

ON THE STUDY OF MEDICAL METEOROLOGY,
ESPECIALLY IN ITS RELATION TO EPIDEMIC
MALADIES.

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I HAVE been honoured by your President with a request that I would this evening address you upon the study of meteorology in its relations to that branch of etiological research which gives its designation to this Society. The compliment is one which I am conscious of not deserving in any way, and, while responding to it, I wish in all sincerity to start by disabusing your minds of any expectation you may have fostered of learning from me to-night anything novel upon this very interesting and very important subject. I am painfully conscious of my unfitness to speak upon it with authority.

We must begin, where all true reformation begins, with an ample expression of our ignorance and shortcomings. We live in an age of precision, precision of observation, logical and strict precision in reference to all scientific questions. It is through precision that all the grand advances in our scientific knowledge, and all the great practical reforms resulting from the application of this knowledge to the exigencies of our daily life, have during the last half century been attained. And what this advance has been all can judge who are old enough to carry back their memories for one half of that period of time. Can it be said that our acquaintance with the bearings of meteorology upon public health, and especially upon the origin, spread, and decline of epidemic maladies has advanced commensurately with our acquaintance with other branches of etiological science? Let me take an instance, and I will select for illustration what has appeared to me to be the purest example of an epidemic malady, a malady which, while spreading from time to time at most uncertain and indefinite intervals over a great part of the world, does not appear to owe its spread in

a material degree to the operation of what we term contagion. You will probably anticipate me when I say I refer to the disease which we here call "influenza". Let us consult all available records of the numerous epidemics of this disease; let us put together, and with all the care we can, estimate the value of the statements given us of the meteorological conditions prior to and during the outbreak of the epidemics and at their decline, and what does it amount to? A tangled skein of apparent contradictions. And yet, if there be a law governing epidemicity, if outbreaks of influenza be not exceptional instances of non-coherence among mundane phenomena, there can be no such contradiction in point of fact. It is unquestionable that remarkable meteorological conditions really have preceded and accompanied these outbreaks, and it would be folly to assume that they had no etiological relation to them whatever. It remains for modern enquirers, with greater facilities for their enquiries than their forefathers possessed, to determine what the relation is. And let us not forget that, in doing this for influenza, it is not unlikely that we shall be taking a most important step in unravelling the complication of questions which still surround the epidemicity of other diseases, such as cholera, the specific fevers, and the epizootics.

I have mentioned influenza first because it appears to me to be the field of etiological research which in its meteorological aspects promises to yield the most abundant harvest of valuable results; but it is an epidemic which happily occurs with comparative infrequency. There are other much more common maladies, the epidemic prevalence of which may be more readily studied and perhaps with the prospect of earlier fruit. I allude to those common diseases which, at short cyclical periods, spread over this land of ours; but the study of which is, so far as meteorological etiology is concerned, somewhat complicated by the fact of the contagiousness of some of them. There are the acute pulmonary affections, which cut off so many of our young and old in the winter months, the diarrhoeal affections which destroy our infant population every summer, whooping cough, small-pox, measles, scarlet fever, what we call the "continued fevers", and such rarer epidemic diseases as diphtheria and cerebro-spinal meningitis. And I mention these diseases because they are at our very thresholds, and every practitioner in the kingdom who pleases to do so, can lend a helping hand in their etiological investigation. What do we know about the meteorological conditions which influence the epidemical spread and epidemical decline of these diseases? Surely

