

THE S I S  
F O R  
M. D. E X A M I N A T I O N.

SUBJECT:- Notes on Cases of Toxic Scarlet Fever;  
with reference to the decline in the  
fatality of Scarlet Fever.

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In the seventeenth century, when scarlet fever was first mentioned by Sydenham, the disease apparently was of a very benign type, and probably would have corresponded to the mild case of scarlatina simplex of the present day. Throughout the eighteenth century and during the greater part of the nineteenth century, though the milder forms were undoubtedly present, the prevailing type appears to have been that of scarlatina anginosa which developed at intervals into epidemics of great fatality.

Until the latter part of the eighteenth century the history of scarlet fever is obscure, but among the various records, many instances occur where the disease proved fatal very early in the illness. In the outbreak of throat disease in North America (1735) the first cases are stated to have died on the third day and it is also recorded that some died quickly as if from prostration. Withering (1778) in his records mentions that the worst cases died as early as the second day while Graves (1834) in his remarks on the Dublin outbreak of 1801-4, records that many cases terminated fatally as early as the second day.

From Willan (1786) comes the first attempt to classify the various types of scarlet fever, which he does as follows: scarlatina simplex; scarlatina anginosa; scarlatina maligna; and sore throat without eruption.

The/

The modern classification of scarlet fever is closely similar to that given by Willan.

The various forms of scarlet fever may be given as follows: -

(1). - Mild Forms. These may vary from the case in which the symptoms are so slight that certain diagnosis is difficult to the average well-marked case of scarlatina.

(2). - Severe Forms. These are divided into (a) septic scarlatina, which is the type usually known as scarlatina anginosa. In this type the severity of the illness is caused by the septic condition of the throat, which in addition to the local ulceration, produces a more or less general septicaemia. Of the severe forms of scarlet fever this type is the most common and may terminate fatally in from one to four weeks according to the severity of the attack. (b) Toxic scarlatina - This is the type which is usually referred to as scarlatina maligna and which, fortunately, is not common. In this fatal type of the disease the throat symptoms are not usually prominent, the prominent feature of this form of the disease being the profound toxæmia from which the patient suffers. The illness terminates fatally in from one to four days.

It is from the severe forms of scarlet fever that the mortality of the disease mainly arises.

Toxic scarlet fever may be divided into three sub-types (Ker) :

(1). The fulminant type which is said to be the real scarlatina maligna. In this type death may occur in from 24--36 hours.

(2). The adynamic type in which the symptoms only differ from the fulminant type in degree, death usually occurring in from 2--4 days.

(3). The ataxic type which presents the same symptoms, though in a lesser degree, but differs in that the cardiac symptoms are more pronounced, death usually occurring in from 3--5 days.

As the cases of toxic scarlet fever about to be related conform with the text-book descriptions of this type of disease, the main features may be shortly given here.

The onset is sudden and great prostration is evident from the very beginning of the illness. Intense headache, sickness and vomiting, diarrhoea and sore throat are the usual initial symptoms. The condition of the throat is usually out of all keeping with the severity of the general symptoms. The rash is very often absent as the case may terminate fatally before the eruption has become apparent. If it does appear it is often badly developed and of a dusky appearance and may be patchy in character. The temperature is usually high in the initial stages and delirium/

delirium may be present to a greater or less degree. The duration of the illness is so short that a diagnosis is often difficult to make and will depend greatly on the knowledge that the patient has been exposed to infection or on the presence of other cases in the family.

The symptoms of headache, sickness and vomiting and diarrhoea may be so prominent as to excite a suspicion of some form of irritant poisoning. This fact is emphasised in practically every text-book and is mentioned by Sir Thomas Watson in his Lectures on the Principles and Practice of Physic (1843) as follows:- "sometimes the patient sinks at once and irretrievably under the virulence of the poison and life is extinguished in a few hours. This may be from the large doses of poison imbibed. The phenomena are analagous to those of the poisons properly so called".

Cases of toxic scarlet fever being fortunately a comparatively rare occurrence, recent medical literature for that reason contains few references to this type of the disease. Most of the references illustrative of this type are to be found in the various text-books on acute infectious diseases.

