The geographical distribution of heart disease and dropsy in England and Wales.

THE

GEOGRAPHICAL DISTRIBUTION

OF

HEART DISEASE AND DROPSY

IN

ENGLAND AND WALES

ILLUSTRATED BY A LARGE COLOURED MAP

BY

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TO

WILLIAM FARR, Esq.,

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SUPERINTENDENT OF THE STATISTICAL DEPARTMENT OF THE GENERAL REGISTER OFFICE,

SOMERSET HOUSE,

THIS WORK

IS DEDICATED, WITH HIS KIND PERMISSION, AS A HUMBLE ACKNOWLEDGMENT OF HIS

FRIENDLY AND EFFICIENT ASSISTANCE DURING ITS PROGRESS,

AND HIS MANY AND GREAT SERVICES IN THE CAUSE OF SANITARY SCIENCE,

BY

THE AUTHOR.

PREFACE.

IT is a remarkable fact that Dr Farr, in his very first letter to the Registrar-General in 1839, when the Act for Registering Births, Deaths, and Marriages in England came into operation, made the following statement:—

'The registration of the diseases of the several districts will furnish medical men with a series of valuable remedial agents. It will designate the localities where disease is most rife, and where there is the most tendency to particular classes of sickness and infirmity.

'In recommending a residence to patients, the physician will find the registered causes of death an indispensable directory; and the utility of a *Sanatory Map of the Country*, such as the Returns will furnish, cannot fail to be felt in England, where a part of the population is constantly migrating from place to place in search of health.

'Much information has been collected respecting the influence of the British climate; but the facts will bring to light many salubrious spots hitherto unknown, and disclose the dangers which infest others unsuspected.

'Invalids resort to some unhealthy places; families carrying their children in autumn, where small-pox and measles are often epidemical, or go into parts of the country where bowel-complaints and fevers are extraordinarily fatal.'

After completing the Map on Heart Disease, I was gratified to find that this prophetic opinion had been expressed by Dr Farr; and I was stimulated to extend my inquiries not only by what he wrote so many years before there were any data whereon to form such a map, but by his confirmed opinion, when he saw the figures of his office chartographically portrayed.

The scope of my work is explained in the few sentences I have quoted, and at present I shall not add to them.

My work was originally intended to have been published in August last; but when Messrs W. & A. K. Johnston examined the Maps of the Registration

Districts contained in the Census Tables of 1851, which they at first purposed to use, these were found to be insufficient, and therefore necessitated reference to a more recent authority. On application to the Registrar-General, the set of Ordnance Maps of England, on which the Districts had been drawn minutely from the Parish Boundaries, was kindly lent to me. This set of Maps, however, had not been revised since 1851, and the whole of the Northern Counties of England (the Ordnance Maps were not complete at that date) were deficient. These defects had to be remedied, by working out the Registration Districts completely on the Ordnance Maps; and an unexpected outlay of time and money was the result. To defray the one, I applied to the Lords of the Treasury for a small Grant, which, on the recommendation of the Registrar-General, was accorded to me; and I now take this opportunity of thanking Major Graham for the hearty and effective support which he afforded me whilst my application was under the consideration of the Treasury, and which eventually led to its being successful.

During the time that I was engaged in 1868, at Somerset House, preparing the basis of my work, I received every kindness and attention from William Clode, Esq., of the Statistical Department: he was ever ready to afford me assistance, and I feel glad thus to acknowledge it gratefully.

I now leave the First Part of my work in the hands of my professional brethren, hoping that it may render them some assistance in that part of their practice upon which our knowledge has always been more or less imperfect.

I trust that my labours, however incomplete, may stimulate others to collect facts relative to the localisation of Disease, and record them, so that in time to come the practical fruit, borne by the study of the Geography of Disease, shall enable it to take its proper position in Medical Science.

ALFRED HAVILAND.

120 King Henry's Road, Hampstead, N.W.
January 1871.

THE

GEOGRAPHICAL DISTRIBUTION

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IN

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CHAPTER I.

SECTION I.

Deaths from all causes.

DURING the ten years 1851-60, there died in England and Wales from *all causes*, 4,210,715 persons, out of a mean population, calculated for the decenniad 1851-61, of 18,996,916.

Deaths from Heart Disease and Dropsy.

During the same period 236,973 deaths were attributed to Heart Disease and Dropsy, according to the Registrar-General's Returns, which are based upon the cause-of-death certificates given by legally qualified medical practitioners: the deaths, therefore, from these combined causes, amounted to more than one-seventeenth of the whole mortality.

Compared with other diseases.

Compared with the death rate from other causes, that from Heart Disease and Dropsy holds a high place in the order of mortality, for although Phthisis claims annually a number of victims doubly greater, yet the sum of those who succumbed to Cholera, Diarrhœa, and Dysentery, during the same period, did not exceed it, whilst that from Small-pox and Scarlet Fever fell short of it by 28,470 deaths.

Difference of mortality between the sexes.

Of those who died from Heart Disease and Dropsy, 109,527 were males, and 127,446 females: the estimated female population of the decenniad was not half-a-million in excess of the male; therefore the number of deaths among females from this cause was both absolutely and relatively greater than among males; absolutely, in the proportion above stated, and relatively, as 13·1 are to 11·8 to every 10,000 persons living.

Mortality varies according to sex and age.

Heart Disease, like some other causes of deaths, varies in its fatal effects according to the *sex* and *age* of the persons afflicted. As a general rule we have seen that females are more prone to become victims to it than males; this rule we however shall see is modified to a certain extent according to age.

TABLE I.

Mean Population, and Deaths from HEART DISEASE and DROPSY, in England and Wales, during the ten years 1851-60.

		All Ages.	Total under One Year.	1	2	3	4	Total under Five Years.	5—	10—	15—	20—	25—	35—	45—	55—	65—	75—	85 and upwards.
Mean Population 1851-61.	Males.	9,278,742	—	—	—	—	—	1,265,830	1,111,954	1,011,594	915,583	827,833	1,356,605	1,074,115	792,246	523,334	285,168	101,371	13,121
	Females.	9,718,174	—	—	—	—	—	1,258,614	1,106,619	997,324	929,333	920,217	1,494,666	1,133,809	830,351	565,586	332,631	128,750	20,274
Deaths from Heart Disease and Dropsy.	Males.	109,527	2,313	1,076	777	639	582	5,387	2,665	2,443	2,948	2,869	6,977	10,767	15,039	21,611	24,849	12,579	1,393
	Females.	127,446	1,969	921	634	494	468	4,486	2,378	2,715	3,275	3,592	9,007	12,673	17,141	25,781	29,657	14,846	1,895
Average Annual Rate of Mortality from Heart Disease and Dropsy at different ages to 10,000 living during the ten years 1851-61.	Males.	11·8	—	—	—	—	—	4·2	2·3	2·4	3·2	3·4	5·1	10·0	18·9	41·2	87·1	124·0	106·0
	Females.	13·1	—	—	—	—	—	3·5	2·1	2·7	3·5	3·9	6·2	11·1	20·6	45·5	89·1	115·3	93·4
Mean of the Two Sexes,		12·4	—	—	—	—	—	3·8	2·2	2·5	3·3	3·6	5·6	10·5	19·7	43·3	88·1	119·6	99·7

The accompanying Table shows that during the first ten years of life, more males die from Heart Disease than females, but that after the first decade up to the one between 75 and 85, the proportional number of deaths from this cause among females is greater than that among males: in fact, during the first ten and the last twenty years of life, the male mortality exceeds that of the female.

Age influences the differential mortality between the sexes.

The mean proportional mortality is greater during the first five years of existence than during any of the succeeding quinquennial periods up to fifth, which ends at 25; after which age the relative mortality in both sexes nearly doubles itself in each succeeding decade, up to that commencing at 75, when only an increase of one-fifth in the mortality takes place, which, however, falls during the last 15 years to less than one-fifth below the preceding decade.

Proportional mortality at different ages.

The age when the *least* relative mortality takes place in both sexes is between 5 and 10, and that when it is *greatest* lies between 75 and 85.

The extremes of mortality in both sexes.

Between 5 and 10 there is the *least* difference in the mortality between the sexes, and between 55 and 65 the *greatest*.

The extreme differential mortality between the sexes.

The difference in the average annual rate of mortality among males and females, being only 1·3 to every 10,000 living, I think I am justified in believing that some other cause independent of sex, operates in the production of that difference, and that the numbers, which express the mean of the average annual mortality, will answer every practical purpose in portraying the geographical distribution of Heart Disease and Dropsy; due regard being paid to any exceptions which may occur during our investigation of the subject.

The difference between the male and female mortality not altogether sexual.

When I describe the geographical distribution of Cancer, the difference between the mortality from this disease, and its seat in the two sexes, is so great, that each will have to be studied separately; and, although in Phthisis the numbers of male and female deaths are nearly equal, yet in consequence of the remarkable relation which appears to subsist between this disease and Cancer, it will be necessary to separate the males from the females, for, unless we do so, the geographical distribution of these two causes of death would not be comparable.

Cancer.

Phthisis.

I will now recapitulate the leading facts which are given above:—

1°. The mortality from Heart Disease and Dropsy amounts to more than one-seventeenth part of the whole mortality from all causes.

2°. More females than males die from Heart Disease and Dropsy, both absolutely and relatively; it is not however probable that the excess arises from a purely sexual cause.

3°. Female mortality is less at the extremes of life than the male.

4°. Between 25 and 75 in both sexes, each decad has a relative mortality nearly double that of the one which precedes it.

I now proceed to the Geographical Distribution of the Statistics of Heart Disease and Dropsy.

CHAPTER II.

SECTION I.

The Geographical Distribution of the Statistics of Heart Disease and Dropsy.

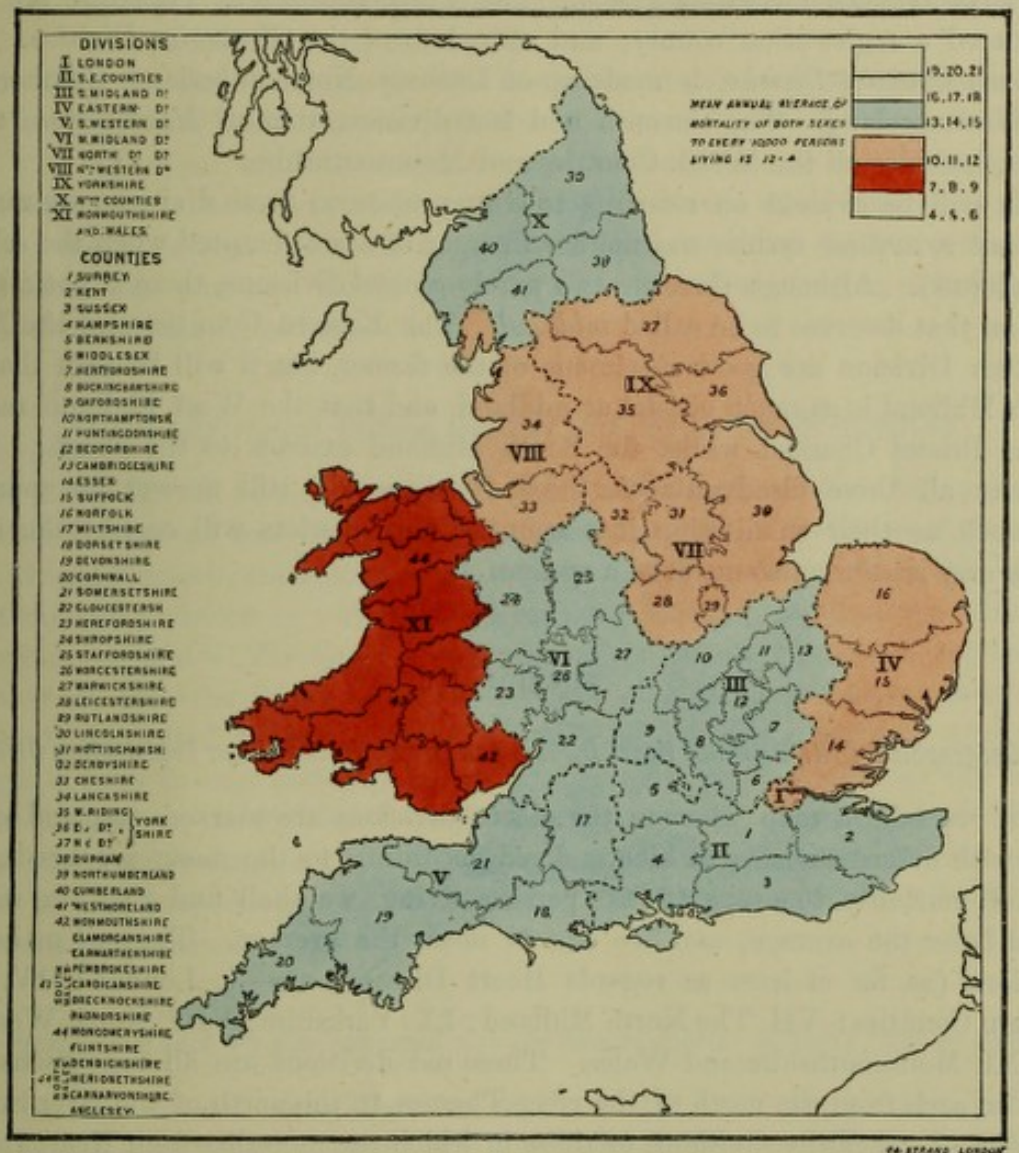
ENGLAND and WALES are divided into eleven Registration Divisions, each of which represents a group of counties, which are again subdivided into Union Districts. During the period I have selected, the ten years 1851-60, each union district had its population carefully estimated according to the death and birth-rate, between the census of 1851 and that of 1861; this estimated mean population forms in the Registrar-General's Supplement to his Twenty-fifth Annual Report a standard which enables us to calculate what proportion the deaths of any district bear to the number of those living within its boundaries: for instance, if there have died in a district, during the decennium selected, having a mean population of 10,000, a hundred persons from any one cause of death, Heart Disease for instance, by dividing the 100 deaths by the number of years over which they were spread, we arrive at the average annual rate of mortality, which would be 10 to every 10,000 living; the numbers therefore that I use are *proportionate* not *absolute;* and being so, it is all the more necessary that the gross sum from which they are deduced should be as large as possible. Until the present time it was impossible to chartographise disease, inasmuch as the numbers were not sufficiently large, and what had been collected were not in a form suitable for the purpose: of this we can complain no more.

Mode of Study.

The mapping of England and Wales into 11 divisions, 53 counties, and 623 union districts, affords us the means of analysing the distribution of Heart Disease, or any other cause of death. By this threefold division we are enabled to sift our facts through three gauges of different degrees of fineness. In the first place, we see what proportion the death-rate from a cause of death bears to the population in each of the eleven divisions; we colour blue or red those divisions which are above or below the average, and then study this gross distribution carefully; our next process is to colour the counties in the same way, and observe whether the distribution at all coincides with that of the divisions; and our third process is to discover whether the proportional mortality of each county is influenced by the mortality in the districts. Having done this we again review our work, and calculate the effect of each of the many causes surrounding us in the production of the distribution, which our coloured map reveals: if during this scrutiny we discover a general law regulating the distribution in each of the three divisions, our last duty is to crucially test the effects of this law, separate the real from the apparent, study the exceptions, and examine their relation to the assumed law; I say assumed law, for we must remember that until it has been proved we ought not to regard it as a law at all; at the same time, it must be remembered that in physical investigations some hypothesis is requisite, in the first instance, to aid the imperfection of our senses; and when the phenomena of nature accord with the assumption, we are justified in believing it to be a general law; these last few lines

embody the opinion of Mrs Somerville, whose world wide fame is an honour to her sex and her country.

I shall now illustrate the principle on which I base my investigation of the Geography of Disease, by an analysis of the total deaths from Heart Disease and Dropsy during the decenniad 1851-60.



SECTION II.

The Registration Divisions of England and Wales.

Monmouthshire and Wales.

The eleven Registration Divisions into which the fifty-three counties are grouped, are named, with the exception of London, Yorkshire, and Monmouthshire, and Wales, according to their position on our island. For instance, we have the *South Eastern Counties Division*, embracing Surrey (*extra Metropolitan*), Kent (*extra Metropolitan*), Sussex, Hampshire, and Berkshire. The *South Midland Counties Division*, including Middlesex (*extra Metropolitan*), Hertfordshire, Buckinghamshire, Oxfordshire, Northamptonshire, Huntingdonshire, Bedfordshire, and Cambridgeshire. Essex, Suffolk, and

Norfolk, constitute the *Eastern Counties Division;* whilst Wiltshire, Dorsetshire, Devonshire, Cornwall, and Somersetshire, compose the *South Western Counties Division.* The *West Midland Counties Division* is composed of Gloucestershire, Herefordshire, Shropshire, Staffordshire, Worcestershire, and Warwickshire. The *North Midland Division* includes within its boundaries Leicestershire, Rutlandshire, Lincolnshire, Nottinghamshire, and Derbyshire. Cheshire and Lancashire form the *North Western Counties Division.* The Three Ridings of Yorkshire are each considered a registration county, and united form the *Yorkshire Division.* The *Northern Counties Division* is made up of Durham, Northumberland, Cumberland, and Westmoreland. The eleventh and last division, that of *Monmouthshire and Wales*, includes all the Welsh Counties and Monmouthshire.

