

PAKISTAN JOURNAL OF HEALTH

Vol : XIII

OCTOBER 1963

No. 3

A QUARTERLY
DEVOTED TO HYGIENE, PREVENTIVE MEDICINE,
MEDICAL SCIENCE AND ALLIED SUBJECTS.



PUBLISHED BY
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INFORMATION

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SOME OBSERVATIONS ON THE EXAMINATION OF CONTACTS OF TUBERCULOSIS CASES REGISTERED IN TUBERCULOSIS CONTROL AND TRAINING CENTRE, KARACHI.

MOHAMMAD IQBAL YAD, M. B. B. S. (Pb.), T. D. D. (Wales), M. C. C. P.

Director, Tuberculosis Control and Training Centre, Karachi.

Tuberculosis Control and Training Centre, Karachi was established in 1951. Till December 1959, 85,386 cases had been registered of which 37.8% were sputum positive at some stage or other.

Ideally, we should have concentrated on all of these infectious cases and extended tuberculosis control measures to their homes. But it was not possible because we did not have the requisite number of trained tuberculosis home visitors. As a pilot project, mainly for training and demonstration purposes tuberculosis home visiting was started, but was restricted to an area within a radius of 3 miles around this Centre. Till 1959, 2,607 homes had been brought under control and our home visitors had made an average of 4 visits per home per annum. A scheme for gradual expansion of this service in the city is under consideration of the Government. When fully in operation, all infectious cases in the city and its suburbs will receive a minimum of 15 visits per annum.

Examination of contacts at home is part of the normal activities of our home visitors. A small study was made in 1956 of contacts examined during 1954 and 1955 and as it gave some interesting information, a somewhat detailed examination of the data available in home visiting department records has been made. Some observations based on the records of all the contacts examined from 1951 up to the end of 1959 are presented.

The index cases of all the contacts examined were sputum positive at the time of Registration and resided within roughly 3 miles around this Centre. Sputum negative cases were excluded from home supervision.

In all 11,700 contacts of 2,607 index cases were examined. The age and sex-wise distribution is given in Table No. 1.

TABLE NO. 1

					Male	Female	Total
0-6	..	..	..	..	1,803	1,710	3,522
7-14	..	..	..	..	1,274	1,404	2,738
15-19	..	..	..	..	404	022	1,026
20 and above	..	..	..	..	1,726	2,688	4,414
Total				..	5,207	6,493	11,700

All the contacts were given a tuberculin test and were X-Rayed. Those who were found tuberculin negative (1st and 2nd dose) were offered B. C. G. Vaccination. Those who did not convert at the end of 3 months were re-vaccinated. Those who had shadows in their X-Rays were registered, their sputa or laryngeal swabs

examined for T. B. and treated as regular patients. Those who did not show any X-Ray shadows were re-examined every six months. Except for 0-6 group in all other ages slightly larger number of females were examined probably because more females were available at home when our staff visited their homes.

The results of tuberculin tests are summarised in Table 2.

TABLE NO. 2

TABLE NO. 2

					No. Examined	Tuberculin Positive	Per cent Positive
Males	{	0-6	..	..	1,803	825	45.8
		7-14	..	..	1,274	1,015	79.7
		15-19	..	..	404	383	94.8
		20 and above	..	..	1,726	1,698	98.4
Females	{	0-6	..	..	1,719	795	46.2
		7-14	..	..	1,464	1,131	77.3
		15-19	..	..	622	577	92.8
		20 and above	..	..	2,688	2,611	97.5
Total					11,700	9,045	77.3

It will be observed, that, in general, the percentage of tuberculin positive cases is higher in the older age groups, and in the female sex.

It will be observed that Infection rate increases steadily with the age. The overall rate 77.5% compares with about 66% in general population as observed in B. C. G. Campaigns.

Not all the tuberculin negative contacts who were offered B. C. G. Vaccination accepted it. The acceptance rate was highest in the youngest age group and dwindled with increasing age as shown in Table 3.

TABLE NO. 3

					Total Tuberculin Negative Contacts	B. C. G. Vaccinated per cent
Males	{	0-6	..	..	856	87.5
		7-14	..	..	225	88.9
		15-19	..	..	11	52.4
		20 and above	..	..	10	35.7
Females	{	0-6	..	..	807	87.4
		7-14	..	..	223	85.0
		15-19	..	..	30	66.7
		20 and above	..	..	37	55.2

Average 85.7

Average 84.5

The conversion rate after B. C. G. Vaccination ranged between 57.2% (males 0-6 years) and 100% in both males and females over 15 years (Table 4).

TABLE NO. 4

						Conversion rate	
Males	{	0-6 ..	..	..	..	57.2	} 59.8
		7-14..	..	..	..	70.0	
		15-19	..	..	..	100	
		20 and above	..	..	..	100	
Females	{	0-6 ..	..	..	..	63.4	} 68.3
		7-14..	..	..	..	76.8	
		15-19	..	..	..	100	
		20 and above	..	..	..	100	
Average ..						64.2	

But the numbers examined for conversion in these age groups were too small. The overall conversion rates are, however, fairly representative, i.e. 64.2% (59.8% in males and 68.3% in females).

Of a total of 11,700 contacts examined, 1839 (15.7%) had shadows in the lungs and were classed as X-Ray positive.

TABLE NO. 5

				Number X-Rayed	X-Ray positive	Percentage		
Males	{	0-6 ..	..	1,803	218	12.1	}	16.3
		7-14..	..	1,274	135	10.6		
		15-19	..	404	64	15.8		
		20 and above	..	1,726	432	25.0		
Females	{	0-6 ..	..	1,710	191	11.1	}	15.2
		7-14..	..	1,464	177	12.1		
		15-19	..	622	105	16.9		
		20 and above	..	2,688	517	19.2		

Incidence of tuberculosis in the general population of Karachi has been estimated at about 4%. The risk of disease in the contacts, therefore, was about 4 times that of general population. Age and sex distribution of X-Ray contacts is shown in Table 5. The morbidity is slightly higher in males (16.3%) than in females (15.2%). It will be observed that the disease incidence increases with age: the rate in under 15 of both sexes taken together is about 11.3% the rate among 15 upwards is 20.5, i.e. almost double although the number of contacts examined was similar in both cases (6,260 Contacts under 15 compared with 5440 over 15 years).

Search for T. B. was made in all X-Ray positive cases. Spot Sputum specimens were collected in the Centre of all the contacts cases over 10 years and a single laryngeal swab was examined in children under 10. All laryngeal swabs were cultivated. Till 1954 all sputa of direct smear negative cases were also cultivated. All cultures were made on L. J. Media. Sodium hydroxide treatment with sulphuric acid was adopted as routine procedure till 1953 when a change over was made to Nassu's swab technique. All cultures were read at 6 weeks and those showing no growth were read as negative. Semars were examined for 3 minutes.

The bacilli-positive rate in contacts under 15 is low i.e. 4.5% in 721 X-Ray positive contacts as compared with 14.2% in 1118 cases over 15.

TABLE NO. 6

				Total No. of X-Ray	Sputum posit've	Percentage		
Males	{	0-6		218	9	5.1	}	11.8
		7-14		135	6	4.4		
		15-19		64	12	18.8		
		20 and above		432	73	16.9		
Females	{	0-6		101	8	4.2	}	9.2
		7-14		177	9	5.1		
		15-19		105	14	13.3		
		20 and above		517	60	11.6		
Total				1,839	191	10.4		

This may be due to the fact that single laryngeal swabs were examined in large number of younger contacts, thus missing some bacilli-positive cases. Possibly some non-tubercular lung shadows were also registered. It will be observed that though X-Ray positive rate is larger in contacts, the bacilli positive rate is quite low (10.4%). In the total number of new cases examined in a year, bacilli positive rate in

our Centre is about 37%. This low bacilli positive rate in X-Ray positive contacts is to early cases being detected, even before they were excreting manifest number of probably due bacilli, thus justifying the need of extensive contact examinations.

A study of assessment of X-Ray Shadows is being made alongwith follow up results of all X-Ray + contacts and shall be reported later.

The city of Karachi suffers from chronic and extensive overcrowding. It is all the more pronounced in areas around this Centre. Segregation of index cases was only possible in 11.5% of families. Here too segregation was confined to night only when the patient slept in separate room. A study of incidence of infection rate and morbidity rate was made in 2607 families. The results are shown in Table 7.

TABLE NO. 7
ACCOMMODATION—SLEEPING SPACE PER HEAD IN THE PATIENT'S ROOM

Sleeping area per person	Families examined number	Contacts examined	TUBERCULIN TEST		X-RAY EXAMINATIONS	
			Positive	Percentage	Positive	Percentage
Less than 20 square feet ..	529	2,592	1,939	74.8	490	15.8
20 to 25 square feet ..	635	2,252	1,706	75.3	396	17.6
More than 25 square feet ..	906	4,620	3,601	77.9	700	15.2
Only one person sleeping with the patient.	238	1,034	837	80.9	156	15.1
Complete isolation, when the patient is alone in the room.	299	1,202	962	80.3	178	14.8
Total ..	2,607	11,700	9,045	78.3	1,839	15.7

It will be seen that 529 families (20.3%) were sharing accommodation where each member had less than 20 square feet sleeping space i.e. 5 people sleeping in a hut-room 10×10 and at least one of them was an open tubercular case. However, there is statistically no significant difference in infection rate between over-crowded families and less crowded families. Nor is there any significant difference in morbidity rate, ranging between 14.8% in families where there was complete isolation at night to 17.6% where the patients shared accommodation with other members of family on the scale of 25 square feet per person sleeping in the same room.

As the infection rate is practically similar irrespective of degree of crowding, so is the morbidity rate. This can possibly be construed as evidence that the morbidity was of endogenous origin.

As economic factors and tuberculosis are closely related further analysis of the data was made for infection rate and morbidity rate among the contacts in different income groups. The total family income was pooled and per capita per diem income was calculated. The results are shown in Table 8.

TABLE NO. 8
STATEMENT SHOWING INCOME OF THE FAMILY PER HEAD AND PER DAY

Different Income Groups	Families examined Number	Contacts examined	TUBERCULIN TEST		X-RAY EXAMINATION		REMARKS
			Positive	Percentage	Positive	Percentage	
Less than annas 8 ..	992	4,310	3,382	78.5	702	17.7	
More than annas 8	875	4,001	3,085	77.1	591	14.8	
Rupce 1 to 2 ..	638	2,013	2,207	75.8	415	14.2	
Rupces 2 to 3 ..	89	411	323	78.6	58	14.1	
Rupces 3 and above	13	65	48	73.8	13	20.0	
Total ..	2,607	11,700	9,045	77.3	1,839	15.7	

As only 13 families (0.5%) had income of over Rs. 5 per head per day, it is better to ignore them. It will be seen that statistically there is no significant difference between very poor and middle class families in infection and morbidity rate. Where the incidence of tuberculosis is high and chances of infection present all and sundry are prone to contract tuberculosis whatever be their income. Dietetic habits may have to be investigated to throw more light on this question. As high income bracket patients were few in the study, incidence in contacts of these patients could not be estimated on the basis of data available.

Babies under 2 years of age are the most dangerous group amongst the contacts. In our country contact of babies is very close to mothers as most babies are breast fed. A comparative study was made of infection and morbidity amongst babies where the index cases was the mother and where it was any other person in the family. The result is shown in Table No. 9.

TABLE NO. 9
EXAMINATION OF BABIES UP TO 2 YEARS OF AGE

When a T.B. patient sputum positive is present in the family.	No. of Babies, Examined	TUBERCULIN TESTS		X-RAY EXAMINATIONS		B. C. G. VACCINATION AND CONVERSIONS			
		Positive	Percentage	Positive	Percentage	B.C.C. Given	B.C.G. Examined for Conversion	Conversion	Percentage
When mother is a patient.	496	168	35.9	62	10.5	301	120	77	64.2
When other than mother is a patient.	806	208	25.8	90	11.2	506	107	59	59.1
Total ..	1,302	376	28.9	142	10.9	807	227	136	59.9

Another un-expected fact is revealed. Although there is a higher infection rate in babies where the index cases in mother (33.9% as compared with 25.8%) there is statistically no significant difference in morbidity rate, i.e. 10.5% in babies where mother is the Index case as compared with 11.2% where other than mother is a patient.

My thanks are due to Mr. Muhammad Shafique Khan, Chief Health Visitor and his colleagues in Home-Visiting department, Mr. Fazl-us-Saeed Khan and Mrs. Mubarika Begum who collected the data for this paper.

SUMMARY

Some observations on the examination of 11700 contacts of 2607 sputum positive tuberculous cases registered in the Tuberculosis Control and Training Centre, Karachi are presented. There was slight preponderance of females over males among the contacts. Infection rate was found to increase steadily with the age. The overall rate of positive tuberculin reaction was 77.5 per cent in the contacts as compared with 60 per cent of general population in B. C. G. Campaign.

The acceptance of B. C. G. was higher in infants and young children and gradually diminished as the age increased. However, the acceptance was slightly higher in the females than in the males. The conversion rate after B. C. G. Vaccination also increased with the age; was about 60 per cent in 0—6 years age group, about 74 per cent in 7—14 years age group and 100 per cent in 15 years and above. Above 15.7 per cent were found with shadows in the lungs on X-ray examination. Of these about 10.4 per cent had positive sputum.

An assessment of the effects of overcrowding on infection and morbidity was made. It was found that there was no significant difference in the infection and morbidity amongst the contacts who lived in the same room as the index case with sleeping area of less than 20 feet per person as compared with the contacts of the households where the patients had separate room to sleep in. An assessment of incidence and morbidity in contacts of different income group was also made and it was found that there was hardly significant difference between the infection and morbidity in contacts of index cases where per capita per diem income of the family was as low as less than Rs. 0.50 paisa or as high as Rs. 5. Similarly no difference in the infection and morbidity was found in the babies who were contacts of infectious mothers or of any other infectious person in the family.

SMOKING AND ITS INJURIOUS EFFECTS ON HEALTH

By

Dr. I. H. RANDHAWA

M.B., B.S., T.D.D., D.T.M.L. H.(Liverpool) M.R.C.P. (C), M.R.S.H. (London).

Smoking cigarettes is a dangerous and deadly habit for many, though not for all. As a matter of fact it should be classed under social evil and banned for general public. It eventually leads to ill-health and suffering both to the young and the old.

Smoking of cigars, pipes, Hookah and Biri, though injurious to health in the long run, are yet less dangerous to smoking of cigarettes. In undivided India the tobacco was brought by the East. India Com'any and 'Hookah' was introduced during the reign of Mughal Emperors.

In sixteenth century the use of tobacco was introduced in Europe mostly in pipes. It was largely replaced seventy years back by cigarettes and its evil effects upon health have been noticed recently which have been supported by scientific research. (Report by Royal College of Physicians, London, 1962 (I).

The ill-effects are due to nicotine in the tobacco, tar and a number of carcinogens nearly sixteen in number (including 3-4-Benz pyrene) which are irritant to the bronchial tube. Nicotine affects the heart, blood-vessels, digestive tract, kidneys and nervous system. Carbon, monoxide and Arsenic found in the smoke are in too small quantities to be harmful. Paper used in making the cigarettes has been blamed but no definite evidence is forthcoming.

Smokers are classed under three categories, according to the number of cigarettes they smoke per day (one cigarette containing 1 GM of nicotine). Those smoking up to four cigarettes a day are light smokers, those upto 10 Cigarettes are classed as medium smokers, those 20—25 or more per day are heavy smokers.

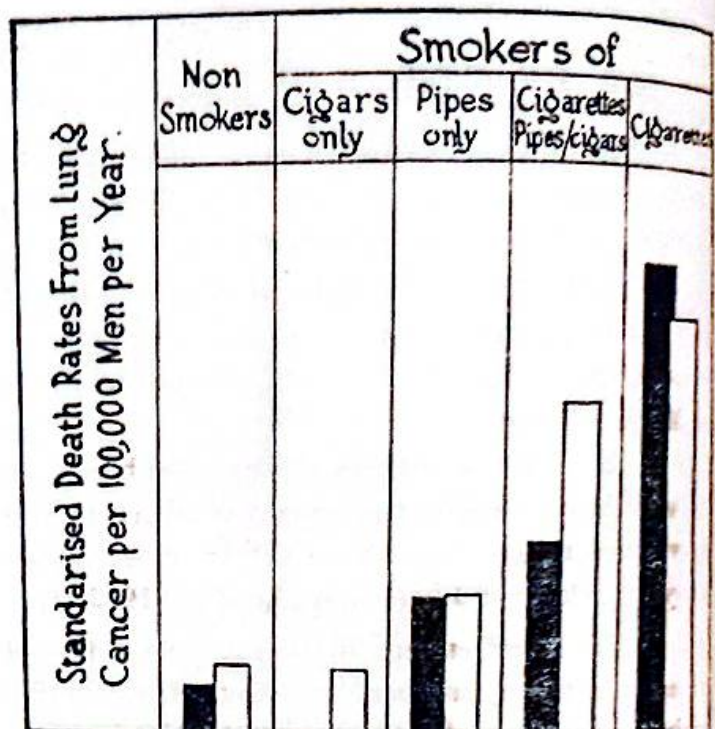
Recently there has been a great increase in deaths from the bronchial cancer, specially during the past 45 years in Western countries and Russia. This increase may be partly attributed to good diagnosis but 23 investigations carried out in 9 different countries including U. K. and U. S. A. have proved that heavy smokers may have 30 times the death rate of non-smokers and incidence many times more in males than in females. The investigations in U. S. A. reveal that pipe smokers had three times the mortality of non-smokers, smokers of cigarettes *plus* pipes or cigars 5-8 times and pure cigarettes smokers about 10 times, the difference being due to the greater tendency of cigarette smokers to inhale the smoke as studied in the United States.

