misguided through lack of a knowledge of how to set about it or through ignorance of statistical concepts. A few simple examples from "real life" might clarify that assertion. In 1946, for instance, I made for the British Medical Association an inquiry into the pre-war incomes of general practitioners—information which was required for submission to the Spens Committee on levels of remuneration in the new health service. It was impracticable to seek this information from all practitioners, and a sample was taken—how is highly important but not relevant to my present point. Let us suppose that out of a total of 20,000 practitioners 5,000 were picked at random to give a representative cross-section. Of these 5,000, however, only 3,000 respond. In other words, the original sample which the statistician is satisfied will, within limits, give the right answers is replaced by a smaller sample which may not be at all representative of the total population. If those who choose to answer are those earning good incomes the resulting figures are too high; if persons earning a lot are too busy to bother with forms they are too low. The actual motives or habits leading to answering are unknown, and there is no means of determining whether or no they are associated with earning capacity. But, on the other hand, some persons do not see why the numbers should not be made up to the original 5,000 required by taking another sample and adding in their replies—there were plenty of practitioners left who had not been approached. The fundamental statistical requirement of quality as well as quantity is overlooked. No mere increase in numbers can produce the representative cross-section sought if those who are willing to respond are basically not representative themselves. Whatever the size of the sample it remains biased. For very similar reasons the follow-up of patients to determine the upshot of treatment may give an erroneous answer if only a proportion of the original treated group can be traced, say, five years later. The question turns upon whether the lost-sight-of are likely to be different in their state of health from the traced—have they more frequently disappeared through death or, on the other hand, through survival in good health and a consequent movement to a distance? Is the sample that can be found representative of the original group?

In the field of association equally simple, but still overlooked, difficulties arise. For instance, we may note that children who contract a disease after inoculation against it die less frequently than uninoculated patients. We must, however, consider whether the two groups are comparable except with regard to the state of inoculation. The inoculated might be of school age and the uninoculated of pre-school age, and we should then expect to see a lower fatality rate in the former compared with the latter, quite apart from inoculation, since the fatality rate normally declines with age. Or we have the uncontrolled observation that patients with a given disease have such-and-such a characteristic or antecedent, and overlook the essential need to know whether they have that characteristic or antecedent any more frequently than happier mortals who do not contract that disease. It all seems distressingly obvious when it is written down; it always does—but the faculty of common sense is not so common. The same mistakes continue to crop up, and the same inefficient numerical treatments continue to be applied to data.

Conclusion

Arithmetic guided by logic has been given as a fairly accurate definition of simple statistical methods, and it is that kind of teaching that would, it is my belief, be of real benefit to the medical student. It should introduce him not only to such general viewpoints as those given above,

to be borne in mind in considering statistical evidence, but also teach him the appropriate methods of handling and presenting data, and familiarize him with the statistical concepts of variability, the ideas lying behind elementary tests of significance, simple means of measuring and interpreting associations, and so on. Such teaching would also, I believe, be of undoubted value to the medical practitioner who found at one stage of his career or another that he wanted to set about a piece of original work—and surprisingly many are drawn to it. How should he set about making the appropriate observations? How many will he need? In what form shall the records be made to ensure completeness and to facilitate subsequent analysis? Will it be sufficient to observe the affected individuals, or must the unaffected be equally carefully included in the inquiry? Must the exposed to risk be enumerated? Will such-and-such a method denote an effective experiment and lead to a clear answer? Will a control group be required, and what, if so, is a satisfactory way of obtaining it? Will it be necessary to have full records for all the population under study, or if a sample be sufficient what is the best means of drawing the sample? And so on. The specific questions involved and the answers to them will, of course, vary from inquiry to inquiry. But the basic ideas behind them will be very similar. Some acquaintance with those ideas will certainly help to make less frequent, at the end of perhaps months of patient work, that unhappiest of statements beginning, "If only I had realized I should need . . ." How often at present does the statistical consultant have to echo sadly, "If only!"