they are frequent enough for us, if we had used all the means we might individually and as a nation have used, to have by this time acquired a very respectable acquaintance with the facts about them. I will not say we know nothing, for, thanks to the Registrar-General and his indefatigable and zealous coadjutor Dr. Farr, we do know something, and through their exertions we have in our hands the means of knowing a great deal more. But we want a Humboldt. And even if we had some one fitted by industry and previous acquirements to grasp with a master's hand the whole maze of facts which have thus been put within reach, and possessing withal the unvarying patience necessary to analyse these facts and to put them in order, we should merely arrive at something which would not afford us all the desired satisfaction. For the Registrar-General deals with deaths, and death from disease is only one phenomenon in its course, and an uncertain, and where we compare one epidemic of a disease with another, and the same epidemic at different periods of its course, a most variable one. I would not even for a moment insinuate a shadow of a doubt as to the immense value of the medico-statistical records issued by the great national office presided over by the gentlemen I have named; but they will probably be ready to admit that for the satisfactory solution of the great questions of medical meteorology now awaiting solution, something more is wanted than records of mortality. What we sorely need, is a record of sickness standing upon such broad basis as are our records of mortality. But I am anticipating—pardon me. I ask, what do we know with precision about the common diseases I have enumerated? Am I wrong in saying that while the Registrar-General has familiarised the public mind with the fact that cold weather enormously increases the mortality referred to pulmonary diseases, notably to bronchitis and pneumonia, and that heats of summer are associated with greatly increased infantile mortality from diarrhoeal affections, we are yet in ignorance why, in years or corresponding months of similar winter cold and similar summer heat, the mortality from these diseases respectively is sometimes so different as it is; and as respects diarrhoeal affections, we are yet in doubt whether it is temperature, or some other meteorological condition combined with it, which is operative in producing the observed result: and whether the result, so far as we know it, is the direct or indirect effect of the conditions referred to. And again, as respects the specific febrile diseases, we are at a loss to understand why, with the specific contagium probably never altogether absent from our midst,

it should operate epidemically at one season of the year rather than at another, and what are the precise meteorological conditions which promote or avert the epidemic spread and promote or retard its decline. Let us ask ourselves if we know why small-pox for instance spread epidemically as it did so recently, and why it did not spread epidemically in the interval between the last and the previous epidemic, notwithstanding the presence of an abundance of foci of contagion. Is it not for us to enquire whether atmospheric conditions had anything to do with the difference? Let us ask ourselves what we know of the meteorological associations of epidemics of whooping-cough, measles, and scarlet fever? Surely these are common enough. It is true that some of them appear cyclically—measles notably so—but what is there that governs these cycles, and what meteorological conditions determine the exact period of the epidemic outbreaks, their duration and cessation? These and similar questions are as yet unanswered. And we have further to learn what these conditions are, probably in part meteorological, which determine the fatality of epidemics—in other words, the severity with which they fall on the individuals attacked. Here is another most important branch of enquiry; for it is certain that there are mild epidemics at one time, severe and very fatal epidemics at another time, of all our common epidemic maladies. Do we know? I for one should be very glad to learn. So far as my own trifling observations go, they have given me a peep behind one corner of a curtain the full raising of which would, I am satisfied, disclose to view some facts of immediate practical value if not to the treatment yet to the prognosis of disease.

So much for our ignorance. Now for our shortcomings to which our ignorance is due. There are three requisites for a comprehensive and successful study of medical meteorology, and these are accurate observations at a sufficient number of meteorological stations, reliable records of sickness and its fatality, and a sufficient staff of workers to analyse and compare facts and work out results. The first we have in great measure supplied to us by our great meteorological societies; the materials for the second requisite exist in an imperfect condition in the records kept by Poor-Law Medical Officers and at public medical institutions, but they are not kept universally as they ought to be, nor have they been utilised as the more perfect of them might have been; the third requisite remains to be found. What we should, in my opinion, aim at first of all is as perfect a system of registration of sickness as is practicable

under existing circumstances of professional education. Towards the attainment of this, the Medical Officers of Health throughout the kingdom might if they pleased contribute most valuable aid. An acquaintance with the amount and character of prevailing sickness is essential to them for the due and efficient exercise of their office. One reason, I believe, why records of public sickness are not properly kept now is that the persons who ought to keep them have not seen the use of keeping them. If the information were sought regularly and were seen to be applied to a useful purpose, I cannot think that it would not be forthcoming. I have myself made the effort in the small district of London, which was formerly under my sanitary supervision; I met with difficulties, as a matter of course, but I surmounted them one after the other, and for several years kept on foot a tolerably satisfactory register of public sickness. I can, therefore, speak with some experience upon this subject. There is no insurmountable difficulty in collecting facts as to sickness, sufficiently precise for practical uses, provided the collector sets about the business discreetly and is sufficiently patient, persistent, and forbearing. Very much more might have been done by local observers, especially by official observers, than has been done in this direction. But, when the facts have been collected (I speak again from experience), the labour of analysis is such as no man engaged in professional practice can hope to be able to supply. It was here that I myself broke down. It is this, I believe, which, more than anything else, has served to discourage the pursuit of medical meteorology, in itself one of the most enticing of studies. What then, is to be done? For amendment ought to follow upon confession of our errors. I am addressing the Epidemiological Society, a Society which, as your President pointed out to you (and I think triumphantly) in his opening address, has already been the pioneer of great practical reforms. A grand opportunity lies before you, an inauguration of a new activity, opening out the prospect of advancing etiological science into an almost virgin field. To whom could the appeal to march on be addressed more appropriately than to you? You have already shown to the country and to the world what the unsupported efforts of a band of determined men can effect in overcoming obstacles and demonstrating the practicability of investigation in one direction. You have been successful beyond your own expectation, for the nation has undertaken that which you showed to be feasible, but could not yourselves have accomplished. Perform the same excellent rôle for medical me-