The Royal College of Physicians, London have recently published figures on the data obtained from the study of Doll and Hill regarding British doctors aged 35 and over. (Doll and Hill—1950 (2).(3).

Table I

Death rates from lung cancer in men according to the type of tobacco smoke¹.

The British figures in this R C P diagram are based on Doll and Hill's study of British doctors aged 35 and over; the U. S. figures relate to Hammond and Horn's study of American men aged between 50 and 69. Only in the United States were there enough pure cigar smokers to estimate their death rate—which was the same as for non smokers. Pipe smokers had three times the mortality of non-smokers, smokers of cigarettes plus pipe, or cigars five to eight times, and pure cigarette smokers about ten times. The differences between cigarette smokers and other tobacco smokers may be due to the greater tendency of cigarette smokers to inhale the smoke.



■ U.K. Figures from Doll & Hill 1956

□ U.S.A. Figures from Hammond & Horn, 1958

Hammond and Horn's study of American men, aged 50-69 and Dorn's study of American ex-servicemen and aged 30 and over (Smoking and health 1962 (1) (2)) supports the above facts. Doll and Bradford Hills' inquiry among doctors indicate that the chance of a man aged 35 dying in the next ten years is 1 in 23 if he smokes 25 or more cigarettes a day, but only 1 in 90 if he is a non-smoker. His chance of dying before the age of retirement is only 15 per cent if he is non-smoker but 33 per cent if he smokes 25 or more cigarettes a day. These figures from men in social class I may under-estimate the hazard in general population.

the risk of getting lung cancer is multiplied as the consumption of cigarettes increases.

This RCP graph is based on three studies.

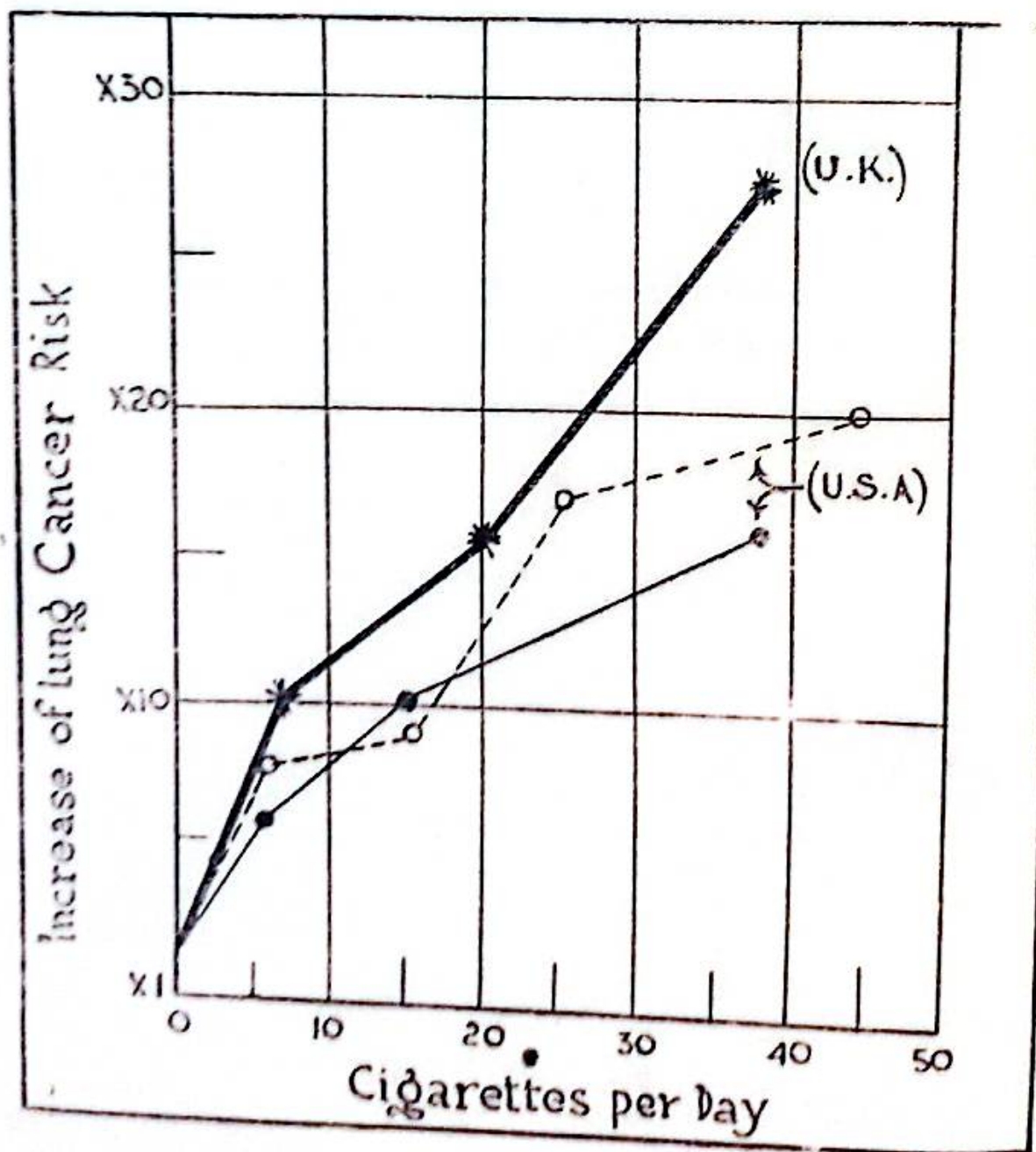
Doll and Hill's study of British doctors aged 35 and over : — * —

Hammond and Horn's study of American men aged 50-69 : — ○ —

Dorn's study of American ex servicemen aged 30 and over : — ● —

The first horizontal line (X10) indicates ten times the lung cancer risk of non-smokers, and successive horizontal lines (X20, X30) indicate multiples of ten. The RCP report suggests that the higher British rates may be due to our habit of smoking cigarettes to a shorter stub length than do the Americans, and to the greater exposure of British men to air polluted by domestic and industrial smoke.

Table II



Higher British rates of cancer may be due to the habit of smoking cigarettes to a shorter stub length than the Americans and to the greater exposure of British men to air polluted by domestic and industrial atmospheric smoke. Air pollution does contribute to the further hazards of smoking cigarettes in causing cancer as in big cities like London and New York. The smoke of factories, chimneys exhaust and vacuum pumps and atmospheric fumes containing industrial sulphuric acid, SO₂ (sulphur dioxide) and SO₃ (sulphur trioxide) are really injurious and irritant to bronchial mucosa. Based on this atmospheric pollution, cancer of the lung is more common in the factory area in North London than in South.

Evidence is coming up in favour of smoking cigarettes as the main cause of bronchial cancer without contributing cause of atmospheric pollution. This is seen in Finland, a rural country which has the second highest rate of lung cancer and the disease in this country amongst smokers is 15–20 times more than non-smokers. This is due to heavy smoking rather than air pollution. In 1961, nearly 23,000 people died from lung cancer in Britain. James Maxwell (Maxwell 1962 (6)) thinks that the real cause of the increase in lung cancer and of many other prevalent diseases may be the twentieth century way of life, in addition to smoking of cigarettes.

OTHER LUNG DISEASES

Chronic bronchitis is a disabling disease in Great Britain and other big Western cities, which causes loss of work amongst labourers of middle age and thus loss to the nation. The patient has smoker's cough which increases in frequency, severity and bouts during the winter, specially in the big cities with air pollution, smoke and smog. This is followed by cough with expectoration, breathlessness and even development of emphysema and right-sided heart failure. The person is completely disabled and death follows due to dyspnoea, respiratory failure, heart failure or respiratory tract infection.

In series of Doll and Hill, death amongst smokers was ten times more than non-smokers. In U.S.A. Dr. Harold Dorn found that death from bronchitis and emphysema was three times as frequent in regular cigarette smokers as in non-smokers. Smoking may contribute to the development of pulmonary tuberculosis specially in the middle age and elderly.

Coronary Heart disease and Coronary Thrombosis are more common in cigarette smokers than in non-smokers, specially in middle age and elderly men. These cigarette smokers have less incidence of coronary heart disease when they give up smoking. It may also contribute to other arterial diseases including Thromboangitis Obliterans (Burger's disease) in males particularly in Jews.

Smoking effects the movements and secretions of the intestines causing nausea, vomiting, loss of appetite and thus loss of weight and may precipitate Peptic ulcers (Gastric and duodenal) cancers of mouth throat and oesophagus are more common in smokers than in non-smokers. Smokers are more prone to accidents than non-smokers. Smoking may impair athletic performances, may have babies that are under night.

SOCIAL ASPECTS OF SMOKING

People smoke as they enjoy smoking. It gives them a feeling of relaxation, relieves anxiety and tiredness and helps to concentrate. Some students during the examinations

obtain special permission from the invigilators to smoke in the examination hall. People enjoy smoking while visiting toilet. I am personally of the opinion that children acquire the habit of smoking when they tend to follow their parents' smoking habit, while grown up people adopt this habit in a society which speaks very high about it. Thus it becomes a social evil and a vicious circle is set up from which it is difficult to get out. Non-smokers enjoy without smoking and it is not understood how smokers claim to lead a more enjoyable life. Smokers rather tend to be restless, appear dull without smoking, less dependable and more neurotic. Smokers are more extroverted than non-smokers. Pipe smokers are more introverted. (B. M. J.—1962 (7).

CIGARETTE SMOKING AND BLOOD-GROUPS

Bernice Cohen and Caroline Thomas (Cohen and Thomas 1962 (8) have investigated the distribution of ABO and Rhesus blood groups in relation to smoking habits of 1,005 white donors whose overall blood groups frequencies were similar to those of the population from which they were drawn. The author found a significant excess of groups B among the group of non-smokers (184) and occasional smokers (51) when pooled and a corresponding deficiency of B among the heavy smokers of cigarettes, who were rather higher in groups O and A than the control. Probably of less importance was the finding that there was a higher proportion of Rhesus negative persons (29.4 per cent) among the small number of occasional smokers than expected (14.4 per cent). A corresponding survey in 393 Negroes showed no abnormal features.

PREVENTION

Less air pollution will reduce the risks caused by cigarette smoking. The harmful effects of cigarette smoking may be reduced by using filters, by leaving longer cigarette stubs, by changing from cigarettes to pipe or cigar smoking. Biri may have harmful effects like smoker's cough but it needs investigations about the type of tobacco used and the harmful effects caused as a result of smoke produced by burning of the plant leaves used for wrapping (Temru).

Children should be persuaded specially in schools not to smoke and the public should be warned about the ill-effects of smoking. Health education may play an important part by cinema slides, pamphlets, lectures and propaganda. Restriction on the sale of tobacco through Excise and Taxation Department, Resolutions on advertising through the publishers and leading papers. It is interesting to note that in Great Britain tobacco manufacturers spent pound 38 million on advertisement against expenditure on health education valued at pound 5,000 during years 1956—60.

Legislation to ban smoking in open public, Increase in tax on cigarettes and tobacco, Contents of tar and nicotine to be declared by manufacturers on cigarette packing. Starting anti-smoking campaigns by associations enjoying high social status in public life Rotarians and Lion Club, etc., Bar Associations, Union Councils, Pakistan Medical Association and other religious societies.

COMMENTS

Smoking has only psychological and social benefits and it does not help to ameliorate the effects of neurosis. It may also help obese people as it causes loss of appetite. Cigarette

smoking not only causes lung cancer and bronchitis, but also contributes to Coronary heart disease, arterial disease and activation of peptic ulcers. In Pakistan the habit of smoking is on the increase every day. With rapid industrial development there is likelihood of air pollution specially in big cities. As such danger of cancer of lung, other respiratory diseases, precipitation of peptic ulcers and coronary heart diseases, etc., is to be feared in future years. We can guard against this by starting anti-smoking campaign and legislation well in time, thus taking a lead as compared to Western countries.

Since the time this article has been written, some new ideas are springing-up based on the research-work. Two American cancer experts Dr. Freumeni and Dr. Laudin of the National Cancer Institute in Maryland had found that there was a higher incidence of abortions still births and premature births among women who smoke. They have also noted significant alteration in sex ratio of the newly-born of smoking mothers. There were more female live-birth among smokers perhaps by "inducing lethal sex linked mutations". Two Harvard University Research-workers were of the opinion that cigarette-smoke contains plutonium, a radioactive element that may cause lung-cancer. Edward Radford and Vilma Hunt have discovered traces of plutonium in cigarette-smoke including the cigarette smoke which has been inhaled in the lungs and bronchial tubes of smokers. They also found that a person who smokes two packets of cigarettes a day absorbs seven-times as much plutonium as that absorbed by non smokers.

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ASSAYING OF HELMACID AS AN ANTHELMINTIC

By

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INTRODUCTION

The appalling insanitary conditions and overcrowding of Lahore particularly in the interior of the town, have resulted in a marked increase in the morbidity rate of the population from gastro-intestinal diseases. The water supply is unsatisfactory; refuse which comprises of faecal matter mixed with house refuse remains heaped up in the streets, and acts as breeding ground of flies. Promiscuous defaecation in public places and poor health education amongst ignorant people further add to the misery. Wasti (1) in his studies in Infantile Gastro-enteritis has observed that diarrhoea was still one of the worst killers of child life in our country. The general practitioners and medical officers attached to hospitals have been observing an alarming increase, particularly in the summer months, in helminthic infections. In the absence of statistical data based on scientific methods, the department of Preventive Medicine, Fatima Jinnah Medical College for Women, Lahore, undertook the study of parasitic load amongst school children. A primary school which is situated in the vicinity of the College was selected for the purpose. It is a mixed school of boys and girls and is run by A. P. W. A. The children studying in this institution are from the lower socio-economic group the community, and are given free education and free books by the association. The school comprises two servant quarters of an old dilapidated building which cannot accommodate all the children; consequently they spend most of their time in the courtyard which has a kucha floor. The majority of the scholars are malnourished.

METHOD AND MATERIAL

The stools of 161 students were examined for determining ova of worms and protozoal cysts. One single examination was made without previous purgation, and revealed 80 per cent infection. The infection comprised ova of *A. lumbricoides*, *A. duodenale*, *H. nana*, *E. vermicularis*, *T. trichura*; and cysts of *E. histolytica* and *G. lamblia*. The investigation was carried out during the months of June and July which are the hottest months of the year in Lahore. This high incidence of helminthic infection was alarming and the school authorities desired some remedy to mitigate the suffering of the school children, who invariably complained of pain in the abdomen and some gave history of passing worms. Accordingly a request was made to Messrs. Glaxo Laboratories (Pakistan) Ltd. for the supply of the drug named HELMACID. The company gladly responded to our request and provided us with a liberal amount of Helmacid free of cost. It is a syrup each drachm of which has an equivalent of 500 mg. of Piperazine hydrate. The drug was administered on two consecutive evenings.

The drug was given to 46 children, 45 of whom were infected with *A. lumbricoides* and one suffered from threadworms, 44 of these were girls and two were boys whose ages ranged from 6 to 14 years. There was a sense of relief amongst the children who took the drug and their parents appreciated the gesture as they saw bunches of worms coming out in stools.

In order to assess the results of the treatment, the children were requested to bring their stools for re-examination; and in spite of our repeated requests and monetary allurements which went up to eight annas per stool, only 23 students who had suffered from *A. lumbricoides* infection, brought their stools for re-examination. Out of this number the stools of 16 children were found negative, but seven were positive although the number of ova was very much reduced. The percentage of cure was 69.5 per cent.

CONCLUSION

1. The stool examination of school children revealed a very heavy worm infection. Infection from *A. lumbricoides* was found to be the heaviest.
2. Helmacid was found to be effective, however the makers of the drug claim 95 per cent cure.
3. There can be a few fallacies in our investigation. In the first instance the number of children examined was not large enough to ensure statistically significant results. Secondly the drug was given to the children to be taken on 2 consecutive evenings and it may be possible that the children took the drug only once.
4. Worm infection is highly prevalent amongst children of lower socio-economic group of the community.

ACKNOWLEDGEMENT

The department of Preventive Medicine of Fatima Jinnah Medical College for Women, greatly appreciates the benevolent gesture of Glaxo Laboratories (Pakistan) Ltd. who supplied syrup Helmacid free of cost for our clinical trial.

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A SURVEY OF HUMAN INTESTINAL PARASITES IN CONSERVANCY STAFF OF THE CITY CORPORA- TION OF LAHORE

By

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INTRODUCTION

I do not see any of it upon you today—or perhaps I am deceived.

*I will run a furrow with my plough—I will press my spade through the sod,
and turn it up under neath ;*

I am sure I shall exposs some of the foul meat.

(Walt Whitman : *This Compost*).

All the text-books on Parasitology state that although the intestinal parasites are cosmopolitan in distribution, yet the organisms inhabit comparatively more people in tropical than in temperate regions. It remained a vexata quaestio and an awe-inspiring statement for a long time, warranting fact finding surveys, specially in the tropics.

During the last quarter of the century some unbiased data from various countries has already been collected. From a perusal of this printed information, one can vouchsafe that the frequency of any parasite in a country, does not depend upon its geographical position alone, but also upon the sanitary standards maintained by its people.

There is no denying of the fact that the temperature and humidity factors are important contributory causes in the maintenance of parasitic diseases in an area. In tropical and sub-tropical countries the inefficient sewage and garbage disposal is *corpus delicti* and cause for high incidence of various parasites. In these regions the house-fly menace is not only great and serious but also important agent of dispersal and dissemination of the intestinal parasites. The promiscuous defecation also results in the contamination of the environments. Over and above the fore-going, the neglect of personal hygiene is the root cause of the trouble.

