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## POST-GRADUATE PUBLIC HEALTH EDUCATION

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The major emphasis in the First and Second Five Year Plan has been mainly in relationship with the increasing number of medical education, the undergraduate medical curriculum, and increasing facilities for post-graduate medical education. In the latter, the major emphasis has been upto now mainly on the clinical aspects and those non-clinical subjects related to medical colleges, namely Anatomy, Physiology, Pharmacology etc. The question of training facilities for work in public health does not appear to have received the attention that it deserves.

A recent survey of the facilities available for an academic course in public health leading to a degree or diploma is given below:

A recent Expert Committee of the WHO that went into the requirements for schools of public health indicated that there are only about 60 schools of public health in the world which have the minimum acceptable facilities regarded as adequate on an international level. The enrolment of candidates in such schools varies considerably, and information from 41 such institutions had estimated that there were only about 2500 students in all the courses leading to degrees or certificates and the number of candidates admitted annually in each institution ranged from 6 to over hundred per year.

It has been difficult to estimate a country's needs for public health officers. No specific

	Year	No. of candidates applied	No. of candidates admitted	No. of candidates passed	Diploma or Degree
1. All-India Instt. of Hyg. & P. H.	1956-57	194	61	53	D. P. H.
	1957-58	143	61	61	
	1958-59	153	62	61	
	1959-60	150	68	57	
	1960-61	110	66	64	
2. Bombay University	1956-57	10	10	2	D. P. H.
	1957-58	14	14	13	
	1958-59	19	19	4	
	1959-60	14	14	11	
	1960-61	13	13	2	
3. Madras	1956-57	5	5	2	B. S. Sc.
	1957-58	5	5	4	
	1958-59	6	6	4	
	1959-60	3	3	1	
	1960-61	Nil	—	—	
4. Nagpur	1960-61	5	4	—	Not yet recognised by Univ. D. P. H.
5. Hyderabad	1960-61	30	12	—	
6. Poona University (Armed Forces Med. College)	1960-61		5		

ratio has ever been established with regard to the number of public health officials required either on a population or other basis. One such study made some years ago in the U.S.A. estimated the need for public health officials to be roughly on a basis of one per 50,000 population. The ratio of schools for the teaching of public health to the population also varied considerably all over the world. There are a number of small countries, e.g., Mexico and Latin America where there is one school for a total population of about 1.5—2 million people. In India, the ratio is obviously much larger and the number of seats available for training in public health to the population would roughly be in the region of one seat for 50 million of the population.

Traditionally also, the Institute of Public Health appears to have been the only institution where training in the administrative aspects of medicine and health has been given. In the modern context, training for health work is now gradually being replaced by a total concept of the administrative aspects of medicine which go beyond the original concept of mere public health or preventive medicine. The concept of training in administration proper has also been developed to an increasing extent in the world in the last few decades. This change is reflected in India where more recently institutes for training of business executives (Institute for Business Management), Staff Colleges for Public and other Administrators as in Delhi and in Hyderabad, have now been established.

It is noted that as far as the administrative aspects of medicine are concerned, an increasing number of individuals, whose background and experience vary widely, are now required to undertake duties in medical administration. The background and experience of Directors of Delhi Services who are responsible for both medical as well as, preventive programmes in areas covering large population groups are extremely varied and range from clinical specialities such as internal medicine, psychiatry, orthopaedic surgery etc. to those who have been concerned mainly with teaching in the non-clinical subjects such as Physiology etc. A number of such individuals in almost all the countries of the world have desired and have welcomed the idea of an orientation in the administrative aspects of medicine. In addition, almost in every administrative office, there are a group of young individuals with equally varied background who are holding junior administrative

posts both in the Centre and in the States. The need for the orientation of such individuals with a wide variety of experience is also being increasingly felt.

In the absence of facilities in the medical education institutes of the classical type that we are concerned with in India, such experience is being mainly furnished through visits and tours to other countries sponsored by a number of bilateral and international organizations.

It is, therefore, felt that when we consider the need for increasing the facilities for training in public health and preventive medicine, we should not lose sight of one of the major activities which such institutions have been holding in the past in other countries of the world, namely the needs for training in administrative aspects of medicine.

It would, therefore, be desirable that for future institutions, where such training will be undertaken, this basic requirement of training of various cadres of individuals of varying seniority and background be taken into consideration so that this country be self-sufficient in such facilities. In other words, the future institution for training in public health should combine with it the functions as are now being undertaken by a staff college, and that it should rightly be a staff college for training in administrative medicine.

If this hypothesis is accepted, we would find that the organization of such an institution requires careful consideration.

An Expert Committee of the WHO, when estimating the basis on which a new school of public health should be established indicated that "where the number of students applying for courses is consistently more than 50 per year, and provided other circumstances justify, consideration should be given to the development of additional schools of public health." It is apparent from the demand as exhibited in the major institution of this country, namely the All-India Institute of Hygiene and Public Health, Calcutta, that there is an increasing demand for training in public health. In addition, in the last 2 years, short advanced courses of about 3 weeks' duration in certain specialities, for example, modern trends in public health administration, in epidemiology, in maternal and child health, have been organized for senior groups, such as Assistant Directors and Deputy Directors of Health Services, Senior Medical Officers etc. The response to such courses by such individuals has been gratifying and would indicate that

this has served to meet a long felt need of those senior officers responsible for various aspects of medical administration, and for study tours, either singly or in small groups, to some foreign countries; or the possibility of meeting in a professional association.

It will be apparent, therefore, that in the First and Second Five Year Plans, there has been little or no attempt to review the training requirements for public health and administrative medicine. What additional facilities are available are mainly due to the doubling of the seats at the one main institution in India, namely the All-India Institute of Hygiene and Public Health. This has resulted in a progressively increasing burden on the staff and facilities of the Institute. So much so that a WHO Consultant group under Dr. Gaylord W. Anderson, Director, School of Public Health, North Carolina, with whom were associated Col. Bozman, lately Addl. Public Health Commissioner to the Government of India, and Dr. T. Mckeown, Prof. of Preventive and Social Medicine of Birmingham, wrote as follows in 1958:

"In an attempt to meet the growing demand the Institute has progressively increased its quotas until today it has reached the point at which one may well ask whether it has not accepted students in excess of the number for which its facilities are designed. When classes pass beyond certain size, instructions become increasingly didactic, and student participation in discussions suffers. Field work also becomes more difficult and tends to take an artificial character or to rely on demonstration rather than student participation. The fields at both Chetla and Singur have been stretched to their limit and can absorb the present student load only through very elaborate preplanning and heavy drains upon the time of the senior staff of the Institute. Thus any further increase in the number of students appears to be highly undesirable. Yet we cannot overlook the fact that students are being turned away, and that in some programmes, notably public health nursing and health education, the number of persons seeking training is likely to increase rapidly in future years.

In our opinion the best solution to this dilemma lies not in attempts to expand the staff and resources but in assistance to other agencies such as Universities and health departments of States to help them to establish schools of public health, or training programmes. The needs of a country of 400

million persons are so enormous that one Institute can obviously train only a small fraction of the required workers. Because of its prestige and resources the Institute will doubtless for a long period have a leading place, but it should concentrate its attention upon programmes designed to produce persons who may well be the leaders of the future".

It is, therefore, considered that the present facilities for training in public health giving the ratio of one seat per 50 million people, are completely inadequate to serve the growing needs in public health and administrative medicine in this country.

The optimum number of candidates a well-equipped Institute of Public Health, possessing facilities meeting recognized International standards, can suitably train, varies between 30—40, but should under very few circumstances exceed 50. By both standards the need for increasing the facilities in India is obvious. In considering the organization of such an institution, it will be highly desirable to provide for those required to undertake leadership in administrative medicine with all the various ramifications that it implies.

In organizing the contents and the methods of teaching, a very important point needs to be given adequate consideration.

It has now become recognized that the "laboratory" and the "wards" of such training institutions are the basic administrative units of the country in which such an institution is located. This has led to the acceptance by the Indian Medical Council and the Medical Colleges in India for the need of having a rural "unit" associated with orientation training centres or departments of preventive and social medicine of the medical colleges. Such units are usually the size of a Community Development Block with a population of 60,000. However, the time has come for us to seriously consider whether such an unit can adequately serve the needs for a Staff College in Administrative medicine which is visualized for future institutions to be established.

Fortunately for us, the concept of a model district for purposes of health administration has already been conceived in relation to certain WHO/UNICEF programmes. It is, therefore, suggested that when the various aspects of administrative medicine practice are being demonstrated, the minimum unit for such an institution should be either a subdivision of a district or a district itself. It is

only when a sizable unit of this type can be associated for demonstration purposes to those who are going to undertake the responsibilities for much larger groups of population, can a tangible demonstration and teaching programme be organized.

It is, therefore, hoped that in future planning serious consideration will be given to the following:

(a) the need for the establishment during the Third Five Year Plan of future facilities for teaching and training in preventive medicine;

(b) the strengthening of departments of preventive and social medicine in Medical Colleges since a great deal of the work of postgraduate education will be relieved if adequately orientated candidates are available.

(c) the need for one of such institutions to be organized in the manner of a Staff College for administrative matters to deal with leaders in health should be considered.

(d) As a corollary to this, the need for suitable administrative units such as a district or sub-division to be utilized by such institutions for demonstration and teaching programmes;

(e) In all Directorates of Health Services, "planning cells" be suitably strengthened in order that they can undertake certain basic responsibilities, namely adequate evaluation of existing programmes, reviewing the gaps required for the future programmes and for having demonstration areas where suitable administrative and other procedures could be tried out in a pilot fashion for adoption later, if satisfactory.

## METHODS OF CLINICAL PATHOLOGY TESTS—ESTIMATION OF EFFECTIVENESS

BY

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In the laboratory examinations of blood, sputum and stool, for detecting the presence of any specified bacilli or parasites, there are invariably many alternative methods available. It is always a problem to choose the best of these alternative methods. One important factor that can serve as a basis for the choice of the best method of examination is the probability that a specimen containing the specified bacilli or parasites will be so declared positive for that organism (i.e., as containing that organism) by the particular method of examination. Obviously, the method which has the highest probability, as defined above, is the most effective and is the one to be adopted in the laboratory if we assume that the other conditions of cost and time are the same for the different methods of examination. The problem of estimation of the probability values for the different methods of clinical pathology examinations is a vital one in the choice of the best methods of examination in the laboratory.

For example, for the detection of hookworm in a given specimen of stools, many alternative methods of examination are available, like, the Normal Saline Method (Smear Method), Willy's Concentrated Solution Method (Centrifugal Method), Direct Centrifugal Flootation (Clayton Lane). The probability that a given specimen containing hookworm ova will be declared positive by any of these methods can be estimated from the data available from a stool survey of a random population.

In this article a general method for estimating the effectiveness (probability, as defined above), of any type of laboratory or other examinations has been developed. The same procedure has been adopted for estimating the effectiveness of Willy's method of examination of stool specimen for the detection of hookworm ova, using the data collected in a stool survey of a sample population of a village in South India.

*Method of Estimation*

Let 'θ' be the proportion of a certain population of persons having a characteristic 'A' (can be infection with a specified type of bacilli or parasite) which is not manifestly known, and let 'P' be the probability that a person having the characteristic 'A' (but not manifestly known) will be declared so on the basis of a certain examination, 'E'. The result of the examination is said to be positive if it declares the person having the characteristic 'A' and +ve otherwise. The problem is to estimate 'θ' and 'P' on the basis of the results of examination of a random sample of persons by the method 'E'.

It is also possible that the same person be subjected to more than one examination (by the method E).....for e.g. it has become customary to examine three specimens of stools from each person for deciding whether he is infested or not with any specified type of parasite. The different cases arising out of examination once, twice or more number of times of every person in the sample, by the method E are dealt with below separately. The following assumptions are however made in the details of the working:

- (a) The probability that the method E declares a person not having the characteristic A as negative is Unity. (Only in the case of person having the characteristic A, the positive declaration is made by the method E with probability 'P').
- (b) In case the same individual is examined more than once, the examinations are independent and hence can be considered to be Binomial trials with probability 'P' in the case of examining a person with characteristic A.

*Case 1: Single Examination of each individual:*

When only one examination (E) is carried out on the 'n' persons in the sample, let n<sub>1</sub> be the number of +ves and the rest, -ves. Since 'θ' is the real proportion of those with the characteristic 'A' in the population, and 'p' the probability that a person with characteristic 'A' will be declared positive by the Test 'E', the expected proportion of +ves in an examination of any random sample of the population is θp, and of negatives, 1-θp.

If we equate the observed to the expected, we get only one independent equation involv-

ing the two parameters θ and p and hence no estimation is possible. However, if we give the estimate of θ as  $\frac{n_1}{n}$  it is under the assumption p=1 and hence an under-estimate.

*Case 2: Two examinations of each individual:*

The three cases that can arise out of the results of the two examinations are:

- Both +ves
- 1 +ve and 1 -ve
- Both -ves

and since we have assumed independence of the examinations, the probabilities in these groups, in the case we examine one person with characteristic A are,

$p^2, 2pq$  and  $\theta q^2$  respectively.

Since θ is the proportion of the persons having characteristic A in the population, the expected proportions in the above three groups, if we examine a random sample of the population, are evidently,

$\theta p^2, 2\theta pq, \theta q^2 + (1-\theta)$  respectively.

If k<sub>1</sub>, k<sub>2</sub>, k<sub>3</sub>, are the observed proportions in these three groups based on the examination of a sample of n persons chosen at random from the population, equating the observed proportions with the expected we get 2 independent equations in 2 unknown θ and p, the solutions of which give the best estimates of 'θ' and 'p'.

Taking the first two groups and equating the observed with the expected, we have

$$\begin{aligned} \theta p^2 &= k_1 & \dots & \dots & (1) \\ 2\theta pq &= k_2 & \dots & \dots & (2) \end{aligned}$$

(2)/(1) gives

$$\frac{2q k_2}{p k_1} \therefore \frac{2 k_2 + 2k_1}{p k_1}$$

or  $p = \frac{2k_1}{k_2 + 2k_1}$

and substituting this value in (1) we get the value of θ.

*Case 3: Three examinations for each individual*

The four exclusive groups in which the results of the three examinations on an individual can fall are:

All the three +ves  
 2 +ves and 1 -ve  
 1 +ve and 2 -ves  
 and all the three -ves.

Under the assumptions made before, the proportion of cases that can be expected to fall in these groups if we examine a random sample of the population are:

$$\begin{aligned} \pi_1 &= \theta p^3 \\ \pi_2 &= 3\theta p^2 q \\ \pi_3 &= 3\theta p q^2 \\ \pi_4 &= \theta q^3 + (1-\theta) \text{ respectively.} \end{aligned}$$

The proportion  $(1-\theta)$  of persons not having the characteristic A in the population will be shown negative in all the three examinations of E and only for the portion ' $\theta$ ' having the characteristic, the probabilities in the four different groups follow the Binomial law (by the assumption of independence).

If  $l_1, l_2, l_3, l_4$ , are the observed proportions in the four groups in the examination of a sample population of size 'n', by equating them with the expected probabilities, we get 4 equations (3 independent) involving ' $\theta$ ' and ' $p$ '.