THE FUTURE OF PUBLIC HEALTH EDUCATION

BY

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When a medical student graduates he generally seeks further hospital experience in the first instance, so that he may practise under the canopy of skilled supervision. After that he ought to spend at least a year as an assistant in general practice; and military service should not tempt him to cut down this period of valuable training in the field, whether he intends to specialize or not. The majority of young medical men and women are well content, when this preparatory phase is over, to build up their life-work in general practice—the most strenuous and the most satisfying of all medical careers. Some of the others will turn to the special branches of medicine, probably because one of these has already stirred their imagination.

The prospect of a career in the public health service does not illuminate the mind with great intensity; but it is a steady light to many who see in it an opportunity for promoting social welfare. There are medical men and women to-day who discover that their interests move towards health rather than sickness; others find that their talents lie in administration; and others, again, believe that a general background of training in preventive and social medicine is a good foundation for practice in certain branches of the national medical service—such as paediatrics, industrial medicine, infectious disease, or bacteriology.

One of the objects of the postgraduate course of education in public health is to lay good foundations for careers in preventive medicine. The course as it stands to-day is

not narrowly vocational, but its content must inevitably change with the changing functions of the medical officer of health. Its first aim is to make good medical officers of health, and I hope that the diploma course will always be flexible, and sensitive to such changes.

Changing Functions of the M.O.H.

In the latter half of the 19th century the work of the M.O.H. was almost entirely environmental, and he was expected to be Jack-of-all-trades—sanitarian, epidemiologist, bacteriologist, and even public analyst. An interesting account of the work of the first medical officer of health has recently been published in Prof. Frazer's monograph on W. H. Duncan, of Liverpool.¹ The first quarter of the 20th century brought the M.O.H. into touch with an increasing number of problems relating to personal health through the maternity, infant welfare, and school health services; and into immediate contact with sickness through schemes for tuberculosis and venereal disease and other conditions in which the social factor was of notable concern. The transfer of Poor Law hospitals from the Guardians to the County and County Borough Councils still further plunged the health officer into clinical responsibilities. At the same time the constant increase in his administrative functions led the M.O.H. daily further away from the practice of medicine, and the complex arrangements for civil defence during the recent war taxed his administrative powers to the full. The medical officers of health accepted these changes as they came and built their new duties into the structure of a health service for the people. In a recent address the Minister of Health paid a just tribute to their constructive work in a century of public service:

"The medical officers of health," he said, "spent their early years in dealing with epidemics and environmental conditions leading to disease, and later they branched out, with very much more success than is generally admitted, into the clinical fields. Although very many claims—and justifiable claims—are made for the voluntary-hospital system, it must never be forgotten that the medical officers of health *inherited* the Poor Law system, and that they had to try and adapt the ugly infirmaries of the past to modern hospital requirements. And whenever people are inclined to make odious comparisons between the standard of some of the voluntary hospitals with the municipal hospitals, they should remember that the medical officers of health had the past to live down and had very adverse circumstances to overcome. In the hospital field they have indeed won very great distinction."

Now we are on the eve of a revolution in the organization of the national medical services. So far as the health officer is concerned a painful operation (as the Minister described it) is about to be performed: the municipal hospitals and practically the whole of the public clinical services which he has done so much to build up are being taken from the local authorities and organized into a national scheme. Where do we go from here?

The established medical officers of health, and particularly the elder brethren, may say with stoic resolution:

"Though much is taken, much abides."

But this is cold comfort for the young who are on the point of choosing a career. There are thus two matters for our special consideration: the present value of a postgraduate education in public health, and the prospects of a full and satisfying life for those who take up preventive medicine as a career.