In the county area of Lanarkshire there have been few cases of the toxic type during recent years, more than eighty per cent of the cases of scarlet fever being classified as belonging to the mild form. In the year 1913 two cases of toxic/

toxic scarlet fever were admitted to hospital in the Lower Ward district while in 1914 three cases were admitted to hospital in the Middle Ward district.

In 1922 during the prevalence of a very mild type of scarlet fever in a small mining village in the Upper Ward district, three deaths, all of whom were children, occurred in one family after a very short illness. On visiting the affected family the remaining cases were diagnosed as scarlet fever one of which was of the toxic type. It was considered probable that the three deaths had been due to the same type of the disease. The outbreak caused some alarm in the village and found mention in the daily press. Unfortunately the Public Health Department of the district were only notified of the occurrence after the third death had taken place.

As far as I have been able to ascertain this has been the only instance in the Upper Ward district for some considerable period of time of an outbreak of toxic scarlet fever limited to a single family.

On Saturday morning, 30th September, 1922, I received a visit from the medical practitioner in the small mining village of Douglas Water. During the week, in his practice, he had had three deaths, all children, in one family, in the village. Each case had presented the same initial/

initial symptoms - pyrexia, sickness and vomiting, headache and sore throat. Each case had died after an illness lasting about 48 hours and having a certain degree of delirium before death. The third death had occurred the previous evening (29th September) and at the time of his visit to me two other members of the family were ill and exhibiting symptoms similar to the previous cases.

The village proper consists of approximately 199 houses and has a population of roughly 1000 persons. 158 of these houses are built of brick with slate roofs and consist of one room and kitchen with scullery and are erected in rows. The water supply is by gravitation but is not laid on to the houses, the water being drawn from stand-pipes distributed throughout the rows. There are no sinks and the drainage for slop waters is underground with surface gratings. The sanitary accommodation consists of ashpits with pail closets.

11 of the houses are privately owned and vary in size and are provided with modern conveniences.

30 of the houses were recently erected by the Local Authority. These houses are double cottages constructed from material of government hostels and consist of two rooms and kitchen with scullery, bath and water-closet.

On visiting the village I found that the affected family/

family resided in one of the new houses erected by the Local Authority. They had recently come to the village from a hamlet several miles distant and the household had consisted of the father and mother and nine children (three of whom were now dead) and had been as follows:-

|                     |   |        |
|---------------------|---|--------|
| Father              | - | (A.L.) |
| Mother              | - | (M.L.) |
| Annie (9)           | - | dead.  |
| James (7)           | - | dead.  |
| Archie (8)          | - | dead.  |
| John (10).          |   |        |
| Alexander (11).     |   |        |
| Margaret (4).       |   |        |
| George (3).         |   |        |
| Robert (1-3/12ths). |   |        |
| Jean (4/12ths).     |   |        |

From the parents the following information regarding the children who had died was obtained:

(1). - Annie L. (8). This child took ill suddenly on Monday evening, 25th September, with headache, sickness and vomiting. Next morning, (26th Sept)., she complained of a sore throat and also of pain in the left side of the chest which was stated by the medical attendant to be due to an old pleurisy. The tongue was very dirty. No rash was noticed but the mother stated she had noticed a few reddish "spots" on the child's chest. She became rapidly worse diarrhoea being present and latterly control of the bowels was lost. She died about 12 o'clock on Wednesday, 27th September, after an illness lasting about 42 hours.

The certified cause of death was "catarrhal pneumonia".

(2). - James L. (7). This child took ill suddenly on Tuesday morning, 26th September with headache, sore throat, sickness and vomiting. The face was flushed and the tongue was dirty. No rash was noticed. Diarrhoea was present later and the child's condition got quickly worse and he died on Thursday 28th September, about 5 p.m. after an illness lasting about 56 hours.

The certified cause of death was "influenza (virulent)".

(3). - Archie L. (8). Illness began suddenly on Thursday, 28th September with headache, sore throat, sickness and vomiting. The tongue was dirty and lips dry. The face was flushed and in this case marked circumoral pallor was noted by the parents. No rash was seen. Diarrhoea was present. The child got rapidly worse and died about 10.45 p.m. on Friday, 28th September, after an illness lasting about 36 hours.