From these equations, the maximum likelihood estimates of ' $\theta$ ' and ' $p$ ' can be obtained by the method of scoring. Trial solutions obtained directly from the four equations may be used and additive corrections to these trial values can be derived from the linear equations framed with the help of the scores and the information matrix. The general procedure of obtaining the additive corrections is indicated below:

If  $\theta_0$  and  $p_0$  are the trial values of ' $\theta$ ' and ' $p$ ' and  $f_1, f_2, f_3, f_4$ , are the observed frequencies in the four groups ( $\sum f_i = n$  and  $f_i = nl_i, i=1, 2 \dots 4$ ) then the score at  $\theta_0$  and  $P_0$  are given by

$$\begin{aligned} \varphi\theta_0 &= \frac{\sum f_1 \sigma\pi_1}{\pi_1 \sigma\theta_0} \\ \varphi p_0 &= \frac{\sum f_1 \sigma\pi_1}{\pi_1 \sigma p_0} \end{aligned}$$

and the information matrix  $I = \begin{pmatrix} I\theta_0\theta_0 & I\theta_0 p_0 \\ I\theta_0 p_0 & I p_0 p_0 \end{pmatrix}$  at the trial values are given by

$$I\theta_0\theta_0 = \sum \frac{1}{\pi_1} \left( \frac{\sigma\pi_1}{\sigma\theta_0} \right)^2$$

$$I\theta_0 p_0 = \sum \frac{1}{\pi_1} \left( \frac{\sigma\pi_1}{\sigma\theta_0} \right) \left( \frac{\sigma\pi_1}{\sigma p_0} \right)$$

$$\& I p_0 p_0 = \sum \frac{1}{\pi_1} \left( \frac{\sigma\pi_1}{\sigma p_0} \right)^2$$

If  $I^{-1} = \begin{pmatrix} I\theta_0\theta_0 & I\theta_0 p_0 \\ I\theta_0 p_0 & I p_0 p_0 \end{pmatrix}$  is the inverse of

the matrix I, then the corrections to the trial values  $\theta_0$  and  $p_0$  are given by

$$\delta\theta_0 = \frac{I\theta_0\theta_0 \phi\theta + I\theta_0 p_0 \phi p_0}{n}$$

$$\& \delta p_0 = \frac{I\theta_0 p_0 \phi\theta + I p_0 p_0 \phi p_0}{n}$$

The improved estimates of ' $\theta$ ' and ' $p$ ' are  $\theta$  and  $p_1$  where  $\theta_1 = \theta_0 + \delta\theta_0$  and  $p_1 = p_0 + \delta p$ . The whole procedure of obtaining corrections is carried out taking  $\theta_1$  and  $p_1$  as the initial values and the process is continued till the corrections become negligible to the required order of accuracy.

The above procedure of estimation by the method of scoring is applicable even in cases where more than 3 examinations are carried out for each individual.

*Illustration :*

The data collected in a stool survey of a random sample of 330 children, of the age group 1-4, in a village in South India are analysed below, by the method explained above. Three specimens of stools were examined for each child by the Willy's method for detecting the presence of any hookworm ova and the results are given below.

Table I

Classification of the result	Observed frequency	Proportion
All three specimens +ve	30	.0909
2 +ve and 1 -ve	20	.0606
1 +ve and 2 -ves	12	.0364
All the three -ves	268	.8121
Total:	330	1.0000

Equating the observed proportions with the probability expressions given in Case 3, above, we have,

$$\begin{array}{rcl}
 \theta p^3 & = & \cdot 0909 \quad 1 \\
 3\theta p^2 q & = & \cdot 0606 \quad 2 \\
 3\theta p q^2 & = & \cdot 0364 \quad 3 \\
 \theta q^3 + (1-\theta) & = & \cdot 8121 \quad 4 \\
 \text{--- gives } \frac{1}{2} \frac{p}{3q} & = & \frac{\cdot 0909}{\cdot 0606} = \frac{3}{2} \quad 5
 \end{array}$$

giving an estimate of  $p$  as  $p_0 = \frac{.8181 \text{ or } .82}{(\text{initial value})}$

Substituting in (4) the value of  $\theta q^2$  from (3)

$$\text{We have } \frac{(\cdot 0364) q}{3 p} + (1-\theta) = \cdot 8121$$

Substituting for  $q/p$ , from (5), in the above equation we have an estimate of  $\theta$  as  $\theta_0 = \cdot 2098$  or  $\cdot 21$

We will improve upon these trial values in order to obtain the maximum likelihood estimate of ' $\theta$ ' and ' $p$ ', by the method of scoring as explained previously. The following table gives the factors necessary to compute the scores and the information matrix.

The numerical values from columns 2 to 4 of the above table have been worked out at the trial values of ' $\theta$ ' and ' $p$ ' already obtained (viz.):

$$\begin{aligned}
 \theta_0 &= \cdot 21 \quad \text{and} \quad p_0 = \cdot 82 \\
 \text{The scores are} \\
 \psi \theta_0 &= \frac{\sum f_1 \sigma \pi_1}{\pi_1 \sigma \theta_0} = -41.502308 \\
 \& \phi p_0 = \frac{\sum f_1 \sigma \pi_1}{\pi_1 \sigma p_0} = -78.186592
 \end{aligned}$$

The elements of the information matrix at  $\theta_1$  and  $p_0$  are

$$\begin{aligned}
 I_{\theta_0 \theta_0} &= \sum \frac{1}{\pi_1} \left( \frac{\sigma \pi_1}{\sigma \theta_0} \right)^2 = 5.983297 \\
 I_{\theta_0 p_0} &= \sum \frac{1}{\pi_1} \left( \frac{\sigma \theta_1}{\sigma \theta_0} \right) \left( \frac{\sigma \pi_1}{\sigma p_0} \right) = \cdot 122847 \\
 I_{p_0 p_0} &= \sum \frac{1}{\pi_1} \left( \frac{\sigma \pi_1}{\sigma p_0} \right)^2 = 3.928419
 \end{aligned}$$

Hence the information matrix for a single observation is

$$\begin{aligned}
 I &= \begin{pmatrix} 5.983297 & .122847 \\ .122847 & 3.928419 \end{pmatrix} \\
 |I| &= 23.489786
 \end{aligned}$$

Classification of the result	Probability $\pi$	$\sigma \pi$ — $\sigma \theta$	$\sigma \pi$ — $\sigma p$	Observed frequency (f)
1	2	3	4	5
All three +ves	$\theta p^3$ = $\cdot 115787$	$p^3$ = $\cdot 551368$	$3\theta p^2$ = $\cdot 423612$	30
2 +ves & 1 -ve	$3\theta p^2 q$ = $\cdot 076250$	$3p^2 q$ = $\cdot 363096$	$3\theta(2pq - p^2)$ = $-\cdot 237636$	20
1 +ve & 2 -ves	$3\theta p q^2$ = $\cdot 016738$	$3p q^2$ = $\cdot 079704$	$3\theta(q^2 - 2pq)$ = $-\cdot 165564$	12
All three -ves	$\theta q^3 + 1 - \theta$ = $\cdot 791225$	$q^3 - 1$ = $-\cdot 994168$	$-3\theta q^2$ = $-\cdot 020412$	268

If the inverse of the matrix I is denoted by

$$I^{-1} = \begin{pmatrix} {}_1\theta_0\theta_0 & {}_1\theta_0p_0 \\ {}_1\theta_0p_0 & {}_1p_0p_0 \end{pmatrix}$$

$$\text{then } {}_1\theta_0\theta_0 = \frac{3.928419}{23.489786} = .1673$$

$${}_1\theta_0p_0 = -\frac{.122847}{23.489786} = -.0052$$

$${}_1p_0p_0 = \frac{5.983297}{23.489786} = .2547$$

The corrections to the nutral valves are

$$\delta\theta_0 = \frac{\varphi\theta_0 I^{\theta_0\theta_0} + \varphi p_0 I^{\theta_0p_0}}{\Sigma f_1}$$

$$= \frac{-41.5023 \times .1673 + 78.1866 \times .0052}{330} = -.0198$$

$$\delta p_0 = \frac{\varphi\theta_0 I^{\theta_0p_0} + \varphi p_0 I^{p_0p_0}}{\Sigma f_1}$$

$$= \frac{41.5023 \times .0052 - 78.1866 \times .2547}{330} = -.0597$$

Hence the improved estimates of  $\theta$  and  $p$  are

$$\theta_1 = \theta_0 + \delta\theta_0 = .21 - .0198 = .1902 \quad \text{And}$$

$$p_1 = p_0 + \delta p_0 = .72 - .0597 = .6603$$

Taking the improved estimates of  $\theta$  and  $p$  as  $\theta_1$  and  $p_1$ , where  $\theta_1 = .190$  and  $p_1 = .760$  and if the corrections are worked out by the above process using these as initial values it is found

$$\delta\theta_1 = .0007 \quad \text{And} \quad \delta p_1 = -.0056$$

The corrections at subsequent stages become negligible to the third place of decimal and

hence the best estimates of  $\theta$  and  $p$  can be taken as .191 and .755 (.19024.0007 and .7603 .0056 corrected to the third place of decimal) respectively. The variances of these estimates at the above values (viz.),

$$\frac{I^{\theta\theta}}{330} \quad \text{and} \quad \frac{I^{pp}}{330}$$

work out to .0005 and .0011 respectively.

*Summary :*

A statistical method for estimating the effectiveness of a clinical pathology examination from the data available from a sample survey is worked out.

Applying the sme method for the data collected in a hookworm survey in a village in South India, the hookworm infestation rate and the effectiveness of Willy's Concentrated Solution method are worked out. The infestation rate is found to be 19.1% and the effectiveness of Willy's method, 75.5%.

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## FILARIASIS IN REWA DIVISION, MADHYA PRADESH

By

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Although filariasis has been recognised as a disease entity since ancient times, it is only recently that there has been renewed interest in epidemiological studies and in the control

of the disease. The discovery of diethyl-carbamazine, a potent filaricidal drug, and of residual insecticides in recent times, have inspired hopes of controlling this disease on

a mass scale. Towards this end, the Govt. of India launched the National Filaria Control Programme, as part of the First Five Year Plan, in 1955.

Under the above programme, a Survey Unit was allotted to the former state of Vindhya Pradesh (now Rewa Division of Madhya Pradesh) in January 1955 to conduct a survey and map out the areas of filarial infection and disease and to obtain information on the degree of prevalence of filarial infection and disease in the endemic areas and to find out the types of infection, vectors of transmission and their bionomics as a preliminary step to institute measures for the control of the disease. The staff engaged in the survey was that recommended by the Malaria Institute of India, Delhi, namely one Filaria Officer, one laboratory assistant, two insect collectors, two laboratory attendants and one peon. The Unit completed the survey of the region in 1958, and the results of the survey are set out in this paper.

### 1. Area & Physiography

The area covered 23,188 sq. miles and comprised mostly of forests, hilly tracts and hilly plateau regions. The mountain ranges were the Kymore and the Satpura hills. The rivers of note were the *Son*, the *Ken*, the *Dhasan*, the *Betwa*, and the *Narbada*. The presence of a large number of lakes in the plains and foot hill regions was a striking geographical feature.

### 2. Population

The population according to the 1951 Census was 35,74,690:—males—1832940; females—1741750; rural—3268780; urban—305910.

The dispersal of population was very scant, the density being 130 per sq. mile. The literacy rate was 9 per cent (1951). The spoken languages were the *Baghelkhandi* and *Bundelkhandi*-local dialects of the Hindi language. Among the people there was a good sprinkling of displaced persons from the Punjab, Sindh and East Bengal. Agriculture was the main occupation of the people. The main crops grown were rice, wheat, *Juar* and pulses.

### 3. Towns and Villages

There were 80 towns in this region—all municipal and notified areas with a population of more than 5,000 having been counted as towns. There were 12,713 villages the

average population of a village being about 250.

### 4. Environmental conditions

(a) *Housing*: The houses in the villages were generally clustered, ill-lighted, ill-ventilated, low-roofed and built of mud or brick with thatched or brick with thatched or tiled roofs, barely containing a couple of rooms for habitation. Most of the houses were of a mixed nature with provision for housing cattle.

(b) *Water supply*: The wells were the main sources of drinking water, both in the rural and urban areas. Most of the wells were shallow and unprotected. Breeding of the culicines was noticed in many instances in the stagnant pools of spilled and washed water near the wells.

Tanks were also seen in large numbers, chiefly near the foot hill regions. Some of these tanks were used for growing the tuber '*singhada*' which is a source of food for the poorer classes. Other aquatic vegetation such as *Pistia*, *Lemna*, and water hyacinth were also frequently seen in the tanks.

(c) *Drainage*: Filariasis is essentially a disease associated with bad drainage. There was no drainage system in the villages; the waste water was let out into the streets and permitted either to collect in cess pits or to meander away till it was absorbed or evaporated. In some of the urban areas, there were drains seen—partly *pucca* and partly *katcha*—but their condition was far from satisfactory, defeating the purpose for which they were laid.

(d) *Climate & Meteorology*: The climate was generally hot and dry during the greater part of the year. The temperature showed a wide range of fluctuation—the maximum and minimum temperatures reaching 47.7°C in summer and 4.4°C in winter respectively. The duration of the rainy season was for about 3½ months, beginning from the last week of June till the end of September, the maximum precipitation occurring during the months of July and August. The annual quantum of rainfall was about 100 c.m., and the number of rainy days in a year about 50. A few showers were also reported towards the end of January and beginning of February. The average annual relative humidity was about 45 per cent. During the monsoon, the relative humidity rose up to 90 per cent. A statement of annual rainfall and temperature is given in Table I & II.

Table I

Annual Rainfall (Centimeter)		
Year	Panna town	Chhatarpur town
1945	74.47	85.44
1946	127.66	68.98
1947	150.19	142.59
1948	152.04	140.58
1949	89.56	127.22
1950	92.55	101.47
1951	133.52	87.72
1951	133.52	87.72
1952	124.71	106.40

Table II

Average Monthly Max. & Min. Temp.—Nowgong  
(Chhatarpur)1955

Month	Max. Temp °C	Min. Temp °C
January	23.1	9.2
February	25.8	10.8
March	35.1	15.5
April	37.4	18.2
May	41.7	25.8
June	39.7	28.1
July	33.2	25.5
August	31.2	24.8
September	31.7	24.4
October	29.7	18.8
November	27.7	9.4
December	24.8	7.8

## 5. Communications

Communications in this region were poorly developed. The important towns were connected by metalled roads, but most of the villages, situated as they were in the interior, were without proper connecting roads. There were regular buses plying between the towns, but access to the villages was generally by foot.

## INVESTIGATION PROCEDURE

The procedure recommended by the Malaria Institute of India, Delhi, was adopted. Night blood was obtained from persons of all ages and both sexes by house to house visits between 8.30 p.m. and midnight. In each case, approximately 20 c.mm of blood was obtained by deep finger prick and thick smears were made in the centre of clean glass slides, dried and numbered, according to serial number. The name, address, age, sex and details of visible filarial manifestations were then recorded in the 'Filaria Survey Cards', against their respective serial numbers.

On the next morning, the slides were dehaemoglobinised, and stained with either aqueous methylene blue or J.S.B.I. dried, and examined for microfilaria. If found positive, the type of infection and its intensity were noted and entered against their names in the filaria survey cards.

Mosquito collection was an important part of the survey. Mosquitoes were collected in the morning hours from all types of dwelling places, and subsequently identified and dissected for filarial infection. A study of their relative distribution, density and breeding places was also made. Wherever pistia plant and other aquatic vegetation were found in the local tanks, a search was made for the breeding of *Mansonioides* species, and vice versa.

## PLAN OF WORK

While adhering to the above investigation procedure, the survey was planned to cover the entire region, districtwise commencing with the highly endemic districts. In each district, priority was given to the survey of all the urban areas, examining a minimum of 5 per cent 'random and representative' population, irrespective of whether the disease was reported from the local hospitals or not. The results are given below under 'Filariasis in the Urban areas'.

Equal importance was also given to the filaria survey of the rural areas, as there was no previous record of the existence of filariasis in the rural areas in this region. As many villages as practicable were surveyed from each district. Some of the villages were chosen from the '3 mile belt' area of endemic areas, basing on the theory that the maximum flight of *C. fatigans* is about 3 miles. The results are given below under 'Filariasis in the Rural areas'.

### I. FILARIASIS IN THE URBAN AREAS

The present survey helped to spotlight that filariasis was chiefly entrenched in the urban areas. A survey of all the urban areas numbering about 80 and covering a population of 3,14,137 was made examining 19,025 people (6 per cent) for filarial infection and disease, according to the procedure outlined earlier.

#### 1. Geographical Distribution

The results of filaria survey district-wise are given in Table III.

