

## TYPHOID CARRIERS IN ABERDEENSHIRE.

BY JAMES P. WATT, M.A., M.D., D.P.H.,

*Medical Officer of Health for Aberdeenshire.*

IN the course of investigations into outbreaks of typhoid in the county for which I act as Medical Officer, I have discovered a number of typhoid carriers whose histories seem worth placing on record as showing the extent to which the endemicity of the disease in rural areas is maintained by carriers. Of twenty-two found, four were identified in 1908, two in 1910, three in 1911, one in 1916, one in 1917, five in 1918, and six in 1919. Five were men and seventeen were women, giving a proportion of 77·3 per cent. of female carriers. Of the chronic typhoid carriers found by the German stations up to the close of 1907, 82 per cent. were women. All of my carriers were intestinal, one being a urinary carrier as well. As in every case attention was directed to the carriers owing to a case or cases of actual typhoid fever occurring; this experience indicates that, as is generally believed, faecal carriers are altogether in excess of urinary carriers, or that urinary carriers may not have the special malignancy commonly attributed to them.

A rural area affords special facilities for the discovery of typhoid carriers owing to the fact that outbreaks tend to recur at the place where the carrier is and that the movements of carriers and patients and their contact with others can be readily determined, while the number of persons among whom the carrier has to be searched for is comparatively limited. "Carriers," says Gay<sup>(1)</sup>, "usually become recognised by careful epidemiological surveys in connection with repeated cases of typhoid fever in a given locality, in association with some particular individual over a period of time, or in connection with some epidemic due to food, in the preparation of which he, or more frequently she, has taken part. In such surveys it is usually possible by a process of elimination to identify the carrier or carriers in a given group of individuals. The method by which this elimination is carried on will depend to a large extent on the individual skill, tact, and experience of the epidemiologist." The chief difficulty lies in obtaining the samples of stools and urine necessary for identification of the typhoid state, and in the intermittency of the discharge of the bacilli often rendering several samples necessary. As there have been no compulsory powers, and it is not clear if there are yet any, to enable one to get these samples where refused, they could be obtained only by favour.

In view of the tragic position of the chronic typhoid carrier, it is a matter of profound regret that all the attempted lines of treatment have met with so little success. Ledingham and Arkwright<sup>(2)</sup> conclude their review of the various

measures tried with the remark, "We have to deplore the fact that so far the attempts to cure intestinal carriers have not yielded results affording convincing evidence of their success. In the case of carriers who are in an early stage of this condition, there may be some hope of effecting a permanent cure by one or other of the methods already tried and quoted above, but in long standing chronic cases the prospect of success of this kind would seem to be extremely remote." According to Nichols<sup>(3)</sup>, removal of the focus of the disease by surgical operation has been successful in over 50 per cent. of typhoid carriers. For carriers who are in advanced years, and many of them are so, operation would not be advisable. It cannot therefore be too earnestly hoped that a treatment will ere long be found which will obviate the need for surgical measures.

I propose in this paper to give an account of the carriers in the order in which they were met with, and to make some observations on the present position of the law in Scotland as regards typhoid carriers.

#### TYPHOID CARRIERS.

*Year, 1908.*

*Case 1. Mrs A., wife of tenant of Farm B.*

The following outbreaks of typhoid fever had occurred at this farm:

1892.	Nov.	2nd.	Daughter, aet. 13 months.
		2nd.	Husband, aet. 28 years.
		2nd.	Daughter, aet. 3 years.
		14th.	Farm servant, aet. 35 years.
1897.	Oct	3rd.	Farm servant. Died.
1906.	Nov.	6th.	Daughter, aet. 9 months.
1908.	Aug.	7th.	Farm servant, aet. 27 years.
		7th.	Farm servant, aet. 15 years.
		8th.	Domestic servant, aet. 17 years.
		16th.	Daughter.

Between 1892 and 1906, there had been cases of illness in the family which the medical attendant, in the light of subsequent events, was inclined to look back upon with suspicion as having been probably typhoid, although he had not at the time diagnosed them as such. Only two children out of a large family would seem to have escaped an attack.

In 1908, a sister-in-law of Mrs A., who had been staying with her family of four daughters for summer holidays in a village near, developed typhoid immediately after her return home, as did also two of the daughters. They had received part of their milk supply from Farm B. I found, however, subsequently that the woman in whose house they were lodging, and from whom they got part of their milk, was also a typhoid carrier so that infection might have come from either source.

The examination of samples of stools and urine which I obtained in connection with the outbreak in 1908 showed Mrs A. to be a faecal carrier. She had had an attack of typhoid in 1890, shortly before her marriage. Her

husband entered Farm B. in 1892, and no outbreak of typhoid was known to have occurred there before that date.

In 1911, another case of typhoid occurred at B., a man-servant, age 19, and in 1914, a young man of 20 living in a neighbouring village who had been working for a time at B. went home from there ill, and the illness proved to be typhoid. No cases have since occurred at B. or been connected with the farm.

I may mention that a new water supply had been introduced prior to 1906.

#### *Case 2.*

The second case identified in 1908 was a woman A. P., age 63, who was acting as housekeeper to a farmer, Mr S. Mr S. was about to be married when he developed typhoid, was removed to hospital on August 31st, and died on September 16th, 1908. A. P. was known to have been working in houses in the county where previous outbreaks had occurred, and suspecting her to be a carrier, I persuaded her to go to hospital where samples of her stools and urine were taken and sent to the laboratory for examination. The stools proved to be positive.

A. P. had passed through a severe attack of typhoid in 1900, while a patient in Banff Asylum. This asylum, as related by Ledingham and Arkwright<sup>(2)</sup>, had, between the years 1893 and 1907, been visited by eleven outbreaks of typhoid with a total of 31 cases. In 1907, a systematic search for carriers was undertaken by Drs A. and J. C. G. Ledingham, and three carriers were discovered among the female patients. These were isolated, after which the outbreaks ceased<sup>1</sup>.

