value, as it causes relaxation of the pylorus in addition to inhibiting the secretion of the gastric juice. As there is certain to be more or less continuous gastric secretion, the stomach should be washed out with an alkaline solution every evening. If the symptoms do not disappear after four weeks, or if they recur in spite of careful dieting, an operation should be advised.

PREVALENT RAIN-BEARING WINDS AND THE MILK SUPPLY OF MANCHESTER DURING THE YEARS 1896-1909.

By W. GORDON, M.A., M.D.CANTAB., F.R.C.P.LOND.,

PHYSICIAN TO THE ROYAL DEVON AND EXETER HOSPITAL; PHYSICIAN TO THE WEST OF ENGLAND EYE INFIRMARY.

In the spring of last year Professor Delépine of Manchester read before the Royal Society of Medicine a very valuable and interesting paper dealing chiefly with the distribution of bovine tuberculous mastitis amongst the farms supplying Manchester with milk. 1,524 farms scattered over an area of nearly 5,000 square miles were carefully investigated and mapped, and it was found that remarkable differences in the prevalence of the disease existed between different districts. Professor Delépine endeavoured to use these differences in prevalence to demonstrate a relation between local incidence of tuberculous mastitis and local state of cowsheds and herds, a relation which, if possible to prove, is obviously of profound importance.

There can be nothing but admiration, in considering this paper, for the way in which the available facts have been collected and arranged, for the great time, labour and skill expended on them, and, not least, for the frank indication of the unavoidable limitations of the material. But with all these in view, seeing the importance of the subject and the apparent magnitude of the opportunity, one cannot but deplore that the result attained fell so far short of being conclusive. While presenting considerable evidence of the influence of what may be called "farm management" in determining a higher or lower degree of prevalence of the disorder, Professor Delépine found himself unable to escape from the embarrassment of some other influence or influences which were unknown to him.

In quoting the following passages from his paper I hope he will not consider I have in any way misrepresented his conclusions. I have lettered the first two paragraphs (A) and (B) respectively for convenience of reference further on. The lettering and figures in the text here and throughout this paper refer to his maps in the *Proceedings of the Royal Society of Medicine*.¹

(A) It would appear from this that in every respect the shippens which were found to produce tuberculous milk were worse than the others [worse as regards the state of the cowsheds and herds]. But if instead of comparing the averages only one compares in each group the state of the tuberculous and non-tuberculous farms in various latitudinal zones, it becomes evident that the averages do not convey the whole truth, for if the non-tuberculous farms situated south of Manchester (Group A, Division XX to XXXI) are compared with the tuberculous farms also situated south of Manchester, one finds that the tuberculous farms in Zone III to XIX, XX to XXI and XXII, are really more satisfactory than the non-tuberculous farms in Zone XX to XXXI, and that it is only south of Zone XXII that the tuberculous farms are worse in every respect than the non-tuberculous farms (not including the Manchester farms).

(B) Another unexpected fact is obvious. Of the five divisions of tuberculous farms, the one corresponding to Zones XXIII and XXIV is undoubtedly the worst, while Division III to XIX is distinctly the best; but notwithstanding the considerable differences indicated in the table, the number of cows with tuberculous udders per cent. of the total number of cows is about the same in all the zones. The same may be said of the cows suspected of disease of the udder; there are slight differences, but these do not correspond in the least with the condition of the farms in the respective zones. I do not think that the differences in these percentages should be taken to indicate important differences in the incidence of tuberculosis, as they may possibly be affected by the more frequent inspection of the proximal farms, which would almost certainly lead to the discovery of some few cases overlooked in the first visits.

It is, however, clear that the condition of the farm, though important, is not the dominant factor, and this makes it necessary to believe in the existence of some cause capable of overpowering the most favourable conditions, and practically independent of the most influential predisposing factors, to account for the focal distribution of cases of tuberculous mastitis.

