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HUMAN ELEMENT IN ADMINISTRATION**

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ABSTRACT

Hunan approach is an important factor in administration. Knowledge of rules and procedures and technical skills are certainly essential, but basic human qualities count more than anything else and make the difference between success and failure in administration These observations were made by Shri Rajeshwar Prasad in the course of his address at the NIHFW Staff College Course held in October, 1978, Other thought-provoking observations made during the course of his address have been summarized below,

"We have gone to extra-ordinary lengths to contrive ways to permit man to walk on the moon but we have still not learned to govern ourselves on earth. We have spent billions to split the atom but hardly pennies to unite humanity. The identification of human talent, the kindling of human motivation, the improvement in human relations in our institutions of productive efforts are a major part of governing ourselves. They continue to elude our grasp more than does the physical universe because we study them with far less dedication and in far 1ess magnitude than we study our physical; environment".

- Glen Stahl

These words emphasize in no uncertain terms the importance of good administration that maximizes human talent to improve productivity in organisations while simultaneously keeping the individuals satisfied and well motivated. Human relations form a crucial part of sound administration as administration consists not only of dealing with files,

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***-Adapted from the key-note address delivered at the Staff College Course held at NIHFW in October 1978.*

materials or blueprints but also with the human beings, each one unique, complex, characterized by his own desires and ambitions, likes and dislikes, conflicts and tensions, strengths and weaknesses. Good administration consists of optimal utilization of strengths and minimization of or diversion from weaknesses.

Human relations in administration are important for another reason. No organization can be built by single individuals, however talented or dedicated. Team effort and team spirit are basic to the success of any organization. Achieving good team work is far more challenging in bureaucratic and hierarchical organisations. Leadership is very important in. any organization. The human qualities of outmost importance are integrity, sincerity and honesty. The most successful of men are not those who burn the midnight oil themselves, but those who are able to inspire and guide others to work for them. The organizational climate is characterized by empathy and reciprocity. A sincere leader or manager encourages the rest of the staff to be sincere. Employee problems need to be dealt with a human touch. At times it may not be indiscrete to deviate from the rules to help a sincere person. One should be a person about whom it could be safely said "he spent his life in kindly deeds. A helping hand for others' needs"

An important aspect of organization leadership is decision-making. Many of our present day shortcomings are due to the lost art of decision-making. This escapism is the mentality of "submit and transmit" which is most unfortunate. Equally undesirable is the habit of writing 'please speak on every paper requiring decision. Too often there is an eternal going round and round, a sort of paralysis by analyses. Sometimes, there may not be even analysis, just plain pure paralysis. A more subtle form of this procrastination is to be seen when difficult issues are referred to Committees and Commissions, whose reports when received months later are duly praised and pigeon-holed or else, these are placed before a conference, which has been aptly defined as "a gathering of important people who singly can do nothing, but together can decide that nothing can be done". Indecision is prevalent even at highest levels. Therefore, one must take decision with his best of ability and in good faith rather than let things linger on. There seems to be a fervent belief in what Oscar Wilde once said "I never put off till tomorrow what I can possibly do the day after".

The issue of centralization *vs.* decentralization has been highly debated. For effective team work delegation of authority is important. Administrators should delegate powers to the maximum but always keep suitable control on the way things are moving. They need to coordinate their affairs with least show of authority. It should be like hard steel kept always under the soft velvet. It is wise to give everyone the fullest sense of importance, because the urge to be important (ego) is as deep rooted in Human nature as the craving for appreciation. Therefore, to get willing cooperation, a person must think and talk in terms of the other man's interests. Baiting the hook to suit the fish is as important when one goes fishing for men. One should not be raffled by opposition and obstruction. A successful man is one who can lay a firm foundation with the bricks that others throw at him.

Relationship with superiors is perhaps the most difficult relationship of all. Here the administrators are at a disadvantage. Superiors generally expect sincerity in work and loyalty to themselves. Loyalty is all the more important because trust begets trust. However, this relationship cannot be established very easily. In such cases it is better to be frank about it. One solution is to get one transferred away (not him). If this is not possible for any reason one must face the situation with grace. Although subtle and delicate it is better to keep a respectful distance in official relations whatsoever be the social or personal relations one may have. Too much of closeness and familiarity often results in contempt or displeasure of the boss and simultaneously create jealousy in colleagues.

Public dealings should be marked with sincerity, courtesy, patience and absolute impartiality. There must be a fixed time in the office when any one can come and see. One must be accessible to the public and give them opportunity to air their grievances rather than allow the accumulated displeasure to reach the superiors. Meeting people is in itself an educational process. It is crucial to maintain absolute impartiality and be always firm and fair besides being tactful and polite. Although one may not be able to fulfill all the needs and wants of people, one must at least be able to give a sense of satisfaction to them. Effective public relations are both a science and an art.

Arbitrary functioning on the basis of individual judgment is no longer possible, but if one is able to win the support of the people, he can achieve all that was ever achieved before and more.

Rigidity will not help anyone, even if one is in the right.

"Here lies the body of William Jay Who died maintaining is right of way

> He was right, dead right, as he sped along But he is just as dead as if he were wrong".

Civil servants have to be adaptable. They should be flexible but at the same time they should not sulk at being overruled.

A balanced sense of humor is crucial to maintain one's mental health. In organization it helps to restore a sense of proportion and one should never lose the sense of humor. Learn to laugh at yourself and you will learn to laugh at life. Humor will also help to tackle difficult, tense situations when other approaches might fail.

There is great strength in humility. As Chinese proverb say "he who treads softly goes far". No matter how high you rise, always remain humble. The abuse of greatness is when it disjoins remorse from power". Let everyone feel at ease with you however big you may be. "There is a great man who makes every man feel small. But the real great man is the man who makes every man feel great" - Charles Dickens. Therefore, lift yourself above yourself and try to think of yourself as the instrument of a higher cause, a higher purpose.

Whatever be the circumstances, always remain human, kind and in the words of Horace Mann "Be ashamed to die until you have won some victory for humanity". So, strive to leave every place a little better than the way you found it. If after you have served and gone, you leave a memory that is treasured and cherished in the hearts and minds of the people you have served them, as public servants, you can ask for no greater fulfillment and aspire for no greater reward.

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INFORMATIONAL AND DOCUMENTATIONAL NEEDS FOR HEALTH AND FAMILY WELFARE PROFESSIONALS**

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ABSTRACT

Accumulation of knowledge alone is not sufficient; of far greater importance is its dissemination and application. Users of information are education leaders, teachers, research workers and students. The documentation information system should not only identify the personnel in need of their services but also maintain a directory of the same. The Documentation Centers, therefore, should provide information relating to behavioral sciences, health practices, demographic aspects, health services structure - its utilization and available health resources - environmental health, detection, diagnosis, management and prevention of diseases, academic and educational information on health education, research activities, and views expressed by people and on development and events likely to have bearing on health and family welfare.

A yawning gap exists between the available resources and health needs of millions of undernourished and disease-ridden people all over the world. Dr. N.R.E. Fend all has summarized the present situation:

"If I am asked to compose an epitaph on medicine throughout the 20th century, it would read: brilliant in its discoveries, superb in its technological breakthrough, but woefully inept in its application to those most in need. Medicine would be judged not on its vast and rapid accumulation

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of knowledge *per* se, but on its trusteeship of that knowledge".

Accumulation of knowledge alone is not sufficient; of far greater importance is its dissemination and application. It is in this context that development of effective infrastructure of informational and documentation services for different levels of health personnel engaged in the task of providing health care to the people is vital to the success of these programmes.

A bewildering multiplicity of terminology bedevils clear understanding of health information system. The variety of terms employed includes medical information system, patient information system, ward management-information system and laboratory information system. Some of these terms emphasize the locus of the system such as the hospital or the wards while others its focus i.*e.* the patient or the health care. Often they are used interchangeably. For the purposes of this presentation, the health information system is a mechanism for the collection, processing, analysis, and transformation of information required for organizing and operating health services and for research and training.

Who are the users of this information? I would classify them into four broad categories:

1. Education leaders, who regardless of academic rank or title, exercise independent judgment and make decisions that have significant impact upon educational programmes *e.g.* Principals, Deans and Heads of Departments.

2. Teachers, who perform the most direct instructional functions, dealing with students in their day to day learning activities,

3. Research workers engaged in investigative projects.

4. Students.

Teaching, training and research in any specialty are closely related functions, but particularly so in the field of medicine and health sciences so that informational requirements of these groups considerably overlap. Even so, the re-

quirement of the research workers will be by and large in research publications and original work, whereas teachers will be more interested in current thoughts, reviews of literature and material relating to teaching technology. They will all be concerned with bibliographies, reprints, annotations and abstracting services, proceedings of conferences, symposia and workshop manuals, book reviews, etc. The requirement of researchers, in addition, will include procurement of microfilms and translation facilities. Among all the users of these groups are likely to make the most extensive utilization of Documentation and Informational services.

In addition to persons devoted to academic pursuits, there exist a large number of private practitioners and physicians serving in rural and tribal areas, in the Primary Health Centers and sub-centers, who constitute important potential clientele for medical and health information systems. In the system of medical education today, any doctor who goes out of the medical colleges has little opportunity to update his knowledge and skills. In the modern world where a virtual explosion of knowledge is taking place in most sciences and the existing stocks of knowledge are being doubled every seven years or so, a programme of continuing education by continual feeding of appropriate information assumes the greatest significance.

Existing Facilities

The existing information system in health and related fields in medicine and family welfare, though inadequate, appears to rest on a very wide base of informational material that is capable of being developed into an effective national documentation-information network in an integrated manner. These facilities are largely provided by post-graduate institutions of teaching, training and research, as well as in the medical colleges. I would briefly consider the existing facilities.