Shortly after her attack of typhoid, in the end of 1900, A. P. was discharged from the Asylum and went to reside for a time at a farm in the vicinity, in the Parish of Kirkmichael. Here occurred the first outbreak with which she was connected. I ascertained through an enquiry kindly made for me by Dr Ledingham, Medical Officer of Health for the county, that during her stay there she assisted occasionally in the work of the kitchen and took the kitchen servant's place when the latter, who was the first known case, became ill. This outbreak produced 13 cases. The following account of it is taken from the *Report* for 1901 of Dr Cameron, Medical Officer of Health for the county:

The most serious outbreak occurred in the Kirkmichael, Tomintoul and Glenlivet Districts. A servant girl was taken ill at a farm in Kirkmichael in April, and the medical attendant told me he suspected typhoid fever; also that he understood there were other suspicious cases there not under his care. The patient was removed to Glenlivet and duly certified. The medical attendant himself contracted the disease. Between hearing of the case and receiving the certificate, a case of typhoid fever was notified from Tomintoul village. On enquiring into the matter, I found that the latter patient also had been in service at the farm above referred to and returned ill to Tomintoul. I also learned from his medical attendant that there was a case of typhoid fever at the farm which he was about to notify. On visiting the farm, I ascertained that the children (three) had been taken ill in March with what was supposed to be measles, and that the farmer himself was just convalescent

<sup>1</sup> Recently two outbreaks have occurred at the Asylum connected with these carriers.

from an attack of bilious fever. I suspected that the farmer and his children had been suffering from typhoid fever, and my suspicions were afterwards confirmed by a bacteriological examination. Another case occurred at the farm shortly afterwards, and two brothers of the Tomintoul patient contracted the disease. These three cases were removed to hospital, the last on the first of June. On July 9th, I received intimation of two other cases of typhoid in the village of Tomintoul in the cottage (semi-detached) adjacent to that in which the previous cases occurred. On visiting the following day, I found other members of the family were ill. They could not be removed to hospital owing to lack of accommodation. Arrangements were made locally. The disease was confined to the family. All the cases recovered.

A. P. came soon after to Aberdeenshire, and at the following places outbreaks of typhoid occurred while she was occupying the position of cook or cook-housekeeper:

1. Oct. 1901. Hotel, village of R.—four cases directly connected with the hotel.
  - (a) Maid servant, aet. 15. Notified October 21st.
  - (b) Daughter of the Proprietrix, aet. 7. Notified October 21st.
  - (c) Merchant's wife in village, aet. 25. Notified November 13th. Getting milk from hotel up to October 29th.
  - (d) The Proprietrix herself. Notified December 18th.

Other five cases of typhoid occurred in the village about this time, but had no known connection with the hotel.

2. Apr. 1902. Farm A. in the district of H.—three cases. The farmer, Mr G., his wife and daughter. All notified April 5th.
3. Jan. 1905. Farm O.—two cases. The farmer, aet. 50, and his son, aet. 16. Notified January 28th.
4. Aug.–Sept. 1907. Farm F.—four cases.
  - Aug. 31st. Farm servant, aet. 16.
  - 31st. Farm servant, aet. 25.
  - Sept. 5th. The farmer himself, aet. 40.
  - 29th. A daughter of the farmer, aet. 4.
5. Sept. 1908. Farm S., where as mentioned the farmer, Mr S., took typhoid and died.

In 1903, while A. P. was in the service of the manager of the G. Distillery in the district of H., he and his daughter each passed through a severe illness which, in the light of subsequent events, was most probably typhoid though not diagnosed as such at the time.

It will thus be seen that exclusive of the two suspicious cases in 1903, A. P. was responsible for 27 cases of typhoid occurring in six outbreaks.

On my recommendation, the Local Authority of the District in which Farm S. was situated resolved, in view of A. P.'s history and the fact that she had no means of livelihood if precluded from following her usual occupation, to offer her the equivalent of the Old Age Pension (she was then about 63), on condition that she engaged in no work that involved the handling of food. To this the Local Government Board gave their sanction. A. P. accepted the offer, and went to live in the Burgh of H. Here she resided alone for two years. I endeavoured, unfortunately without success, to obtain for her work of a kind that she could do without risk to others. As she had been accustomed to an active life, she tired of having nothing to do, and decided at the end of that time to give up her allowance and go back to work. She got an engagement in the neighbourhood. She was there, however, only a few weeks when

she again became insane and was removed to Banff Asylum. There the examination of her stools showed them to be still positive.

She recovered within a year and was discharged on March 6th, 1911. I obtained the sanction of the Committee to offer her her allowance again, but she refused it and fell back upon parochial relief. On November 12th, 1913, a case of typhoid was notified to me from a farm, three miles from the Burgh of H. where she was living. On enquiry, I found that A. P. had been temporarily engaged to help in the kitchen work. The patient, a farm servant, aet. 21, had a very severe attack. This was the last case with which A. P. was connected. She lived on in the Burgh of H. in receipt of parochial relief till November of 1918, when she died of acute bronchitis and asthma complicated with heart disease. To the end she remained convinced that she was not a typhoid carrier, and that she was the unfortunate victim of official interference which she very bitterly resented.

I may mention that this case is quoted (p. 35), by Ledingham and Arkwright(2), to whom I supplied the data there given.

*Case 3. Miss S., aet. 53, sister of a farmer occupying Farm T.*

An outbreak of typhoid at this farm in the autumn of 1908 led to Miss S. being identified as a carrier. Her history was as follows. Thirty-one years before, in 1877, she had an attack of typhoid fever. She was then 22 years of age. At that time, her mother being dead and her father having married again, she was living, with a brother, at a Farm G. in the vicinity of Aberdeen occupied by her grandfather, Mr R. Mr R. was a dairy farmer. Her grandmother, Mrs R., whom she helped with the work of the house, was not in good health and died shortly after. Miss S. then kept her grandfather's house up to the time of his death which occurred in 1889. Miss S.'s brother succeeded to the farm, and he and Miss S. continued to dairy till 1899, when they removed to a farm in Kincardineshire, W. M. There they remained till 1907. In that year they left W. M. and went to Farm T. in Aberdeenshire.

In the course of the 31 years from 1877 to 1908, no fewer than 24 cases of typhoid fever had occurred at the three farms of G., W. M. and T., among the servants, and in addition to these 24 cases, Miss S.'s brother, as also a nephew who stayed at G. and worked on the farm, had been attacked, making a total of 26 cases of definite typhoid, apart from some illnesses at G. diagnosed as influenza, but which were most probably cases of typhoid. As will be noted from the Table, two cases of typhoid also occurred among near neighbours while they were at W. M., probably from infection from Miss S.

The following Table gives a list of these cases with dates and details furnished to me by Miss S. and her brother. For particulars of the cases at W. M., I am indebted to Dr Macnaughton, County Medical Officer. I may mention that Miss S. assured me that no case of typhoid fever had occurred at G., or been associated with G., before her attack.

*Typhoid Carriers in Aberdeenshire**Farm G.* 1877–1899.

Miss S.'s attack was in July of 1877.

(R.I. = Royal Infirmary; C.H. = City Hospital; D.H. = District Hospital.)