A careful consideration of the statistical facts recorded in this paper and of facts which I have observed in connexion with a number of farms that I have been able to study closely has led me to the conclusion that cows in a state of advanced tuberculosis, and emitting discharges loaded with tubercle bacilli, constitute the chief factor determining the distribution of bovine tuberculosis.²

Reviewing these statements and the facts recorded in his paper, it is evident that Professor Delépine is correct in thinking that some other influence (or influences) which he had not taken into account had interfered with his result, preventing him from demonstrating the relation, which he has otherwise made so probable, between farm management and the prevalence of bovine tuberculous mastitis. His assumption, however, that this influence is that of "cows in a state of advanced tuberculosis, and emitting discharges loaded with tubercle bacilli," cannot be admitted, so far as the distribution of disease amongst the whole number of farms (tuberculous and non-tuberculous) is concerned.

Such discharges may, it is true, account for the fact that within the different groups of tuberculous farms—that is, amongst farms where advanced cases are generally present (since cows with tuberculous mastitis "are, in the majority of cases, suffering also from more or less advanced tuberculosis of other organs")³—no sanitary measures short of the removal of these cases appeared to make much difference in the percentage of cows suffering from tuberculous mastitis; and we may conclude, with Professor Delépine, that this reasonable explanation meets the difficulty raised in his paragraph which I have lettered (B). But it is impossible so to explain away the difficulties referred to in paragraph A, or to account for the distribution of tuberculous farms amongst the whole number of farms. Professor Delépine himself tells us⁴ that "although infection from farm to farm is not impossible, it is not of common occurrence." Besides, even if one admitted the assumption to be a possible truth—which cannot be done—it would only move the question a step further back to, "What, then, accounts for the distribution of these advanced cases in the whole area?"

The fact is that Professor Delépine has not taken into account, as a possible factor in the problem, a most powerful influence affecting the prevalence of tuberculosis—one to which, during the past ten years, I have repeatedly called attention—namely, the influence of strong prevalent rain-bearing winds. These winds, I have shown over and over again, have a most remarkable power of increasing the mortality from human tuberculosis of the lungs in localities exposed to them, and, as I have more lately indicated, of similarly increasing the mortality from other forms of human tuberculosis.⁵ It is not unreasonable to suppose that they may similarly influence the distribution of bovine tuberculosis, though this has not hitherto been suggested. Dr. Delépine's maps afford a unique opportunity of ascertaining whether they do so or not. I propose to show that they do, and that the "cause capable of overpowering the most favourable conditions," which he found to be interfering with his conclusions, was just this influence of wind (possibly together with others which are as yet unknown); also that when steps are taken to prevent the interference of wind exposure with the other investigation, the relation between prevalence of tuberculous mastitis and farm management seems (if I rightly understand and interpret his figures and statements) to become capable of proof.

Before undertaking the detailed examination of the topography of so wide an area it is obviously necessary to inquire into the nature of the available material, in order to ascertain how far satisfactory conclusions may be based upon it; so that it is in no carping spirit that I review the limitations of the very valuable facts which Professor Delépine has presented.

In the first place, the farms indicated are, in many districts, only a few of the milk-supplying farms in those districts, and it might be alleged that these relatively few farms cannot be regarded as representative of their districts. But seeing that they are selected simply because they supply Manchester with milk, and for no other reason, I take it that they may reasonably be regarded as representative of their surroundings, provided a considerable number are grouped together. Dr. Delépine has evidently taken this view.

Again, farms remote from Manchester have apparently

been less often inspected than farms nearer to it, and so the remoter farms may seem freer from tuberculosis than is really the case. There is no escaping from this possibility, and the only means of avoiding error from it is to constantly bear it in mind. Dr. Delépine draws attention to it, but evidently considers any error produced by it will be inconsiderable.

Further, in the maps supplied in the *Proceedings* it has been found impossible, it is stated, to ensure entire accuracy "in square mile areas where farms were numerous." But by tracing out Professor Delépine's mile and four mile squares on Bartholomew's excellent reduced Ordnance Survey Maps (half an inch to the mile, with colours to indicate heights), I believe I have been able to identify the situation of his farms with at least enough certainty to draw the conclusions which follow.

