

AN EXTENSION OF A PROBABILITY MODEL FOR CLOSED BIRTH INTERVAL

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ABSTRACT

Based on some simple assumptions regarding human reproduction process, a continuous time probability model for describing variation in any closed birth interval of a woman of a marital duration (t) has been developed. The model incorporates the possibility of the woman being adolescent sterile at the time of consummation of marriage. The estimates of truncation bias in the mean closed birth intervals are also obtained. For illustration, the model is applied to an observed closed birth interval between first and second births of the women with marital duration of seven years.

The observed lengths of closed birth intervals of a married woman are frequently taken as indicators of her reproductive performance. In fact, for assessing the impact of family planning programmes on fertility in the developing countries, the conventional fertility rates are not suited as sensitive indices. In case of retrospective surveys, it is inquired whether a difference or no difference in the mean live birth interval based on recently married women as compared to older married women bears out a change in fertility. Further, the data on closed birth interval are often used for estimating the probability of monthly conception (fecundability), births averted by contraceptive usage and for estimating other biological parameters of the human reproduction process. However, interpretation of ~~the closed birth~~ interval as a measure of fertility has been very difficult for several reasons. Firstly, it is not clear, as to what time of fertility a particular closed birth interval refers. Secondly, a direct comparison of closed birth intervals of younger and older marriage cohorts cannot be made because women of recent marriages will always

*Paper presented at the Third Annual Conference of the Indian Society for the Theory of Probability and Its Application, New Delhi, 20-22, August 1981 (University of Delhi).

be having smaller marital durations than women of older marriages and therefore the birth intervals based on the former groups suffer from a selection against long intervals which, may or may not vitiate the result Sheps* and Sheps *et al.*². The same problem arises when the onset of menstruation or ovulation shortens or curtails the course of reproduction. While in demographic context, for duration of marriage and age at marriage, this situation of truncation in time can be handled through a proper technique of standardisation, it will not be possible to handle it when the truncation occurs randomly due to adolescent sterility of the women right in the beginning of the reproductive process or menopause and secondary sterility in the later part of the reproductive life of the woman. Thirdly, the analysis of closed birth interval further poses a problem when the women take recourse to induced abortion in addition to the spontaneous abortion. As a result, less number of women with given marital duration will be able to close their birth intervals.

As such, the data analytic approaches for comparing closed birth intervals might lead to misleading results. A more unbiased and appropriate approach to ascertain the biological parameters of human reproduction from the data on different closed birth intervals will be development of a suitable probability model which incorporates some biological parameters. Further, timing of onset of ovulatory menstrual cycle or secondary sterility among the women are completely unknown phenomena to the women and they can only be ascertained through formulation of suitable models. There have been however, some efforts to develop models of time of first birth through which extent of adolescent sterile women has been estimated (see Pathak and Prasad, and Pathak). In these studies, however, period of reproduction was treated infinite. In this paper, an attempt has been made to develop a probability model for any closed birth interval of a woman of the given marital duration by assuming that there is a chance that the woman could be adolescent sterile at the time of her marriage. In the following section, the model has been derived under some simplistic assumptions. For illustration, the model has also been applied to an observed data on the second closed birth interval.

The Model

Following assumptions are made to derive the model for

the closed birth interval of a woman who married in her adolescence (below age of 20 years):

1. At the time of marriage, the woman is either biologically mature to conceive or is not biologically mature. Let α and $1-\alpha$ be the respective probabilities;
2. Given that the woman is not biologically mature to conceive at the time of her marriage, the time of her first ovulatory menstruation (from the date of her first marriage) follows a negative exponential distribution with parameter u ($u > 0$);
3. Time interval of first conception from the point of attaining biological maturity to conceive or of the marriage which ever is later follows an exponential distribution

$$f_0(t) = \lambda e^{-\lambda t}, \quad \lambda > 0$$

4. The duration between the r^{th} and $(r+1)$ the conception follows a displaced exponential distribution with p.d.f.

$$f_r(t) = \lambda e^{-\lambda(t-h)} \quad \begin{matrix} t > h \\ h > 0 \end{matrix}$$

Where h is the rest period associated with a live birth conception;

5. It is assumed that every conception leads to a live birth and the chance of miscarriage is zero; giving rise to a **1:1** correspondence between a pregnancy and a live-birth during the period of observation. This assumption is quite strong. However, as a first approximation, miscarriage can be accounted through increasing h and suppressing λ ,

6. We denote by $(0, t)$ the total period of marital duration enjoyed by the woman.

Now it is for consideration the length of the r^{th} interval from $(r-1)^{\text{th}}$ to the r^{th} birth, where marriage is defined as the zeroth birth. Let $X_r(t)$ be the random length of the r^{th} interval measured at a duration of marriage equal to t years. In the hypothetical case let X_r denote the random length of the r^{th} birth interval when the duration of fecund marriage of the woman is infinite. In real cases, where marital life

is limited to fixed number of years, $X_r(t)$ can not be said to be representative of X_r . In fact observation on X_r are censored. The value of X_r at which censoring occurs depends on t , r and on n , the parity at time t . However, in case the woman is not fully matured at the time of marriage, it also depends on the proportion of woman who are adolescent sterile at the time of marriage and the random time taken by such women to become fully matured. In fact, in such cases, the process of regular reproduction is delayed by a random time which is being determined by the assumed distribution for the onset of ovulation under the assumption 2.

Let $X_r(t)$ denote the length of the r^{th} closed interval ascertained on or before t then under the above assumptions, it can be seen that

$$f_r(x/t) = \alpha \frac{Fr^{-1}(t-x)fr(x)}{Fr(t)} + (1-\alpha) \frac{Fr^{*-1}(t-x)fr(x)}{Fr^*(t)} \quad \text{----- (1)}$$

$h < x \leq t - g - (r-2)h$
 $t > g + (r-1)h$

Where

$$Fr(t) = 1 - \sum_{\delta=0}^{r-1} \left\{ \exp\{-\lambda(t-g-(r-1)h)\} \left\{ \frac{\lambda^\delta (t-g-(r-1)h)^\delta}{\delta!} \right\} \right\} \quad \text{----- (2)}$$

$$Fr^*(t) = \sum_{k=1}^r (-1)^{k-1} \frac{\mu^k}{(b-\lambda)^k} \left[1 - \sum_{\delta=0}^{r-k} \left[\exp\{-\lambda(t-g-(r-1)h)\} \left\{ \frac{\lambda^\delta (t-g-(r-1)h)^\delta}{\delta!} \right\} \right] \right. \\ \left. + (-1)^r \frac{\lambda^r}{(b-\lambda)^r} \left\{ 1 - \exp\{-\lambda(t-g-(r-1)h)\} \right\} \right] \quad \text{----- (3)}$$

$$fr(x) = \lambda \exp[-\lambda(x-h)] \quad \text{----- (4)}$$

$t > g + (r-1)h$
 $h < x \leq t - g - (r-2)h$

The above expressions are the extension of the Model obtained by Singh *et al*»* For $r=1$ and $h=0$, the model obtained by Pathak and Prasad³ can be obtained.

Proof

Let $T^\wedge$ be the random length of the interval from marriage to the i th birth, that is, $T_i = \sum_{j=i}^\infty X_j(t)$, f_i and $F_i(t)$

$$\sum_{j=i}^\infty$$

be the p.d.f. and c.d.f. respectively of $T^\wedge$. It is easy to show that $F_j(t)$ is the convolution,

$$F_i(t) = \int_0^t g_i(t) F_{i-1}(t-x) dx, \quad i > 1$$

When $g_j(t)$ is the p.d.f. of X_i , given infinite time for reproduction. In case time t is finite,

$$f_i(x/t) = \frac{f_i(x) F_{i-1}(t-x)}{F_i(t)} \quad x \leq t-t_{i-1} \quad \dots \quad (5)$$

(See Sheps and Menken[^])

Again under the assumption that the woman is not adolescent sterile at the time of marriage and she gets 1 births in time t , namely $(t_1, t_2, \dots, t_i \text{ point})$ is given by

$$\int_{(i-1)h}^{t-g} \lambda dt_1 \dots \int_h^{t_3-h} \dots \int_0^{t_2-h} dt_1 e^{-\lambda t_1} e^{-\lambda(t_2-t_1-h)} \dots e^{-\lambda(t_i-t_{i-1}-h)} \dots (6)$$

After integrating the above we get the expression (2) given earlier. In case, however, the woman is anovulatory at the time of marriage, assuming that she ovulates at point t_0 , and conceives i times at $t_1, \dots, t_i$, we have probability of i births in time t given by multiple integral

$$\int_{(i-1)h}^{t-g} \lambda dt_1 \dots \int_h^{t_3-h} dt_2 \int_0^{t_2-h} \lambda dt_1 \int_0^{t_1} \mu e^{-\mu t_0} dt_0 e^{-\lambda t_1} e^{-\lambda(t_2-t_1-h)} \dots e^{-\lambda(t_i-t_{i-1}-h)} \dots (7)$$

After solving the above integral, we obtain the expression (3).

Since women who are fecund at the time of marriage and who are anovulatory at the time of marriage are mixed with proportions and $i - \alpha$ we obtain the expression (1) from expressions (4), (5) and (6).