The earlier medical officers of health had to be expert in sanitary science. Applied chemistry and the primitive but rapidly growing science of bacteriology were within the

sphere of their routine duties, and postgraduate courses of instruction in public health very properly offered laboratory study in these subjects. Before long, however, the immense broadening of these fertile acres led to specialization, and the practising health officer had to leave laboratory work to the expert. His own interest turned more and more to the pressing questions of personal health as successive Governments placed on local authorities one responsibility after another in the range of social medicine. Instruction in the social aspects of disease and in the administration of the personal health services was gradually added to the curriculum (often, it must be confessed, long after the need had arisen), but the diploma course remained essentially unaltered, founded deep on the nether springs of science and built to a Victorian model. The transfer of hospitals in 1929 had little immediate effect on public health teaching, and, indeed, no important change took place until the war of 1939–45, when plans for a national medical service began to be laid in an atmosphere of evanescent idealism. At the same time clinicians rediscovered the principles of what good medical officers of health had been practising for two generations—the application of medicine to man in his environment—and gave it the useful descriptive title of "social medicine." In this way the medical profession brought the social aspects of medicine into the foreground, and physicians have made an important contribution to the advancement of public health

New Curriculum for D.P.H.

The new curriculum for the Diploma in Public Health, which was approved by the General Medical Council at the end of the war, has now been in operation for two years. The course covers one academic year of full-time study (and provision is made for an equivalent period of part-time study). The first three months of the period consists of a preliminary course for a "Certificate in Public Health," dealing mainly with subjects which ought to be taught in the undergraduate curriculum as the basis of preventive and social medicine. It covers the historical approach to public health and the care of the poor, and leads naturally to a general study of central and local government as they stand to-day, including the services for health and social security. On this broad basis the student is encouraged to build up a conception of the functions of the medical officer of health—statistical, epidemiological, and environmental. Practical demonstrations in class and visits to places and institutions are arranged to illustrate the subject-matter of didactic lectures.

At the end of the first three months a Certificate in Public Health is granted to those who pass an examination. This preliminary course, it is hoped, will be a useful preparation for those who intend to follow any branch of preventive and social medicine, such as paediatrics, mental health, infectious diseases, and the school medical service.

The final course, covering a period of six months after the certificate has been obtained, is intended primarily for men and women who wish to become health officers. The curriculum changes its emphasis with the varying needs of the service, but has two broad divisions into (a) basic subjects, and (b) elective subjects. Every student is required to take a full course of six months' study in the basic subjects, but is allowed—within well-defined limits—to follow his bent in the elective subjects. The essential subjects are as follows: (1) epidemiology; (2) medical statistics; (3) physiology (including nutrition) applied to health; (4) public health law, administration, and practice. The elective subjects include these groups: (1) administrative; (2) occupational; (3) statistical; (4) tropical (comprising medical entomology, parasitology, and tropical hygiene). These

¹ *Duncan of Liverpool*, by W. M. Frazer. Hamish Hamilton, 1947.

groupings are illustrative only, and have not yet been developed in detail; but they represent a tendency towards freedom of choice, provided that the student can reasonably apply himself without diffusion of effort.

Two other features of the D.P.H. course stand out prominently: the day-book and the dissertation. Every student is required to keep a day-book in which he enters his observations during field visits, his notes on current public health activities as represented in both medical and lay press, and a précis of any special studies that he wishes to follow during the course. The dissertation, on the other hand, is intended to stimulate private reading, in the school library or elsewhere. The student has an almost unlimited choice of subject, and an opportunity to show his industry in the day-book and his imagination in the dissertation.

Careers Open to Students

We have seen that the course of study for the Diploma in Public Health has claims to survive in its own right, irrespective of the vocations which its students may follow. We are concerned, however, with the careers which are likely to be open to students; these must be considered in turn.

