Moreover, there are among us people who "catch cold" more frequently than their neighbours. Most of them, but not all, will be found to have one or other of the septic foci mentioned above. Whether or no, the suggestion may be advanced that these people are "carriers" of the virus, and very prone to auto-infection and to the heightening in virulence of the infective agent to such a degree that during the acute stage it can pass from one person to another. Thus the general population, the majority of whom are presumably not themselves carriers, is periodically exposed to infection from a large number of centres simultaneously. Indeed, the well-known appearance of a pandemic in England every spring and autumn can best be explained by the concurrence of attacks in carriers susceptible of meteorological influences, and transmitted by them to a populace whose resistance is low.

To put the matter in a nutshell, a susceptible person or child—often a sufferer from chronic nasal catarrh—develops acute catarrh spontaneously, and proceeds to infect his healthy neighbours; and exposure, fatigue, malnutrition, like any debilitating circumstance, favour the onset of the disease, both in the susceptible and in the more resistant, but they are not indispensable factors in the causation.

The treatment of nasal catarrh, of the chronic as well as of the acute variety, is dictated by our views upon its etiology. You and I, as rhinologists, deal with local causes, as outlined above, sometimes with success, sometimes not. Secondly, bacteriologists, convinced of the evil wrought by bacteria, seek to maintain the patient's resistance at a high level by the administration of vaccines, with, I am afraid, not invariable success. Sometimes a course of vaccines will be followed by a year of freedom from acute attacks. At other times an acute attack will set in a week or two after the course of vaccines is concluded. Nevertheless, a course of vaccines twice a year in susceptible people is a simple, harmless procedure, which every now and then is followed by a prolonged intermission. Let us, however, again utter the warning that not even the most potent vaccine will remove nasal polypi. In other words, always look out for and remove local causes as a preliminary.

But at the same time as the specialists are trying their luck, the general physician, the general practitioner, and the general public as well, are all equally busy with their methods of treatment, with the result that the patient is subjected to a bewildering shower of remedies, all of them successful, for a cold in the head gets well of its own accord until the next time. There is, indeed, no practical method of preventing this contagious disease, and there is no specific cure. All we can do is to remove, when possible, all local sources of sepsis and irritation, and to build up and maintain a high resistance against the coryza-producing virus, whatever it may be, by sensible hygienic measures, both personal and communal.

In this connexion we ought perhaps, in our capacity as rhinological experts, to express some sort of opinion upon certain therapeutic counsels that have, of recent times, become very prevalent, if not very popular.

In the first place, we are often advised, if we wish to keep ourselves free from infection, to sniff every day various chemical solutions up the nose. By the way, I am not acquainted with any rhinologist who follows this ritual himself. Perhaps for the very good reason that it is probably quite ineffective and certainly not free from danger. I have known an acute otitis media result from this insult to the upper air passages.

Again, we have to encounter the cold-water, open-air crank, who puts down all the ills that flesh is heir to, and specifically nasal catarrh, to living and working indoors. But this is the twentieth century. Few of us can afford to revert to savagery, and, if we did, how long could we keep it up here in England without developing an acute antrum? Yet these exuberant Bohemians, not content with their own virulently ascetic practices, inflict them also upon their children; and you will see their long and skinny daughters, with red-rimmed eyes and weeping noses, sent out to face a Kingsley's nor-easter, nude and purple

from the ankles to the nates. No one will ever persuade me that that regimen is either safe or sensible—or even decent.

As a matter of fact, this hardening process is not modern. It is very ancient, having been in vogue for something like 2,000 years to our knowledge. Listen to the orations of Aristides—not Aristides the Just, I may say.

"His health," he tells us, "was bad about the time of the winter solstice. It was a stormy day. The god ordered him to rub himself over with mud, and run three times round the Temple. It was a north wind and keen frost. He did as Asclepius ordered, then bathed at the well, and felt fine. . . . But—a companion who imitated him had a paralytic spasm and could scarcely be restored to heat."

Is it asking too much of them to beseech our open-air faddists as they are strong to be merciful, remembering that most of us are but a feeble folk, who, after exposure to rigorous cold, do not experience a warm vasomotor reaction, but, like the companion of Aristides, fall therefrom into a "paralytic spasm," and can "scarcely be restored to heat."

Finally, there are those who go to the opposite extreme, and, wrapping garment after garment around themselves and their children until they have as many coats as an onion, live in a continual bath of perspiration. Rendering themselves thus sensitive to every breath of air they fear a draught as they should the devil, and no wonder, for a current of fresh air is to such people, with their soppy skins and flabby circulation, a real source of discomfort and even at times of danger.