It will be evident on referring to a map whereon these divisions are marked out, that a natural system was neither thought of nor attempted when the scheme was adopted. Although there are two purely *coastal* divisions, there is not a single division that deserves to be called *midland.* The Eastern Counties and the North Western Division are good specimens of the former, but it will be seen that the North Midland is as much coastal as midland, and that the West Midland reaches to the Bristol Channel, whilst the South Midland extends to the Wash. With however all these disadvantages, these divisions will still answer our purpose, inasmuch as their subdivision into counties and districts will correct the errors which may arise from so artificial a system.

SECTION III.

The Geographical Distribution of Heart Disease and Dropsy in the eleven Registration Divisions.

If we take a map whereon the eleven divisions are marked out, and colour each with different shades of blue and red according to the mean average annual rate of mortality to every 10,000 persons living, we shall find that six will be *red* or *below* the average, and five *blue* or *above* the average. The *red* or *healthy* divisions (as far at least as regards Heart Disease) are—I. London: IV. The Eastern Counties: VII. The North Midland: IX. Yorkshire: VIII. North Western: and XI. Monmouthshire and Wales. These red divisions are all contiguous, and form an arch from the north of the river Thames to the north of the river Severn. The *blue* or unhealthy divisions, or those in which the mortality from Heart Disease is greatest, are the V. South Western: II. The South Eastern: III. The South Midland: VI. The West Midland: and X. The Northern Counties.

Such a simple map as the one I have now described, draws our attention to several facts, which will have to be analysed in the sequel.

1°. Not one of the divisions is coloured so as to indicate either the greatest or least mortality; there must therefore be some parts of each *blue* division having a low rate of mortality, and in some parts of each *red* division a high rate. How these parts are disposed, and by what laws they are governed, can only be seen in the next stage of our inquiry.

2°. We see that all the six red divisions have an extensive sea-board, excepting London, which however lies on the bank of the largest tidal river in our country.

3°. The Westerly *red* divisions present themselves to the prevailing south-westerly, westerly, and north-westerly sea-winds, which have traversed a wide expanse of ocean. The Easterly look towards the German Ocean, and afford every facility for the free access of the north-easterly sea-winds.

4°. The five *blue* or high mortality divisions embrace a large number of really *midland* counties, which, from their very position, do not enjoy a pure and uncontaminated sea-wind.

5°. Like the *red* divisions, the *blue* comprehend an extensive sea-board,—the whole of the south coast, the north coasts of Cornwall, Devon, Somerset, and Kent, and the eastern coast of Northumberland and Durham.

These are the bare facts which strike the eye at once when looking at a map showing the divisional distribution of Heart Disease: there are however others which claim our attention before we leave this part of our subject, and foremost among them are the following:—

The Mortality of each Division compared with the Density of Population.

In Table II. will be seen the relative density of the eleven divisions, according to which it appears that the two most densely populated divisions—I. London, VIII. North Western, are coloured *red*, or have a low mortality from this cause; whilst the two divisions in which the greatest death-rate is marked, viz.—II. The South Eastern, and V. The South Western, have comparatively a sparse population. Again, if we take the thinly inhabited northern counties, and compare them with the thinly inhabited Welsh counties, we shall find that a death-rate above the average obtains in one division, and an exceedingly low mortality in the latter. So far therefore as the divisional distribution is concerned, we do not find that the mortality from this cause is in the direct ratio to density of population, but rather in the inverse proportion; the counties and the districts will either confirm or refute this proposition.

The Mortality of each Division compared with the Annual General Mortality from All Causes.

The three most healthy divisions, as shown by Table II., are the II. South Eastern: III. The South Midland: and the V. South Western, all of which have a mortality of 20 per 1000 as compared with the average of all England of 22; now all these divisions have a high death-rate from Heart Disease, whereas those that have the highest annual death-rate, viz.—I. London: VIII. The North Western: and IX. Yorkshire, are distinguished by their death-rate from Heart Disease being below the average. From this we should conclude that the causes regulating the General Mortality of England are not identical with those which influence the Geographical Distribution of Heart Disease: again must we refer this proposition to more delicate analysis.

TABLE II.—HEART DISEASE AND DROPSY.

The Average Annual Rate of Mortality in each of the Eleven Registration Divisions of England and Wales to 10,000 living, during the ten years 1851-60.

DIVISIONS.	MALES.	FEMALES.	MEAN.	Density of Population. Acres to a Person. 1851-60.	Annual Mortality to 10,000 living.
I. LONDON, ...	12·7	12·4	12·5	·03	240
II. SOUTH EASTERN COUNTIES, .	13·6	14·4	14·0	2·34	200
III. SOUTH MIDLAND „ .	12·0	14·0	13·0	2·53	200
IV. EASTERN „ .	11·1	11·8	11·4	2·85	210
V. SOUTH WESTERN „ .	13·1	15·3	14·2	2·74	200
VI. WEST MIDLAND „ .	12·4	14·1	13·2	1·69	220
VII. NORTH MIDLAND „ .	11·5	13·6	12·5	2·83	210
VIII. NORTH WESTERN „ .	10·8	12·0	11·4	·74	26·0
IX. YORKSHIRE, . . .	11·0	12·6	11·8	1·92	23·0
X. NORTHERN COUNTIES, . .	12·6	13·2	12·9	3·29	220
XI. MONMOUTHSHIRE AND WALES,	8·3	10·6	9·4	4·18	210
ENGLAND AND WALES, .	11·8	13·1	12·4	1·96	220

SECTION IV.

The Divisional Mortality in relation to the Sea-board.

The Divisional Mortality in relation to sea-board.

We must remember in discussing this part of the subject that the physical and geological characters of our coastal barrier are as varied as they possibly can be. By a reference to the accompanying outline map showing the divisions of England and Wales, coloured red or blue, according to the mortality being above or below the average, it will be seen that eight of the eleven divisions have an extensive coast-line, and therefore have a large portion of their area exposed to the direct influence of sea winds; of these eight, five show that their mortality from Heart Disease is below the average, and three above it: the Western and Eastern divisions of low mortality extending from the north bank of the river Severn along the Welsh, Cheshire, and Lancashire coasts across England, through Yorkshire, and thence along the Lincolnshire, Norfolk, Suffolk, and Essex coast line until they reach the northern bank of the Thames, forming, in this manner, an arch of divisions which encompasses the West Midland (VI.), and the South Midland (III.) Counties, divisions having a high mortality. The three high mortality divisions having an extensive coast line are the Northern Counties (X.), and the South Eastern (II.), and South Western (V.), Counties. The inland division of London (I.) has a low mortality, and will be discussed separately. We have now, therefore, to see what relation subsists between these three groups of divisions, the Northern and Southern, where there is a high mortality, and the Eastern and Western, where the reverse obtains; but, before doing so, it will be necessary to make a few remarks upon some of the more prominent characters of our coast.

Coast line of England and Wales, Extent.

The coast line of England and Wales, from Berwick round to the Solway Firth, if followed along the principal estuaries and other inlets, exceeds 1800 miles. Knowing therefore as we do, that almost every variety of geological formation is to be found in England and Wales, and that nearly all the strata which make up our country, are exposed, at some point of our coast, to the constant washings of the seas which surround us, we shall be prepared to find every diversity of form in the natural sea-wall within which we live: we shall find its continuity broken up by the outflow of great and small rivers; we shall see that in ages gone by, mightier rivers than any which exist in our land now, like the Thames before it shrank to its present dimensions, have scooped out immense courses, which admit not only the tidal wave, but the sea breezes to penetrate far inland up their broad vales. On the other hand, the tourist may travel for miles and scarcely discover a gap in the high rocky barrier which hems in the valley lands of the south of England. In some parts of the coast will be seen the mouths of tidal rivers, whose tributaries have traversed valleys, which, from their aspect, are favourable to the afflux of the air that sweeps from the sea into the interior; in others, we shall find tideless rivers, that have struggled through deep and tortuous defiles opening sluggishly on the strand, with their mouths and the valleys through which their streams have flowed at right angles, both to the incidence of the tidal wave, and to the full afflatus of prevailing winds. Whatever effects, therefore, we may expect to be derived from any climatic element, we must look for in those parts where the least hinderance to the full enjoyment of its advantages, or otherwise, are to be found.

The Divisional Mortality in relation to Sea-board.

Sea Air.

From the fact that five out of the eight coastal divisions are characterised by low mortality, and that the only two really midland districts are remarkable for the large relative number of deaths which occur in them from Heart Disease, we are naturally led to inquire, What has the proximity to the sea to do with the cause of this great difference? With the sea coast we always associate sea breezes and powerful sea winds, which blow straight to us from the bosom of the ocean, either in the form of gales, or of those more gentle breathings which are so refreshing to the overworked and the weak. Sea air, however, has a variety of qualities; it may be laden with ozone, and be a powerful oxidiser; it may be mighty in its force, and sweep all air sewage before it, provided no obstruction exists to its full sway; it may be moist and warm, like the south-west, or cold and dry, like the east. All the winds, however, that blow to our coast are not truly sea winds, the east wind is a land wind, it has passed over Europe from the north before it arrives at our shores, and has become *effete*, cold, and dry; and its short passage across the narrow sea between England and the Continent is insufficient to restore its lost qualities: we must remember that some of our westerly wind has blown over Ireland before it reaches us, and that Scotland has had the advantage of a great portion of the north-westerly winds which blows from the Atlantic towards the north of England: that part of the north-west wind, however, which passes directly to us through the North Channel, and impinges on the North Wales and Cheshire coast, is a pure sea air: we shall have, therefore, in the sequel, to remember what our true sea winds are. The ozoniferous south-west wind is at once the most perfect and the most powerful sea wind that we enjoy, and its climatic influence is immense, bringing, as it does to our country, warmth ozone,

The Winds.

moisture, and force from the wide expanse of the Atlantic between our western coast and the Gulf of Mexico. The north-east wind spreads its influence over a great portion of England, and is little contaminated with land-air; unlike, however, its great antagonist, except in its purity, it is comparatively dry, and the quantity of ozone it bears is said to be not great, its force, however, is at times considerable, and thus is it a powerful cleanser of air-sewage and miasma, when these causes of disease are not protected from its purging. The north-west wind, as we have seen, comes to us through the North Channel unpolluted by land air; and another belt is enjoyed by the north-west of Cornwall; this wind also sweeps over our island at times with prodigious force, and thus has a benign influence on those parts of England which are protected from other winds. All the other winds are more or less contaminated with land air, and were it not that their dynamical element plays an important part, by occasionally sweeping up valleys which are not visited by the great prevailing sea winds, their influence on health, in consequence of their impurity, would more likely be injurious than beneficial. The north wind comes to us from Scotland, and ranks, perhaps, the highest in purity; then comes the west, which blows over Ireland from the Atlantic; the south-east arrives here warm and moist, after passing over France and the Mediterranean Sea from the coast of Africa; the south has also passed over nearly the same ground and the same sea, although it has the advantage of coming from the Atlantic; and the east we have seen to be an almost unmitigated *effete* land air which has passed over the cities of the continent.

The Character of the Coast-line of the High and Low Mortality Divisions compared.

The Characters of the several Coast-lines compared.

It will be evident from the short sketch I have just given of the manner in which our principal winds come to us, that stress only has been laid upon those which powerfully affect our climate at different intervals. I have not attempted to describe the many local causes which operate in deflecting the general currents of the atmosphere. In many parts of England we find recorded, day after day, gentle winds from all quarters; in many instances these have local causes, for it is well known that independently of the larger circuits which the winds perform, there are smaller ones constantly travelling over the face of the country, although of a less definite character. Again, we have the land and sea breezes which, near the shore, during a great portion of the year exert their gentle influence, which is either limited to the immediate locality, or extended inland, according to the character of the coast itself. Again, we must also bear in mind that some of the chief winds do not always flow to us from the same point, but get deflected in their course before they reach our shores; this, however, is too wide a subject to be discussed here, although it is fraught with interest, especially when we consider the variable chemical qualities of the atmosphere in which we live.

The North (X) and the South (II and V) High Mortality Coast Divisions compared.

The Northern and Southern Coast Counties' Divisions compared.

In all these three divisions we find certain characters as to height of coast, the directions of the rivers, and the inlets from the sea, which are remarkable for their resemblance, 1° the tract immediately bordering the sea coast of the Northern Counties' division, although low, is backed by a high range of the carboniferous formations, which protects the country behind from the direct influence of either the south-west, or the north-east wind; this character more or less obtains along the whole of the Northumberland carboniferous range until we reach the Tyne, where the geological formation of the coast changes, the direction of the rivers and valleys alter, both of which we shall find in the sequel to be coincident with a low mortality in one of the counties of this division. From the Tweed to the Tees there is no considerable inlet from the sea of sufficient magnitude to admit far inland any considerable amount of uninterrupted sea wind, and the valley lands are all protected from the north west by the high range of hills on the border land of England and Scotland. We must remember, however, that the mortality in the division, although above the average, is not greatly so, and that the whole division both as to its general altitude and width of valleys contrasts favourably with the southern coastal divisions, which I will now speak of. The northern coasts of the southern divisions form the southern boundaries of the two of the greatest sea inlets that penetrate our country, but at the same time we must observe that from the North Foreland in Kent, to Bideford or Barnstaple Bay, off Devonshire, there is but one inlet of any importance,—the Southampton Water,—along this continuous line of rocky coasts; and it is remarkable that almost without exception the smaller inlets are at right angles to the course of the tidal wave and the prevailing channel winds. The coast rocks are composed of every variety of geological formation, from the London clay to granite; as a rule they are precipitous and barrier-like, and the rivers which pass to the sea through them have, with few exceptions, their axes at right angles to the tidal current and the prevalent winds. The inlets on the north coast are those of the rivers Taw, Parrett, and Avon.

The Coastal Divisions having a low Mortality.

Let us now take the coastal divisions, where a low mortality from Heart Disease is registered. These divisions have a sea board which extends throughout the greater portion of the Western and Eastern coasts of England and Wales; on the Welsh side, however, the geological formations are of the oldest and most stubborn material, whilst on the east they are more or less recent and easily worn; precipitous and wall-like rocks, even on the coast of Wales, are the exception; and on the Eastern coast low and unimpeding rocks extend nearly throughout that long range of coast. Again, these two coasts are intersected by every variety of sea inlet, all of which are in the direct axis of the prevailing sea.

Welsh and North-Western Coasts.

In Wales the mountain rivers run down to the sea through valleys which are open even up to their very sources, in many instances, to the influence of the south-west on the Western, and of the north-west wind on the Northern side. If we enumerate the many bays, all of which are to a certain extent inlets to the land within, we shall find them extending from Swansea Bay to the river Conway. The hill ranges also of Wales

facilitate the passage of a full volume of sea air from the coast far inland. On the coast of the North-Western division we see that the Cheshire and Lancashire coasts are comparatively low, and contain two considerable inlets,—the mouths of the Dee and Mersey, besides those of the Ribble and Morecambe Bay, the latter of which are open to the south-westerly gales, and the former to those from the north-west; they open also into low undulating new red sandstone vales of great width, a feature which must not be forgotten. On the east coast we find the East Riding of Yorkshire presenting a grand, precipitous, and protecting barrier of oolitic rocks, to the sea; but from the Chalk Cliff of Flamborough Head to the mouth of the Thames the coast is low, and admits everywhere a full play of sea air from almost any quarter that it may blow. The sea inlets on the eastern side are also considerable. Yorkshire shares with Durham the inlet of the Tees, one of great importance: it has its analogue in that of the western river Dee, opening, as it does, into a new red sandstone country, and having its course directed to the sea by the hills which form the watershed of a more southerly river system. The rivers of the Cleveland Hills north of the eastern Moorlands, nearly all open into the German Ocean, in the direct axis of its sea winds and tidal wave. The next great sea inlet is that of the mouth of the Humber, which continues into the flat alluvial, and new sandstone vale of York, where the rivers from Yorkshire and the Midland Counties meet after traversing broad vales which give access to the afflux of wind from the German Ocean, and admit of their being swept by the north-westerly and south-westerly winds. The next great inlet is the Wash, its low coast and extensive alluvial flats admit of air flushing in all directions; and lastly, we have the grand tidal Thames on which the London Division (I.) lies, whose mouth is the termination of one of the broadest and most extensive vales in England, stretching as it does from the extreme points of the coasts of Essex and Kent to the middle of Berkshire.

The East Coast.

Recapitulation.

Recapitulation.

1°. England and Wales are divided into eleven Registration Divisions.

2°. Two only of these divisions are strictly Midland (III. and VI.), whilst all the other nine have an extensive coast line.

3°. The two Midland Divisions (III. and VI.) have a mortality from Heart Disease and Dropsy above the average.