National Medical Library: It is situated in the campus of the All India Institute of Medical Sciences adjoining the Indian Council of Medical Research, New Delhi. It provides reference and bibliography services to medical profession in the country. It brings out a union catalogue of medical periodicals in Indian Libraries.

All India Institute of Medical Sciences Library: It houses 23 thousand volumes of bound journals; 37 thousand books, 8 thousand pamphlets, monographs and reports, and subscribes to about 500 periodicals. It has also procured a significant number of back volumes of journals in several specialties. The services given by this library include reference on demand, bibliographies and photo-duplications.

Institute of Research and Reproduction, Bombay: It provides reprint services to researches on bio-medical aspects of population and family welfare.

Central Health Education Bureau, New Delhi: It brings out selected bibliography on health- education and prepares other audio—visual aids.

Institute of Rural Health and Family Planning, Gandhi-gran: It gives reference services to the researchers and trainees of the Institute.

International Institute of Population Studies, Bombay: This Institute has a library that publishes quarterly acquisition lists and compiles bibliographies on fertility and family welfare.

Family Planning Association of India, Bombay: This organization publishes a quarterly journal called "Journal of Family Welfare" and a monthly Newsletter called "Planned Parenthood".

Office of the Registrar General of India, New Delhi: It issues quarterly acquisition lists, serial list and bibliographies, such as Bibliography of Social Studies in India.

In addition to all these, there are 106 medical libraries in the country, seven central training Institutions, 44 health and family planning training centers, 12 demographic and communication action research centers located in academic institutions or universities and important research and training institutes like, Post-graduate Institute of Medical Education and Research, Chandigarh, Jawaharlal Institute of Post-graduate Medical Education and Research, Pondicherry, All India Institute of Hygiene and Public Health, Calcutta, All India Institute of Speech and Hearing, Mysore, National Institute of Tuberculosis, Bangalore, All India Institute of

Mental Health, Bangalore, Central Leprosy Teaching and Research Institute, Chingleput, V.P. Chest Institute, Delhi, Haffkine Institute, Bombay, School of Tropical Medicine, Calcutta, etc. All these institutions have well-staked libraries relating to their own specialties. In addition, several of these institutions provide general library facilities as well. Thus, relatively speaking there is considerable material scattered all over the country that needs to be linked together into an effective national base.

Development of documentation services in this country, on the other hand, is relatively of recent origin when compared with the establishment of libraries. Noteworthy centers include Indian National Scientific Documentation Centre (INSDOC), Regional Documentation Centre in Human Reproduction, Family Planning and Population Dynamics of SEARO of WHO in New Delhi, Social Science Documentation Centre of Indian Council of Social Sciences Research, and International Institute for Population Studies, Bombay.

The library and documentation services at the National Institute of Health and Family Welfare have been visualized as a national centre to collect compile and disseminate technical knowledge and information related to health and family welfare planning programmes. With the merger of the erstwhile National Institute of Family Planning and National Institute of Health Administration and Education into one organization, the scope of informational and documentation services expected of the new Institute has considerably widened so as to include all aspects of health, medical and family welfare services. The documentation services initialed by the Documentation Centre of the Institute are both anticipatory and responsive in nature. These include:

Anticipatory Documentation Services

Abstracting Bulletin: The first issue of the abstracting bulletin containing latest information culled out from journals research reports, conference papers etc. was released in 1977 with quarterly periodicity from 1978 onwards.

Accessions List: The issue of accession lists is a bimonthly event. So far these have been issued yearly.

Bibliographies: Bibliographies on demand are prepared to answer specific enquiries and also to include specific topics of Importance.

Responsive Documentation Services

Document Copying Services: Xerox copying as well as electronic stencil cutting services are being done.

Technical Enquiry Services: Technical enquiry services involving mostly reference service is also being given on small scale. These services will be intensified with the widening of information document base.

Inspite of these numerically impressive facilities, access to information for a common physician or teacher of health professions is not easy. The mainstay of information is through published work subscribed by the libraries. Personal subscriptions to journals and magazines are extremely limited by its prohibitive cost and even more limited is exchange of information through personal contacts. No doubt, most specialist societies and associations do organize annual scientific conferences but attendance at these is confined to not more than 5 per cent of the professions. Most of the libraries offer skeleton service, functioning as they do within constraints of space, inadequate financial support, and dearth of trained staff and above all lack of any training in the use of library. The result is that most of the health sciences workers prefer to go without any information rather than pursue their efforts further, being too conscious of the limitations under which the library system functions.

Information Content

Medical sciences are one of the most organized in so far as bibliographical indexing and abstracting services are concerned. However, not many libraries in India possess the necessary reference tools. There exists vast amount of Indian literature in medical and health related subjects that remain totally uncovered. The available tools include:

Indian Science Abstracts (INSDOC), Union Catalogue of Medical Periodicals in Indian Libraries (MML), Regional Union Catalogue of Scientific Serials, Delhi Medical Libraries (INSDOC), Indian National Bibliography (Central Reference

Library, Calcutta), Health Statistics of India (Directorate General of Health Services, DGHS), Directories of Medical Colleges (DGHS), Directories of Hospitals in India (DGHS), Directories of Specialized Treatment Centers in India (DGHS), Pharmacopoeia of India (DGHS), Indian Pharmaceutical Guide (Pomposh Publication), Indian Medical Register (Medical Council of India), Union List of Social Sciences Periodicals (ICSSR), Vital Statistics of India (Registrar-General of India).

It must, however, be realized that apart from published literature, enormous data is compiled and produced at various levels that remains inaccessible *e.g.* Census Reports, Survey of Current Interests in India, Annual Reports of Union and States Medical and Health Directorates. Similarly data generated in hospitals, institutions and departmental files languishes in the absences of any central clearing house for information of this material.

The kind of knowledge acquired by an individual is, *inter alia*, determined by the nature of information content fed to him during the acquisition stage. The Important sources of information generation and the journals that contain information in health sciences are acquired largely from more scientifically developed countries. The information content of these journals has relevance primarily to situations in those countries. It is, therefore, no wonder that health professionals in our country have often come up against severe criticism for total lack of perspective in planning for their specialized fields in the Indian situation. It is true that during the past two decades, more and more local information related to health fields is being published from the country but its significance can be judged from the fact that out of 175 journals in the field of medicine and health from India, only 45 are documented in Index Medicus or Excerpts Medica - the two most widely consulted reference tools in these fields.

Proposed Set Up

What should be the proposed set up of information network in health and medical sciences to meet the

technological demands in the country? This is one of the objectives of the present Workshop, and I would have been content to leave this question to be answered by the experts but for the responsibility assigned to me in the guidelines provided for the preparation of this note. We have a very wide field to cover. Apart from diagnostic and clinical information for which we still have the largest clientele, the future horizons of health services are likely to impose increasing demands on demographic and environmental information and data on morbidity, health care needs, health resources and facilities, and medical care utilization. A tremendous amount of data is currently being collected by means of such data gathering as vital statistics, hospital discharge statistics, *ad hoc* surveys on morbidity and utilization of health services. Our immediate need is to develop a structural system for dealing with it.

For its optimal utilization, the documentation information system should not only identify the personnel in need of their services but preferably maintain a directory of the same. Such a directory would also facilitate inter-group contacts and avoid duplication of efforts by different agencies.

An active documentation-information system must rest on the tripod of (a) good information base; (b) documentation and (c) reprography services. Such comprehensive facilities do not obtain anywhere in the country today in subjects of health and family welfare. The services expected of a national centre must include the traditional components of any information network namely; (i) acquisition; (ii) analysis, storage and retrieval; (iii) dissemination. For effective functioning, the acquisition policy of a national centre cannot but have its roots in country's requirements. The current workshop is an effort on the part of the Institute to identify with the assistance of the specialists, in health related fields, the clientele in the need of information and the nature of information required. As 1 mentioned earlier, most of the information is generated abroad and there is, therefore, need together such information as is not available at these sources. In health sciences considerably information is being generated also in the South East Asian countries that

has particular relevance to us since we share many common health problems peculiar to developing countries. One of the impediments that I can visualize in the utilization of this information is the language barrier. Published information in the South East Asian countries would be in their own languages. Organization of translation facilities, therefore, must be one of the functions of National Documentation Centre,

The complete information expected to be given by a National Centre concerned with health and family welfare is extremely difficult to enumerate. This information system has several dimensions to consider. The type of information that this centre may be called upon to provide could broadly be as under:

1. Information relating to behavioral sciences e.g. social ecology, social psychology, social anthropology including well known knowledge, attitude and practice studies. Social relationships between local power structure and the people.

2. Health practices pertaining to nutrition including food availability, food production, storage and utilization. Customs regarding births, children, marriage, puberty, death.

3. Demographic information in terras of numbers, ages, distribution, occupation, nature of employment, seasonal movement of populations.

4. Information on health services structures, its utilization and available health resources.

5. Environmental health including physical conditions that directly impinge upon health such as climate, water-ways, general terrain, means of communication.

6. Information on Government policies and programmes, legislation, health intelligence, health planning and management, manpower development.

7. Information on detection diagnosis, management and prevention of disease, including communicable diseases.

8. Academic and educational information on health education, research activities, new research projects, data on ongoing schemes; national, regional and international scientific meets, proceedings of conferences, workshops and seminars.

9. Information on views expressed by people, press and the politicians on the whole spectrum of health activities.

10. Information on development and events likely to have bearing on health and family welfare.

The information and documents should not only be stored in a way that they are retrieved when required quickly without loss of time but also analyzed, compiled and information disseminated generally and selectively. The organization of indexing and abstracting services should be in such a fashion that the Information is brought to the notice of the users expeditiously. Ultimately it may be both efficient and economical to develop modern technique of information storage and retrieval employing computer facilities.