- |     |       |            |   |
|-----|-------|------------|---|
| 1.  | 1877. | Sept.      | Servant girl.   |
| 2.  | "     | "          | Miss S.'s brother.  |
| 3.  | "     | Nov.       | Grieve on farm. Very severe attack.   |
| 4.  | 1878. | July.      | Servant girl. Mild case.  |
| 5.  | "     | Aug.       | Farm servant. Removed to R.I. Mild case.  |
| 6.  | 1882. | Spring.    | Servant lad. Removed to R.I. Very severe.   |
| 7.  | 1883. | Summer.    | Cousin—young lad aet. 21—working on farm. Very severe.  |
| 8.  | 1885. | "          | Kitchen maid, aet. 20. Mild.  |
| 9.  | "     | "          | Milk boy, aet. 15. Removed to R.I. Severe.  |
| 10. | "     | "          | Man servant, aet. 22. Removed to R.I. Severe.   |
|     | 1893. | —          | Two severe cases of "influenza" in this year, one of them fatal after a short illness, were probably cases of typhoid. Other cases of "influenza," according to Miss S., occurred at G. between the years 1892 and 1897 and were also possibly typhoid. |
| 11. | 1897. | Aug. 9th.  | Farm servant. Removed to R.I. Very severe.  |
| 12. | "     | " 11th.    | Farm servant. Removed to R.I.   |
| 13. | 1898. | July 21st. | Farm servant, aet. 16. Removed to R.I. Died.  |
| 14. | "     | Nov. 18th. | Domestic servant. Went home ill to her mother's house in Aberdeen—found there to be suffering from typhoid. Removed to R.I. Died.   |
| 15. | "     | Dec. 2nd.  | Farm servant. Removed to R.I.   |

*Farm W. M., Kincardineshire,* 1899–1907.

- |     |       |             |  |
|-----|-------|-------------|--|
| 16. | 1900. | Aug. 26th.  | Farm servant, aet. 23. Too ill for removal. Treated in farm house. Died.   |
| 17. | 1901. | Jan. 29th.  | Farm servant, aet. 22. Removed to C.H.   |
| 18. | "     | Mar. 16th.  | Farm servant. Removed to C.H.  |
| 19. | 1902. | Sept. 6th.  | Farm servant, aet. 20. Removed to C.H.<br>(This month, September 1902, two near neighbours, I. N. and Mrs G., had very severe attacks of typhoid.) |
| 20. | 1903. | Sept. 11th. | Female servant, aet. 22. Removed to County Hospital.   |
| 21. | 1904. | Jan. 25th.  | Farm servant, aet. 18. Removed to County Hospital.   |
| 22. | "     | Mar. 16th.  | Female servant, aet. 18. Removed to County Hospital.   |
| 23. | 1905. | Sept. 5th.  | Farm servant. Removed to R.I. as suffering from pneumonia. Found to be typhoid and removed to C.H.   |

*Farm T.,* 1907–1908.

- |     |       |            |   |
|-----|-------|------------|---|
| 24. | 1908. | July 24th. | Domestic servant. Removed to D.H. Died. |
| 25. | "     | Aug. 28th. | Farm servant, aet. 46. Removed to D.H.  |
| 26. | "     | Oct. 13th. | Farm servant, aet. 40. Removed to D.H.  |

*Outbreak in Aberdeen through milk from G.—26 cases.*

In 1898, Miss S. was associated through their milk supply with an outbreak of typhoid in Aberdeen in which 26 cases occurred. The outbreak commenced in November of 1898 and continued into January of 1899. It was found to be connected with a dairy R. in W. G. Street—to which Miss S. supplied milk, and suspicion was directed to Miss S.'s milk through the fact that a domestic servant, who had gone home from G. to her mother's house in Aberdeen ill, was found to be suffering from typhoid fever and removed to the Royal Infirmary (case 14 of Table). The beginning of this outbreak is thus described by Dr Hay in his *Report* for November 1898:

At the moment of writing, a third milk epidemic of typhoid appears to be commencing. To-day (Thursday) three cases, occurring in three quite separate families in different parts of the town and in no way associated with the other outbreaks, have been reported, and they all have the same milk supply. These cases, taken along with other two reported early in the week which also had been obtaining a part of their milk from the same dairy, make it

only too probable that the milk of this dairy also is infected. Enquiry was at once made into the source of the infection, but this is attended with much more difficulty than in the preceding outbreaks, owing to the dairyman, who has a business of considerable extent, deriving his supplies from a large number of farmers. We have, however, we believe, succeeded in tracing it to a farm in the Newhills District outside the City boundary from which a case of illness which was found to be typhoid, and which has indeed terminated fatally, was removed to the Royal Infirmary during the present month. We hope to be able to arrange with the help of the County Authorities for the immediate stoppage of this milk supply to any part of the City until these authorities are satisfied that the risk of the infection of the milk has entirely ceased. Meanwhile, a dairyman in the City, who has been obtaining a portion of his milk supply from this source, has undertaken to stop it forthwith. Owing, however, to the lengthened period of incubation of typhoid fever, it is likely that several cases, perhaps numerous cases, from this source will continue to develop themselves during the next two or three weeks.

As mentioned above, 26 cases in all, infected by milk from R.'s dairy, occurred before the outbreak stopped.

With Dr Hay's permission, I made an examination of the City notification Registers, and found that from 1891 to 1899, inclusive of the 26 cases in this outbreak, a total of 41 cases of typhoid had been notified among the customers of R.'s dairy in W. G. Street, and Miss S. informed me that during all these years this dairy received milk from G. When they went to Kincardineshire Miss S. ceased to supply milk to R., but for two years sent milk to a dairy W. in Aberdeen. I found from the notification registers that in these two years 15 cases of typhoid occurred among the customers of this dairy while only 6 cases occurred in the next seven years. This, of course, might have been merely a coincidence.

It seems not improbable that the milk from G. caused typhoid fever in Aberdeen at an earlier date. Miss S. and her brother told me that in 1885, Professor Simpson, at that time Medical Officer of Health for the City, "visited the farm in connection with typhoid," and that he had the water supply, which was derived from a pump near to the dungstead, analysed. It was found, however, satisfactory. It will be seen from the Table that in that year three cases of typhoid occurred at G., two were removed to the Royal Infirmary, and there may have been cases in Aberdeen connected with G. In a letter, in reply to an enquiry, Professor Simpson says: "The name G., Newhills, is familiar to me, and I am almost sure that one of the outbreaks was traceable to this farm." The late Mr Reid, Sanitary Inspector for the Aberdeen District, told me that he remembered on more than one occasion accompanying Professor Simpson to G. in connection with typhoid fever in the City after he joined the City staff in 1883.