4°. Of the nine Coastal Divisions three (II., V., X.) have a high rate of mortality from Heart Disease and Dropsy, and six a low rate (I., IV., VII., VIII., IX., XI.).

5°. The low mortality in two-thirds of the Coastal Divisions is suggestive that proximity to the sea coast, and the winds directly received from the ocean, may influence the causes of Heart Disease.

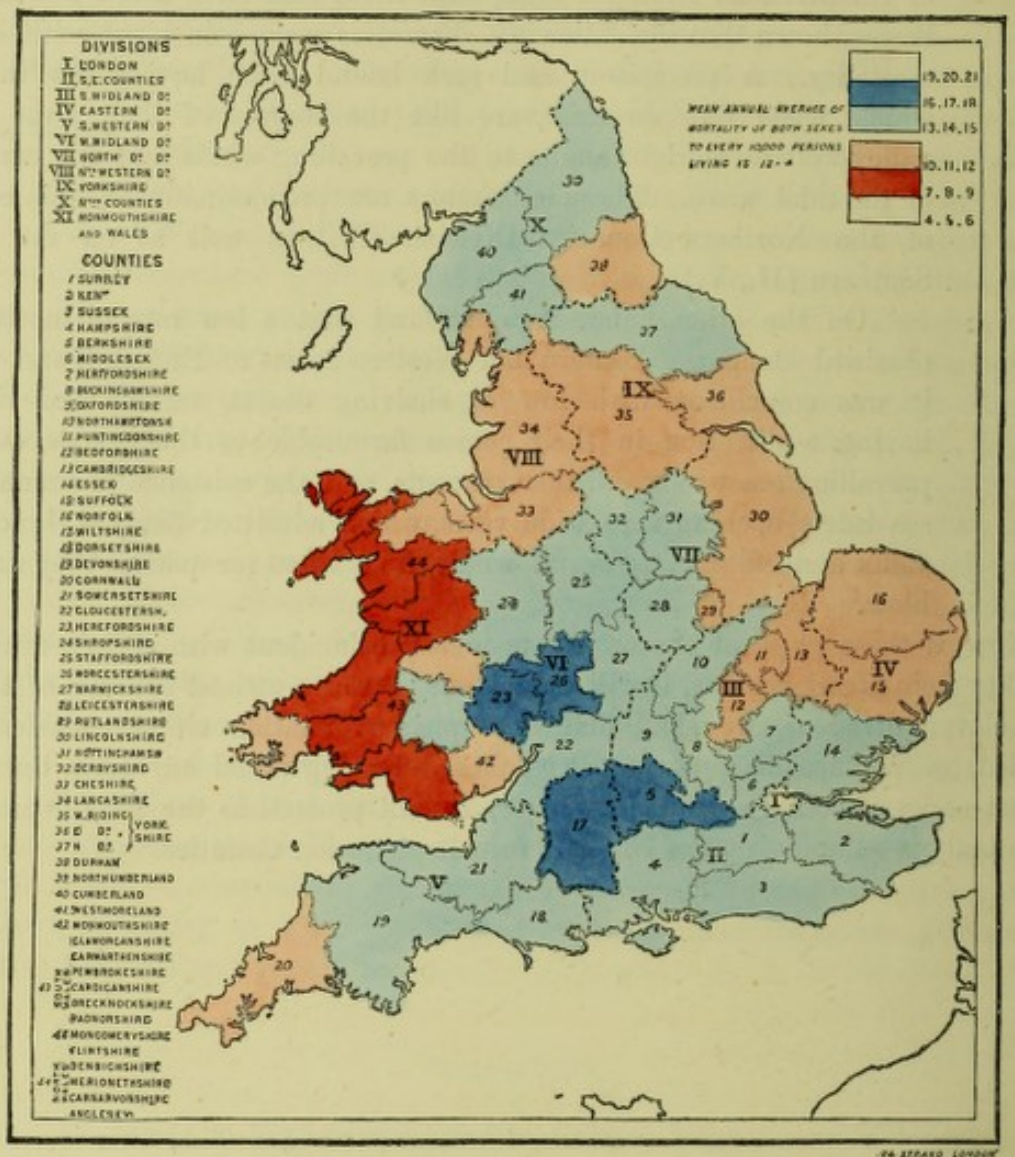
6°. Three of the Coastal Divisions, however, having a high mortality and an extensive sea-board, it was necessary to compare the characters of the respective coast-lines in order to ascertain what were coincident with high and what with low mortality, on the principle that the effects of a climatic element with regard to the causation of disease must be

looked for in those localities where there is the least hinderance to its full operation.

7°. On comparing the characters of the coast-line which formed the boundaries of the divisions having a high, with those that have a low mortality, it was shown that the following characters were coincident with high mortality. A precipitous and rock bound coast having few inlets, which, when they do exist, are like the courses of their river and valley system at right angles to the prevailing winds and the current of the tidal wave. These characters are predominant on the coast of the Northern Counties Division (X.) as well as on the two Southern (II., V.).

On the other hand, it was found that a low rate of mortality obtained along the Eastern and Western coasts of England, and that it was coincident with low or shelving coasts, valleys and rivers having a direction in their course favourable to the free access of prevailing sea winds and tidal currents, and the existence of numerous sea inlets opening into wide vales, which admitted freely a thorough afflux and efflux of powerful winds, from whatever quarter they might blow.

Now, if these physical characters are merely coincident with certain rates of mortality from Heart Disease, it will be evident that on a stricter analysis of these great eleven divisions, we shall find the apparent relation either considerably modified, or perhaps disappearing altogether. Having sifted our facts through the first series of coarsely defined divisions, I shall proceed to the second process of our analysis—the division of England into Registration Counties.



CHAPTER III.

SECTION I.

The Geographical Distribution of Heart Disease and Dropsy in the Registration Counties.

ENGLAND and WALES are divided into 53 registration counties, of these 27 are coastal, the remaining 26 being more or less inland, and divisible into inland and midland. Of the 27 coastal counties 16 have a low rate, and 11 a high rate of mortality. It will be our duty, in the next place, to see the position of these several counties in the divisions we have been discussing. In the Northern Counties Division (X.) the county of Durham stands out conspicuously as having a low mortality, and it will be remembered that at the River Tyne the geological character of the country and the direction of the rivers and valleys changed

Relative Mortality of the Registration Counties.

Northern Coastal Counties.

between that river and the river Tees (p. 17). Pursuing our course along the Eastern Coast Divisions (IX., VII., IV., I.,) we find the North and East Ridings of Yorkshire, and Essex, having a high mortality, whilst Lincoln, Suffolk, and Norfolk, have one below the average: in the former instance we have alluded (p. 17) to the precipitous and protecting barriers of oolite rocks which protect from the immediate effects of the North Sea winds the county of the North Riding, and, therefore, the mortality in this county is not inconsistent with the physical characters described; again, the East Riding, from Flamborough Head to the mouth of the Humber, has a low coast, and its mortality is considerably lower than that of the North Riding (13·3), being barely over the average (12·5); and with Essex, the mortality in which is not high, although above the average, has many of its river courses and sea inlets at right angles to the winds from the Northern Sea. Of the seven counties which form the sea margin of the South Coast Divisions (II., V.) one only, Cornwall, is seen to be coloured red, and its mortality is at the average of 12·4 deaths to every 10,000 living. It must be observed, however, that this county is a peninsula, and peculiarly well situated for the free access of sea-winds, which blow with considerable force over this part of the country. On the western sides of Wales and England which I have said are so favourably circumstanced with regard to their sea inlets, the direction of their valleys and river courses, and, I may add, the unbroken violence of their winds, there is not a single county from Monmouth to Lancashire having a mortality above the average, Cumberland alone forming an exception, and although its south-west boundary has every advantage of being thoroughly exposed to the south-west wind from the Irish Channel, we must remember that the greater portion of this beatiful county is protected by the lofty range of the Cumbrian Hills, which protect its deep and luxuriant valleys.

Eastern Coastal Counties.

Southern Coastal Counties.

Cornwall.

Western Coastal Counties.

With regard to the 26 Inland Counties, 6 only have a mortality below the average; and it is noteworthy that all these, without exception, are contiguous to coastal counties, which have free access from the sea through inlets such as the Wash, on the eastern side, and on the Welsh side the inlets of the Dovey and other rivers from Cardigan Bay, or else are so elevated as to receive the full afflatus from the sea without interruption. The remaining 20 counties in which the death rate from Heart Disease is great, are all more or less protected; those counties whose towns and villages lie in deep and well sheltered valleys, such as Herefordshire, Berkshire, Derbyshire, and Wiltshire, being characterised by the highest degree of mortality.

Inland Counties.

We therefore see that the death rates from Heart Disease and Dropsy in the several counties are still coincident with certain physical characters of the country, in the same manner that we observed they were when discussing the divisional mortality; the coincidence, however, is in the county divisions of a more definite character.

The coincidence between the death rate and the physical character of Counties.

Recapitulation.

Recapitulation.

1°. The coastal counties in which a low mortality from Heart Disease is registered, are more numerous than those where the death rate from this cause is above the average.

2°. Those coastal counties most exposed to the prevailing winds and most free from obstructions to their full operation, have the least mortality.

3°. Those coastal counties such as those along the south coast which have barrier like rocks, and other characters which tend to interfere with the full sweep of the sea winds, are those only which have a high mortality.

4°. Out of the 26 inland counties which are all more or less protected by those bordering the coast, 6 only have a mortality below the average, and these are contiguous to coastal counties.

5°. The counties in which the mortality from Heart Disease is greatest, are those that are the most inland or the most protected by their physical surroundings.

SECTION II.

The Relative Mortality of the Coastal, the Inland, and Midland or Central Counties.

If we group the counties in the following manner, we shall find that a high death rate from Heart Disease and Dropsy is also coincident with an inland or sheltered position, and that there is a certain progressive increase of mortality from the circumference of our peninsula toward its more central localities.

Coast Counties.

The mean annual mortality of the entire series of the 27 *Coast Counties* is 11·9 to every 10,000 living.

Inland Counties.

The mean annual mortality of the 20 *Inland Counties*,—viz.: those which are situated between the coastal and the midland counties, is 12·5 to every 10,000 living.

Midland Counties.

The mean annual mortality of the 6 *Midland* or *Central Counties* is 15·1 to every 10,000.

We therefore remark from the above figures that coincident with the lowest amount of exposure to the sea air, as in the Midland Counties, is the highest amount of mortality in those counties; and that, on the other hand, the lowest amount of mortality is coincident with the greatest amount of exposure; and again, that the counties which lie intermediately between these extremes, have also an intermediate death rate within a decimal of the average.

Recapitulation.

Recapitulation.

1°. By a map of England and Wales, on which the relative mortality was coloured blue and red, according to its being above or below the average, it was shown that of the eleven great divisions two-thirds of those divisions which had an extensive sea-board, had a low mortality coincident with their marine boundaries.

2°. It was also shown that the two divisions which had little or no sea-board, but on the contrary were surrounded on all sides by other divisions, had a high mortality.

3°. It was also shown that the coastal divisions which had a high mortality, had also coincident with it certain physical characters which obstructed the free passage of the prevailing winds up the inhabited valleys and river course.

4°. On separating these divisions into counties, we found that the same facts were still coincident, although, from a minuter division, they were more defined, and admitted of a more careful analysis.

It remains for us now to test these coincident facts, by submitting the counties themselves to a similar analysis,—viz.: by estimating the relative amount of mortality in each of their 625 union districts, after which we shall be enabled to see if the remarkable coincidences we have noted in the divisions and counties, between their mortality and their free exposure to, or seclusion from, the sea air, are still existing: if they are, we shall be enabled to follow them as minutely as the division of England into 625 parts will enable us; beyond this we have no further data to go, and no minuter division on which to depend.

CHAPTER IV.

SECTION I.

The Geographical Distribution of Heart Disease and Dropsy in the six hundred and twenty-three Union Districts of England and Wales.

WE now come to the last analytical process—the division of the counties into Districts; here again the artificial system of boundary lines is more perplexing than in either of the other two; still, we cannot help it, but only regret that so much valuable information should be wasted, which, had a natural system been adopted, would have been a grand acquisition for the student of the Medical Geography of England. It will be well however to point out a few of the obstacles to portraying the distribution of disease in our country, the artificial and irrational system throws in our path. Let us take Chichester for instance: the city itself is in the Westhampnett District, whilst the district called Chichester lies to the north-east of Westhampnett, between Worthing and Midhurst; again, Bognor belongs to Chichester district, and lies in Westhampnett; another portion lies in the Midhurst and a fourth in Worthing district,—nothing can be so absurd as to call these outliers Chichester—villages and towns so circumstanced cannot be called allied in any way except through the medium of the rate-collector—they are not like geological outliers, which are recognised by well defined characters—geographically speaking, they belong only to those places where they are situated. The same system obtains in the London Division: the district of St George's, Hanover Square, intersects that of Westminster, cutting it entirely into two; again, Clerkenwell separates one part of the Holborn district from the other. East London is separated by the City of London; and Greenwich is cut into two by Lewisham, and again by its natural boundary, the Thames. The river system of England, instead of being a guide, seems to be neglected in every instance where advantage could be taken of it. In France, the Departments have at all events some reference in many instances to the watershed, and this alone is valuable, as by it we are enabled not only to remember the position of the Departments, but we obtain a general idea of the aspect of the watershed whereon these divisions lie. To exemplify this: The river *Loire* gives a name to several departments—*Haute Loire*, where it rises; *La Loire*, through the middle of which it winds as a fully formed river; *Soane et Loire*, where it forms the western boundary of the department traversed by the Soane; *Du Loiret*, where it receives the little Loire, or Loiret; *Du l'Indre* and *Loire*, where the first now falls into it; *Le Maine* and *Loire;* and lastly, that of *La Loire Inferieure*, where it comes to the end of its course and falls into the ocean. The French have also Departments called *Les Bouches du Rhone*, *Bas Rhin*, and *Haut Rhin*, in fact, a large proportion of their divisions are named after rivers, which is far nearer a natural system than anything we can produce in the registration maps of this country. We certainly meet with every now and then such descriptions as *Upton-on-Severn*, or *Henley-on-Thames*, or *Burton-on-Trent;*

Boundaries of Districts Artificial.

The System obstructive to the Geography of Disease.

London.

French System of Departments more natural.

but these are names given to districts from towns, the French would have called the last district the Dore and Trent district, for here these become confluent. Upton-on-Severn would be called the Lower Severn. Gloucester the Leddon and Severn, Wheatenhurst the Stroud and Severn. Other difficulties are also presented to the Medical Geographer of England. The city of Chester, with its population of over thirty thousand persons, is included in the Flintshire and Cheshire district of Great Boughton; in this case the city contains more than half the population of the whole district, and whatever may be its mortality, whether climatic or social, the whole of Great Boughton has to be coloured in accordance with it; it is evident that every town like Chester, Bridgewater, Chichester, Bath, Taunton, Margate, Ramsgate, etc., should have a separate district, with union-house included, so as to enable the public to see the exact mortality and its relative proportion to the neighbourhood.

Large Towns and Watering Places ought to have separate districts and Union-houses assigned to them.

In Thanet, the union-house is situated in the parish of Minster, and to this place the poor are sent in good time, so as to prevent them dying within the precincts of Margate and Ramsgate; the consequence of this is that this little parish has an unnaturally large death rate, and Margate and Ramsgate are held up as good specimens of excessively low mortality. Places of public resort for health sake, ought to be the very first to be made into separate districts, for, constituted as they now are, a place redolent with the effects of cess-pools and defective drainage may be made to look quite healthy when its excess of mortality from these causes, both among the natives and the visitors, are averaged with the healthy returns of the surrounding parishes, or by the forced exodus of dying paupers to a neighbouring workhouse.

Thanet illustrates the bad System.

SECTION II.

Arrangement of the Union Districts of England and Wales.

The Divisions and the Counties, although their boundaries are frequently of a most artificial kind, undetermined by any natural physical character, except the sea coast, and the courses of a few of the largest rivers, have however given us some clue to the distribution of the disease under discussion, it only now remains for us to see if the coincident facts displayed in our two first chapters are also to be found in this, our third, wherein the general facts elicited during the examination of the divisions and the counties will be dissected by the minuter division of the counties into districts, of which there are in all 623.

Introduction.

We have seen how the death rate in the counties modified that of the divisions; we shall now see how it is affected in the counties by that of the registration districts. When speaking of the coast-line, both in our first and second chapters, I particularly mentioned the fact, that our western and eastern coasts were characterised by the number and the size of their sea inlets; whilst, on the contrary, the south coast had but one of any importance. The general effect of these sea inlets upon the health of the country, would perhaps be more prominently seen in the great divisions than in the counties themselves, for, as I have just said, the boundary lines of the counties have been determined

Sea Inlets.

generally, in a most arbitrary manner, although some of the largest rivers have been made to divide one county from another; the sea inlets, however, are precluded from showing anything but a general effect. The sub-division of the counties into districts admit of another element, and allow us to follow up the great rivers, as they divide counties, and give access through their valleys of the sea air and tidal wave, to inland parts. These sea inlets may be considered extensions of the coast-line along the banks of rivers; we should therefore expect to find, if the coastal districts corroborate the coincident facts which we have observed to obtain in the distribution of Heart Disease both in the divisions and counties, that the lower rate of mortality observed in the former instances, will now be seen to follow up these sea inlets, modified of course by their position with regard to the axes of the prevailing winds and tidal wave, as well as by the physical characters of the country through which the rivers wind. I shall now proceed to divide the districts into Coastal, Inland, and Midland, as I have done the counties, in addition however to these we are enabled to add a peninsular and insular series.