Lastly the most important aspects of the national centre is prompt, timely and universal dissemination of information to Its users. Correct, complete and timely information is the greatest asset for any organization in providing efficient services and avoiding costly mistakes.

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A PROBABILITY MODEL FOR FORWARD BIRTH INTERVAL

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ABSTRACT

A probability model to represent the distribution of forward birth interval (the interval between the survey date and the next birth) is derived under certain assumptions, A comparison of the conception rate estimated from the data on forward birth interval, with that prior to the survey date, may be useful to assess the impact of a family planning programme introduced in a community at the survey date.

The study of closed and open birth intervals as sensitive indices of fertility are of crucial importance for the detecting of current changes in natality patterns of women who are still in reproductive ages. Such changes have two aspects: (i) with what spacing women have children, and (ii) how many women of a given birth order ever proceed to the next parity. The closed birth interval is a good index of fertility in regard to the first aspect and measures the pattern of reproduction only of those women who continue to reproduce. It does not measure the second aspect. To remove this limitation of closed birth interval, Srinivasan proposed the open birth interval', which can be used for both the situations. The open birth interval, however, has also a limitation: it gives an account of fertility performance prior to the survey point. However, if a family planning programme' is introduced in a community and a measure of its effectiveness is desired, the open birth interval is not

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suitable. For this purpose, we introduce the forward birth interval which is defined as the time between the survey date and the date of the next birth posterior to the survey point. It is similar to forward recurrence time in renewal theory. Hennery studied the straddling birth interval (the closed birth interval that straddled the survey point) and its left and right fractions to estimate fertility of subsequently fecund women of a particular age group. These fractions are known as open and forward birth intervals respectively.

In the renewal theory, it is well known that the limiting forms of the probability density functions of backward recurrence time and forward recurrence time are identical on the assumption that the renewal densities do not change over time according to Cox and Miller. However, if renewal density changes after some time (say survey point) then the distribution of forward birth interval and open birth interval will not be identical. In this paper, a probability distribution for the forward birth interval is derived under the assumption that a family planning programme has been introduced in the population at the survey point. The expressions for the means and the variances for different situations have been obtained and a procedure to find out estimates of some of the parameters has been outlined.

Model

Suppose a female is married at time zero (0) and the successive births to her occur at times $T_1+T_2+...T_r$ for r = 1,2,3, where T1 is the time of first birth since marriage and T_r (r > 1) is the time between the $(r-l)^{th}$ and r^{th} births. Further, let us assume that the intervals T_1, T_2, T_3 are mutually independent random variables and T_2, T_3 have a common distribution f(t). However T_1 has a different probability density function, because the starting point of T_1 is not a birth. From Cox and Miller, it can be seen that the above birth process is a modified renewal process.

Suppose that a survey is conducted at time T, where T is a distant point since marriage and let U_t and V_t respectively be the open and forward birth intervals then the limiting probability density functions of U_t and V_t will be the same and are given by f1-(t) = (1-F(t)) / μ, where μ. = θE(T_r); r>l and F(t) = os^t f(x)dx.[3] This is on the assumption that the

renewal densities do not change over time. If we assume that a female has CD a constant risk of conception 'm', (ii) a constant period of non-susceptibility 'h' associated with each delivery and (iii) there is one to one correspondence between a conception and a live birth, we have

$$f(t) = m\, e^{-m(t-h)}, \quad t > h.$$

These assumptions are similar to those considered by Brass, Dandekar, Singh and others^*-**". Obviously we get:

$$f_1(t) = \frac{m}{1+mh}, \quad o < t < h$$

$$= \frac{m}{1+mh}\, e^{-m(t-h)}, \quad h < t < \infty$$

with

$$E_1(V_t) = \frac{m\,h^2}{2(1+mh)} + \frac{1}{m}$$

and

$$V_1(V_t) = \frac{6+(1+mh)^2}{12\,m^2} + \frac{2}{3m^2(1+mh)} - \frac{1}{4m^2(1+mh)^2}$$

However, if after T, [illegible] proportion of the females uses some contraceptives of a given effectiveness so that the risk parameter becomes 'm' instead of ^{T}m', the p.d.f. f* (t) of V_t becomes:

$$f_1^*(t) = \frac{m}{1+mh}, \quad o < t < g$$

$$= \frac{\alpha m_1}{1+mh}\, e^{-m_1(t-g)} + \frac{m}{1+mh} - \frac{\alpha m}{1+mh}\, e^{-m_1(t-g)}, \quad g < t < h$$

$$= \frac{\alpha m_1}{1+mh}\, e^{-m_1(t-g)} + \frac{\alpha m}{1+mh}\, e^{-m_1(t-h)} + \frac{(1-\alpha)m}{1+mh}$$

$$e^{-m(t-h)} - \frac{\alpha m}{1+mh}\, e^{-m_1(t-g)}, \quad h < t < \infty$$

and

$$E_1^*(V_t) = \frac{(1+mh)^2 - 2\alpha(1+mh)+1}{2m(1+mh)} + \frac{\alpha\{(1+m_1 g)+m(h-g)\}}{m_1(1+mh)},$$

$$V_1^*(V_t) = \frac{1}{12m_1^2 m^2(1+mh)^2}\Big[12(m_1-m)^2\{2\alpha^2 m^2 hg - \alpha^2(1+mh)^2 - \alpha^2 mg(mg-2) - 2\alpha mg(1+mh)\} + 12(m_1-m)\{\alpha m_1 m^2 g(g-mh\overline{h-g}) - 2\alpha m(1+mh)^2\} + m_1^2\{(1+mh)((1-mh)^3 + 6mh+14) - 3\}\Big],$$

where $E_1^*(V_t)$ and $V_1^*(V_t)$ are the mean and variance of the forward[1] birth interval and g is the gestation period.

If $\alpha = 1$, the p.d.f. of V_t becomes $f_1^{**}(t)$, where

$$f_1^{**}(t) = \frac{m}{1+mh}, \qquad 0 < t < g$$

$$= \frac{m_1}{1+mh} e^{-m_1(t-g)} + \frac{m}{1+mh} - \frac{m}{1+mh} e^{-m_1(t-g)}, \quad g < t < h$$

$$= \frac{m_1}{1+mh} e^{-m_1(t-g)} + \frac{m}{1+mh} e^{-m_1(t-h)} - \frac{m}{1+mh} e^{-m_1(t-g)}, \quad g\ h < t < \infty$$

and

$$E_1^{**}(V_t) = \frac{mh^2+2g}{2(1+mh)} + \frac{m(h-g)+1}{m_1(1+mh)},$$

$$V_1^{**}(V_t) = \frac{1}{12m_1^2(1+mh)^2}\Big[12(m_1-m)mg\{g-m_1 h(h-g)\} + mh\{12m_1^2 h^2 + (2+mh)(2+m_1^2 h^2)+12\}\Big]$$

In the above cases, the models imply implicitly the continuance of observations till the last women gives birth. Usually it is not feasible to continue the study for a longer duration and the observations are truncated after certain time. If the study terminates at time 'T' the modified expressions are:

$$f_{T'}(t) = \frac{f_1(t)}{F_1(T')}, \quad o < t < T'$$

$$f^{*}_{T'}(t) = \frac{f^{*}_1(t)}{F^{*}_1(T')}, \quad o < t < T'$$

$$f^{**}_{T'}(t) = \frac{f^{**}_1(t)}{F^{**}_1(T')}, \quad o < t < T'$$

with

$$E_{T'}(V_t) = \frac{1}{F_1(T')}\left[\frac{mh^2}{2(1+mh)} + \frac{1}{m} - \frac{(1+mT')}{m(1+mh)}\, e^{-m(T'-h)}\right],$$

$$E^{*}_{T'}(V_t) = \frac{1}{F^{*}_1(T')}\left[\frac{mh^2}{2(1+mh)} + \frac{1}{m} \quad \frac{\alpha(m-m_1)}{mm_1^2(1+mh)}\right.$$

$$\left\{m_1(1+mh)-mm_1 g + m(1+m_1T')\, e^{-m_1(T'-g)}\right\}$$

$$\left. - \frac{\alpha m(1+m_1T')}{m_1^2(1+mh)}\, e^{-m_1(T'-h)} + \frac{(1-\alpha)(1+mT')}{m(1+mh)}\, e^{-m(T'-h)}\right]$$

$$E^{**}_{T'}(V_t) = \frac{1}{F^{**}_1(T')}\left[\frac{mh^2}{2(1+mh)} + \frac{1}{m_1} + \frac{(m-m_1)}{m_1^2(1+mh)}\right.$$

$$\left\{(1+m_1T')\, e^{-m_1(T'-g)} - m_1 g\right\}$$

$$\left. - \frac{m(1+m_1T')}{m_1^2(1+mh)}\, e^{-m_1(T'-h)}\right]$$

and

$$E_{T'}(V_t^2) = \frac{1}{F_1(T')}\left[\frac{m\,h^3}{3(1+mh)} + \frac{2}{m^2} + \frac{h^2}{1+mh} - \frac{\{1+(1+mT')^2\}}{m^2(1+mh)}e^{-m(T'-h)}\right],$$

$$E^*_{T'}(V_t^2) = \frac{1}{F_1^*(T')}\left[\frac{m\,h^3}{3(1+mh)} + \frac{2\alpha}{m_1^2} + \frac{2(1-\alpha)}{m^2} + \frac{h^2}{1+mh}\right.$$

$$+ \frac{\alpha(m-m_1)}{m_1^3(1+mh)}\left(m^2h^2 - m_1g(2+m_1g) + \{1+(1+m\,T')^2\}\right.$$

$$\left.e^{-m_1(T'-g)}\right) - \frac{\alpha m_1\{1+(1+m\,T')^2\}}{m_1^3(1+mh)}\,e^{-m_1(T'-h)}$$

$$\left. + \frac{(1-\alpha)\{1+(1+mT')^2\}}{m^2(1+mh)}\,e^{-m(T'-h)}\right],$$

$$E^{**}_{T'}(V_t^2) = \frac{1}{F^{**}(T')}\left[\frac{mh^3}{3(1+mh)} + \frac{2}{m_1^2} + \frac{mh^2}{m_1(1+mh)}\right.$$

$$+ \frac{m-m_1}{m_1^3(1+mh)}\left(\{1+(1+m_1\,T')^2\}\,e^{-m_1(T'-g)} - m_1g(2+m_1g)\right)$$

$$\left. - \frac{m\{1+(m_1T')^2\}}{m_1^3(1+mh)}\,e^{-m_1(T'-h)}\right]$$

where

$$F_1(T') = \int_0^{T'} f_1(t)dt, \quad F_1^*(T') = \int_0^{T'} f_1^*(t)dt$$

and

$$F_1^{**}(T') = \int_0^{T'} f_1^{**}(t)dt.$$

Hence expressions for the variances can easily be obtained.