Human infection with intestinal parasites occurs from ingestion of infected material. Some of the helminthic parasites are propagated when the raw or uncooked animal products containing infective stages of the parasite are eaten. The protozoan cysts and ova of some helminthic parasites set stream of events flowing when swallowed or inbibed in

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contaminated food or drink. Other helminthic parasites, having complex life history, are however, transmitted when the susceptible host comes in close contact with soil, polluted by infected human faeces, and containing infective filiform larvae.

Wenyon and O'Conner (1917) and other workers fixed the responsibility of spreading the intestinal parasites on the club-servants, cooks and waiters, food handlers and food vendors. The house-wife, who remains more exposed to infection, may likewise have comparatively higher incidence. For infection in infants, the charge leveled against mothers, is that she feeds faeces to her baby. Infection in toddlers and children occurs when their mummy is unmindful of the dangers involved when the courtyard is contaminated with faecal matter. Even a liberal man under these conditions cannot exonerate her of these grave charges in endemic areas.

Food habits and personal cleanliness are important spokes of the wheel of parasitism. The class of people, which keep our houses broomed, drained and dusted ought to have the highest load of the parasites. If the parasites are capable of taking advantage of a profession and occupation, then the scavenger class, which carries the dust, dung and human excreta out of the houses, streets and towns will form the first line of propagation of parasites. With a view to find out the degree of prevalence of intestinal protozoa and helminthic parasites in such a class of people, we arranged a fact finding study in the conservancy staff of the City Corporation of Lahore. The historians admit readily enough the substantial virtues of the people of Indo-Pakistan sub-continent. It is interesting because the country presents a natural and tranquil growth of society of its own. There is no parallel in the modern history to the formation and evolution of caste system which this country presents. It awakens ours concern to know its evolution because we venture to confine our survey to this community.

We think, it would be false to write about our observations without speaking of the community involved in the present survey. We don't claim it a revelation nor an emotional note. It is an unconscious residue of admiration we have for the class involved. This note may be taken as an epitome on our cultural situation. Briefly speaking, it is a fascinating story of the great gulf which the intellectuals of the hoary past dug deep and wide between the high and low and mighty and meak members of the then society. Unfortunately the Great Moghals and Mighty British failed miserably to rectify the harm done to the humanity by evolving a classification based on occupations. The following account gives us in brief as to how this "conservancy staff" came into existence.

ORIGIN OF CASTES

وَلَا تَصْغُرْ خُذْكَ لِلنَّاسِ لَا تَمْشِ فِي الْأَرْضِ فَرْحًا إِنَّ اللَّهَ لَا يُحِبُّ كُلَّ مُخْتَالٍ فَخُورٍ

The traditional history of India gives us a unique glimpse of the origin, modification, transition from medieval to modern and development thereof of the castesystem.

"And do not turn your face away from people in contempt nor go about in the land exulting over much : Surely Allah does not love any self conceited boaster " Al Quran 21 : Sure Luqman : (8).

It is not only interesting, but also an important event of splitting, isolation and organisation of communities for mutual benefit of the speculated superiors. It is the story of Brahman teaching, which was most magnetic in character and penetrating in nature. It furnishes a thrilling chapter to the history. Caste system created a common bond, which no secular authority could provide elsewhere. It inter-linked diverse beliefs, evolved constant pattern and laid foundation stone of a valiant nation.

The earliest inhabitants of Northern India, were presumably of Dravidian stock. Aryans invaded the subcontinent from South-Eastern Asia *via* Kabul some 3,000 years before Christ and after perpetual strife subjugated the aborigines. The conquerers either absorbed some of the over-throws within themselves or drove them to the far flung forests. This was the time, when the two alien races virtually continued merging. The absorption and assimilation of the aborigines within Aryan fold was mainly accomplished between the seventh and eleventh centuries A.D. It is strongly contemplated that the process continued thereafter as a consequence of final conquests.

The chronicals and other documents of this period are fragmentary and meagre, lending little clue to distinguish between facts and fictions. The scholars, who determined the cardinal facts of prehistoric Indian subcontinent, assign 650 B. C. to these events. For an orthodox Hindu, however, the Indian history begins from 300 B. C. when the constitution of Aryans and Dravidians Society was tribal in character. At this time Aryans had an open class system. Every one was both a soldier and a husband man. The seed of taboo was either not sown or did not sprout by then. Everyone, irrespective of creed and colour was sacred and inviolable. The word *superior caste* did not exist and no one in the community was above the next below.

The Aryans of this period were proud of their ancestry, fair complexion and superior civilization. They were custodians of sacred books and lores. They were slaves of traditions and myths. This attitude ultimately did not only give rise to the creation of castes and creeds but also gave birth to "colour complex". Although hereditary vocations were conspicuous by their absence, yet three classes, *viz.*, *Kashatriya* (warriors, rulers), *Brahmans* (priests and men of letters) and *Vaisya* (commonality) were fully recognized in form but not in practice. Anyone by choice, wisdom or by prowess or by favour of rulers could aspire to rise above his class. The ancient Aryans were exogamous and allowed their men to marry women of a lower class. The reverse, however, was not known. By recognising castes, the Aryans may be blamed to have introduced a solvent in the tribe. The process truly carved a tradition for the separation of lowest from the aristocracy. It was the time when the aborigines were permitted to associate with Aryans and were placed in another distinct class *Sudras*.

The *Rigveda* furnishes tolerably detailed material to show that Aryans were split up in many tribes. They were conscious of a unity of race and religion. In current affairs they arrogantly distinguished themselves Aryans (kinsman) in contrast to aborigines, whom they named as *Dasyus* or *Dasas* (fiends). The *Dasyus* also meant *Krishnas* (black-skinned) where as Aryans stood for a fair-coloured race.

After several hundred years of incursion and final conquest, the Aryans secured unchallenged political supremacy in North-West India and seriously contemplated to move further east. It was the time when the society had already become more complex with conspicuous tendency to hereditary vocation. Necessity created conditions to recognise

division of labour. As a consequence creation of permanent class of fighters was strongly felt. It was not only to watch, ward and consolidate the conquered territory, but also for future expansions of the holdings. This necessity warranted to absolve agricultural and industrial part of the population of other duties. All out efforts were therefore made to give full facilities to people to follow their specialised pursuits uninterrupted. This was another step to create castes and creeds.

The devotion to gods and goddesses was entrusted to priests. With the passage of time, this class made the religious ceremonies tough, complex and beyond common man's apprehension. It became a specialised pursuit, enough to create a whole time priest-craft and laid foundation for an aristocracy and class supremacy in the Aryans. The vedic religion became their exclusive possession. The Vagabrant Brahmins or ascetics claimed to possess a mythical geneology of all clans. It was another tool which carved out the twice borns and separated them from those who stood on the first step of the ladder.

The priests established temples and monastries for the repose of statues and effigies of dieties. They prayed day in and day out before the gods and goddesses for temporal blessings. With the passage of time, they very successfully inculcated the idea that it was their mighty torrent of prayers alone which could convey the human soul safely across the seemingly shoreless ocean of existence. By virtue of being custodians of religious ceremonies, they posed to have direct approach to heavenly powers and therefore responsible for the salvation of human race. These ardent worshipers, under the guidance of kings attained an un-precedental monopoly and later enjoyed an unrivalled dominant status of a sacerdotal caste. They gained an ascendancy over Kshatrya rulers and thenceforth divided the society into either pures or impures. The four-fold division then onward became more manifest. This attitude did not only distinguish but transformed classes into castes and social strata. Each class became separated by impassible barriers interpreted by heredity. Inter-marriages were prohibited and eating together was banned. The prohibition laws were rigid, most defensive and tenable in character, and worked like a strong rampart round the caste of Hindoo religion.

The superior cult of Aryans and isolated, servile and obsequious status of conquered was fully recognized in the then constitution. When the sacerdotal class raised itself to a position of sanctity and inviolability, the rest of the Aryans exalted themselves over and above the Dasas and proceeded to organise themselves on the principal of exclusiveness. The upper classes did not only separate themselves from the lowers, but the process also repeated itself until the lowest were left out and ultimately reduced to the condition of serfs. The fourth class of artisans *Sudras* at the bottom of the list and below the *Vaisya* was established.

SPECIALISED SERVANTS

The people, who fell into the class of *Sudras*, consisted of the conquered aboriginals, who had become associated with the Aryans society. Now there occurred a conspicuous economic independence between the high and low classes. Some of the *Sudras* became specialised domestic servants and others kept the houses of the upper classes well broomed, well dusted and well drained.

For a long time a clump of bushes or a grove of trees satisfied the urge of privacy during defaecation. With the aggregation of population in cities and towns, necessity of

of latrines was felt and established. This required frequent removal of the human waste and privy contents to the fields or manure pits. The job specialisation tendency of the time created a *bona fide* class of scavengers. This class ultimately became homogenous and unique and an essential part of our growing society. A "broom down" strike in our living memory bears testimony to their importance in the set up of our society. It has always remained a strongest challenge to the Municipal administration, responsible to maintain sanitation in cities.

It will not be out of place to mention that the indigenous population, now represented by Sudras, had a closed system. During the vedic period they were strongly antagonistic towards the Aryans. In matrimonial matters they were strongly endogenous. To our mind the untouchability was mutual and was instrumental in establishing classification according to occupation and function.

The society of the subcontinent owes a sense of gratitude to this occupation because in the absence of proper methods of disposal of faecal matter, sanitation standards could not be secured, even to the level available now, without this class of people.

GENERAL CONSIDERATIONS

In addition to climatic considerations, the distribution of parasites depends, to a very great extent on the distribution of their hosts. The physical surroundings of an area also play an important role in restricting the distribution of the loath-some creatures. It is also true that moisture, availability of aquatic medium, warmth and shade limit growth of parasites during free-living phase and may restrict infection rate in a community. Customs, habits and community practices may proportionally reduce or increase the incidence of a parasite in two different sections of the same population. A parasite may not be of any Public Health significance in those, who do not come in contact with the infective stage of the parasite but the members of the same community who are within the beat or source of contamination may have a high rate of infection.

The adaptation of the parasite to a host has gradually developed over a long period of years. All members of the host-species are usually equally susceptible to the infection with the difference that the communities, who are associated with the infection since time immemorial are comparatively better adapted to the parasite concerned than those in which the infection is of recent origin.

Age and racial resistance or even immunity, due to light infection acquired early in life, is considered to be likely by the present-day parasitologists. The scavenger class is handling dust, dirt and dung, meddling with mud, muck and manure and carrying sweepings out (like most of the Indo-Pakistan mothers) and is coming in direct and closer contact with some parasites since the time the Indo-Pakistan Society evolved the castes, creeds and classes. Although we know that human excreta, is undoubtedly most potential source of human infection with protozoal and helminthic parasites, yet we are not in a position to make a dogmatic statement concerning the level of infection in this community. We also do not know if this special community, which has been subjected to some infections or the infection assumes a mild chronic form. The present study was planned to fulfil this desideratum. If this study helps to provide us answers to some of the questions in parasitology, we will consider it a modest achievement and if it induces some healthy criticism, we will deem it to have served another useful purpose.

The Lahore City Corporation—Lahore is situated in $31^{\circ}=35'$ North and $72^{\circ}=20'$ East, on the left bank of the River Ravi. The native city stands high on the debris of ages. The portion of the city outside the walls once consisted of numerous thickly inhabited suburbs. These abadis now form the major part of the modern Lahore but part still maintains the fine rural outlook.

The northern and western part of the city are low lying and usually inundated during floods. The upward portion is irrigated by the perennial Upper Bari Doab Canal. The major production of vegetables is achieved by well irrigation. It is also supplemented by sewage water.

Being an important commercial centre of the country, Lahore, is connected both by rail and roads with all the important cities of the country. A net work of metalled roads and Kacha pathways connect it with important towns of the district. A number of ferries on the rivers, Sutlej and Ravi, are also source of trade connections.

Trades of useful character have largely increased in Lahore during recent years. There are now a number of new factories. Being the headquarters of provincial Government Lahore contains the principal offices and educational institutions. The number of hands employed to run both the government machinery and the private firms is large. The movement of people from one or other part of the country to this town is extensive. If one from a far flung region visits it on business, the other comes for sight seeing. Lahore has not only remained a grand resort of people of all nations, but also remained a fine market for all types of products. There is lot of work of all descriptions ranging from beggary on wards in this town. The office of the Employment Exchange attracts job seekers of varied definitions to come to Lahore for their share of bread and butter. In this zeal of service, it also kept on bringing in new strains and new forms of human parasites. To quote an example, hook-worm cases continued pouring in unchecked from and beyond Sialkot district since long. Hospitality of Lahorites has now become proverbial.

Lahore retains many splendid memorials of Mughal period. It is a magnificent city of gardens and a great attraction for lovers of beauty. Lahore is a place of antiquity. It also remained a centre of religious teachings, resort of Ecclesiastics, mystics, saints and soofis and numerous mendicants. Due to these attractions, Lahore has always more of the guests than hosts.

Lahorites are of very social nature, inquisitive and ardent seekers of truth and knowledge. Their relationship is spread far and wide in the province, warranting frequent movements from place to place to maintain mutual connections and kinship. They rigidly observe the pithy saying:

**Relatives are those who meet (1),*

Wells are those which flow, (2),

Fields are those which are tilled (3), and

Paths are those which are trod (4)

-
- *1. *Saakh mildian de*—Relative mightier is he, who runs cart wheels round and treads the gravel path in heat, just you to meet.
- *2. *Khu wag-diyande*—Well it is, which goes round and round, to produce proud melody on every tune and bathes each blade in water sheet.
- *3. *Khet wahndiyande*—Fair fields of corn, oat, wheat and barley grow there, where the farmer runs plough-share, broadcasts seed, folds his arms and takes ease.
- *4. *Rah chaldiyan de*—Path it is, where one stamps, strolls and loiters, to enlighten or to give form and flavour or tries and tries again to trim and make his countrymen neat.

Indiscriminate movements help the intestinal parasites to spread from endemic areas to other places with ease. As quoted above, the hookworm disease was formerly confined to submountainous regions, but now the parasite is as common in Lahore as it is in some parts of Sialkot (Ahmad 1959).

TABLE I

Shows incidence of Hookworm infection in three areas of West Pakistan investigated during 1956-59

Year	SIALKOT			LAHORE			HAZRO		
	No. of persons examined	No. of persons positive	Per cent +ve	No. of persons examined	No. of persons +ve	Per cent +ve	No. of persons examined	No. of persons +ve	Per cent +ve
1956-57	4,641	1,003	21.60	2,578	1,626	12.98	..	..	..
1956-59	11,562	2,990	25.86	5,153	909	17.64	5,053	489	8.65

Meteorology—

The meteorological factors are known to effect both the spread and elimination of intestinal parasites in a community. The rainfall, temperature and humidity are also taken limiting factors in establishing definite seasonal cycle, and epidemic of diarrhoeas and dysenteries.

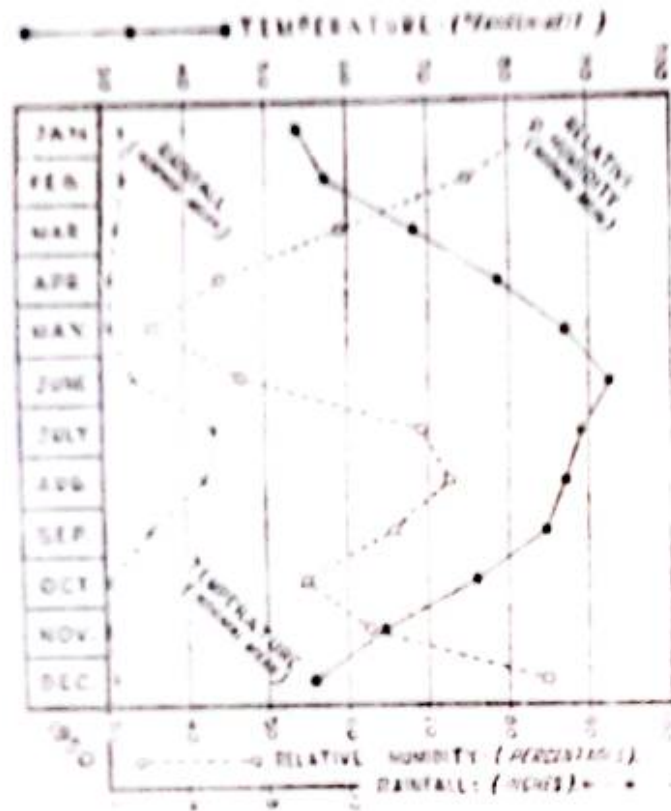
The climate of Lahore does not differ from that of the Punjab Plains in general. From Public Health point of view, the summer in Lahore commences from April and continues through June. The first fortnight of April may be fairly wet with wide spread thunder storms. It may become abnormally hot in May and June. There may be some rains in the first week of May but later the weather has the tendency to become dry and hot. As the warm season progresses, the day's temperature steadily rises and mean maximum temperature may oscillate between 105—117° F. The highest peak remains unabated for not more than two days at a stretch in May. The usual mean daily temperature, however, ranges between 80—100° F. The rains during this part of the year are scanty and scarce. The east-ward passage of the western disturbances pass over Lahore during June, when there may be some showers. The dust raising winds are special features of these months. The dust storms are boon in disguise for winnowing of spring crops (Rabbi) but also a message of weal and woe to the public health workers as they may play an important role in the distribution of helminthic eggs and protozoan cysts from one place to the other. The dust storms are known to account for the high incidence of giant round worm in places which are well kept and well maintained. Moderate activities of monsoons commence in

July and continue through August. Moderate to heavy down pour may be recorded during the first week of August. The weather may remain dry thereafter except occasional mild showers. In September there may be copious amount of rainfall. Heavy rains in catchment area during this period may engulf Rachna Doab in floods. From middle of September to middle of November, the remains of monsoons push Lahore into winter season. The month of November is most pleasant. The real winter sets in by the middle of December and continues through March. During the month of December, Lahore may experience severe cold wave when its temperature may be below freezing point. The low temperature is usually associated with wide spread frost. Winter rains are also one of the characteristics of Lahore and one-third of the total rains are received during this season. Down pour is usually copious in January and March. Lahorites also receive their share of cold spells and experience the fangs of the chill during this period. Considerably low temperature and frosty conditions occur in February. In some years, there may be severe hail-storm in March. For several days the weather remains dry. An active western disturbance may cause fairly wide spread rains. In the wake of this disturbance, a cold wave may advance and bring down night temperature below freezing point and give a set back to the summer season ahead.