The Relative Mortality in the Coastal Registration Districts.

Coastal Districts.

Length of Coast-line.

In England and Wales, out of the 623 Registration Districts, there are 133 which are washed by one of the three seas that surround Great Britain, therefore there is nearly one Coastal District to every five inland. The coast-line of England and Wales, from Berwick round to Solway Firth, if followed along the principal estuaries and other inlets of sea-water, exceeds 1800 miles, which, if we take the joint area of England and Wales to be 58,320 English square miles, is in the proportion of one mile of coast-line for every 32½ miles of surface. Of the 133 Coastal Districts, 50 have a mortality registered from Heart Disease *above* the average, and 83 *below* it.

The Three Coast Groups.

If we separate the three coasts of the triangular portion of Great Britain, comprising England and Wales, into I.—The East Coast, from Berwick to Easting; II.—The South Coast, from Dover to Helston; and III.—The West Coast, from Penzance to Wigton; we shall be enabled to see whether the low or the high mortality in any of these coast districts is coincident with similar physical features to those already observed along the coast of the Divisions and the Counties.

SECTION III.

The East Coast.

Five Groups.

There are 41 districts on the East Coast from Berwick to Eastry; of these, 29 have a mortality *below*, and 12 *above*, the average; they are separable into five groups: I.—The Northumbrian high mortality group extends from the Tweed to the Tyne; II.—The Durham and North-East Yorkshire low mortality group, comprehends the coast-line between the south bank of the Tyne to the river Esk, on which Whitby is built; III.—The small East Yorkshire high mortality group is confined by the high oolitic and chalk rocks, which stretch from Whitby to Bridlington Bay; IV.—The

extensive low mortality group, which extends along the low coast, which characterizes the sea-board between Bridlington and the Isle of Sheppey; and V.—The East Kent Districts of Thanet and Easting; this may be called the Lincolnshire and Eastern Counties' group.

The Northumbrian Group.

The excess of mortality in this group is not great; it is however coincident with the following physical characters; the rivers Tweed, Coquet, Wensbeck, and Tyne, flow from west to east into the North Sea, at right angles to the incidence of the tidal wave, which, along this coast, rolls twice a day from the Orkneys southwards, until it enters the mouth of the Thames; the courses of these rivers being nearly all from west to east, and extremely tortuous, whilst tending to the sea through the carboniferous limestone hills of Northumberland, offer every obstruction to the prevailing winds, whether they come direct from the sea like the north-east, or remotely from the south-west. The valleys of Northumberland are well protected; the moorlands are too bleak, and the valleys too little ventilated: the aspect of the coast is nearly due east.

Durham and North East Yorkshire Group.

The next group is the Durham and North East Yorkshire. Its low mortality co-exists with the following geological and physical characters. The aspect of the Durham coast is north-east by east, and that of the Yorkshire almost due north-east, so that they are favourably circumstanced with regard to the sea wind from the German ocean. The rivers from the Tyne to the Tees have their courses especially towards their embouchures directed from the south-west to the north-east to a greater extent than those in Northumberland, although, except the latter river, they are not very favourably disposed for the reception of the tidal-wave. The Tees, however, and the rivers which flow from the north side of the Eastern Moorland, have their courses, and the valleys through which they run, offering every facility for the free access of the ocean winds from the North Sea, and form a remarkable contrast to those which are met with on the southern side of the moorland, where the Rye and the Derwent take their sources, and where the valleys of this locality are sheltered by the towering oolitic range which extends from Old Peak to Hambleton End. The new red marl cliffs offer no obstruction to free ventilation, as they are not high, and are divided by the considerable sea inlet of the Tees' mouth. The oolitic Cleveland range open their valleys, through which their drainage flows, so as to receive every breath of wind that comes from the north-east.

The East Yorkshire Group.

The East Yorkshire group of high mortality, is bounded by a precipitous coast of oolite and chalk cliffs; it has no sea inlets; in fact, the watershed is directed inland from the high hills bordering the coast. Its coastal boundary offers every obstruction to free ventilation from sea-winds,

Scarborough.

except in the case of places like Scarborough, which, in the most pre-eminent degree, enjoys every advantage that a free access to pure oceanic air can give.

The Lincolnshire and Eastern Counties Group.

The Lincolnshire and Eastern Counties group has a remarkably low death-rate from Heart Disease: with the two Yorkshire, it embraces 26 districts, interrupted only by two districts having a mortality above the average—Maldon and Wisbeach; the coincident watershed and other physical characters of this group may be shortly summed up: a

low coast, a flat country within the sea-board line, a comparative absence of deep and protected valleys, and their large sea inlets, which extend far into the country in the mouth of the Humber, the Wash, and the mouth of the Thames. This large group offers every facility for winds from all quarters sweeping well over its surface, whilst it admits the beneficial influence of the sea-winds to penetrate far inland up the courses of its rivers, which are favourably directed for free ventilation.

East Kent Group.

The next and last group, comprising the East Kent Districts of Thanet and Eastry, offers a strong contrast to the one we have just examined. Thanet is certainly a rock bound district; and its chief towns, Margate and Ramsgate, are so situated as to enjoy every advantage of the most benign influences of sea-air; the construction however of these towns, their defective sanitary regulations, bad drainage and cesspools, have a marked influence on the mortality from any disease produced by the accumulation of air sewage.

Margate and Ramsgate.

When Margate and Ramsgate are made into separate Union Districts, their relative healthiness will be made patent to all: whereas, under the present system, the general healthiness of the island masks the real state of things in these two watering places; and conversely, their fruitfulness in some diseases, arising from social causes, gives an unhealthy aspect to the whole district, when coloured according to undissected statistics. In watering places generally, the rule is to see how the local figures agree with those from the whole district; if, on taking the aggregate, the numbers are favourable, they are adopted; on the other hand, if the local statistics show a low death-rate, which is nearly always the case when the Union House is not situated within the parish or sub-district of the place of resort, then they are paraded in pamphlets and newspapers, to the utter confusion of those who depend upon such wilful misrepresentations.

SECTION IV.

The South Coast.

There are 40 districts skirting the south coast from Dover to Penzance inclusive, 28 of which have a high, and 12 a low mortality; in fact, this group may be described as one of high mortality, interrupted at intervals by districts having one below the average. The general physical characters of this coast are high precipitous cliffs from Kent to Cornwall, with the exception of the coast of Hampshire to the east of the Southampton Water. Along this coast there are 20 rivers which empty themselves into the English Channel, not one of which has its course in the axis of the prevailing winds, and their mouths so open, as not to favour the upflow of the tidal wave, with the exception of those on the coasts of Penzance and Truro; and the inlet of the Tamar, which admits the south-west gales to Plymouth and the country in its rear, both of which are characterised by a low mortality. Two insignificant rivers, which have their inlets at Poole and Christchurch, have their courses from the west to the east; they admit the south-easterly gales, but the country through which they trend is protected by the Dorsetshire north and south Chalk Downs, from the south-west winds.

The low mortality districts are instructive: between Dover Cliffs and Beachy Head we see three—Elham, Romney Marsh, and Hastings; these occupy the littoral of the Wealden clays, the comparatively low coast of which offers little or no obstruction to free ventilation; this is especially seen in the district of Romney Marsh, the low mortality of which is coincident with a flat alluvial country, like that which characterises the eastern districts of Holbeach, Spalding, and Spilsby, in Lincolnshire. Rye can hardly be called a costal district, inasmuch as the great portion of it lies embedded in the valleys that are sheltered by the lofty ridges of the Wealden series, the southern series of which form the cliffs from Hastings to Hork Point. To the west of Brighton the coast becomes again low; at Westhampnett we find the promontory of Selsea intersected by a flat alluvial country, surrounding the peninsula of Bracklesham Beds of the middle eocene: the low mortality of this district is coincident with every facility for the free passage of the winds. The inlet of the Southampton Water carries us to South Stoneham, in which Southampton is situated, the town of which has a mortality of only 12·8, or 0·1 above the average. Christchurch, although sheltered from the south-west, has the valleys through which the Stour and Avon flow, opening towards the south-east winds. Weymouth is a peninsula, and admits winds from all quarters except from the north-east, from which the South Downs protect it; the high mortality of Dorchester we may note *en passant*, is also coincident with the high sheltering range of the same downs, which keep the south-west wind from it; it is also screened from the north-east by the Dorsetshire North Downs. From Portland to Plymouth the coast is rock bound, and the villages and towns protected in the midst of luxuriant red sandstone valleys. The inlet of the Catwater, leading out of the Plymouth Sound, has a direction favourable both to the access of the south-westerly winds and the tidal-wave. St Austell and Liskeard are also favourably circumstanced for free ventilation from the south-west, although rock bound, inasmuch as the embouchure of the river Fowey, the tributaries of which flow from the north-east to the south-west: we must not forget that passing along the north of these districts are parts of the Ocrinian chain. The inlet of the Fal, although considerable, is protected from the full influence of the south-west wind by the lofty Trappean and other igneous rocks, which characterise the district of Helston. Penzance and Helston are in reality peninsulas, and are breathed on and ventilated by winds from all points of the compass; they contain much elevated land, and coincident with these physical facts is the one that they enjoy nearly the lowest rate of mortality.

Southern low Mortality Districts.

Romney.

Southampton Water.

Catwater.

Penzance.

SECTION V.

From Redruth to Wigton there are 52 districts, a portion of the boundaries of each of which is washed by the sea, and exposed to its winds; of these 42 have a mortality *below*, and 10 *above* the average. Along the south coast we have first seen that *low* mortality districts were the exceptions to the rule, when the sea-inlets were unimportant and limited, the coast bound by

West Coast.

precipitous rocks, and the courses of the rivers running at right angles to, instead of in the axis of the prevailing winds and the tidal wave.

We shall now see that *high* mortality districts are the exceptions along the coast where the sea-inlets are of high importance, open towards the eyes of the prevailing winds, and penetrate far inland; when the coast, although rocky to a great extent, is so formed as to give access to winds from the south-west, the west, or the north-west; sloping upwards inland where the rivers have their sources, through the valleys of which the gales are guided to every village on their banks: this is especially seen in Wales. The Lancashire, Cheshire, and Westmoreland coast is low, and studded with sea inlets; the coast of Cumberland is also comparatively depressed, although it soon rises in the district of Whitehaven to the lofty ridge of the Cumbrian range, which protects the adjoining district of Cockermouth to the north; the valleys of the Whitehaven District all look towards the prevailing south-west winds from the Irish Sea, and are easily flushed of their air sewage by its strength. The north-west coast of Cornwall and Devon, and north coast of Somerset, are somewhat similar to some portions of the south coast. The inclination of the coast is from south west to north-east, therefore the winds from the former quarter do not impinge upon it, although whatever inlets there are receive the full afflatus from the north-west. From Redruth to Bedminster the sea inlets are as follows:—St Ives Bay, between the low mortality districts of Redruth and Penzance; the mouth of the river Allan, on which Padstow lies, enters the low mortality district of Bodmin; the mouth of the Taw, which flows into Barnstaple Bay, penetrates Barnstaple, coloured red; the inlet of the river Parrett, on which Bridgewater is built, and where the tidal-wave flows up in the form of what is called a 'bore,' twice a day, as far as Langport, is a very considerable one, and traverses a flat country; Bridgewater and Langport are both low mortality districts; and lastly, Bedminster is separated from Clifton, both being characterized by their low mortality from Heart Disease, by the tidal and important sea-inlet of the Avon.

Welsh Coast.

Cockermouth.

Whitehaven.

Coast of Cornwall, Devon, and Somerset.

Sea Inlets.

Parrett. Bridgewater.

Avon.

Bedminster.

Low mortality being the rule in the western coast districts, I propose taking those exceptional districts which are marked blue, in order to see what they teach us. The high mortality districts on the coast of Cornwall, are Truro, St Columb, Camelford, and Stratton. They all have a precipitous rock bound coast at right angles to the south-west winds; they are however exposed to the north-westerly; but the most densely populated portions lie in valleys protected from their influence by high ridges as the Pinhallon and Newton Downs in Truro, the Pyndar Downs in St Columb, and in Stratton the ridge to the west of the sources of the river Bude.

High Mortality Districts.

On the coast of Devon the district of Bideford has some remarkable physical features, which are especially interesting, coincident as they are with a high rate of mortality. We have seen in the district of Scarborough (the town itself is included in the district, although it is differently situated from any other inhabited place within the boundaries), that the greater portion of it is sheltered by the oolitic hills, which give rise to the sources of the rivers Derwent and Rye; in fact, we know that many of their streams have their

Scarborough.

origin within a very short distance of the coast itself; we find that this character of the country is coincident with high mortality, not only in the coastal district, but in those which are contiguous; now, if we examine the country of the Bideford and Stratton Districts, we shall find towering rocks bounding the coast on each side of Hartland Point, and giving rise to the numerous sources of the Torridge and the Tamar, some of the former beginning to flow towards the south, within a mile or so of the cliff edge; the courses of these rivers indicate at once the aspect of the beautiful valley country through which they flow, and bespeak at once shelter and protection from the rude gales from the ocean; but whilst thus protected there is an amount of air sewage, having either an animal or a vegetable origin, always remaining behind, which, from the peculiar construction of the valley system, is never swept entirely away.

Bideford and Stratton, Hartland Point.

Barnstaple offers a remarkable contrast to the Bideford district; here we have the opening of the River Taw, penetrating the country, and receiving tributaries which flow from Kentisbury and Berry Downs, the valleys of which open so as to receive the south-westerly winds. The adjoining coast of Williton district is partly of red sandstone and partly of lias: it is precipitous. The streams run at right angles to the course of the winds in the Bristol Channel, and the country itself is protected by Oare Hill, Exmoor Forest, and Brendon Hills. Cardigan is favourably situated for a low mortality in many respects; but we see this large district is coloured blue, I suspect that some social cause, such as exists at Norwich, King's Lynn, Ipswich, and Colchester, in the Eastern Counties, exists here, and, like Chester, the whole district is obliged to be coloured in accordance with the excessive mortality of the town, instead of each place bearing its own burthen, as they do in the eastern counties, where separate districts are assigned to the principal towns. St Asaph is a district, although a great portion of it is in deep and protected valleys, yet an exceedingly populous portion of it lies in the Vale of Clwd, up which there is not the slightest obstruction to the north-westerly winds; the next district, Holywell, is healthy, but it must be remembered that it has the sea inlet of the Clwd on the west, and that of the Dee on the north-east.

Barnstaple.

Williton.

Cardigan.

St Asaph.

Holywell.

The last is Cockermouth, a district to which I have already alluded, as offering a strong contrast to its neighbour, Whitehaven; the latter looks towards the sea, and is well disposed to receive the full afflatus from its surface, as well as the incidence of the tidal wave; it has an annual rate of mortality of 11·7 to every 10,000 living, whilst Cockermouth, which is cut off from it by the ridge of the Cumbrian Hills, and is protected on all sides from the sea-air, numbers annually 15·6. It is a fact worth noting here, that the oolitic Yorkshire group is the counterpart of what we see in Cumberland; there the tidal-wave comes from the north, and so do the prevailing winds; they both impinge upon the northern part of this group and distribute their full influence there, whilst the sheltered parts to the south are seen to be coloured blue, this high mortality we have seen to be coincident with lofty surroundings; on the west the tidal-wave and prevailing winds come from the south-west, Whitehaven district is exposed to them, and is healthy, Cockermouth is screened, from them and its mortality is high above the average.

Cockermouth.

Yorkshire and Cumberland compared.

Recapitulation.

1°. There are three coast-lines around England and Wales, the East, the South, and the West; they are composed of 133 Registration Districts, of these 83 have a mortality below, and 50 above the average annual rate. The Coastal Districts therefore agree with the Coastal Divisions, and the Coastal Counties as to the coincidence of proximity to the sea, and a low mortality from Heart Disease and Dropsy.

2°. When the three coasts are compared, we shall find that the Eastern and Western have the most extensive, as well as the greatest number of sea inlets, and that the south has but one inlet of any importance, all the others being limited as to their extension inland, and opposed to the general direction of the sea-winds and tidal-wave so far as regards their axes.

3°. The East coast is comparatively low, and throughout a large area offers no obstruction whatever to the free access of the sea-winds; and the West coast, although more rocky, has innumerable inlets and an inland surface sloping upwards, instead of downwards from the sea, so that it presents to the prevailing winds when they blow, especially on the Welsh, Cheshire, Lancashire, and Cumbrian coasts, every opportunity of fully flushing the valleys.

4°. Coincident with the great numbers of sea inlets and low coast-line on the Eastern side of England, we find a low mortality in 29 out of the 41 districts.