The certified cause of death was "acute gastro-enteritis".

In each of these three fatal cases the initial temperature was stated to have been 102° F. and a degree of delirium was present in each case before death.

The two patients who were suffering at the time of visit were the mother, (Mrs. L)., and the eldest boy, (Alexander L).

Patient 1. - Mrs. L. - This patient stated that on Wednesday, 27th September she first began to complain, suffering from headache. On the following day, (28th)., the headache was very/

very much worse and she complained also of a sore throat. Sickness and vomiting were also present that day, - two days before I saw her. On examination the face was flushed and her temperature was 102.5° F. Pulse, 120 per minute and of good tension. The tongue was furred and dirty and showed no signs of "peeling". The pharynx and tonsils were very red and much congested and a small patch of exudate was present on the right tonsil. No evidence of any rash could be seen and patient stated that none had been observed by her. The skin was warm and dry. The submaxillary glands were swollen and tender. Heart, lungs and abdomen appeared normal. There was no diarrhoea. The pupils were medium in size and reacted normally to light. Patient complained of her throat being very painful and that she had been spitting up a good deal of mucus. The headache was now very much better. She was quite clear mentally and appeared to be recovering from her illness. This was the third day of the disease.

Patient 2. - Alexander L. (11). This boy took ill suddenly on the night of Friday, 29th September, with severe headache, sore throat, sickness and vomiting. No diarrhoea was present at that time. On examination the face was flushed and nasal discharge was present of a thin watery character. Temperature was 103.5° F and the pulse was 130 per minute and very soft. The tongue was furred and dirty and/

and his lips were dry. The pharynx and tonsils were very red and congested but were quite clean. The pupils were medium in size and reacted normally to light. No definite rash was apparent but a faint flush, indefinite in character, was present on the arms, thighs and legs. The skin was warm and moist. The heart sounds were soft and rapid and the lungs and abdomen appeared normal. No pain or tenderness was apparent on palpation of the abdomen. Diarrhoea had commenced that afternoon (30th) and the stool seen was of a dirty green colour and of a bad odour. The child was quite conscious and complained of his throat being very painful and answered clearly when spoken to but prostration was marked and the child appeared to be very ill and in an extremely toxic condition. This patient was still in the first 24 hours of his illness.

DIAGNOSIS. - Scarlet fever of a very mild type had been present in the village since the beginning of the year. In these two cases and in the three fatal cases, headache, sickness and vomiting and sore throat were the initial symptoms in each case, the similarity being marked. These symptoms, in conjunction with the knowledge of the prevalence of scarlet fever at once suggested this line of investigation. A case of scarlet fever had been removed to hospital from the village a week previously. On enquiry, however, no contact with this case/

case could be made out. On further enquiry it was found that one of the family, (Margaret L. - aged 4), had been dismissed from hospital, - having suffered from scarlet fever, - on 14th August, 1922, about six weeks previous to the sickening of the first fatal case. Considering the history of the above cases, along with that of the fatal cases: (1) the similarity of the initial symptoms in each case: (2) the presence of scarlet fever in the locality: (3) the recent case of scarlet fever in the family: (4) the evidently infectious nature of the illness: (5) the rapidity with which the cases proved fatal: and (6) the presence of the faint, indefinite flush on the arms, thighs and legs of patient No. 2, I came to the conclusion that the fatal cases had been, in all probability, cases of toxic scarlet fever, and that, of the two present patients, Alexander L., was suffering from the same type of the disease, while Mrs. L. was probably now recovering from a sharp attack of scarlet fever of the ordinary type.

Both patients were removed to the County Hospital, Motherwell where the diagnosis was confirmed. On removal to hospital these cases passed out of my care.

A point of interest in connection with the diagnosis of these cases was the opinion that the illness had been caused by some irritant poison. It was stated that the children of the village, amongst whom were the children of this family, had bought and eaten a quantity of small, hard pears two days before the/  
the/

the onset of the illness of the first fatal case in the family. This statement was investigated but no evidence was found to support the suspicion of poisoning from that source.