The proposed model involves four parameters α, h, m and m1. If h and m are known, the remaining parameters α and m1, can be obtained by the method of moments. Since the expressions for mean and variance of the forward birth interval are not explicit, we can obtain the values of the estimates α of and m1 by the method of iteration. The parameter 'h' can be estimated from the data collected in the survey whereas 'm' can be estimated from the data on open birth interval.

It should be mentioned that the model does not take account of couples who are either sterile or become so during the period of study. However, if the incidence of secondary sterility is small, the model is expected to describe the
situation.

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LEGALISATION OF ABORTION: A SOCIAL PERCEPTION

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ABSTRACT

The present study is focused on the perception of legalization of abortion by the society. The study was undertaken to determine the knowledge and attitude of married women towards MTP based on a random sample survey conducted in Dadar and Mahim areas (G/North Municipal Ward) of Greater Bombay, in early months of 1978.

Termination of pregnancy has been recognized as one of the most widely used method of population control. Countries which have shown dramatic fall in their birth rates within a stipulated time have known to use widespread abortions. It is estimated that every year about 35 million abortions (legal or illegal) occur in the world. Indian women account for nearly 5 million of them.

In India, prior to the Medical Termination of Pregnancy (M.T.P.) Act of 1971, abortions were illegal except to save the life of mother. The Act now provides that any consenting woman, irrespective of her marital status can seek pregnancy termination for physical, mental or socio-economic reasons. Though the law is liberal, yet data as per Table 1 shows that a very small number of abortion seekers have used the facilities In subsequent years, however, the demand for abortion has Increased, yet it is still much below the expected level.

Many attempts have been made to investigate the reasons

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for the poor acceptance of M.T.P. and it was reported that there was gross underreporting of events (it is found that legal abortions still greatly outnumber illegal abortions). Another explanation is lack of proper facilities for M.T.P, Very few hospitals have been approved for doing M.T.P. and almost all of them are located in cities or towns.

The study is based on a random sample survey conducted in Dadar and Mahim areas (G/North Municipal Ward) of Greater Bombay, In early months of 1978, 2370 housewives were interviewed for their socio-economic and demographic characteristics and knowledge and attitude towards M.T.P,

TABLE 1

ANNUAL ACCEPTANCES OF M.T.P IN INDIA

Year	Number of M.T.P
1972-73	24,100
1973-74	44,100
1974-75'	97,756
1975-76	2, 14,197
1976-77	2, 78,013

Source: Family Welfare Planning in India, Year Book, 1976-77.

TABLE 2

SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Characteristic	Per cent	Average
Median age	-	35.54 years
Duration of marriage	-	17.6 years
Number of living children	-	3.0
Proportion of Hindus	85.90	-
Proportion of Muslims	4.51	-
Proportion of Christians	4.70	-
Proportion of joint families	51.70	-
Proportion of literates	71.50	-
Proportion of primary educated women	37.10	-
Proportion of graduates and postgraduates	4.85	-
Proportion of employed wives	6.80	-
Average monthly family income	-	Rs.486

Analysis and Discussion

For the purpose of the study, only currently married housewives were taken into consideration. The majority of the women were in higher age group (median age 35.5 years). Only 32.5 per cent women were below 30 years of age. Their average marriage duration was also more (17.6 years). As a consequence of higher age and longer married life, couples had large families with 3.0 living children on an average (Table 2).

The religious composition of the respondents was 85.9 per cent Hindus, 4.5 per cent Muslims and 4.7 per cent Christians. As compared to Bombay's religious composition, proportion of Muslims was comparatively less and of Hindus comparatively more. As per 1971 census, the data on family structure show that the sample proportion of joint families was more (51.7 per cent), the extended nuclear families having also been covered under joint families. Literacy level of the respondents was quite good (71.5 per cent). Majority of women (37.1 per cent), however, were educated up to primary level only. Proportion of secondary or higher education attainment of women was 26.4 per cent. Irrespective of educational attainments, only 6.8 per cent were gainfully employed. Majority of employed wives were either in clerical' jobs or were skilled/unskilled workers (36.8 per cent). Their average monthly family income was Rs.486.00.

From the above analysis it is apparent that respondents represent the middle socio-economic group of the society. Since this group is most affected by any social and economic change, hence by studying the attitude towards M.T.P. of this group, it would be possible to get a real insight in the subject matter.

In a review of family planning studies, a very close association between education and acceptance of family planning has been reported. It was concluded that education influences the attitude and make people more receptive to new ideas. Therefore, it was assumed that attitude towards abortion would also be influenced by education. To determine the extent of this influence, attitude towards HT.P was studied with reference to the educational attainments of respondents.

In the sample of 2370 women, 23 (.96 per cent) were not aware of the Medical Termination of Pregnancy Act. The reason could be that most of these women were illiterate (65.2 per cent) and newly married, and have pleaded ignorance which may be due to the fear of social criticism.

Medical Termination of Pregnancy Act was passed in the year 1971, and was implemented in the year 1972. Therefore, it was expected that after six years of passing the said Act, majority of women would be well aware of this important Act. The data shows that only 49.7 per cent women knew about the liberalization of abortion. Many reasons can be given for this poor knowledge of the abortion law. Most prominent reason seems to be that liberalization of abortion has not been publicized and it is left entirely on health personnel to inform people about this social change. Predominant sources of information about M.T.P., continues to be literature and newspapers which reach to a limited number of educated people. A strong positive association between education and knowledge of M.T.P. Act also substantiates it (Table 3).

It is evident from the table that with the rise in educational standard, more people are aware of the M.T.P. Act. From a level of 21.5 per cent among illiterate, awareness increases to 52.1 per cent among women educated up to primary level to 100 per cent among post-graduates. It also shows a significant magnitude of increase in knowledge from lower to higher educational groups. This indirectly reflects the extent of influence of education on the knowledge of M.T.P. Act.

TABLE 3

EDUCATION Vs. KNOWLEDGE OF M.T.P. ACT AND M.T.P. CLINICS

Knowledge	M.T.P. Act				M.T.P. Clinic				Total
	Yes		No		Yes		No		
Education No.	No.	%	No	. %	No.	%	No.	%	
Illiterate	140	(20.99)	527	(79.01)	129	(19.34)	538	(80.66)	667
Literate	74	(41.22)	106	(58.78)	40	(22.22)	140	(77.78)	180
Primary	455	(52.06)	419	(47.94)	281	(32.15)	593	(67.85)	874
Secondary	391	(78.32)	121	(21.68)	251	(49.02)	261	(50.98)	512
Graduate	87	(91.58)	8	(8.42)	57	(60.00)	38	(40.00)	95
Post-graduate	19	(100.00)	-	-	13	(68.42)	6	(31.58)	19
Total	1166	(49.72)	1181	(50.28)	771	(32.85)	1576	(67.15)	2347

With the implementation of M.T.P. Act, the number of clinics approved for providing M.T.P. services has been increased considerably. Greater Bombay has a large number of such clinics. Some of them are even publicizing about M.T.P. services, yet only 32.8 per cent women knew about it. Knowledge of M.T.P. clinics was associated with the educational attainments individual had.

Table 3 also shows a consistent increase in the knowledge of M.T.P. clinics with the rise in educational level. While among illiterates only 19.3 per cent women knew about M.T.P... Clinics, whereas in primary education group this proportion goes up to 32.1 per cent and among post-graduates, it is 68.4 per cent.

Poor knowledge about M.T.P. Act and M.T.P. clinics and its dependence on education, illustrates one of the main reasons for poor acceptance of M.T.P. Besides knowledge, attitude also affects the acceptance of M.T.P. To study the attitude towards M.T.P., respondents were asked to suggest whether under following circumstances they would recommend M.T.P.

1. If the pregnancy seriously endangers the women's health.

2. If there are changes of getting a deformed or abnormal child.

3. If a couple cannot afford another child.

4. If the pregnancy has occurred after having the required number of children.

5. If the pregnancy has occurred inspite of using family planning methods.

Data in Table 4 (a & b) shows that attitude towards M.T.P. was more favorable on health grounds (1 & 2) than on humanitarian grounds (3, 4 & 5). To be specific, 72 per cent women were in favor of M.T.P., if due to pregnancy there is a danger to the life of mother, and 73.2 per cent would recommend abortion, if there are chances that if the child is born it would be abnormal or deformed. But if the pregnancy has occurred after having required number of chil-

TABLE 4(a)

EDUCATION Vs RECOMMENDATION OF M.T.P ON HEALTH GROUNDS

i. If the pregnancy seriously endangers the woman health.

ii. If there are chances of getting a. deformed or abnormal child.