1. The Office of Medical Officer of Health

The withdrawal of hospital administration, and of clinical and associated organizing functions in connexion with tuberculosis, venereal disease, and other "community" diseases, from the sphere of the M.O.H., and the redistribution of the clinical side of maternity and child care, undoubtedly take away from the M.O.H. many of his most interesting duties. In commenting on this the Minister of Health (in the speech already referred to) said:

"I do not think that the medical officers of health have any reason to believe that their functions in the future are going to be less important than they were in the past. On the contrary, the medical officers of health are going to be very important links between the Regional Boards, between the health committees and the local medical committees and the Executive Councils responsible for the general public service—a very important link indeed."

This statement refers merely to co-ordinating functions which the M.O.H. will take in his stride, but it emphasizes the need for offering more instruction in medical administration. The Minister went on to deal with another aspect of the new health service:

"It has been pointed out," he said, "that on paper it looks as though the health service had some very serious crevasses. . . . Well, the medical officers of health are going to be the bridges that will carry you over from one side of the precipice to the other, and that locally and functionally they will be able to bring about the unification in practice of a scheme which superficially looks divided, and I would much rather have unity in practice and superficial schism than superficial unity and muddle in practice. And therefore I am confident that the medical officers of health are not at the end of an epoch, but at the beginning; that they are not at the beginning of an epoch of declining usefulness, but, on the contrary, I believe that their value is going to expand, and their importance is going to grow, and that they are going to achieve new distinction."

These are heartening words to perplexed medical officers. They refer, however, almost entirely to further administrative duties, and as such they will be loyally undertaken by medical men and women whose talents and interests are primarily administrative. It should be noted in passing that some people argue that administrative work is a waste of medical training. There is no substance in this argument. No single road leads to a career in administration; some enter this field through law, others through a basic education in classics and philosophy, and others, again, through business training. The medical man who finds, after graduation, that his talents lie in administration is entitled to pursue the career of his choice, and he brings many real advantages to his service as a medical administrator.

Nevertheless, there are many medical men and women in the public health service to-day who have a deep interest in personal health, in social betterment, and in the association between individual health and the health problems of the community as a whole. Must we assume from Mr. Bevan's address that the Government cupboard is bare, so far as these items are concerned? I do not think so. The Minister was referring only to the effects of the new Act, of the changing order, on health officers. There is another side to the whole matter which the Minister had no special cause to examine. The addition of clinical and quasi-clinical duties, including the hospital services, to the medical officer of health was not part of a well-designed policy; it was a course of expediency, because the M.O.H. happened to be the only person at hand sufficiently trained in administrative medicine to accept these burdens. *They are not, and never were, the proper duties of a medical officer of health.* The fact that he undertook them willingly, and carried them out with distinction, is quite beside the point. They are now in good shape, and the M.O.H. should be content to hand them over to the "clinical" authorities, especially as they have discovered the supreme importance of the social aspects of medicine. The hospital authorities were never more fitted than they are to-day to receive the "trust" of social medicine, and the medical officers of health have no reason to be ashamed of their period of trusteeship.

What work of noble note remains for the M.O.H. of the future? The answer is simple and urgent. He will be able to get back to his own job, in which there are vast, ill-explored territories for development. I do not hesitate to say that epidemiology and statistics are crying out to be yoked together in nation-wide investigations; that the study of the causes of sickness needs the co-operation of a whole army of health officers; and that the early ascertainment of sickness deserves immediate and intensive study. To take a single illustration: we do not know nearly enough about the earliest signs of such conditions as cerebral palsy, or acute rheumatism, or poliomyelitis (to take a few diverse conditions at random). Secondly—and a matter of even greater importance—we do not make enough effort to assess the signs and symptoms of health. The result is that we have little understanding of how to promote health, and most of our education and propaganda to-day is feeble and ill-informed. It may seem a startling statement to make, but one of the jobs of a medical officer of health is to promote health. He has hitherto been far too much concerned with sickness. I do not blame the M.O.H., because the task of health education is colossal. Government (as witness the so-called National Health Service Act), local authorities (as witness their immense pride in elaborate hospitals), the medical profession (whose financial interest is biased in favour of sickness), and the undiscerning multitude (who spend their time swallowing gaily advertised or threatening medicines) are all interested in sickness, not health. So the annual report of the average medical officer of health is one of the dullest and most uninspiring documents in the world of medicine.