FILARIASIS IN REWA DIVISION—PARK

Table III  
Filaria Survey in the Urban Areas

District	Urban population covered	Population examined	No. with Filarial infection	No. with Filarial disease	Fila Infec. Rate %	Fila Disease Rate* %
Sidhi**	...	...	...	...	...	...
Shahdol	49,630	2,526	36	18	1	0.5
Rewa	66,294	3,417	77	5	2.2	0.1
Satna	38,589	3,668	251	32	6.8	0.8
Panna	25,450	2,730	331	60	12.1	2.1
Chhatarpur	55,709	2,770	170	62	6.1	2.5
Tikamgarh	37,437	1,972	48	13	2.3	0.6
Datia	41,028	1,942	162	27	8.3	1.4

\* This refers to the disease rate as determined by examination during night surveys. Filarial fever was not taken into account. Lymphadenitis was omitted from routine examination as it was not easy to examine people for such a lesion and this condition was not always due to filaria' (M.I.I.).

\*\* There were no urban areas in Sidhi District.

It will be seen from Table III that there were no urban areas in Sidhi district as well as filariasis. A survey of the rural areas (vide Table X) in Sidhi district revealed that it was free from filariasis. Thus Sidhi was the only district that was free from filariasis.

In all the remaining districts, both filarial infection and disease were encountered. The filarial infection rates varied between 1 to 12.1 per cent, and the filarial disease rates between 0.1 to 2.5.

In Shahdos, Rewa, and Tikamgarh districts, the filarial infection rates varied between 1 to 2.3 per cent, and the disease rates between 0.1 to 0.6 per cent; these were the districts of low endemicity. In the remaining districts, namely Satna, Panna, Chhatarpur and Datia, the filarial infection rates varied between 6.1 to 12.1 per cent and the disease rates between 0.8 to 2.5 per cent; these were the districts of high endemicity.

In the districts of low endemicity (Shahdol, Rewa and Tikamgarh), it may be observed that the disease rates were rather high compared to the infection rates. Thus in Shahdol district, the filarial infection rate was 1 per cent and the disease rate 0.5 per cent. This seeming inconsistency may be attributed to the relatively smaller size (5 per cent) of the population examined. Generally it is recommended that in areas of low endemicity, a higher percentage of the sample (at least 10 per cent) should be examined. But as the present survey was of a rapid nature involving an extensive area and a vast population, detailed investigations could not be undertaken.

Another point that deserves mention, in this connection, is that in mass surveys pertaining to filaria, 'filarial infection rates' appear to be more reliable indices of the filariosis of a community than 'filarial disease rates'. It was our experience that in many places where this

survey was conducted, people with disease manifestations were more eager to get themselves and their families examined than the otherwise healthy individuals and families. Such demands cannot be lightly brushed aside in mass campaigns. It is probably because of this factor that the disease rates appear to be proportionately higher as compared to the infection rates. Filarial surveys conducted in the other parts of the country also reveal similar discrepancy. Thus Sinha (1960) found an infection rate of 9.6 per cent and a disease rate of 14.8 per cent in Basti town (Uttar Pradesh); Varma *et al* (1960) reported an infection rate of 18.5 per cent and a disease rate of 12.6 per cent in Sultanganj area (Bihar).

Subject to these limitations, the data presented in Table III show a fairly accurate picture of filarial infection in this region and that filarial infection rates appear to be more reliable indices of the filariosis of a community than filarial disease rates.

#### 'Filarial Belt'

A glance at Table III gives unmistakable evidence that as one proceeds westward from Satna towards Datia, the intensity of filarial infection and/or disease are on the increase. Thus the entire area from the west of Satna district extending upto Datia and Gwalior may be called the 'filarial belt' of the present Madhya Pradesh. The areas worst affected in Rewa Division were Panna, Chhatarpur and Datia.

#### 2. Age & Filariasis

The pattern of filarial infection and disease in a community are best appreciated by a study of their prevalence in different age groups. With this view, the findings of survey of all the urban areas (where filariasis was encountered) are consolidated and classified according to age, and are given in Table IV.

Table IV  
Filarial Infection and Disease According to Age

Age Group (Years)	Number examined	Number with Filarial disease	Filarial Disease Rate %	Number With Filarial infection	Filarial Infection Rate %
0—5	480	...	...	4	0.8
6—10	1,786	1	0.05	54	3.0
11—20	3,915	17	0.4	302	7.7
21—30	4,661	58	1.2	352	7.5
31—40	2,527	73	3.8	217	8.4
41—50	1,017	40	3.08	91	8.9
Over 50	427	28	6.5	44	10.2

It will be seen from Table IV.

(1) That commencing in the age group 0-5, the filarial infection showed a steep rise in the age group 10-20, and maintained thereafter, more or less, a steady upward trend. This trend is in keeping with the nature of the disease that with an increase in age, there is an increase in the rate of infection. The earliest age at which filarial infection was found was 3 years. Iyengar (1933), Krishnaswamy (1955) and Kant *et al* (1956) observed filarial infection at 2 years. Varma *et al* (1960) reported filarial infection at the age of 3 years.

(2) That filarial disease, appearing in the age group 6-10, showed a gradually increasing trend, which is typical of the chronic nature of the disease. Further, the disease rate was low in children below 10 years. Farooque and Qutubuddin (1946), Krishnaswamy (1955), Kant *et al* (1956) and Varma *et al* (1960) recorded similar observations on the filarial disease rate.

The earliest age at which filarial disease found was 9 years. Iyengar (1933) observed filarial disease at 8 years age while Krishnaswamy (1955) found filarial disease at 5 years, Kant *et al* (1956) at 4 years age and Varma *et al* (1960) at 3 years age.

(3) That between the age groups 11-20 and 41-50, the filarial infection rate varied little, but the disease rate increased substantially. Similar trend was also observed by other workers in India. Krishnaswamy (1955) and Dutta (1960) reported a progressive rise in filarial infection rate only upto 20 years; Kant *et al* (1956) observed a progressive rise upto 30 years. Raghavan (1955) sums up saying: 'It is generally accepted that the infection rate rises with age in the earlier years (upto twenty or thirty) but not as consistently in the later age groups. This difference is probably due to the fact that some of the persons developing disease become negative for microfilariae'.

### 3. Type of Infection

In all the areas surveyed, the parasite identified was *W. bancrofti*. A point of interest was that a few atypical forms of *Mf. bancrofti* were found in Chhatarpur district. Initially they were mistaken for *Mf. malayi* as they showed secondary curves, smudged nuclei and a prominent excretory pore, but on detailed study (by the Malaria Institute of India, Delhi) they were found to be *Mf. bancrofti*, because of the absence of 'the characteristic bulbous swelling of the terminal nuclei at the caudal end, and the relatively narrow free cephalic space'. This throws light on the possibility of a different strain of *Mf. bancrofti* existing in this area, notably in Chhatarpur district. Further studies concerning the biology of the parasite in this region are worthwhile.

### 4. Intensity of Infestation

The number of microfilariae in a unit quantity of blood (20 c.mm) may be regarded as an index of the degree of microfilarial infestation in an individual. When all the positive slides are graded according to the number of microfilariae, we get an idea of the levels of infestation in a community. In the present study, about 500 slides were graded for intensity of filarial infestation and the results are shown in Table V.

Table V  
Intensity of Microfilarial Infestation

Number of Microfilariae	Number of smears graded	Percentage
1—2	80	18.7
3—5	111	25.9
6—10	86	20.1
11—20	73	17.09
21—50	53	12.5
51—100	17	3.9
101—200	7	1.6
Total	427	...

It will be seen from Table V that 64.5 per cent of the positive slides showed less than 10 microfilariae in approximately 20 c.mm of blood. Only 5.5 per cent showed very high rates of infestations, i.e., 50 and above. A similar observation was made by Raghavan (1955) that a comparatively low number of microfilariae are usually met in 20 c.mm samples of blood in the Wuchererian infections in India, which is at variance with the observations made, for example, in *W. bancrofti* in East Africa. High densities of microfilarial infestation in the blood of the host are generally unfavourable for the survival of the vector species, and diminish the chances of successful transmission.

### 5. Silent Areas

As a routine, all the urban areas were surveyed whether filarial disease was reported or not. In doing so, we were able to uncover some silent areas, i.e., areas where filariasis was not suspected because of absence of manifestations of filarial disease. A striking example of such an area was Amanganj (Panna District) where on survey the filarial infection rate was found to be 14.1 per cent, and the disease rate nil. Dissection of *C. fatigans* revealed active transmission. It is possible that these silent areas were newly infected, and that in course of time filarial disease would appear. Thus the presence of silent areas appears to be an important feature in the epidemiology of filariasis.

### 6. Filarial Disease

The factors limiting the validity of filarial disease rates in a community have already been discussed. One more factor that deserves mention was the difficulty in collecting data regarding genital affections in women; it was likely that such manifestations in case of females were missed.

Subject to these limitations, out of 19,025 persons clinically examined 217 showed visible manifestations of filarial disease. This gave a gross disease rate of 1.1 per cent. The youngest age showing disease manifestations was 9 years. An analysis of manifestations of filarial disease is given in Table VI.

Table VI

*Analysis of Manifestations of Filarial Disease*

Sl. No.	Classification	Number affected
1.	Elephantiasis of lower limbs	135
2.	.. of upper limbs	31
3.	.. of both lower limbs	7
4.	.. of both upper limbs	2
5.	.. of scrotum	41
6.	.. of Right hand & left leg	1

It will be seen from Table VI that elephantiasis of lower limbs was the most common visible manifestation.

### 7. Filarial Disease & Filarial Infection

It is well known that with the appearance of filarial disease, the blood infestation of filarial parasites begins to decrease. In chronic cases of filarial disease, the blood is usually negative for microfilariae. Out of 217 persons with filarial disease whose night blood was examined for microfilariae, only 4 (1.8 per cent) were found to be positive for microfilariae. The relation between filarial disease and infection in the present series is set out in Table VII.

Table VII

*Relation Between Filarial Infection & Disease*

	Number	Number for <i>Mf.</i>	Infection Rate %
1. Persons with filarial disease	217	4	1.8
2. Persons without filarial disease	18,808	1,071	5.6

### 8. Mosquito Fauna

Routine collection of mosquitoes and their identification and dissection for the developmental forms of the filarial parasite was an important part of the survey. The following species of mosquitoes were encountered. The list does not claim to be an exhaustive one because of the rapid nature of the survey.

#### (a) *Culicines*

The species identified were: *C. fatigans*, *C. sinensis*, and *C. bitaeniorhynchus*. Of these, *C. fatigans* was found to be the most frequently occurring species. It accounted for 60-90 per cent of the total collections in urban areas and 30-40 per cent of the total collections in the rural areas.

That *C. fatigans* is predominantly a domestic species was also our experience. For its day

time resting, it showed a preference to human and mixed dwellings. Of the total catches, 44.4 per cent were from human dwellings, 36.9 per cent were from mixed dwellings, and 18.7 per cent were from cattle sheds. Thus the yield from cattle sheds was poorer as compared to the yield from human and mixed dwellings. A point of interest regarding the resting habits of this species was obvious preference to rest, while indoors, within 2-3 feet from floor level. The breeding places were cesspools and drains. No breeding was observed in tanks and lakes. Ratio between males and females varied between 1 to 3.5.

#### (b) *Anophelines*

The following species were noted: *A. subpictus*, *A. annularis*, *A. pallidus*, *A. culicifacies*, and *A. fluviatilis*. Of these *A. subpictus* was the more widely distributed and widely prevalent species, occurring mainly in cattle sheds. The rest of the species were constant in occurrence, although their numbers were relatively smaller.

#### (c) *Mansonoides*

The species noted were: *M. annulifera*, and *M. uniformis*. Of these, *M. annulifera* was the more prevalent species. In one place (Maihar, Satna District) there was a high prevalence of *M. annulifera* (during rainy season) accounting for 54 per cent of the total catches. Breeding of the *Mansonoides* was found in association with the aquatic plant, *Pistia stratiotes*.

#### (d) *Armegeres*

A comparatively rare species, found notably in Chhatarpur district.

### 9. Vectors of Transmission

Incrimination of vectors was an important part of the survey. With this view, dissection of female mosquitoes of various species was carried out, chiefly in those areas where filariasis was encountered. As a result of these studies it was found that *C. fatigans* was the natural vector of transmission. All the developmental stages of the parasite were found. Attempts to find filarial infection in the anophelines and mansonoides species were not successful. The results of mosquito dissection are set out in Table VIII.

Table VIII

## Mosquito Infection Rates

Place	Number		Mosquito Infection Rate, %
	Number of <i>C. fatigans</i> dissected	Number Positive	
Satna ...	599	14	2.3
Nagod ...	19	4	21.0
Panna ...	55	10	18
Devendranagar ...	10	1	10
Amanganj ...	8	2	25
Gunor ...	28	2	7.4
Chhatarpur ...	281	15	5.4
Bijawar ...	12	2	16.8
Maharajpur ...	18	1	5.5
Laundi ...	19	6	32
Harpalpur ...	24	2	8
Rajnagar ...	30	3	13.3
Tikamgarh ...	120	18	15
Niwar ...	20	2	10
Datia ...	85	32	37
Seondha ...	32	11	34
Baroni ...	26	5	19
Rewa ...	128	3	1.5

A fairly good idea can be had from Table VIII regarding the mosquito infection rates at different places.

## II. FILARIASIS IN THE RURAL AREAS

Equal weightage was also given for the detection of filariasis in the rural areas. During the present survey, 382 villages (out of 12,713) were surveyed covering a population of 2,71,487. The number of people actually examined for evidence of blood infestation was 23,612. The number of villages surveyed, district-wise is given in Table IX.

Table IX

## Distribution of Villages Surveyed District-Wise

District	Total Number of villages	Number surveyed	Per cent surveyed
Satna ...	2,129	97	4
Panna ...	1,089	48	4.4
Chhatarpur ...	1,139	58	5
Tikamgarh ...	983	54	5.4
Datia ...	447	21	4.6
Shahdol ...	2,156	30	1.4
Rewa ...	2,685	40	1
Sidhi ...	1,915	34	1.3

Out of 382 villages surveyed, filarial infection was found in 17 villages. The details are set out in Table X.

Table X  
Results of Filaria Survey in Rural Area

District	Rural population examined	Filarial Infection Rate, %	Filarial Disease Rate, %
Satna ...	11,594	0.1	0.1
Fa'na ...	2,091	0.5	0.04
Chhatarpur ...	2,668	...	...
Ti'camgarh ...	2,437	0.01	0.003
Datia ...	720	...	...
Shahdol ...	1,091	...	...
Rewa ...	1,388	...	...
Sidhi ...	1,603	...	...

It will be seen from Table X that filariasis was not a public health problem in rural areas. It is possible that with increasing urbanisation of rural areas, rapid methods of transport, industrialisation, and movement of population filariasis may spread to rural areas in course of time, if effective methods to control the disease in the urban areas are not undertaken. (Since completing the survey, control measures had been instituted under the National Filaria Control Programme)

SUMMARY

1. Filaria survey of the Rewa District of Madhya Pradesh was carried out under the National Filaria Control Programme during 1955-'58.

2. With the exception of Sidhi District, filarial infection and disease were found in most of the urban areas of the remaining seven districts.

3. Filarial infection rate varied between 1 to 12.1 per cent, and the disease rate between 0.1 to 2.5 per cent.

4. The disease manifestations noted were elephantiasis of the upper and lower extremities, and scrotum.

5. The type of infection noted was *W. bancrofti* and the vector was *C. fatigans*.

6. Filarial infection and disease manifestations were noted at the age of 3 and 9 years respectively.

7. Filariasis was not a public health problem in rural areas.

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# APPLICATION OF INSECTICIDES

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## *Introduction*

The discovery of insecticides like DDT, BHC, etc. revolutionised the control of vector borne diseases such as malaria, yellow fever, typhus, plague, etc. Pest control by the use of chemicals is also of vital importance for increased agricultural production. This subject has expanded at such a rapid rate that at present more than 2,00 insecticides are in commercial use. It is, therefore, of utmost importance to select a proper insecticide for achieving success in a specific project. The selection of insecticide depends upon the objective of the control, the species of the insect the control of which is desired, biology and ecology of insect specie etc. Further-more the insecticide should be properly applied which in turn is dependent upon the type of formulation, the application techniques and the spraying equipment. In this note some of these points have been briefly discussd.