TABLE II

Showing the range of monthly mean temperature (Fahrenheit), Relative humidity (per cent) and rainfall (inches) of Lahore

Month	MEAN TEMPERATURE		1962	MEAN RELATIVE HUMIDITY		RAINFALL	
	Monthly Range			Monthly Range	1962	Monthly Range	1962
	Maximum	Minimum					
January	62.9—70.4	40.0—56.3	54.9	88—94	63.0	0.35—3.81	1.04
February	66.7—79.1	42.8—49.8	58.3	70—86	62.1	0.00—1.03	0.97
March	78.7—84.5	55.0—57.7	67.9	57—77	46.1	0.33—2.50	0.79
April	87.9—99.6	67.3—70.0	78.8	43—62	33.8	0.01—1.58	0.57
May	96.6—104.4	70.8—74.6	87.9	33—48	28.9	0.00—0.80	0.59
June	104.8—108.3	78.2—82.7	92.4	43—53	42.4	0.23—2.13	1.64
July	98.4—101.7	80.4—81.7	89.8	62—79	60.7	2.57—8.16	5.45
August	93.7—97.3	78.8—80.3	87.8	75—83	62.4	2.46—11.49	5.15
September	90.2—98.6	72.5—78.8	85.2	60—83	54.5	0.44—19.4	2.20
October	83.8—92.0	62.8—68.3	76.0	62—78	46.5	0.00—0.95	0.24
November	76.8—81.8	48.8—54.0	65.1	69—89	54.0	0.00—11.4	0.10
December	67.7—71.8	39.7—46.9	56.4	83—95	65.5	0.00—2.81	0.47



GRAPH SHOWING NORMAL TEMPERATURE (deg. fahrenheit), RELATIVE HUMIDITY (percentages) AND RAINFALL (inches) OF LAHORE 1950.

Influence of climatic factors on the incidence of intestinal parasites is the manifestation of combined effect of suitable soil, compatible agricultural practices, sanitation and habits of the people. It is the sum total of optimum environmental conditions which is responsible for large number of people in tropics and subtropics than in temperate region with the intestinal parasites. It is commonly observed that the infection leading to clinical conditions occur in great number in summer than in winter. In this connection the absolute humidity and atmospheric temperature of the place are important factors. Deficient winter and spring rainfall tend to influence both temperature and humidity and thereby raises or lowers the infection rate. It warrants to investigate the highest point and lowest point of infection in different parts of a year. We need to know if these seasonal changes actually cause abrupt rise and steep fall in the number of cases. This information will not only explain the annual periodicity but will also help in a parasite eradication programme.

People of Lahore :

In the last decade there was a marked increase in the population of Lahore. The density, according to recent statistics is 10,133 persons per square mile. The increase largely occurred due to influx of refugees from the east. Most of agricultural tribes have now taken abode in the metropolis and changed their parental profession. This mass movement of the people did not increase congestion alone but also played an important role in the spread of intestinal parasites. The refugees were obliged to leave behind immovable property back home and the customs check posts did not allow them movable valuables but the heavy load of intestinal parasites were allowed to pass unchecked from beyond the border to West Pakistan. As far as consensus of opinion goes, some of the helminthic parasites either were unknown or occurred in "not detectable" number in Lahore and its suburbs before partition. Today the incidence of hookworm and round worm infection in Lahore is considerable (Statement VII). Favourable conditions of temperature and humidity together with agricultural practices lent a helping hand to the intestinal parasites to rehabilitate with ease in this area. Today the agricultural land around the city is highly contaminated.

Soil of Lahore :

The soil is an organ of digestion and respiration of mother earth. Like liver, it neutralises and destroys toxic substances returned to it by plants and animals. In the eyes of a parasitologist it is teaming with a variety of primitive form of animals and swarming with worms, insects, rodents and many other animals. Soil is also natural reservoir of our water supply. Adding of human faeces to the soil amounts to sowing the seeds of intestinal parasites. The polluted soil endangers the water supply. Occasionally, through the filth flies, the harmful organisms are carried back to human food. The soil provides facilities to some of the intestinal parasites to pass part of their life cycle in it before passing over to the new host. The development of worms occurs best in moist sandy soils. Low lying alluvial soils also provide excellent conditions for the development and embryonation of intestinal parasites.

Lahore is situated in an alluvial plain. The soil is for the most part is sandy-loam in character and varies in fertility according to the amount of sand it contains. Formerly a wilderness, it has now been turned by Bari Doab Canal into a fertile and prosperous tract. Indigenous flora is rare, except on the waste lands where miles of scrub along the river bank exists. Wheat is chief spring crop. Gram and barley are also grown. In autumn harvest cotton, maize, rice and millets occur in the order of importance given. The vegetables are extensively grown in the land flanking the city. The cultivation depends largely on wells, water lifts, inundation channels, canal irrigation and at places supplemented by sewage water. The comprehensive cropping scheme adds copious amount of organic matter and increases moisture retaining quality of the Lahore soils. The lands remain under cultivation almost throughout the year. Irrigation with shallow Persian wells does not drench but keep the soil moist. Extensive use of night soil as chief fertilizer for intensive vegetable gardening, extensive fodder raising and tobacco growing works like seeding of intestinal parasites. The sewage water, which is exclusively used in vegetable growing, is concentrated emulsion, containing teeming millions of parasitic protozoan cysts and helminthic eggs.

The patches of green land, serve as lungs of the City Corporation of Lahore. The promiscuous use of night-soil has converted these fields into hatcheries for intestinal parasites and turned them into source of contamination. It amounts to adding of fuel to the fire. The lands of Lahore provide all the favourable conditions of warmth, moisture and shade for the developing helminthic eggs. The protozoan cysts and infective stages of worms remain viable in these environments for weeks and months.

In one of the surveys, carried out by the D.P.H. students of this Institute in 1956, the percentage of hookworm infestation in representative soil sample from within Corporation of the City of Lahore was found to vary from 9.95-15.47 (Choudhry 1956, Nasrullah Jan 1956 and Khan, 1956).

Something startles me where I thought I was safest;
I withdraw from the still woods I loved;
I will not go now on the pastures to walk;
I will not strip the clothes from my body to meet my lover the sea;
I will not touch my flesh to the earth, as to other flesh, to renew me.
Walt Whitman this comports

Water Supply of Lahore—

وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ ط

In Lahore, we derive our water supply from Percolating wells, Deep tube-wells, Shallow insanitary wells and Norton's Abyssinian tube wells (hand pumps).

There are nearly 30 percolating wells situated in Badami Bagh from where water is pumped into a high service tank reservoir (in Lange Mandi) and thence distributed mostly to the walled city. Although these wells are covered and necessary precautions taken to prevent their pollution, yet being sunk in a low lying area, they are likely to be contaminated by flood, overflow and seepage water from the River Ravi.

*We have made of water everything living (Al Quran : 27, Al Ambiya : 30).

To supplement the growing requirements of the population inside the walled city some Deep Tube-wells have also since been constructed. The rest of the city, for the most part, gets its water supply from the deep tube-wells. There are nearly 60 such wells but their yield is not sufficient to cope with the requirements of the areas they serve.

Quite a number of Shallow Insanitary Wells sunk some half a century back or earlier are still in use even in places where piped water supply has been provided. This is due to the fact, that the municipal water supply is inadequate and intermittent.

In the unplanned 'abadis' as well as in villages included in Lahore Corporation limits where water mains are out of reach, the population depends for their water needs upon insanitary wells and hand pumps.

Sanitation of Lahore:

There is no doubt that within the limits set by funds, an ever increasing effort is being made to improve sanitary conditions in Lahore. Work on the drainage and sewerage schemes may be seen in progress in one or the other part of the city at any time of the year. The benign Government has also provided an additional incentive for safe water supply to the people. However, the proper disposal of faecal matter yet remains a problem.

The races, which have not yet recognised civilization, and the tribes, which are still nomadic, move away from the excreta, while those who are civilized remove all waste away from their habitation. According to this definition, we are unable to draw a line of demarcation between rural, semi rural, semi urban and urban communities in this country.

The largest number of houses here have surface privies and are mostly used by women, "stay-at-home" folks, invalids and some children. Most of the male adults, specially living on the periphery of the town, still prefer to go out in the open. The toddlers and children, however, practice promiscuous defecation in the street drains. The number of septic tanks privies are rare and may be counted on finger tips.

Although the hygienic considerations warrant the choice of a human waste disposal method, which may involve minimum public health dangers, eliminate all possible discomfort and prevent nuisance, yet it lays stress that the sanitary standards should be obtained with least expense to the people. In a country like ours, where human excreta is gold amongst fertilisers, we can't adopt or dare suggest a method which may interfere with its economic importance. The aesthetics demand that manure dumping depot should be away from living quarters so that the house-fly nuisance does not increase, the manure heaps do not present unsightly look and create offensive atmosphere either.

The common man and the community needs to know the inherent dangers involved in the improper disposal of faecal matter.

We need to know that the community's health comes on the top of manurial value of the human excreta. There is still greater need for evolving a satisfactory privy, which may be constructed economically by our people. Most of the privies at present in use in the country, of course provide privacy rather than sanitation. In cities, where the dwellings are concentrated and huddled together, removal of night-soil from door to door involves a hazard which may better be felt than spoken. We have to convince the unconvinced that insanitary conditions involve much heavier economic strain than the financial burden involved in the construction of a good privy.

Flush type of toilets are almost unknown in the town.

The kitchen refuse, house sweepings and the night-soil is daily removed from the houses and dumped in filth depots, located either in front or close to the house. From the filth depots the whole mass is removed to the outside either in open carts or trucks. It is both hideous and dirty method.

Sewage disposal in Lahore

The system of sewage disposal in Lahore is not satisfactory. There is a net work of open sewerage draining away sewage from various parts of the city which discharge their contents into several main sewage channels. These are led to various disposal works at the outskirts of the city where after screening out large solid particles, the sewage is sold out to the cultivators through the same system or irrigation channels as is practised by the Government Irrigation Department. Practically all the cultivated farms along Ravi Road, Shalamar Gardens, Samanabad, Sanda, Rajgarh and other areas within a radius of a few miles from the walled city, are irrigated by this untreated sewage. Mainly the vegetable crops are grown all the year round on these fields. The bulk of vegetable supply of Lahore is derived from this sewage farming. Some of the vegetables like radish, carrots, turnips, water-melons, cucumber, salad, tomatoes, etc., are eaten raw and without being subjected to the proper washing or disinfection. A good deal of intensive research yet remains to be done to determine the role of these sewage irrigated farms in the dissemination of parasitic infections amongst the consumers.

Residential areas of Conservancy Staff

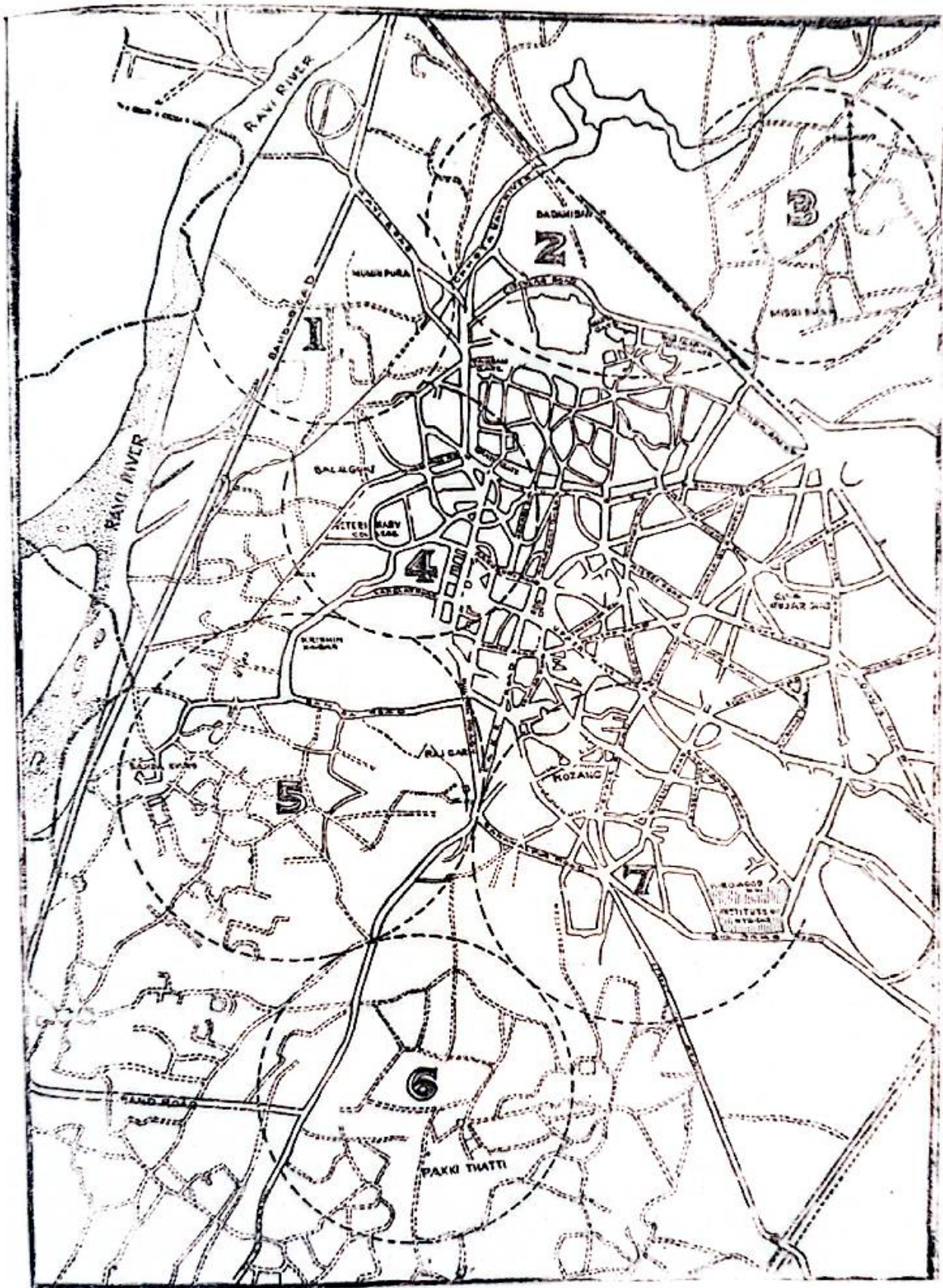
Here, a note on areas, from where the conservancy staff of the corporation usually originate will be useful.

1. *Ravi Road, Bilal Ganj and Krishan Nagar Area.*—This area extends from Orphanage on Multan Road (Milestone 3.3 from District Courts) to the Ravi Bridge. The whole belt is irrigated by untreated sewage from Lahore city. It is interspread with most insanitary type of small abadis, the inhabitants of which are constantly exposed to parasitic infections of the intestines. The Bilal Ganj and Krishan Nagar colonies lie on the fringe of sewage farming, towards the city. These are the largest abadis. Krishan Nagar is quasi-modern and well planned while Bilal Ganj and Sanda sub-areas have sprung up without any plan. The bulk of fresh vegetable supply is mostly derived from this area.

2. *Badami Bagh Area.*—This segment of the city is comparatively low lying and subject to flooding during rainy season. It is mostly factory area, with scattered colonies for the accommodation of workers. These colonies are most ill planned and possess very poor environmental sanitation.

3. *Misri Shah Area.*—Misri Sah abadi is one of the oldest of Lahore Slums and has always remained biggest plague spot. It is situated on a low lying land. A small drizzle in the town may cause flood condition in this locality. The housing conditions are nothing but deplorable. There is marked congestion in this area. Comparatively high sub-soil water results in keeping the houses damp almost all the year round. This locality still presents a picture of a typical slum area.

Pakki Thalli.—It is a village due east of Lahore-Multan Road at a distance of about one mile. The land around it is agricultural and is irrigated mostly by persian wells.



MAP OF LAHORE SHOWING AREAS FROM WHERE CCL
CONSERVANCY STAFF COMES

The fields serve the purpose of natural privies for defecation of village folks and also for all the servants and poor-class people of the Samanabad area. To raise fodder crops quickly, the farmers of this area extensively use raw manure consisting of human and animal excreta and house and street sweepings. These environments, in addition to the distribution of intestinal parasites, also provide optimum conditions for fly breeding. During fly-breeding season this area therefore, swarms heavily with the filth flies.

Mozang And Adjoining Areas.—This is one of the oldest satellite of Lahore City and presents a usual picture of an unplanned town. Conservancy system is mostly of old type. The method of removal and disposal of filth and night soil is most deplorable.