The first time Farm G. was visited in connection with typhoid was in 1878. In that year Dr Burr and Dr Blaikie Smith were sent by the Parish Council of Aberdeen to investigate, because the Governor of the Poorhouse, which received its milk supply from G., reported that there was an outbreak of typhoid fever at the farm (cases 1, 2, 3 of the Table). The sanitary condition of the premises was found to be bad and Mr R. was warned. I could not

find, however, from the Parish Council records of that date any indication that cases of typhoid had occurred among the inmates of the Poorhouse.

It may be mentioned that both at G. and at W. M. every effort had been made to put the farms into good sanitary condition, no less than £300 having been spent at the latter farm on water, drainage, and a new sleeping-place for the men servants. Miss S. assured me that they left this latter farm "just to get away from the typhoid," and that they had gone to Farm T. "because cases of typhoid had never been known to have occurred there."

On learning that she herself had been the source of all the outbreaks, Miss S. was eager to know whether there was any cure for her condition. She decided finally to consult a surgeon in Aberdeen. The surgeon whom she consulted found that she was suffering from gall-stones and recommended an operation. The operation was carried out and two large gall-stones were removed. Typhoid bacilli were found in the bile and in the centre of one of the gall-stones examined. Miss S. proved to be suffering from tubercle, both of lungs and abdomen, and survived the operation only a month.

Miss S. was convinced that her infection came from a Farm W., three or four miles distant from G., and that it was brought to her by a maid-servant who came from W. to G. in 1877, and who had shortly before passed through an attack of typhoid fever there. All the maids at this farm, according to Miss S., got typhoid fever, the cause being put down to a "bad drain." The tenant of W. at that time was a Mr D. I have since ascertained that he and four members of his family suffered from typhoid in 1862, the first to take it being a daughter who had been visiting a house in the vicinity where cases of typhoid were. From this date to 1879 when Mr D. left the farm, outbreaks of typhoid repeatedly recurred at W., the maid-servants as mentioned above being chiefly attacked. It is significant that when Mr D. removed in 1879 to another farm an outbreak occurred there soon afterwards. Mr D. was married three times and cases occurred also among children of the third family, one of the daughters of this family having two attacks. The history clearly suggests that Mr D. had become a carrier from his attack in 1862, and was the source of the outbreaks at Farm W. and so possibly indirectly of Miss S.'s attack.

*Case 4.* Mrs B., aet. 28, wife of a cottar at Farm T.

Three cases of typhoid fever occurred in her house and the house adjoining in August and September of 1908. The first case was that of a man lodging in the adjoining house who was notified on August 26th. A child of Mrs B. was notified on September 14th, and her husband on September 24th. Mrs B. had passed through an attack of typhoid fever before her marriage when she was a servant at Farm S. where the series of cases occurred described on p. 434. Samples of her stools and urine were obtained and submitted for examination. The stools proved positive. With regard to the first of the three cases there was no evidence that the man had partaken of food in



Mrs B.'s house. Both houses, however, were served by one privy, and the midden connected with it was undrained and in a very filthy condition.

I lost sight of Mrs B. subsequent to these cases till 1921. When investigating the cause of a case of typhoid in the village of N. P. in that year, I found that she was living in the house adjoining that in which the case had occurred. She was now a widow, and had come to this house with her family a few months previously from Aberdeen where she had been resident for six years. The two houses were served by two privies which had a midden between them common to both privies, and the mother of the child with typhoid had to cross this midden when cleaning out her privy. The midden was in a very filthy condition. I obtained a sample of stools and urine from Mrs B., but they were negative.

1910.

*Case 5.* Mrs R., wife of a manufacturer, living at M.

There had been a number of outbreaks of typhoid at M. of which the following is a list subsequent to notification:

- 1894. June 16th. Domestic servant, aet. 20.  
July 31st. Boy (son of employee), aet. 8. Died.
- 1896. Aug. 16th. Domestic servant, aet. 24.  
Sept. 1st. Mrs S. (wife of employee), aet. 27.  
10th. Domestic servant of Mrs S.
- 1906. June 15th. Domestic servant. Died.  
Dec. 24th. Employee, aet. 17.
- 1907. Feb. 14th. Mrs C., aet. 24, sister of last case who stayed with her.  
19th. Sister of Mrs C., aet. 13.
- 1908. July 20th. Man working temporarily at M., aet. 29.
- 1910. Sept. 29th. Case in house near, lad of 19, connection not very definite.

Mrs R. had an attack of typhoid in 1881. At that time a sister who came to nurse her and a maid developed typhoid, as did also a sister-in-law who lived next door and her maid. The local medical practitioner informed me in 1894 that "Mrs R.'s house for the last fifteen years had been periodically visited by typhoid fever." Everything had been done at M. in the way of sanitary improvements to try and stop the recurring outbreaks, but without avail.

While investigating the case in 1910, I obtained samples of stools and urine from Mrs R. whom I strongly suspected of being a carrier. Both stools and urine proved positive—the only case of a double carrier I have found. Strict precautions were enjoined and observed, but in spite of these another case, that of a maid-servant, occurred in September of 1912. It was then decided to inoculate the maid-servants, and this was always done up to Mrs R.'s death in 1922. No case subsequently occurred at M. or was traceable to Mrs R.

*Case 6.* Mrs M., wife of farmer occupying Farm C.

The following outbreaks were associated with her:

- 1904. Sept. 18th. Domestic servant, aet. 22.  
Nov. 29th. Mrs M., a neighbour, aet. 35, getting milk from C.
- 1906. June 15th. Farm servant, aet. 18.
- 1907. Dec. 27th. Farm servant.
- 1910. June 14th. Farm servant, aet. 23.  
Aug. 15th. Domestic servant, aet. 19.  
Nov. 9th. Mrs T., a neighbour, aet. 43, supplied with milk from C.

Mr M. himself had an illness in 1909 which was diagnosed as influenza, but which might have been typhoid. He was confined to bed for three weeks, and, after a relapse, for three weeks more, insomnia being a marked feature of the illness. A prolonged illness of one of the children was probably also typhoid.

Mrs M. had passed through an attack of typhoid in 1903. The examination of the stools and urine in connection with the outbreak in 1910 showed her to be a faecal carrier. No further case occurred at C. till 1917 when a domestic servant, aet. 18, developed typhoid. This case presented certain interesting features. She was thought at first to be threatening an attack of appendicitis and went home. She was sent to the Royal Infirmary for operation by her own medical attendant. The examination made there suggested the possibility of typhoid, and the blood was examined with positive result. She was accordingly removed to the City Hospital. The symptoms of appendicitis, however, became more pronounced and she was operated on. She proved to be suffering from both diseases, but made a good recovery.