It has also to be remembered that the artificial reduction, so to speak, of the tuberculosis in the farms by removal of infected cattle must tend to reduce the contrasts created by natural predisposing influences. About Manchester itself, especially, this is likely to be the case where the farms are more fully under control, and where so much has evidently been done by the sanitary authorities to reduce the amount of the disease.

Lastly, when one comes to discuss together the influences of wind exposure and of farm management, as only a general idea of the positions of the 385 farms used by Professor Delépine is given in the investigation of the effects of the latter, it will be seen to be impossible to come to any positive conclusion, except that his proposition, whilst extremely probable, still remains to be proved.

In short, it seems to me there is, in Professor Delépine's paper and maps, material provided of a very valuable kind for the investigation of the relation between strong, prevalent rain-bearing winds and the distribution of bovine tuberculous mastitis. To that investigation I will first address myself.

Afterwards, should such a relation be clearly shown to exist, it should be possible, when the masking effect of such an influence is avoided, to show that the relation between bovine tuberculous mastitis and farm management may thereby be made easier to examine.

Incidentally, it will be necessary to consider what possible influences may be exercised by soil and altitude.

INFLUENCE OF PREVALENT RAIN-BEARING WINDS.

The area discussed in Dr. Delépine's paper is divided by the Pennine Chain into a western region of flat or undulating country reaching from North Lancashire into North Shropshire, and an eastern region of hills and valleys stretching across into Yorkshire, Derbyshire, and Staffordshire.

The western region is swept freely by the prevalent rain-bearing winds of this country—the south-west, west, and north-west—down, at all events, to nearly the latitude of Chester (Zone xxii), where the Welsh mountains begin to afford some shelter from the west and south west winds, and to give, about the latitude of Ellesmere (Zone xxviii), some shelter also from the north-west.

The eastern region, on the other hand, is predominantly a region of shelter from all these winds, most of the farms lying in valleys which afford pretty effectual protection. It must not, however, be supposed that all of these farms are thus protected; some stand high in apparently wind-swept situations. The contrast, therefore, between the eastern and the western regions as regards such shelter and exposure is not absolute but relative, yet is evidently so pronounced as to afford a very valuable opportunity for investigating the relation between prevalence of bovine tuberculous mastitis and exposure to these winds.

The comparison between shelter and exposure may be best made by dividing the whole area into districts, which I shall now proceed to describe, indicating in each instance not merely its exposure or shelter in respect of westerly winds, but also its geological structure and elevation; for both of these latter factors require to be taken into account—the first because it does actually sometimes affect the frequency of tuberculosis, at all events in man; the second because it is popularly supposed to do so.

C to G, IX to XIII.—This district contains the few farms which lie out on the flats of Lancashire in the Zones ix to xiii; they stand on a slightly undulating surface of upper and lower trias (Keuper marl, raised beach

and Bunter sandstone) at an elevation of only from about 20 to 100 feet above sea level except a single farm rather higher. There are only 13 of them, and one was tuberculous, giving a percentage of 15.4. Their fewness, their distance from Manchester, and the fact of their slight elevation not exposing them very much to the wind, as well as the comparatively pervious soil, makes these difficult to lay stress on.

I to L, IX to XIII.—The hill farms of Zones ix to xiii are included in this district. Most of them are in Ribblesdale, from which the hills must block out west and north-west winds considerably, and whose kink near its entrance probably shuts out much of the south-west; other farms lie in even more sheltered situations. They stand at heights varying from about 150 to 750 feet, often on steep slopes, on a soil chiefly composed of the Yoredale series of rocks, a few, however, resting on millstone grit or on coal-measures. Most, I imagine, can be classed as sheltered. Out of 66, only 7, or 10.6 per cent., were found to be tuberculous.

Zones XIV to XVII.—Almost all the farms in these zones cluster in and about North Manchester, at elevations of about from 20 to 500 feet—mostly between 200 and 400 feet—in situations exposed for the most part to westerly winds. They nearly all lie on coal-measures, but there are a few on millstone grit or on trias. Amongst 101 only 15, or 14.8 per cent., were found to be tuberculous. It must, however, be remembered that Dr. Delépine points out that the farms in and round Manchester are exceptional in the control exercised over them and the great improvements effected by the sanitary authorities. The lowness of these figures may, therefore, be reasonably attributed to those improvements. At all events, the suspicion that it may be so attributable cannot be put aside. To this I shall refer again presently.