## *Choice of Insecticide*

The selection of a particular insecticide will depend on its effectiveness in a particular situation, toxic hazards in its handling, and its effects on aquatic animals, as well as volatility, and on many other considerations. Because of its high residual effect, mild toxicity, and least volatility, DDT is perhaps the most widely used insecticide now available. It is the insecticide of choice for use as a residual spray in residential houses for the control of mosquitoes and flies. Dieldrin is more toxic, its acute toxicity being about four or five times that of DDT. Dieldrin has been used extensively in the control of agricultural insects, and in public health activities against domestic flies, mosquitoes, sand flies, ticks, and against DDT-resistant adult house flies. Dieldrin should not be used in dairy farms, in food handling establishments, or directly to animals. Benzene hexachloride has been used primarily as an agricultural insecticide, and also against pests of public health importance. Because of its objectionable odour, its use is largely limited to out-door applications, where care must be taken to avoid contamination of food products.

Application at the rate of one pound of technical BHC (12% of gamma content) per acre has controlled *Aedes*, *Culex*, and *Anopheles* mosquito larvae in ponds for about one month. Application of as many as five such treatments each season for three consecutive years, did not result in any injury to fish. Chlordane, which is a dark viscous oily liquid soluble in most organic solvents but insoluble in water, is more toxic to man or animals than DDT. It has been used in the control of agricultural pests and chiefly against house flies resistant to DDT. For controlling roaches it is the insecticide of choice, being used as a 2 to 3% emulsion or oil spray. Chlordane concentrates should be stored in glass or aluminium containers.

Aldrin is a buff coloured crystalline solid soluble in most organic solvents but insoluble in water. Unlike most other chlorinated hydrocarbon insecticides, it is stable in the presence of alkaline and metallic chloride materials. It is more volatile than chlordane and has got considerable fumigant properties. It is also more toxic than DDT. It has been used chiefly in the control of agricultural pests, but less extensively in the public health field than that of its sister compound dieldrin.

Lindane has the highest acute toxicity of the various isomers of benzene hexachloride. It has a slightly musty odour being decidedly more volatile than DDT. Fish is extremely susceptible to lindane poisoning and should not be exposed to lindane vapours. Particular care should be taken to avoid contamination of food stuffs, and it should not be directly applied to dairy animals. It has low chronic toxicity, and because of the relatively low dosage required, its use has been approved for controlling flies in dairy barns, the recommended dosage for residual spraying being 25 mg. of lindane per square foot of surface. Where the human body louse is resistant to DDT, lindane has successfully controlled louse infestations when applied as a one per cent powder.

Large number of organophosphorous compounds have been synthesised during these years, some of which i.e. diazinon, malathion are being used for the control of insects of public health importance, mainly houseflies.

In general, these compounds are quite volatile and therefore their deposits do not show long residual toxicity against insects. Furthermore, some of these compounds are known to have high mammalian toxicity. These compounds give effective control of insects resistant to both DDT and dieldrin.

The use of pyrethrum for the disease control on any large scale has now-a-days almost stopped. This insecticide is, however, very good as a household insecticide for the control of nuisance insects. The use of this insecticide unlike that of synthetic insecticides does not involve any toxic hazard.

#### *General Precautions:*

As a general rule, in using any of the insecticides, reasonable precautions must be taken to avoid breathing the dusts, mists, or powders, and to avoid direct skin contact with the insecticide in any form. Contaminated skin area should be washed with soap and water, and excessively contaminated clothing should not be worn. When using concentrated form of dieldrin, chlordane, aldrin, or such toxic insecticides, the workers should wear water-proof, xylene resistant gloves and suitable protective clothing.

Great care should be taken in preventing accidental poisoning due to an insecticide being mistaken for flour, sugar etc, and used with food stuff. The containers should, therefore, be properly labelled.

#### *Formulations*

There are a number of ways in which the insecticides can be applied. For residual spraying they are usually applied in the form of (a) solutions, (b) emulsions, or (c) suspensions. DDT is usually applied as 5% solutions, emulsions or suspensions mixed on a weight volume basis to contain 0.5 lbs. of DDT/imperial gallon; i.e., one pound if 50% DDT is used. In the national malaria eradication programme in India a dosage of 100 mgms. of DDT per square foot has been adopted as the standard for residual spraying.

The type of formulation to be used depends on the nature of the surface on which the insecticide is to be applied. DDT solution in kerosene when applied on a smooth surface like glass or metal, dries up and forms crystals. There is loss of toxicity due to removal of crystals either by the physical movements of the insects or other mechanical disturbances. A

5% solution when applied on absorbent surface like wall board, largely disappears below surface and there is a temporary loss of toxicity. But as the solvent evaporates, crystals form and creep out to the surface and produce a bloom or efflorescence. Residual toxicity reappears in this case. The same thing occurs in unpainted wood, card board, paper and such fabrics. If DDT solution is applied on mud plaster or unsized cement, 80 to 90% of the solution disappears below superficial layer 0.1 mm. thick, and does not appear again. For mud walls suspensions are better. In the bamboo, palm and thatched huts of Amazonia, solutions achieved 79% kills, while suspensions gave 93% kill. DDT suspension in water is prepared from commercial 50% or 75% of DDT water—dispersible powders.

Emulsions have more or less the same effects as solutions. Emulsions and suspensions are comparatively cheaper than oily solution. Further disadvantage of oily solution is that oil is likely to be stolen by unscrupulous workers. In high class houses, suspensions are undesirable as they produce unsightly white residues. Oily solutions may however cause stain to certain finishes. Oily solutions should be avoided for lime-washed surfaces to prevent attack by alkali. Application should be delayed till lime wash is at least seven days old.

#### *Spraying Equipments*

*Compression Sprayer:* In this type, the spray liquid is pushed to the nozzle by a body of compressed air. The sprayer is of the cylindrical type fitted with a hand operated air pump together with a discharge line consisting of hose, cut off valve, lance, nozzle and other accessories. The cylinder may be of stainless steel, brass, silicon bronze, or galvanized iron and of seamless or welded construction. The maximum height of the cylinder is 21" and maximum diameter 8". The weight of the empty sprayer should not exceed 15 pounds. The total capacity of the cylinder is 2½ gallons. It is filled with 2 gallons of liquid, and air is pumped into the remaining space by means of a vertical pump. The pump should be able to produce within the tank, when filled with liquid to a liquid charge level mark, a pressure of 50 pounds per square inch on completion of not more than 50 full strokes of the plunger. There should be a constant pressure valve capable

of delivering uniformly a set discharge pressure at the nozzle, irrespective of the fluctuating pressure in the tank. The usual set pressure is 10 pounds per square inch at nozzle tip. There should be a pressure release valve to release pressure from the tank without danger to the operator.

#### *Nozzle*

The nozzle should produce a spray in the form of a flat fan making an angle of 55° to 65° at the tip of the discharge point. This angle shall cover a line of between 47 to 58 cm. when the nozzle tip is held perpendicularly at a distance of 18" from a flat surface. The discharge at the centre should be 4½" thick, 3" at a distance of 7" from centre, and '0' at the end. The discharge should be at a rate of 23-27 fl. oz. per minute at 10 p.s.i.

#### *Hose*

The discharge line is connected to the synthetic rubber hose of inside diameter 5/16" and outside diameter ½". The length of the rubber hose is usually 5 ft. for compression sprayers.

#### *Stirrup Pump*

The simplest hydraulic sprayer is the stirrup pump or the bucket pump. This is a plunger pump which delivers by hose to a rod and nozzle. The pump may be of the same material as prescribed for a compression sprayer tank. The total height of the pump, excluding the stirrup is not less than 28 inches, and the total weight of the sprayer complete with all accessories, excluding the

discharge line, should not exceed 10 pounds. The bore of the barrel should be between ¾" to 1¼".

The discharge line will be the same as for a compression sprayer, the length of the rubber hose being usually 15 ft.

#### *Other types of sprayers*

Various other types of sprayers are also used ranging from the smallest hand sprayer to power operated large units. These are however not suitable for use in any large scale specially in rural areas of countries like India. Stirrup pumps and compression sprayers are the two types which are being largely used in the malaria eradication programme in India.

#### *Supervision*

Preparation of the mixture of the correct proportion and consistency is of primary importance. It should also be applied to the surface at the correct rate and uniformly. As unscrupulous workers are likely to throw away the mixture without applying it properly on the walls and ceilings of all the houses to be sprayed, proper supervision is necessary at all stages and at all levels. Without proper supervision from the beginning to the end, the desired results can never be achieved.

#### *Acknowledgement*

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# INDIAN JOURNAL OF PUBLIC HEALTH

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## TRAINING IN PREVENTIVE MEDICINE AND PUBLIC HEALTH IN INDIA

We have completed two five year plan periods during which Central assistance has enabled 18 Medical Colleges to develop departments of Preventive and Social Medicine. But the number of colleges has increased from 13 in the pre-Independence regime to very nearly 60. There has been commendable progress in the expansion of Medical Education. But the fact that most of the colleges have yet not been able to provide the chair of Preventive and Social Medicine indicates the deplorable dearth of properly learned personnel to fill the Chairs.

Numerous Conferences on Medical Education have been held since 1955 under various auspices but no definite and final decisions have yet been taken as to the curricula and content of studies, syllabus, time taken and facilities for field training when applicable. This, it appears, has occurred as a result of variance in the recommendations of the experts selected by the Medical Council on the one hand and those of the expert bodies and associations on the other. In so far as Preventive and Social Medicine is concerned the task of formulating proposal regarding Curriculum, Syllabus etc. was assigned to members of the Council who, however brilliant and efficient they might be in their own specialities, were not familiar with the teaching of Preventive Medicine and all that it means to-day. More disappointing is the fact that where decisions have been taken, very little attempt, if any, has been made by the Universities to implement them.

We understand that the Medical Council of India is going to hold a Conference very soon to which the various University authorities, Teachers of specialities, the Medical Association and the Public Health Association of India have been invited to thrash out the whole question of Medical Education in the undergraduate level. Furthermore they have decided to deliberate on the issues of the Post-graduate Medical Education in all Specialities and lay down a Standard to be uniformly followed by all Universities conferring such post-graduate degrees.

The Medical Council of India is the sole body statutorily entrusted with the maintenance of the Standard of Medical Education in India and the sooner it lays down the standard in full consultation with the State Universities, and the sooner the latter implement it in practice the better for the country.

## EDITORIAL

The development of departments of Preventive and Social Medicine on sound basis properly equipped and staffed will have an effective impact on attracting Medical Students to take up careers in Public Health. Well-oriented young graduates in the Health Services of the State will undoubtedly improve the quality of work, particularly in view of the Community Development and integrated Health Service in the country. But, for the development of the Department of Preventive and Social Medicine, teachers have to be found. Hitherto the practice has been to send a few people abroad and train them. It is both uneconomical and time consuming when the crying need of the hour is more trained teachers without the least possible delay. It should therefore be our duty to train them in the country against the background of local conditions and problems in Social, Economical and Environmental.

In order to meet the demand for teachers a course was designed at the All-India Institute of Hygiene and Public Health in association with the colleges in Calcutta. But this facility has not been fully utilised. A frantic effort is also being made by some Universities to confer M.D. degree in Preventive and Social Medicine the successful candidate to be appointed as the professor to meet the Medical Council requirements. These haphazard attempts will not meet the country's requirements if teachers soundly and efficiently trained are to be provided to all the Medical Colleges. Facilities for training in the four corners of the country should be provided with full complement of staff and equipment and laboratory. We have more than once suggested that in India there should be 3 additional institutions like the All-India Institute of Hygiene, Calcutta; one each at Delhi, Madras and Bombay, where all zonal post-graduate teaching in Preventive Medicine and Public Health should be imparted on the same basis and pattern of work and efficiency as in Calcutta though fully developed institutional training as well as field practice by pupil participation.

We have at present in India barely one seat per 5 million population whereas the demand for such training overwhelmingly exceeds the number of seats available. The Expert Committee of the W.H.O. indicated that "When the number of students is consistently more than 50 per year and provided other conditions justify it, opening of additional schools should be considered". Mere expansion of the solitary institute available today for P.H. training will not meet the case as the average admission in the institute has exceeded 65 per year. However laudable may be the efforts of the teachers for accommodating such a large number, it cannot be doubted that they have admitted much in excess of the number for which the facilities of the institute have been designed with the invariable result of teaching tending to become non-didactic, and pupil participation in field practice becoming less in evidence. India with her 438 million population therefore needs more than one Institute to produce adequate number of teachers in the field of Health. In building up these institutions it will be highly desirable to keep in view the necessity of making provision for training such persons as would undertake leadership in health, in Administrative Medicine with all its implications and ramifications.

At present there are about 900 trained P.H. workers in Service in the country. The ratio of trained P.H. workers to the population is 1 per 4.6 lakhs.

Bhore Committee's Survey revealed that in 1944 we had 44 P.H. trained Medical practitioners serving undivided India. In the decade 1935-44 the number of whole time Health Officers who were graduates in Medicine and possessed P.H. qualifications increased only by 6, and licentiates by 18. During the last 15 years we have added another 400 to the list of trained P.H. workers in the country. One need not show that this is a figure far too inadequate to meet the growing requirements of health administration and the increase in population. The position will be more difficult with the progressive expansion of the Community Development and extension services scheme where integrated health services will have to be rendered through at least one fully trained Medical Officer with P.H. qualification, for every 60,000 population block. Furthermore, the pattern of staff in the State and Central Health Administration has changed and is changing with the expansion of administrative scope of activities necessitating thereby the appointment of Specialists in fields such as Nursing, Maternity and Child Health, Sanitary Engineering, Nutrition, Epidemiology and Health Education. Looked at from all these angles and aspects, the necessity for training Post-graduate P.H. workers in the Medical as well as Para-medical spheres brooks no delay. The first and the second five year plans mainly emphasised the increase in the number of Medical Colleges and under-graduate medical students particularly in relation to non-clinical subjects such as Anatomy, Physiology and Pharmacology. We expected that the Third Five Year Plan would pay some attention to the problem of training in public health. If it is not too late, we recommend that one or two of the new institutions suggested above, be taken up during the third plan, and the fourth plan may be entrusted to complete the full requirements of the case. We are not aware of the recommendations of the Mudaliar Committee but we trust that they too have considered this question seriously and have made similar recommendations in this respect.

In all instances of new undertakings of this nature we should not lose sight of the present trends in the training in Health Administration and a Cell therefore should be provided for training in Administrative Medicine. Owing to the fact that expansion of health services in newer and newer directions is placing greater and greater responsibilities everyday on individuals with varying backgrounds of experience, both clinical and non-clinical, the need for orientation in administrative medicine has become imperative. In many States in India the service has not been integrated at the top or at the intermediate levels of administration even though integration has been placed at the periphery. It has been often found that owing to seniority in service an Officer is literally pushed to the top straight from a position where he had no opportunities of acquiring the necessary background of administrative experience. With orientation programmes such senior officers can be given the necessary training in administrative medicine in the four institutions suggested. These institutions can fully take up research work not only in various specialities as at present, but research in Public Health practice, in evaluation of health programme and appraisal of Health Centres in the States, and thus render a very useful service to the Planners and Health Organisers of the States.

Elsewhere in this issue is an article by Dr. Jungalwalla in which he very pointedly draws attention to the depressing man-power situation for Public Health

## EDITORIAL

work and to the urgent need for expanding the training programme, orientation of senior officials in administrative medicine by organising at least one institution in the manner of a staff college and developing scientific administrative field units District or Sub-divisional wise for demonstration and teaching. This can be developed in the same way as Staff Colleges for Central administration have been developed at Delhi and Hyderabad. He has also showed the urgency of research in Public Health practice as well as in appraisal of health work *vis-a-vis* the plan and the programmes of various States.