An examination of Mrs M.'s stools in 1921 showed her to be still a carrier. A positive result was not obtained till the sixth sample was examined.

The treatment of this case with detoxicated vaccine is described in a paper in the *Lancet*, 1923, i. 378. I may mention that the non-agglutinating bacillus referred to in that paper reappeared, and that an extensive investigation which Professor Carl Browning of Glasgow University very kindly made of it showed that it was a true *Bacillus typhosus* with deficient agglutinability. A course of vaccine prepared from this bacillus itself was then tried. The results of this treatment will be given later when more samples have been examined, but the results so far seem interesting.

1911.

*Case 7.* Mrs R., wife of crofter and labourer, carrying on a small dairy business in the village of M.

The following cases were associated with her through the milk supply:

1902.	June 30th.	Male,	aet. 43.
1907.	Mar. 19th.	Female,	„ 7.
	Apr. 9th.	Male,	„ 10. Died.
1908.	Aug. 19th.	Female,	„
1910.	Aug. 8th.	„	„ —
1911.	June 7th.	Male,	„ 47.
	7th.	„	„ 14.
	27th.	„	„ 14.

It was in connection with this last outbreak that I obtained samples of stools and urine from Mrs R. who had passed through an attack of typhoid earlier in her life. The examination of the stools showed her to be a faecal carrier. Mrs R. undertook to give up all personal connection with the dairying work, and engaged a woman to milk and do everything in connection with the dairy. Her daughter later took this woman's place. The dairy is now closed.

*Case 8. Mrs W., wife of farmer, occupying Farm A.*

In the latter part of 1911 and the beginning of 1912, the following cases of typhoid were notified from this farm:

1911. Sept. 3rd. Servant girl, aet. 14.  
 Dec. 2nd. Mrs S. (monthly nurse attending on Mrs W.), aet. 45.  
 19th. Domestic servant, aet. 31.  
 21st. Stepson of Mrs W., aet. 9.
- 1912 Jan. 21st. Farm servant, aet. 17.

I obtained samples of stools and urine from all the adults on the farm. The stools of Mrs W. proved positive. I did not obtain a history of her having had an attack of typhoid, but there had been typhoid fever at the farm occupied by her father when she was a girl, and it is possible that she may have had a mild and unrecognised attack then.

In February of 1913 another case was notified from A., a domestic servant. Then a long interval elapsed without any further outbreak till 1921, when a domestic servant was removed to hospital suffering from typhoid. The case was a very mild one. I obtained two samples of stools and urine from Mrs W. but both were negative.

A further outbreak occurred in connection with A. in the end of 1922 and beginning of 1923. Two servants (M. and F.) left the farm ill and one of them caused two cases before the nature of his illness was recognised. Eight samples of stools from Mrs W., eight from the stepson who had typhoid in 1911 and two from Mr W. have been examined since, but all have been negative

*Case 9. Mrs R., wife of labourer, in the village of S., associated with one case of typhoid in 1905, and with another case in 1911.*

A sample of stools examined in connection with the case in 1911 showed Mrs R. to be a faecal carrier. No cases of typhoid have since been traceable to, or associated with her.

1916.

*Case 10. Mrs McR., aet. 45, widow, acting as temporary cook to Miss W., tenant of Farm C.*

In 1916, an outbreak of typhoid fever with five cases occurred at or in connection with this farm. The first case was reported from Edinburgh, a girl of 14, who had been staying on holiday at a house near Farm C., the occupants of which got milk from C. The case was reported on September 25th, while Miss W., aet. 61, the tenant of C., who had been ill for some time, was notified on September 27th. Mrs B., in whose house the case notified from Edinburgh had been living, fell ill and was notified on September 30th. Two more cases occurred in October, one a lad of 17, son of Mrs B., and the other a niece of Miss W., aet. 44, who had come to look after the house. Miss W. was being treated at home. The following table shows the cases with the dates of notification:

- |       |       |  |
|-------|-------|--|
| Sept. | 23rd. | Girl, Edinburgh case, aet. 14.           |
|       | 27th. | Miss W., occupant of farm, aet. 61.      |
|       | 30th. | Mrs B., neighbour getting milk, aet. 53. |
| Oct.  | 17th. | Son of Mrs B., aet. 17.                  |
|       | 17th. | Miss M., niece of Miss W., aet. 44.      |

I succeeded in obtaining samples of stools and urine from the two domestic servants employed at C. The stools of the cook, Mrs McR., proved positive. I could get no history of her having had an attack of typhoid or any previous association with typhoid, though, according to her statement, she had milked cows and had been engaged in work likely to spread infection. Her home was in Aberdeen, and she had been temporarily engaged as cook by Miss W. She returned to Aberdeen soon after. Dr Hay, to whom I communicated the circumstances of the outbreak, persuaded her to go to the City Hospital for treatment. After six weeks' stay there, as the stools became negative, she was discharged. It should be mentioned that while she was at C. she assisted in milking the cows.

In January, 1924, Mrs McR. has again been associated with an outbreak of enteric fever—three cases having occurred in a family related to her with whom she was staying, the first case having sickened fourteen days after her arrival. Typhoid fever in this family was confirmed bacteriologically but the examination of two samples of faeces and urine from Mrs McR. gave a negative result.

1917.

*Case 11.* Mrs T., widow, aet. 65, living alone in the village of P., and doing such work as nursing, milking, etc.

In 1917, an outbreak of typhoid occurred in the village of P. with the following cases:

June	19th.	Male,	aet.	10.
	28th.	Female,	„	8.
	30th.	„	„	35.
July	4th.	Male,	„	6.
	6th.	Female,	„	69.
	7th.	„	„	23.
	14th.	„	„	37.
	15th.	Male,	„	7.
	19th.	„	„	3.

The cases occurred in five households which got their milk from a croft where one cow was kept and the surplus milk sold. The milking was done by the sister of the tenant of the croft and by Mrs T. I obtained samples of stools and urine from both. There was no history of either having passed through an attack of typhoid. The first two sets of samples were reported negative, but a third set which, with some difficulty, I succeeded in obtaining, I had examined in two laboratories and this examination showed Mrs T. to be a faecal carrier. This result was subsequently confirmed by a number of examinations of her stools. As stated she had no history of ever having passed through an attack of typhoid or of ever before having any association with typhoid. She had had an attack of influenza in the winter of 1916–17, but the symptoms were very indefinite.