Estimation of Truncation Bias in the Closed Birth Interval

Difference between the expected closed birth interval with time being fixed and the average closed birth interval

when time is infinite gives the truncation bias in the closed birth interval. When the time is infinite any closed birth interval is obviously equal to

$$E(x/\infty) = h + \frac{1}{\lambda} \quad \dots \quad (8)$$

When the time is finite the expected r^{th} closed birth interval is given by

$$I_1 = F_r^{-1} \left[M - \sum_{s=0}^{r-2} \frac{\lambda^{s+1} \exp[-\lambda(T_1 - h)]}{(s+2)!} (T_1 - h)^{s+1} (T_1 + (s+1)h) \right] \quad \dots \quad (10)$$

$$\text{where } T_1 = T - g - (r-2)h$$

$$M = h + \frac{1}{\lambda} - (T_1 + \frac{1}{\lambda}) \exp[-\lambda(T_1 - h)]$$

$$I_2 = F_r^{-1} \left[M \left[\left(\frac{\lambda}{\lambda - \mu} \right)^{r-1} - \sum_{k=1}^{r-1} \frac{\mu \lambda^{k-1}}{(\lambda - \mu)^k} \right] + I_{21} + I_{22} \right]$$

$$I_{21} = \sum_{k=1}^{r-1} \sum_{s=0}^{r-k-1} \frac{\mu \lambda^{k+s}}{(\lambda - \mu)^k} \frac{(T_1 - h)^{s+1} (T_1 + (s+1)h) \exp[-\lambda(T_1 - h)]}{(s+2)!}$$

$$I_{22} = \left(\frac{\lambda}{\lambda - \mu} \right)^r \left[(T_1 - \frac{1}{\lambda - \mu}) \exp[-\lambda(T_1 - h)] - (h - \frac{1}{\lambda - \mu}) \exp[-\mu(T_1 - h)] \right]$$

The bias in r^{th} closed birth interval is obtained by subtracting expression (9) from the expression (8). Some numerical calculation have been made to assess the extent of truncation bias associated with different closed birth intervals when the marital durations are fixed. We assume that $h = 1.25$ or 1.50 years and $g = .75$ year $\lambda = .40$ or $.60$, $\alpha = .95$ and $u = .20$. For illustration, the results are presented in the Table 1 below for marital duration of $f = 5$ or 10 years.

From this table it is clear that the theoretical value of the truncation bias in closed birth intervals increases as the order of the closed birth interval increases. However, for a fixed marital duration, as expected, the truncation bias decreases as the fecundability increases but increases

TABLE 1

PATERN OF TRUNCATION BIAS IN ESTIMATING CLOSED BIRTH INTERVALS FOR DIFFERENT VALUES OF t , h AND WHEN $\alpha = .2$ $\mu = .95$.

t (Years)	h (Years)	Average closed birth intervals when $t =$		Bias in	the closed birth intervals of order						
				1	2	3	4	5	6	7	
5	1.25	.4	3.75	0.92	1.54	2.06	-	-	-	-	
		.6	2.92	0.34	0.49	1.28	-	-	-	-	
	1.50	.4	4.00	0.99	1.72	2.25	-	-	-	-	
		.6	3.17	0.84	0.95	1.50	-	-	-	-	
	10	.4	3.75	0.13	0.53	0.94	1.33	1.90	2.00	2.52	
		.6	2.92	0.03	0.14	0.32	0.62	0.93	1.12	1.44	
	1.50	.4	4.00	0.14	0.60	1.09	1.54	1.20	2.11	-	
		.6	3.17	0.03	0.17	0.45	1.08	1.09	1.30	-	

as the period of amenorrhea increases. For fixed parity, the truncation bias decreases as the marital duration increases. Though the values are only tentative, they indicate the importance of truncation bias in blurring the interpretation of the observed closed birth intervals of different orders. The bias may be even more than 2 years in case of some extreme parities, when t is large enough and fecundability level is also high, the extent of this bias may not be significant for the first few parities.

Application

For the application, the distribution derived earlier may pose some problems as it has several parameters and the known methods of estimation might lead to intractable equations. However, for specific order of closed birth interval it is possible to obtain some pilot estimates of the parameters of interest such as C^* , u and μ . The application of the proposed model has been illustrated with data on second closed birth interval (the interval between 1st and 2nd births) taken from Varanasi Survey of 1969-70 as reported by Singh *et al.* Here, we assume two groups of women, one having their rest period $h = 1.00$ year and the second with $h = 1.5$ years with their proportions equal to .50 in the mixture. A minimum X^2 estimates of α , β and μ are obtained by generating the

expected frequencies for $\alpha = .80$ (.02), .96, $\lambda = .40$ (.05), .60 and $\mu = .10$ (.05), .40. These estimates are only partially X^2 estimates as full space of the parameters has not been scanned. They can therefore, be treated as the pilot points for obtaining better estimates, such as, B.A.N, estimates. The observed and expected frequencies based on the partially minimum X^2 estimates are given in Table 2.

It is clear that the model describes the data quite satisfactorily. As such it can be used to ascertain the extent of adolescent sterility among the married women on the basis of their responses for their closed birth intervals. A comparison of the fitted values clearly indicates the bias for the digits of completed years such as 2 and 3. On the basis of the present analysis it is felt that data on closed birth intervals should be used more carefully and before pattern of fertility could be inferred one should control for the factors such as age at marriage, marital duration, and some social and cultural factors which determine the pattern of breast feeding or prevalence of induced abortion in the society. The model can, however, be made more general by assuming a distribution of 'h' and by accounting for the induced abortion. Nevertheless, it can be used for graduating the data on closed birth intervals. The estimates of the parameters are not minimum X^2 - estimates and they can be at most treated as pilot points to obtain more efficient estimates. A more general treatment of the problem is under study.

TABLE 2

OBSERVED AND EXPECTED DISTRIBUTION OF FEMALES ACCORDING TO TIME FROM FIRST BIRTH TO SECOND BIRTH, VARANASI SURVEY (1969-70)

Time in Years	Observed Frequency	Expected Frequency $\alpha = .96, \lambda = \mu .50 = .20$
1.0-1.5	25	25.6
1.5-2.0	40	46.2
2.0-2.5 $X^2 = 5.09$	37	34.6
2.5-3.0 d.f. = 6	21	25.6
3.0-3.5	25	18.7
3.5-4.0	17	13.3
4.0 and above	19	20.0

Lkkjk'k

मानव प्रजनन प्रक्रिया के बारे में साधारण अभिकल्पनाओं के आधार पर एक महिला की वैवाहिक अवधि के किसी भी संवृत जन्म-अन्तराल (क्लोजड बर्थ इन्टरवल) में होने वाले परिवर्तनों का विवेचन करने के उद्देश्य से एक सतत-समय-प्रायिकता मॉडल (कॉन्टीन्यूअस टाइम प्रोबेबिलिटी मॉडल) का विकास किया गया है। इस मॉडल में विवाह-संसिद्धि के समय महिला की किशोरकालीन बंध्यता संबंधी सम्भावना को समाविष्ट किया गया है। माध्य संवृत-जन्म-अन्तरालों में छिन्न-अभिनति (ट्रंकेशन बायस) संबंधी आंकलन भी किये गये हैं। दृष्टांत रूप में इस मॉडल का प्रयोग एक महिला के विवाह की सात वर्ष की अवधि में पहले तथा दूसरे बच्चे के जन्म में प्रेक्षित-संवृत-जन्म-अन्तराल (आबजरवड क्लोजड बर्थ इन्टरवल) के लिए किया गया है।

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BEHAVIOURAL DIMENSIONS OF POPULATION AND DEVELOPMENT

S.R. Mehta

ABSTRACT

An attempt has been made to examine the socio-psychological perspectives on communication and decision-making alongwith utility maximization model of economics. Since, the population education is a functional prerequisite of the societal system both at the micro and macro levels, and the behavioural dimension of various studies carried out in the field of family planning and fertility behaviour remained thin, therefore, a plea has been made for the promotion of behavioural research in population field and linking it with health and technological innovations for better planned development efforts.

Population problem gets into focus as a result of disequilibrium caused by deaths and births. Medical technology has advanced considerably over the years but birth than death control technology arrived late in the developing countries. Further, there has been a problem of introducing birth control technology at the individual level. This may not be consistent with an individual's core value system and a family may favour a high fertility pattern. This would require looking at some of the social cultural, economic and psychological determinants of fertility.

Evidence of empirical research into the determinants of fertility exists both at the micro and macro level. There is an increasing significance of non-economic factors in influencing the fertility behaviour both at the micro and macro levels. That would imply conceiving development not in terms of economic growth but explicitly stating it as growth plus social change!. Economic growth cannot be sustained without effecting changes in attitudes and values of the people. Population growth gets operationalized at the 'family' or 'household' level. As such it becomes imperative to see the relevance of some of the socio-psychological perspective on communication and decision-making

processes at the 'Couple' or 'family' level in addition to the utility maximization model of economics, often associated with 'tests' or 'preferences' of the people and cost-benefit analysis of children in terms of their marginal utility to the household. In regard to economic decision theory and fertility behaviour², it is stated that economic theory assumes rationality but fails to spell out the way decisions are made because maximization is frequently an incompletely stated postulate and many procedures are involved in arriving at a maximizing decision. Further, without specifying the content of utility, it is difficult to analyse whether the outcome of decision fits the content or not.