The Central Ministry of Health alone can give effect to the training scheme in the lines; as suggested above. The Honourable Minister of Health has taken up a number of programmes of new studies and investigations—one among many is the Morbidity Survey of India. We sincerely hope that the training in Public Health in all its aspects as outlined above will also receive his earnest consideration.

# REPORTS & REVIEWS

## INDIA'S THIRD PLAN

### *The Objectives*

The proclaimed objectives of the Third Plan are these:—

1. To secure an increase in the national income of more than 5 per cent (and nearer six per cent) a year;
2. To grow all the food we need and more cash crops for industry and export;
3. To produce more steel, chemicals, power and fuel and develop machine-building so that the country can rely on its own resources in the next ten years or so for further industrial progress;
4. To find more jobs for people and make the best use of their labour; and
5. To promote equality of opportunity and reduce disparities of wealth.

### *The Outlay*

In financial terms the programmes formulated to achieve these goals will require a total expenditure of Rs. 11,600 crores. Of this sum Rs. 10,400 crores (Rs. 6,100 crore in the public sector and Rs. 4,300 crore in the private sector) will form investment.

### *The Benefits*

In concrete terms the benefits from the expenditure will be:

Jobs for at least 14 million people and partial employment for some 3 million more;

Protected water, approach roads and other basic amenities for the bulk of the country's villages;

Free education for all children below 11;

At least 17.5 oz. of food grains per person per day (1.5 oz. more than now);

At least 17.2 yards of cloth per person;

More doctors and nurses;

Scholarships amounting to Rs. 37 crore annually;

More than 2,78,000 new houses in urban areas and 1,25,000 new houses in village areas.

All in all the national income will go up by 30 per cent to Rs. 19,000 crore by 1965-66,

and the per capita income by 17 per cent to Rs. 385.

### *Some Programmes*

Irrigation will spread to 20 million more areas, taking the total to 90 million acres;

Power production capacity will go up to 12.7 million kW (one and a quarter times increase);

Advances given to farmers by co-operatives will go upto Rs. 530 crore.

The Community Development movement would have spread to all the villages;

The Railways will be able to haul 245 million tons of goods instead of the present 154 million tons. They will also add 1,840 engines, 11,000 wagons and 7,800 passenger coaches during the five years;

There will be 365,000 commercial motor vehicles on the road (three-quarters' increase);

Seven million backward class students in technical institutions will be receiving scholarships;

The target for production of food grains is 100 million tons per year;

There will be 240,000 hospital beds and 81,000 doctors;

More than 73,000 new primary schools will be opened, taking the total to 415,000 schools;

There will be 20.4 million more students in schools;

The intake at degree level in engineering colleges will have gone up to 19,100 as against the present 13,900;

Some 300 more industrial estates will have been established;

Some 17,000 more post offices will be opened;

Fifty-five more cities will have milk supply schemes.

In the aggregate, the production of the organised industries will be up by 70 per cent. The index will stand at 329 compared to 100 in 1950-51.

### *Technical Training Schemes*

Technical education is very closely associated with the programme of industrial and agricultural development. It is estimated that

the Third Plan will require a total of 151,000 trained engineers and the Fourth Plan as many as 200,000. There will be need also for about 820,000 skilled workers in engineering trades and about 450,000 in non-engineering trades during the Third Plan period. The requirement will be much larger during the Fourth Plan period.

To meet this demand the in-take capacity of engineering colleges will be increased from 13,800, and of polytechnics from 25,750 to 38,500. Part-time and correspondence courses in engineering and technology will be also introduced. The number of training institutions for craftsmen will be increased to 318 by 1965-66 and in-plant training and evening classes will be arranged for employed industrial workers. The intake capacity of agricultural colleges will be increased from 4,600 to 6,000 and of veterinary colleges from 1,300 to 1,565.

For teachers of all categories, and particularly science teachers, more training facilities have been provided. About 59,000 additional personnel will be trained in the Third Plan as block development officers; extension officers in agriculture, animal husbandry, industry, co-operation and *panchayats*; overseers; social education organisers; *Gram Sevaks* and *Gram Sevikas*. In the field of co-operation, the additional requirements of senior, intermediate and junior categories of personnel will be nearly 14,000. Five thousand welfare workers will be needed for voluntary organisations; 3,000 for looking after the programmes for handicapped people, women and children, and 14,000 for the welfare of backward classes. A large number of industrial administrative and managerial personnel as well as statisticians will also be required. Facilities to train them will be provided in existing and new institutions.

#### *Public Health*

The programme for eradication of malaria will be completed and nation-wide control campaigns will be initiated for small-pox and tuberculosis. Special measures will be taken to control cholera.

The number of practising doctors is expected to go up from 70,000 to 81,000 and of nurses from 27,000 to 45,000.

Other important schemes included in the Plan relate to development of indigenous systems of medicine, health education, health

insurance, school health service, maternity and child welfare, and nutrition.

In view of the sharp increase in the rate of population growth, a high priority has been given to family planning programmes in the Third Plan. These programmes provide for education and motivation for family planning, provision of services, training, supplies and research. The number of family planning centres will increase from 1,649 to 8,200 and sterilisation facilities will be provided through medical and health centres.

It is an important object that supplies of good drinking water should become available in most villages by the end of the Plan period. Village water supply will receive special attention. Other rural amenities like linking roads and school buildings will be taken care of through programmes of community development and rural works.

The Third Plan also includes provision for adequate water supply for the rapidly increasing urban population. Some 664 water supply and drainage schemes at an estimated cost of Rs. 112 crore were taken up in the Second Plan. Such of these schemes as have not yet been completed will be completed and some new urban schemes will also be taken up in the next five years.

#### *Scientific Research*

New institutions for research in fields like petroleum technology and for the development and production of scientific instruments will be set up. Problems of utilisation and disposal of industrial and agricultural wastes will be given further attention. Provision will also be made for expanding facilities for basic research in universities and technical institutions.

The Atomic Energy Commission will be expanded and further strengthened.

#### *Flood Control and Irrigation*

The allocation for irrigation and flood control programme during the Third Plan is Rs. 661 crore. This includes Rs. 436 crore for irrigation projects carried over from the Second Plan, Rs. 164 crore for new projects and Rs. 61 crore for flood-control, drainage, anti-water-logging and anti-sea-erosion schemes. New projects to be started during the Third Plan include about 95 new medium irrigation schemes.

*Three plans compared*

		Total Investment (Rs. Crores)		
		I	II	III
Public	...	1,560	3,650	6,100
Private	...	1,800	3,100	4,300
Total:	...	3,360	6,750	10,400

SOVIET 20-YEAR PLAN

The new programme of the Soviet Communist Party, officially announced recently, promised that housing will become rent-free in the Soviet Union in the 1970's. At the same time, public transport in the cities will also become free.

The programme which laid out an economic plan for the next 20 years, said that, at the end of this period, hot water and gas would become free of charge while free food would be available for sections of the population.

The new policies, it said, would be possible because the Soviet economy would achieve an abundance of wealth and material for the whole population during the second half of the 20-year plan. This would enable distribution in accordance with requirements.

During the 20-year period taxes would gradually be abolished and retail prices reduced. Education, medical treatment, and child care would all be free.

Between 1970 and 1980 children will get free school clothing and other school necessities. There will also be free nurseries, kindergarten, and the mass development of free boarding schools, and free hot lunches in all schools.

It also promised that luncheons will be free in factories, collective farms and various other State enterprises. The working week will be reduced to 36 or 34 hours and miners will be given a 30-hours five-day week. Collective farmers will become eligible for pensions. The present overcrowded homes for the aged will be improved by construction of a network of 'old folk' homes for all who want to enter.

GONORRHOEA—A GROWING PROBLEM

The early promise of the immediate postwar period that penicillin was the ideal drug to control gonorrhoea has not been fulfilled.

After fifteen years this venereal infection is still widespread, uncontrolled and one of the challenging health problems of the world.

Bulletin No. 3, Vol. 24, (1961) of the World Health Organization reveals that gonorrhoea not only has held its own, but in some countries has even increased. This failure should be recognized and calls for alertness by health administrations, the Bulletin states.

*"Teenage" Problem*

The disease is occurring more often than formerly in the 15-19 age group and has become a part of the "teenager" problem in Sweden, the United Kingdom and the United States, according to the Bulletin.

Gonorrhoea remains a dangerous disease of women. In spite of the general belief that penicillin treatment has greatly reduced complications, they still occur in ten per cent of cases and two to three per cent of women become sterile. Moreover there are large reservoirs of undiagnosed infection in women, difficult to deal with because symptoms often are lacking.

*Difficult to trace*

The complacency of the public is given as one of the reasons for the present situation. The introduction of the "ideal" drug, penicillin, fostered indifference and carelessness. Consequently many patients are now repeaters. Other important contributory factors are the highly infectious character of the disease and the particularly short incubation period which makes it difficult to trace contacts.

The problem is still more difficult since it is now necessary to use from four to six times as much penicillin to cure gonorrhoea as ten years ago. The possibility that the gonococcus is developing resistance is very real, and careful studies are needed to elucidate this matter. As yet there is no internationally agreed methodology for determining the penicillin sensitivity of the gonococcus and the different methods in use have only recently begun to be studied, under the auspices of WHO.

*Many undetected cases*

In spite of the increase in gonorrhoea in 15 out of 22 countries studied by WHO, it is certain that the disease is even more common than official statistics indicate. A recent survey in Britain suggested that the true incidence might be at least 15% higher if all cases were reported. In the United States,

special surveys have shown that there are probably five to ten times as many cases as are reported officially in that county. Even so, statistics place gonorrhoea third and syphilis the fourth most frequent infection among communicable diseases reported in 1959. Only measles, scarlet fever and streptococcal sore throat were higher.

*New approaches to control*

Recent laboratory research has resulted in the identification of biochemical fractions of the gonococcus which have made it possible to develop improved diagnostic procedures (fluorescent antibody techniques). This research may open the way to the production of an immunizing agent. Unless this happens, some investigators think that effective control of gonorrhoea cannot be achieved, especially in some of the large ports of the world where extensive reservoirs of the gonococcus remain.

DANGER OF FOOD ADDITIVES

A number of natural and synthetic compounds used to preserve foods can be dangerous in the long run when taken in large quantities. They include such ordinary substances as citric and ascorbic acids, that have the added properties of improving flavour and food value of fruit juices.

The task of determining the amount of certain of these compounds that can be consumed daily without harmful effects has been completed by a Joint FAO/WHO Expert Committee on Food Additives, a highly technical study undertaken for the first time on an international basis.

Earlier meetings of this Joint Committee, concerned with more general aspects of the problem had stressed the need for an evaluation of the toxicological risks in the use of food additives. They recommended that a

beginning be made on the biological properties of a number of substances used as antimicrobials and antioxidants—chosen because they are widely used to prevent wastage, especially in tropical countries where heat destroys the keeping qualities of many foods.

This meeting of the Committee prepared a monograph on each of the 35 antimicrobials and antioxidants under review, based on the information available from every possible source. These probably will be published in the WHO Technical Report Series and should prove to be especially useful in the developing countries to help officials and technicians who are framing and applying laws and regulations for the protection of the public.

These monographs are intended for guidance only, however. Throughout the eight days of the discussions, it was constantly stated that each country ultimately would have to find its own solution to the problem of any particular food additive because conditions of life, food habits and dietary patterns vary so greatly.

But about baby foods the Committee believed that they should be prepared without food additives at all, if possible. The mature person is usually equipped with detoxicating mechanisms that are not yet fully developed in a baby, with the result that the risk of poisoning through the indiscriminate use of food preservatives is much greater.

The Committee also noted the serious lack of trained pathologists and toxicologists capable of carrying out the necessary investigations to ensure progress in this field, and recommended that FAO and WHO encourage the establishment of more adequate training facilities.

It also felt that work should continue in evaluating the risks involved in the use of emulsifiers, stabilizers and similar substances added to many foods, and should be extended to include antibiotics, food colours, etc.

THE SUN WILL WORK FOR US

By

N. ZHELEZNOV

“The last ton of coal on our planet was mined!” This sad news, economists assert, may resound throughout the world already in 2061. And as far as petroleum and gas are concerned, the reserves of these fuels

will probably be exhausted even earlier, say at the end of the 20th century.

Such an unhappy picture is depicted by heliotechnicians as soon as the talk touches on the prospects of utilizing new forms of

power, and specifically the energy of solar radiation.

The future generations, and perhaps the generation of the present-day schoolchildren, will wonder how our priceless wealth—the energy of the sun—was uneconomically used. For the sun brings our planet such an amount of heat which would suffice to evaporate the Azov Sea within several minutes. The earth receives in one year considerably more power than is contained in all the world reserves of power resources, excluding of course, the possible resources of thermonuclear energy.

#### *From Solar Kitchen to Solar Electric Station*

The first units compelling solar energy to do useful work (solar kitchens, bathhouses and driers) were made back in the thirties, but at that time work in this direction was considered more like an absorbing experiment: the efficiency of the initial solar transformers working on metal thermo-elements was too low. Thanks to the work of the pupils of the late Academician A. Ioffe in connection with the successes scored by the physics of solids, semi-conductor material have been obtained at the present time—thermocouples which can provide an efficiency coefficient of up to 13 per cent. This means that the utilisation of solar rays can hold a worthy place in the country's power balance already in the near future.

The staff of the heliotechnical laboratory is excited now by the problem of creating within the next two or three years thermo-electric generators which would become the prototype of the power plant of the future. The process of the transformation of energy there will proceed as "cleanly, noiselessly and without any human beings' help" as when solar light turns into energy-rich organic matter in plants.

The second important direction in which a group of enthusiasts of the laboratory is now working is the elaboration of photoelements transforming radiant energy directly into electricity. Crystals with given properties obtained by physicists enabled heliotechnicians to create transformers with an efficiency of as much as 10-11 per cent.

In recent times photo elements too began to be used successfully for the transformation of

solar energy directly into electricity. Scientists proposed that spherical mirrors focusing the rays be used for increasing the "harvest" of energy obtained per unit of the photoelements' area. The photoelements are cooled by water to prevent in such cases the inevitable overheating.

The concentration of solar rays as much as 160-fold led to a 70-fold increase in the output of electricity. Thus another path to the conquest of radiant energy has been discovered.

#### *Solar Houses*

The laboratory is flooded with sunlight. The sweltering July noon made the huge windows facing Lenin Prospect very hot.

"Come back in about two years," the staff members of the laboratory joked. "Then we heliotechnical specialists won't have to feel embarrassed for receiving you in such a hot room. Special surfacing material with the properties of a semi-conductor put on the window panes will transform the warm sun-rays into coolness and bring fans and air moisteners into action."

The hosts of the solar laboratory drew for us a picture of the morrow of solar energy. Numerous solar combines will gather the "harvest" of radiant energy throughout the country, and especially in the countryside of the southern republics. In the next several years they will be able to release 50-60 per cent of the fuel in small-scale power consumption in our southern areas, where 50 million people live. These accumulators of solar energy will help set up and expand oases in deserts, improve the conditions for the growth of farm crops (heating the ground at times of frosts, watering the fields with warm water, creating the best conditions for raising such crops like *chlorella*).

The heliotechnicians enthusiastically talk about the "solar house" project, the prototype of the future residence. The roof of such a house will have additional functions to its main job now: it will serve as a sort of reception device of an electric station, which will provide an abundance of energy even for a multistorey house.

## MYCERIN, A NEW ANTIBIOTIC

G. KUDRYAVTSEVA

Today everyone seems to know the story of the remarkable mould from which penicillin, a miracle drug, was obtained. The discovery of penicillin brought about a veritable revolution in medicine. It ushered in a new era—the era of antibiotics, or chemicals secreted by microorganisms and capable of inhibiting and even killing bacteria and other microbes.

Penicillin was followed by gramicidin, streptomycin, biomyacin, and levomycetin. They were thought to protect man's health for ever.

Sometimes, however, they failed. As was found, the microbes went "dodging," as it were. Microbes began developing drug-resistant strains.

This spurred the search for newer antibiotics. The Department of Infectious Pathology and Experimental Therapy had to try hundreds of packages and test-tubes with soil coming from all possible places.