After all, we all know quite well the golden rule of health in these matters. Let us seek the *via media*, and expose our system to extremes of no kind, neither over-coddling nor overtaxing our bodies. By that means we shall obtain the best results—save, to be sure, in the daily press, for this kind of advice is much too quiet and sensible to furnish our journalists and our journalistic medical geniuses with the excitable headings their souls hanker after.

THE INCIDENCE OF TUBERCULOUS INFECTION IN THE MILK SUPPLIES OF SCOTTISH CITIES.

BY

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For a number of years attention has been directed to the danger of the milk supply as a potential source of infection of the population with bovine tuberculosis. The report of the Royal Commission on Tuberculosis drew attention to the need for adequate control of the milk supply by local health authorities, and since the issue of that report considerable improvements have been effected, both by legislation and by voluntary efforts on the part of individual milk producers. The increased control of city milk supplies by more frequent periodical tests, the Tuberculosis Order (by which local authorities have the power to inspect all cows which are giving milk for public consumption, and to order the slaughter of those which are either excreting tubercle bacilli in their milk or are in an advanced stage of the disease), and the voluntary establishment of tuberculin-tested herds by individual owners, all tend towards ensuring a decreased incidence of infection in the milk supplied to the large centres of population.

During the last few months considerable attention has been devoted in the public press and elsewhere to the potential danger of the milk supply, and somewhat indiscriminate statements have been made as to the actual extent of the tuberculous infection of milk. Unfortunately no collected data of the present position with regard to infection appears to be available, and, in order to fill this gap in our collected knowledge, an attempt has been made to put together such relevant information as is available with regard to the milk supply of Scotland.

An examination of the older literature reveals the following series of figures, most of which were obtained prior to 1914.

TABLE I.

Locality.	Authority.	Percentage of Infected Milk.
London	Medical officer of health	9.9
Manchester	Delépine	8.7
Edinburgh	Miller and Mitchell	16 to 20
New York	Grund and Wilcox	11.5
Philadelphia	Campbell	13.8*
Four cities, U.S.A.	Lochead	8.3
General results, U.S.A.	Lochead	6.7 to 19.5

* 13.8 per cent. sold as raw milk; 8.3 per cent. sold as pasteurized milk.

These figures, while showing considerable divergence from one another, all point to the very considerable infection of the city milk supplies examined by these various authorities.

In the present survey an analysis has been made of the infection of the milk supplies of Edinburgh, Glasgow, and Aberdeen, as evidenced by the data available in the reports of the medical officers of health of these cities, and by personal inquiry from the officials.*

It should be emphasized here that the figures quoted refer only to samples of *raw* milk. Actually a considerable proportion of the milk supply—in Glasgow as much as 80 per cent.—is pasteurized before delivery to the consumer, and the risk of infection will be very considerably reduced. Further reference to this point will be made later.

Tuberculous Infection of City Milk Supplies.

In collecting the figures from the various reports, only those which referred to infection as determined by biological (inoculation) tests were included, since microscopic tests are at best only a very rough guide to the presence of tubercle bacilli.

In the first instance the collection of data was limited to the infection of samples of mixed milk received from country sources. It was at once found that the year-to-year variations were so great as to nullify entirely any direct yearly comparisons between the different cities, owing to the comparatively small number of samples tested each year. For instance, the results for Edinburgh for each of ten successive years were found to be 8.5, 9.3, 9.9, 11.6, 2.2, 5.3, 14.0, 8.1, 10.9, and 5.7 per cent. It was therefore found necessary to take an average of the results over an extended number of years, and in this way it was possible to obtain figures which were of definite significance. These figures are summarized in Table II.

TABLE II.—*Tuberculous Infection of City Milk Supplies.*

(Samples of mixed (raw) milk taken from bulk on arrival by transport from country sources.)

City.	Years.	No. of Samples Examined.	No. of Samples Infected.	Percentage of Samples Infected.
Edinburgh ...	1918-1927	795	67	8.5
Glasgow ...	1921-1927	1,083	28	2.6
Aberdeen ...	1922-1927	1,205	66	5.5

It will be seen that the difference between the percentage of infected samples in each of the three cities—Edinburgh, Glasgow, and Aberdeen—is most striking. The question was at once raised as to how far the results obtained during the periods examined were true indications of the average infection of the whole of the milk supply of each city. Further information was therefore sought in order to determine (a) how far the results at each centre agreed with those obtained in previous years, and (b) how far the possible variations in the technique of the test at each centre might render the results incomparable.

* No other Scottish cities have sufficient data for comparison.