C to M, XVIII and XIX.—The majority of these farms also are grouped in and round Manchester, this time on its southern side. The majority are on trias, at elevations of about from 70 to 300 feet. There are 77 of them, and 15 were found tuberculous—that is, 19.4 per cent. It is possible that these farms also have been improved by the care of the sanitary authorities of Manchester, and, but for that, might have shown a higher percentage of tuberculous disease.

Both of these two last districts, being close to the public health authorities, have doubtless been several times inspected, and probably present their true percentage of tuberculosis.

N to P, XVIII and XIX.—This district contains a small group of sheltered farms (most of them, at all events, are sheltered) lying amongst the hills between Stockport and Glossop on coal-measures, at heights varying from about 350 to 800 feet. There are 24 of them, and 3 were tuberculous, or 12.5 per cent. Not being far from Manchester, this low figure is probably not due to infrequent inspection.

C to H, XXII to XXIV.—The slopes of Delamere Forest afford an interesting comparison. The forest forms a ridge with a general elevation of about 400 ft. running from NNW. to SSE., and at least 18 miles away from the northern commencement of the Welsh mountains, which there rise to about 1,200 to 1,300 feet. The forest affords protection from west and south-west winds to farms on its eastern side, but practically none from north-west winds.

On its westerly slope (G, xxii to xxiv, except one farm in G, xxii, which is clearly on the eastern side), there are 50 farms, of which 20, or 40 per cent., were found tuberculous; and west again of these, in perhaps a rather less exposed situation (E and F, xxii and xxiii), 20 farms had 7 tuberculous, or 35 per cent., 4 of these 7 being on a mound rather higher than the majority of the rest.

On the easterly side of the forest, on the other hand (H, xxii to xxiv, with the single farm taken, as above, from G, xxii), out of 19 farms only 3, or 15.8 per cent., were tuberculous.

The heights of these farms in this area vary from about 30 to 400 feet. Those on the west of Delamere Forest are mostly on lower trias, those on the east of it on upper trias. Those on the east are certainly more elevated than those on the west, and it is possible that the very high percentages to the west of the forest were partly due to dampness of subsoil close to the river Gowy, but this will not entirely explain the facts, since many of the tuberculous farms were well above the river.

I to M, XX to XXIV.—This is a 20 mile square lying south of Manchester, consisting of undulating country, low round river beds on the west, but eastwards rising to a height of about 500 feet towards Macclesfield and Congleton. It is generally very exposed, except in its westerly lower lands and in its south-eastern corner; the subsoil is practically all of upper trias; 520 farms here showed 144 tuberculous, or 27.6 per cent.

It is also instructive to compare the five constituent north to south divisions of this area, I, J, K, L, M. In the most westerly, I, the least exposed, the percentage was 15.7; in the next two, J and K, well exposed to west, south-west, and north-west, 31.1 per cent. and 30.6 per cent. respectively, but in the two most easterly, L and M, the percentage fell to 27.1 and 27.6; in M, at all events, a good many of the farms were in shelter at its southern extremity. Being close to Manchester, it is possible that this area has been unusually often inspected, which may have somewhat raised the figures.

In striking contrast to this specially exposed area are the much more sheltered areas across the hills eastwards.

N to P, XX to XXII.—Behind Macclesfield and about Chapel-en-le-Frith, mostly well sheltered in high hills at elevations varying apparently from about 500 to 1,000 feet, lie 169 farms, on soil chiefly composed of Yoredale rocks, but also a good deal on coal-measures and millstone grit. Of these 169 only 24, or 14.2 per cent., were tuberculous. These are no further from Manchester than the last, and there is therefore no reason to suspect the figures of being unduly low from want of inspection. The following, however, are further off, and hence may have been less often inspected, and thus present unduly low percentages.