Recommendation of M.T.P. Education	I			II		
	Yes (%)	No (%)	Indifferent (%)	Yes (%)	No (%)	Indifferent (%)
Illiterate	60.56	12.44	24.74	60.87	10.49	26.39
Literate	65.55	12.78	17.78	66.67	11.67	18.33
Primary	74.60	13.66	9.50	73.23	12.13	12.01
Secondary	79.88	15.62	4.30	87.10	6.83	5.27
Graduate	93.69	7.37	-	93.68	4.21	1.05
Postgraduate	94.74	5, 26	-	88.42	10.52	-
Total	71, 96	13.38	12.86	73.20	10.10	14.57

TABLE 4(b)

EDUCATION Vs RECOMMENDATION OF M.T.P. ON HUMANITARIAN GROUNDS

i. If couple cannot afford another child.

ii. If the pregnancy has occurred after having the required number of children.

iii. If the pregnancy has occurred inspite of using family planning methods.

Recommend-ation of M.T.P. Education	I			II			III		
	Yes	No	In-diff-erent	Yes	No	In-diff-erent	Yes	No	In-diff-erent
Illiterate	45.43	19.63	32.83	24.59	20.54	52.62	38.38	22.19	36.58
Literate	52.22	22.22	22.22	46.67	22.22	27.22	46.11	23.89	26.67
Primary	58.81	23.34	15.79	56.18	24.60	16.93	54.35	25.06	18.19
Secondary	76.93	15.13	7.61	76.95	14.84	7.81	74.02	16.01	5.27
Graduate	83.76	10.52	5.26	83.16	9.4 7	5.26	84.21	10.53	1.05
Post graduate	47.37	42.22	10.52	68.42	31.58	-	57.89	36.84	5.26
Total	59.39	20.07	18.86	52.19	20.58	25.26	54.79	21.69	21.26

dren or in spite of using family planning methods, or due to failure of contraceptives only 50 to 60 per cent women were willing to recommend M.T.P.

Proportion of respondents having negative and indifferent attitude towards M.T.P, was nearly the same but varies in different circumstances. For example, on health grounds (1 & 2), 10 to 15 per cent respondent were against or indifferent towards abortion while on humanitarian grounds (3, 4 & 5) nearly 20 per cent respondents were against or indifferent towards abortion. In general only 174 (7.4 per cent) women were against recommending abortion in any circumstances.

It is apparent here that most of the women are in favor of M.T.P., but the circumstances under which they would recommend it, vary significantly. Data also shows that majority of women have a firm attitude towards M.T.P. (Proportion of women with indifferent attitude was nearly 20 per cent).

As expected, education to a great extent influences the attitude towards M.T.P. In general, with the rise in educational level, women become more and more favorable towards M.T.P., but among post-graduates comparatively less women were in favor of M.T.P. Negative and indifferent attitude towards M.T.P. also declines with the rise in educational level, but the proportionate decline in indifferent attitude was more rapid as compared to negative attitude. Under different circumstances also (1 to 5) with the rise in educational level, attitude towards M.T.P. becomes more favorable and proportion of women with negative attitude declines. But education fails to influence general attitude towards M.T.P. which is more favorable on health grounds than on humanitarian grounds. In other words proportionate changes in attitude from illiterates to post-graduates follow almost the same pattern in all the five circumstances.

Summary

This study shows that even after six years of legalization of abortion, knowledge of M.T.P. Act and M.T.P. facilities is very poor. Furthermore, knowledge is greatly influenced by the education. These are two important reasons for poor acceptance of M.T.P. Since it is not possible to educate women overnight, efforts can be made to publicize the

M.T.P, services so that a significant dent can be made on the population problem

The majority of the women, however, were in favor of recommending abortion, though their attitude was more favorable on health grounds than on humanitarian grounds. Only a small fraction of women (7.4 per cent) was against M.T.P. Attitude towards M.T.P. was also positively associated with education.

Study also shows that inspite of poor knowledge of M.T.P. Act and M.T.P. facilities, majority of women were in favor of recommending abortion. In other words, general atmosphere in the society is not against medical termination of pregnancy, and if efforts are made this positive attitude can be cultivated among the people.

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EPIDEMIOLOGICAL ISSUES IN NUTRITION**

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ABSTRACT

Epidemiological research in the field of nutrition in India has not received adequate attention. On account of this inadequacy, operational research in this field has also lagged very far behind. Worse still, because of this lacuna, there has been a tendency towards rather hasty transplantation of ideas developed through animal experimentation, biochemical studies and clinical research in the formulation of community action programmes. Epidemiological and other studies in relation to the so-called "protein Gap" and alleged permanent brain damage due to severe malnutrition in infancy provide very illuminating examples. Most of the nutritional research must emanate from the people themselves - from epidemiological studies. Areas for other studies are identified on the basis of epidemiological studies Social, economic and biological implications of conditions of various grades of malnutrition prevalent in the country and identification of effective ways of dealing with them within the existing constraints offer a wide range of very fruitful inter-disciplinary research in nutrition in India,*

As has been the case of the specific etiology school of the bacteriological era, proportionately greater emphasis on animal experimentation and biochemical research has tended to put disproportionately greater emphasis on specific etiological factors in the causation of various nutritional disorders. However, as, unlike the disorders caused by pathogenic microbes, nutritional disorders are mostly caused by

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absence of certain nutritional components, rather than entry into the body of noxious disease causing agents, the study of nutritional problems has got even more complicated and confused by the determination of the so-called recommended allowances for various nutrients, such as calories, proteins, class of proteins, essential amino acids, essential fatty acids, vitamins, minerals and other trace elements.

In view of this, in the case of study of nutritional disorders, it was not possible to develop even a counterpart of the Koch's Postulates to regulate the specific etiology approach of nutritional research. In spite of the many remarkable advances made in research methodology in nutritional research laboratories in different parts of the world, it has been rather difficult to determine precisely the human nutritional requirements. Because of ambivalence in this field, the label of some nutritional "disorders" has changed more than once because of revision of "recommendations". Dependence on "recommendations" of this type is liable to create conditions which tend to promote what Ivan Illich has termed as professionalization and mystification of science -You must have such and such quantities of nutrients (often even of such and such brand) because some "experts" have recommended them on the basis of his studies in (mystical) laboratories The situation becomes even more complicated when such mystification is used as a means for commercial exploitation by the food and drug industry.

It is, however, not being contended that there is no need of any yardstick in the form of recommended requirements to ascertain the nutritional requirements of an individual or of a community. It is only being pleaded that the recommendations are derived from a much wider scientific base in which the starting point is the individual or the community and animal experimentations, biochemical studies and clinical studies are conducted with the aim of having a better understanding of the objective reality as it exists in the individual or the community. In other words, the strategy of nutritional research should be based on epidemiological considerations, rather than the other way round, as is often the case.

Implications of Imbalance in Nutrition Research

The far-reaching conclusions derived on the basis of

researches on neurological consequences of severe malnutrition in infancy and child-hood offers an example which elaborates on a wide spectrum of the issues raised above. - Had efforts been made to derive conclusions on the basis of epidemiological studies - for example, a natural experiment to compare the mental health of those who underwent severe malnutrition in infancy with that of a carefully matched control group, both in India and cross-culturally — it should have provided most compelling data to call into question the very basis of the conclusions which were arrived at on the basis of laboratory studies. It was like looking at an object from the wrong end of the telescope and as the viewer happened to possess considerable prestige and power, he could make people believe that what is so clear to them (i.e. to the people) even with the naked eye is wrong and what the expert sees through the mystifying end of the telescope is right! A number of experiments conducted on laboratory animals have indicated that severe malnutrition in early life causes permanent neural lesions. Taking the cue, micro—anatomists and bio-chemists set about to conduct extensive experimentation to work out the micro-anatomical and biochemical intricacies behind the observations from animal studies.

The choice of the experimental tools that were used subsequently to measure the possible damage to the brain of human beings due to severe malnutrition depicts perhaps the lowest point in conducting studies which have such far reaching significance and consequence. Arriving at conclusions regarding brain damage among malnourished children by using the so-called intelligence tests - some were claimed to be specially adapted to the Third World or were made "culture free" - is as imprecise as making early diagnosis of a malignant pulmonary tumor merely on the basis of auscultation of the chest. Notwithstanding the epidemiological evidence to the contrary and overlooking the gross limitations of the tools for measuring mental health, eminent, nutritionists from different corners of the world felt so exercised over the alleged imminent danger to mental health of hundreds of millions of future citizens of the world that the then Secretary General of the United Nations, U. Thant felt compelled to issue a special statement in 1968 warning the world of the disaster ahead if urgent steps were not taken to correct malnutrition by filling what he had termed as the "Protein Gap". Elsewhere the author has made a more detailed analysis of the sociology of generation of this type of know-

ledge and has discussed the possible political and economic motivations behind it 5,6 .

Ironically enough, the very consideration of the concept, genesis and measurement of intelligence brought into a much sharper focus the central relevance of certain "non-nutritional" issues, such as social, economic and ecological considerations, in the development of intelligence of an individual. Not only did these additional dimensions of mental health put the issue or more correctly, the non-issue, of nutrition and mental health in its correct perspective, but it also underlined the fact that the social, economic and ecological considerations which emanate from political forces, both national and international, are of paramount importance in ensuring that each individual gets an opportunity of developing the full potential of his mind, according to his or her own choice.

The story of the "Protein Gap" follows a, similar pattern. Work of scientists, who are cloistered in their laboratories to unravel the intricacies of protein requirements, of first class and second class proteins and of essential amino-acids have received more than their due quota of attention. Invoking these findings, the world protein industry gallantly offered to brace itself to shoulder the enormous burden (reminiscent of White Man's burden) of meeting the challenge of providing protein to the underprivileged children of the world, through international, "bilateral" and private and proselytizing charitable agencies. Unfortunately for them, however, a series of field studies exploded this myth of protein gap. It was found, again and again, that in fact it was mostly a calorie gap, and proceeding further, that this calorie gap is more often than not a mere reflection of the social and economic relations of a community and that such relations are regulated by the political system of the community or the country 7,8,9 . One might as well raise the question: why did it take such a long time to discover such a straightforward fact?