Socio-Psychological Perspectives on Communication and Decision-making

The basic dynamic core of social change, the diffusion and adoption process, revolves around an innovation. Considering innovation as a basis of all personality, social and cultural change. The adoption of an innovation by an individual or other relevant unit of adoption is considered as the fruition of a decision-making process often influenced by deliberate plans, strategies, personality, creative ability and basic needs of people. When an innovation is diffused to, and adopted by a sufficiently large number of relevant units in a social system, so as to register an impact, it is said that a change has occurred in that particular system.

Decision-making is a complex phenomenon and involves interaction of so many factors.. An individual in order to make up his/her mind to adopt an innovation has to do an introspection of his or her self and also has to analyse his or her external environments. The individual attempts to weigh the *pros* and *cons* about the innovation before adopting the same. There are positive motives which accelerate his or her tendencies to adopt whereas there are negative motives which retard his or her tendencies. The interaction of these conflicting motives often results in ambivalence. The individual tends to resolve this by acquiring additional information or knowledge, developing rational orientations and by increasing his or her interaction with his or her socio-cultural environments. In this process he or she orients his or her goals and values. In this respect communication effects through various channels produce attitudinal change which in turn affects the direction of his or her decisions. Thus in

order to produce change, people should communicate effectively with one another and process the information for appropriate decision-making.

Some of the under current feelings, ideas and thinking of an individual are associated with the expectations arising Out of a particular action. Therefore, before an individual makes a decision on a particular social situation, he or she has to keep in view the benefits he or she has to accrue or derive from that action as well as to the probable consequences, that may, to a greater extent be in his or her favour. These probable results would, by and large, be subjective depending upon the individual's perceived notions as well as the physical and the socio-cultural environments in which he or she is interacting. So, the individual makes efforts to desire maximum utility from a particular action. Thus, the utility and the probable consequences associated with the action become the two important dimensions of the decision-making process. Further, there is evidence from experimental psychological research that as motivation increases, decision performance comes closer to maximization.

Again, in a group or family pressure decision, if an individual finds that he or she is being induced to take an action that conflicts with his or her own initial belief, this produces a dissonance or tension which is uncomfortable. If an individual is actually induced to act on a social situation for which he or she has no positive attitude, he or she will tend to reduce the dissonance caused by changing his or her initial *belief* so that jt could conform to the behaviour expected of him or her. The group pressure, in that way may, bring about a change in attitudes through extrinsic motivations to act in a certain way.

Within the functional perspective, it is suggested that the behaviour is the result of the motivation and values which in turn are determined by the social system; in which the individual lives. At the individual (intrinsic) level, the individual's motivation and values including his or her attitudes influence his or her behaviour. At the social (extrinsic) level, his or her behaviour is influenced by the expectancy of reward and punishment from the social significant persons within the society and by the social system. The social system, at the individual level produces relevant motivational patterns in the members of the society and these

help to maintain it and are thus functional. At the societal level, it produces reinforcing mechanisms such as child rearing practices, the school system and other institutions of socialization which produce processes of institutionalization. The routinization of these processes, however, effects the reward and punishment system in the society and greatly influences human behaviour. However, motivation and expectancy are not unidirectionally related to the social system and its reinforcing mechanisms. In due course of time, motivational patterns and expectancy framework, acquire great influence, they not only maintain the social system but also began to determine it to some extent.

The decision-making at the family or household level in regard to the fertility behaviour is also largely influenced by the motivational patterns generated by information processing through various communication channels or by acquiring knowledge through formal or non-formal methods. The reinforcing mechanism though the institutions of family and school system affect the behaviour of individuals towards the limitation or otherwise of family size. Educational processes in interaction with the reinforcing mechanisms of the social system thus influence the direction of decisions and in that sense education becomes a functional prerequisite of the system. To rationalize decisions in regard to fertility behaviour, population education inculcates new thought patterns and values among the individuals. They are prepared as potential actors functional to the increasing needs of the society, one of which being the control of population growth.

Even at the macro level, education has been reported to influence the decline of fertility. A number of indicators to describe the profile data from Latin America and the Caribbean of a country at the different stages of the demographic transition has been constructed with⁸. According to their analysis the marked decline in fertility, among other things, is associated with literacy rates of 78 per cent, a primary school enrolment ratio of 65 per cent, a labour force in non-agriculture of 52 per cent, an urbanization rate of 40 per cent, and a secondary school enrolment of 22 per cent. Examining the Indian data on some of the above indicators of development, we observe that our achievements are still behind the suggested criteria of success for a marked fertility decline. In our context, the adult literacy rate is 36 per cent, the expectation of life at birth is 52 years; the primary

school enrolment is 79 per cent of the age group the labour force participation in non-agriculture is 29 per cent; urbanization rate is 22 per cent; the secondary school enrolment is 28 per cent of the age-group. Though, the enrolment rate of students at the primary level is encouraging, yet we know that almost one-third children of 6-11 age group are not attending and out of those who are enrolled, more than 50 per cent drop-out before they reach the fourth class and nearly half of them drop-out in class 7 itself¹⁰. This affects the secondary enrolment ratio of students as well. As such, education in our context has to be reinforced strongly so as to register an impact of the people in terms of generating necessary motivational patterns to meet the challenge of population growth. Population education, therefore, both at the micro and macro level is an important functional prerequisite of the societal system but its operation at the micro level becomes more significant for effecting a decline in the fertility.

But in order to understand the dynamics of educational programmes for population control, the influence of social, cultural and psychological factors needs to be analysed and studied. Though a large number of studies as many as 535 were carried out by 1973-74, under the National Family Planning Programme; yet their contribution for the successful implementation of the programme was limited. By and large, the bureaucratic structure ignored the findings of even some of the good studies and made no attempt to interpret the findings for developing the programme. A large majority of these studies were of KAP type and did not provide an understanding of the communication and decision-making processes involved towards fertility control at the family or household level. It is stated that despite the establishment of four Family Planning Communication Action Research Centres and ten Demographic Research Centres by 1966, the social science components of population research remained weak as these centres were mainly managed by persons other than social scientists. As such, there is an urgent need to promote research related to behavioural dimensions of population and development and focus studies on building knowledge in regard to communication and decision-making perspective suitable to our social and cultural setting.

Health, Population and Technology

Population problem cannot be considered in isolation from health in the context of development of a nation. There is

a linkage between health and population in the sense that high mortality rates induce families to have many surviving children so that they can be assured of a surviving progeny. In a country like India, with high birth rates, children constitute relatively a higher proportion of population and they are susceptible to diseases more than the adult population. Early deaths of children motivate mothers to go in for pregnancy again and often it involves health hazards after the third delivery or so. At the family level, population pressure also increases the tendency of going in for abortion which also involves health risks with the mother. Population pressure on land also results in over cropping, soil degradation and consequently poor nutrition. It may also force people to migrate resulting in cultural and physical health problems. Moreover, one finds it difficult to ensure safe or sufficient water supply, garbage disposal and sanitation. The above analysis suggests integrating population control measures with health dimensions as a part of strategy of development of the developing nations. In short, the focus of development has to be on human resource development services such as education, population control and health. These would ensure a greater labour participation rate and generate more productive work; consequently increasing the provision of goods and services to meet the essential needs of the population.

It has also been observed that the transfer of technology related to population control from the developed to the developing countries, has not been accepted by a large number of eligible couples, especially in the rural areas as they find these neither effective nor suitable for family limitation. Most of the family planning methods, except sterilization, are either not practicable for couples in the village or they being clinical oriented in most cases are not suitable to be used because of problems of privacy, shyness, modesty and fear of public opinion etc. Even sterilization requires a higher order of motivation and again it is the women rather than men who are subjected to it. As such, practically speaking, villagers have hardly any choice of family limitation. So, there is a need to develop certain indigenous medicines or drugs like 'Paper Pill' which is indigenously developed in China. However, it may be difficult to follow the 'Group Motivation' approach of China where the commune leaders decide as to who in the commune would have a child in a particular year. Such an approach does not fit in our cultural ethos and values.

Conclusion

To conclude, it can be said that in the context of developing nations, development planners must give precedence to educational and technological innovations over and above the demographic and utility models to appropriate or stabilize the population growth conducive to development. These innovations tend to influence the decision-making and determine demographic structure and utility maximization of the family or the household to a large extent. As such, development planning, first, should conceive population problem in the context of health and design strategies to tackle them in an integrated fashion. Secondly, the communication barriers and the information processing at the family level should be taken care of through various population education methods and media. This can be augmented by promoting research in behavioural dimensions of population and development in our socio-cultural setting and enabling planners and administrators to have better understanding of communication and decision making perspectives. Finally, the eligible couples (1.12 million) should be provided with suitable methods which may be easy to adopt and practical to continue on a long-term basis.