At last in testing a handful of soil brought from some remote place in the Krasnodar Territory, physician Yulia Solovyeva isolated a peculiar microscopic fungus. She placed it into a Petri dish filled with agar-agar. The fungus felt comfortable, and within a short time the whole of the jelly in the dish was covered by a pinkish mould. The mould was secreting antibiotic chemicals, and a wide space free of test organisms was formed around the microbe.

"I think we've found what we are looking for," Solovyeva told Professor Planelies, Corresponding member of the USSR Academy of Medical Sciences and her chief. "I think this is the thing."

Solovyeva was excited. The years of painstaking work seemed to have brought in the desired result.

"What shall we call it?" the Professor asked her.

"Oh, we are still too far from it," replied the investigator.

Planelies examined the results of the tests and investigations again and again. No, his experience did not fail him: the new antibiotic could be isolated.

"Don't say that!" he joked. "The parents ought to think of their child's name well before it is born. So what name will you suggest for the offspring of this reddish fungus?"

The would-be antibiotic was christened 'mycerin'—the abbreviation of 'myceto' for 'fungus' and 'erin' for 'pinkish.'

The new antibiotic was isolated chemically, purified and tested for its bacterial activity—its response to other bacteria. It proved to be very efficient over a wide range of bacteria. What was particularly important was that it could kill bacteria resistant to penicillin and streptomycin. All this was learned by chemist Zoya Belova.

That was a victory. The strenuous effort had culminated in a success. Now the turn had come of detailed studies into the properties and potentialities of the new antibiotic. It was injected into mice, rabbits and monkeys. The results cleared the way for clinical tests of the antibiotic.

Mycerin was tested on adults suffering from acute paraproctitis, chronic osteomyelitis, phlegmon, large suppurative wounds, burns, necrotic and trophic phenomena.

What was particularly promising was that the antibiotic was active in cases of pneumonia and gastro-intestinal diseases in children.

*For Commercial Production*

The next task was to make the antibiotic suitable for commercial production. It was a long-established fact that antibiotics often lost their bactericidal properties when produced in quantity.

"To tell the truth we were loath to let go mycerin" says Planelies. "This was why a scaled-down plant was set up right on the Institute's premises."

The midget pilot plant was arranged in a small room. It consisted of two fermentators—or tanks holding a few pails each—to grow the fungus in a culture medium, small centrifuges to separate the mycerin mould from the culture medium and the antibiotic from the mould. The chemical was then concentrated in a special contraption and treated by the chromatography method to obtain a chemically pure product.

"At that stage we found we had been wrong in calling our 'child' mycerin—the powder was white or yellowish, but not pinkish."

The pilot plant proved very helpful. Today this antibiotic is being produced on a large-scale by the No. 2 Moscow Pharmaceutical Factory.

## NOTES & NEWS

### HIGHEST BIRTH AND DEATH RATES

Africa's birth and death rates are probably the highest in the world according to U.N. population experts.

The experts, reporting their findings in the U.N. demographic year book said, the African birth rate was 47 per 1,000 and the death rate 28. Africa was not increasing its population as rapidly as South America or Oceania but was ahead of North America, Asia, Europe and the Soviet Union.

The lowest birth rates in the world were in Europe where the average number per 1,000 inhabitants was 19. For the world as a whole the average birth rate was 36 per 1,000 and the death rate 19.

The Soviet Union recorded the lowest death rate-eight-followed by Oceania-nine. North America-nine and Europe-10.

### *Life Expectancy*

A newborn baby in Norway had the longest life expectancy of any in the world.

Norwegian male babies could expect to live an average of 71 years while female babies had a probable life span of 75 years. Males born in the Netherlands and Sweden also had an expected span of 71 years. In England and Wales, female babies could expect to live up to 74.

The shortest expected life-time for a modern baby was in Guinea where a 1955 survey showed a probable expectancy of 30.5 years for either sex; and India—32.45 for males and 31.6 for females.

### *Infant Mortality*

Northern Rhodesia's native population has one of the four highest infant mortality rates in the world, but its European inhabitants have one of the lowest.

More than 200 of every 1,000 non-white babies born in the British administered protectorate die before their first birthday in a death rate equalled only in Uganda, Guinea and Sikkim.

The infant mortality rate among Northern Rhodesia's European population is 16.9 per 1,000.

### RS. 29 CRORE FOR SLUM CLEARANCE IN THIRD PLAN

The growth of population as revealed in the 1961 Census—in particular, that of the urban population—has underlined the need for measures for slum clearance and slum improvement. This problem has for some time been receiving high priority from the Central and State Governments. During the Second Plan, a sum of slightly more than Rs. 10 crore is expected to have been spent on slum clearance schemes. As against this, the Third Plan provides for a programme of about Rs. 29 crore.

By the end of the Second Plan, 208 projects costing about Rs. 19 crore and involving the provision of houses to 58,200 families living in slum conditions had been taken up in different towns and cities. About 18,000 units have already been completed and leased out at subsidised rents. For those families who cannot afford to pay even these low rents, the scheme provides for skeletal housing and open developed plots with a separate washing platform and latrine for each family. It is left to the slum dwellers to build huts of a prescribed pattern on a self-help basis, under the technical guidance of State Governments.

Various difficulties have arisen in implementing the programme, such as the long and tedious procedures of acquiring slum areas, the non-availability and high cost of alternative sites, inability of the slum dwellers to pay even the subsidised rent and their innate reluctance to move from areas selected for clearance. Certain States like Mysore, Madras, Madhya-Pradesh, Assam, Punjab, West Bengal and Delhi Administration have enacted legislation for speedier acquisition of slum areas and for reducing the rate of compensation. Other States are likely to do the same.

### *Short-term Relief*

The opinion of experts familiar with the problem is that while a long-term plan has to be pursued, it is even more essential to think of short-term measures such as the provision of sanitary latrines, proper drainage, uncontaminated water supply, moderately good

approach roads, paved streets and proper lighting. Larger resources were therefore provided for dealing with slum problems in six major cities of Calcutta, Bombay, Madras, Delhi, Kanpur and Ahmedabad. The total subsidy for slum clearance was raised in these cities from 30 per cent to 62½ per cent and the Central Government's share from 25 per cent to 37½ per cent.

During the Third Plan the scheme will apply to all towns having a population of a lakh or more, with priority being given to the six big cities mentioned above. Greater emphasis is to be placed on the provision of basic amenities in slum areas which are not likely to be demolished in the early future. State Governments will arrange for survey of slum areas classifying them into areas which may have to be acquired and redeveloped completely and those which can be made habitable through improvement of environmental conditions. Where improvements are carried out by local bodies, it may be necessary to give them grants for providing essential services.

Voluntary organisations and social workers can play an important role in implementing the slum improvement programme.

While the work of slum clearance proceeds apace, it is equally important to ensure that new slums are not allowed to grow up. For this, besides preparing and implementing master plans for all growing towns and cities, it will be essential strictly to enforce municipal bye-laws and building regulations and at the same time expand housing facilities for low-income groups and the economically weaker sections of the community. As a transitional measure, the provision of night shelters and dormitory accommodation for pavement dwellers and non-family workers assumes considerable urgency. Special attention has also to be given to the housing of sweepers and scavengers, a neglected sector of the weak and under-privileged class.

(YOJANA)

### FOOD FROM TIDAL LANDS

It is the general impression that tidal lands would not be adaptable for agriculture. But experience elsewhere as well as in our own country shows that tidal, marshy lands can be reclaimed by simple treatments at small cost.

A belt of tidal lands runs almost all along the coastline in India. This includes the river

deltas and the several back-waters biting into the coastline. By far the largest land stretch that comes under this category is the *Sundarbans* in West Bengal, and the estuaries of the Cutch peninsula come next. Hitherto these had hardly been considered fit for any use. It is noteworthy that in certain parts of the country, entrepreneurs have launched agricultural practices in this type of land with varying success. But no concerted effort appears to have been made, nor a rational approach to the problem has been attempted to salvage them for gainful use.

By far the major portion of tidal lands lies at the sea level or down to 3 metres (10 feet) below it. Close to the sea or connected with it, they are subject to saline action.

For proper utilisation of such marshy lands, the main requisite is formation of bunds isolating a convenient number of blocks of sizes varying from 40.4 hectares (100 acres) to 809 hectares (2,000 acres) with water courses in between. Earthen bunds can safely resist the water pressure which varies with the tide levels around the bunds.

After isolating the blocks, the water inside the bunds is pumped out into the intervening canals and the entire area drained for agricultural operations.

The reclaimed soil should be analysed and suitable manure should be applied for making up the deficiency of soil nutrients. Such a technique has been adopted in the San Francisco bay in the United States by reclaiming nearly 121,406 hectares (300,000 acres) and on the Kerala coast nearly 40,470 hectares (1 lakh acres) of tidal lands.

The question will naturally arise how in a tidal area fresh water can be supplied for successful cropping. Normally, cultivation in this part can be done throughout the year if fresh water is available.

However, it is only during the monsoon, say between June and September, that there will be assured fresh water supply from rainfall. It is, therefore, possible to take a monsoon crop without much difficulty. If reservoirs can be constructed for water supply during the non-monsoon months, such storage can be utilised for another crop in the post-monsoon period.

An advantage which this proposal presents is the complete elimination of canal and canal structures for leading water from the storage to the fields, the field level being all below the sea level. The intervening canal space between blocks would remain filled up with

fresh water during monsoon periods. Irrigation requirements will be met by drawing water from the canals through pipe holes across the bunds.

Even if major storages in the high reaches of a river are not possible, there is still scope for maintaining fresh water from rains that collect in half of the blocks in the tidal area by bunds and using the same for the remaining half of the blocks parcelled out from the tidal lands. This, therefore, enables quick results being achieved without large scale investment on major engineering structures.

On a modest estimate it appears possible to develop tidal lands to the extent of nearly 8 lakh hectares (2 million acres) in India. Reckoning on a crop yield of half a ton per acre per crop annually, reclaimed lands can be expected to yield 1,016,050 metric tonnes (1 million tons) of foodgrains. The main engineering work involved being earth bund formations, it gives scope for a large number of local, unskilled labour to be employed. It also lends itself to comparatively quick results in raising food crop. On an average an investment of about Rs. 750 per hectare (Rs. 300 per acre) will be enough for completing the project, and the total capital investment will be Rs. 60 crores over a period of five years. Most of this investment should be in the form of loans to the cultivators themselves for making bunds and other preliminary works, reimbursable in 15 years.

#### ELECTRICITY FROM TIDAL POWER

The ocean wastes 36,000 million kilowatt-hours every day in the tides. This lost energy corresponds approximately to all the power used by the earth's population in twenty-four hours—electrical, mechanical or animal power. Harnessing the sea is, therefore, a very tempting prospect.

The dreams of the pioneers of tidal power have become reality, says a UNESCO news report, after twenty years of research and experimentation. The Ranco 'tidal trap', capable of forcing the sea to lend a few crumbs of its colossal power, will supply an average of 544 million kilowatt-hours per year. The decisive element in this victory of science has been a strange, pot-bellied machine weighing eighty-nine tons, with a four-bladed propeller at one end. It resembles a huge airplane engine.

The construction of the world's first tide-driven electric power plant, begun at the end of last year, will be completed in the spring

of 1966 at the mouth of the Ranco River, near St. Malo, in France. It will take six years to close the estuary of this river in Brittany with a dike 2,600 feet (800 meters) long. Then twenty-four turbo-generator sets will go into service. Each of these sets, composed of a generator driven by a turbine in the form of a ship's propeller, will be housed in a sub-merged water-tight shell. Driven by water flowing at a rate of 635,000 cubic feet per second, this "battery" of turbo-generators will feed 240,000 kilowatts of current into the French power grid, both for industry and domestic purposes. (The kilowatt is a unit of electric power corresponding to 1.36 horsepower. As an example, a light bulb can consume 100 watts, or one-tenth of a kilowatt).

If all goes according to plan, even more daring undertakings will become possible. For example, the huge neighbouring bay of Mont St. Michol could be closed off. Then the sea would provide from ten to fifteen kilowatts per second that is, fifty to sixty times more than the Ranco tidal power plant.

Astronomists, however, warn us that there may be a few pitfalls on the road to electricity from the sea. Tides are of astronomic origin because they are the result of the influence of the sun and the moon upon our planet. That tidal energy which is going to transform into electricity must be taken from somewhere. It is taken from the kinetic energy of the earth's rotation. The more tidal power plants are built, the more the earth's rotation speed will be slowed up.

This 'breaking' will not be very serious. If we harness the equivalent of 1,000 million kilowatts of power, we will end up by losing about ten hours over 2,000 years. We have lost just about this much since the birth of Christ without generating electricity during that time. The energy was simply frittered away in the breakers.

#### AN ARID EARTH—IN 1,000m YEARS

Water from the earth is being drawn ceaselessly towards the cosmos without the slightest hope of returning and 1,000 million years from now the globe risks becoming a desert. This discovery was revealed by the American astronomer, Dr. John Brandt, in a report published by the California Institute of Technology at Pasadena.

Dr. Brandt reached this conclusion following the discovery by U.S. Navy rocket probes of a gigantic hydrogen cloud floating in space

1,300,000 kilometres in diameter and trailing a tail 6,000,000 kilometres long.

The astronomer said the cloud was formed in the following manner: water which escapes from the earth due to evaporation arrives at an altitude of 80 kilometres from the earth. At this point the vapour is so fine and unstable that the sun's rays provoke a sort of natural electrolysis.

### TAMING HYDROGEN POWER

A Swedish research team has reported sensational progress in the work to tame hydrogen power for peaceful purposes.

A team spokesman said they had managed to keep ionized hydrogen gas under control in a specially constructed "magnet bottle" for 7000th part of a second. That period of time was said to be very close to what was needed for a working hydrogen power reactor.

The report was termed a "scientific world sensation" by Swedish papers.

The team is headed by Dr. Sten Lenhmert, a 35-year-old professor of electro-dynamics at the Royal Institute of Technology in Stockholm.

### FRESH WATER FROM THE SEA

An atomic power station operating a machine to extract the salt from sea water could provide water for developing millions of semi-desert acres in Australia within the next twenty years. This project is regarded now as a feasible possibility.

A few years ago it would have been thought of as flighty and imaginary, but modern research and economic studies have brought it to the stage where it can be realized in practice with no more than the application of known techniques.

Fresh water could be produced from the sea by this method within the framework of the present economic structure at a cost of 7/- to 8/- (Australian) for every thousand gallons. There exists a hope that within the next decade new discoveries will lower the cost.

The Officer-in-Charge of the Chemical Engineering Section (Dr. H. R. C. Pratt) recently told the Society of Chemical Industry of Victoria that South Australia will utilize all available natural water supplies in the next ten to fifteen years so that an atomic treatment plant for sea water will be essential for further development. Such an installation

would cost £50-90 million today, depending upon the size, but it could supply the whole of the city of Adelaide with fresh water and with 30 to 40 per cent of its power as well as producing large quantities of commercial salt.

It would also assure a steady supply of fresh water free from the weather variations which govern the natural supply.

(*Food Science*).

### CONSTRUCTION OF HOSPITALS

To render prompt and effective medical service, the Employees State Insurance Corporation has ordered the construction of a number of hospitals, annexes to existing hospitals and dispensaries, according to the annual report of the corporation for 1960-61. But serious difficulties are being encountered in selecting sites in big cities, in procuring the necessary raw materials such as steel and cement and the purchase of specialized equipments.

Consequently, the opening of the Mahatma Gandhi Memorial Hospital in Parel, Bombay, likely to be the largest Employees State Insurance hospital in the country, has been delayed.

For want of sufficient medical facilities the implementation of the scheme in greater Calcutta with an insurance population of 325,000 is still undecided.

### SOLAR POWER PLANT

A sun-powered electrical plant has been developed at Pittsburgh which could bring light, power and trouble-free irrigation to millions in under-developed countries.

Dr. S. V. Herwald, Vice-President of Westinghouse Electric Corporation's research division, said that the thermo-electric generator could become as commonplace in these countries as the windmills which once dotted the American and European landscape.