These, then are the additional dimensions of a nutritional problem in a community. At best, laboratory and clinical studies of the problem of nutrition provide only some dimensions of the problem, it is essential to have some additional dimensions of the problems by having an under-

standing of the problems as they actually exist in the community their epidemiological dimensions, the role of the food industry, the problem of poverty and the various social, economic and political dimensions of poverty.

Epidemiological Studies in Nutrition in India

Despite some very vital shortcomings in the research design and data collection; for example, sample selection, coverage, reliability and validity of data and statistical validity of certain conclusions the Khanna Study, conducted way back in the fifties, did provide enough epidemiological information to identify weanling diarrhea as a clinical entity 10,11 . The Project Poshak brought out certain operational data which led to rethinking on a vital aspect of a community nutrition programme. Similarly, valuable operational insights were obtained from the nutritional studies of the India Population Projects in Kamataka and Uttar Pradesh and the Palghar Project and the Kasa Project in Maharashtra.

The very fact that these very limited epidemiological studies proved to be so valuable for developing community nutrition programmes in effect underlines the need for developing a much stronger and much more extensive epidemiological base through covering wider fields and through better designed epidemiological studies. Considering the requirements of the action programme in the field of community nutrition in India, there is considerable need for collection of key epidemiological data, both in quantitative and in qualitative terms. Because of some major gaps in this field, not only has it not been possible to provide a sound enough epidemiological framework for formulating approaches to laboratory and clinical researches in nutrition, but sometimes findings from laboratory and clinical researches formed the main guidelines for formulating community nutrition programmes, leading to disappointing consequences. Lysine fortification and promotion of high protein diets are only two examples.

An Epidemiological Approach and Nutrition Programme

Experience with the Applied Nutrition Programme and iron and folic acid and Vitamin A supplementation programme for rural populations bring into focus yet another dimension

of the problem of nutrition in rural communities. Even if it is presumed that these programmes were based on careful epidemiological analysis of the problem and that the selected lines of interventions were epidemiologically the most suitable in terms of returns from the investment, such shortcomings as administrative laxity, logistic inadequacies and inadequate community response are often found to be crucial enough to thwart the very purpose of the programme. This approach, which:

a. takes into account at least the key factors that are involved in problem solution - for example, epidemiological, administrative, logistical, social and economic factors; and

b. on the basis of such an interdisciplinary study, which seeks to identify an effective programme of action (which has been tested under actual field conditions) within the existing constraints.

is often called an approach of operational research. Operational research studies on these lines are badly needed to come to grips with some of the most important and most urgent nutritional problems of a rural community. And for this purpose, again, it is necessary first to study the problems in all their epidemiological dimensions. As pointed out earlier, such an understanding is of crucial importance for identifying the additional problems which need intensive studies in the laboratory, in the animal house, in the clinical ward and in the field.

Conclusions: Epidemiological Issues in Nutrition

Economists in India have tended to use the capacity of an individual to buy the minimum recommended calories for himself/ herself to draw the so-called poverty line. Sukhaome has been questioning the statistical basis of this definition of under nutrition and that of poverty for considerable time. However, he does not question the extensive prevalence of poverty and hunger in rural and urban population in India Very recently, Pannikar has published a report which paints a grim picture of rural poverty in Kerala. It also relates employment and income with food intake among selected agricultural households in the Kuttanad area of Kerala. The National Nutrition Monitoring Bureau of

the National Institute of Nutrition, Hyderabad, as also several surveys which were earlier conducted by the NIN, all have the same refrain23. Unfortunately, such studies have not been complemented by much more intensive epidemiological studies of malnutrition and under nutrition in a community. Even if one leaves aside the wider social, economic and political dimension of the problem of nutrition, one needs to answer questions such as these:

i. What happens, socially, clinically and biologically, when different individuals are exposed to different grades of nutritional deprivation? It may be stressed once again; the problem is not that such and such individuals fall short of the recommended allowances by such and such degree. The problem is what are the actual, *tangible* manifestations of such deficiencies?

ii. How are these inter-related with other health problems and social parameters such as education, housing, clothing, etc.?

iii. What are the possible ways of tackling such problems under the existing constraints and how to identify the most effective ways of dealing them?

Answers to such questions can be found only by stepping up epidemiological studies in the field of human nutrition, both quantitatively as well as qualitatively. The body of knowledge thus covered, Nutritional Epidemiology, will enable us to place laboratory research in nutrition in its proper perspective. As a sequel, such a combination of epidemiological data and the complementing laboratory data sets the stage for conducting operational research to formulate epidemiologically efficacious, socially acceptable and nationally applicable nutritional programs for dealing with the problems of nutrition in rural or urban communities as an integral part of the overall efforts to improve the quality of life.

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HEMOGLOBINOPATHIES AND ALLIED DISORDERS IN INDIA - A PUBLIC HEALTH PROBLEM

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ABSTRACT

Among the hereditary hematologic disorders, thalassaemias, abnormal hemoglobin syndromes and glucose-6-phosphate dehydrogenase (G-6-PD) deficiencies are problems of considerable public health importance. They produce hemolytic anemia of varying severity.

The available knowledge of hemoglobinopathies and allied disorders is still inadequate in India, Coordinated investigative study must be undertaken among various endogenous groups (including tribal's) of India under different ecological and social settings with a view to delineate the nature and extent of prevailing haemoglobinopathic disorders. Attempts should also be made to determine probable susceptibility or resistance of haemoglobinopathies with diseases and also to evaluate the causes of variation of the incidence of haemoglobinopathic disorders in particular ecological settings. Social and public health aspects of haemoglobinopathic disorders pose a significant problem which should be dealt with on a priority basis.

Hemoglobin, the respiratory pigment of erythrocytes, is a conjugate of the protein goblin and the pigment haem. Haem is a metal complex consisting of an iron atom in the centre of a prophyrin structure. The globins' moiety of the haemoglobin molecule is composed of two pair of polypeptide chains: one pair of alpha chains, each consisting of 141 amino acids and one pair of beta chains, each composed of 146 amino acids. Haem group is responsible for carrying oxygen and in a normal

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hemoglobin molecule, four haem groups are attached to four polypeptide chains which in total consist of 574 amino acids. Synthesis of polypeptide chains are regulated by structural and operator genes.

In the haemoglobinopathies, the actual chemical structure of hemoglobin is abnormal, and the alteration in structure may affect the rate at which hemoglobin is synthesized in the body, or the fate of the red cells that contain abnormal pigment.

The abnormal hemoglobin's result from substitution of one amino acid for another in the normal peptide sequence of one of the sub—units of the globin portion of hemoglobin. These abnormalities in aminoacid sequence arise through mutations of the genes that determine the structure of the polypeptide chain concerned. Examples of these changes are the electrophoretically detectable abnormal haemoglobins like HbS, HbC, HbD, HbE, etc., occurring in the heterozygous or homozygous states. Mutations affecting the operator genes through special regulator genes result in quantitative difference in the synthesis of polypeptide chains - there is reduced synthesis of normal hemoglobin. Examples of these are thalassaemias and their variants. Besides these significant haemoglobinopathies, there exists an important enzymatic disorder called glucose-6-phosphate dehydrogenase (G6PD) deficiency which is an inherited sex-linked defect affecting an enzyme whose function is necessary to maintain the full viability of the red cells.

Since thalassaemias, abnormal haemoglobin syndromes and G6PD deficiency produce varying grades of haemolytic anaemia, there is need to study their present state of distribution in India among various ethnic groups under different ecological settings. This would be useful with a view to evaluate the nature and extent of selective forces operating in a population so that necessary effective steps could be taken from public health point of view.

The Thalassaemias

Thalassaemia represents a group of hereditary disorders of hemoglobin synthesis with varying severity. The production of normal hemoglobin (HbA.) is inhibited due to anomaly

in the orderly synthesis of one or the other polypeptide chain of the hemoglobin molecule. Indeed, the thalassaemias are often classified as haemoglobinopathies. They differ, however, from the other disorders of hemoglobin formation in that no abnormal hemoglobin chains are formed. The rate of adult hemoglobin formation, however, is diminished and as a consequence thereof, various combinations of normal polypeptide chains may exist in abnormal quantity.

Classification

With the advancement of the knowledge about the structure of the hemoglobin molecule, it is now possible to distinguish a great majority of thalassaemias. The two commonly found thalassaemias are beta-thalassaemia in which beta-chain synthesis is reduced and alpha-thalassaemia where alpha-chain synthesis is affected. Both alpha and beta thalassaemias may exist either in the heterozygous state (when the gene for thalassaemia is inherited from either father or mother) or in the homozygous state (when the gene is inherited from both parent).

Beta Thalassaemias The characteristics of Beta Thalassaemia are as follows:

HOMOZYGOUS BETA-THALASSAEMIA is clinically known as thalassaemia major (Cooley's anemia), a disease requiring frequent flood transfusions and is often terminating fatally in early childhood.

Thalassaemia major is usually recognized during the first year of life. The characteristic features include bone pain and recurring bouts of fever from an early age. There is usually retardation of growth and mental development. Affected infants fail to thrive and gain weight normally and become progressively anemic. There is marked pallor, patchy skin pigmentation, chronic leg ulcers and abdominal distension. The bones of the cranial vault are often grossly thickened. Faces assume a typically mongoloid appearance with prominent zygomata, the nose being concave with a sunken bridge and the upper jaw overdeveloped. The degree of anemia is always severe, the red cell count usually being in one to two million range. The stained blood shows a marked hypochromia, many of the cells showing only a

thin rim of hemoglobin. Red cells of very varying size, many distorted forms (poikilocytes) and target cells are also present. Foetal hemoglobin is usually present in very large amounts and values of 50-90% are usual. The percentage of hemoglobin A2, as estimated by starch block electrophoresis, is very variable in thalassaemia major. The haemoglobin A2 level has been found to be elevated in the parents of patients with the clinical picture of thalassaemia major. The serum iron concentration is characteristically higher than normal.