Housing Conditions in Lahore.—In the walled city of Lahore in particular, and practically in all old habitations in general, the housing conditions are highly insanitary. Almost all the houses are constructed back-to-back, all multi-storied and about narrow lanes and bye-lanes. Since independence, there has been mass migration of population from across the border settling mostly in big cities like Lahore and together with rapid upward trend towards industrialisation and migration of population from villages, the population of Lahore has grown several times whereas the pace of planned construction of new houses has been far too slow for various reasons. This has resulted in too much overcrowding in the already congested localities. There are only limited number of localities like civil lines, Government and railway colonies and some ultra modern colonies like Gulberg which have been constructed by Lahore Improvement Trust. These colonies are inhabited by very well-to-do cross-section of the population. In these parts of the city, the housing conditions are comparatively satisfactory. There is, however, an unauthorised mushroom growth of innumerable new colonies, which have been built without due regard to the provision of proper roads, drainage and other essential sanitary requirements. Such colonies or slum areas are for the most part concentrated along the River Ravi, and its tributary called *Chhotta Ravi*, Shad-Pagh, Misri Shah, Ghore Shah, Baghbanpura, Mughalpura and a large number of other abadies on northern side of the main railway Line may be cited as example.

The conservancy staff involved in the present investigations mainly lived in areas shown in the map.

Diarrhoea and Dysentery.—The water-borne outbreaks of diarrhoeas and dysenteries are common in places where safe water-supply is unknown. Errors in treatment of water and subsequent delivery of this water to the consumer may also lead to the outbreaks of enterogastric troubles.

Apparently water is seriously considered as a vehicle for the ingestion of protozoan cysts. In Lahore, where gross faecal contamination of the water goes without saying, transmission of *amoebiasis* and *giardiasis* may be slow but is sure. In the city, the supply line frequently runs along the drains and is mostly submerged in sewage water. These pipes, more than often, leak and are intermittently under negative pressure and therefore likely supply a direct faecal contamination in the drinking water.

In various hospitals of Lahore, the annual number of patients treated for dysenteries is more or less equal to malaria. Amoebic dysentery cases are more or less half the number of cases of bacillary dysentery, and, diarrhoea cases are equal to the combined amoebic and bacillary cases. The ratio of death per 10,000 of population in Lahore may be 0.45.

TABLE III

Showing number of patients treated for amoebic and bacillary dysenteries and for diarrhoeas in West Pakistan hospitals and dispensaries during 1953—59.

	1953	1954	1955	1956	1957	1958	1959
Amoebic dysentery cases	92,121	107,727	153,913	130,922	187,204	198,797	210,757
Deaths ..	105	107	114	151	213	78	120
Bacillary dysentery	219,063	292,586	274,288	334,464	311,981	381,984	379,740
Deaths ..	97	136	108	95	176	164	144
Diarrhoea cases ..	465,452	336,513	498,139	575,977	605,805	1,160,991	891,244
Deaths ..	132	144	97	107	46	150	218

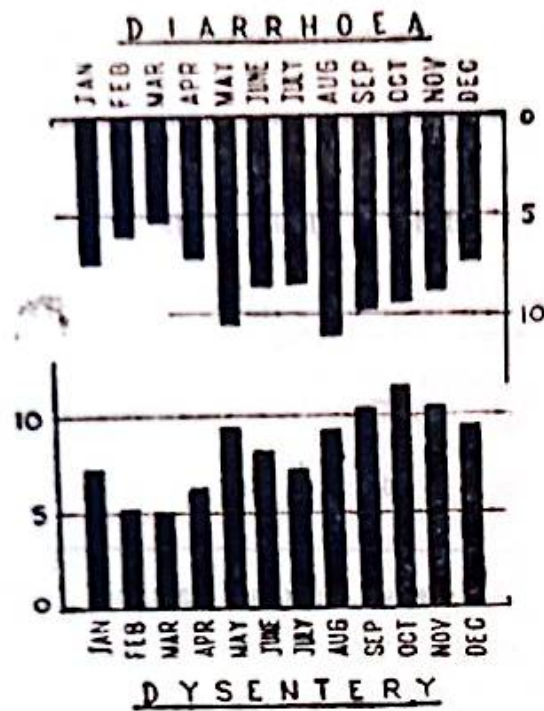
The annual number of deaths reported for the two causes during dicimium 1941—1950 in former Punjab present the following picture.

TABLE IV

Giving annual deaths due to dysenteries and diarrhoeas during dicimium 1941—1950 in former Punjab together with other relevant information

	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Annual deaths in former Punjab	5,123	7,270	7,167	5,160	3,123	3,363	6,099	6,832	5,161	4,193
Percentages of death for all cases	during the period 1920—1948						..	1.65	1.58	1.14
Death rate for the district ..	during the quinquennium 1945-48						..	19.4	18.2	19.8
Annual death rate in Lahore ..	during the quinquennium 1945—1948						..	0.53	0.26	0.21

Diarrhoeas and dysenteries cases also fluctuate during different parts of the year. Deaths due to these causes recorded in Lahore durig 1950 are given below. A perusal of these figures will show, that the highest number of deaths due to these two causes occurred during the period of May and September. The mean ratio of deaths per 1,000 population was found to be 0.25. In males the mean ratio (0.28) was higher than in females (0.25). When the rural circles and other towns are taken, the two rates vary considerably. This variation from month to month may be due to flies, cockroaches and



GRAPH SHOWING NUMBER
OF DIARRHOEA & DYSENTERY
CASES IN LAHORE DURING
DIFFERENT MONTHS IN
1950

TABLE V

Showing deaths registered for dysenteries and diarrhoeas in Lahore District during 1950.

January February March April May June July August September October November December	TOTAL			RATIO OF DEATH PER 1,000 OF POPULATION			Mean ratio of death per 1000, population of the province
	m.	r.	Total	m.	f.	Total	
25 21 22 24 67 71 54 74 42 26 51 31	298	210	508	0.28	0.25	0.26	0.58

	Deaths	Ratio per mille	Deaths	Ratio per mille
Lahore town	269	0.32	117	0.14
Chunnian	2	0.18	..	..
Qasur	20	0.32	23	0.37
Pattoki	1	0.10	..	..
Rural circle of Lahore	55	0.08	21	..

other insects which abound in Lahore houses during this period. It is a controversial point and needs to be confirmed because the cases to us do not appear to be strictly coincidental with an increased fly population.

In rural dispensaries, owing to the difficulty of making differential diagnoses, the amoebic and bacillary dysenteries are not properly classified. In some cases even all dysenteries and diarrhoeas are usually classified together. However, according to uniform clinical opinion, the rate per mile in rural areas, is usually less than urban areas.

TABLE VI

SHOWING DEATHS REGISTERED FOR DYSENTERIES AND DIARRHOEAS IN RURAL DISPENSARIES

January	February	March	April	May	June	July	August	Septem- ber	October	Novem- ber	Decem- ber
813	643	476	725	1,181	1,153	897	1,058	972	654	852	754

From these figures it appears that the maximum cases in rural areas occur during the monsoon period while, the lowest incidence of dysenteries and diarrhoeas occurs during the drier part of the year. Although these figures are usually based on clinical diagnosis and are not helpful to the laboratory man yet one gets some idea of the relative prevalence of amoebic dysenteries.

THE INTESTINAL PARASITES

Host-parasite Relationship

The human race is about five thousands years old and several animal parasites got associated with the race a little before the dawn of civilisation. This association has continued to the present day and without any shadow of doubt may continue as long as human race endures but of course in a modified way in some cases.

Those, who have devoted some thought and study on human parasites, may have a vivid idea that the ways, in which the marked, masked and minute parasites affect the so called 'superior caste' of the vast creation of God, are various and varied. The parasitologist may not also miss to mark that there is always a tremendous and relative degree of pathogenicity due to the on slaughts of the guest (*Parasite*) on the host (*victim*).

Some of the animal parasites found in human alimentary canal are most important etiological agents of human diseases. The moment a parasite manages to get into the human system, the humoral and cellular reaction to the invasion awaken the defense mechanism. In early stages of invasion, the parasite actually raids to plunder than to conquer. During these exploitations, the parasites aim to over run the domain (appropriate residence) and subjugate the host without endangering its life as it is in the interest of its own security. This is the time when the host disputes every step of the invasion. The hostile incursions are continued persistently for centuries after centuries, incessantly from generation to generation and continuously in families to gain advantage over the host. A period of partial truce reaches where some members of the parasite species continue inflicting pain while another group chooses to make complete treaty and establishes partnership. The amoebic protozoa (*Entamoeba histolytica*) occurs in two distinct races, one race causes asymptomatic infection (infestation) while the other race, which has not reached an equilibrium with the host may cause serious disease conditions. Certain parasites successfully take up existence in those with lower threshold of resistance due to malnutrition or other causes. Moderately light infections usually pass on un-noticed in some. When the number of a particular parasite is restricted, the harm done or wear and tear caused is repaired before the appearance of symptoms. A heavier burden increases intestinal pathology and produces prodromal, objective, signs and subjective symptoms. The common colon amoeba (*Entamoeba coli*) is well adapted to its host. This appreciably compromising attitude towards the host providing housing facilities and ensuring food supply, develop after continuous association. The parasite becomes contented with the waste products and reduced to strictly commensal in practice. Although living at the expense of the host yet causing no damage. A parasite may fall under the category of *saprozootics* or *coprozootics*. The possibilities of the parasites—even most innocents—inducing allergic condition, are also not slight. The metabolites of the endoparasites and their elaborate secretions may also have deleterious effect on the host. Viewing the parasitic animals from all possible aspects, one may conclude that pathology and symptomatology varies widely not only from species to species but also within a species. A parasitologist must start work in an objective spirit and avoid all bias when surveying a community. Indications, contra-indication and behaviouristic pattern of the host should not be taken to tell the name of the parasite. The information does not say "it is" but what *it is likely to be*.

The main purpose of the survey is to know the real status of the parasites found in a community. Provide pre-requisite for the control and eradication of these animal parasites which are responsible for some serious clinical and public health problems and warrant immediate attention. Methodical finding of facts is a most important consideration before an effective line of action, is suggested, recommended or adopted.

Most of the public Health Administrators and social scientists have maintained that high incidence of animal parasites in the communities exist because those involved in the triad are either ignorant or indifferent, of the source of infection. The poor section of a community has comparatively high incidence than the well-to-do section because of living under poor sanitary environments. It reminds us of the old saying "*If poor die who lives.*" It is in the interest of high and mighty that the parasite index in the poor section of the community is brought to the lowest level. A good plan for community improvement warrants starting work from the first step of the ladder. A practical prophylaxis will not work well, if those who are exposed to infection and also hard hit are not involved in the programme. Preferential treatments do not have social repercussions alone but are also retributory of parasites. The neglected section of the community continues serving as a hatchery and the well cared for section continues getting its share of parasites unawares. All efforts made to check, eradicate or eliminate parasites are wasted in such cases and breed frustration.

During our routine stool examination, we have most commonly come across common round worm (*Ascaris lumbricoides*) eggs in the samples collected from elites living in ultra modern parts of Great Lahore, and holding very high rank in the superior civil services. The parasites in their relations to us, make no distinction between healthy, walthy and wise. The parasitologist also do not draw any line of demarkation between high and low. The man is a *sine qua non* for the existance of *Ascaris* worms. The worm is interested in securing entry through proper channel and behaves alike, both in those who live in ultra modern Gulberg and also in those who live in slum Ichhra. We advocate removal of plague-spots. Preach to awake and motivate to aesthete those who are in dire need of "awareness" in the words of Byron "*Woe to the conquering not to the conquered host.*"

Although the contact of a parasitic organism with man is purely a biological accident, yet he still remains more important than all the other animals as direct or indirect transmitter of animal parasites. Morbidity and mortality in low income groups is a vital loss. It is preventable. To build up stable economy of Lahore, the Lahorites must endeavour to safeguard the health of the man who lives in slums and works behind the plough. Cleaner Lahore is our target. Bulls-eye lies in "scrubbing of the scrub" and not "cleaning of the clean."

A WORD TO THE MICROSCOPIST

There are already a variety of laboratory methods and techniques in use in parasitological work. Rapid changes are also taking place in these laboratory procedures. The choice of a method out of many available, is an individual decision. Availability of material is usually the only convenience and consideration in the choice of the method in our country.

In our experience, it is not the method alone, but extensive practice and adequate confidence which bears fruit. The laboratory worker has to develop a very high level of patience and perseverance before claiming to be a faultless microscopist.

Although in parasitology "*to be uncertain is to be uncomfortable but to be certain is to be ridiculous*" yet one cannot afford to vouch for an observation unless and until one is not hundred per cent sure to have detected a particular parasitic form. Please accord us permission to pose a word of warning to the clinical laboratories in the country, who declare greater number of stools positive for amoebiasis daily than what we found during the last 15 years at the Institute of Hygiene and Preventive Medicine. May we quarrel with our technique or the set of our eyes or the fancy, our colleagues are enjoying outside. To us, a loose remark is a blunder of very great magnitude. To label a negative sample as positive is comparatively greater sin than to say negative to a doubtful case. We stand for repeated examinations, on several consecutive days for all the disputed cases.

The helminthic and protozoan infections of the intestinal tract are usually detected by faecal examination. In the presence of light infection, however, repeated examinations both by direct and concentration method must be employed. The technique of examination selected must be used as a laboratory exercise before it is adapted. It is a pilot project, in our opinion, which makes us wise.

Collection and handling of specimens and hints on the smear technique may be found in almost all the hand-books and manuals for laboratory workers. Brief instructions given below are some of the salient steps followed in coprological examination.

- (i) Collect stool samples into clean one ounce containers.
- (ii) Ensure that the sample collected are without admixture of urine.
- (iii) Examine specimens, as far as possible within two hours after evacuation, because sufficient decomposition advances and changes are caused thereafter, as to interfere in correct identification of the animal parasites.
- (iv) Specimens meant for determination of helminthic ova, may be preserved in 5 per cent phenol or little formaline. There are remote chances of detection of protozoan parasites in such stools. Two vial method, part preserved in a fixative of choice (MIF or PVA) and part without any fixative will enable the laboratory to recover all diagnostic stages of the parasites present in the stool sample. In this survey we could not manage to make use of this technique due to certain unavoidable circumstances.
- (v) Administer a suitable saline cathartic before stool collection to detect protozoal infections.
- (vi) Examine freshly passed stools, while still warm, to detect protozoal trophozoites (vegetative forms). Stool containers if kept in warm water trough (at 98° F) and slides examined on a warm stage, may give more satisfactory results. We should not forget that prolonged warming quickens disintegrations also.
- (vii) Smears spread uniformly and adhere perfectly on chemically clean slides.

Any thing approaching a complete analysis of stools is a waste of time for clinicians. A parasitologist, however, gives due importance both to microscopic and macroscopic examinations and insists that the differentiation of faecal contents may help in an indirect determination of protozoal and helminthic parasites involved.

THE FAECAL CONSTITUENTS

A normal stool is a mixture of water, bulk of undigested and indigestible remnants of the food ingested, mucous and other products of digestive and respiratory tract, products of decomposition, free living organisms and pseudo-parasites, eggs of parasites, helminths, cysts of parasitic protozoa, eggs of mites, larvae of helminths and insects, round worms, tape worm segments, trophozoites and droplets of oil. Faecal contaminants and artefacts are real headaches of a microscopist. These objects may resemble, more or less strikingly, one or the other genuine parasites and occasionally confuse even a seasoned eye and frequently puzzle the zealous in the beginning. It reminds us of Omar Khayam, who once said : *He who has a thousand friends has not a friend to spare, And he who has one enemy will meet him every where.* (Emerson).

Parasite	Faecal contaminants and artefacts involved
1. Adult helminths and proglottids.	Mucous casts from respiratory, urinary and intestinal tracts.
2. Round worms ..	Fibers from fruits and vegetables. Maggots of dipterous flies.
3. Helminthic eggs and Protozoal cysts.	Pollen grains, fungus spores, yeast cells, diatoms, stone cells, pasendrymatic cells of vegetables. Partly digested protein cells. Eggs of mites and worms. Air bubbles, droplets of oil. Myxosporidian and Microsporidian cysts ingested in infected animal tissue. Free living parasites-protozoal or accidentally ingested eggs of nematods.

Quantity of stool depends upon the amount of vegetables and roughages taken. Communities living on concentrates alone pass very meagre amount of faeces in 24-72 hours. However, in some cases the amount of stools may lead to a guess. For instance, in amoebic dysentery generally copious stools are passed while in bacillary dysentery stools are scanty.

Frequency—Also depends upon the diet. One stool after 3-4 days is not uncommon in those who take little roughages while in Indo-Pakistan 1-2 stools a day are normal.

Consistency—Depends upon diet, drug and disease. Soft and well formed stools are normal. Hard stools are passed in chronic constipation. Rocky hard, rounded scybalous masses indicate habitual constipation. An obstruction in the rectum will flatten the stool into plain-spherical, ribbons or tapes. Soft, musky or liquid stools may be either due to cathartics, indigestion or diarrhoeas.

* *Colour*—Of the stool is usually due to the presence of urobilin and its derivatives, activity of bacterias, types of food ingested and intake of drugs.

Colour	Diet or Drug	Remarks
1. Yellow or Golden Yellow.	(i) Unchanged bilirubin Milk diet in children and adults.	.. Unchanged bilirubin gives golden colour.
2. Light or dark brown.	(i) Urobilin (bacterial activity or reduction of bilirubin).	It is usually normal stool.
3. Haemotoxin red, dark, brown or Reddish or black.	(i) Iron tonic (ii) Bismuth salts (iii) Various fruits and vegetables.	.. (i) Source of haemorrhage near the rectum, bright red as in piles, prolaps rectam, rectal polypi and sometimes even cancer rectum, thyroid and tuberculosis ulceration and also non specific ulceration of the lower part of intestines. .. (ii) Diarrhoeal stools-haemorrhage may be high up in gastro-intestinal tract. (iii) Red streaks of blood—suspect lesion of rectum and anal region as in anal fissure, cancer rectum or colon, intestinal intussusception.
4. Dark gray, putty colour	(i) Cocoa, Chocolate	.. (i) Deficient bile, obstruction to out flow or it is deficient.