Coincident with the rocky and precipitous coast of the south, an absence of important sea inlets, and the courses of the rivers being at right angles with the prevailing winds, we find that of the 40 districts 28 have a high mortality.

And lastly, coincident with the physical facilities afforded on the western coast, for a full purging by the strong winds from the Atlantic, of the valleys from air sewage, it will be seen that out of the 52 districts, from Redruth to Wigton inclusive, 42 are below the average, and only 10 above it.

5°. The Coastal Registration Districts, as a rule, have a low mortality from Heart Disease and Dropsy, this is in conformity with what has already been observed in the Registration Divisions and the Registration Counties.

CHAPTER V.

SECTION I.

The Relative Mortality of the Inland Registration Districts.

THE Inland Districts are not so easily grouped as the Coastal, and as a question may arise as to my selection of them, I shall adopt at once a plan which shall do away with all doubt on this point. Let us first take the inland groups comprised within the lines of 0° and 1° W. Long.; and 51° to 52° N. Lat.; within this area it will be seen that although the high mortality districts predominate, there is not one of the sixth degree or highest; and that, on the other hand, to the north there are several districts of low mortality contiguous with those which border the coast of the Wash, and the banks of the rivers which flow into it; to the east there is a group of low mortality districts, which are continuous with the riparial districts of the great sea inlet of the Thames; to the south there is another group which is continuous with those from the south coast; and lastly, an isolated group to the south-west, the elevated districts of Farnham, and Farnborough, which, independent of their dry Bagshot soil, are freely exposed to the winds from all quarters. The low mortality of this area is coincident with proximity to sea inlets and elevated land. If we take the area above within the same lines of longitude, intersected by 52° and 53° N. Lat., we shall find an almost universal low mortality, and this is coincident with proximity to the flat lands in the neighbourhood of the Wash. Above this area again, between 53° and 54°, the same low mortality prevails, and here we have it coincident with the flat country around the sea inlet of the mouth of the Humber, and the flat Lancashire coast. On the west, if we trace the areas between the 2° and 3° of longitude, we shall find that low mortality is coincident with the great sea inlets from the north to the south of England.

Inland Districts.

Eastern.

Western.

SECTION II.

The Midland District may be fairly represented by the area embraced by the lines of the 2° and 3° of W. Long.; and 51° and 52° N. Lat.; here we do not find one single low mortality district; there is no sea inlet, nor river even, in the axis of the prevailing winds; on the contrary, in the next area to the west, we see the oolitic and chalk hills ranging almost due south and north, giving rise to rivers which flow from the Atlantic Ocean, and offering a barrier to the full afflux of the most powerful winds from the south-west; from other winds also, this area is protected by the continuation of these hills to the north-east; and we see in the area to the west, where the hills go from the south to the north, that in their immediate neighbourhood to the east, where there is the most protection from the winds, there is the greatest mortality in the whole of England from Heart Disease.

Midland.

Wilts.
Berks.
Hants.

Derbyshire.

Herefordshire, Worcestershire, and Brecknockshire.

Again, if we take the Derbyshire group, we find that the greatest mortality is coincident with the greatest seclusion from the sea-winds; and in the Western Counties of Herefordshire, Worcestershire, and Brecknock, a remarkable group of high mortality presents itself; here all the rivers are at right angles to the prevailing winds; and the mountains which give them origin, rear themselves to the west, and act as efficient barriers to the purging influence of the powerful winds which we have seen to have such full sweep over the Welsh coast.

Westmoreland.

Yorkshire.

The protected districts of Westmoreland and Yorkshire have a high mortality, and are thoroughly inland. It will be remarked, however, that the highlands between the two seas, where the winds from both the Irish Sea and the German Ocean can sweep over without hinderance, there is to be found an uninterrupted belt of low mortality districts,—the very centre of England. Warwickshire is characterised by the terminations of three of the most important sea inlets of our island,—the Wash, the red sandstone vale, commencing in Cheshire, and the valley of the Severn and Avon.

SECTION III.

The Relative Mortality of the Insular and Peninsular Districts.

Insular.

There are four Insular Districts, three of which have a low, and one a remarkably high mortality; the average annual rate of mortality in each is as follows:—Anglesea 6·5, Isle of Wight 12·5, Isle of Sheppey 10·4, and the Scilly Isles 15·3, to every 10,000 living. This last exception to the rule is remarkable, and requires further investigation into its cause; in all these districts the mortality is greater amongst the males than females, but in the isle of Scilly the proportion is as 136 females to 170 males. Even including the Scilly Isles, the rate of mortality in insular districts is below the average, being 11·1 to every 10,000 living.

Peninsular.

There are 12 Peninsular Districts, having a mean annual mortality to every 10,000 living of 11·1, the same as the insular: they are Pylde 11·1, Wirrall 8·7, Pwllheli 10·9, Haverfordwest 12·5, Pembroke 12·2, Penzance 8·9, Swansea 7·4, Weymouth (Portland) 11·4, Thanet 16·6, Hoo 9·3, Tendring 12, Patrington 12·2. Again we see in this last series of districts, the most exposed of any to the direct influence of the sea-winds on all sides, that a low rate of mortality is coincident with their favourable position for free ventilation.

Recapitulation.

1°. The Inland Districts have a higher mortality than the Coastal; the low mortality inland districts, however, on both the eastern and western sides of England, are to be found contiguous to those which border the great sea inlets, and the coast, as well as where there is elevated ground, admitting of ventilation on all sides.

2°. The Midland groups of Districts, which are not intersected by the great sea inlets, but are protected by high ranges of hills on all sides, have the highest mortality. And lastly,

3°. The Insular and Peninsular Districts, the most exposed to the sea-winds of all districts, have a low mortality from Heart Disease and Dropsy.

We have thus seen that the same general law obtains throughout the three divisions of England and Wales into Registration Divisions, Counties, and Districts, viz.:—*That wherever the sea air has uninterrupted access, as over a flat country, up broad vales or valleys, and elevated country, we find a low mortality from Heart Disease and Dropsy; and that on the contrary, in places where the tidal wave has no access, where the rivers run at right angles to its course, or to that of the prevailing winds, there we find the highest mortality from this cause of Death.*

CHAPTER VI.

SECTION I.

The Geographical Distribution of the six degrees of Mortality from Heart Disease and Dropsy.

In the map which shows the distribution of Heart Disease in the eleven Registration Divisions, we see that only three degrees of mortality are represented: the division which has the greatest mortality is the South Western V., and the lowest mortality is found in the XI. Division North and South Wales. It will be well to take each division separately.

In the Eleven Divisions.

I. *London.*—The mortality of this important division was only 12·5 to every 10,000, notwithstanding its twenty-six hospitals which are open to applicants from so many surrounding counties, and even foreign countries. If a line be drawn from the north of the Islington District (near Highgate) to the south of the Lambeth near Lower Norwood, it will be found that the great mass of the area of this division to the east of this line is coloured red, indicating a low mortality: whilst to the west the prevailing colour is light blue, which represents a death-rate just above the average, the fourth degree of mortality. The exceptions on the Eastern side are first, Greenwich, which include the military town of Woolwich as well as its own Naval Hospital (1851–60); and secondly, the high mortality group, which the City of London, St Saviour, St Olave, West London, Strand, St Giles', Holborn, and Clerkenwell, compose. Both Greenwich and Woolwich are favourably situated for receiving every advantage which the tidal influence of the Thames and the sea-winds, which are favoured in their course up the river by the heights of Essex, Kent, and Surrey, can afford. In 1868, when reading my first paper on this subject, I drew attention to the remarkable fact, that wherever there is a garrison or military town in a district, it matters not what the climatic or physical surroundings of the district may be, a high mortality from Heart Disease among males is sure to be found. In London the difference between the mortality from Heart Disease among males and females is not so great as it is throughout England, the proportion being as 12·7 males to 12·4 females. In Greenwich, inclusive of Woolwich, the average annual rate of mortality from Heart Disease and Dropsy is as 17·2 males to 13·2 females; whilst in the adjoining district of Lewisham the proportion is 10·8 males to 12·2 females. We shall have occasion to revert to this subject when we examine other districts, like that of the Medway, containing military towns such as Chatham and Rochester. The group of high mortality next to be considered is the one which embraces the Thames immediately to the east of our imaginary line: it contains every grade of high mortality. The greatest mortality is to be found in St Saviour's and St Olave; these districts contained Guy's and St Thomas's Hospitals: the two districts are taken together, as it was found that a very large proportion of the deaths that took place occurred in those hospitals, and that it was impracticable to give the corrected mortality of these two districts separately, parts of both hospitals being situated in each of the districts: whilst much of the excess

London Division.

Eastern Districts.

Military Towns.

Woolwich.

of the mortality from Heart Disease may be attributed to the attraction to these great hospitals of bad cases from other districts scattered over the home counties; we must not forget that the ventilation of these districts is of the worst description possible. We must ever remember that the street system is to towns what the river system is to the country. We have found, throughout our examination, that low mortality from Heart Disease is almost invariably coincident with free access of the prevailing sea-winds, and that, were the converse obtained, it was coincident with high mortality. Streets, like rivers, should traverse a town so as to admit of the freest access to the prevailing winds, if they do not, there will ever be lurking about some air-sewage waiting to do mischief at a moment's notice. The three main thoroughfares of the united districts of St Saviour and St Olave are all at *right angles* to the winds which sweep up the Thames; to the east of London Bridge there is no wide street at all; the whole of the two districts being made up of an intricate interlacement of narrow streets, alleys, and *cul-de-sacs*, out of which it is almost impossible to drive the air-sewage. The mortality is 20·7, the highest average annual rate of mortality in that part of England to the east of the 1° W. Longitude, although not higher than that of Frome, and considerably less than that of Wilton, both of which are shut out from the direct influence of sea-air.

Street System in Towns.

West London ranks next as to its mortality; here the main thoroughfare, Farringdon Street, is at right angles to the prevalent winds; and those lying between it and Chancery Lane and Grey's Inn Lane, as well as the streets to its east, are so arranged as to give the idea of a design to exclude fresh air as much as possible: the opening of the Holborn Viaduct, and the demolition of hundreds of hot-beds of disease and crime, has, however, given such a breathing power to this district, that there is every reason to believe that during the next decad its rate of mortality 18·1 will be considerably modified. Fleet Street is feeble as a ventilating thoroughfare; in fact, its position and its narrowness render it an obstruction rather than otherwise. West London includes St Bartholomew's Hospital, for which a correction has been made. Clerkenwell, Holborn, and the City of London have the lowest of the high mortality group. Although the City of London has a less density of population than other districts, yet none of its streets are so built as to give a thorough ventilation to the inhabitants: the streets leading to the river are at right angles to it, and none of the principal thoroughfares are so built in relation to other streets, as to admit of free draught. Although above the average, we must not think the mortality of Clerkenwell high, 13·4, when we consider not only the density of the population, but the social condition of the people: a portion of it is on the high ground adjoining the elevated and extremely healthy district of Islington; where the high site, wide streets, and semi-detached houses offer free ventilation on all sides, especially to the north-east, where the sea-winds from the German Ocean have full play when they prevail. Holborn has a mortality similar to that of the last district 13·4: it includes the hospital for sick-children, for which a correction has been made by the Registrar-General. The mortality of Holborn partakes of the character of the generality of the districts which lie to the west of the line which bisects this division.

West London.

City of London.

Clerkenwell.

Holborn.

The large mass of districts lying to the east have a low mortality, and this is coincident with the fact that they first receive the full afflatus of the winds from the sea, which blow freely over the low lying ground between the rivers banks and the heights of Essex, at Epping and Hainault, on the north, and those of Kent on the south. The winds flow unrestrainedly over the flats in the district of Hackney to the northern heights of Islington (Highbury) and Hampstead. To the east many of the principal thoroughfares are in the axis of the prevalent winds, and admit a thorough air flushing from all quarters: this fact is coincident with a low mortality from Heart Disease.

Western Districts.

The Western Districts, which receive the sea and river winds after they have passed over those on the east, we see, as a rule, have a mortality above the average, although not greatly so: those districts which are exceptional are Hampstead, the greater portion of which lies high, and has a site of London clay and Bagshot sand; St George's, Hanover Square, and Westminster, within which group are Hyde Park, Kensington Gardens, and St James' Park, all of which exercise a most beneficial influence on the health of the inhabitants: these open spaces for the most part lying on gravel, and not overcrowded with trees, are vast reservoirs of pure air, a great portion of which, at times, is derived from the tidal-breeze. St Pancras and Marylebone have a higher rate of mortality than we otherwise would be led to expect from their position; both have wide streets and open spaces, such as Regent Park and Primrose Hill; considering, however, that St Pancras contains University College Hospital, and the Royal Free Hospital, and St Marylebone, St Mary's Hospital, for which, however, corrections are made, the mortality is not excessive, especially that of St Pancras, which is only 12·8; that of Marylebone is 15·0. Regent's Park and Primrose Hill, although admirable play and exercise grounds for the people, are not such good reservoirs of air as Hyde Park, their clay soil, and the wooded character of the boundaries of the Park, fail to give that bracing character to the superincumbent air which we find so invigorating in Hyde Park or on the top of Hampstead Hill.

The Parks.

The River Thames.

The Division of London is characterised by the great sea inlet of the Thames, which traverses it from east to west: coincident with this physical feature, which has such a remarkable influence on its climate, we have already said that the mortality from Heart Disease and Dropsy is only 12·5. The bidiurnal rise and fall of the tide at London Bridge is between 16 and 20 feet; if we consider the effect of a rise or a fall of such a vast surface as the Thames presents in it course through London, we shall be able to appreciate the influence it exerts in changing the air; when it rises it brings with it an inrush of pure air, which displaces that pervading the low localities in the neighbourhood of its banks; whilst on its return to the sea it again exerts its power of withdrawing the air from the lower grounds, and carrying it seaward; whilst that from the higher locality takes its place, so that there is a constant change at every tide, especially in the riparial districts. In addition to this, the tidal-wave is generally accompanied by its own peculiar breeze, which has a far wider influence than is generally suspected. If a contour map of London be taken, it will be easily seen what an extensive surface is capable of being flooded by the uplifting of the air 16 or 20 feet above low tide. Every precaution should be taken, therefore, to

preserve our river pure, and not allow the air from the sea to be contaminated by the foul gases of sewage, which neutralise its power before it reaches this great city.

Recapitulation.

Recapitulation.

1°. A line drawn from Highgate to Lower Norwood will separate the Division of London into a Western and an Eastern Division.

2°. The Eastern Division is nearly entirely coloured *red*, indicating a low mortality.

3°. The Western Division is nearly entirely coloured *blue*, indicating a high mortality.

4°. The Eastern Division receives first the full influences of the sea-winds of the ocean, and its main approaches are favourable to their free access. The Western receives these winds after they have passed over the most densely populated districts of the Eastern Division.

5°. The Eastern Division contains the high mortality district of Greenwich, this is coincident with the existence of a military town within its area.

6°. In the Eastern Division the low mortality group, embracing the Thames, is characterised by having the streets in its several districts so arranged as to preclude free ventilation by the winds which sweep from the sea up the river.

7°. The exceptions on the western side of London to the high mortality are Hampstead, Westminster, and St George's, Hanover Square; coincident with this low death-rate from Heart Disease, we have in Hampstead elevated ground capped by Bagshot sand, and full exposure to prevailing winds on all sides. In the other two districts coincident with low mortality are the parks and gardens, which have a gravelly soil, and in Hyde Park sparse foliage.

8°. London as a division has a low mortality, 12·5, and coincident with this it is traversed by the great sea inlet, the Thames, which has an average rise and fall of the tide between 16 and 20 feet.

SECTION II.

The South-Eastern Counties Division.

II. *The South-Eastern Counties Division.* As all the divisions except London, have been previously more or less discussed, I shall not now devote so much space to them as I have just given to that of the metropolis; it will be only necessary after what has been said, to give a short account of some of the more salient features in the distribution of Heart Disease in each. The South-Eastern Counties' Division has the second highest mortality of the eleven; its annual average rate of mortality to every 10,000 living, is 14·0. It has three districts occupied by soldiers, all having military hospitals; for instance, the district of Medway includes Rochester and Chatham, and the Military Hospitals; Portsea Island, Portsmouth, and its Military Hospital;

Military Towns.

and Alverstoke includes Gosport and Haslar Hospital. All these districts are favourably situated so far as free access of sea-air is concerned, but coincident with their military occupation, all have a mortality above the average, and two out of the three have a greater mortality among the males than the females, which we know not to be the rule throughout England. Medway 15·8 males to 13·4 females; Portsea 12·5 males to 12·8 females, and Alverstoke 15·9 males to 11·7 females. On the other hand, it has two military camps, Aldershot, in the districts of Farnborough and Farnham, and Shorncliffe in that of Elham, the former on the heathery downs of Bagshot sand, near Frimley, and the latter on the breezy chalk downs of Kent, near the source of the Little Stour. These three districts have a low mortality; in fact, the two first stand out conspicuously in the midst of districts having a death-rate above the average; and it must be further noted that in all these districts, the mortality amongst females is the greatest. For instance, Farnham 9·4 males, 13·5 females; Farnborough 9·7 males, 13·0 females; Elham 11·0 males, 12·0 females. This is an interesting fact, and worthy of strict investigation. This division contains districts having the three degrees of high mortality; two, Andover and Alresford, have the southern greatest degree of mortality, and eighteen have one of the fifth degree, or next to the highest. With the exception of Thanet and Rye, all these are inland districts, and well sheltered from the prevailing winds. The most remarkable group is the circular one which surrounds Wantage: it is composed of the districts through the protected valleys of which the Thames, the Ock, and the Kennet trend, the sources of these rivers to the west of this group at once indicate the range of hills which intercepts the full influence of the south-west and westerly winds; the Marlborough Downs and the Cotswold Hills to the west, are the barriers which are coincident not only with the high mortality in this division, but with that of those adjoining.