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इस लेख में संचार के सामाजिक-मनोवैज्ञानिक दृष्टिकोण तथा अर्थशास्त्र के उपयोगिता-अधिकतमकरण मॉडल (यूटीलिटी मैक्सिमाइजेशन मॉडल ऑफ इकानोमिक्स) के आधार पर निर्णयन प्रक्रिया का विवेचन करने का प्रयास किया गया है। जनसंख्या शिक्षा चूंकि सामाजिक प्रणाली के माइक्रो (व्यष्टि) तथा मैक्रो (समिष्ट) – दोनों स्तरों पर ही एक कार्यरत पूर्वापेक्षा के रूप में है और चूंकि परिवार नियोजन तथा प्रजनन-व्यवहार के क्षेत्र में किये गये अध्ययनों में व्यवहारिक-आयामों पर बहुत कम अध्ययन किया गया है, अतः जनसंख्या के क्षेत्र में व्यवहारात्मक

पहलुओं पर अनुसंधान की गति को तेज करने तथा बेहतर ढंग से सुनियोजित विकास के लिए इन्हें स्वास्थ्य एवं तकनीकी उपलब्धियों के साथ जोड़ने के बारे में मत प्रकट किया गया है।

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HEALTH STATUS OF PENSIONERS OF LUCKNOW CITY

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V. Bhushan and V. K. Srivastava**

ABSTRACT

This study included 440 pensioners drawing their pension from Lucknow Treasury. The majority (92.3%) of the pensioners retired when aged 55-59 years and most of these (46.6%) were presently in the age group 60-64 years. Only 63 (14.3%) pensioners reported a change in their health and vigour after retirement and most of these (42.3%) were those who were compulsorily retired. There were 146 pensioners found ill at the time of survey, 49 (11.1%) suffering from acute illness and 97 (22.1%) from chronic illnesses. The status of mental health was found changed in 98 (22.3%) pensioners after retirement. The commonest acute illnesses encountered were fever (7.7%), skin diseases (4.8%), diarrhoea and enteritis (2.1%) and acute eye conditions (0.9%), whereas hypertension (6.4%) and cataract (6.1%) were the most common chronic illnesses at the time of survey. The mean systolic and diastolic blood pressure of the pensioners was 129.1 mm and 78 mm of Hg respectively. The mean haemoglobin level of the pensioners was 10.3 gm per cent and 81 (31.3%) pensioners were found anaemic (Hb level less than 10 gm per cent). Glycosuria was present in 49 (15.4%) pensioners and in 61 (29.9%) of 204 pensioners whose stool could be examined, there was presence of one or the other ova or cyst; the commonest being Ascaris (11.8%).

Old age is the natural process of human life and is characterised by unique features presenting a broad spectrum of medico-social problems. Retirement after years of active service is a crisis in every man's life and brings with it serious problems. The retirement age for workers in public and private sectors has been fixed as 55 or 58 years in most and 60 or 61 years in few institutions. Today, there is a growing number of retired persons. Retirement is both, the

best of times and the worst. It depends on how it affects a person materially and emotionally. The aging brings lot of physical changes in the body which incapacitate persons. There is a decrease in the matabolic and endocrine activities of the body and these may lead to various diseases of the old age having special characteristics of multiplicity and chronicity.

Several workers are engaged in studying the problems of aged persons, but none has studied the problems of retired personnel in particular. This study, therefore, aimed to explore the health problems of the pensioners emerging after the retirement, so that the planners and the authorities are able to solve these in future.

Materials and Methods

The present study was carried out during the year 1977-78. In all, there were 7,245 pensioners in Lucknow who were drawing their pension from the Treasury. Of these, only 5,109 retired males were the subjects of the present study. A total of 639 women and 1,497 pensioners residing outside the city of Lucknow were excluded from the study due to practical reasons. A sample of 10 per cent was taken from the study population on the basis of systematic random sampling. According to this procedures, 510 pensioners were included in the study population but only 440 of them could be contacted and therefore included in the study.

Each pensioner was interviewed in detail regarding his personal characteristics, sickness and state of health, and information were collected on a pretested schedule. This was followed by recording of the blood pressure. Respondents were also posed certain statements pertaining to their pattern of sleep, appetite, irritability and feeling of depression or insecurity after retirement. The responses elicited were scored and analysed to know the mental health after retirement.

Stool samples were collected from the pensioners to find out presence of cysts and ova of helminths and protozoa by examining it under microscope. Analysis of urine was done to find out the presence of sugar using Benedict's reagent. The estimation of haemoglobin in blood was carried out by Sahil's method as described by Wintrobe.

Results

Out of the total 440 pensioners studied, 205 (46.6%) were presently in the age group of 60-64 years followed by 97 (22%) who were in the age group of 65-69 years. There were 55 (12.5%) pensioners aged 70 years or more. The maximum number 406 (92.3%) of pensioners retired when aged between 55-59 years and the reason of retirement in majority of them was superannuation (Table 1).

The health and vigour was found affected in 27 (40.9%) pensioners out of 66 who had been compulsorily retired (Table 2). As compared with this only 36 (9.6%) out of 374 pensioners who had retired on superannuation or retired voluntarily showed decline of health and vigour and this difference was found statistically significant ($P < 0.001$).

TABLE 1

AGE AT THE TIME OF RETIREMENT AND PRESENT AGE

Age at the time of retirement (Years)	Present Age (Years)					Total	
	50-54	55-59	60-64	65-69	70 & +	No.	Percentage
40-44	1	-	-	-	-	1	0.2
45-49	3	4	-	-	-	7	1.6
50-54	22	1	3	-	-	26	5.9
55-59	-	52	202	97	55	406	92.3
Total	26	57	205	97	55	440	
Percentage	5.9	12.9	46.6	22.0	12.5		100.0

TABLE 2

EFFECT OF RETIREMENT ON HEALTH AND VIGOUR

Health and Vigour	Reasons of Retirement						Total	
	Superannuations		Voluntary		Compulsory		No.	Per cent age
	No.	Percentage	No.	Percentage	No.	Percentage		
Affected	29	46.0	7	11.1	27	42.9	63	14.3
Unaffected	319	84.6	19	5.0	39	10.3	377	85.7
Total	348	79.1	26	5.9	66	15.0	440	100.0

The status of mental health remained unchanged after retirement in 342 (77.7%) pensioners, while in 98 (22.3%) it was found affected. Of those whose mental health was found affected, 63 (64.3%) also reported change in their authority in the family, whereas this figure was only 49.4 per cent in those whose mental health remained unaffected (Table 3). This association between the changes in family authority and state of mental health after retirement was found statistically significant ($P < 0.001$).

There were 146 (33.2%) pensioners found ill at the time of survey; 49 (11.1%) suffering from acute illnesses and 97 (22.1%) from chronic illnesses. Of the 49 pensioners suffering from acute illnesses, 30 (61.2%) were having one illness and 19 (38.8%) were having two illnesses. The most common acute illness encountered was fever (7.7%) followed by skin infections (4.8%), diarrhoea and enteritis (2.1%) and acute eye conditions (0.9%) (Table 4).

Among 97 pensioners suffering from chronic illnesses, hypertension (6.4%) and cataract (6.1%) were the most common chronic illnesses observed at the time of survey. The other important chronic illnesses as shown in Table 5, were diabetes mellitus (5.9%), arthritis (4.3%) and bronchitis (3.4%).

TABLE 3
STATE OF MENTAL HEALTH AND AUTHORITY IN THE FAMILY AFTER
RETIREMENT

Family authority	Mental Health				Total	
	Affected		Unaffected			
	No.	Percentage	No.	Percentage	No.	Per centage
Changed	63	21.1	169	72.8	232	52.7
Unchanged	35	16.8	173	83.2	208	47.3
Total	98	22.3	342	77.7	440	100.0

TABLE 4

PRINCIPAL CAUSES OF THE ACUTE ILLNESSES AT THE TIME
OF SURVEY

(n=440)

Diseases	Number	Prevalence percentage
Fever	34	7.7
Skin diseases	21	4.8
Diarrhoea and enteritis	9	0.9

TABLE 5

PRINCIPAL CAUSES OF THE CHRONIC ILLNESSES
AT THE TIME OF SURVEY

(n = 44)

Diseases	Number	Prevalence Percentage
Hypertension	28	6.4
Cataract	27	6.1
Diabetes mellitus	26	5.9
Arthritis	19	4.3
Bronchitis	15	3.4
Ear diseases	13	2.9
Eye diseases	11	2.5
Asthma	11	2.5
Piles	10	2.3
Skin diseases	9	2.1
Hernia	7	1.6
Coronary Heart Disease	4	0.9

The mean systolic and diastolic blood pressure of the pensioners was 129.1 mm of Hg and 78 mm of Hg respectively. The mean systolic blood pressure continued to rise upto age of 60-64 years and thereafter a gradual decline of mean systolic blood pressure was noticed (Table 6). In this study, a blood pressure reading of 160/100 mm of Hg and above was considered as hypertension and 100/60 mm of Hg and below, as hypotension. As per this criteria, 28 (6.4%) pensioners were hypertensive and only 3 (0.7%) were hypotensive.

The mean haemoglobin level of the pensioners was 10.3 gms. per cent and it was apparently lower in the pensioners of the age of 60 years and above. Out of 259 pensioners examined, 81 (31.1%) were found anaemic; the haemoglobin level being less than 10 gms. per cent (Table 7).

The urine samples of only 319 (72.5%) pensioners could be examined. Albumin was found in the urine of 32 (10.0%) pensioners. Glycosuria was present in 49 (15.4%) pensioners. The presence of glycosuria was highest in the age group of 70 years and above (27.3%) and lowest (7.7%) in the age group 50-54 years (Table 8). Though, there was an increase in glycosuria with the increase in the age, however, it was not statistically significant ($P > 0.05$).