Colour	Diet or Drug	Remarks
5. Tarry black ..	..	(i) Viscid fluid; source of haemorrhage in stomach and upper part of intestinal tract, as in peptic ulcer, liver cirrhosis portal obstruction. Other conditions may be cancerous, tuberculous and non-specific ulcerative lesions of small intestines, amyloid disease of the lower part of intestine, mesenteric thrombosis or embolism and rarely ankylostomiasis.
6. Dark green or green	(i) various leafy vegetables.. (ii) Large doses of calomel. (iii) Biliverdin. (iv) Chromogenic bacteria.	Diarrhoea in childhood, septic in infantile diarrhoea.
7. Pale fatty and frothy stools.	(i) very fatty food, undigested	(i) Tuberculous peritonitis (interference with absorption of fat). (ii) Pancreatic disease, as tumour of the head of pancreas, coeliac diseases of children, Kwashiorkor disease, etc.

Odour—Indole and skatole are the chief products of decomposition imparting offensive smell to stools. Amount of meat in the diet and the activity of putrefactive bacteria impart more to this smell. Milk and vegetable diets lessen its strength. Sour smell in the infants stool is due to milk diet. Malignant ulceration in the rectum imparts foul stench to the stools.

Mucous—An irritated or inflamed gastrointestinal tract throws out large amount of mucous which does not mix well with the stools. Small and well mixed mucous in stools indicate lesions in small intestines. In dysentery, ileo-colitis and intussusception the stools are composed of mucous and steaks of blood. Steaks and ribbons of altered mucous occur in mucous colitis and membranous enteritis and are often mistaken for tape-worms. Brown or black jelly-like mass of mucous may also pass in acute cases of secretory neurosis.

Concretions—Are of rare occurrence, but may be looked for in all cases of obscure colicky abdominal pain for several successive days by passing through a gauze. Gallstones have faceted surfaces. Gall Stones have to be differentiated from others by detecting cholesterol and bile pigments in them.

Animal parasites—Of one kind or the other are always present in human stools. Man, in the eyes of parasitologists, is a moving zoological garden. He is a microcosm liberally supporting both microscopic and macroscopic small life and more often at his own expense. The microscopic forms occur, teeming million in numbers and of endless diversity of forms and structures. Nearly all the macroscopic parasites deposit enormous number of eggs, characteristic to each species. Eggs of some species, however, hatch during transit through the intestines and the larvae are defecated in stools. Ova of the beef tape worm (*Taenia saginata*) pass enclosed in the proglotids.

The bulk of stool consists of variety of microscopic elements. Each of these elements may be taken for one or the other intestinal parasite. A detailed study of these artefacts will help the microscopist in the identification of parasites and in avoidance of much of the errors.

Microscopic elements of normal faeces	Mistaken parasites
I—REMNANTS OF FOOD	
1. <i>Fruits and Vegetable fibers</i> —Are spiral structures with pits, dots or reticulate markings.	Fibres of banana (segmented and firm oval cells) may be confused for tape-worms. Long fibres of poorly masticated vegetables are mistaken for round worms.
2. <i>Vegetable cells</i> —cells with double contour and many may contain chlorophyll.	Vegetable cells are usually mistaken for ova of helminthic parasites.
3. <i>Vegetable hairs</i> —With homogenous and highly refractile wall with distinct central canal extending throughout the length.	Cells of oranges and other fruits are suggestive of pin worms. Usually mistaken for larvae of other helminthic parasites also.

Microscopic elements of normal faeces

Mistaken parasites

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| <p>4. <i>Starch granules</i>—Recognised by staining reaction and form.</p> <p>5. <i>Muscle fibers</i>—Are yellow, transversely striated cylinders with rather squarely broken ends. Eosine stained specimen stain out distinctly.</p> <p>6. <i>Fats</i>—Are either neutral fats, fatty acids and soaps. <i>Natural fats</i> appear as droplets or yellowish flakes. <i>Fatty acids</i> are flake-like or needle-like crystals. Soaps are well defined amorphous flakes as rounded masses.</p> <p>7. <i>Connective tissue</i>—Are colorless yellowish threads with poorly defined edges and indefinite longitudinal striations.</p> <p>8. <i>Elastic fibers</i>—Are more definite in outline, branched and anastomose.</p> | <p>May be confused with the ova of helminthic parasites.</p> <p>May be confused with the larvae or proglottids of tape worms.</p> <p>May be confused with the helminthic eggs.</p> <p>May be confused with roundworms.</p> <p>May be mistaken for pin-worm.</p> |
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II—BODY CELLS

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| <p>9. <i>Epithelial cells</i>—Are casted from digestive tract, if more in number indicate catarrhal inflammation of any part of the canal (colon).</p> <p>10. <i>Squamous cells</i>—Are derived from anal orifice and give no clue to site of lesion.</p> <p>11. <i>Pus corpuscles</i>—Indicate catarrhal and ulcerative condition of digestive tract, extent and severity of the lesion can be guessed from the number. Large number of Polymorphonuclear pus cells and macrophages occur in bacillary dysentery. These mononuclear phagocytic cells, having large vesicular nuclei, may also contain ingested leukocytes and erythrocytes.</p> <p>12. <i>Eosinophils</i>—In masses of mucous discharged in intestinal allergy.</p> <p>13. <i>Erythrocytes</i>—Originate from colon rectum or anus. RBCs. from small intestines get altered distorted/lysed/digested by the time voided in faeces.</p> | <p>Irregularly segmented strands of mucous may simulate tape worms.</p> <p>..</p> <p>Mononuclear macrophages are mistaken for Entamoebae. The character of nucleus will make distinction easy.</p> <p>...</p> |
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Microscopic elements of normal faeces	Mistaken parasites.
III—CRYSTALS 14. (i) Slender and needle-like-fatty acids and soaps. .. (ii) Triple phosphate crystals .. (iii) Octahedral crystals of Calcium oxalate after ingestion of certain vegetables. (iv) Charcot-Leyden crystals in ulcerative conditions of intestines. (iv) Distinguishing point between amoebic and bacillary dysentery exudates. (v) Hematoidin crystals are yellowish or brown and needle-like or rhombic. (v) hemorrhage into bowel.	
IV—BACTERIA 15. (i) Gram positive <i>Lactobacillus acidophilus</i> produce acid but not gas in infants. .. (ii) Gram-negative bacilli of colon bacillus group appear after weaning and present in adults. .. (iii) In pathologic conditions the bacterial flora changes.	
V—YEASTS AND MOULDS 16. Yeast cell chains are present in normal stools. Moulds consist of a large central-clear body, surrounded by narrow rim of cytoplasm and containing a number of refractile spots or nuclei.	
VI—ANIMAL PARASITES 17. <i>Coprozoic protozoa</i>—The free living protozoa generally get into the human body through contaminated food or contaminated stools after evacuation. Trophozoites of <i>Cercomonas</i> and <i>Bodo</i> species commonly encountered. The parasites continue moving for hours after the stools are cooled.	
Spores of moulds and yeast cells are mistaken for cysts of intestinal protozoa. Presence of <i>Contractile vacuoles</i> distinguish free living protozoa from parasitic species.	

Microscopic elements of normal faeces	Mistaken parasites.
18. <i>Larvae of insects</i>—Are occasionally found. The larvae either arise from eggs swallowed in contaminated food or are imbibed with the food. Maggots (Myiasis: flies), grubs (canthariasis: beetles) and caterpillars (scholechirosis: butterflies and moths).	Larvae may be mistaken for the helminths in early stages. Microscopic examination, however, dispels the error.
19. <i>Mites</i>—Are most catholic arthropods. <i>Glyciphagus prunorum</i> feed on organic matter. <i>Tyroglyphus</i> species relish cheese and cereals. Tarsonemids and Pediculoidis may cause gastro-enteritis, if accidentally ingested in food, these appear in stools.	Mites, ingested and temporarily lodged in the intestinal crypts, are voided in the faeces. Sac like unsegmented body fused with cephalothorax and typical rostrum will easily separate them from helminthic worms.

HELMINTHIC AND PROTOZOAL PARASITES IN HUMAN EXCRETA

There are a number of helminthic and protozoal parasites which have been recorded from the intestinal tract of man. Some of these parasites are specific to *Homo sapiens* and are lineal descendants of those which adapted themselves to their simian ancestors. The others are common in animals which are either closely associated or are domesticated by him. Still there are others which have adapted themselves slowly from a free-living to a parasitic existence.

The primitive, Glacial age hunters, became infected with tapeworms and giant round worm of wild oxen and wild boars. The human race changed its pattern of life from aborigines to pastoral and nomadic type of life and ultimately to the present day civilized communities. The society established village life. The agricultural practices and tilling methods helped parasites, viz., hook worms, round worms, Strongyloides and Trichocephalus to become endemic in agricultural communities. The animals, like house rats and dogs, did not lag behind in contributing their parasites to man. It is suspected that some of the human tape worms are obtained from these animals. Our knowledge of parasites is still incomplete as Copper has remarked *knowledge is proud that he has learned so much, Wisdom is humble that he knows no more.*

TENTATIVE KEYS FOR THE IDENTIFICATION OF COMMON HELMINTHS (EGGS, LARVAE, ADULTS) AND PROTOZOAS (CYSTS, TROPHOZOITES) FOUND IN THE HUMAN EXCRETA

*As some day it may happen, that a victim may be found,
I've got a little list, I've got a little list,
Of society offenders who might well be underground,
And who never would be missed—who never would be missed!*
(Sir W. S. Gilbert, *kakos* song)

During the present studies we encountered only eleven different forms of parasites. For the benefit of our laboratory workers, we give below a tentative key for the identification and determination of these forms.

I—HELMINTHIC EGGS

- 1(12) Eggs without operculum.
- 2(7) Eggs not embryonated or incompletely embryonated.
- 3(6) Fertile eggs ovoidal.
- 4(5) Shell thick and hyaline, usually provided with an outer mammilated, albuminoid covering which is characteristically bile-stained. Size 45-75 X 35-50 M. Infertile eggs elongately ovoid. Giant Intestinal Roundworm : *Ascaris lumbricoides* Linnaeus, 1758.
- 5(4) Shell thin and hyaline, never provided with mammilated, albuminoid covering.
Old World Hookworm—*Ancylostoma duodenale* (Dubini, 1843)
American Hookworm—*Necator americanus* (Stiles, 1902).
- 6(3) Eggs narrowly barrel-shaped; with dark brown, plug-like semi-opaque whitish swellings on each end. Size 50-54 X 22-23 M.—Common Human Whipworm—*Trichocephalus trichiurus* (Linnaeus, 1771)
- 7(2) Eggs are fully embryonated.
- 8(11) Eggs containing non-ciliated embryo (oncosphere) with 3 pairs of hooklets.
- 9(10) Egg shell thin, more-or-less hyaline. Poles with buttons or thickening from which filaments originate and run to both sides of the inner shell wall. More or less spherical, 30-47 M in diameter. Murine Tapeworm—*Hymenolepis nana* (von Siebold, 1852).
- 10(9) Eggs shell thick, brown and radially striated. More-or-less spherical, 30-43 M in diameter. Beef Tape worm—*Taenia saginata* Goeze, 1782.
- 11(8) Eggs containing a rhabditiiform larva. Narrowly ovoid, relatively thick-shelled, one side flattened or plain while broadly convex on the other. Size medium 50-60 X 20-30 M. Common Seatworm—*Enterobius vermicularis* (Linnaeus 1758).
- 12(1) Eggs with an operculum or lid. Fish Tapeworm—*Diphyllobothrium latum* (Linnaeus, 1758).

II—HELMINTHIC LARVAE

- 1(6) Moderately short larvae, Oesophagus muscular, with bulbar swellings.
- 2(5) Oesophagus with posterior bulbar swelling only.
- 3(4) Pre-oesophageal buccal chamber long and narrow. Rhabditiiform larvae of hookworms. Old World Hookworm—*Ancylostoma duodenale* (Dubini, 1843)
American Hookworm—*Necator americanus* (Stiles, 1902).
- 4(3) Pre-oesophageal buccal chamber very short and squat. Rhabditiiform larva of human threadworm—*Strongyloides stercoralis* (Bavay, 1876).
- 5(2) Oesophagus with a medium and a posterior bulbar swelling. Rhabditiiform larva of Japanese Thread-worm—*Rhabditis hominis* Kobayashi, 1914.
- 6(1) Elongate, narrow larvae. Oesophagus long and narrow.

- i(ii) Tail end briefly coiled. Filiform larva of Human Threadworm—*Strongyloides stercoralis* (Bavay, 1816).
- ii(i) Tail-end sharply pointed. Filiform larvae of Old World Hookworm—*Ancylostoma duodenale* (Dubini, 1843) and American Hookworm—*Necator americanus* (Stiles, 1902).

III HELMINTHIC ADULTS

- 1(12) Worms not made of segments.
- 2(11) Worms without suckers and crown of hooklets. Body always cylindrical—NEMATODA.
- 3(10) Anterior extremity never bent. Males without bursa copulatrix, imperfectly chitinised, spicules however present.
- 4(9) Anterior extremity without lateral dilatation or alae. Oesophageal bulb also absent.
- 5(8) Very small worm, usually less than 6 cm in length.
- 6(7) Worms composed of a hair-like anterior part and a much stouter posterior part. Human Whipworm—*Trichocephalus trichiurus* (Linnaeus, 1771).
- 7(6) Cylindrical worm, oesophagus running to about one-third of the body-length. Human Threadworm—*Strongyloides stercoralis* (Bavay, 1816).
- 8(5) Worms resembling common earthworm, with three teeth—a dorsal and 2 subventral finely toothed lips. Male with definitely pointed and curved, like a hook posterior end. Female with straight and pointed posterior end. Giant Intestinal Roundworm—*Ascaris lumbricoides*, (Linnaeus, 1758).
- 9(4) Anterior extremity with conical alae. Oesophagus dilated posteriorly into a bulb. Female with a long and finely pointed tail. Male with a truncated and slightly coiled tail end. Common Seatworm—*Enterobius vermicularis* (Linnaeus, 1758).
- 10(3) Cylindrical worms, slightly narrowed anteriorly. Anterior end directed, somewhat dorsad. Males with companionate bursa, considerably broader than long, giving expanded appearance to the tail end—Hook worms.
 - i(ii) Buccal capsule with a pair of well developed articulated dental armature. Each Plate with two large teeth, outer is somewhat larger, inner one with an inconspicuous median dental process. In male, bursa supported by fleshy rays, the pattern of which is characteristic for the species (*Dorsal ray* single with bifurcated tip; *Externo-dorsal* arising from the root of the dorsal and running along it; *Lateral rays* three, subequal well separated and divergent; *Ventral rays* two, divergent). Old World Hookworm—*Ancylostoma duodenale* (Dubini, 1843).
 - ii(i) Buccal capsule small, with two ventral semilunar cutting plates and two poorly developed dorsal plates. Depth of the mouth cavity with a pair of short triangular lancet and a median dorsal tooth. In male, bursa supported by fleshy rays, the pattern of which is characteristic of the species (*Dorsal ray* small, bifurcated at tip; *Externo-dorsal*, slender unbranched, divergent; *laterals* large, trifurcated, posterior and medial arms close together and external arm divergent. *Ventral pair* two cleft). American Hookworm—*Necator americanus* (Stiles, 1902).

11(2) Worms with 2-3 suckers. Body leaf-shaped, ovoidal or even cylindrical. Flukes—TREMATODA.

i(ii) Body cylindrical. Sexes always separate. During greater part of reproductive life however, the female is carried in gynaeceophoral canal of male. Portal blood stream flukes—*Schistosoma*.

ii(i) Body dorso-ventrally flattened, leaflike. Hermaphrodites. Liver and intestinal flukes—*Fasciola*, *Fasciolopsis*, etc.

12(1) Worms made of segments. Body elongate ribbon-like, usually dorso-ventrally flattened. All Possessing antero-posterior polarity. Head (*scolex*) with suckorial pockets or grooves and frequently a rostellum with a crown of hooklets for attachment to the tissue of the host. Anterior region, posterior to head and neck, may consist of a single unit or divided transversely into separate, sexually complete units (*proglottids*), in distinct stages of development, i. e., region of growth (neck), immature, mature and gravid proglottids. Tape-worms—CESTODA.

13(20) Genital pores situated on the margin of the segments. Head with four symmetrically arranged hemispherical suckers.

14(19) Genital pore unilateral.

15(18) Ripe uterus sac-like, never breaking up into egg balls.

16(17) Rostellum short, armed with single circle of spines. Dwarf Tape worm : (*Hymenolepis nana* Von Siebold, 1852).

17(16) Rostellum pyriform, unarmed. Common Murine Cestode: *Hymenolepis diminuta* (Rudolphi, 1819)

18(15) Ripe uterus with central stem and 18—30 compound lateral branches on each side. Beef Tape worm: *Taenia saginata* (Goeze, 1782).

19(14) Genital pore on each lateral margin: Dog Tape worm: *Dipylidium caninum* (Linnaeus, 1758).

20(13) Genital pore situated on the flat surface of the proglottids. Head with two slit-like sucking grooves (*bothia*). Fish Tape worm: (*Diphyllobothrium latum* (Linnaeus, 1758).

IV:—PROTOZOAN TROPHOZOITES

1(24) Trophozoites found in diarrhoeic or dysenteric stools (Direct saline slide preparations).

2(13) Cytoplasm unprotected by any skeletal structure therefore have no fixed shape and form. Movements affected by formation of changeable protoplasmic processes (*pseudopodia*)—RHIZOPODA.

3(12) Pseudopodia formed steadily: Digestive vacuoles with bacterias, yeast cells and starch granules.

4(11) Mononucleate.

5(10) Glycogen vacuole not distinct.

6(9) Nuclear membrane with peripheral chromatin.