N to P, XXIII to XXVI.—Round Leek in Staffordshire, also mostly in shelter, at heights apparently varying about from 400 to 1,000 feet, on soil chiefly and about equally composed of coal-measures and Yoredale rocks, but also partly of millstone grit and lower trias, there are 144 farms, with only 21, or 14.5 per cent., tuberculous.

Q to S, XX to XXII.—Even more remarkable is a group of 43 farms near Bakewell, which at elevations apparently of about 400 to 1,000 feet, almost wholly on Yoredale rocks and in marked shelter, only showed 5 tuberculous, or 11.6 per cent.

Q to S, XXIII to XXVI.—South of Bakewell, at heights probably varying from 300 to 1,000 feet, and also practically wholly on Yoredale rocks, 172 farms gave 29 infected farms, or 16.8 per cent. Most of these farms are in shelter, but some are evidently in very wind-swept places.

C to M, XXV to XXVII.—Crossing the hills westwards again, an area open mostly to the north-west, but less exposed than the areas directly north of it to the west and south-west winds (since it is more under the lee of the Welsh mountains), has 97 farms, with 21, or 21.6 per cent., tuberculous. These farms lie almost all on upper or lower trias, at elevations of about 150 to 300 feet.

C to M, XXVIII to XXXI.—Still further south and still more under the shelter of Wales lies a district which, being more undulating, is also more self-sheltering. Here, of 40 farms standing at elevations of about 200 to 300 feet, almost all on upper and lower trias, 6 were found tuberculous, or 15 per cent.

N to O, XXVII to XXX.—Lastly, once more passing eastwards over the hills, a small, well-sheltered group of 19 farms, south of Cheadle, at elevations of about 300 to 500 feet, and practically all placed on upper trias, showed only a single farm, or 5.2 per cent., infected.

It is well to observe that a few farms round Uttoxeter, at lower levels on upper trias, just east of this last group, were very tuberculous, but they are in most cases clearly placed in less sheltered situations. Their presence, however, serves to indicate that the more remoteness of this district need not be held to account—wholly, at all events—for its low percentage.

To make clearer the very remarkable contrast presented by the more exposed and more sheltered districts just described, I have constructed first Table I, which, without taking into consideration any modifying circumstances, compares all the districts on the west of the Pennine Chain with all those in its sheltering valleys. The percentages of the farms found tuberculous in the western region are generally considerably greater than in the eastern, and the aggregate figures present a striking contrast.

Table II strengthens this contrast by comparing the

TABLE I.—GENERAL COMPARISON OF THE WESTERN REGION WITH THE EASTERN.

Western.					
District.	Soil.	Approximate Elevation.	Total No. of Farms.	No. found Tuberculous.	Percentage.
C to G, IX to XIII ...	Trias	Feet. 20-100	13	1	15.4
XIV to XVII ...	Coal-measures	20-500	101	15	14.8
C to M, XVIII to XIX ...	Trias	70-300	77	15	19.4
C to F, XXII and XXIII ...	Trias	30-100	20	7	35.0
G, XXII to XXIV ...	Trias	78-450	50	20	40.0
H, XXII to XXIV ...	Trias	70-400	19	3	15.8
I to M, XX to XXIV ...	Trias	66-550	520	144	27.6
C to M, XXV to XXVII ...	Trias	150-400	97	21	21.6
C to M, XXVIII to XXXI ...	Trias	200-300	40	6	15.0
Totals ...	—	—	937	232	—
Average ...	—	—	—	—	24.7

Eastern.					
District.	Soil.	Approximate Elevation.	Total No. of Farms.	No. found Tuberculous.	Percentage.
I to L, IX to XIII ...	Yoredale	150-750	66	7	10.6
N to P, XVIII and XIX ...	Coal-measures	350-800	24	3	12.5
N to P, XX to XXII ...	Yoredale, Coal-measures, Millstone grit	500-1,000	169	24	14.2
N to P, XXIII to XXVI ...	Yoredale, Coal-measures, Some trias, and millstone grit	400-1,000	144	21	14.5
N O, XXVII to XXXI ...	Trias	300-500	19	1	5.2
Q to S, XX to XXII ...	Yoredale	400-1,000	43	5	11.6
Q to S, XXIII to XXVI ...	Yoredale	300-1,000	172	29	16.8
Totals ...	—	—	637	90	—
Average ...	—	—	—	—	14.1

western and eastern figures at corresponding latitudes. Here Zone XIV to XVII is only omitted because it contains no sheltered district to compare with the exposed.