In November of this same year (1917), Mrs T. went to keep house for a friend for a few days when the latter was away on holiday, and five weeks later a lodger in the house, a lad of 20, was removed to hospital suffering from typhoid.

As Mrs T. had no adequate means of livelihood without doing work which involved the handling of food, the District Committee agreed, on my recommendation, to make her an allowance of 10s. a week on condition of her abstaining from any kind of work connected with food or with nursing. This she accepted, and drew the allowance till her death which took place in 1920.

1918.

*Case 12. Mr M., tenant of Farm N.*

The following outbreaks had been associated with this farm during the tenancy of Mr M.:

1901. June 6th. Farm servant, aet. 18. (This case went home ill and infected several members of his family.)  
 1915. — Son, aet. 8.  
 1916. — Farm servant, aet. 16.  
 1917. Nov. 29th. Farm servant, aet. 42.  
 Dec. 1st. Farm servant, aet. 16.

In connection with the outbreaks in 1916 and 1917, samples of stools and urine from Mr M. and his wife and son, were examined—one set in 1916 and two in 1917—but were reported negative. In 1918, I obtained other samples although no other outbreak had occurred in the interval as I felt convinced that Mr M. was a carrier. He was not married in 1901 when the first outbreak occurred and he alone therefore had been at the farm on the occasion of all the outbreaks. As I anticipated, the stools of Mr M. proved positive. No further case occurred at N. till 1922 when a maid-servant became ill, went to her home in Aberdeen where her illness was found to be typhoid and she was removed to hospital. I failed to obtain samples of stools from Mr M. in connection with this last case, but the examination of a sample of stools in connection with another case which occurred in 1923 showed that Mr M. was still a carrier.

*Case 13. Mr S., crofter, occupying croft of B. of A.*

Mr S. worked in his spare time on farms in the neighbourhood, and it was observed that he had been working at three places at the time when cases of typhoid had occurred there. He was in this way associated with the following outbreaks:

1912. Farm A.—four cases.  
 Aug. 9th. Farm servant, aet. 30.  
 Sept. 20th. Son of previous case, aet. 4.  
 Oct. 18th. Farm servant, aet. 16.  
 18th Domestic servant, aet. 16.  
 1914. Farm B.—five cases.  
 Oct. 27th. Farm servant, aet. 24.  
 28th. Farm servant, aet. 29.  
 31st. Farmer, aet. 38.  
 Nov. 26th. Female servant, aet. 27.  
 30th. Female servant.  
 1917. Farm C.—one case.  
 Sept. 21st. Female, aet. 50.

For this last case I could find no possible cause apart from the fact that Mr S. whom I knew to have had an attack of typhoid a number of years before, had been working at the place for some time and would have been there at the probable date of infection. I obtained two samples of his stools and urine and they were examined, one on November 12th and the other on November 24th, 1917, but both were reported negative. I retained the conviction, however, that Mr S. was a carrier, and in September, 1918, though no fresh cases had been associated with him, I obtained further samples from him as also from his wife and daughter, who also had had typhoid fever at the time of Mr S.'s attack, and had them examined in two laboratories. The stools from Mr S. proved positive. No further case was associated with him till 1922 when a boy, a grand-nephew, who had been on a visit to Mr S. developed typhoid immediately after his return home. I asked for but did not obtain further samples of stools from Mr S. An outbreak with four cases at a farm adjoining in 1923 was almost certainly connected with Mr S. Samples of stools were again refused.

In illustration of this last case, it may be worth while giving the following history of a farm servant who was associated with four outbreaks of typhoid at farms on which he was working when the outbreaks occurred, but who refused to give me samples of his stools and urine so that I could not definitely determine whether he was a carrier or not. His history certainly pointed very strongly to his being a carrier. It was as follows:

This man (U.) had an attack of typhoid in 1892 and in 1900 two of his sons, in 1907 a daughter (2½ years), and in 1909 another daughter (7 years) all had attacks of typhoid fever. U. was working as a farm servant on the following farms when outbreaks occurred:

- 1905. Farm A.
  - Sept. 1st. Daughter of farmer, aet. 23. Died.
  - Dec. 31st. Boy, child of cottar, aet. 11.
- 1906. Jan. 21st. Daughter of farmer, aet. 19.
  - 21st. Son of farmer.
  - 27th. Domestic servant.
- 1907. Farm L.
  - Jan. 29th. Farm servant, aet. 33.
  - Feb. 7th. Wife of last case.
  - Apr. 15th. Child of U. (cottar house), aet. 2½.
- 1909. Farm A.
  - May 15th. Farm servant, aet. 20.
  - July 24th. Farm servant.
  - Aug. 14th. Farm servant.
- 1911. Farm E. C.
  - Sept. 10th. Farm servant, aet. 17.
  - 20th. Son of farmer, aet. 21.
  - 20th. Daughter of farmer, aet. 15.

In connection with the outbreak at E. C. in 1911, I used my utmost efforts to obtain samples of stools and urine from U., but his wife persuaded him not to grant my request.

*Case 14.* Mr L., aet. 67, retired.

Mr L. had an ambulant attack of typhoid in 1918. He was never confined to bed, but his blood and stools were positive. His wife had an attack at the same time which proved fatal. Mr L.'s stools continued positive for a number of months and were still positive when the examinations were discontinued. No case of typhoid, however, has been associated with him.

In 1922, in connection with an outbreak of what proved to be para-typhoid fever in a house near by, I took the occasion to have a series of samples of Mr L.'s stools examined. All proved to be negative.

The infection to Mr L. and his wife came from a neighbouring farm through the milk which was the source of the epidemic in Aberdeen in 1918.

*Case 15.* Mrs P., aet. 33, residing in the village of P.

Mrs P. had an attack of typhoid in 1917 along with two of her children. She was treated in hospital and discharged only after several examinations of her stools and urine had shown them to be negative. In the following year another child of hers was notified on September 21st and another on November 7th as cases of typhoid. There was a possible source of infection through the milk from a case which had occurred at the dairy where Mrs P. got her milk supply. In view, however, of Mrs P.'s attack in the previous year, I thought it well to have a sample of her stools and urine again examined. The stools proved positive. She has been connected with no case since nor has any further sample been examined.

*Case 16.* A. B., aet. 45, servant at a dairy farm.