The following note of the later condition of the two patients after admission to hospital was given to me by the Physician-Superintendent of the County Hospital, Motherwell:

(1). - Mrs. L. Urine contains a trace of albumen. On October 3rd temperature and pulse were normal and desquamation had commenced on the upper arm and lobes of the ears. She made an uninterrupted recovery and was discharged on November 1st.

(2). - Alexander L. Urine contains a trace of albumen. Bowels are loose and still greenish in colour. Twelve hours after admission he was still quite conscious but the diarrhoea was worse and pulse increasing. The temperature had dropped one degree. A faint macular rash was beginning to appear on the chest and the tongue was commencing to "peel" at the tip. In the evening (1st October), he became delirious and got much weaker in a few hours and died 30 hours after admission, after an illness lasting about 48 hours.

A culture from the throat showed short chains of streptococci and some gram-positive cocci.

On lumbar puncture the fluid was clear and sterile. A blood culture was sterile. Leucoctyes numbered 15000 and blood films showed nothing abnormal in the red cells.

SUBSEQUENT CASE. On Monday morning, 2nd October, I again visited this family which now consisted of the father, John L. (10), George L. (3), Robert L. (1-3/12) and the infant Jean L. (4/12). (I had allowed the child, Margaret L., to be removed by the grandmother to an isolated cottage several miles distant on the night of the 30th September.) All appeared well with the exception of Robert L.

Patient No. 3 - Robert L. (1-3/12ths). This child looked ill and feverish and had been sick and vomiting during the previous night. The pharynx and tonsils were congested but quite clean. The tongue was furred and dirty. Temperature was 103° F and the pulse 122 per minute and of good volume. The heart, lungs and abdomen were normal. No definite rash was noted though a diffuse redness was present over the buttocks the area of which coincided with the wet napkin in which the child was lying. He was removed to hospital and later developed a scarlatiniform rash and by the 5th October desquamation was typical and the tongue had "peeled". He was discharged from hospital on the 29th November.

The same night, (2nd October), I was asked to see George L. (3), who was stated to have been sick and vomiting during the evening. His tongue was furred but the throat and tonsils were clean and appeared normal. No sore throat was present. No rash was seen. Temperature was subnormal. Pulse was 90 per minute and of good volume. This child was removed to/

to hospital for observation and later was discharged as a negative case on the 19th of October after 17 days observation.

Out of this family of 11 persons, 4 had evidently died from scarlet fever, while 2 mild cases had recovered. Counting the previous case in the family, a total of 7 cases had occurred, and those who escaped the disease were the father, John L., George L., (negative case), and the infant Jean L.

The contacts in connection with these cases were nine in number and all, except one, were within the district. No cases developed in the village that could be definitely connected with this household as it was impossible to exclude other possible sources of infection. No cases developed amongst the contacts outwith the village.

On investigating the circumstances in connection with a case of scarlet fever which occurred in the home of one of the contacts, the following facts were elicited. This contact had been a friend of Mrs. L., and had assisted in nursing the family until the 30th September, when the diagnosis of scarlet fever was made. She had also assisted in the cleaning of the house after disinfection. The case which occurred was a child, (7 years), and this was the first case to be notified after the removal of the last patient from the family of L. The last L. case was removed on the 2nd October and this case was notified on the 16th October. On investigation/

investigation no case of suspicious illness could be discovered, but it was found that the mother had returned to the house of Mrs. L. on the 11th October in order to get clothes for those of the L. family in hospital, and again she had returned to the house on a similar errand on the 14th of October. Her child took ill on the 16th October.

Infection in the Family of L. - Previous History. -

None of the family had had scarlet fever before. There was a history of pulmonary tuberculosis from the mother's side - her brother undergoing treatment at the time in a sanatorium. Also, John L. was a notified case of pulmonary tuberculosis and, for a period of six months, had undergone sanatorium treatment, returning home in the month of June.