THE HETEROZYGOUS state of beta thalassaemia is generally known as thalassaemia minor or thalassaemia trait or Cooley's trait. The symptoms produced by the disease in the heterozygous state are far less serious than in homozygotes, and most patients are capable of leading moderately active lives. The clinical manifestations of thalassaemia minor are very variable, ranging from an asymptomatic state without shortening of red cell survival or splenomegaly to a moderately severe haemolytic state with splenomegaly. The majority of thalassaemia carriers are not anaemic. The haemoglobin A2 has been found to be elevated in thalassaemia minor. This finding has become the main diagnostic feature in heterozygous beta-thalassaemia minor. In heterozygous thalassaemia, the foetal haemoglobin (HbF),if detectable at all, is present only in small amounts in the majority of the cases.

ALPHA THALASSAEMIA: There are two clinical forms of alpha-thalassaemia (a) haemoglobin Bart's hydrops syndrome and (b) haemoglobin H disease. Unlike the beta-thalassaemia trait, the carrier state of alpha-thalassaemia is difficult to diagnose. It is recognised by the presence of Hb-Bart's in a new born and also by the occasional presence of small quantities of HbH in adult heterozygotes.

DELTA-CHAIN THALASSAEMIA: Complete absence of haemoglobin A2 was found in a 60 year old Greek male who had the haemotolo-gical stigmata of thalassaemia trait. Through a normal wife, this individual had several children, some of whom were normal, the others having thalassaemia trait with normal levels of hemoglobin A2. This person was considered to be heterozygous for both the form of thalassaemia associated with defective beta and delta chain synthesis (normal A2 beta-thalassaemia) and an inherited defect in delta chain

synthesis - delta thalassaemia". Further evidence about the existence of delta-chain thalassaemia was obtained from population surveys in Greece in which unusually low levels of haemoglobin A2 were found in several members of the same family?.

Hereditary Persistence of Foetal Hemoglobin - Differentiation from Thalassaemia

Hereditary persistence of foetal haemoglobin is a condition characterised by the persistence of high level of foetal hemoglobin into adult life in the absence of any severe haeaotological manifestations. The condition was first described in 1955 by Edington and Lehmann and has since, by virtue of its clinical and biochemical characteristics, been clearly distinguished from beta—thalassaemia which it superficially resembles. It has been described in the homozygous state (F—F) and the heterozygous state either alone (A-F), or in association with the sickle—cell gene (S-F), haemoglobin C gene (C-F), beta—thalassaemia gene (beta—thalassaemia-F) and the alpha—thalassaemia gene (alpha— thalassaemia—F). It is characterised by (a) absence of any haematological changes (b) Hb-F 20—30% (c) decreased percentage of HbA2 (d) homogeneous distribution of intracellular HbF (e) very mild haemolytic amaemia occurs while in interaction with sickle-cell gene.

Hereditary persistence of foetal hemoglobin appears to result from a failure of both beta and delta-loci with persistent and effective gamma chain synthesis, resulting in high and constant levels of foetal hemoglobin persisting in each red cell into adult life.

Diagnosis of Thalassaemia: beta-thalassaemias: The diagnosis of classical thalassaemia major is usually possible from the clinical and haematological data and also from family studies. It is, thus, important to determine the level of haemoglobins F and A2 in both patient and parent. High A2 beta thalassaemia homozygosity can be diagnosed, if both parent have increased haemoglobin A2 levels and the patient having a variable increase in haemoglobin F,usually in excess of 20 per cent of the total hemoglobin. The variable level of hemoglobin is of much help in the diagnosis of homozygous beta-thalassaemia. Electrophoresis studies on the parent will also indicate whether the patient is truly homozygous

for high A2 beta-thalassaemia or heterozygous for high A2 thalassaemia and one of the beta-thalassaemia variants. Thalassaemia major can be distinguished from severe iron-deficiency anemia by the more severe changes in the erythrocytes in the former disease, by the presence of large amounts of Hb-F, raised serum-iron levels and increased iron content of the bone-marrow in thalassaemia major, and by the fact that the patient suffering from thalassaemia fails to benefit from intensive treatment with iron.

Alpha Thalassaemia: The clinical and electrophoretic characteristics of haemoglobin H disease are easily recognised. The alpha-thalassaemia - alpha chain haemoglobin combinations can also be recognised with the presence of about 70 per cent of abnormal haemoglobin, 20-30 per cent haemoglobin A, haemoglobin H and Bart's also being present in small amounts in some cases.

Distribution in India

Beta-Thalassaemiai The first instance of thalassaemia in India was recorded in a 2-1/2 years old Bengalee hoy. Since then several reports have appeared describing cases of awareness of the condition and better diagnostic facilities awareness of the condition and better diagnostic facilities have brought to light a large number of subjects with thalassaemia in various forms; heterozygous, homozygous and in combination with various abnormal haemoglobins (S,D,E,H, J&K). Investigations have been mostly reported from hospitals. Reports on thalassaemia include 7 cases of Thalassaemia Major from Delhi, 4 cases of The Major and 1 case of Th. Minor from U.P., 175 cases of Th. Major in Bengali Hindus from West Bengal, 234 cases of Th. Syndromes and 160 cases of Th. Major from Maharashtra, 80 cases of Th. Major from A.P.,118 cases of Th. Minor from A.P. and several other isolated case reports from different parts of the country 10,11,12,13,14,15. It is, however, observed that in most of the cases no proper classification of the affected individuals according to their ethnic background or their family history has been attempted. Data on the frequency of thalassaemia are very limited. Frequency of the thalassaemia trait to an extent of 3.7% was reported from Bengal, 4.2% trait in Chitrapur Saraswats, 5.15% in Punjabi Khatri, 17.4% in Halai Lohana and 15% in Bhanushali Community of Maharashtra 13,16,17.

Alpha-Thalassaemia: A case of Hb-H thalassaemia from Calcutta and two cases of Hb-H disease from Ahmadabad have been reportedly,19. Hemoglobin Bart's to an extent of 2.4% was detected in cord bloods from Bengal[12]. A survey in cord blood carried out in Bombay showed 9 cases of alpha-thalassaemia.

Abnormal Hemoglobin's

Abnormal hemoglobin's are inherited as simple Mendelian characters. Although, it is likely that all the variants of hemoglobin A are allelomorphs, direct proof of this assumption has so far been obtained for hemoglobin A,S,C, and E only.

The common mode of inheritance in abnormal hemoglobin is attributed to the presence of specific gene which in heterozygous state does not usually cause any significant handicap to the person concerned. In homozygous state, this may, however, produce various grades of hemolytic anemia. The heterozygous condition is also known as "disease".

HAEMOGLOBIN S (SICKLE - CELL HAEMOGLOBIN): This is the most commonly found abnormal haemoglobin in India. Severe and often fatal anemia occurs when the HbS is in a homozygous condition (Sickle-cell anemia). In such cases, a fresh blood-film usually shows some red cells with a bizarre sickle-shape. But in the heterozygous state, it results in the asymptomatic sickle cell trait, the blood looks normal but when it is deoxygenated by sealing a drop of blood under a cover slip, preferably after the addition of a reducing substance such as sodium metabisulphite (Na2S205), the red cells show sick ling.

The frequency of Hb—S varies in different ethnic groups; where this gene is high, hemolytic anemia in childhood can be a public health problem directly attributable to this deleterious gene.

Sickling was first demonstrated in India In the tribal groups of the Nilgiri hills in South India. Later studies showed sick ling in fairly high frequencies among various other tribal groups of India.

DISTRIBUTION IN INDIA: It has been observed from the studies

that sick ling has been reported mostly from the various tribal groups and lower caste communities of India. Among the tribal groups, the highest frequency of sickle cell trait has been noticed among the Adiyan (32%) of North Wynad, Kerala. Next higher frequencies have been reported among Irulas (31.45%) of Nilgiri Hills, Gamit (31.4%) of Gujarat, Veddids (31%) of South India, Paniyan (29.73%) of North Wynad, Kerala,Muria (26.6%) Bhatia (28%) and Raj Gond (27.8%) of Bastar, Madhya Pradesh 21,24,25,26,27, Besides, sickling is also found in some low caste populations which are of mixed origin and have tribal component in their genetic makeup in varying degrees *e.g.* Mahars (38.21%) of Madhya Pradesh, Relli (30%) community of Andhra Pradesh, Sorthi (30.6%) of Bombay 23,28,29. Although findings of Hb-S were confined mainly to tribal groups and scheduled caste populations, isolated hospital cases of sickle cell thalassaemia have been reported from various parts of India 30, 13,31,32,33. Most of these cases, however, were not properly classified ethnically.

HAEMOGLOBIN D. DISTRIBUTION IN INDIA: Haemoglobin D, found in India and known as Hb-D Punjab, is a beta-chain variant, and was first reported from Poona in a Sikh soldier. Later investigations in Punjab showed further incidence of HbD in Sikhs (2%) and Punjabis. Ten cases of HbD (unknown community) from Uttar Pradesh, 9 cases of HbD in Bengalees from West Bengal, 13 cases of HbD of unknown caste from Assam have also been reported. Hardly any case has been reported from Central India. Cases of Hb-D thalassaemia and Hb-D trait have been reported in Gujarati speaking (1.72%) and Sindhi-speaking (1.13%) Lohanas from Bombay. Two instances of Hb-D trait have been observed in the Khoja Community of Bombay. Hb-D trait (.0.3%) has been noticed in the Goan Population. Except a few isolated cases of Hb-D from Mysore, Tamil Nadu and Kerala, almost no other instances of Hb-D have been reported from South India.