We must not forget housing, which is perhaps the most urgent health project of this age. Here I can say with the intense conviction of personal experience that housing is the most fascinating, the most hopeful, and one of the most neglected functions of the M.O.H. I do not mean its negative aspects—the eradication of defects—which have always been done with skill and persistence even under the shell-fire of gross unpopularity. I mean the positive side, the joy of planning.

2. Other Careers in Medical Administration

The course of study for the D.P.H. is intended to be educational in a broad sense. It serves as a gateway to appointments in Central Government departments and in other public organizations which combine medical and administrative functions. The medical staffs of the Ministries of Education, Health, and National Insurance are good illustrations, and it is noteworthy that recent senior appointments have been filled by experienced medical officers of health. Indeed, the great majority of medical posts in Central Government departments are filled by persons who hold the D.P.H., and many of them have had practical experience in local government. This is as it should be, for the diploma course pays special attention to the relationship between central and local government.

Outside the Government services there are many responsible posts for which an understanding of medical administration is a qualification. Voluntary associations, organizations for research, and some of the new regional authorities may well regard training in the principles of preventive and social medicine as a valuable asset in a candidate. The undergraduate medical course is a good foundation, too, for a career of this kind, because it lays great stress on human relationship. In the United States it is possible to take up a career in public health without a medical qualification, but those who do so regret, as a rule, that they had not first graduated in medicine.

3. Industrial Health

Most of the appointments made hitherto in the industrial field have been mainly clinical, and a fine service of industrial medical officers is developing in this country. In recent years a diploma has been established by various medical authorities to meet the needs of these officers. This diploma is called the Diploma in Industrial Health in conformity with the misuse of the word "health" now so widely current in official documents and even in Acts of Parliament. Side by side with this important advance in medicine there are signs of a thrust forward towards an industrial health service. Further legislation will be necessary to secure this, but one may prophesy with confidence that within the next decade there will be a steady demand on the part of local authorities and large industries for supervising medical officers whose training and outlook are based on public health.

4. Tropical Hygiene

A similar tendency may be detected in the Colonial medical services. Until recently all the bias in training has leaned towards the practice of medicine in the Tropics. The new line of advance has as its object the improvement in the health of the general population of the Tropics.

In European countries much was known of the life-history of the peoples before the rise of modern medicine. In the Tropics, on the other hand, clinical treatment was applied in the absence of reliable vital statistics; the birth and death rates, let alone the more subtle indices of social and physical health, are little more than guesswork. The health of the Tropics has been studied by groping in the dark. The opportunities for men and women educated in preventive medicine are therefore almost unlimited.

5. Investigation and Research

If we confine the term "research" to the direct studies of Nature undertaken by the physical sciences we are left with a vast territory—only partly explored—in which investigations in preventive and social medicine can be carried out. In the postgraduate course for the D.P.H. the nature and scope of these investigations are plotted out, and the students have the advantage of co-operation in teaching between a number of university departments, especially in sociology. Recent investigations carried out in the field of public health by physicians, health officers, and students of social science—to mention only three companies out of a large army—have demonstrated clearly that there is space for new workers with fresh minds.

These are a few of the ways that lie open to the student who enters the health service. The future lies with the team of workers who can bring to the common store treasures of varied experience . . . "not forsaking the assembling of ourselves together, as the manner of some is."

Announcing that the part-time nursing campaigns are now meeting with widespread success, a circular from the Ministry of Health to local authorities points out that certain difficulties have arisen over classification and rates of pay. It suggests that 1s. 9d. per hour might be appropriate for those volunteers who have had nursing training or experience in the past, but who, through retirement from the profession on marriage, or for other reasons, had not applied within statutory time limits for State registration, admission to the list of nurses under Section 18 of the Nurses Act, 1943, or for State enrolment. A higher rate, perhaps 2s. per hour, might be suitable for a woman holding a certificate of three years' nursing training issued by a hospital before July, 1925.