This family came to reside in Douglas Water in May, 1922. They had escaped the infection in the village until July, though the children were mixing with other children and five of them were attending school. The first case in the family was the child Margaret, aged 4, who was not attending school. She was notified and admitted to hospital as a case of scarlet fever on 4th June but discharged on the 26th of June as a negative case. At that time she was in good health and no evidence of any nasal or aural discharge was seen. It was/

was stated that she remained well until the 3rd of July when she was again notified and admitted to hospital as a case of scarlet fever. She was discharged on the 14th of August as a typical mild case after a period of six weeks isolation in hospital. On discharge desquamation had finished and no nasal discharge or otorrhea was present. Six weeks later the first fatal case in the family sickened. During that month (September), 5 cases of scarlet fever had been notified in the village but no contact with any of the affected families could be traced. Contact with missed or unknown cases cannot, of course, be excluded.

One views with suspicion the previous case as the origin of this outbreak in the family though there is little evidence to support it. Previous to the 25th September, when the first fatal case sickened, the child Margaret appears to have been in good health and there had been no evidence of any discharge from ears or nose since her dismissal from hospital. When I examined her on the 30th September her throat was clean and nose and ears were dry. There had been no complaint of sore throat. Acting on the assumption that she might have been the origin of the infection in the family, I allowed the grandmother to remove her that night to an isolated cottage several miles away to stay with two adult relatives. On the 2nd October, when I saw her again, nasal discharge of a thin, watery character was present which was attributed/

attributed by her relatives to her having got "cold" during her journey. Her throat was clean and appeared normal. By the 5th of October the nasal discharge had ceased and her nose was dry.

On enquiring into the sleeping arrangements in the house at Douglas Water it was discovered that the child Margaret slept in the same room as the first two fatal cases. She had occupied the same bed as her sister - the first fatal case, - while her brother, - the second fatal case, - occupied a bed by himself in the same room. The third and fourth fatal cases had slept together in the second room while the two mild cases, - R.L. and Mrs. L., - slept in the kitchen.

In recent literature it has been mentioned that there may be in scarlet fever carriers of the infection who present no visible evidence of the disease but who may be infective to others. Such an instance was published lately (Bruce Young) in which the infection had evidently continued in the nasopharynx of the patient after discharge from hospital, for a period of 26 weeks and during that time gave rise to several cases of scarlet fever, though the nose and throat had appeared perfectly healthy.

The presence of the toxic type of the disease in this family is difficult to explain. With the exception of the first toxic case all had been perfectly healthy. In this case there was stated to have been an old pleurisy but no definite history/

history could be obtained regarding this. Increased susceptibility from lowered vitality due to the tubercular taint in the family would have led one to suppose that the boy, John L., (a case of tuberculosis) should have contracted the disease, but on the other hand, it might be said that his residence in a sanatorium had increased his resistive powers. Also, in the presence of such a virulent infection, one would have expected the infant in the family to contract the disease.

The virulence of an organism may be increased by passage through susceptible animals or by sub-culture on suitable media. Assuming that the first mild case in the family may have suddenly become infective it is feasible that the organism, having lived on a suitable medium and sub-cultured on to the same medium, i.e., another member of the same family, might have developed an increased virulence towards that family and produced in it a fatal type of the disease.

Opinions differ as to the part that blood-relationship may play in the causation of a fatal type of the disease. In recorded cases illustrative of this question, emphasis is laid on the fact as to whether or not, a member of the household --- not a relative --- escapes the infection. It appears, in most instances, that if this member of the household does escape the infection, blood relationship is supposed to play some/

some part, while if the disease is contracted, blood relationship is not supposed to have any part in the causation of this type of the disease.

Both of these suppositions, however, may be influenced by other factors. For example, this member of the household may have a degree of immunity conferred on him or her by age or by a previous attack, and in this way escape the infection, or if the disease is contracted, it is often found that this person is one who has been nursing the patient and thus exposed in a much greater degree to the infection. For these reasons, it may be said that the evidence concerning the part that blood relationship plays, is not conclusive.

It has been stated (Trousseau) that scarlatinal epidemics may be full of danger for an entire population or they may assume that character only for a single family. The malignancy limits itself to a single hearth and in such cases the disease is malignant for all persons within its circle.