HAEMOGLOBIN E. DISTRIBUTION IN INDIA: This hemoglobin variant was studied in Bengalees and Assamese and found in Hindus and Muslims alike in Bengal. In a study among unrelated Bengalee Hindus, 3.9% showed this trait. In Totos in Totopura in Assam, a higher incidence of 19.8 per cent was reported. Among Kachari women of Assam, a frequency of 7.5 per cent HbE was observed. Subsequent, studies in Bengal showed cases of HbE trait, HbE disease (homozygous), Hb-E thalassaemia and Hb-DE disease.

Isolated instances of Hb—E trait were reported from Agra, Uttar Pradesh, Patiala, one Tamil-speaking family from Madras and one of a Bengal-Tamil ancestry and in a Muslim family from Aurangabad. in a Hindu male in Trivandrura, Kerala. Haemoglobin E-Thalassaemia was reported in a Muslim (Bohra) family in Maharashtra, two instances in a family from Uttar Pradesh and nine families in Bombay.

HAEMOGLOBIN J: First report of Hb-J trait in an Indian was found in a Gujarati woman which was detected in a survey of Indians living in and near Kampala, East Africa. Two members in a Bengalee family were reported to have the Hb-J trait and other members to have Hb—J interacting with beta-thalassaemia, thus indicating that this haemoglobin is a beta-chain variant. Similar finding was reported from Gujarati speaking Lohana families in Bombay. Incidences of Hb-J trait were also reported from Nagpur (Harijan family), Bombay (Halai & Cutchi Lohanas), Ahnedanagar (Mahar).

HAEMOGLOBINS K, L, M AND Q: Very few examples of these variants are seen in this country. The first report of the presence of Hb-K was found in an East Indian family. Subsequently, instances of Hb-K were reported from Madras, Bengal and Goa.

Hemoglobin L, a slow-moving, was first reported from London in a Punjabi individual. Later on incidences of Hb-L were reported from Gujarati speaking Lohanas, Halai, Cutchi and Goghari Lohanas. Haemoglobin M was first studied in a Punjabi family living in Amritsar. Haemoglobin M was reported in a Muslim Khoja family in which father and all the four children were found to be carriers of this trait[69].

Haemoglobin Q, a new variant, was reported in three Sindhi families from Bombay and also from two unrelated Sindhi families as well as from Goa.

Glucose-6-Phosphate, Dehydrogenize Red Cell Enzyme Deficiency

Glucose-6-phosphate dehydrogenate is an important enzyme of the red blood cell and its deficiency is inherited as an X-linked trait. Males who carry the gene show full expression

but expression in female heterozygote's varies greatly. Glucose-6-phosphate dehydrogenate deficiency is one of the most common of inherited red cell enzyme defects which renders individuals vulnerable to drug induced hemolytic anemia. Deficiency of enzyme concerned in red cell metabolism results in sensitivity to sulpha and anti-malarial drugs such as primaquine phosphate. It is estimated that more than 150 million people suffer from this defect all over the world, thus exerting a great strain on the preventive facilities of public health departments. More recently it has become apparent that a very extensive genetic polymorphism exists for the enzyme, G-6—PD. A particular variant may be described in terms of (1) quantization of its enzymatic activity, (2) its. Electrophoresis mobility and (3) its biochemical characteristics To date, the vast majority of surveys have been concerned only with the level of enzyme activity, and not with the electrophoresis types.

DISTRIBUTION IN INDIA: Investigations in India have shown that the G-6—PD deficiency exists in considerable and varying frequencies in different regions. The factors responsible for the maintenance of the gene in India are largely undefined. The distribution of the deficiency has been shown to be connected with, the prevalence of falciparum malaria — it has been suggested that G—6—PD deficiency confers some resistance to falciparum malaria and this has stimulated surveys in various populations under different ecological settings.

Comparatively large data have accumulated in Western India. Considerable heterogeneity in G-6—PD deficiency exists in this region. High frequencies of G—6-PD deficiencies have been reported by different workers among Parsis of Maharashtra -*i.e.* 19 per cent, 17.3 per cent, 15.7 per cent, 12.3 per cent respectively . These differences may be due to different methods used, non-standardization of techniques and sample size. A very high frequency of 20 per cent G-6—PD deficiency has been reported among Sindhis of Maharashtra which needs further confirmation. Gonds of Nagpur also show a high frequency (17.30%), the reason for maintenance of high G-6-PD gene (Gd) over here should be investigated further.

Only few studies are reported from the South. A high incidence of 14.0 per cent of G—6—PD deficiency has been reported among the tribals in Thailavaram in Andhra Pradesh

whereas other studies conducted in Tamil Nadu, Kerala, Karnataka has exhibited low frequencies. Further large scale studies should be undertaken in these regions. Likewise the eastern region of India needs to be further explored for the enzyme deficiency. The frequency of Gd gene in Bengalis has been shown to be around 5 per cent.

Uttar Pradesh presents a heterogeneous picture of enzyme deficiency in which intra group differences among Brahmins and non-Brahmins have been reported. A very high frequency of enzyme deficiency (30%) has been reported among the Sindhi patients of Agra which needs to be further checked against its distribution in Sindhi population. A Punjabi group (Khatris) shows 14 per cent of enzyme deficiency; further work on other groups should be undertaken in this region.

Avenues for Further Research

Much attention has been focussed on the possible association of genetic markers with disease in the last two decades. Studies carried out by Allison suggest a positive selective advantage enjoyed by persons with sick ling gene against falciparum malaria in the African Continent. Similar geographic correlation between the sickle cell trait and malarial endemicity was noted by Neel and others" . Genes determining glucose-6-phosphate dehydrogenize (G-6-PD) enzyme deficiency in red cells and Thalassaemia (Cooley's anaemia) have also been suspected to enjoy the selective advantage against malaria . The list of genetic markers aiding selective advantage against malaria has been steadily enlarging. However in India, very little Information is available on this subject. Correlation of sickle-cell trait and G-6-PD with malarial endemicity among the lower castes-communities was shown by Deshmukh and Sharma. Association of other genetic markers with malaria has not been reported. Wide variations in the incidence of sickle-cell trait and G-6-PD deficiency have been noted to occur among the tribal populations and other communities.

No systematic study has been carried out in India among the tribal areas where malaria has been in hyper endemic form to find out the causes of variation of genetic markers and the prospective association of specific genetic markers in their protection against particular type of malarial infection

(i.e, Plasmodium falciparum or Plasmodium vivax). Moreover, we have no information in the Indian context about the fertility trends of tribes living in different malarial experience.

THALASSAEMIA: Thalassaemia in some form or other is the commonest haemoglobinopathy in India, It has been reported from almost all regions and is widespread. But the frequency of the different types of thalassaemia in different parts of the country and also in various communities is not much known. Most of the reported studies are on case studies from the hospitals. A systematic study in different parts of the country and in various castes, communities,. tribal and. non-tribal groups should be undertaken in order to detect the incidence of thalassaemia in homozygous and heterozygous forms and in association with other abnormal hemoglobin's. The research design must be based on standard statistical principles. Diagnostic criteria should be firmly laid down and uniformly followed. The families of affected individuals should be thoroughly screened.

Care should be taken to differentiate the thalassaemia trait from anemia due to iron and folic-acid deficiency. Quantization of HbA2 is essential and in some instances, it may be necessary to estimate the serum iron level as well.

ABNORMAL HAEMOGLOBINS: It may be pointed out that although sickle-cell hemoglobin (HbS) has been investigated in various parts of South, West and Central India, yet very little study has been reported from Northern and Eastern India covering Jammu and Kashmir, Punjab, Haryana, Rajasthan, Delhi, Uttar Pradesh, Cis-Himalayan region, Bihar, Orissa, Bengal and Assam.

Similarly other abnormal hemoglobin variants like HbD, HbE, HbJ, HbK, HbL, HbM and HbQ have not been systematically explored in various endogenous groups of India. Future studies should aim at gathering definite information of the incidence of these abnormal hemoglobin variants and their association with diseases, if any, in different ecological settings of the country, both among tribal and non-tribal, higher and lower caste groups. Particular emphasis should be laid on carrying out investigation in areas and communities not yet covered by previous studies. Rural population, particularly the endogamous groups, needs to be investigated.

It is worthwhile to investigate a possible relationship with malaria in different ecological settings of the country.

GLUC0SE-6-PH0SPHATE DEHYDROGENASE RED CELL ENZYME DEFICIENCY: More large scale intensive studies should be carried out among different endogamous groups and tribal populations under different ecological settings particularly in Eastern India, Central India and Southern India using a standardized uniform method of detection for the enzyme deficiency. However, there is an urgent need to compare critically the results with different tests on the same group of individuals. Emphasis should be laid on screening the normal population instead of hospital cases. Moreover, the probable factors (i.e. malaria, inbreeding, endogamy etc.) responsible for the maintenance of the Gd gene in diverse Indian population should be explored in depth for sane tangible conclusion.

Conclusion

The available knowledge of haemoglobinopathies and allied disorders is still inadequate for India as a whole. Coordinated investigative study must be undertaken among various endogamous groups (including tribal's) of India under different ecological and social settings with a view to delineate the nature and extent of prevailing haemoglobino-pathic disorders in relation to one another and with reference to associated environmental stressors. Attempts should also be made to determine probable susceptibility or resistance of haemoglobinopathies with diseases and also to evaluate the causes of variation of the incidence of haemoglobinopathic disorders in particular ecological settings. Social and public health aspects of haemoglobinopathic disorders pose a significant problem which should be taken care of in a planned manner.

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