Amongst the districts in Table I are, however, included two districts which I have referred to as doubtful, namely, those including Manchester and its immediate neighbourhood where special measures have been taken to reduce the frequency of tuberculosis, namely, XIV to XVII and C to M, XVIII and XIX.

Another district, C to M, XXVIII to XXXI, which is probably considerably sheltered, as I have indicated, not only by the mountains of Wales, but by its own undulations, is also

TABLE II.—COMPARING PERCENTAGES OF WESTERN AND EASTERN REGIONS AT CORRESPONDING LATITUDES.

Western.		Eastern.	
District.	Percentage.	District.	Percentage.
IX to XIII, C to G ...	15.4	IX to XIII, I to L ...	10.6
XVIII and XIX, C to M	19.4	XVIII and XIX, N to P	12.5
C to F ...	35.0	XX to XXII { N to P ...	14.2
G ...	40.0	{ Q to S ...	11.6
XX to XXIV { H ...	15.8	XXIII to XXVI { N to P ...	14.3
{ I to M ...	27.6	{ Q to S ...	16.8
XXV to XXVII, C to M	21.6	XXVII to XXXI, N, O	5.2
XXVIII to XXXI, C to M	15.0		

included amongst those which are exposed; and so is district H XXII to XXIV, which, as has been seen, is only exposed to the north-west. Omitting these four districts one obtains Table III, where the more exposed districts

TABLE III.—TABLE I WITH DOUBTFUL DISTRICTS OMITTED.
Western.

District.	Soil.	Approximate Elevation.	Total No. of Farms.	No. found Tuberculous.	Percentage.
C to G, IX to XIII ...	Trias	Feet. 20-100	13	1	15.4
C to F, XXII and XXIII ...	Trias	30-100	20	7	35.0
G, XXII to XXIV ...	Trias	78-450	50	20	40.0
I to M, XX to XXIV ...	Trias	66-550	520	144	27.6
C to M, XXV to XXVII ...	Trias	150-400	97	21	21.6
Totals ...	—	—	700	193	—
Average ...	—	—	—	—	27.5
Eastern.					
The same as in Table I ...	—	—	637	90	14.1

are seen to have nearly twice the percentage of tuberculous farms that the more sheltered districts have.

But even this striking contrast does not show the full measure of the difference between exposure and shelter. Table IV gives the comparison between 52 fully exposed

TABLE IV.—COMPARISON OF EVIDENTLY WELL-EXPOSED WITH EVIDENTLY WELL-SHELTERED FARMS OVER 300 FEET HIGH.

District.	Soil.	Approximate Elevation.	Total No. of Farms.	No. found Tuberculous.	Percentage.
In M, XX to XXIV ...	Trias	Feet. 400-550	52	20	38.4
In Q to S, XX to XXVI ...	Yoredale	300-1,000	82	7*	8.5
In N, O, XXVII to XXX† ...	Trias	300-500	19	1	5.2

* Of the 7 tuberculous 5 were over 600 feet high.

† The farms in this district, though few, are more comparable in soil and elevation.

farms just west of Macclesfield on high ground fronting the west, and 82 farms evidently very well protected in the valleys between Buxton and Warksworth. Here the exposed district shows a percentage of tuberculous farms more than four times as great as does the sheltered!

But, it will be asked, have soil and altitude nothing to do with the origin of these differences?

THE INFLUENCE OF SOIL.

I have elsewhere shown that the influence of soil on the prevalence of human phthisis is decidedly less powerful than the influence of prevalent rainy winds. For the present inquiry there is not sufficient material to enable one to decide on the part it plays in determining the incidence of bovine tuberculous mastitis. For that purpose soils must be compared in shelter, and, as the great majority of the sheltered farms in this area are on Yoredale rocks only, it seems undesirable to found conclusions on the comparatively few placed on other formations. Yet it is worth noticing that N, O, XXVII to XXXI, is the only sheltered district standing on trias, and that it has the lowest percentage of tuberculous farms.