- 7(8) Peripheral chromatin in irregular clumps or coarse granules. Karyosome large, irregular and eccentric. 15—50 M in size: Colon Amoeba: *Entamoeba coli* (Loesch, 1875).
- 8(7) Peripheral chromatin distributed-regularly or massed at one or both poles. Karyosome minute, central. 15—50 M in size. California Amoeba: *Entamoeba polecki* (Von Prowazek, 1912).
- 9(6) Nuclear membrane with no peripheral chromatin Karyosome large. 5—12(7) M in size. *Endolimax nana* (Wenyon and O'Connor, 1917).
- 10(5) Glycogen vacuole pronounced. Nucleus indistinct. Nuclear membrane delicate. Karyosome large, more or less central, irregularly rounded and surrounded by a layer of small chromatin granules, close to the Karyosome or forming a distinct ring. 4—20(9-14) M in size: *Iodamoeba butschlii* (Von Prowazek, 1912).
- 11(4) High percentage binucleated. Nuclear membrane delicate, with no chromatin on the periphery. Karyosome with 4—8 discrete chromatin granules. Usually 7—12 M in diameter: *Dientamoeba fragilis* (Japps and Debell, 1918).
- 12(3) Pseudopodia explosive, blade-like. Digestive vacuole with RBCs. Nucleus small, indistinct. Nuclear membrane delicate, fine granules of chromatin on the periphery, Karyosome central. 10—30 M in diameter. Dysentery Amoeba: *Entamoeba histolytica* (Schaudinn, 1903).
- 13(2) Cytoplasm protected by skeletal structure (pellicle) or definite cell membrane (periplast), therefore are more or less of constant shape and form. Movement affected either by fixed- several whip-like, irregularly lashing appendages or numerous hair-like, regularly moving fibres or filaments covering the body.
- 14(23) Body of the organism with 2—8 whip-like, irregularly moving flagella.
- 15(22) Flagellates with one nucleus.
- 16(21) Flagellates with more than two flagella at the anterior, broad end of the body.
- 17(20) Flagellates without axostyle. There is also no undulating membrane (no costa).
- 18(19) Anterior, broader end, with 3 free flagella. One short flagella passes through the cytostome, cytostoma runs in a spiral manner and is re-inforced by marginal fibre (shepherd's crook). Measuring 10—20 M: (*Chilomastix mesnili* (Wenyon, 1910).
- 19(18) Anterior end with three free flagella. Fourth flagella directed backwards, part of which adheres to the body. Cytostome not present. No cytostomal fibres. Karyosome large. Measuring 4—10 M: *Enteromonas hominis* (deFonseca, 1915).
- 20(17) Flagellates with distinct slender axostyle, extending through the body and protruding through posterior end of the body as a sharply pointed prominent tail. Anterior flagella 4-5, in addition a recurrent flagella arising anteriorly and running posteriorly as to form the edge of undulating membrane (which joins the body along a well-marked line-costa). Measuring 7—15 M: (*Trichomonas hominis* (Davaine, 1860).
- 21(16) Flagellates with two anterior flagella. Cytostome running from the anterior end to the middle of the body. A fibril borders the cytostome but is not 'shepherd's crook curve type'. Measuring 4—10 × 5 M: *Retortamonas intestinalis* (Wenyon and O'Connor, 1917).

- 22(15) Bilaterally symmetrical, roughly pear-shaped flagellates, with posterior end attenuated. Nuclei two, spherical and located in anterior portion of the body which is largely occupied by cytostome. Nuclear membrane distinct, karyosome central, large, peripheral chromatin granules wanting. Four pairs of flagella, each arising from anterior, lateral, ventral and posterior positions. Axonemes of the posterior flagella run through the middle of the body as far as centre of the cytostome as to form axostyle and divide the body into two halves. Posterior to sucking disc, near its hilum there are two median bodies (parabasal bodies). Measuring $9-22 \times 5-15$ M. Duodenal flagellate of man: *Giardia intestinalis* (Lambl, 1859).
- 23 (14) Body of the organism profusely covered with short, delicate thread like cilia. Ovoid, with a funnel-shaped cytostome opening on slightly flat anterior end. Cytoplasm with a spherical, ellipsoidal, elongate or kidney-shaped macronucleus and a quite small rounded micronucleus near it: Measuring $50-200 \times 40-70$ M: *Balantidium coli* (Malmsten, 1857).

V:—PROTOZOAN CYSTS

- 24(1) Cysts are found in formed stools (usually by concentration method, stained with iodine).
- 25(38) Cysts small, never more than 30 M. in diameter. Nuclei spherical.
- 26(31) Cysts more or less spherical or subspherical in form.
- 27(30) Mature cysts with 5—8 nuclei.
- 28(29) Mature cysts with 4 nuclei. Nuclear membrane delicate, inner surface with a single layer of minute chromatin dots. Karyosome minute and central. Glycogen mass if present, diffuse. Chromatoidal bodies when present, rod-like with rounded or squarish ends. 5—12 or 12—20 M. in diameter: *Entamoeba histolytica* (Schaudinn, 1903).
- 29(28) Mature cysts with 8 nuclei. Nuclear membrane thick, inner surface lined with coarse chromatoidal dots, or irregular mass. Karyosome minute and eccentric. Chromatoidal bodies where present, filamentous or sheaver of splinters with pointed ends. 10—30 M. in diameter: *Entamoeba coli* (Loesch, 1875).
- 30(27) Mature cysts usually mono-nucleated.
- (i) (ii) Nuclear membrane thin, peripheral chromatin evenly distributed as minute speherical-granules or flattened plaques. Karyosome central, chromatoidal body with angular or pointed ends or thread-like. Glycogen mass may be present. An inclusion mass may also be present. 5—20 M. in diameter
Entamoeba polecki (Von Prowazek, 1912)
- (ii) (i) Nuclear membrane indistinct. Peripheral chromatin very little. Karyosome large, polymorphic. No chromatoidal bars. Glycogen vacuole present, large and a symmetrical. 5—20 M. in diameter: *Iodamoeba butschlii* (Von Prowazek, 1912)
- 31(26) Cysts ovate, ellipsoidal, pyriform or Lemon shaped.

- 32 (37) Cysts ovate or ellipsoidal in form with 2—4 or more nucleated.
- 33 (36) Cysts with more or less defined filamentous inclusions.
- 34 (35) Glycogen mass diffused. Filamentous inclusion ill defined. Measuring 8—10 M: *Endolimax nana* (Wenyon and O' Connor, 1917).
- 35 (34) Cysts with well defined central axonema and numerous filamentous inclusions—flagella, lateral sheilds, and curved fibrils. Nuclei arranged on both sides of the central axoneme. Measuring 8—14 × 7—10 M. *Giardia intestinalis* Lambl, 1859.
- 36 (33) Cysts with no defined filementous inclusions. Nuclei dispersed, 1-2 at each pole. Measuring 6—8 M. *Enteromonas hominis* (de Fonseca, 1915).
- 37 (32) Cysts with one nucleus.
- (i) (ii) Pyriform cysts. Nucleus with compact and central karyosome. Nuclear membrane with fine chromatin granules. Two fibrils extend from nuclear region to attenuated end of cyst and appear like a typical birds-beak. Measuring 4—7 × 5 M: *Retortamonas intestinalis* (Wenyon and O' Conner, 1917).
- (ii) (i) Lemon-shaped cysts. Cyst wall at narrow end thick as to appear a nipple-like protuberance. Karysome large and central. Cytostomal fibre remains as a prominent curved structure. Measuring 6—10 M *Chilomastix mesnili* (Wenyon, 1910).
- 38 (25) Cysts more or less twice as large as the preceding species. Ovate in form, encysted organism with or without alae. Cyst wall thick refractile. Macronucleus and contractile vacuoles conspicuous. Measuring 50—75 M in diameter : *Balantidium coli* (Malmsten, 1857).

HOW TO USE THE TENTATIVE KEY GIVEN ABOVE.—

The beginner can hardly expect to recognise all the parasites encountered during the first few attempts. However, one would become knowing the common ones soon if one stops worrying and musters patience.

With the organism in sight, read the first couplet of the key. If it agrees, well and good, it is either a hint to read the next couplet below or leads to the name of your organism. If it does not agree, it invites your attention to the number given in parentheses and representing the opposite character. Continue in this manner with each couplet until you reach a statement, which agrees with your specimen and ends with the name of the organism.

These keys never claim to be perfect and errors and omissions are acceptable without comments. Reasonable amount of practice is what is most desirable to satisfy curiosity, differentiate myth from truth, and separate fagot, fagin and foe from a friend.

Parasitologists do not trust memory and consider immediate recording as an indispensable must. All observations, both macroscopic and microscopic should be carefully recorded in a *proforma* prepared well ahead, in the light of work in hand. A sample of data sheet meant for individual case, is given below. It was found convenient and meaningful for the survey reported hereafter. It is well remarked that "It is better to have data which you do not use than to have data which you do not have." We therefore, aimed to have extensive information, even unimportant, with a view to sort out later and eliminate unnecessary items. Writing may be reduced to bare minimum by adopting "tick mark to what applies".

SAMPLE OF RECORD FORM

DEPARTMENT OF MEDICAL ENTOMOLOGY
AND PARASITOLOGYINSTITUTE OF HYGIENE AND PREVENTIVE
MEDICINE, 6—BIRDWOOD ROAD
LAHORE.

PARASITE SURVEY

Page one

Serial No. _____

Date _____

Institution/Locality _____

1. Name _____ Sex _____ Age _____

2. Occupation _____ Literate/Illiterate.

3. Address _____

4 Housing	Water supply	Storage of water	Food Sanitation	Latrine	Drainage	Refuse collection	Refuse Disposal (Manure Garbage)	Domestic animals
Pacca/Kacha	Wells	Matka	Safe	Field	Pacca/Kacha	Bin	Heap	Cows
Over-Crowding.	Hand-pump.	Tank, Hamam.	Refrigeration.	Open-privy.	Open	Closed	Pit,	Buffaloes,
Damp & Dingy.	Tap.	Pitcher	Cooked	Fly-proof.	Under-ground,	Covered	Trench.	Goats
Shared-animals	Tube-wells	Balti	Fresh	Flush	Sewage,		Field	Sheep.
	Surface water.		Washed.	Bore-hole	Soak-age.	Heap		Donkeys.
	Canal		Open		Pits.	Open.		Camels.
	River				Pond	Top-dressed		Horses.
	Ponds							Dogs.
								Poultry.

5 Personal Hygiene and Habits	Physical Condition	Working Capacity	Preventive Measures
-------------------------------	--------------------	------------------	---------------------

Good	.. Well nourished	.. Excellent	.. Water supply treated.
Satisfactory	.. Under nourished	.. Average	.. Anti-Fly measures. ..
Poor	.. Mal-nourished	.. Below par (poor, very poor).	Anti-mosquito operations.
			Anti-malaria/eradication.
			Dog destruction.
			Rat extermination.
			Anti-H/worm.

6. Complaints/Clinical signs/History

7. Stool Examination: Specimen No. _____ Date _____

(i) Chemical Reaction: Acidic/alkaline.

(ii) Physical: Macroscopic..... Date.....

Odour: Putrid, inoffensive, rancid, sour.

Colour: Creamy, yellow, brown, red, green, black.

Consistency: Fluid, semi-solid, formed, hard.

Curds: Small, large, soft, hard.

Mucous: Strings, balls, casts or ribbons.

Blood: Tinged Mucous, localised, diffused, changed.

Parasites: Round worm/segments/head/maggots/grubs/caterpillars.

(iii) Microscopic

Date.....

Exudates	Blood	Crystals	PARASITES		Miscellaneous
			Protozoan c/t. No.	Helminthic o/a/ No	
Bacillary	.. Diffuse	.. Char. ley.	.. E. hist	.. A. lumb	.. mites
amoebic.	.. Clumped	.. Fatty	L/R	.. H. worm	.. Maggots.
Indefinite		acid soap.	S/R	.. H. nana	.. Caterpillars.
without			E. har	.. T. trich	.. Grubs.
			E. coli	.. E. verm	..
		Bismuth	.. I. but	.. S. ster.	
			G. int	.. T. sag.	
		Iron	.. C. mea	.. Tricho	
		Tr. phosphates	E. hom		
			T hom.		
		Ca. oxalate	.. D. frag.		

8. *Blood Picture:* Specimen No. _____ Date _____
 (i) D. L. C. P. _____ L. _____ M. _____ E. _____ B. _____
 (ii) Haemoglobin percentage (Sahli's method/Tallqvist's Scale)
 (iii) Blood Parasites: V. _____ F. _____ M. _____

9. *Treatment*

Date	Doses	Duration	Parasite cure	Clinical cure	Observation period	Relapse Recurrence
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
..	..	..	..	..	..	..
10. <i>Notes and Remarks:</i>						

CROSS INFECTION STUDY IN SERVICES HOSPITAL, LAHORE

By

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The object of this work was to study hospital cross-infection through bacteriophage typing.

A large amount of work has been done in recent years in various countries on the analysis of Staphylococcal epidemics in Hospital communities, Nursing Homes, and Maternity and Child Institutions. Colebrook¹ presented an interesting series of historical surveys relating to infections encountered by various types of hospitals during the past century. The realisation of the problem, however, became more acute with the advent of anti-biotic therapy. Staphylococci rapidly develop resistance to antibiotics and within a few years staphylococci resistant to more than one antibiotic appeared. These multiple resistant Staphylococci presented a serious problem in hospital cross-infections. (Caswell)². Since 33 per cent of normal population are nasal carriers of Staphylococci the tracing of epidemics within a community in which the inmates are constantly changing such as a hospital is difficult. This difficulty was partly overcome by Phage typing. A large amount of work in Phage typing has been done by Staphylococcal Reference Laboratory, Public Health Services, Colindale. Blair and Williams³ (1961) give a detailed procedure of the carrying out of Staphylococcal Phage typing.

In various epidemics different Phage types have been isolated. Thus in England (Allesin 1949)⁴ a Staphylococcal Phage type 6/47 was isolated from an epidemic of food poisoning. In other epidemics different Phage types were isolated but they generally belonged to group III, i. e., showed lysis with Phages 6, 7, 42B, 47, 54, 70, 73, 75, 53, 77. In skin infections Phage type 52, or 52A, or 52A/79 have been isolated (Anderson and Williams)⁵. In Philadelphia Caswell² (1958) isolated Phage type 42B/52/81 from surgical wounds, infective traumatic wounds, burns, other cutaneous infections and (Pneumonia.)

Shaffer⁶ and his associates report the isolation of Phage type 42B/444/47C/52/80/81. From 19 nursery outbreaks in the U. S. Reports of a similar Phage type from nursery outbreaks in other countries are on record.

Wysham, and Curby⁷ analysed the Staphylococcal population in a general hospital in Washington and found that 40 per cent of the cultures were not typable with common routine Phage types. The common Phage types isolated by them were 53/54/77/V. A. 4 and 52/42B/42A. The Pakistan Armed Forces Council of Medical Research⁸ (1962) reported an outbreak of staphylococcus Phage type 80/81 food poisoning in an Army Unit in Pakistan. The outbreak was traced to a food handler.

Blowers⁹ (1955) in his paper discusses the causes of cross-infections in the surgical wards and suggests remedial measures for their control.

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Material and Method

The study under discussion was carried out in Services Hospital, Lahore. The hospital is a general hospital admitting government employees. It is a newly constructed modern building with high degree of cleanliness. Nasal swabs of the hospital staff which included doctors, nurses, bearers, orderlies, ayas and sweepers were taken. Only patients of surgical wards were investigated. From each patient three specimens were taken; from the nose, surgical wound and blanket. Nasal swabs were collected from the anterior nares. The swabs were moistened with broth before hand. From blanket samples were collected by opening a culture medium petri dish and rubbing it on one square foot of the blanket making to and from movements. The plates and swabs were transported to our laboratory where the swabs were sub-cultured on blood agar. Colonies isolated were identified. Coagulase positive Staphylococci were selected for further study.

The Phages used for typing were obtained from Department of Health, Education and Welfare, Public Health Services, Bureau of State Services, Communicable Disease Centre Diagnostic Reagents Section, Chamblee, Georgia, U. S. A.

The following 21 basic Phage types were used :—

29, 52, 52A, 79, 80	..	..	..	(Group I)
3A, 3B, 3C, 55, 71	..	..	..	(Group II).
6, 7, 42B, 47, 53, 54, 75, 77	..	..	..	(Group III).
42D	..	..	..	(Group IV).
81, 187	..	..	..	(Group V).

Media

The procedure followed was according to Blair and Williams 3.

1. For the growth of Staphylococci-Nutrient broth with 400 micrograms per ml. of calcium chloride was used. The broth was prepared from fresh beef in our laboratory.

2. Salt Mannitol Agar

Digest broth	..	..	..	..	2500 ml.
Sodium chloride	..	..	..	..	187.5 G.
Mannitol	..	..	..	..	25 G.
Bacto agar	..	..	..	..	50 G.
Phenol red	..	..	..	..	25 cc. of 2.5%.

The above was sterilized at 15 lbs. pressure for 10 minutes after adjusting PH. to 7.4 This medium was used for sampling blankets.

3. Agar medium for Phage typing—

Plates used for Phage typing were made with 1.5 per cent nutrient agar [prepared in our laboratory. 400 ug/ml. of calcium chloride was incorporated in the nutrient agar

Titration of stock Phages

The Phages received from the U. S. A. were put up against their corresponding propagating Staphylococci to determine the RTD. (Routine Text Dilution). 10 fold dilutions of the Phages were made in broth. 10—10 dilutions were put up. One drop of each dilution was applied to the surface of an agar plate previously spread with a 4 hours' culture of the propagating strain. The plate was incubated at 30°C overnight. It was examined the following morning and the RTD determined. The RTD was taken to be the highest dilution that just failed to give confluent lysis. In our final test both RTD and 1000 RTD were used.