With regard to the first point the following facts were ascertained. The Edinburgh results agree fairly well with those previously obtained in this city by other workers; they are, in fact, on the whole lower than those previously published. For the years 1905 to 1914 the percentage of infected samples in the Aberdeen supply was 5.9, a total of 289 samples being examined during this period. This percentage agrees closely with that shown in Table II. The number of tests carried out at Glasgow since 1908 has been considerable, and a summary of the tests is given in Table III. The results of these tests show good agreement among themselves. It would be expected that the lowest incidence of infection would be found in the samples from individual cows (mostly taken in attempting to trace cows responsible for the infection of mixed milk samples), that the milk of cows with udder disease would show a higher percentage of infection, and that the highest figures would be obtained from mixed milk samples, where the milk of a number of cows is bulked. The collected results shown in Table III bear out these points. Further, the general results of the tests are of the same order, and the two mixed milk results (3 per cent. and 2.6 per cent. respectively) show good agreement.

It appears, therefore, that at all three centres there is sufficient evidence to show that the results represent a true average of the normal infection of each city's milk supply.

TABLE III.—*Glasgow Milk Supply.*

Details of Samples.	Years.	No. of Samples Examined.	No. of Samples Infected.	Percentage of Samples Infected.
Samples from cows with disease of the udder	1908-13 1921-27	3,384 2,173	84 32	2.5 1.5
Samples from cows supplying hospitals	1908-13 1921-26	413 3,014	5 17	1.2 0.56
Mixed milk supplied to hospitals	1921-26	923	28	3.0
Mixed milk of city (see Table II)	1921-27	1,083	28	2.6

We have therefore to turn to the second point—namely, to ascertain whether the variations in the results can be attributed to differences in technique in testing the milk samples. By the courtesy of the officials concerned I have been provided with the details of the technique used at each centre, and these details have been tabulated in Table IV.

TABLE IV.—*Details of Biological Tests.*

City.	Biological Tests.	Percentage of Milk Samples Infected.
Glasgow ...	Single guinea-pig inoculation. 1 c.cm. or more sediment inoculated subcutaneously.* Guinea-pig killed at three weeks.	2.6
Aberdeen ...	Single guinea-pig inoculation. Centrifuged deposit from one pint of milk treated with antiformin, washed, and inoculated. Guinea-pig retained if necessary for eight weeks.	5.5
Edinburgh	Duplicate guinea-pig inoculation. 6 to 8 oz. milk centrifuged, and half the sediment (including preparations from the cream layer) inoculated into each guinea-pig subcutaneously. First guinea-pig killed at four weeks; second kept up to eight weeks if necessary.	8.5

* Sediment obtained by allowing milk to settle for twenty-four hours in long cylinders, and centrifuging the lower layer: quantity of milk variable, up to one quart. The quantities of milk quoted in these tests refer to samples from mixed milks only.

It will be seen from this table that the tests vary at each centre, and that the employment of duplicate guinea-pigs and of a long period between inoculation and post-mortem examination coincides with the highest apparent incidence of infection. It might be assumed from this fact

that the lower incidence of infection of the milk supplies of Aberdeen and Glasgow indicates that, at these centres, the technique is not sufficiently sensitive to demonstrate infection in a number of tuberculous samples. The use of antiformin at Aberdeen, and of a short period between inoculation and post-mortem examination at Glasgow, might account for the variations in the results. On the other hand, there are certain facts which might be urged against such an assumption. At each centre it is usually found possible, by biological test of milk samples, to locate the individual cow which is causing infection of a given milk supply, and this would appear to provide a check on the reliability of the methods employed.* Again, the figure given for the percentage infection of milk from individual cows supplying hospitals (0.56) agrees closely with that obtained from post-mortem examinations of dairy cows at slaughterhouses, where approximately 0.5 per cent. are found to have infected (tuberculous) udders. Further, the discrepancy between the Edinburgh and Glasgow results is so great that the three-week test at the latter centre would have to be assumed to miss more than two-thirds of those samples which would have been found positive by the use of a four- to eight-week test used at the former centre—an assumption whose justification might be doubted.†

If, however, it is assumed that the tests at each centre are strictly comparable, we are faced with a quite extraordinary difference in the incidence of infected milk in the various country districts from which the city supplies are drawn. Such a difference may actually exist, but the criticisms of the tests at the individual centres prevent any definite conclusion being reached.

The outstanding fact brought out in this short discussion is therefore the need for the adoption of a uniform test at each centre. It is only by the standardization of technique that results can be obtained which will be directly comparable and beyond criticism.

The Incidence of Abdominal Tuberculosis.

It is an established fact that a considerable proportion of cases of abdominal tuberculosis is due to infection of bovine origin, and it is assumed that such infection is, in a number of cases, caused by the consumption of tuberculous milk. If tuberculous milk is, in fact, a frequent cause of infection, we should expect that the differences in the incidence of tuberculous milk in each of the three cities referred to above would be reflected in the mortality from abdominal tuberculosis.

