugees" newly uprooted from coastal areas because of the gradually rising sea level.

Without fundamental changes in population growth rates and patterns of environmental conservation, it is likely that the disequilibrium between population, resources and technology will produce ever-worsening levels of acid rain, depletion of the ozone layer, deforestation, desertification, accumulation

A high population growth rate in Nepal puts an increasing strain on resources and the environment. The attainment of sustainable development through an effective balance between population and resources can save humanity from disaster. (United Nations photograph)

of non-degradable chemicals, depletion and loss of topsoil and other permanent damage to the world's ecosystems.

Therefore, it is necessary to work towards stemming the tide of such worsening trends or, at least, minimizing their consequences. It is of paramount importance to act now before the situation deteriorates further and the damage already done becomes irreversible. This is the challenge that must be met by the community of nations and by people everywhere.

This concern has found expression in the International Development Strategy for the Fourth United Nations Development Decade, which was adopted by the General Assembly at its forty-fourth session. The General Assembly recommended adoption of the following five priority aspects of development: eradication of poverty and hunger; human resources and institutional development; population; environment; and food and agriculture. These tasks are to be done by promoting the development of developing countries within the context of strengthening global development.

Survival equation

The attainment of sustainable development through an effective balance between population and resources can save humanity from disaster, or at least from permanent crippling. Certainly, each country and preferably each community should pursue such a balance in a serious and effective manner. It should be stressed that such a balance is by its very nature dynamic, not static.

The dynamic equilibrium that determines the sustainability (S) may appropriately be conceptualized by a simple equation of the process of interaction between the three key factors: population (P), resources (R) and ingenuity (I).

$$S = \frac{R \times I}{P}$$

While this is only a conceptual equation - since numerical values cannot easily be assigned to the components R, I and even P – it does show that sustainability is a function of the intelligent use of natural resources. As natural resources diminish and population increases, the impact of human ingenuity takes on even greater importance.

This is particularly true as regards political, social and economic organization of human action, as well as technological management of natural resources. It also highlights the crucial importance of innovative approaches, such as the "greening of technology", for the survival of humankind in the next century.

Population (P) should be considered not merely as steadily increasing "numbers" negatively contributing to the depletion of natural resources. Instead, population, as the most important activator of the interaction process, should be conceived of as a mass of people having varying dynamic characteristics as to: growth (whether plus or minus); distribution (where they live and where they migrate); and composition (age and gender structure, literacy etc.). It should also be underlined that an appropriate level of population growth has often been a facilitator, if not a requisite, of sustainable growth.

The equation also helps to explain why the limited availability of natural resources played only a minor role in the modern economic growth of European societies, Japan, Hong Kong and others. It illustrates that economic growth is dependent on production technologies, social organization and management skills. Moreover, this equation may serve not only as an analytical tool to assess options but also as a strategic planning tool to help to determine the direction and type of action that should be taken in order to restore and maintain the optimum equilibrium in the population, resources and ingenuity nexus, with regard to particular situations at various levels, i.e. local, national, regional or global.

Mass commitment

The time is short and the challenge formidable. But to lose any more time is only to court disaster for everyone. It is necessary to try to harmonize self-interest with the collective goal of saving the Earth by fostering sustainable development.

Humankind has witnessed turbulent times throughout the 1980s, with a new generation of ecological crises, international debt issues, rampant violence and the plague of drug traffic around the globe. However, as we now prepare for the twenty-first century, some encouraging signs of a community of interests are seen coming to the surface.

Thanks to a mass consciousness of human rights and fundamental freedoms all over the world, and likewise owing to the rapid advancement of globally shared technologies and communications, the impulses of reform are gathering an energy and setting a pace exceeding the anticipations of decision-makers and expert observers.

Humankind has to restore and maintain harmony in the ruptured relationship between humankind and nature that at present threatens both. All of us must join together to meet the serious challenges that lie ahead. Together, and only together, will we perish or survive. The choice is still ours. It is time to act before it is too late.