teology—if you fail yourselves to effect all you aim at, you may still see before you the prospect of inducing our National Governors to take up your work and to prosecute it to a satisfactory conclusion.

I have hitherto confined my remarks to the epidemic diseases common to this country, and I have done so purposely; for it is abundantly clear that this work must be commenced at home, where the facilities of enquiry are most readily attainable, and where home sympathies can be enlisted in its behalf. But you cannot stop there, nor can you even be strictly limited, however you may desire it, to home observations. And here again it appears to me that, with your already organised foreign correspondence, you are especially fitted for the task I suggest you should undertake. For these common home maladies, when epidemic, are not only epidemic in England. They have a march, passing through other countries to arrive here, exerting concurrently in foreign lands and invading other nations after they have done their fatal work among ourselves. And to draw inferences as to our own epidemics, and their relation to local meteorological conditions alone, might, and probably would, lead to serious mistakes. It would be for you to endeavour to organise similar observations abroad to those you may organise at home. It may not be in your power, without such a paid staff as circumstances would probably forbid to such a small Society as this, to do much more than collect facts; but, in the absence of any systematic collection of facts at present, this would be doing a great deal. The time will surely some day come, when the facts you may have gathered will find their expositor. You will, at any rate, have shown the way to overcome the first obstacle to a true medical meteorology.

It is not for me, on this occasion, to suggest further than I have done in what way it would be most advantageous to set about the collection of sickness statistics; it is enough to say that all at present practicable is the collection of statistics of what may be termed public sickness, that which seeks medical relief at the hands of poor-law medical men and the various public institutions established for giving medical relief to the needy. It is a subject which has occupied the thoughts of many men more fitted for consultation upon it than myself. All I desire to say now is that the registration should include all cases, both surgical and medical, and not be limited to the classes of disease liable to prevail epidemically. And for this reason, namely, that it may be that certain atmospheric conditions so affect the

human constitution as to lessen its power of resistance to *all* causes of disease. I would not exclude surgical cases from enumeration, first, because it may be difficult always to do so, and secondly, because it is probable that the error thus introduced would be one of uniform magnitude, whilst it is probable that surgical diseases are influenced equally with diseases usually considered medical by conditions of weather.

The final object of the study, apart from the practical application of the truths to be evolved, is, not merely to ascertain the fact that such and such conditions of atmosphere are favourable, or the reverse, to epidemic extensions, although this is the first thing to bring out, but how it is and why it is that such is the case. We may say that it is certain even now that weather and season do influence in some way the spread of epidemics. Putting aside respiratory diseases and diarrhoeal affections, about which nobody can for a moment dispute, I have shewn in an analysis of some thousands of cases recorded in my old health district at Islington, that during twelve years while measles, for instance, occurred with regularity as an epidemic once in two years, the greater proportion of cases happened in the months of May, June and July, and that there was exhibited another like tendency to epidemic spread in the months of November, December and January. This has no reference to the mortality. I am speaking of cases. It appeared also that there was a mean temperature, namely between 43 deg. and 49 deg., which favoured the epidemic spread of the disease both in the spring and autumn, and further, that a temperature above 60 deg. and below 42 deg. tended to arrest the epidemic spread of the disease. Again, as respects scarlatina, the fact came out most distinctly, that this is *par excellence* a disease becoming epidemic towards the beginning of the summer quarter. The smallest number of cases was observed in the month of March, there was a slow and steady increase to June, the month of July showed a rather sudden increase in the number of cases, and the largest number occurred in the months of September, October and November. Again, I am speaking of cases not of deaths, for the fatality of the disease, at its minimum in the summer, arrives at its maximum in the cold and damp weather of autumn and winter. Mortality tables are specially unreliable as indicating prevalence in respect of this disease. With respect to temperature as influencing prevalence, it appeared to me that a mean temperature between 56 deg. and 60 deg. was that most favourable to an epidemic outbreak, that a higher tem-