Medical Memoranda

Acute Haemolytic Anaemia (Lederer type)

Lederer in 1925 reported three cases of acute haemolytic anaemia "probably of infectious origin." The onset was characterized by rapid development of pallor, icterus, weakness, rise of temperature, and evidence of haemolysis. The blood picture was dominated by a very profound, rapidly progressive anaemia, with marked leucocytosis and erythroblastemia. A striking feature was the dramatic response to blood transfusion, with prompt cessation of haemolysis and complete recovery. According to Giordano and Blum (1937) about fifty reports of this type of anaemia have since appeared. The following report is based on a case of this kind of anaemia.

CASE REPORT

A tailor aged 22 was in good health until a few days before the present illness, when he had progressive fatigue, headaches, and shortness of breath. On April 2, 1946, he suddenly became ill with chill, fever, some vomiting, and marked pallor. The urine was dark reddish-brown and the temperature 102.2° F. (39° C.). He was admitted to hospital with a temperature of 103.1° F. (39.5° C.). He appeared to be seriously ill and had a very anxious expression. The skin was pale, moist, and icteric. Physical examination was essentially negative: we found only a splenic enlargement. A blood count on April 6 showed: Haemoglobin, 30%; red cells, 1,500,000 (normoblasts 13%, reticulocytes 32%); colour index, 1; white cells, 55,000 (myelocytes 2%; metamyelocytes, 5%; rod forms, 6%; neutrophils, 60%; lymphocytes, 27%); fragility of erythrocytes, normal; van den Bergh, indirect, positive; urobilin, ++. The urine was highly coloured and contained traces of haemoglobin and albumin. The blood culture was sterile. On April 10 a blood count showed: haemoglobin, 30%; red cells, 1,800,000; colour index, 0.8; white cells, 40,000 (myelocytes, 3%; metamyelocytes, 6%; rod forms, 5%; neutrophils, 68%; lymphocytes, 18%); normoblasts, 13%; van den Bergh reaction indirect positive; urobilin ++. Injections of liver extract were given, but there was no real improvement. On April 12 he was transfused with 150 ml. of blood. The treatment was followed by an immediate improvement. The temperature fell to normal. On April 15 a blood count showed: Haemoglobin, 88%; red cells, 4,100,000; colour index, 1; white cells, 10,250 (rod forms 3%, neutrophils 59%, lymphocytes 38%); urobilin, nil. The patient left hospital on April 24. He has remained in good health, and a blood count on May 12 showed: haemoglobin, 86%; red cells, 4,300,000; colour index, 1; white cells, 8,000, with no appreciable change in the differential count.

COMMENT

Lederer's anaemia may occur at any age. The onset is sudden, without any previous history of anaemia or jaundice. The patient presents a picture of acute and critical illness with approaching coma. Physical examination usually reveals splenic enlargement. The blood picture is characterized by a rapid drop of erythrocytes and haemoglobin and the appearance of immature and reticulated red blood cells. The presence of megaloblasts in the circulating blood is emphasized by Lederer (1930). O'Donoghue and Witts (1932) denied the occurrence of megaloblasts in Lederer's anaemia. In my case megaloblasts were not found in the peripheral blood or in the bone marrow. The anaemia is usually associated with marked leucocytosis, often with a leukaemoid reaction. A further dominant feature of this form of disease is the excessive destruction of the red blood corpuscles. The most important evidences of haemolysis are the hyperbilirubinaemia, the increased excretion of urobilin and the haemoglobinaemia. The differential diagnosis includes acute leukaemia, erythroblastic anaemia, and blackwater fever. The preferred treatment is blood transfusion. Nothing was known about the pathogenesis of the disease. The infectious origin is very suggestive, but all attempts to cultivate a micro-organism have completely failed.

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