TABLE 6
DISTRIBUTION OF MEAN SYSTOLIC AND DIASTOLIC BLOOD
PRESSURE ACCORDING TO AGE

Age group (year)	No. of individuals	Systolic blood pressure		Diastolic blood pressure	
		Mean	S.D.	Mean	S.D.
50-54	17	122.6	11.8	76.4	8.9
55-59	41	130.8	10.2	77.6	6.4
60-64	226	132.2	15.4	79.8	10.8
65-69	102	126.4	14.4	74.8	8.7
70 & above	54	122.2	17.6	77.4	9.1
Total	440	129.1	14.8	78.0	9.6

TABLE 7
HAEMOGLOBIN LEVELS OF PENSIONERS ACCORDING TO THEIR AGE

Age group (years)	studied No.	Haemoglobin levels (Gm. Percentage)		
		Mean	S.D.	Range
50-54	13	12.2	0.9	10.4-13.6
55-59	29	12.8	0.5	10.8-14.4
60-64	152	10.4	1.2	8.2-12.8
65-69	37	10.2	1.1	9.0-11.2
70 & above	28	11.0	0.6	8.5-12.0
Total	259	10.3	1.0	8.2-14.2

TABLE 8
GLYCOSURIA IN PENSIONERS ACCORDING TO AGE

Age group (years)	No. studied	Glycosuria	
		No.	Percentage
50-54	13	1	7.7
55-59	35	5	14.3
60-64	167	21	12.6
65-69	71	13	18.3
70 & above	33	9	27.3
Total	319	49	15.4

Of the 204 pensioners 61 (29.9%) whose stool could be examined, showed presence of ova and cysts in their stools (Table 9). The overall prevalence of infestation varied from 27.6 per cent to 36.8 per cent in various age groups, however, it was not much different ($P > 0.05$). Ascariasis was the most common worm infestation (11.8%) followed by *E.histolytica* (7.8%) and *Enterobius* (6.4%). A small percentage of pensioners also showed presence of *Taenia* (2.4%) and *Ankylostoma* (2.5%) in their stools.

Discussion

Though a number of studies have been carried out on the problems of aged in India²⁻⁷ none has attempted to study the problems of retired personnels. The present study was carried out on 440 retired persons of State of Uttar Pradesh, who have been drawing their pension from the Treasury of Lucknow.

The majority (92.3%) of the pensioners retired between 55 and 59 years and a majority of these retired on superannuation. Presently 46.6 per cent of the pensioners were aged 60-64 years, while 5.9 per cent and 12.5 per cent of them were between 50-54 years and 70 years and above respectively.

TABLE 9
HELMINTHIC AND PROTOZOAL INFESTATION IN THE PENSIONERS
ACCORDING TO AGE

Age group (years)	No. examined	Number Positive					Total	
		Asca- ris	Tae- nia	Anky- los- toma	Enter- obius	E.histol- ytica	No.	Percent age
50-54	10	2	-	-	-	1	3	30.0
55-59	17	2	1	-	1	1	5	29.4
60-64	127	16	3	2	7	7	35	27.6
65-69	31	1	-	1	5	4	11	35.5
70 & above	19	3	1	-	-	3	7	36.8
Total	204	24	5	3	13	16	61	
Percentage		11.8	2.4	1.5	6.4	7.8	29.9	

Health and vigour after retirement was found affected in 14.3 per cent pensioners and this phenomenon was found significantly more in those who compulsorily retired. This can be attributed to the consideration that the stress arising out of the forced retirement leaves one in such a dilemma, the challenge of which is difficult to meet. The state of mental health after retirement was found affected in 22.3 per cent pensioners. This was significantly associated with the change in authority of the pensioners. Mitra *et al*,⁵ noted 21.7 per cent of aged persons worried and depressed while Sudan⁶ remarked that age plays a significant role in the increase in anxiety; the common manifestations being distress, loneliness and loss in memory.

Nearly one-third of the pensioners were ill at the time of survey of which two-third were chronically ill. Amongst the acutely ill highest prevalence was that of fever (7.7%) followed by skin infections (4.8%), while hypertension (6.4%), cataract (6.1%) and diabetes mellitus (5.9%) were the most common chronic conditions.

Raj and Prasad identified 59.6 per cent aged males sick at the time of survey. Mitra found 12.7 per cent of aged persons acutely ill, 23.2 per cent chronically ill and 11.2 per cent having indifferent health at the time of survey. Purohit and Sharma reported that all the persons were sick and illnesses per sick person were 4.07 per cent. The main causes of illness reported by them were chronic bronchitis, anaemia, constipation, cataract, periodontal diseases etc. Sudan⁶ in his study found various physical ailments in the aged, common being constipation (90.0%), indigestion (57.7%) and backache (36.7%).

In this study, the mean systolic and diastolic blood pressure was 129.1 and 78.0 mm of Hg respectively and 6.4 per cent of the pensioners were found hypertensive, while 0.7 per cent were hypotensive as per adopted criteria. Raj and Prasad and Mitra have also made similar observations in respect of mean systolic and diastolic blood pressure of the aged.

The mean haemoglobin level of the pensioners was 10.3 gms. per cent. Though this was higher than the levels observed in those aged 60 years and above the difference was not significant statistically. Mitra⁵ reported mean haemoglobin

level as 11.4 gms. per cent which is higher than the findings of the present study. The lower haemoglobin level in pensioners after the age of 60 years may be attributed to the increasing incidence of achlorhydria with age, which is well recognised after the age of 60 and is generally thought to be one of the factors responsible for anaemia in the old age.

The prevalence of glycosuria was observed in 15.4 per cent of 319 pensioners whose urine samples could be examined. There was no significant association between the age and glycosuria. Raj and Prasad observed glycosuria in 14.8 per cent of the aged 50 years and above and it closely corresponds to the present findings. However, Mitra reported a lower prevalence (13.6%) of glycosuria in the aged persons.

Out of the 204 pensioners whose stools were examined, 29.9 per cent were found to harbour one or the other helminthic and protozoal infestation. Prevalence of ascariasis, amoebiasis, enterobiasis and ankylostomiasis was 11.8, 7.8, 6.4 and 1.5 per cent respectively. The higher age groups were affected more as compared to lower age groups. Mitra reported presence of ova and cysts in stools of 39.4 per cent aged at Lucknow and found higher age groups affected more as compared to lower age groups and these findings are similar to the findings of this study.

Conclusion

In conclusion, a very small percentage (14.3) of pensioners suffered from change in health and vigour and specially if they were compulsorily retired. The status of mental health was changed in 22.3 per cent of pensioners. A significant percentage (31.3) of the pensioners were found to be anaemic.

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यह अध्ययन लखनऊ कोशागार से पेंशन प्राप्त करने वाले 440 पेंशनभोगियों पर किया गया था। अधिकांश पेंशनभोगी (92.3 प्रतिशत) 55–59 वर्ष की आयु में रिटायर हुए थे तथा अध्ययन के समय इनमें से अधिकांश (46.6 प्रतिशत) 60–64 वर्ष के आयु-वर्ग में थे। केवल 63 पेंशनभोगियों (14.3 प्रतिशत) द्वारा

बताया गया कि रिटायर होने के पश्चात उनके स्वास्थ्य तथा स्फूर्ति में परिवर्तन हुआ है, इनमें से अधिकांश वे लोग थे जिन्हें अनिवार्य रूप से रिटायर किया गया था। सर्वेक्षण के समय 146 पेंशनभोगी बीमार पाये गये, 49 (11.1 प्रतिशत) ऐसे थे जो बहुत सख्त बीमार थे तथा 97 (22.1 प्रतिशत) पेंशनभोगी जीर्ण रोगों से ग्रस्त थे। सेवा-निवृत्ति के पश्चात 98 पेंशनभोगियों (22.3 प्रतिशत) के मानसिक-स्वास्थ्य स्तर में परिवर्तन पाया गया। इन पेंशनभोगियों में जो सबसे अधिक सामान्य बीमारियां पाई गईं वह इस प्रकार थी: बुखार (7.7 प्रतिशत), चर्मरोग (4.8 प्रतिशत), अतिसार एवं आन्त्रशोध (2.1 प्रतिशत) तथा आंखों की अतिक्षीण स्थिति (0.9 प्रतिशत) जबकि सर्वेक्षण के समय हाइपरटेंशन (6.4 प्रतिशत) तथा मोतियाबिन्द (6.1 प्रतिशत) रोग सबसे अधिक आम जीर्ण-रोग थे। पेंशनभोगियों का मीनसिसटालिक रक्तचाप तांम डायस्टालिक रक्त-चाप क्रमशः 199.1 एमएम तथा 78 एमएम.एचजी था। पेंशनभोगियों का मीन हैमोग्लोबिन स्तर 10.3 एमएम प्रतिशत था तथा 81 पेंशनभोगी (31.3 प्रतिशत) में रक्त की कमी पाई गई (हीमोग्लोबिन स्तर 10 जीएम प्रतिशत से कम था), 49 (15.4 प्रतिशत) पेंशनभोगियों में मधुमेह पाया गया था तथा 204 पेंशनभोगियों में से जिन 61 पेंशनभोगियों (29.9 प्रतिशत) का टट्टी का परीक्षण किया गया था, उसमें किसी न किसी प्रकार का अण्डाणु अथवा सिस्ट विद्यमान पाया गया, जबकि कृमि रोग आम (11.8 प्रतिशत) पाया गया।

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**LAPAROSCOPIC STERILIZATION: PERSPECTS OF ACCEPTANCE IN
RAJASTHAN (INDIA)**

S. K. CHOUDHARY and R. C. CHOUDHARY

ABSTRACT

Women volunteers numbering 552, who had undergone laparoscopic sterilization in a four days camp held at Udaipur, Rajasthan in 1981, were interogated about their knowledge regarding methods of family welfare, motives for laparoscopic sterilization alongwith their socio-economic status. The findings revealed that the reasons for acceptance of this method of family limitation were simplicity, quickness, safety, no hospitalization and early resumption of domestic work.