In this outbreak a mild infection affected a small community and in a certain family six members one after another contracted the disease, four of whom succumbed to a malignant type of the infection after a short illness.

Such an outbreak as this raises the question of a family pre-disposition to the disease and opinion as to the existence of such appears to be divided. That some families have displayed a susceptibility to this disease has often been noticed/

noticed, as, on exposure to infection, all the children contract the disease, without the malignant type being present, while other families appear to be immune. Also, it is known that, though exposure to infection may have occurred, the disease may not be contracted, while on another occasion, though there has been less exposure to the infection, the disease may be contracted.

Henoch has recorded - "striking to me appears the fact, noted undoubtedly by many other physicians, that if scarlatina breaks out in a family and one of the children dies of the malignant form, very frequently also a second and a third child are taken off under similar conditions and in this way whole families can die out. It appears probable to me that under such conditions the case is one of a mixed infection".

Can this outbreak of toxic scarlet fever, limited to a single family, be said to be an example of a family presenting an unusual susceptibility to the disease?

They had escaped the infection prevailing in the community for a considerable time. During five months they had had every opportunity, apparently, of contracting the disease and in addition they had had the opportunity of contracting it from the previous case within the family.

Outbreaks such as this, limited to a single family, are difficult to account for, especially when the prevailing type/

type of the disease was so mild.

The origin of the infection is difficult to state definitely though suspicion points to the previous case in the family. There was no visible evidence of any infective condition in this child. It was after an interval of seven days from the sickening of the first fatal case that nasal discharge was observed which might have been a simple catarrhal condition.

From the similarity of the symptoms in each case and from the presence of three definite cases of scarlet fever it can be said, with some degree of certainty, that the first three deaths in the family had been due to toxic scarlet fever.

The four toxic cases showed a striking similarity to the text-book descriptions of that form of the disease, even to the suspicion of poisoning as the cause of death.

After this fatal outbreak the prevalence of the disease diminished in the village.

As these cases were investigated from an administrative point of view, the first most important point was the correct diagnosis and after that the removal of the patients to hospital, and the taking of all necessary steps to prevent further spread of the infection.

#### Prevalence of Scarlet Fever in the Village of

Douglas Water. - The disease made its appearance in the village in January, 1922, the first notification being received on the/

the 13th January. This was a girl of 13 years who was reported to have had scarlet fever when two years of age. From March to July, 1921 she had been treated in a local cottage hospital on account of "rheumatism". On the 1st of January, 1922 she had complained of severe pains in her legs. Her doctor was in attendance and on the 11th of January she was again removed to the cottage hospital. Two days later she developed scarlet fever and was transferred to an infectious disease hospital. She was discharged from hospital on the 22nd of February having been a mild case of scarlet fever and returned home. After her arrival there she apparently was the cause of another case of scarlet fever in the family. After careful enquiry the origin of the infection could not be traced. No case of scarlet fever had been notified in the village during the year 1921. Such a case as this would probably lend support to the de novo hypothesis of past years though the possibility of chronic carriers in scarlet fever, just as in diphtheria, should not be lost sight of.

Scarlet fever was present in the village throughout the whole year though during the months of November and December only one case was notified in each month. The following Table shows the number of cases occurring in each month, including the first three fatal cases:

| Jan. | Febr. | March. | April. | May | June. |
|------|-------|--------|--------|-----|-------|
| 3    | 3     | 17     | 5      | 9   | 4     |

| July. | August. | Sept. | Octr. | Novr. | Decr. |
|-------|---------|-------|-------|-------|-------|
| 5     | -       | 10    | 4     | 1     | 1     |

making a total of 62 known cases.

The greatest number of cases occurred during the month of March in which 17 cases were notified, the greatest number notified in one week being 8. With the exception of the toxic cases, the disease during the year was of an exceedingly mild type. In all 38 families were affected of whom 1 supplied 7 cases, 1 supplied 4 cases, and 4 supplied 3 cases each.

Several factors assisted in prolonging the prevalence of the disease. The mildness of the disease probably accounted for a certain number of "missed" cases, one of the chief causes of the spread of infection. This also increased, to some extent, the difficulty of controlling the outbreak. The majority of the cases were so mild that it was difficult often to make it understood that the illness was of an infectious nature.