perature was not unfavourable to it, but that a fall of mean temperature below 53 deg. tended to epidemic arrest. Small-pox, in my Islington experience, presented the smallest number of cases in September and October, and the largest number in March, April and May, the graduation of cases in intermediate months being tolerably uniform. This is clearly a disease the extension of which is promoted by cold weather and checked by hot weather. Very different this to popular opinion and to opinions I have heard openly expressed by some medical men. It is not true, as some have supposed, that all zymotic diseases are promoted by hot weather, and checked by cold weather. It appeared to me that a mean temperature of about 52 deg. was an important temperature as respects small-pox; a temperature below this promoting its spread, and a higher temperature checking it.

Now I beg to interpose a caution. I am not putting forward these few observations as settling the question raised as regards these diseases. I am quite aware that they were not all made in perhaps the best possible way, and that even if they were absolutely true for Islington, they might not be similarly true for the whole of London, for the whole of England, or for other countries. I merely adduce them to show that seasons and atmospheric conditions, do in a definite manner promote or check the epidemic extension of these common maladies, and that these conditions are, with the exercise of proper care and due patience, capable of being ascertained. The next question will be how they operate.

In considering this, when we are dealing with diseases of a contagious character, we have to keep in mind that conditions of weather and seasons may operate by their influence upon the functions of the body which is open to receive the contagion, by leading people out of doors where they mix with others, or by keeping them within doors and huddled together, or finally by their influence on the contagion or morbid product which is the agent of contagion. It will have to be determined in which, or whether in all, of these ways, atmospheric conditions operate in promoting or checking each form of contagious epidemic disease. And probably all these modes of operation may be ascertainable in respect of diseases not regarded as contagious, such as influenza. For although a disease may not be contagious, in the sense that the morbid material is not reproduced in the subject attacked, and so is not communicable from them to the healthy, it by no means follows that there is no

materies morbi at all in question. It may be that there is one which has some nidus in which it propagates itself other than the human body, such as the bodies of the lower animals or something not living at all, such as water, the soil, or the air itself. See then where you are being led, and how this field of investigation opens out before you.

And there is a yet further point to be ascertained at which I have hinted already, namely what influence is exerted by meteorological conditions in preparing the way for epidemic extensions. What is the reason of the cyclical recurrence of epidemics of which measles is so curious an instance? Is there anything similarly cyclical in the meteorology of the places where such cyclical recurrences are observed? For surely there must be some ascertainable reason for so remarkable a phenomenon. There must be some reason why contagious diseases fall into abeyance as epidemics for a period more or less decided in duration, but differing in different diseases. And what is it which determines the mildness or fatality of epidemics when they do occur? All these questions have to be considered from a meteorological point of view. Possibly their solution may be discovered when they are regarded on this side.

Above all things let us collect facts, and keep *a priori* reasoning within its proper sphere in these matters. But at the same time let us not be blinded, by the special study in which we are engaged, to the fact that there may be other influences, not meteorological, which govern the period of origin and decline of epidemics. I will merely mention one, "acclimatisation". Are there not facts on record leading to the belief that the human body may become, in time, so accommodated to the presence of morbid influences, as to become insusceptible to their operation? May not this, to some unknown extent, explain the fact of the cessation of epidemics after lasting for a time, notwithstanding the multiplication of contagious foci, and not merely, as is commonly said, the exhaustion of subjects who are susceptible because they have not previously suffered from an attack of the disease? Let us recollect the epidemic law of Dr. Farr, so strikingly illustrated by the cattle plague of 1865. Let us not forget also to enquire to what extent it is true that the intensity of operation of a contagious principle lessens by its repeated transmission through the bodies of men and animals.

I have now performed the task I had set myself; I feel that I might lessen the force of what I have written were I to enter into details. My paper is intended to be suggestive and nothing more.