In India, the world's second most populous country, efforts towards reducing the family size have been made since 1965 under National Family Planning Programme. The programme had suffered setbacks from time to time inspite of the cafeteria approach for contraception. The male sterilization is popular only amongst the elite group. The low social class females prefer to be sterilized due to various social-cultural and economic reasons. With the advent of laparoscopic female sterilization in the Western World, it also came to the countries of third world. Other than the advantages of the method in terms of speed, simplicity and cost effectiveness, and the factors which could facilitate the acceptance of laparoscopic sterilization have been explored in this study.

Methods

A group consisting of 552 females who had undergone laparoscopic sterilization willingly at Udaipur in a family planning campaign in 1981 was studied. The age at marriage and cohabitation, religion, occupation, education, number of children, number of living male children, socio-economic status and knowledge regarding other family planning methods were enquired. It was also asked from whom they had the knowledge of family planning including laparoscopic sterilization.

Observation and Discussion

The campaign was conducted for four days with an average of 138 laparoscopic sterilizations per day. A majority of 68.74 per cent of acceptors were in the age group of 25 to 34 years, which is an ideal age for contraception as shown in Table 1. However, Lee *et al.* had reported higher number of women below 20 years. Hindus were 91.66 per cent and remaining 8.34 per cent were Mohamedans, which corresponds to the local religion structure. Most of acceptors were from nuclear families (58.34%) which showed a felt need for a small family norm. Remaining 41.66 per cent of acceptors were from joint families displaying awareness for small family.

Surprisingly, a majority 79.16 per cent got married before the age of 18 years. Others 20.83 per cent married at the age of 18 years and above. The age at cohabitation was below 18 years in 37.5 per cent. The official age at marriage for girls is 18 years as given in Table 2. The cohabitation in the local culture corresponds to a separate ceremony after marriage and should be treated as real age at marriage. The mean age at marriage was 15.18 years and that of cohabitation was 18.12 years.

The average number of children per acceptor was 3.9 and the average number of living male children being 2.2. In the Indian culture, it is a ritual to have atleast one male child to perform the last rites. Because of this stigma, none in our study group was without a male child. Lee *et al.* reported that among the women who underwent sterilization 4.5 per cent had no child, 11 per cent had one child and most of them (57.4%) had two children.

Two-third of the study group belonged to social class II and III and the remaining one-third to social class IV and V. The male partners in a majority of 60.41 per cent were engaged in business and others in decreasing order, in government service 16.66 per cent, in private service 12.52 per cent and others 10.41 per cent. A large proportion (45.84%) of the acceptors were illiterate and 31.25 per cent had education upto primary standard, 18.75 per cent upto middle and remaining 4.16 per cent had passed high school. None had University degree. Nagraj *et al.* observed only 0.2 per cent educated women amongst the acceptors of laparoscopic sterilization⁵. Education did not seem to affect the choice for laparoscopic sterilization.

TABLE 1

AGE DISTRIBUTION OF LAPAROSCOPIC STERILIZATION ACCEPTORS

Age group	Number	Percentage
Less than 25 years	46	8.33
25 to 29 years	127	22.91
30 to 34 years	254	45.83
35 to 39 years	103	18.75
40 years and above	22	4.16

TABLE 2

DISTRIBUTION OF AGE AT MARRIAGE OF THE ACCEPTORS

Age in years	Number	Percentage
Less than 14 years	92	16.66
14 to 17 years	345	62.50
18 to 21 years	104	18.75
22 years and above	11	2.08

The education of the husbands was better where 27.08 per cent had passed high school and 16.66 per cent were graduate and only 10.11 per cent were illiterate.

A sizeable number of acceptors (85.41%) believed family planning to be the means of limitation of births and none had an idea that the programme intends to help the sterile couples too.

Distribution of acceptors according to knowledge of various family planning methods is given in Table 3. Many couples had knowledge of more than one method. The most popular method being conventional contraceptives and intrauterine devices. Next in order was tubectomy and laparoscopic sterilization. There were 18.75 per cent women who had no idea of contraception before coming to the camp.

For laparoscopic sterilization they were motivated by various mass media "and publicity methods like film slides, pamphlets, newspapers, radio etc. Others got the knowledge from health workers, doctors, relatives, husbands and friends in the decreasing order.

TABLE 3

DISTRIBUTION OF ACCEPTORS ACCORDING TO KNOWLEDGE OF
DIFFERENT FAMILY PLANNING METHODS PRIOR TO STERILIZATION

Family Planning Methods	Number	Percentage
Conventional	287	52.08
IUD	310	56.25
Oral Pills	23	4.16
Tubectomy	92	16.66
Laparoscopy	12	2.08
None	103	18.75

Most of the women (89.58%) felt free from botheration as the procedure of laparoscopic sterilization takes less time. Twenty-five per cent were attracted by good incentives and less complications.

Only 36.45 per cent of the acceptors opted for conventional tubectomy, whereas remaining 63.55 per cent would have gone back without sterilization had the opportunity of laparoscopic sterilization not been there. As expected 89.5 per cent had consent of their husbands before coming to the camp. The conventional tubectomy is becoming less popular as it requires atleast a week's stay in the hospital, is considered a major operation, and has more complications according to the respondents. It is a practice in this area, not to resume routine domestic work when the lady has undergone a major operation. Under such circumstances the quick method of laparoscopic sterilization with minimum hospitalization, no general anaesthesia, hardly any complications and a rapid return to their domestic work including childcare, has been a boon and hence preferred?.

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राजस्थान के उदयपुर क्षेत्र में 1981 में लगाये गये चार-दिवसीय शिविर में जिन 552 महिलाओं ने दूरबीन नसबन्दी (लेपरोस्कोपिक स्टरलाइजेशन) कराई थी, उनसे परिवार नियोजन विधियों संबंधी उनके ज्ञान, दूरबीन नसबन्दी के उद्देश्यों, तथा इसके साथ-साथ उनके सामाजिक-आर्थिक स्तर के बारे में प्रश्न किये गये। प्राप्त परिणामों से ज्ञात होता है कि लोगों द्वारा परिवार नियोजन की इस विधि को स्वीकार करने के मुख्य कारण थे— इस विधि का बहुत सरल होना, आपरेशन जल्दी हो जाना, अस्पताल में भर्ती की आवश्यकता न होना तथा नसबन्दी के पश्चात घरेलू कामकाज संभालने के लिए जल्दी ही स्वस्थ हो जाना।

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**REVIEW OF RESEARCHES IN HEALTH
ECONOMICS CONDUCTED IN INDIA**

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ABSTRACT

An attempt has been made in this study to compile a review of researches in health economics conducted in India. The main areas of research pertain to need and demand, supply of health care services and impact of diseases and programmes, including cost benefit and cost effectiveness studies. The future areas of research in health economics have also been indicated.

The research in health economics gained momentum particularly during the last two decades but much of the work was done in the developed countries, such as USA, UK etc. As has been mentioned by Weisbrod, the research in this field was directed at developing a better understanding of the complex process by which the state of health is defined, measured and improved. There have been studies, both positive and normative, in the areas such as production function, cost and supply of health services, demand for health, prices and incentives, financing, cost-effectiveness and cost-benefit analysis. However, in the developing countries like India, the interest in the field has been very limited and as such not many researches are there in this field. Whatever research have been done in this field are scattered which makes it difficult to cover all of them. However, on the basis of available literature in the form of books, reports and articles published in various journals, an attempt has been made to compile a review of the studies in health economics conducted in India.

The studies have been grouped under three heads; viz.

(i) need and demand, consisting of studies on personal health expenditure; (ii) supply, consisting of studies related to cost-analysis of various types of services/programmes; and (iii) economic impact of diseases, including cost-benefit analysis of family planning and other programmes.

Need and Demand

The Department of Hygiene and Public Health of the John Hopkins University studied various aspects of health services and needs by using functional analysis method. The data was drawn from extensive survey in Punjab and Mysore in India, apart from field area in Turkey. The results were presented area-wise. In respect of health needs the study revealed that about 61 per cent of care needs remained to be unmet. Regarding the utilisation of medical care, the study revealed that the mean average payments in the case of qualified indigenous medical practitioners in Punjab and Mysore were Rs.0.10 and Rs.0.52 respectively. The similar cost for qualified medical practitioners in the two areas were Rs.0.71 and Rs.0.41. An individual was found to spend an average of Rs.1.99 and Rs.1.90 per illness episode in Punjab and Mysore, respectively.

In order to obtain the base-line data regarding health aspects of community, a series of General Health Surveys were conducted in selected blocks of Captainganj Miraj and North Arcot district during 1955-56. One of the main purpose of these surveys was to examine the utilisation of available health care services and to know the expenditure on medical care. In one of the health survey conducted in the Captainganj block in Kanpur by Seal and others, revealed that about 63 per cent of families did not incur any expenditure on medical care. The annual per capita expenditure on health was Rs.1.53 for the community as a whole. The percentage of expenditure on medical care increased with economic status, i.e. 0.5 per cent to 1.0 per cent for those spending less than Rs.300 and 2 per cent for those spending more than Rs.300 per person.