Phage typing of cultures isolated—

Nutrient agar plates (prepared as given above) were dried for 4 hours in the incubator. The cultures to be tested were put upon broth early in the morning and incubated at 37°C for 4 hours. Plates were then inoculated with these cultures by flooding surface of agar with 1.2 cc. of broth culture and drying off the excess with a sterile pipette. They were left at room temperature for 1/2 hour, to ensure drying. Small drops of Phage dilutions were applied using 1 ml. syringe fitted with No. 19 gauge needle. The agar plates were ruled in a definite Phage sequence. The drops were allowed to dry by leaving the plates on the bench for 1/2 hour. The plates were then incubated for 18 hours at 30°C.

Reading of Results—

The degree of lysis observed both at RTD and 1000 RTD were entered as under :—

- ++ = more than 50 plaques; semi confluent or confluent lysis.
- + = 20 : 50 plaques;
- + = less than 20 plaques.

Less than 20 plaques were ignored in final recording of the result.

Results are given both at RTD and 1000 RTD.

Results

A total of 30 members of the hospital staff were tested. (Table I A). Out of these 10 were found positive for *Staphylococcus pyogenes*. This gives an overall percentage of 33. This figure corresponds to that of hospital staff tested in foreign hospitals where 25—40 per cent members may be found positive (Lepper 10 1955). The Phage pattern varies (Table I B) which indicates that these members of the staff do not derive the Staphylococci they carry from one constant source. The organisms isolated are all (36) resistant to Sulphadiazine, 3 out of 36 are resistant to Penicillin 1 to Streptomycin and 2 to Tetracyclin group of drugs. These multiple resistant Staphylococci may have been picked up from the hospital. Their Phage patterns however, differ so that they are not derived from one source.

TABLE I-A
PREVALENCE OF STAPHYLOCOCCUS PYOGENES AMONG HOSPITAL STAFF

Serial No.	Occupation	Total	Positive	Negative
1	Nurses	10	2	8
2	Matron	1	1	..
3	Doctors	3	..	3
4	Nursing Orderlys	3	2	1
5	Aya	2	1	1
6	Bearer	3	1	2
7	Sweepers	4	2	2
8	Theatre Assistant	4	1	3

TABLE I-B
ANALYSIS OF STAPHYLOCOCCUS PYOGENES FROM HOSPITAL STAFF

Serial No.	Occupation	Staph Pyogenes	SENSITIVITY							1000 RTD
			SDZ	PEN	STR	TET	CHL	ERY	RTD	
1	Nurse A ..	+	R	S	S	S	S	S	29 ..	29/52/55/71/83-A
2	Nurse B ..	+	R	S	S	S	S	S	80/81 ..	29/52/52-A/80/81.
3	Matron ..	+	R	S	S	S	S	S	3 A/29	3 A/3 B/3 C/29/47/52/55/71/83 A.
4	Nursing Or-derly.	+	R	R	R	R	S	S	Not Typ-able.	29/52/55/71/83-A.
5	Nursing Or-derly.	+	R	S	S	S	S	S	47 ..	47
6	Aya ..	+	R	S	S	S	S	S	6/7/29/47/54/75.	6/7/29/47/52/54/55/71/75/77/83 A.
7	Bearer ..	+	R	R	S	S	S	S	3 A/71	3 A/29/52/55/71.
8	Sweeper ..	+	R	R	S	S	S	S	Not Ty-pable	29/52/71.
9	Sweeper ..	+	R	S	S	S	S	S	Ditto.	3 A.
10	Theatre Assis-tant.	+	R	S	S	S	S	S	Ditto.	3 A.

NOTE :

SDZ.	Sulphadiazine	R = Resistant.
PEN.	Penicillin	S = Sensitive.
STR.	Streptomycin	+ = Scanty growth.
TET.	Tetracycline	++ = Moderate growth.
CHL.	Chloromycetin	+++ = Profuse growth.
ERY.	Erythromycin.	

The surgical unit had 6 nurses, 4 theatre assistants, 2 doctors 11 nursing orderlys, 1 bearer and 2 sweepers. Out of these 2 nurses, 1 bearer, 1 sweeper and 1 theatre assistant were positive. The sweeper and Nurse A carried the same Phage type namely Phage type 29. (Table II). Both the organisms are resistant to Sulphadiazine. In addition the organism carried by the sweeper is also resistant to Penicillin. 6 patients out of 18 had Phage type 29 on their blankets. 6 patients out of 18 were nasal carriers of the same Phage type. The operation wounds of 4 patients out of 10 were secondarily infected with the same organism. Wounds of 8 patients were not sampled since healing had taken place.

TABLE II

SURVEY OF STAPHYLOCOCCUS PYOGENES IN SURGICAL WARDS OF SERVICES HOSPITAL

Serial No.	Occupation	Staph	SENSITIVITY							1000 RTD
			SDZ	PEN	STR	TET	CHL	ERY	RTD	
1	Nurse A ..	+	R	S	S	S	S	S	29 ..	29/52/52-A/55 71/77/83-A.
2	Nurse B ..	+	R	S	S	S	S	S	80/81 ..	29/52/52-A/80/ 81.
3	Bearer ..	+	R	R	S	S	S	S	2-A/71	2-A/29/52/55/ 71
4	Sweeper ..	+	R	R	S	S	S	S	29 ..	29/52/52-A/71
5	Theatre Assis- tant	+	R	S	S	S	S	S	2-A ..	2-A/71.
P ¹	Patient ..	+	R	R	R	R	S	S	3-C ..	3-C/71
	Blanket P ¹	+	R	R	R	R	S	S	3-C ..	3-C/71.
	Wound P ¹ ..	+	R	R	R	R	S	S	3-C ..	3-C/71.
P ²	Patient ..	+	R	S	S	S	S	S	29 ..	29/52/52-A/55 71/83-A.
	Blanket P ²	+	R	S	S	S	S	S	29 ..	29/52/52-A/55 71/83-A.
	Patient ..	+	R	R	R	S	S	S	181 ..	181
P ³	Patient ..	+	R	R	R	S	S	S	181 ..	181
P ⁴	Patient ..	—	R	S	S	S	S	S	29 ..	29/52/52-A/71 80.
	Blanket P ⁴ ..	+	R	S	S	S	S	S	29 ..	29/52/52-A/55 83-A.
	Wound P ⁴	—	R	R	R	R	S	S	29 ..	29/52/52-A/55 83-A.
P ⁵	Patient ..	+	R	R	R	R	S	S	29 ..	29/52/52-A/55 83-A.
	Blanket P ..	—	R	R	R	R	S	S	29 ..	29/52/52-A/55 83-A.
	Wound P ⁵ ..	+	R	R	R	R	S	S	29 ..	29/52/52-A/55 83-A.
P ⁶	Patient ..	—	R	R	R	R	S	S	77 ..	77/80.
	Blanket P ⁶ ..	—	R	R	R	R	S	S	77 ..	77/80.
	Wound P ⁶ ..	—	R	R	R	R	S	S	77 ..	77/80.
P ⁷	Patient ..	—	R	R	R	R	S	S	77 ..	77/80.
	Blanket P ⁷ ..	+	R	R	R	R	S	S	77 ..	77/80.
	Wound P ⁷ ..	—	R	R	R	R	S	S	77 ..	77/80.
P ⁸	Patient ..	—	R	R	R	R	S	S	77 ..	77/80.
	Blanket P ⁸	—	R	R	R	R	S	S	77 ..	77/80.
	Wound P ⁸ ..	—	R	R	R	R	S	S	77 ..	77/80.

TABLE II

Serial No.	Occupation	Staph	SENSITIVITY							1000 RTD
			SDZ	PEN	STR	TET	CHL	ERY	RTD	
P ⁹	Patient ..	+	R	R	R	S	S	S	29/83-A	29/52/52-A/83-83-A.
	Blanket P ⁹	+	R	S	S	S	S	S	29/83-A	19/52/52-A/83-A.
P ¹⁰	Patient ..	—								
	Blanket P ¹⁰	+	R	S	S	S	S	S	29	29/52/52-A/55/81.
	Wound P ¹⁰	—								
P ¹¹	Patient ..	—								
	Blanket P ¹¹	—								
	Wound P ¹¹	+	R	S	S	S	S	S	29	29/52/52-A/55
P ¹²	Patient ..	+	R	R	S	S	S	S	187	187
	Blanket P ¹²	—								
P ¹³	Patient ..	+	S	S	S	S	S	S	Not typ-able.	52
	Blanket P ¹³	+	S	S	S	S	S	S	Not typ-able.	52
P ¹⁴	Patient ..	+	R	S	S	S	S	S	187	187
	Blanket P ¹⁴	+	R	S	S	S	S	S	187	187
P ¹⁵	Patient ..	+	R	S	S	S	S	S	29	29/80
	Blanket P ¹⁵	+	R	S	S	S	S	S	29	29/80
	Wound P ¹⁵	—								
P ¹⁶	Patient ..	—								
	Blanket P ¹⁶	—								
	Wound P ¹⁶	+	R	S	S	S	S	S	29 ..	29/52/52-A/71
P ¹⁷	Patient ..	+	R	R	R	S	S	S	29 ..	29/52/52-A/71/83-A.
	Blanket P ¹⁷	—								
	Wound P ¹⁷	+	R	R	R	S	S	S	29 ..	29/52/52-A/71/83-A.
P ¹⁸	Patient ..	+	R	R	R	S	S	S	29 ..	29/52.
	Blanket P ¹⁸	+	R	R	R	S	S	S	29 ..	29/52.
	Wound P ¹⁸	—								

Note—P¹, P², P³ etc., are the letters affixed to specimens taken from the same patient.

Results of drug sensitive pattern of *Staphylococcus pyogenes* isolated are mentioned in Table I and II and are summarised as under:—

	S	P	Str	T	C	E
Sensitive ..	5%	50%	66%	78%	100%	100%
Resistant ..	95%	50%	33%	22%	..	..

Table III gives the sensitivity pattern of *Staphylococcus* Phage type 29. The organism carried by Nurse A is resistant to Sulphadiazine alone, and that carried by the sweeper to Sulphadiazine and Penicillin. 9 *Staphylococci* isolated from patients blankets and wounds have the same sensitivity pattern as the *Staphylococcus* from the nurse, whereas only 2 correspond to that of the sweeper. This is obvious since the contact of the nurse with patients is closer than that of the sweeper. The blankets of the ward are heavily infected and constitute the main reservoir of cross-infection. They were being washed in the ordinary way with no sterilization at any stage.

TABLE III

Serial No.	Occupation					SENSITIVITY					
						SDZ	PEN	STR	TET	CHL	ERY
1	Nurse A	..	..	..	..	R	S	S	S	S	S
2	Sweeper	..	..	..	..	R	R	S	S	S	S
3	Patient ¹	..	..	..	..	R	S	S	S	S	S
4	Blanket p ²	..	..	..	..	R	S	S	S	S	S
5	Blanket p ⁴	..	..	..	..	R	R	R'	R	S	S
6	Patient ⁵	..	..	..	..	R	R	R	R	S	S
7	Wound p ⁶	..	..	..	..	R	R	S	S	S	S
8	Patient ⁸	..	..	..	..	R	R	S	S	S	S
9	Blanket p ⁹	..	..	..	..	R	S	S	S	S	S
10	Blanket p ¹⁰	..	..	..	..	R	S	S	S	S	S
11	Wound p ¹¹	..	..	..	..	R	S	S	S	S	S
12	Patient ¹⁵	..	..	..	..	R	S	S	S	S	S
13	Blanket p ¹⁶	..	..	..	..	R	S	S	S	S	S
14	Wound p ¹⁶	..	..	..	..	R	R	R	S	S	S
15	Patient ¹⁷	..	..	..	..	R	R	R	S	S	S
16	Wound p ¹⁷	..	..	..	..	R	R	R	S	S	S
17	Patient ¹⁸	..	..	..	..	R	R	R	S	S	S
18	Blanket p ¹⁸	..	..	..	..	R	R	R	S	S	S

S = Sulphadiazine
P = Penicillin
Str = Streptomycin

T = Tetracycline
C = Chloromycetin
E = Erythromycin

Direct infection of wounds during dressing by the hands of the nurse is also evident. In patient No. II and No. 16 wounds were infected whereas blankets and nasal swabs were negative. The sensitivity pattern of the *Staphylococcus* is the same as that of the organism carried by nurse A. 4 organisms isolated were in addition resistant to Streptomycin, and 2 to streptomycin and Tetracycline. These organisms are sensitive to Chloromycetin and Erythromycin. Streptomycin and tetracycline are in common use in surgical wards where as Chloromycetin and Erythromycin are rarely used.

Recommendations—

Blankets—These should be autoclaved at 5 lbs. pressure for 15 minutes (Blowers)⁹ Subsequently they should be washed in the ordinary way. After washing 3 rinses should be given in an anionic antiseptic incorporated in an oily base. Oiling of blankets prevent dissemination of fluff. Any anionic antiseptic may be used such as "Arquad". This antiseptic has a specific killing power on *Staphylococci* and prevents the built up of the organism in the blankets.

Blankets should be washed.

(a) After the discharge of a patient.

(b) After the death of a patient.

(c) Every three months if a patient's stay in hospital is longer than 3 months.

Carriers among staff—

A. Where possible such staff members as Nurse A in our study should be transferred to a medical ward or given a duty which does not involve contact with open wounds. Bacimycine cream is administered intranasally, thrice daily over a period of 5 weeks. This eliminates the *Staphylococcus* being carried in the nose in the majority of cases.

B. Nurse must wear proper masks during dressings. Hands should be scrubbed before each dressing and where possible dressings should not be done in the general wards but in special plenum ventilated rooms.

Conclusion and Summary—

The prevalent *Staphylococcal* Phage type isolated in Services Hospital was Phage type 29. It was carried in the nose of one of the nurses and one sweeper. Blankets and postoperative wounds of patients were found positive with the same type. Patients also acquired the same from the contaminated surroundings and harbour the organism in their nose. Remedial measures to prevent cross-infection have been suggested.

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BOOK REVIEWS

THE PRINCIPLES AND PRACTICE OF MEDICINE

EDITED BY

SIR STANLEY DAVIDSON, B.A., M.D., F.R.C.P., LL.D., F.R.S.

(Pp. xii + 1139, 35s.) *Edinburgh and London : E. & S. Livingstone, Ltd., 6th Ed. Reprint 1963*

The demand of a reprint of the 6th Edition published in 1962 is a proof of the popularity of this useful book. It is an ideal book for the undergraduates and the general practitioners.

DISEASES OF INFANCY AND CHILDHOOD by Sir Wilfred Sheldon, K.C.V.O., M.D., F.R.C.P. (Pp. x + 563, 56s.) London: J. & A. Churchill, Ltd., 8th Ed. 1962.

Sir Sheldon has revised this standard book on Paediatrics incorporating certain diseases which had been previously omitted for example Haemoglobinopathies. It is a well illustrated volume and will be a useful reference book for the family doctor.

WHITBY AND BRITTON DISORDERS OF THE BLOOD by C. J. C. Britton, MD., D.P.H. (Pp. vii + 870. 100s.) London J. & A. Churchill, Ltd., 9th Ed. 1963.

This excellent book has been thoroughly revised and brought up-to-date. Dr. F. G. J. Hoyhoe has revised the chapter on "The cytochemistry of haemopoiesis". Dr. G. H. Tovey has rewritten the chapter on "Blood groups and blood transfusion". Useful recent references have been given at the end of each chapter. It is a valuable reference book for the haematologist.

CLINICAL PHARMACOLOGY by D. R. Laurence, M.D., M.R.C.P. (Pp x + 542, London : J. & A. Churchill, Ltd., 36 s.) 2nd Ed. Reprint 1963.

It is a useful book both for the medical student and the general practitioner. A reprint has appeared quite soon after the second edition, which reflects on the immense popularity of this book.

ANTISERA, TOXOIDS, VACCINES and TUBERCULINES in PROPHYLAXIS and TREATMENT by H. J. Parish, M.D., F.R.C.P., D.P.H. and D. A. Cannon O.B.E., M.B., B.S., F.R.F.P.S. (Pp. viii + 315. 40 s.) Edinburgh and London : E. & S. Livingstone 6th Ed. 1962.

The present edition has been published soon after the fifth published in 1961. The book has been thoroughly revised and brought up-to-date. It will be a useful handy reference for the busy physician.

EMERGENCIES IN MEDICAL PRACTICE by C. Allan, Birch, M.D., F.R.C.P. (Pp. xii + 784. 50 s.) Edinburgh and London : E. & S. Livingstone. 7th Ed. 1963.

It is a well written and beautifully illustrated book. It is recommended to those who are engaged in the practice of medicine.

PROGRESS IN MEDICAL LABORATORY TECHNIQUE, edited by F. J. Baker. (Pp. vii + 191. 35s.) London : Butterworths, 1963.

This is the second series of Progress in Medical Laboratory Technique. The book has been divided into ten chapters. The first chapter deals with recent advances in

chemical pathology. The second describes the investigations of megaloblastic anaemias. The other chapters deal with disorders of coagulation, problems of ABO blood group systems etc. Each chapter has a list of useful references. It will be a readable book for all interested in the Laboratory diagnosis.

INFECTION IN HOSPITALS EPIDEMIOLOGY AND CONTROL. Edited by R. E. O. Williams and R. A. Shooter (Pp. viii+355. 52s. 6d.). Oxford: Blackwell Scientific Publications, 1963.

This book embodies the proceedings of a symposium organized by the Council of International Organization of Medical Science held at the Wright-Fleming Institute, St. Mary's Hospital Medical School, London from 24th to 28th September 1962. More than 100 participants from different countries attended this seminar. This volume is recommended to the Hospital Administrator and those interested in the prevention and control of infection in hospitals.

ZAFFAR-UL-AZIZ, D. Bact.