The new solar power plant uses an eight-foot saucer-shaped mirror which gathers sunlight and focuses it on a thermo-electric generator—a small metal "box" about eight inches square and two inches thick.

The generated power drives an electric motor with a water pump directly connected to it. These are the only moving parts in the whole irrigation system.

Dr. Herwald said that a 50-watt prototype of the system had already been built and

tested. A full-scale unit will have the capacity of producing up to 200 watts, pumping enough water from a depth of 20 feet to irrigate about four acres of land or it could supply the personal needs of 1,200 people, giving them five gallons of water each a day.

#### POISONOUS CONTENT IN COLOURED TURMERIC

The Rajasthan Government has warned the people against the purchase of coloured turmeric or turmeric powder, one of the most extensively used spices in the country, following the discovery of poisonous content in the colouring matter.

In a handout, the Government said that in turmeric and turmeric powder the content of lead chromate used for colouring yellow varied from 1,000 to 1,500 parts per million.

"Lead chromate", the handout added, "is a highly poisonous substance and its accumulation in the system leads to stomach upsets, changes in blood, weakness and damage to the nervous system and can also be fatal."

#### RESEARCH IN RADIATION MEDICINE

The Union Government would shortly set up in Delhi an institute for research in radiation medicine in the country.

The initial cost of establishing the institute would be about Rs. 9 lakhs. At the initial stage it would consist of laboratories for research and for treatment and diagnosis of patients by radioactive isotope techniques.

#### MASS X-RAY OF CALCUTTA STUDENTS

A new scheme for simultaneous mass miniature X-ray and health examination of college students started recently in the premises of the University Science College, Calcutta. Arrangements have been made to bring students from colleges to the Science College for examination.

There are about 75,000 men and 10,000 women students in colleges in and around Calcutta. The newly admitted students in colleges number about 30,000 men and 5,000 women. With the existing staff at its disposal, the University's Board of Health is expected to examine 12,000 students a year.

Examination will be conducted from 1 p.m. to 4 p.m. Buses with 30 or 40 students will run every 40 minutes from 12-30 p.m. from colleges to the examination centre.

DR. S. C. SEAL

Dr. S. C. Seal, M.B.B.S., D.P.H., Ph.D., F.N.I., F.A.P.H.A. (Hon.); late Professor of Epidemiology, All India Institute of Hygiene and Public Health, Calcutta and the Managing Editor of this Journal has been appointed as Deputy Director General of Health Services, New Delhi, in addition to his duties as the Officer on Special Duty (Morbidity Survey) since July 1961.

## ABSTRACTS

INDUSTRIAL METHEMOGLOBINEMIA  
BY H. C. HALSTED, J. Occup. Med. Chicago.  
1960, Dec., V. 2, No. 12, 591-6.

This review of chemical cyanosis from aromatic nitro and amino compounds includes recognition and control; Methaemoglobin (MHb), being oxidized haemoglobin, holds O<sub>2</sub> tightly bound, not available for tissue use. Reduction to haemoglobin (Hb) is slow. A co-existing decrease in dissociation of unaffected residual oxygenated haemoglobin increases tissue hypoxia. Hb complexes, MHb precursors, may be unidentified by conventional spectrophotometric analysis though this is satisfactory for guidance in medical control of methaemoglobinaemia.

It is usually an onlooker who first notices the characteristic blue lips: hence the advice that when leaving, workers should attend for inspection of skin and nails. If no cyanosis has developed during bathing and changing, it is unlikely that serious intoxication will develop later.

Mild intoxication, MHb 15-25% is often undetected or belittled by the subject, who may exhibit euphoria. Bed-rest and hourly blood sampling is advocated until MHb begins to decrease. Meanwhile, the history should elicit whether safety and hygiene rules had been followed—or whether accidental exposure had affected others; the skin, ears, nostrils and nails are cleansed and clothing, caps and shoes are changed again. The patient may return to work where there is no exposure, until the blood becomes normal. He should abstain from alcohol. Why it reawakens symptoms is obscure: possibly because it stimulates the oxidation mechanism, or affects reduction or liberates stored toxic compounds.

Moderate intoxication, MHb 25-50%, causes headache, vertigo, weakness, rapid pulse, marked cyanosis but rarely dyspnoea at rest. Oxygen relieves headache: It does not speed conversion of MHb but may saturate remaining Hb. Intravenous dextrose seems to hasten the normal reversible process: ascorbic acid does not and is not ideal for acute industrial methaemoglobinaemia as opposed to the familial idiopathic variety. When MHb

reaches its peak it falls to normal in 24-48 hours.

Severe intoxication, MHb 50%, causes apprehension and dyspnoea. At 60-70% lethargy, convulsions and coma may develop. This medical emergency is treated by slow intravenous injection of 1% methylene blue in low dosage, 1-2 mgm. per kgm. This substance can itself form Mhb, but *in vivo* substance can itself form MHb, but *in vivo* accelerating reduction. Large doses cause untoward effects. (Bulletin of Hygiene.)

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### LEAD POISONING FROM HOME-MADE WINE

BY P. T. WHITEHEAD & A. P. PRIOR,  
*Lancet*, 1960, Dec. 17, 1343-4

This is a fascinating account of a case of severe lead poisoning now a rare condition although occasional cases occur from the ingestion of lead from "bizarre sources" which have included lead nipple shields, batteries burned on domestic fires and even the lead in the print of newspaper used as toilet paper.

The patient, a village butcher aged 52, was admitted to hospital in November 1958 for epigastric pain of 3 weeks' duration. A tentative diagnosis of lead poisoning was made on the evidence of the blood picture and a daily urinary excretion of lead of 0.31 to 0.4 magm. Discharged over Christmas, he was re-admitted in early January for an epileptic fit. A certain diagnosis of lead poisoning was then possible on the results of investigation by electroencephalogram, the blood picture and urinary excretion of coproporphyrins and up to 1.0 mgm. of lead in 24 hours. Treatment with calcium disodium versenate resulted in the urinary excretion of as much as 17 mgm. of lead on one day and he recovered completely.

During his first stay in hospital the patient was questioned about his work, hobbies and diet. He admitted that he was "an enthusiastic maker and drinker of home-made wine" and had been so for 20 years. Investigations of his diet, the well-water of his home and the beer at his "pub" were all negative. His wine-

making equipment was inspected but appeared to be in order.

After the second stay in hospital the search for the source of lead was found to contain 7.5 mgm. of lead per litre. In its manufacture the ripe fruit was first soaked and at a later stage allowed to ferment in an earthenware vessel known as a "jowl". This jowl, inherited from an aunt in 1958, was found to be over 100 years old and a relic of the age when such containers were glazed with soft lead glazes. Tested with a 1% solution of acid, the jowl yielded 1000 mgm. of lead per litre.

The patient had been consuming about 2 pints of the wine a week.

There is a short but interesting discussion and the warning that in the production of home-made wines antique earthenware vessels should be avoided.

—(*Bulletin of Hygiene.*)

#### PULMONARY TUBERCULOSIS— THE LAST STAGES?

J. Royal Soc. Health, 1960, November-December, V. 80, No. 6, 487-506.

This symposium was opened by V. H. Springett (Birmingham) whose paper was entitled *Clinical and Statistical Aspects* (pp. 487-490).

The recent rapid decline in mortality rate from tuberculosis in England and Wales has been due to chemotherapy but it should not be forgotten that there had been a substantial decline in the previous 100 years. Rates of decline have been greatest in early age and least in the elderly, especially males. In order to be effective, chemotherapy must include an adequate combination of drugs and continue for at least 18 months if the sputum has been positive. Sputum conversion can be achieved in less than a year in every case where the patient is co-operative and the organisms are sensitive to at least 2 of the 3 main anti-tuberculous drugs. The right place for the sputum-positive patient is hospital until tubercle bacilli disappear from the sputum.

Many of the patients treated at home do not take their drugs regularly. The best home treatment is daily streptomycin with 200-300 mgm. of isoniazid given by the nurse at the time of injection.

If all methods of tuberculosis prevention and control are used, if facilities for diagnosis and treatment are available, if the fall in incidence of the disease in young people continues, Springett believes that with the death of the present generation of persons aged 45 and over (in a proportion of whom the disease will inevitably appear) the end of tuberculosis in the community will be in sight.

A. B. Semple (Liverpool) dealt with the role of the local health authority (pp. 491-494). With the advent of specific chemotherapy the chain of infection began to be broken; Hospital beds are now plentiful and owing to this it has been possible to apply powers of compulsory removal and detention to recalcitrant patients with much benefits to themselves and their families.

The importance of the work of the health visitor in preventing the spread of infection and her value in getting contacts to attend the clinic were emphasised.

The Liverpool mass radiography campaign of 1959 took in 472,667 persons (76.5% of the available population over the age of 15 years). The discovery rates of active tuberculosis and lung cancer were 2.3 and 0.35 per 1,000 respectively. In the 45-49 age-group the tuberculosis rates were 4.52 in males and 1.38 in females and in the group over 60 years 5.55 and 0.88 respectively, for persons needing treatment.

The routine BCG vaccination of school children aged 13-14 years is in full swing with an acceptance rate of 70-80%. Vaccination of the newborn is also done—but not routinely except in tuberculous families.

T. M. Pollock (London) dealt with BCG vaccination (pp. 494-498). Much of his paper was concerned with the result of the vaccination trial of the Medical Research Council which showed that in the first 5 years after entry the incidence of tuberculosis in the vaccinated group was one-sixth of that in the negative unvaccinated group.

The finding of a high incidence in original reactors with hypersensitivity (induration of 15 mm. or more to 3 TU) indicates that such children should be given X-ray examinations regularly after leaving school.

The incidence in natural reactors with low sensitivity was lower than in unvaccinated non-reactors, which suggests that a low degree of tuberculin sensitivity is associated with some protection against tuberculosis. The presence of a large group of natural reactors in a community will detract from the value

of BCG vaccination in the community and is an indication for vaccination at an earlier age when fewer children are as yet infected.

E. V. Kuenssberg (Edinburgh) spoke of the family doctor and tuberculosis (pp. 498-503). In 1951 there were 122 patients with tuberculosis in his (group) practice, and in 1959 there were 19 (7.64 and 1.01 per 1,000 patients respectively). No patient died from tuberculosis in 1959. The general medical practitioner still has an important duty in supervising patients under treatment or removed from the tuberculosis register and in persuading members of their families to be examined or to accept BCG vaccination. Kuenssberg has examples of failure in communication between chest physician and family doctor and stressed the need for full information about changing methods of procedure so that family doctors could co-operate fully and efficiently.

In the ensuing discussion speakers from the United States, Argentina and England took part. Some of the matters raised are reflected in the replies. Springett agreed that the time had come to use compulsory powers. He recommended chemoprophylaxis for recent tuberculin converters but not routinely for schoolchildren with strong tuberculin sensitivity.

Sample also thought that medical officers of health should look at the powers for compulsory removal seriously in order to get all dangerous infectors under control. There should be an aggressive search for tuberculosis in the community.

Pollock did not feel that the current BCG vaccination programme impedes tuberculosis control by any other method. Case finding through the tuberculin testing of children could be put into operation at any time below the age of 13 years.

(Bulletin of Hygiene).

#### PREVENTION AND ITS HISTORICAL DEVELOPMENTS

BY PROF. ADALBERTO PAZZINI, Director of the Institute for History of Medicine, Rome University, *Archivio di Medicina Mutualistica*, xx, 1960.

Considering as preventive medicine all means capable of preventing diseases, particularly infectious illnesses, or to stem them when they have developed (prevention for

those not yet hit) or to immunize the individuals against an eventual infection, the author starts from the mythical legends, arriving through the various centuries up to the present day.

Particularly the so-called "pestilences" of the past and the means used to fight them, offer the best field of observation, as also the prophylactic measures against endemic diseases (f.i. leprosy) and prevention against poisons, like Mithridate's antidote and theriac.

The development of sanitary legislation with its departments and officials, the concept of contagious disease and its first interpretation with the subsequent rise of the microbiological principle, its further investigation and improvement followed by the vaccination, the various "advices" against the pestilences, the prophylaxis against puerperal fever and the first trials of immunization followed by L. Pasteur's really efficient ones, A. Bassi's first hygienic principles, constitute the chapters of this history, which culminates in our days, with the various legislations for the prevention of disease (tuberculosis, venereal disease, pellagra, tumours, a.s.o.) and with measures applied according to the latest acquisition of modern science.

#### PREVENTION IN ITS MEDICO-LEGAL ASPECTS

BY PROF. RINALDO PELLEGRINI, Emeritus Professor of Legal and Insurance Medicine, Padua University, *Archivio di Medicina Mutualistica*, xx, 1960.

The author describes the characteristics of previsibility, prevision, providence, and prevention. Regarding the last he considers the biological prevention, studying separately the medico-legal prevention and the legal medicine of prevention. He explains the aims of the latter, the problems concerned, the reasons, also of a historical nature, for the great importance it acquired in modern social life. He describes and comments the legal rules which concern it directly or indirectly and of which there are numerous indications in the Italian Constitution; in the public right (including the prevention as crime); in private right; in the law of public safety; in the unified test of sanitary laws concerning also sports and schools; in the law about lunatic asylums; in the prison regulations; in the laws about the protection of female and adolescent labour

and the prevention of accidents and occupational diseases; in the traffic regulations; in the foreign legislations particularly concerning the relations between accident prevention and investigation of drunkenness. He then explains the various methods of prevention and its medico-legal aspects according to whether it is active or passive, generic or specific, pharmaceutical, surgical, climatic, prothetic, physical, psychical, necessary or superfluous; direct or subordinated simple or complex. The author points out that from the deontological and sometimes from the penalistic point of view, the omission of prevention can assume the significance of imprudence when notwithstanding the knowledge of the damage which can be caused, the necessary action is not taken; of negligence, when under the same circumstances, after having recognized the necessity of its use one does not give the necessary instructions or obey the orders received or one omits the necessary investigations; of lack of skill when an ignorance of the technical and medico-legal elements, which permit an efficient application of prevention, of the duration of the relative measures and the time when they must be applied can be proven, of inobservance of laws and regulations when the rules regarding prevention are not applied.

He then examines the friction zones which emerge in relation to prevention measures and the concept of "prevalent interest" introduced recently into the law, was also the interferences between preventive and curative treatment.

The author examines also the circumstances which justify, from the medico-legal point of view, the omission of prevention. He underlines the fact that every medical speciality and superspecialty has its own methods of prevention, which ought to be treated in separate monographs, under consideration of the casuistic.

#### PRESENT ASPECTS OF THE PREVENTION OF DISEASES

BY PROF. GENNARO DI MACCO, Director of the Institute for General Pathology, Rome University, *Archivio di Medicina Mutualistica*, xx, 1960.

The prevention and therapy of the pathological phenomena should be considered complementary aspects of medicine. The deep

significance of preventive medicine, had been accepted by Greek philosophy, in the myth of Hygea, an integration of the myth of Aesculapius, deified as a healer. As prevention has the objective of preserving health (normal morpho-functional balance, with efficient reaction to the noxae), and well-being (optimal health condition integrated by ceneesthesia) the limits of preventive medicine are very wide, like those of medical knowledge. On the other hand, as only phenomena which can be foreseen, can be prevented, it is evident that the scientific basis of every preventive activity is the etio-pathogenesis. The etiologial prevention (of the causes) and the pathogenetic prevention (of predisposition in connection with organismic reactivity) can be carried out with various means: periodical examinations, institution of sanitary book, early diagnosis, medical education of the physician and the public, a.s.o.; the auxological, gynecological, gerontological and professional prevention need further development; the eugenic prevention and that of cardio-vascular diseases, cancer, diabetes and mental diseases has to be organized. A coordination of the activity of the government medical, cultural and assistance institutions, which have various tasks, converging for preventive purposes, would be advisable. The present increase of organismic characters and therefore of pathological predisposition, causes new and complex problems of individual and social preventive medicine, for the responsible institutions.