Ram and Dutta conducted a study in the Miraj taluka in 1974. A sample of 10 per cent households was taken for the study. It was found that about 20 per cent households did not seek medical care even for major illnesses. In the case of those availing of medical services, allopathic doctor was preferred even if he was available at a distance. The average annual household expenditure on medical care was Rs.72; while per person expenditure on medical care was about Rs.12.40. The study indicated that education and income have a direct effect on expenditure on medical care. Rao and Fernandes⁵ undertook a similar study in the two talukas of North Arcot district. The data was collected through interviews and prospective study. The study reported on average health expenditure of

Rs.13.00 per person and Rs.80.00 per family per year. It was also discovered that the expenditure on medical care in villages was affected by the income and size of the family.

The above mentioned studies show an increasing trend in the health expenditure. It is also revealed that such expenditure is positively related with the income and family size.

Supply of Health Services

The studies on supply of health services were limited mostly to utilisation of health services and cost of medical care services.

Ram and Dutta conducted another study in the Miraj Taluka to assess the utilisation of Primary Health Centre (PHC) and sub-centre facilities. Ten per cent of the household constituted the study sample. The study revealed that 13 per cent of the household utilised the services provided by the PHC, while 16 per cent of the households visited sub-centre for medical care of their families. The pattern of utilisation of PHC and the sub-centre services reveal that perhaps distance was the main reason for the low utilization of the available medical care. It was further observed that the visit to PHC and sub-centre was inversely correlated with income and education.

The unit cost of services and facilities have been studied by a number of authors. The study on Functional Analysis of Health Needs and Services by John Hopkins University², also provides the cost analysis of the services provided by the PHCs in Punjab and Mysore. It was found that total annual operating cost of a PHC was Rs.1,59,700 (approx.) in Punjab and Rs.83,400 (approx.) in Mysore during 1968. The higher cost in the case of Punjab was due to more staff and their higher salaries. The average health centre expenditure per outpatient visit was Rs.1.45 and Rs.0.97 in Punjab and Mysore, respectively. Unit costs of service contacts were also worked out.

Shipra Banerjee carried out a study of public expenditure on health and its beneficiaries in Gonda PHC in Aligarh District. She found out that the total PHC expenditure during 1978-79 was Rs.3,48,143.00 with recurring and non-recurring expenditure accounting for 98 and 2 per cent respectively. The staff salaries accounted for 78 per cent of total expenditure followed

by drugs 16.5 per cent. The per cent distribution among PHC headquarters, sub-centre and field was also worked out to 25, 9 and 66 per cent respectively. She worked out percentage distribution among various functions performed by the PHC; viz. medical relief 16 per cent, family welfare 23 per cent, maternal and child health 22 per cent, communicable disease 32 per cent, environmental sanitation 5.0 per cent, vital statistics 1.5 per cent and health statistics 0.5 per cent in line of the functional analysis study² reported earlier. She calculated cost per outpatient visit, per outpatient and per inpatient for PHC to be Rs.1.71, Rs.2.53 and Rs.343.00 respectively. The unit costs for sub-centre and field in respect of outpatient visit worked out to be Rs.15.04 and Rs.2.17 respectively. She also interviewed the beneficiaries which revealed that out-of-pocket expenditure for the current illness was Rs.3.25; one visit to PHC costed Rs.0.30 on transport etc. while one visit to private practitioner costed Rs.53.00. The findings of the two studies show that PHC expenditure has been increasing with time.

Sharina and Bhatia studied the cost-structure of rural health cooperatives in Delhi. The study revealed that average expenditure per patient was Rs.1.01 during 1957-58 but came down to Rs.0.63 in 1964-65. The contribution from per patient visit towards staff salaries and medicines was Rs.0.57 and Rs.0.18 respectively in 1957-58 and Rs.0.36 and Rs.0.16 during 1964-65. This shows that in 1964-65, the revenue from patient visits was able to compensate a major portion of expenditure incurred on staff salaries and medicines because the expenditure had gone down by about 40 per cent in the year 1957-58.

Cost-studies on hospital set-up have been of varying nature. Sharma and Timmappaya, conducted a pilot study in hospital cost analysis in Faridabad and Gurgaon districts of Haryana in 1968-69. They provided the methodology for determining the unit cost of various services provided in a hospital and used it to work out the cost of inpatient and outpatient care. The cost per in patient day was Rs.5.54 whereas cost per out-patient visit was Rs.0.91. In the cost-structure, staff salaries accounted for the major portion about 50 per cent of the unit cost, i.e. Rs.3.76 and Rs.0.51 respectively, for inpatient day and outpatient visit. Cost of medicines was Rs.1.95 and Rs.0.26 respectively for inpatient and outpatient care. Kataria *et al* carried out a similar study of cost analysis for the Nursing Home of Willingdon Hospital, New Delhi

in 1972. The study revealed that unit costs per inpatient day and outpatient visit were Rs.58.41 and Rs.9.87 respectively. The staff salaries accounted for Rs.23.20 (41.4%) and Rs.3.47 (35%) in respect of inpatients and outpatients. The outpatients receive their medicines from their respective dispensaries and are not disbursed through the Nursing Home. The unit cost of drugs and medicines in respect of inpatient days was Rs.14.50 (24.8%). The unit costs of X-ray, laboratory tests, and blood bank were Rs.7.00, 2.59 and 7.64 respectively. The diet charges accounted for Rs.7.53 per inpatient day. The unit costs of operations worked out to Rs.126.32 per operation. The cost of washing 100 pieces of clothes worked out to Rs.12.45. The average total cost per inpatient was worked out to Rs.662.

Sinha worked out inpatient costs in two hospitals of Delhi during 1964-65. He found that inpatient costs in the two hospitals were Rs.15.05 and Rs.21.46. The staff salaries contributed most to these costs, being 62.1 and 61.5 per cent of the total costs, in the two hospitals. Drugs and chemicals accounted for 11.3 and 12.8 per cent respectively. These findings are in contrast to those obtained in the study of Willingdon Nursing Home but fairly agree to those of Sharma and Timmappaya.

Apart from studies on cost analysis of the hospital as a whole, certain studies were undertaken in respect of various departments of the hospital. The quality control unit of Indian Statistical Institute (ISI), New Delhi conducted department-wise cost studies in the Safdarjung Hospital, New Delhi, during the year 1968-69. They obtained unit cost of laundry services to Rs.11.77 per 100 pieces, unit cost in Plastic and Burn Operation theatre to Rs.144.53 per operation cost per patient in VDTTC Department to Rs.7.99, cost per operation in the Orthopaedic Department to Rs.137.78, cost at the Central Sterilisation Room to Rs.4.67 per man hourly, cost per exposure at the X-ray Department to Rs.7.29 and the cost of the food serviced to Rs.2.16 per patient day.

Gangopadhyay, while studying radiological services in two large Delhi hospitals, worked out the unit cost of radiological services. It was found that the average cost per X-ray exposure was Rs.6.80 in Willingdon Hospital during 1975, whereas the corresponding unit cost for Safdarjung Hospital was Rs.7.11. The unit cost of certain other services was also worked out for the Willingdon and Safdarjung Hospitals respectively viz. I.V.

Paelography: Rs.65.37 and 65.10, Barium meal Rs.41.22 and Rs.40.95, Bronchography Rs.50.8 and Rs.50.47, Barium Enema Rs.34.02 and Rs.33.75, and Hysterosalpingography Rs.61.75 and Rs.61.48. These findings show that unit costs of various tests in the two hospitals were almost similar.

Anand studied the cost of linen services in five hospitals of Delhi during the year 1965-66. The unit cost of linen services varied between Rs.0.29 to 0.45 in the case of government owned hospitals, while it was Rs.0.94 in a private hospital.

Sengupta, studied the cost composition of institutional treatment provided by various agencies, such as government civil dispensaries, government subsidised dispensaries, ESIC, Police, Railways, Local bodies, private hospitals, TB Clinics etc. The findings were on an average, the component of staff salaries accounted for 66 per cent of the total cost while drugs and medicines contributed 32.1 per cent. The percentage composition of other costs in institutional care rendered by various agencies were also calculated.

The erstwhile National Institute of Health Administration and Education carried out a study on Central Government Health Scheme. The study findings revealed that the cost of medicine varied according to the status and class of the employees. The class-wise cost of medicine per illness worked out to be Rs.5.2 for upper class, Rs.4.0 for middle class and Rs.2.2 for the lower class, while the total cost per illness per person varied among classes *e.g.* Rs.7.43 for MPs, Rs.5.40 for Class I, Rs.5.25 for Class II, Rs.3.52 for Class III and Rs.2.71 for Class IV employees.

Chaudhury examined the pattern of health expenditure of CGHS beneficiaries in Delhi. The study revealed that average monthly cost per episode of sickness/health care for CGHS beneficiaries (medicines and investigation), was Rs.8.61 in the retrospective and Rs.10.90 in prospective studies. The average private health expenditure incurred per beneficiary per month was found to be Rs.6.90 and Rs.6.79 while the CGHS expenditure per beneficiary per month was Rs.2.06 and Rs.2.50 respectively in the retrospective and prospective studies.