Military Camps.

High Mortality Districts.

This division has on its north boundary the sea-inlet of the Thames, and coincident with this we find its riparial districts having a low mortality—from Thanet to Kingston there are 13 riparial districts, including the southern part of London, 10 of which have a low mortality; the exceptions are Thanet, before alluded to, p. 28, Medway having the military towns of Chatham, Rochester, and Dartford. The riparial districts of south London have already been discussed. The high mortality districts of Andover and Alresford are protected on all sides by overshadowing hills, and I have often heard my friend Jabez Henry Elliott, Esq., who lives at Andover, and who has one of the most extensive practices in Hants, declare his opinion that the cause of the excess of Heart Disease in his district is the prevalence of rheumatism, which crops out on every occasion, and is the bugbear of the medical man; during convalescence from other diseases it often checks the steady course to health by its unwelcome appearance. Both districts are agricultural. The lowest mortality in this division is to be found in the flat district of Romney Marsh, where the sea-air has full sway; and in the exposed districts of Hoo and North Aylesford, at the

Low Mortality Districts.

Inlet of Thames.

Highest Mortality. Andover and Alresford.

The Lowest Mortality.

nouth of the Thames; here the low mortality is again coincident with the unchecked afflatus of the ocean winds and the tidal breezes. The mortality of Southampton is low, being only 12·8. It s situated in a district, South Stoneham, having a low death-rate from Heart Disease; and on the north-east bank of the only considerable sea-inlet on the south coast of this division, the Southampton Water.

Southampton.

Recapitulation.

Recapitulation.

1°. The districts in this division having the highest mortality are to be found inland; and its only inland county, Berkshire, which is free from the influence of the Thames or the coast, has the fifth degree of death-rate.

2°. The sea-inlet of the Thames flows along the greater portion of its northern boundary; the reparial districts have a low mortality.

3°. The districts in which military towns are situated have a high rate of mortality, and more males die from Heart Disease than females.

4°. The districts having the lowest mortality are those most exposed to the full influence of the east-winds.

SECTION III.

III. *The South Midland Counties Division.* This division, I have previously remarked, cannot properly be called midland, inasmuch as one of its counties stretches to the Wash (Cambridge). The average annual rate of mortality in this division is 13·0 to every 10,000 living. The five high mortality counties, 10, 9, 8, 7, dominate the three having a death-rate below the average, viz., 11, 12, 13. On looking at a map of the counties, it will be at once seen that there is a natural division between those coloured blue, and those coloured red. The former having a high rate of mortality, are the inland: of these Oxford and Middlesex, the most inland of all, have the highest rate; whereas the three coastal counties have a low rate, and those lying nearest the Wash have the least mortality.

The South Midland Counties Division.

Mortality.

The Counties having a High and Low Mortality.

The district map gives a more minute detail; and here it will be found that the low mortality districts are to be found in the level country from the Wash along the banks of the Ouse, the Welland, and the Nen; these wide flat vales seem to offer free access to the winds from the German Ocean nearly up to the sources of the rivers which traverse them; on the borders of Oxfordshire, Buckinghamshire, and Hertfordshire, a different watershed occurs, that of the Thames, the oolitic and chalk ridge of which protects the districts within the basin from the winds from the Wash; and coincident with this sheltering, we find a high mortality; the valley system, especially on the oolitic range, is very intricate. The rivers Cherwell and the Thames (until it arrives

The Vales of the Ouse, Welland, and Nen.

The Thames basin.

at Reading) have their courses north and south at right angles to the prevailing winds from both oceans; and coincident with this, we find that there is a riparial group of high mortality districts, of the fifth degree, which is continuous with the one already alluded to, when examining the circular group of high death-rate in Berkshire; Berkhampstead and Woburn are both well enclosed by hills and protected on all sides; coincident with this is a high mortality. Wisbeach, although a coastal district, is coloured blue, its death-rate is only slightly above the average, viz., 12·7, or 0·3 in excess. There are four districts having a very low mortality (2nd degree), all are exposed to the sea-winds. It is to be remarked that within this division, our two great English Universities are included, Cambridge and Oxford. The latter we find has a low mortality from Heart Disease, in the midst of districts having a high death-rate from this cause, whilst the former has a rate above the average, although in the midst of a district having nearly the lowest degree of mortality, and surrounded by others of nearly the same character.

Berkhampstead and Woburn.

Cambridge and Oxford.

During the decad 1851-60, in Cambridge there died 12·7 males and 12·6 males, mean 12·6; and in Oxford 9·1 males and 12·3 females, mean 10·7.

Harrow School is also situated in the Hendon District, where the mortality is as follows, 14·5 males, 12·5 females, mean 13·0. The district of Hendon is encircled by hills from which the tributaries of the river Brent flow; the Harrow ridge, whereon the school is built, is lofty, about 200 feet above Trinity high-water mark, which gives it certain advantages over the valley lands that are enclosed.

Harrow.

Hendon is protected by the Hampstead Hill, which is 431 feet high; it has a capping of Bagshot sand, and on its summit receives every wind that blows, without interruption; coincident with this, we have already seen that it has a low mortality, 12·0.

Hampstead Hill.

Recapitulation.

Recapitulation.

1°. The counties which compose this division form themselves into two groups—5 midland having a high, and 3 coastal a low mortality.

2°. The high mortality counties have their districts well protected by their valley system; the low mortality counties have their districts exposed freely to uninterrupted air flushing over the flat lands bordering the Wash.

3°. Cambridge has a mortality above the average, and Oxford one below it; each form exceptions to their surrounding districts.

4°. Harrow is in the district of Hendon, but is considerably above the mean level of the district.

SECTION IV.

IV. *The Eastern Counties Division.* The area of this division has the lowest level throughout its entire extent to be found in England, and, from its low sea-board, offers the least resistance to the full sway of the sea-winds from the German Ocean; in fact, owing to its general flatness, it is capable of being swept by winds from all quarters; coincident with this capability of being thoroughly purged, we find it having a low mortality, 11·4.

The Eastern Counties Division.

Flat Country.

All the counties are Coast Counties. The most exposed county, Norfolk, has the lowest death-rate from Heart Disease, 10·1. The most sheltered county, Essex, a portion of which is within the London clay ridge of the Thames basin, has the greatest mortality from this cause of death, 12·7. The low mortality counties are continuous with those of the last division, which border the Wash; and the disposition of the low mortality districts is coextensive with the contour line of less than two hundred feet; these districts are continuous, not only with those of the last division, but also with those of the coastal parts of the North Midland Districts, VII. Coincident with the high mortality in the districts of Thingoe, Thetford, and Stow, there is the valley system of the Little Ouse and the Lark rivers, the death-rate, however, is only slightly above the average. The London clay and chalk heights of Essex, whence arise the Chelmer, the Stort, and the Roding rivers, give shelter to the country to the south; and coincident with this, we find a group of districts having a death-rate above the average. This we see, is continuous with the group already noticed in the last section, as being within the basin of the Thames. This division has one district of the lowest degree of mortality, Tunstead, it lies on the coast, and is exposed to the full blast of the sea-winds. There are also several districts having the second degree of mortality: these also are exposed to the prevailing winds. The principal towns are nearly all coloured blue, except Yarmouth, having a mortality above the average; for instance, King's Lynn 15·6; Norwich 13·3; Bury-St-Edmunds 16·5; Ipswich 13·2; and Colchester 16·7. In Colchester there is a military camp. In King's Lynn the number of male deaths is remarkable, viz., 18·1 to 13·1 females, or 6·3 above the male average. The low mortality of Yarmouth is also remarkable. This division forms the boundaries of two of the great eastern inlets, the Thames and the Wash, the riparial districts of which all have a low mortality.

Death Rate of Counties.

Low Mortality.

High Mortality.

Tunstead.

High Mortality in Principal Towns.

The high mortality in the large towns I cannot help ascribing to defective sanitary regulations therein, and place them in the same category with Margate and Ramsgate.

Recapitulation.

1°. The average annual rate of mortality is low, and this is coincident with flatness of country and unobstructive sea-board.

2°. The most protected county, Essex, has the highest mortality; the most exposed, Norfolk, the lowest.

3°. The high mortality group in the centre is coincident with the valley system of the Little Ouse and Lark rivers, and that in the south of Essex with the sheltering ridge of the watershed whence arise the Chelmer the Stort and the Roding.

4°. The high mortality in the principal towns arises, in all probability, from neglect of sanitary laws.

5°. Yarmouth has an exceptionally low mortality.

SECTION V.

Instead of examining the divisions in the numerical order of the Registrar-General, I prefer taking them consecutively from south to north, and thence to the south again; this will be a more natural order, and assist the memory by reference to the facts indicated in contiguous divisions

VII. *The North Midland Counties Division* lies to the north of the Eastern Counties Division IV.: it certainly is not a purely Midland Division, in as much as it embraces the large coastal county of Lincoln, which extends from Norfolk to Yorkshire. Here the low mortality in Lincolnshire and Rutland dominate the high mortality in the remaining three Inland Counties, Nottinghamshire, Leicestershire, and Derbyshire, if we take the mean of the whole division, which is 12·5; on dividing it into counties we find that those having the lowest mortality are nearest the coast, for instance, the mortality of Lincolnshire is only 10·3, and that of Rutlandshire 11·8; whereas the most Midland County, Derbyshire, has a death-rate of 15·5, it contains no district having one below the average, and the intermediate counties of Leicestershire and Nottinghamshire, a death-rate of 12·8 and 12·6. The low level of all the counties except Derbyshire is coincident with this low mortality. The valley of the Trent is in the axis of the north-east sea-winds, in the first part of its course, and its riparial districts have a death-rate all below the average; when it gets inland, however, it still favours the winds from the north-east; and coincident with this course we find that the districts which skirt its banks have a mortality only just above the average. The group of high mortality districts, comprised of Chapel-en-le-Frith, Bakewell, Ashborne, and Belper, lies in the valleys of the rivers Dove and Derwent, both of which run at right angles to the prevailing winds, whether they be north-east, or south-west, or north-west. Barrow-on-Stour has a fifth degree of mortality, it is traversed from south-east

The North Midland Counties Division.

Mean Mortality.

Coast Counties.

Midland and Inland Counties.

The Trent.

Highest Mortality.

to north-west by the river Soar, and is therefore not in the axis of the winds from the German Ocean; Blaby, however, where the Soar takes its rise, is more or less elevated, and its aspect is generally towards the north-east. The three most exposed districts, Spilsby, Spalding, and Holbeach, have the lowest mortality. All the principal towns have comparatively a low death-rate from Heart Disease. This division forms one of the boundaries of the great eastern sea-inlets, namely, the Wash, and the mouth of the Humber; and the riparial districts along each have a low mortality. The districts having a low death-rate in this division are continuous with those in the last; and, coincident with this fact also, an extensive level area, which offers little or no obstruction to the full force of the sea-winds. We have found coexisting with the broad flat country of the coastal counties of the South Midland Division, a low rate of mortality; and that coextensive with this level character in Lincolnshire, a mortality considerably below the average obtains: we shall now follow this low tract, and coincident low mortality into the vale of York, of the next division. Buxton is in the elevated part of the district of Chapel-en-le-Frith, and Matlock in the well sheltered district of Bakewell, which is protected from the sea-winds by the East Moor.

Lowest Mortality.

Inlets of Wash and Humber.

Buxton and Matlock.

Recapitulation.

Recapitulation.

1°. The mean mortality of this division is low; the low mortality of Lincolnshire and the other adjoining counties dominates the excessive mortality of Derbyshire.

2°. Among the counties the one having the highest mortality is the most midland, Derbyshire 15·5, that having the lowest, the most coastal, Lincolnshire 10·3.

3°. The course of the river Trent through this district forms the access for the winds from the German Ocean.

4°. The Derwent and the Dove traverse a series of districts in the north-west of Derbyshire, at right angles to the prevailing winds; these districts form a group of high mortality, the most sheltered by the East Moor, Bakewell, has one of 17·7, and Chapel-en-le-Frith 17·1.

5°. This division forms one of the banks of the two great sea inlets, the Wash and the mouth of the Humber. The riparial districts have a low mortality.

6°. The districts having a low mortality, and lying on the level country of this division, are continuous with the low mortality districts of the last division, which also had a low alluvial site.

7°. Buxton and Matlock lie in the districts which have the highest mortality from Heart Disease.

SECTION VI.

IX. *Yorkshire.*—Yorkshire is the best type that we have in England of what our counties and districts would be if determined by our watershed. This division is rather more than a tenth part of the whole of England and Wales, and is divided into three Registration Counties, the North, East and West Ridings, or Trithings; about seven-ninths of its whole extent falls within the basin of the Humber (Hughes), and the waters of this vast area are conveyed to that river by its great tributary the Ouse.

Yorkshire.

The mortality in this division is below the average, 11·8. The North Riding is protected from the sea-winds by the precipitous cliffs along the coast from Redcar to Flamborough of the oolitic and chalk formations; its mortality is 13·2. Moreover, the valley of the Derwent is sheltered by the high range of oolitic hills to the north (Eastern Moorlands), whence descend the Rye, the Pickering, and the Derwent. The only low mortality district is Easingwold, 12·0, a great portion of which lies on the elevated tract of the oolitic Howardian Hills. To the north of the Eastern Moorlands, exposed to the full sway of the sea-winds from the German Ocean, are the districts of Stokesley, Guisborough, and Whitby. All the rivers and becks, including the Esk, flow directly into the sea, and their valleys are swept by every breeze that comes from it. The districts most exposed are the two first, and their mortality is the lowest. We must remember that this rounded coast so projects that the tidal wave, in its course from north to south, impinges immediately upon it. The town of Scarborough has every advantage which position can afford. The district, however, is in a great measure protected by the high hills behind, such as Olivers Hill and Seamen Beacon, that form the eastern boundary, with others of the valley of the Derwent which courses from north to south, and then from east to west in this district.

Mortality, North Riding. High Mortality Districts.

Low Mortality Districts.

Scarborough.

The East Riding has a comparatively low coast, with the exception of the northern part from Filey Point to Bridlington Bay, including the bold chalk promontory of Flamborough Head. The districts to the west of these cliffs have a mortality above the average, although not considerably; one of the districts is York, which is remarkably well situated in its vale, up through which sweep the winds without hindrance. The remaining high mortality districts are those through which the river Hull passes from north to south in its passage to the Humber. The town of Hull itself, although on the tidal Humber, has its river as well as its principal streets at right angles to the healthful gales which blow up this sea inlet, like some of the districts surrounding the Thames. The districts having the lowest mortality are Skirlaugh, 12·2, and Patrington 10·2, the latter is a peninsula, and most exposed, it terminates at Spurn Point. In Skirlaugh the men die in greater proportion than the women, as 13·8 to 10·6.

East Riding.

York.

Hull.

The West Riding.—The mean mortality of this large Riding is only 11·8, it will be seen that in the southern part of the Riding where the rivers are fully formed and have considerable valleys, which are, as it were, so many ramifications of the great sea inlet of the Humber, all the

West Riding.

districts, with two exceptions, Barnsley and Leeds, are coloured red; and that in the north-western portion, where are to be found the sources of these rivers in the deep valleys of the Pennine range, which defines the watershed of the western portion of the county, the districts are coloured blue. The majority of these districts have, however, a mortality only just above the average. Otley has a remarkable death-rate 17·6 males to 20·2 women, mean 18·9; Ripon 16·6, Barnsley 14·6, and Leeds 13·0, which must be considered low, for its two hospitals must attract severe cases from the neighbouring districts. The remarkable group of low mortality districts which follow the courses of the Aire and the Calder, in the latter case to the very western confines of Yorkshire, is continuous with the one already described, which stretches from the Wash and the Humber to Yorkshire, and not only so, but with the low mortality group the North Western Counties Division VII., the base of which stretches from Whitehaven to the estuary of the Dee, and then follows the course of the Ribble to join the Yorkshire group. From the Wash to the mouth of the Ribble there is an unbroken line of low mortality districts. The sea breezes from the German Ocean pass up the valleys of the great Yorkshire rivers, and flood the eastern part of Yorkshire with fine sea air; whilst from the Irish Sea come the north-westerly gales, which perform a similar part on the west of the great Yorkshire ridge: and coincident with this air flushing from both seas, we get a belt of low mortality which stretches from sea to sea.