#### INFLUENCE OF SEGREGATION OF TUBERCULOUS PATIENTS FOR ONE YEAR ON THE ATTACK RATE OF TUBERCULOSIS IN A 2-YEAR PERIOD IN CLOSE FAMILY CONTACTS IN SOUTH INDIA

BY C. V. RAMAKRISHNAN, R. H. ANDREWS, S. DEVADATTA, WALLACE FOX, S. RADHAKRISHNA, P. R. SOMASUNDARAM & S. VELU—*Bull. Wld. Hlth. Org.*, 1961, 24, 129-148.

1. A total of 191 South Indian patients with pulmonary tuberculosis (in a comparison of a year of home and sanatorium chemotherapy) had 693 close family contacts, that is, relatives living, cooking and feeding with them for at least the three months immediately prior to diagnosis.

2. The families were drawn from the lower income groups in Madras city and their living conditions and dietary standards were poor.

3. The contacts were studied to determine the attack rate of tuberculosis during the first two years of a 5-year follow-up.

4. The main comparison was between 256 contacts of 75 patients treated at home and 274 contacts of 73 patients treated in sanatorium, in the families where the only infectious member was the index case. (The index cases had been allocated at random to treatment at home or in sanatorium, all with combined chemotherapy, for a year. In the second year all were treated at home, the patients with active disease at 12 months and half of those with quiescent disease receiving further chemotherapy.)

5. The two contact groups were similar at the start of treatment for the index cases and were followed with equal intensity by radiography, tuberculin testing and bacteriology, both in the first year and in the second year. The coverage by radiographic examination at 3, 6, 9, 12, 18, and 24 months in the two groups combined was 91%, 87%, 88%, 94%, 88%, and 94%, respectively.

6. There were 20 deaths, 13 in the home and seven in the sanatorium contacts. One of the home and two of the sanatorium contacts died of tuberculosis.

7. During the first year active tuberculosis developed in 27 contacts—namely, nine (3.5%) home contacts (six initially tuberculin-negative) and 18 (6.6%) sanatorium contacts (six initially tuberculin-negative). There were no cases among the initially tuberculin-negative contacts in either group in the second year, but there were three (1.9%) in the initially tuberculin-positive home contacts and four (2.4%) in the corresponding group of sanatorium contacts.

8. Of the 34 cases which developed in the 2-year period, 17 were under the age of five years and 24 under the age of 10 years. A number of the lesions were serious and there were three cases of tuberculous meningitis and two of miliary pulmonary tuberculosis.

9. Eighteen (53%) of the cases arose in the first three months. These have all been attributed to infection by the index case before the start of treatment, since they included all the six cases in initially tuberculin-negative sanatorium contacts who had been immediately segregated from the index case.

10. Serial tuberculin tests were made during the two years; they did not give evidence

of more tuberculous infection in the home than in the sanatorium contacts.

11. The attack rate of tuberculosis in the contacts of the patients treated at home with effective chemotherapy was no greater than that in the contacts of the patients segregated in sanatorium. It is concluded that the major risk to the contacts in this study resulted from exposure to the index case before diagnosis and, further, that close family contacts offer scope for the investigation of chemoprophylaxis.

#### PROGRESS IN THE SECOND AND THIRD YEARS OF PATIENTS WITH QUIESCENT PULMONARY TUBERCULOSIS AFTER A YEAR OF CHEMOTHERAPY AT HOME OR IN SANATORIUM, AND INFLUENCE OF FURTHER CHEMOTHERAPY ON THE RELAPSE RATE

BY S. DEVADATTA, R. H. ANDREWS, J. H. ANGEL, A. L. BHATIA, WALLACE FOX, B. JANARDHANAM, S. RADHAKRISHNA, C. V. RAMAKRISHNAN, T. V. SUBBIAH & S. VELU—Bull. Wld. Hlth. Org., 1961, 24, 149-175.

1. In the main analysis of a year's study of combined chemotherapy with isoniazid plus PAS at home or in sanatorium, it was reported that 130 of 163 South Indian patients with pulmonary tuberculosis had attained bacteriological quiescence at one year (Tuberculosis Chemotherapy Centre, 1959). Of these, 126 were allocated at random to treatment at home for a second year with isoniazid alone or with a placebo, calcium gluconate. The daily dosage of isoniazid was 200 mg. for patients weighing 100 lb. or more, 175 mg. for patients weighing 80-99 lb. and 150 mg. for patients weighing less than 80 lb. The daily dosage of calcium gluconate was 500 mg.

2. At two years, 60 of the 61 patients in the isoniazid series who still had bacteriologically quiescent disease were allocated at random for a third year to isoniazid in the same dosage (30 patients) or to the placebo (30 patients).

3. The patients in the calcium series continued on calcium gluconate in the third year unless their disease was no longer bacteriologically quiescent at two years.

4. The main comparisons for the second and third years are between (a) 61 calcium and 65 isoniazid patients; (b) 57 home and 69

## ABSTRACTS

sanatorium patients; (c) 42 patients with residual cavitation at one year and 84 patients without cavitation at one year. A comparison for the third year is made between 30 patients who received two years of chemotherapy and 30 who received it for three years.

5. One patient (Home, cavitated) who received isoniazid in the second year died in the seventeenth month, the cause of death being unestablished.

6. At the end of the third year there was relatively little difference between the progress of patients in the various subgroups; six (10%) of 61 patients who received one year of chemotherapy relapsed bacteriologically, as compared with three (5%) of 65 who received two or three years of chemotherapy; three (5%) of 57 patients treated at home in the first year relapsed as compared with six of 42 patients with the "open negative" syndrome at one year relapsed, as compared with five (6%) of 84 in the non-cavitated series. In all, nine (7.1%) of the 126 patients relapsed in the second or third year, eight (6.3%) of these having relapsed in the second year.

7. None of the 60 patients in the comparison of two years and three years of chemotherapy, based on random allocation, relapsed (although one in the 3-year series produced an isolated positive culture at 36 months).

8. The regularity of self-administration of medicine was checked by counting the stocks of pills and by urine tests for isoniazid. Pill counting at surprise visits to the home revealed inaccuracies of the order of 20%, there

being no major differences between the patients originally treated at home and in sanatorium or between the males and the females. Urine specimens were obtained at planned visits to the Centre for the patients receiving isoniazid. They yielded negative results in approximately 20% of tests.

9. In addition, the progress in the second and third years of the 10 patients with disease whose bacteriological status at one year was in doubt has been studied. Of these 10 patients, three had a bacteriological relapse; in each instance an apparently isolated positive culture at 12 months proved to be beginning of the relapse.

10. It is concluded that in the second and third years there was relatively little difference between the patients whose disease attained quiescence following a year of domiciliary chemotherapy and those whose disease attained quiescence following a year's treatment with the same combination of drugs in sanatorium. Secondly, there was no evidence that a second or third year of treatment with isoniazid alone gave better results than a year of chemotherapy followed by careful observation of the patient and further chemotherapy if a relapse occurred. Thirdly, patients with residual cavitation at one year had slightly higher relapse rates than those without residual cavitation.

11. Taken in conjunction with earlier studies, the present study confirms the value of properly planned domiciliary chemotherapy for one year even in the most adverse environmental and dietary circumstances.

# ANNUAL INDEX

Conference Proceedings (CP); Symposium (S); Notes and News (NN); Association News (AN); Book Review (BR); Leading Articles (LA); Reports and Reviews (RR); Editorial (E); Abstracts (A):

<b>A</b>	
Activities of the Union Ministry of Health (NN)	77
A doctor's approach to Industrial Medicine—by Dr. H. P. Dastur (BR)	48
All out offensive against Tuberculosis (NN)	78
An arid earth in 1000 m. years (NN)	137
Antimicrobial Therapy of Tuberculosis (RR)	64
Application of Insecticides (LA)	122
Artificial Cooling and Life (RR)	98
A vaccination Against Measles (NN)	76
<b>B</b>	
Barkat Narain, Col.—Presidential address (CP)	7
Bhaskaran Dr. T. R.—Prevention and Control of River Pollution (S)	25
Bhide, Shri K. R.—Welcome address (CP)	3
Bio-ecological Studies of Sewage Purification and Drinking Water (A)	81
Budget estimates (AN)	46
<b>C</b>	
1961 Census of India (E)	95
Chopra, Dr. R. L.—Kulu Valley Mass V. D. Control Campaign (AA)	19
Circumin as Colouring Agent for Vanaspati (NN)	104
Colonel Amir Chand Trust Fund Prizes for Medical Research (NN)	43
Complications of Isoniazid Treatment (NN)	75
Construction of hospitals (NN)	138
<b>D</b>	
Danger of Food Additives (RR)	132
Das, Dr. C. R.—Frequency of Agglutinin in the Sera of Normal Subjects of a West Bengal village against Some Common Enteric Organisms (LA)	84
Dasgupta, Dr. S. R.—Eye Strain and Visual Hygiene in the Health of the School Children (S)	13
Das, Sri N.—Treatment and Disposal of Sugar Factory Effluents (S)	21
Dastur, Dr. H. P.—A doctor's approach to Industrial Medicine (BR)	48
Dutta, Dr. S. P. <i>et al</i> —General Health Survey in an Urban Health Centre (LA)	90
Diarrhoea and Sanitation (NN)	76
<b>E</b>	
Effect of Clottings on the Pulmonary function (A)	81
Eleanor Roosevelt International Cancer fellowships (NN)	43
Electricity from tidal power (NN)	137
Endemic Goitre in India (E)	72
Epidemiological Studies of Prematurity in Japan (A)	80
European Seminar for Sanitary Engineers (NN)	42
Excreta Disposal in Rural India—Shri N. Mazumder (S)	32
<b>F</b>	
Experimental Studies on the Examination of Coliform organisms in Water (A)	81
Expert Committee of Mental Health (NN)	42
Expert Committee on Health Statistics (NN)	75
Eye Strain and Visual Hygiene in the Health of the School Children—S. R. Dasgupta (S)	13
<b>G</b>	
General Health Survey in an Urban Health Centre—Dr. S. P. Data <i>et al</i> (LA)	90
General Review of Nutrition of Government of A. P. (1959)—(RR)	70
Get rid of those plastics Bags (NN)	77
Ghosh, Dr. G.—Nitrates in Water with reference to Methaemobinaemia (LA)	55
Ghosh, Dr. G.—Application of Insecticides (LA)	122
Gonococcal resistance to Penicillin (NN)	40
Gonorrhoea—a growing problem (RR)	131
<b>H</b>	
Health Education in School—Dr. J. Nath (S)	15
Highest birth and death rates (NN)	135
How to popularise Latrines in Indian Villages—Shri S. Mukherjee (S)	27
<b>I</b>	
Improved Pasteurizer (NN)	105
Inaugural address—by Shri D. P. Karmarkar (CP)	4
India's Third Plan (RR)	129
Industrial Methaemoglobinaemia (A)	140
Industrial Safety and Health (RR)	67
Industrial Wastes—Legal aspects—Shri M. K. Roy (S)	23
In the depths of life (RR)	62
<b>J</b>	
Jamuar, Dr. B. P.—Thoughts on How to popularise Latrines in Rural areas (S)	30
Jha, Sri D. N.—Problems of Industrial Wastes in Bihar (S)	19
Jugalwalla, Dr. N.—Post-graduate Public Health Education (LA)	107
<b>K</b>	
Karmakar, Shri D. P.—Inaugural Address (CP)	4
Kulu Valley Mass V. D. Control Campaign 1959—Dr. R. L. Chopra (LA)	49
<b>L</b>	
Large-scale Testing of Measles Vaccine (NN)	104

## ANNUAL INDEX

<p>Lead poisoning from home-made Wine (A) ... 140                      Leprosy and the Law—Dr. V. K. Sharma (LA) 87</p> <p style="text-align: center;">M</p> <p>Manufacture of Free flowing Table Salt (NN) 105                      Mass X-ray of Calcutta Students (NN) ... 139                      Mathematics of the brain (RR) ... 101                      Mazumdar, Shri N.—Excreta Disposal in Rural India (S) ... 32                      Malted Milk Powder (NN) ... 105                      Methods of Clinical Pathology Tests—K. Srinivasan (LA) ... 110                      Mitra, Dr. D. D.—Primary Vaccination of Young Babies (LA) ... 83                      Mukherjee, Shri S.—How to popularise latrines in Indian Villages (S) ... 27                      Mycerin—A new Anti-biotic (RR) ... 134</p> <p style="text-align: center;">N</p> <p>Narasimhan, Shri D.—Field Survey of Insecticide Susceptibility of Disease Vectors (LA) 57                      Nath, Dr. J.—Health Education in School (S) 15                      New drug for Burn Victims (RR) ... 100                      Nitrates in Water with reference to Methaemoglobinemia—Dr. G. Ghosh (LA) ... 55</p> <p style="text-align: center;">P</p> <p>Park, Dr. J. E.—Filariasis in Rewa Division (MP) (LA) ... 114                      Pill that controls pregnancy (NN) ... 42                      Poisonous content of coloured turmeric (NN)                      Post-graduate Public Health Education—Dr. N. Jungalwalla (LA) ... 107                      Premature African Babies (A) ... 80                      Present aspect of prevention of diseases (A) ... 143                      Presidential Address—by Col. Barkat Narain Dr. T. R. Bhaskaran (S) ... 19                      Prevention and its historical developments (A) 142                      Prevention in its medicolegal aspects (A) ... 142                      Primary Vaccination of Young Babies—Dr. D. D. Mitra (LA) ... 83                      Problems of Industrial Wastes in Bihar—D. N. Jha (S) ... 19                      Proceedigs of the fifth Annual General Meeting AN) ... 47                      Prototype hearing aids (NN) ... 106                      Public Health Aspects of Low Birth Weight (NN) ... 75                      Pulmonary Tuberculosis—The last Stage? (A) 141</p>	<p style="text-align: center;">R</p> <p>Rehabilitation of Leprosy Sufferers (NN) ... 103                      Reports of the General Secretary (AN) ... 44                      Research in Radiation Medicine (NN) ... 139                      Roy, Shri M. K.—Industrial Wastes—Legal Aspects (S) ... 23                      Rs. 29 Crores sum Clearance in third Plan (NN) ... 135</p> <p style="text-align: center;">S</p> <p>Salmonella Heidelberg in a Rural area of West Bengal—Dr. D. N. Sengupta <i>et al</i> (LA) ... 61                      Sanitation—"Keystone of Progress" (NN) ... 38                      Seal, Dr. S. C. (NN) ... 139                      Sengupta, Dr. D. N. <i>et al</i>—Salmonella Heidelberg in a Rural area of West Bengal (LA) ... 61                      Sensitivity to Primaquine (NN) ... 41                      Sharma, Dr. V. K.—Leprosy and the Law (LA) 87                      Sinha, Sri S. N.—Waste Disposal and River Pollution ... 22                      Solar Power Plant (NN) ... 138                      Soviet 20-Year Plan (RR) ...                      Srinivasan, Dr. K.—Methods of Clinical Pathology Tests (LA) ... 110                      Substitute for Curarine (NN) ... 78                      Sun will work for us (RR) ... 132</p> <p style="text-align: center;">T</p> <p>Taming Hydrogen Power (NN) ... 138                      The Dead can help the living (RR) ... 63                      The epidemiology of Mental Disorders (NN) 102                      The Health Inspector—man with a future (NN) 41                      The Surgeon and the heart (RR) ... 68                      Thoughts on how to popularise latrines in rural areas—Dr. B. P. Jamuar (S) ... 30                      Training in Preventive Medicine and P. H. in India (E) ... 125                      Treatment and Disposal of Sugar Factory Effluents—Shri N. Das (S) ... 21                      Treating of T.B. patients at Home (NN) ... 108                      Tuberculosis Control in Third Plan (NN) ... 41</p> <p style="text-align: center;">W</p> <p>Waste Disposal and River Pollution in Dehri-on-Sone—Shri S. N. Sinha (S) ... 22                      Welcome Address—by Shri K. R. Bhide (CP) 3                      Windmills for rural Water Supply (NN) ... 77                      Work of W.H.O. in 1961 (NN) ... 36                      World Congress on Gynaecology and obstetrics (NN) ... 106</p>
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