An analysis of the number of deaths occurring as a result of abdominal tuberculosis in the cities has revealed the following results.

TABLE V.—Mortality from Abdominal Tuberculosis.

City.	Years.	Average No. of Deaths per Million of Population.	City.	Years.	Average No. of Deaths per Million of Population.
Edinburgh	1911-20	120	Edinburgh	1921-27	83
Glasgow ...	1911-18	171	Glasgow ...	1919-27	91
Aberdeen	1913-20	133	Aberdeen	1921-27	92

From these results it appears that while there was a slight variation in the death rate between the cities during the earlier years, the death rates for all four cities during the last eight or nine years have been practically identical, although these were the years during which large variations were found in the incidence of infection of the city milk supplies.

* In this connexion, however, it should be noted that the methods of testing mixed milk (that is, milk from a number of cows) and of milk from an individual cow are not necessarily comparable. In the latter infection is generally heavy, and a short period between inoculation and post-mortem examination may be sufficient to reveal infection; in the former the infection is considerably diluted and a longer period is undoubtedly necessary.

† By the courtesy of Mr. A. Goffin, F.R.C.V.S., I have been provided with the details of the tests carried out at Edinburgh during the last five years. Out of a total of 38 positive samples, 28 (or nearly 75 per cent.) have been diagnosed by post-mortem examination at the end of four weeks. The remaining 10 positive samples required periods averaging about six and a half weeks for diagnosis.

Infection of the population by the consumption of tuberculous milk is obviously more likely to affect the infant population most heavily; it has been estimated that 50 per cent. of the cases of abdominal tuberculosis in children under 5 years of age is of bovine origin, and is to a great extent due to infection of the milk supply. A check was therefore made of the deaths of abdominal tuberculosis in children under the age of 5 years, since this should give a more accurate estimate of milk-borne infection. There was again found to be no considerable difference between the death rates in the two cities, the figures being as follows:

Edinburgh (1921-27)	...	37 deaths per annum per million population.
Glasgow (1921-27)	...	31 deaths per annum per million population.

The attempted correlation between the incidence of tuberculous milk and the mortality from abdominal tuberculosis in the cities investigated is, however, complicated by the fact that a considerable portion of the milk supply is pasteurized before delivery to the consumer; and while recent work indicates that pasteurization is not an absolute safeguard against tuberculosis, it very greatly reduces the risk of infection.

If the occurrence of abdominal tuberculosis provides an indication of the relative cleanliness of the milk supply, it appears that the occurrence of living tubercle bacilli in the milk as delivered to the public (that is, after pasteurization or other treatment) is the same for each of the three cities investigated.

The Value of Tuberculin-tested Herds.

The figures which formed the basis of the first section of this paper referred to the incidence of infection in the general milk supply received from country sources. The percentage of infected samples was shown to be variable, but in every case it was significant from the point of view of the possible transmission of bovine tuberculosis to man. In the second section reference was made to the value of pasteurization in decreasing the risk of infection, but it was stated that pasteurization could not be considered an absolute safeguard against tuberculosis.

The movement for the establishment of tuberculin-tested herds was based on the assumption that dairy herds which had been cleared of tuberculosis, and which were subsequently tested at intervals in order to ensure the early elimination of any new reactors, would provide the consumer with a guaranteed tubercle-free milk. The criticism has been made that even these precautions do not give an absolute guarantee of freedom from infection, on the grounds that the interval between periodical tests (usually six months) may permit a cow to develop tuberculosis and possibly therefore to excrete tubercle bacilli in the milk. Such a criticism is *a priori* hardly valid in view of the general recognition that infection of the udder takes place only in the later stages of the disease. Certain results obtained at Glasgow provide, however, a remarkable practical demonstration of the value of tuberculin-tested herds in ensuring the production of tubercle-free milk.

During the years 1909 to 1914 the city hospitals were supplied with milk which was obtained from herds under the strict supervision of the veterinary officer. The herds were not regularly tested with tuberculin, but careful examination of the animals was made periodically and any suspicious animals were at once re-tested with tuberculin. As a result the periodical testing of the milk from these herds revealed only one infected sample during these five years.

From 1921 to 1926 the hospitals were supplied with milk from untested herds, and, out of 923 samples examined, 28 (or 3 per cent.) were found to be infected.

During the years 1927 and 1928 the hospitals were supplied with milk from tuberculin-tested herds, and, out of 550 samples examined, not one sample was found to be infected. This is the more striking as the quantity of milk tested is relatively large, amounting to approximately half an ounce for every gallon of milk supplied to the hospitals.

These figures effectively demonstrate the entire freedom from infection of milk from tuberculin tested herds, and illustrate the unique value of such milk from the point of view of public health.