A. B. had conducted the dairy operations at Farm F. for a number of years. She had been connected with several cases. A servant girl at the farm had an attack of typhoid in November, 1896, while the tenant of the farm, her first master, died of typhoid in 1909. I endeavoured in 1908 to obtain samples of her stools and urine, but without success. In connection, however, with a case which occurred in 1918 among the customers of the dairy, I succeeded in obtaining samples from her of stools and urine, as also from her master and mistress, both of whom had had typhoid fever. The first two sets of samples were reported negative, but a third set, which I obtained and had examined in two laboratories, showed that A. B. was a faecal carrier. She was immediately removed from all connection with the milk and every precaution taken. No case was subsequently connected with the dairy, which has since been closed, or with her.

In 1920, A. B. attended the City Hospital in Aberdeen for treatment. There her stools were found to give almost pure cultures of typhoid bacilli.

1919.

*Case 17.* Mrs B., crofter's wife, aet. about 60.

*Case 18.* Mr R., crofter, aet. about 75.

*Case 19.* Mrs R., wife of above, aet. about 70.

These three carriers were identified at the same time through an outbreak of typhoid in 1919. Their two crofts were within half a mile of each other. The circumstances of this outbreak were as follows: On May 22nd, two children, brother and sister, age 13½ and 12, were notified from a house in the vicinity of these crofts as cases of typhoid. Their mother had been for six weeks previously nursing a man who had been suffering from what had been diagnosed as an attack of influenza. This man was a son-in-law of Mrs B. and worked on her croft, but had a home of his own. I had long suspected Mrs B. of being a carrier from outbreaks with which I knew her to have been associated, and her history suggested that this illness of her son-in-law might really be typhoid. I communicated my suspicion to his medical attendant who had a sample of blood taken and examined. The result of the Widal test was positive. Before the contacts could be inoculated, a grand-daughter of Mrs B., a girl of 17, who was acting as a servant to her, was notified from her home, whither she had gone ill, as a case of typhoid. In the course of the investigations, I found that the mother of the two children, first notified, obtained her milk from Mrs R. I knew that Mrs R. also had been associated with two outbreaks of typhoid, and as she and her husband had both had typhoid, as also had Mrs B., I asked for and obtained samples of stools and urine from all of them. The examination showed all three to be faecal carriers. There were therefore two sources from which the children might have received infection, but it was most probably, I think, carried by their mother from Mrs B.'s son-in-law while she was engaged in nursing him.

I may add that the district of M. in which these crofts were situated was in former years noted for its typhoid incidence.

The following were the outbreaks with which Mrs B. and Mrs R. had been previously connected:

*Mrs B.*

1892.	Aug. 26th.	Female, married.	Living in same house as Mrs B.
	27th.	Male, husband of above.	
1893.	Mar. 17th.	Female, aet. 13.	Milk from Mrs B.
	May 26th.	Male, aet. 29.	" "
1897.	July 19th.	Male, adult.	" "
1898.	Sept. 3rd.	Male, adult.	" "
1901.	May 15th.	Female, adult.	" "
1904.	Oct. 10th.	Male, adult.	" "

*Mrs R.*

1893.	June 24th.	Male, aet. 52.	Milk from Mrs R.
	24th.	Female, aet. 10.	" "
	25th.	Male, Mrs R.'s husband, aet. 46.	
	25th.	Female, Mrs R.'s daughter, aet. 16.	
	25th.	Female, girl living in house, aet. 12.	
1903.	Oct. 28th.	Male, farm servant, aet. 18.	

*Cases 20 and 21.* Mr R., farm servant, and his wife.

These two carriers were found in 1919 in connection with an outbreak at a farm where four cases occurred and where the man was a farm servant.



He and his wife had passed through an illness two years before which was almost certainly typhoid though not diagnosed as such at the time. Both were found to be faecal carriers.

*Case 22.* Mrs B., aet. 70, widow, living with two grandchildren in the village of C.

In 1918–19 the following outbreak of typhoid occurred in this village:

1918.	Sept.	27th	Female,	aet	44.
	Nov.	13th.	„	„	13.
		16th.	„	„	5.
		22nd.	„	„	2.
1919.	Jan.	3rd.	„	„	8.
		17th.	„	„	9.
		18th.	„	„	6.

The source of the outbreak was for a time very difficult to ascertain. No connection through milk could be found between the cases. Samples were obtained from all the milkers involved in the different supplies, but they proved negative. Later, information was given to me by the mother of two of the cases that the two grand-children of Mrs B., who lived close to her, had had prolonged illnesses in August and September, 1918, which were unattended by a doctor. I found on enquiry that the symptoms in these cases pointed to typhoid, and this was fully confirmed by the examination of samples of blood from each of the two children, the blood giving strongly positive Widal reactions. They had really been the first cases in the outbreak, and the other cases could be linked up with them. The grandmother had had a very severe attack of typhoid seven years before during the epidemic in Peterhead where they were then living, as also had her husband and three of the family, one of the family dying. Mrs B. readily agreed to give me samples of stools and urine and the examination of these proved her to be a faecal carrier. She had only come to the village of C. six months before, having lived from the time of her attack up to that date in the town above mentioned, but she had not been associated there with any outbreak of typhoid.

I may add that nearly all the children in the village and some of the adults, about 85 in all, were inoculated as a preventive measure before the discovery of Mrs B. as a carrier. Mrs B. has since died.

It may be worth recording here the facts regarding two farms in the county at which the occurrence of outbreaks over a long series of years pointed clearly to the presence of carriers. One of these was Farm B. in the A. District, occupied by Mr R. Here for thirty years, prior to 1894, outbreaks of typhoid had occurred so frequently that in the district the illness came to be known as the “B” fever. As happens in such cases, it was the new servants chiefly that took the disease. Many of them, going home ill, carried infection to their families. The number of cases of typhoid directly or indirectly connected with B. was put in the district as high as 50–60. The last case occurred in February, 1893, a servant girl, 15 years of age. A new water supply had been introduced

at the farm a number of years before and the drainage entirely renewed, but this had had no effect upon the incidence.

In 1894, Mr R.'s son succeeded to the farm. No case occurred after Mr and Mrs R. left. I learned recently that Mrs R. had an attack of typhoid fever when she was a girl, and at that time there was a serious outbreak at her father's farm. All the circumstances point to her having been the carrier.

The other case to which I would refer was Farm S. in the D. District. From 1896 to 1906, there had been recurring outbreaks at this farm, as the following table will show:

1896.	Oct.	1st.	Farm servant,	aet. 28.
		1st.	" "	" 16.
		1st.	Domestic servant,	" —
		7th.	Farm servant,	" 16.
		7th.	" "	" 21.
1897.	Sept.	9th.	" "	" 19.
1900.	Aug.	6th.	" "	" 18.
	Oct.	22nd.	" "	" 17.
		30th.	Boy in cottar house,	" 6.
1901.	Feb.	25th.	Farm servant,	" 22.
	Aug.	28th.	" "	" —
1906.	June	3rd.	" "	" 24.
	Aug.	17th.	Domestic servant*,	" 25.
		25th.	Farm servant.	