Khatri did a comparative study of the costs pattern of three dispensaries - one each pertaining to different agency,

viz. Central Government Health Scheme (CGHS), Employees State Insurance Corporation (ESIC) and Delhi Administration (DA), located in the vicinity of Shakti Nagar, Delhi. The study findings were based on three-year data from 1976-77 to 1978-79, and the year 1976-77 was taken as baseline. On comparison with baseline, it was found that the total expenditure during 1978-79 showed a rising trend in all the three dispensaries. Viz. CGHS: 19.8 per cent; ESIC: 38.3 per cent and DA: 27.0 per cent. The share of salaries ranged between 27.6 to 41.0 per cent in the case of CGHS, 46.5 to 51.9 in case of ESIC and 49.8 to 59.7 in case of DA. The average unit costs per unit visit (over 3 years), were Rs.7.37 for CGHS, Rs.3.49 for ESIC and Rs.1.69 for DA; the corresponding per patient cost being Rs.19.32, Rs.15.83 and Rs.4.32 respectively. Cost per day of dispensary worked out to be Rs.2,333.26 for CGHS, Rs.3,092.73 for ESIC and Rs.417.45 for DA. The cost-structure of the three dispensaries was found to be similar.

In an exploratory study on urban Maternal Child Health and Family Welfare Centre, Gupta and Juyal presented data on cost of activities and services rendered, as well as unit costs. Unit cost per MCH and Family Welfare visit per case was Rs.6.58 in 1974. The corresponding cost for home visit was Rs.8.85. The unit costs obtained in this study have been compared with those reported by other studies. A comparative study of the unit cost of various services provided by two urban family welfare centres, one under government and the other under nongovernmental set-up in the Union Territory of Delhi was conducted by Bhasin on the basis of detailed cost analysis using the activity (observational) analysis for cost apportionment, she found out that 72.02 per cent and 55.8 per cent of the cost is apportionable to the activities carried out at the clinic of the two types of centres under study, respectively. The allocation of expenditure to the direct patient care was 35.89 per cent and 26.85 per cent respectively for the two centres. The author also calculated the unit costs per service contact, in respect of 12 types of services rendered by the two centres.

Economic Impact of Diseases

A study on economic impact of Malaria Eradication Programme was undertaken by Sengupta. A sample of four States was selected using stratified random sampling for the study. However, due to lack of required data, the analysis was carried

out in respect of one State only, i.e. Rajasthan. After taking into account the various sources of data, reference to past studies and study findings, various indices were prepared. It was observed that average costs per malaria control unit for the year 1953-54 to 1957-58, ranged between Rs.2.91 and Rs.3.94 lakhs (average operational costs per unit were in the range of 0.87 and 1.34 lakhs while the cost of materials and equipments ranged from Rs.1.85 to 2.59 lakhs). Similarly, the average cost of a malaria eradication unit during 1958-59 to 1971-72 varied between Rs.3.27 and 5.10 lakhs (the average expenditure per unit on materials and equipment and operational cost varied between 0.85 and 2.75 and Rs.1.61 and 3.21 lakhs respectively). This showed that eradication programme was marginally expensive due to the higher operational costs.

Apart from the study on economic impact, studies on cost-benefit and cost-effectiveness of various programmes were also undertaken. Ramaiah carried out cost-benefit and cost-effectiveness analysis of the two strategies adopted for the National Smallpox Eradication Programme (NSEP). The two strategies compared were one with emphasis on vaccination followed during 1962-72 and the other based upon intensive surveillance and containment measures followed during 1973-75. The findings revealed that the cost of effectiveness of NSEP during 1962-73 was of the order of about Rs.7,209 million per one per cent while that of intensified campaign was Rs.2,834 million per one per cent. The cost-benefit study revealed that eradication programme had additional benefits of Rs.728 million which would have been spent to keep the disease under control and towards other direct and indirect costs. The total cost of the intensified campaign was estimated to be Rs.762.9 million which would have been Rs.1,820.713 million without the changed strategy. Hence, the net benefit to the society was worked out to be Rs.1,057.813 million. Ramaiah also carried out a cost-benefit analysis study in respect of malaria eradication programme. In this study total cumulative cost of malaria was calculated, with National Malaria Control Programme (NMCP) and National Malaria Eradication Programme (NMEP) and without these programmes. The savings in cost due to reduced incidence of disease arising out of the programme is compared to the cumulative programme costs to work out cost-benefit ratios. Such ratios have been calculated for the years 1953-54 to 1976-77. It was found that the net benefit of the NMCP/NMEP have strong positive correlation with programme expenditure

($r = 0.8686$) and 75 per cent of variation in benefits can be explained only by the variation in programme expenditure. It was further noted that the sources of the benefits were savings in the cost of treatment (68.3%) and future earnings cost 14.2 per cent due to reduction in the incidence of the disease consequent upon the NMCP/NMEP.

Cost-Benefit Analysis of Family Planning Programme

Several studies have been attempted on the cost-benefit analysis of the family planning programme in India. Basu calculated the benefit cost ratio of the family planning programme to be 32:1 on the basis of cumulative expenditure till 1967-68 and births averted by the performance. Repetto³² calculated benefit cost ratio to be 5:1 for the programme which was least. Mehta³³ using 1970-71 performance and expenditure and applying a 10 per cent discount rate, computed benefits to be at least sixteen times the cost. Juyal while studying interrelation of health, population and development calculated the cost-effectiveness (both average and marginal) in respect of per 1 per cent of effective couples protected and per birth averted for the years 1966-67 to 1980-81. Suri³⁵ reviewed some of the cost-benefit studies conducted earlier by Coale and Hoover, Enke, Dameny, Simmons and others.

Discussion

The foregoing survey of the available researches show that a very limited coverage in the field of health economics has been achieved. The main findings of this survey may be broadly summarised as follows:

1. Majority of the studies related to the cost analysis of services, pertaining to different set-ups. The main objectives of these studies were to identify wastages and ways and means to plug them. Underutilisation of resources is the main area identified by the various authors. Poor bed occupancy, idle equipments and large proportion of idle time are some such examples. It was further noted that lack of proper recording of activities performed also resulted in reflecting low output and high unit costs.
2. The studies on economic impact and cost-benefit and cost-effectiveness analysis move a step beyond the usual cost

analysis studies as former also deal with the impact of the services rendered under the programme. Hence, they yield useful data for planning and management. The results of the studies, discussed earlier, indicate as to which of the strategies would be more cost-effective, *e.g.* Sengupta found that control programme was marginally cheaper than eradication programme; Ramaiah showed that intensified programme against smallpox was more cost-effective than immunisation based programme.

3. The general findings in respect of demand and utilisation of health services is lack of need and demand and lack of utilisation of existing services apart from the low coverage of the facilities.
4. Similarly, the information revealed by General Health Survey and other community studies how that only a small fraction of income is spent on health care.

The subject area and findings of these studies show that there is a notable absence of research work on the role of health in respect of economic development and human capital formation. Except the study on functional analysis of health services², there is no detailed study on the need, demand and utilisation aspects. In the case of supply of health services the main areas not represented are production function, variables affecting supply of services and facilities etc. Financing of health services both at personal and community level has received a limited attention. The distribution of services and facilities and their linkages have not received particular attention. Furthermore, the studies mostly pertain to institutions covering a limited area. Only few studies had been taken up at block or district level. In a recent study, carried out on economic analysis of health services in the Western Uttar Pradesh by Juyal, health services have been viewed as an integral part of the broader socio-economic system. While health variables affect economic development, various socio-economic variables, in turn, affect health services also. By using data drawn from primary and secondary sources and applying various statistical techniques, the author has studied contribution of health variables to productivity, role of health in economic development and effect of socioeconomic variables on the demand and supply of health services. The other important areas dealt with relate to production function, distribution of services and facilities, financing

Of services both at personal and community levels, economic impact of morbidity and mortality; etc.

It may thus be concluded that except for few instances here and there, the researches conducted do not cover the subject area of health economics adequately. There are certain important areas which require attention of researchers on priority basis. A list of some such suggested areas is given as under: (i) need and demand for resources required for health programmes; (ii) development of resource allocation models for optimum utilisation of manpower and facilities in various set ups like PHC; (iii) utilisation of various facilities like PHCs; (iv) cost analysis of services provided by various facilities like PHC, district hospital, teaching hospital etc. and development of standard costing methods; (v) comparative studies to evaluate different alternatives such as ambulatory surgical procedures VS., Institutional procedures; home delivery vs. hospital delivery, sub-centre/community health guide VS. Anganwadi Workers, Male MPW VS. Birth Attendant; diagnostic centre VS. hospital OPD; Minilap Vs. laproscopic sterilisation; IUD VS. Oral Contraceptives and effectiveness analysis of MPW Scheme, etc.; (vi) cost benefit analysis of sophisticated equipments like scanners, creation of super-specialities like renal units with transplan coronary care unit etc.; (vii) integration of various programmes at implementation level, and (viii) development of a uniform health information system.

Some of these areas like cost analysis and utilisation of PHCs have been reported earlier also. Still, some studies on these aspects from time to time will provide useful information both planning and implementation of health facilities and programmes.

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इस अध्ययन के माध्यम से देश में स्वास्थ्य अर्थ-व्यवस्था पर किये गये अनुसंधान अध्ययनों की समीक्षा संकलित करने का प्रयास किया गया है। इन अनुसंधान अध्ययनों के मुख्य विषय-क्षेत्रों के रूप में, स्वास्थ्य देखरेख सेवाओं की आवश्यकता, मांग तथा आपूर्ति और रोगों तथा कार्यक्रमों के प्रभाव के साथ-साथ इन अध्ययनों में लागत-लाभ तथा लागत-प्रभावकारिता संबंधी पहलुओं को लिया गया है। स्वास्थ्य अर्थ-व्यवस्था के क्षेत्र में अनुसंधान के भावी पहलुओं की ओर भी इस लेख में संकेत किया गया है।

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