Several instances also occurred of slight sore throat without any other definite symptom and many of these cases were not attended medically.

Another cause of the protracted prevalence was undoubtedly the large number of susceptible persons. During the previous year no case had been reported, and in the 9 years/

years previous to 1922 a total of only 27 cases had been notified and in four of these years no cases had been reported. The following Table shows the number of cases occurring in Douglas Water and in the Upper Ward District as a whole, during the past 10 years:

|                      | 1913 | 1914 | 1915 | 1916 | 1917 |
|----------------------|------|------|------|------|------|
| Douglas Water        | 3    | 7    | -    | 4    | 5    |
| Upper Ward District. | 185  | 485  | 316  | 265  | 73   |
|                      | 1918 | 1919 | 1920 | 1921 | 1922 |
| Douglas Water        | -    | -    | 8    | -    | 62   |
| Upper Ward District. | 138  | 142  | 163  | 263  | 400  |

The social customs of the people also assisted in the spread of the infection. Living in such close proximity to one another it can readily be understood how easily the disease could be spread as many of the families were related to one another. Hospital accomodation being limited in the Upper Ward District several cases had to be isolated at home and in view of the visiting inclinations of the people, it is not to be wondered at that the disease persisted so long.

Age & Sex Distribution of the Cases. - Children under 1 year are comparatively rarely attacked by scarlet fever and during/

during the year no cases under 1 year of age occurred. The greatest number of cases occurred in the 'second five years of life, and the incidence then declines with each age period. That females are more frequently attacked than males is shown in this small epidemic, as in the total number of cases, females preponderated being 34 or 54.8 per cent. of the total cases while the males numbered 28 or 45.2 per cent. The following Table gives the age and sex distribution:

| Age.       | Males. | Females. |
|------------|--------|----------|
| - 1        | -      | -        |
| 1 - 2      | 3      | -        |
| 2 - 3      | 2      | 1        |
| 3 - 4      | 2      | 2        |
| 4 - 5      | 2      | 3        |
| 5 - 10     | 9 **   | 14 *     |
| 10 - 15    | 5 *    | 6        |
| 15 - 25    | 4      | 6        |
| 25 & Over. | 1      | 2        |

\* Fatal Cases.

Season and Rainfall. - The majority of epidemics take place during the autumn months and in general the prevalence and mortality of the disease is greatest in the autumn, the mortality being highest in the month of October.

In dealing with small numbers variations to the rule are apparent. This small epidemic began in the month of January and the greatest number of cases occurred in the spring months - February, March & April.

The tendency of infection to spread is said to be increased/

increased by deficient rainfall and absence of wind and checked by heavy rainfall. Rainfall by itself can hardly be credited with such a definite effect upon the prevalence of the disease. The influence of deficient rainfall on the prevalence of scarlet fever is not a direct one (Brownlee). There was some evidence (he states) that if a period of deficient rainfall coincided with the epoch at which from a study of the periodicity of the disease, an epidemic was to be expected, the rainfall deficiency increased the magnitude of the epidemic. Deficiency of rainfall was not, however, a sufficient single cause of an epidemic.

The following Table gives the rainfall for the district, the number of cases of scarlet fever notified in Douglas Water and in the Upper Ward district during the past 10 years: -

|                      | 1913. | 1914. | 1915. | 1916. | 1917  |
|----------------------|-------|-------|-------|-------|-------|
| Rainfall in inches.  | 30.80 | 33.65 | 32.05 | 48.30 | 34.35 |
| Douglas Water.       | 3     | 7     | -     | 4     | 5     |
| Upper Ward District. | 185   | 485   | 316   | 265   | 73    |
|                      | 1918. | 1919. | 1920. | 1921. | 1922. |
| Rainfall in inches.  | 34.75 | 31.85 | 38.75 | 39.70 | 30.15 |
| Douglas Water.       | -     | -     | 8     | -     | 62    |
| Upper Ward District. | 138   | 142   | 163   | 263   | 400   |

School. - There were 340 scholars on the roll of the village school. During the month of March, when the prevalence was greatest, the school was kept constantly under supervision and on numerous occasions throughout the year, the whole school or various classes, were examined. At no time was there any evidence of the school being the cause of spread of the infection. In such a village as this the children are as much in contact with one another outside school hours as during school hours. It was noted that no case occurred at that time or indeed during the whole year in any of the hamlets or cottages in the surrounding district from which the children attended the village school. The infection appeared to be centred in the village, and I believe the continual visiting of one another's houses played a much greater part in the spread of the infection than any effect the school may have had. Of the total 62 cases, 32 or 51.6 per cent were of school age.