\* *This case is carrier No. 4.*

The carrier at S. was most probably the housekeeper, Miss G. Mr P., the tenant of the farm, was unmarried. Farm S. was not the only place where Miss G. was associated with typhoid. Cases of enteric had occurred at Farm L. which Mr P. had occupied before going to S., and where also Miss G. acted as his housekeeper. After Mr P.'s death, Miss G. left S. and went to reside at C. There in 1910, enteric fever broke out in a family living in a house adjoining. One of the children of this family, 3½ years old, who was in the way of going into Miss G.'s house and getting food from her, developed typhoid and was notified on October 27th. Two more cases occurred in the house from which the first case, which had not been removed to hospital, was notified, and were reported on November 29th and December 8th. On this occasion I obtained a sample of Miss G.'s stools and urine, but they proved negative, and further samples were refused. One negative result is, of course, inconclusive. Miss G. died some time later, but no cases were associated with her subsequent to 1910, and no further cases have arisen among those closely associated with her during her life.

#### POSITION OF THE LAW IN SCOTLAND IN REGARD TO TYPHOID CARRIERS.

Up to 1919, there was no legal recognition of a carrier. In the Public Health (Pneumonia, Dysentery, etc.) Regulations issued in that year, carriers of dysentery were recognised and certain powers granted in regard to "such as were concerned with the preparation or handling of food or drink for human consumption." By Article 14 of the Regulations, these powers were extended

to embrace typhoid carriers. "The responsible manager of the trade or business is to afford the medical officer of health all reasonable assistance in getting a clinical examination of such person carried out." It does not say what is to be done if the person suspected refused to give the samples of stools and urine necessary to prove whether they are carriers or not. There seems no power to compel them to do so though a suspicion or a reason to believe that a person was a carrier would probably be sufficient to exclude him or her from the work of handling food.

By the Public Health (Infectious Disease Carriers) Regulations, issued in 1921, a Local Authority is given for three months the same powers over a carrier as are given by the Public Health Act over persons suffering from the disease. For the purposes of the Regulations, a person has to be certified as a carrier by the medical officer of health and one registered practitioner, and to be "a danger to others by reason of the probability of his spreading infectious disease." The certificate is to extend for three months, a further certificate to be granted on a re-examination. At any time during the currency of the certificate, the carrier can demand to be re-examined on giving to the medical officer of health of the area not less than 48 hours' previous notice in writing, and if as a result of any such re-examination the person is not certified as aforesaid, the Regulations shall cease to apply to and as respects him.

Two points do not seem to be adequately recognised by these Regulations, first, that, with few if any exceptions, a chronic typhoid carrier remains a carrier for life, and second, that owing to the intermittency of the discharge of typhoid bacilli in the stools, negative results would constantly be obtained and carriers cleared while they still remained dangerous foci of infection. They would not readily thereafter give further samples of stools or urine. Further, there is no power given for an examination of those who are not concerned with the preparation or handling of food or drink for human consumption.

I am strongly of opinion that power should be given to obtain samples of stools and urine compulsorily where these are refused and where the evidence is such as would justify a warrant being granted. Removal to hospital for a limited time might be required so as to ensure a proper examination. Refusal to grant samples has more than once interfered with the complete investigation of important epidemics, such for example as that in Aberdeen in 1912. Certain facts that came subsequently to light added probability to the source of this epidemic being infection of milk from a carrier. I discovered some years after that the woman suspected of being the carrier in 1912 was, in 1892, associated with an outbreak of typhoid—six cases in four families—in a small village to which at that time she supplied milk. Only one sample of stools and urine was obtained from her in 1912, and further samples were refused. The sample was negative, but one negative result is, of course, inconclusive. Dr Hay<sup>(4)</sup>, in his *Report* upon the epidemic, says that he had a personal interview with

the Medical Member of the Local Government Board as to whether the law gave power to obtain such samples compulsorily. The latter was inclined to think that the Public Health Act did give the necessary power, but admitted that, although cases presenting a similar difficulty had previously arisen, the Board had as yet not seen its way to advise the adoption of compulsory measures. Dr Hay adds, "it is doubtful if there is legal power to compel such examination."

I frequently have been refused samples where the evidence pointing to a certain person being a carrier and the cause of an outbreak seemed very strong. Such refusal of samples is not likely to grow less as powers over carriers are increased.

If, as the result of a bacteriological examination, a person is certified to be a carrier, and his or her living is interfered with, compensation should be given for any loss incurred thereby, and proper provision should be made, if required, for their maintenance. This expense should not devolve on Local Authorities, but should be borne, partly or mainly, by the State. One reason that may be noted in passing is that carriers are more likely to be identified in rural areas, and that too much of the burden would fall upon such areas, while the discovery and control of carriers is equally important for the towns in view of the danger of milk epidemics. The whole question is one that should be dealt with on the most comprehensive lines.

#### CONCLUSIONS.

1. That the chief source of typhoid fever and the sole cause of its remaining endemic in a rural area is the presence of carriers in that area.
2. That almost all these carriers are faecal.
3. That when the carrier condition becomes chronic, recovery seldom, if ever, takes place, as far as our present knowledge goes.
4. That the law dealing with typhoid carriers requires expansion of the powers conferred.
5. That proper provision should be made for the maintenance of typhoid carriers where their means of livelihood has been interfered with, and that this should be done mainly by the State.
6. That every effort should be made by the Government to encourage and co-ordinate work directed towards finding a cure.

The problem of the cure of carriers is perhaps the most important of all Public Health problems of the present time. As the *Lancet* puts it in a leader of November 13th, 1920: "The 'carrier' problem in infectious disease is one of the most difficult and, at the same time, one of the most urgent questions from the point of view of the hygienist, the bacteriologist, and the medical practitioner. It is incidentally one of great interest to the Public, although it may be doubted whether that interest has yet been sufficiently aroused.

Nor is the time quite ripe for insisting upon public education, since it must be confessed that efficient methods of discovering the carriers and of rendering them innocuous have yet to be evolved."

In conclusion, I take leave to say that the more my experience of administrative work in a rural county has been, the more am I convinced that rural areas offer opportunities for the elucidation of epidemiological problems such as cannot be got in crowded cities, and this holds more particularly in the case of typhoid and diphtheria.

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