Low Mortality Group.

Stretches from the Wash to the Ribble.

The division of Yorkshire has the sea inlet of the Tees to the north, and that of the Humber to the south, the riparial districts of both of which have a low mortality, except Hull and Sculcoates.

Sea Inlets.

Recapitulation.

Recapitulation.

1°. The mortality in this division is low: it has only one district of the fifth degree, although it has six of the second or nearly the lowest.

2°. The northern part of the Division from the coast of Scarborough to the ridge of high hills between Yorkshire and Lancashire, contains nearly all the high mortality districts in one large group: in this part are the sources of the rivers.

3°. The southern part of this Division, from the mouth of the Humber to the confines of Lancashire and Cheshire, contain nearly all the low mortality districts; here the courses of the fully formed rivers favour the free access of the winds from the German Ocean.

4°. The other group of low mortality districts lies to the north of the North Riding, and are all freely exposed to the influence of the tidal wave and prevailing sea winds.

5°. All the principal towns have a low mortality.

6°. That part of England between the mouth of the Ribble and the mouth of the Humber is the narrowest and most deeply penetrated by sea inlets; it is characterised by an uninterrupted belt of low mortality districts.

SECTION VII.

X. *The Northern Counties Division.*—The Mortality of this division is 12·7, or only slightly in excess of that of England and Wales.

The Northern Counties Division.

This division embraces Northumberland, Cumberland, Durham, and Westmoreland; it is remarkable for the facts that it is washed on the east by the German Ocean, and on the west by the Irish Sea; and that within its boundaries it has almost every character of the distribution of Heart Disease to be found in England and Wales. For instance, from the Tweed to the Tyne we find a river system very similiar to what we have observed along the south coast, where the mortality is above the average; in both cases the rivers are numerous, and have their courses generally terminating in the sea at right angles to the prevailing winds and the incidence of the tidal wave; in the south coast the south-west and westerly are the prevailing winds, and the tidal wave flows from west to east along the English Channel; the direction of the rivers and the valleys which they traverse, are, as a rule, at right angles to both wind and tide; the former blow *over* them and not *up* them; consequently there was hindrance to thorough air flushing, and wherever this obtained we found coincident high mortality from Heart Disease and Dropsy.

The Coast between the Tweed and Tyne.

High Mortality along the Coast.

On the east coast of Northumberland, from the Tweed to the Tyne inclusive, there are fourteen rivers and burns, all of which, without exception, run to the sea and open into it at right angles to the course of the tidal wave, and nearly so to that of the prevailing north-east winds from the North Sea. Here we must again recall the fact, that the tidal wave has a course from north to south, inasmuch as when it reaches the east coast from the Atlantic, it has taken more than half the circuit of the British Isles, from Penzance round to the Orkneys, and along the coast of Scotland. Presently, when we come to the Cumberland coast, we shall see how the courses both of the tide and the winds are reversed. Coincident with the facts just stated, we find that all the coastal districts included between the Tweed and Tyne have a death-rate above the average, although only of the fourth degree, and in reference to this I must draw attention to the fact, that the coast of Northumberland between these rivers, is not so precipitous nor so obstructive as that which bounds many parts of the south coast where the mortality reaches the fifth degree. Below the river Tyne the character of the country entirely changes; the red-sandstone takes the place of the carboniferous lime-stone and coal formation; the coast looks towards the north-east, and forms a complete bay, which is open alike to the full afflatus of the sea winds and tidal wave; moreover, the rivers Wear and Tees pass to the sea and open into it from the south-west, so that their courses and their valleys are so directed as to be free to admit every air purging that the German Ocean affords them; coincident with this we find that the county of Durham has an exceedingly low mortality, 10·4, and that only three of its districts—Teesdale, Darlington, and South Shields, have a mortality above the average, and this only of the fourth degree. It is instructive to watch the course

High Mortality.

The Coast between the Tyne and the Tees.

Low Mortality.

Durham.

River Tees.

of the river Tees, where in the latter part it runs through Stockton, and has its axis in the direction of the prevalent sea wind it is accompanied by low mortality; but, on the other hand, in the former part, where it runs through Teesdale and Darlington from north-west to south-east, and therefore at right angles to the prevailing winds, it runs through the midst of high mortality districts. As to Sunderland there is in all probability some local cause to account for its excess of deaths. Weardale is a broad carboniferous limestone vale and admits freely the sea winds. Teesdale, on the contrary, is sheltered by the lofty range which divides the sources of these two rivers, and which, on the north sides, gives rise to more than ten sources of the Wear, all running from the hill side through wide valleys in the direct axis of the prevailing winds from the sea. Weardale has a very low mortality 8·8, Teesdale 14·2.

Sunderland.

Teesdale and Weardale.

The Northern Counties Division has really no inland counties, for Westmoreland, which is the most so of the four, has an important sea inlet penetrating its south-western boundary; the embouchure of the river Kent, which opens into the Bay of Morecambe, an inlet that exercises a powerful influence on the ventilation of the coastal area of Cumberland and Westmoreland. To show, however, how typicial this division is of what obtains throughout England, we will now examine the Inland Districts; this can be done by drawing a semi-circular line from the north of the Glendale to the south of the westward district; this line will pass through the districts of Glendale 13·2, Rothbury 15·2, the extreme eastern end of Billingham 12·2, Hexham 15·1, Alston 15·4, and westward 14·1; these are essentially the midland districts of this division; the mean average annual mortality to every 10,000 living in which is 14·2. The only exception as to mortality among them being Bellingham, this is bounded on the south-west by a lofty range of carboniferous limestone hills, which have an aspect facing the north-easterly sea winds; from this range the north Tyne receives nearly a dozen tributaries, all having the troughs of their valleys corresponding to the direction of the prevailing winds, and the town of Bellingham itself is situated within a short distance from the point where the river Reed becomes confluent with the North Tyne; after passing through a broad valley from north-east to south-west, through which a copious air flushing from the ocean has no obstruction. On the contrary, in the Hexham and Haltwhistle Districts, the tributaries of the South Tyne run more from south to north, and the South Tyne itself, in the first part of its course, runs from south-east to north-west.

Inland Districts.

High Mortality.

Bellingham.

Hexham.

The western part of this division may be divided into two parts, the north and south; it is a natural division defined entirely by the watershed. If a line be drawn from a point between Workington and Whitehaven, and made to take a south-easterly direction as far as the south-eastern boundary of Westward, it will represent sufficiently the elevated ridge of the Cumbrian Hills, which separates the two water-sheds of the Cumbrian Lake county. This ridge of towering fells, having an average height of 2000 feet, acts as a barrier on the north side, to keep the direct influence of the sea winds from the valley of the Derwent to the great valley of the Eden, which is also sheltered by a high ridge of carboniferous limestone rocks to the north-east; on the south side

Western part of the Division.

Two Watersheds, North and South.

North.

however, we find all the streamlets, and rivers and the valleys, through which they course, running straight to the sea and exposed in every instance to the full flushing influences of its winds. From Morecambe Bay to St Bees Head there is scarcely a valley but what is air purged every time the wind blows toward it from the Irish Sea. What, therefore, are the coincident facts relative to the mortality from Heart Disease? On the north and sheltered side there is a high, and on the south exposed side, a low mortality. The map shows at once the line of demarcation between the two watersheds. When examining the northern districts of the North Riding, we found that there was a similar, although not so lofty a ridge, stretching from the south of Whitby to the eastern boundary of the North Allerton district, and separating the watersheds of the eastern part of the North Ridings; we found, however, that the southern districts had a high, and the northern a low mortality; and coincident with this we know that the sea winds came from the north-east, and that the tidal wave rolled from north to south; the very reverse of what obtains in Cumberland, where the sea winds are from the south-west, and the tidal wave from the south; and we have just seen that coincident with this reversal of the course of the wind and tide, a reversal also in the position of the low and high mortality districts. The sea inlet of the Solway Firth must now be noticed briefly: it will be seen at a glance that it is so placed as to receive, without interruption, the south-westerly winds; at its extreme point, where the rivers Liddle and Line become confluent in Solway Moss, to the south-west of the district of Longtown, the mortality of which is one of the lowest throughout the division, being only 9·0, the low flat alluvial district of Wigton projects seaward so as to receive a full sweep of the sea winds, and coincident with this is its low mortality, 10·8. Carlisle lies to a certain extent inland in the vale of the Eden, but its mortality of the fifth degree is higher than its position would lead us to expect; it may probably be placed in the same category with Chester, and some of the towns in the Eastern Counties Division IV. All the districts lying within the sheltered vale of the Eden have a high mortality. The principal towns Newcastle, Carlisle, and Sunderland, have a death rate above the average; and Durham, Kendal, and South Shields, below it.

High Mortality.

South.

Low Mortality.

Compared with Eastern part of North Riding.

Mortality of the Principal Towns.

Recapitulation.

Recapitulation.

1°. The mortality from Heart Disease in this division is low, although above that of England and Wales.

2°. Its coasts are washed by the Irish Sea and the German Ocean, and the distribution of the mortality from Heart Disease is typical of what obtains throughout England.

3°. The coast districts of Northumberland, with their numerous rivers running at right angles to the sea wind and tidal wave have a high mortality resembling the coastal districts of the south of England.

4°. The coast districts of Durham, where the rivers have a direction favouring the access of sea winds, such as the sea inlet of the Tees, are characterized by a low mortality.

5°. The Inland districts have a mean average annual mortality of 14·2.

6°. The western part is divided naturally by the high ridge of the Cumbrian Hills; on the north and sheltered side there is a high mortality from Heart Disease, when, on the southern and exposed side a low mortality obtains.

7°. On comparing the mortality and the aspect of the western part of the division with those of the eastern part of the North Riding, we find the direction of the prevailing winds and the flow of the tidal wave the opposite to what takes place on the Cumbrian coast, we find also that the position of the high and low mortality districts is reversed.

8°. The sea inlet or the Solway Firth has a powerful influence on the ventilation of the county to the north-east, and Longtown which is situated so as to be well flushed by the winds which blow up this inlet, has the lowest mortality in the division.

7°. All the districts in the doubly sheltered valley of the Eden have a high mortality.

8°. The death rate in the principal towns is not excessive, and in three is below the average.

SECTION VIII.

VIII. *The North-Western Counties Division.*—This, next to London, is the smallest and most important division in England and Wales. It

North-Western Counties Division.

is a purely coastal division, like the Eastern Counties, and, like it also, it has a low mortality, 11·4. Notwithstanding it includes such a number of large and densely populated towns, such as Liverpool, Stockport, Manchester, and Birkenhead. The mean density of the whole

High Mortality Districts.

division is ·74 acres to a person. Out of thirty-five districts, there are only seven having a death-rate from Heart Disease above the average, and in each instance the excess of mortality is on the female side, and the density of the population considerably above the mean of the division, well illustrating the remark that I made at p. 14, relative to density of population and the death-rate from Heart Disease. Macclesfield 15·7, belongs to the Derbyshire group already described. Great Boughton 15·6, includes Chester; and the high mortality from Heart Disease in that city being recorded with the whole division, an imperfect idea is given of the relative mortality between the city and the adjoining country: from its surroundings, Great Boughton is open to all the beneficial influences which proximity to the sea can give. This is one of the blots of the present map of the Registration Districts, which, along with others, I hope ere long to see effaced from it. In Clitheroe more than 30 per cent. of adults are employed in agriculture; and as an agricultural district, it ranks next to Ormskirk and Garstang: it is the least densely populated district in the two cotton counties of Lancashire and Cheshire.

From the mouth of the Dee to the mouth of the Duddon there are no less than eight sea inlets, all of which are the mouths of rivers which

Low Mortality Districts.

flow through this division in the axis of the three principal sea winds which on this coast prevail, namely, the south-west, the west, and the north-west. All the valleys are well flushed with pure air, and

coincident with this, the mortality is as low as that of the flat division in the Eastern Counties, where little or no impediment, as we have seen, is offered to the winds from the German Ocean. The exposed districts of the peninsula of Wirral, Ormskirk, and the red sandstone heights of Nantwich and Congleton, where arise the sources of the river Weaver, have the second degree of the lowest mortality. Moreover, the low mortality group of the division adjoins that of Yorkshire, and completes the belt of red districts which stretches from the mouth of the Humber to that of the Ribble.

Liverpool, etc.

Liverpool, Manchester, and most of the principal towns, except Chester and Ashton-under-Lyne, have a low mortality.

Recapitulation.

Recapitulation.

1°. Although a most densely populated division, the mortality from Heart Disease is considerably below the average.

2°. Of thirty-five districts, seven only have a death-rate above the average, and these are all inland.

3°. The twenty-eight low mortality districts are freely exposed to the winds from the Irish Sea, and have all their rivers and sea-inlets in a direction calculated to receive one or more of the prevalent sea-winds.

SECTION IX.

Monmouthshire and Wales Mortality.

XI. *Monmouthshire and Wales Division.*—This division has the lowest mortality, 9·4, of all the eleven; it has but one county, Brecon, that has a death rate above the mean annual average. Like England, Wales has a ridge of hills extending from north to south, and separating its water-sheds. We may divide them into the Coastal and Inland Watershed; or, the Western and Eastern.

The districts of the Coastal Watershed may be divided into three amphitheatres.

Coastal Watershed. North Amphitheatre.

The northern extends from the extreme north-west point of the Isle of Anglesey to the Point of Air, the extreme north-west of Flintshire; it comprises five districts, three of which have a degree of mortality the lowest but one; one, Holywell, of the third degree, and one, St Asaph, one degree above the average; coincident with the low death-rate of the four, is the fact that they all look towards the Irish Sea, and receive freely, without obstruction, the full influence of the sea winds from the north-west. The Isle of Anglesey receives also the south-west, it has the lowest mortality of the group. St Asaph is well situated, so are Denbigh and Ruthin in the red sandstone vale of the Clwd, so that they have every advantage which such an inlet can afford; perchance some social cause is here existing, which is the cause of the excess of mortality similar to what we have seen on the eastern coast. The inland valley system of this district is intricate and not well disposed for air-flushing; the population in it, however, is sparse, and could hardly dominate the death-rate of the district.

The western amphitheatre stretches from the Menai Straits to St David's Head, the extreme western promontory of Pembrokeshire; it has five considerable sea inlets, including the Menai Straits, the terminations of rivers flowing from the highlands, besides eighteen rivers of varying magnitude, all of which run in the axis of one of the three prevailing sea-winds which sweep over St George's Channel. All the twelve districts, with one exception, Cardigan, 13·5, are below the average. Cardigan is well situated, like St Asaph, and has a considerable inlet, that of the river Teifi; its high mortality cannot be explained by its position; some other cause is operating, which future investigation will explain. All the other eleven districts have a low death-rate. Two, Fistiniog and Tregaron, have the lowest degree of mortality. The first is situated on the sea inlet of the Glaslyn; the second is a highland district, receiving winds from all quarters: it is on the border of the two systems of watershed. All the other districts have a mortality of the second degree; it is the largest group of this low rate throughout England and Wales, and is continuous with the groups of the same degree to its north, south, and west.

West Amphitheatre.

Cardigan a high Mortality District.

Low Mortality District.

The southern amphitheatre extends from Milford Haven to the district of Monmouth, through which the Wye passes to reach the sea; it looks towards the Atlantic Ocean and the Bristol Channel, and is more irregular than the other two in form: it has four considerable sea inlets, besides forming the *irregular northern* shore of the largest sea inlet throughout the country, the Bristol Channel. It has but two districts above the average, Monmouth 12·1, and Chepstow, 14·2; through these districts the Wye runs at right angles to the sea amidst some of the deepest and woodiest valleys that can be found. All the other districts are well exposed to the sea winds, and in all, except Pembroke, the mortality is of the second degree. Llanelly, which lies on the sea inlet which it shares with Cardiff and Gower, has the lowest death-rate, that of the first degree.

South Amphitheatre.

The inland watershed of Wales comprises the sources of the Dee, the Severn, the Wye, and the Usk; all the districts that lie in it are at a great elevation, and although screened from the winds that blow from the St George's Channel, the Bristol Channel, and the Atlantic Ocean, they are fully exposed, from their altitude, to the upper currents of the pure atmosphere, which, after its force has been broken, descends from above upon them, as well as to the direct upper currents from the German Ocean. There is only one high mortality district in this group, Brecon, which lies immediately under the hills which supply the sources of the Towy, as well as the other numerous rivers of South Wales.

Inland Watershed.

Recapitulation.

1°. The mortality of this division is the lowest of the eleven 9·4; and coincident with this all the three coasts have their river systems so disposed as to admit of the free afflatus of all the three sea winds which blow over the Irish Sea—St George's Channel, the Atlantic, and Bristol Channel.

2°. The districts on the inland watershed are on elevated ground, and with one exception only, have a mortality below the average; coincident with this, their position enables them to receive the upper stratum of pure

air from the west without its force, whilst their altitude enables them to receive the sea winds from the German Ocean undiminished in power.

SECTION X.