On the other hand, it may be confidently stated that soil has nothing to do with creating the marked differences between the more exposed and the more sheltered districts, for almost all the exposed districts are on trias, which I find is often associated in England with relatively low human phthisis mortality, whereas most of the sheltered districts are on Yoredale rocks, which seem often associated with relatively high human phthisis death-rates

in this country. In fact, it is not impossible that soil here tends to lessen the contrast created by rain-bearing wind.

THE INFLUENCE OF ALTITUDE.

I have shown elsewhere that there is no valid evidence in favour of any influence of altitude *per se* on the prevalence of human phthisis, and the only effect I can trace from it in this country is an apparent increase of the effects of wind exposure in elevated situations.

Table V will, I imagine, deter those who are not acquainted with my work from assigning to altitude here any very important rôle.

TABLE V.—COMPARISON OF ALTITUDES, WESTERN AND EASTERN SEPARATELY, OMITTING THE DOUBTFUL DISTRICTS.

Western.		Eastern.	
Altitude in Feet.	Percentage as above.	Altitude in Feet.	Percentage as above.
20-100 ...	15.4	300-500 ...	5.2
30-100 ...	35.0	150-750 ...	10.6
78-450 ...	40.0	350-800 ...	12.5
150-400 ...	21.6	300-1,000 ...	16.8
66-550 ...	27.6	400-1,000 ...	14.3 and 11.6
		500-1,000 ...	14.2

There can, in fine, I submit, be no reasonable doubt—assuming, as we must, that Dr. Delépine's published maps are not wholly devoid of value—that amongst the farms here indicated during the years 1896 to 1909, exposure to the prevalent rain-bearing winds tended powerfully to increase the prevalence of bovine tuberculous mastitis.

THE INFLUENCE OF FARM MANAGEMENT.

This brings me to the consideration of the difficulties which have unfortunately hampered Professor Delépine in his research.

In view of the powerful influence of wind exposure which I have just shown to exist, it is obviously no longer admissible to compare together districts of quite different conditions as regards wind exposure in order to trace a connexion between farm management and bovine tuberculosis. Dr. Delépine, in the paragraph I quoted and marked B at the beginning of this paper, has, as I have already pointed out, satisfactorily explained one apparent contradiction. But, in the paragraph which I marked A, his real difficulty has arisen from comparing together zones of quite different exposure conditions. Difficulties so created are of no final importance; and, were one aware of the exact location of the 385 farms he used for his investigation, it is possible one could at once establish the fact of the influence of farm management by the comparison of farms in shelter; or, failing this comparison which is the safest method to pursue, by comparison of farms in comparable situations as regards wind exposure and shelter. I say "possible" because, as I have already pointed out, without knowing the precise position of these farms one can draw no certain conclusions.

It is worth noticing that the farms in and about Manchester afford a marked contrast between the sanitary conditions presented by the tuberculous and the non-tuberculous; also that south of Zone XXII—that is, where a large proportion of the farms begin to be in shelter—the relation between farm management and tuberculosis is stated to come out distinctly.

In view of the great probability that the relation between bovine tuberculosis and farm management is a real and intimate one and of the great importance of actually showing it to be so, it would seem worth while to reconsider the subject on the lines which I have just ventured to suggest. It only remains to thank Professor Delépine for having afforded me, by his valuable paper, a unique opportunity of examining the effect of these winds on a form of bovine tuberculosis, and to congratulate Manchester on its public health administration.

REFERENCES.

- 1 Proc. Roy. Soc. Med., vol. iii, No. 7, May, 1910, Epidemiological Section, pp. 224 and 227. 2 Pages 238 and 239. 3 Page 219. 4 Page 253.
- 5 The Influence of Strong, Prevalent, Rain-bearing Winds on the Prevalence of Phthisis, 1910.