VI. *The West Midland Counties Division.*—This division has a mortality of 13·2; it is the most sheltered of all the eleven, lying as it does in the vale of the Severn, which runs through it from north to south at right angles to the sea-winds from both the western and eastern seas: the Severn valley has the old red sandstone hills of Herefordshire, and the new red sandstone hills of Shropshire on the west and north, and the new red sandstone hills of Staffordshire and oolitic range of Gloucestershire on the east and south. In Herefordshire there are some of the sources of the Wye and the fully formed river runs through this county at right angles to the course of the winds from the sea. The riparial districts of this beautiful valley country all have a high mortality, and form a remarkable triangular group, which has its apex at Brecon, one of the Welsh districts, and its base inland, extending from Church Stretton to Alcester. This group is separated from the high mortality group of Gloucester to the south of the Severn, by a series of districts of low mortality, which follow the course of the Severn and Avon into Warwickshire. This last remarkable series is in the direct axis of the prevailing south-westerly wind which comes immediately from the Bristol Channel, and is nearly continuous with a similar series that follows the courses of the rivers which arise at the intervening ridge of elevated land that gives rise to the rivers which flow into the Wash: so that even if we take the districts that are coloured blue in the line from the Severn to the Wash, we shall have a belt of low mortality districts stretching from sea to sea. The northern part of this division comprehends the heights of Staffordshire and Warwickshire, which give rise to the south-west sources of the Trent; within this elevated country we find a group of districts, including Birmingham, all having a low death-rate from Heart Disease. This group is continuous with those districts of low mortality which will be found in the south of Shropshire. A group of high mortality is seen to extend from Oswestry to Burton-on-Trent, nearly all of which lie immediately to the south of the hills which give origin to some of the sources of the Severn and the Trent: in fact, this group nearly defines the boundary line between the watershed of Shropshire, Staffordshire, and Warwickshire, and that of Cheshire. On a reference to the small map of the counties, it will be seen how strongly the counties of Hereford 17·5, and Worcester 15·6, stand out, with their intense blue, indicating high mortality; essentially midland, surrounded on all sides, they have no equal in mortality except in the counties of Wilts 16·0, and Berks 16·6, which are separated from them by Gloucester, through which the series of low mortality riparial districts of the Severn and Avon are found.

West Midland Division.

High Mortality.

Low Mortality.

Within this division there are five districts of the greatest mortality, Leominster 18·8, Weobly 20·5, Upton-on-Severn 19·7, North Leach 20·1, and Dursley 20·1, all sheltered districts and out of reach of the direct influence of the sea-winds. In Herefordshire there is an extensive group of districts having a mortality of the fifth degree. All the

Highest Mortality.

principal towns of this division have a high mortality except Birmingham. Rugby, which is situated near where the Avon takes its rise, has a low mortality like the neighbouring district of Foleshill; the heights of Dunsmore Heath, to the south-west of Rugby are so situated as to favour the afflatus of the south-west winds to this and the adjoining district.

Recapitulation.

1°. The division has a very high death-rate from Heart Disease, and contains two counties, Hereford and Worcester, which have the greatest mortality in England of any county except Wilts and Berks. This high mortality is coincident with a midland and most sheltered position.

2°. It contains a group of low mortality districts to the north-east, which are situated on the elevated country around Birmingham, and extend to the borders of Wales.

3°. The districts lying immediately to the south of the heights which separate the watershed of Shropshire and Warwickshire from that of Cheshire, have a high mortality.

4°. To the south there are five districts of the greatest mortality, all of which are sheltered and well protected.

5°. The riparial districts which follow the Severn and Avon in the axis of the south-west wind from the Bristol Channel, have a low mortality.

6°. All the principal towns, except Birmingham, have a high death-rate. Birmingham is the most elevated and exposed.

SECTION XI.

V. *The South-Western Counties Division.*—Having entered so fully into the characters of this division in a former chapter, I have little now to add except a few general remarks. Like the South-Eastern Division, the South-Western has a ridge running through it of a most irregular altitude, separating its southern from its northern watershed. The catchment basins of the rivers Parrett and Avon are worthy of notice as typical: both these rivers are tidal for many miles up their course; and as I have before stated, the first has the remarkable tidal phenomenon called the *bore*, like the *Severn*. The character I wish to note is that the immediately riparial districts are of low mortality, in each case, whilst the districts surrounding them have a mortality so little above the average, that they almost define the watershed of the hills whence they arise, to the east of which, however, we see an abrupt line of high mortality districts which swells the death-rate of Somersetshire, Wiltshire, and Dorsetshire. In Devonshire the midland group of districts, Southmolton and Crediton, are sheltered on every side, and their population lives in deep valleys. They have a mortality of the sixth or greatest degree. Again, Dorchester and Beaminster are surrounded on all sides, and so is Frome. In Wiltshire we have that remarkable group which follows the tributaries of the Avon; they are also sheltered on all sides, and in every instance we have a mortality of the highest degree; in fact, within Somersetshire and Dorsetshire, there are no low mortality districts except where there are sea-inlets; and in the inland county of Wilts, there is absolutely none,

The South-Western Counties Division.

it forms with Berks, a group which was alluded to in the last Section, when comparing it with the Hereford and Worcester group.

Military and Naval Districts.

In Devonshire there are the Districts of Stoke Damerel and East Stonehouse; the former has a naval, and the latter a military hospital. Both of these districts have a mortality above the average—Stoke Damerel 13·3; East Stonehouse 16·8; whilst Plymouth, which is well open to the south-west winds, and has no military hospital, has only a death-rate of 11·9.

The low mortality district of Tavistock embraces a great portion of the elevated granitic height of Dartmoor, in which arise so many rivers that flow both to the English and Bristol Channels.

All the principal towns, except Plymouth, have a death rate above the average.

Recapitulation.

Recapitulation.

1°. The death-rate of this division is high, 14·2.

2°. In the whole of this division there are no low mortality districts, except where there are sea-inlets which admit freely the prevailing winds and the tidal wave; or else, where there is elevated land, as that of Dartmoor.

3°. All the principal towns have a high mortality, except Plymouth and Bridgewater.

4°. All the highest mortality districts are sheltered and completely hemmed in by hills.

5°. The influence of the tidal rivers is seen beyond the immediate riparial districts.

6°. Like the South-Eastern Division, it has a north and south watershed, although the separating range is more diversified and irregular in its course.

CHAPTER VII.

SECTION I.

IT now only remains for me to add a few concluding remarks relative to the extremes of mortality, the probable causes of the excess of Heart Disease, and the use of the map which accompanies this memoir.

Extremes of Mortality. Highest.

On looking at the large coloured map of the districts, the dark blue and the bright red localities strike the eye at once. All the dark blue, where the highest or first degree of mortality is to be found, is in the south-west and south of England, and contiguous to, or lying in, the midst of groups of the second degree. In the West Riding there is an exception to this rule, for we find Otley (now Otley and Wharfdale) lying almost entirely within a group of districts having a death-rate below the average.

Characterized by an Agricultural Population.

The seventeen high mortality districts of the south-west of England are arranged in Table III., from which it will be seen that all of them have an agricultural population greatly in excess of the average for England and Wales, which is 14·6 to every person aged 20 years and upwards; the mean of the whole number is 30·8, or more than double the average; the inhabitants, however, are otherwise variously employed.

Otley has its population not only engaged in the manufacture of cloth and worsted, but it has an agricultural population above the average.

Lowest.

On comparing the districts having the lowest death rate, which are placed in the lower part of Table III., with those having the highest, we shall find that they have one thing at least in common, an agricultural population in excess of the average; they differ, however, in the fact, that minerals instead of animal vegetable products occupy those not engaged in the fields, with the exception of Tunstead, which has its adults employed in agriculture to the extent of 40·2 per cent., a larger population than in any other district, whether of the highest or the lowest mortality.

Where Highest Mortality to be found, Districts.

Between the two extremes of death rate there is little else worth alluding to that forms a common character. The highest mortality districts are always to be found in the most sheltered spots, and are generally those that are leewardly nearest to the sheltering range; without exception all the eighteen districts of the highest mortality are so situated.

Lowest Mortality Districts, where found.

All the four districts having the lowest mortality are, on the contrary, some of the most exposed in England and Wales; a glance at the map at once shows this, and without exception, all are surrounded by groups of the next degree of mortality.

V Shaped Series of High Mortality Districts.

If we trace the first and second degrees of mortality from Mid-Devon to Radnorshire, we shall find that they form a V shaped series, having its apex at Henley-on-Thames, its north-west extremity ending at Presteigne in Wales, and its south-west in South Moulton in Devon; all these districts are to the leeward of ranges of hills which protect them from the powerful influence of the south-west winds.

It will be observed, what has been before alluded to, that the valley of the

TABLE III.

Districts having the Highest Mortality from Heart Disease and Dropsy.

Counties.		Districts.		Persons Employed in *Agriculture* to every 100 living at 20 years of Age and upwards.	Special Occupation.	Mean Population, 1851–61.	Mortality from Heart Disease and Dropsy, 1851–60.	Average Annual Rate of Mortality to every 10,000 Living.	Excess above the Average Annual Mortality 12·4.
No.	Name.	No.	Name.	1861.					
4	Hants, .	113	Alresford . .	29·9	—	7,301	159	21·7	9·3
,,	,,	118	Andover, . . .	30·1	—	17,198	352	20·4	8·0
17	Wilts, .	260	Warminster, .	28·7	Woollen Cloth, .	16,505	330	19·9	7·5
,,	,,	263	Alderbury, . .	25·2	—	14,839	327	22·0	9·6
,,	,,	265	Wilton, . . .	34·7	Carpets, ...	10,703	258	24·0	11·6
,,	,,	266	Tisbury, . . .	35·6	Quarries, ...	10,022	224	22·3	9·9
18	Dorset, .	275	Dorchester, . .	28·5	—	24,887	469	18·8	6·4
,,	,,	277	Beauminster, .	33·6	Hemp, Flax, . .	13,928	296	21·2	8·8
19	Devon, .	292	Crediton, . . .	34·8	Woollen Stuffs, .	21,001	391	18·6	6·2
,,	,,	294	S. Moulton, . .	39·2	—	19,588	382	19.2	6·8
21	Somerset,	320	Wincanton, . .	29·9	Gloves, ...	21,405	410	19.0	6·6
,,	,,	321	Frome, . . .	19·1	Woollen Cloth, Coal,	24,515	510	20·7	8·3
22	Glo'ster, .	333	Dursley, . . .	21·3	Woollen Cloth, .	14,067	284	20·1	7·7
,,	,,	341	North Leach, .	37·2	—	10,940	220	20·1	7·7
23	Hereford,	349	Weobly, . . .	39·3	—	8,867	182	20·5	8·1
,,	,,	351	Leominster, . .	32·2	—	15,201	286	18·8	6·4
26	Worcester,	388	Upton-on-Severn,	25·1 Mean	Gloves, ...	19,540 Total	384 Total	19.7 Mean	7.3 Mean
				30·8		271,807	5464	20·4	8·0
35	W. Riding,	493	Otley, ...	17·2	Cloth, ... Worsted, ...	20,022	548	20·2	7·8

Districts having the Lowest Mortality from Heart Disease and Dropsy.

									Defect below the Annual Mortality 12·4.
16	Norfolk, .	230	Tunstead, . . .	40·2	Coal, Copper, . .	15,065	97	6·4	6·0
43	Carmarthen,	586	Llanelly, . . .	15·9	Tin, Iron, . . .	25,742	140	5·4	7·0
,,	Cardigan,	598	Tregaron, . . .	41·3	Lead, ...	10,572	78	6·4	6·0
44	Merioneth,	618	Festiniog, . .	27·4 Mean	Slate, Copper, . .	17,225 Total	105 Total	6·1	6·3
				31·2		68,604	420	6·0	6·4

Severn and Avon cuts through the north-western extremity of the series, and that there is to be found the only break in the series; coincident with this break in the range of the hills between Wales and Gloucester is a series of low mortality districts; this valley is well flushed with the sea air which rushes up it from the south-west, purging as it goes. At the apex of this remarkable series is an isolated district Wantage, having a lower mortality than its neighbours; it occupies the high ground between the vale of Kennet on the south, and that of the Thames on the north: both these vales are sheltered, and both have a high mortality of the second degree.

SECTION II.

Author's Opinions.

Heart Disease endemic.

I cannot conclude without expressing my opinion that the great majority of Heart Disease cases in our country have their origin in Rheumatism, and that this desease in many parts of England is endemic.

Heart Disease insidious.

Heart Disease, if we use the term generally, has almost every variety of cause imaginable; but *the* Rheumatic Heart Disease which kills in such large proportions, is of insidious growth, often unsuspected in youth, and frequently allowed to remain unheeded until it has taken too firm a root to be removed. I believe that it does not require a regular attack of rheumatic fever in order to set up disease in the heart, my experience extending now over nearly a quarter of a century in hospital and private practice, leads me to believe that in certain localities rheumatic disease begins to show itself very early in life: and that from neglect of the first symptoms much mischief accrues. In the agricultural districts we see too frequently the crippling effects of chronic rheumatism.

Rheumatic Fever not necessary as a cause.

Heart Disease shows itself early in life.

Local Region of the Material of Rheumatism.

I think that the coincident phenomena displayed in the foregoing pages point to some *materies morbi*, resident in certain localities, perhaps in all; the only difference being that one district is frequently purged by the beneficial influence of the sea-winds, whereas another is sheltered so as to admit of an accumulation; this accumulated air-sewage may have either an animal or a vegetable origin, or both; it is impossible to say—all that we know is, that it is coincident with excess of rheumatism and excess of mortality from Heart Disease. What we see obtain in the deep unventilated valley districts of Devon, Dorset, Hants, and Hereford, we find in towns where a free flushing of the air-sewage is precluded by the natural position of the town itself; or, if well situated for air flushing, by the bad arrangement of the streets, which are so built as to intercept what otherwise would thoroughly ventilate them, and either chemically or physically rid them of the disease poison.

As in Valleys, so in Towns.

Low Wages of Agriculturists.

In the agricultural districts I have no doubt that low wages and low living conspire to render the body unfit to contend against the external influences which are to be found in certain districts; an ill-fed agricultural labourer turns out early in the morning to attend to his duties in the fields, often before the dew is off the ground, when the air is

most chill, and when the exhalations of the night are most noxious; it cannot therefore be wondered at that a large proportion of this class are to be found amongst those who succumb to rheumatism and its sequels—Heart Disease and Dropsy.

Practical Suggestions.

The dark blue places on the map are places to be avoided during convalescence, when a change of air is required for a rheumatic case; and again, the map shows us, if it be true that rheumatic Heart Disease is the most prevalent form of that disease in England, that localities having the characters which have been set forth as coincident with a high death-rate, should not be selected for residence by those who wish to avoid the risk of evoking a disease to which their bodies are already too prone.

These are two practical points of immense importance to the medical practitioner and his patient; but the facts already detailed involve a great many more, which will suggest themselves to those who have enjoyed much experience in their profession.

A grand lesson is taught us by the map, of the beneficial effects of free ventilation, and one which we should ever remember when building our streets, our houses, and our hospitals.

Influence of Sea-Winds, both Physical and Chemical.

I do not think that the influence of the sea-winds on the mortality from Heart Disease is altogether physical, I incline to the view that there is a chemical element as well in operation; I think that ozone may not play an unimportant part in destroying the material of rheumatism; if so, in the wards and chambers where cases of rheumatic fever lie, we should not only take care that the ventilation is perfect without draught, but that the atmosphere is impregnated with artificially formed ozone; this experiment, I feel, is worth a trial: I know its efficacy in fever.

Ventilation and Ozone in bed-chambers.

On one thing I feel confident, that the removal, as soon as practicable, of a patient suffering either from the chronic or the acute form of rheumatism, to a locality unfavourable for the development of the disease, is quite essential in order to expedite recovery.

SECTION III.

Explanation of the Colouring of the Map.

The colouring of the map is so arranged as to show six degrees of mortality; three above and three below the average, 12. The *highest* mortality is indicated by the *deepest* blue, and the lowest by the *deepest* red; the intermediate shades lessen in depth as they approach the average line. The *highest* or *first* degree of mortality indicates 19, 20, 21, and upwards to every 10,000 living, as the *annual* average rate of mortality.

Degrees of Mortality.

The *second* degree of mortality, 16, 17, 18, to every 10,000 living.

Third degree of mortality 13, 14, 15, to every 10,000 living. These three degrees of high mortality are coloured in different shades of blue.

The districts having a mortality below the average are coloured red in different shades, the lightest being next to the light blue.

The *fourth* degree of low mortality comprises 10, 11, 12, to every 10,000 living.

The *fifth*, 7, 8, 9; and the *sixth*, which is of the deepest red, 4, 5, 6.

The total number of deaths represented on the map of Heart Disease and Dropsy for the decad 1851–60, is 236,983.

Statistics to be added in Appendix.

The figures belonging to each district may be found in the Registrar-General's Supplement to his Twenty-Fifth Annual Report, published in 1864; these figures will be reproduced in an Appendix to this work, when complete, and be printed side by side with those belonging to other causes of death.

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