Milk Supply. - The milk supply was constantly under supervision but at no time was there any suspicion attached to it.

Return Cases. - Fifty cases were removed to hospital being 80 per cent of the total cases. Cases that could with certainty be counted as return cases numbered 2, being 4 per cent.

Fatality of the Outbreak. - The 4 fatal cases have been/

been referred to. These occurred between the 27th September and 1st October. One other death was recorded in the month of November. This was a child who had been admitted to hospital as a mild case of scarlet fever but developed albuminuria and died suddenly after a period of three weeks in hospital. This would give a fatality rate of 8 per 100 cases for the epidemic. This figure, however, is probably a little higher than it should be, on account of "missed" cases. The fatality rate for the whole district for the year is 2 per 100 cases.

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Little or nothing is known of the real origin of scarlet fever and definite knowledge of its early prevalence is lacking. One modern writer (Nash) states - "it is clear that a good many of the descriptions of morbilli given by the Arabian physician, Rhazes, (10th century), are in all probability, severe forms of scarlet fevr". The date of its first appearance in Europe is impossible to guess though it is recorded that the oldest writing, relating probably to an epidemic of scarlatina on the European continent dates from Scicily in 1543, (Hirsch). It would appear, therefore, that scarlet fever was probably present long before the period from which we derive definite records of the disease.

Among/

Among the earliest references to scarlet fever in medical literature are those of Sydenham (1675); Sibbald (1684); and Morton (1694). Sydenham in describing "Febris Scarlatina" records that "it was a disease that might occur at any time of the year but mostly at the end of summer, attacking whole families but more often the children than their elders. It was a mild affair requiring no treatment other than that the patient should stay indoors but not all day in bed." It appears, however, that the disease was occasionally fatal.

Sibbald also records that very few died from this disease but the opinion of Morton, however, was "that this scarlet fever was a form of measles differing only in the form of the rash".

Though the rash and desquamation and the apparently benign type of the disease is described no mention is made of "sore throat", the outstanding symptom of the various epidemics of "throat disease" in the 18th century.

Whether this disease that Sydenham described was really a mild type of scarlatina or not, it is from him that we derive the name scarlatina.

During the 18th century epidemics of "sore throat" and of "sore throat with rash" are recorded. The symptoms are narrated in greater detail and a noticeable feature of these records is the fatality of the prevailing throat disease of that time especially amongst children.

In the earlier part of the 18th century scarlet fever is said to have been present in both Scotland and England, it being recorded/

recorded that "scarlet fever" and "sore throat" was present in Edinburgh and in parts of the surrounding country. The first great fatal outbreak of "throat disease", which is believed to have been scarlet fever, occurred in North America in 1735. The appearance of the rash in this outbreak was such that this fatal disease was named by the people "scarlet fever". The description given by Douglass records the initial symptoms - the condition of the throat, the eruption and desquamation.

The fatality of this outbreak was very marked. The first cases were children all of whom died on the third day and it is stated that of the first 40 cases none recovered.

Among the various epidemics of "sore throat" is found Fothergill's description of a "throat disease" which he calls "sore throat with ulcers" (1746). This epidemic broke out in and around London and was the cause of great mortality amongst children. His description records that "the throat became sore and there was nausea, vomiting and purging. The uvula, tonsils and pharynx were of a florid red with a broad spot or patch irregular in shape and of a pale white colour. Usually on the second day of the disease the face, neck, breast and hands became of a deep erysipelatous colour with perceptible swelling, the fingers in particular being often of so characteristic a tint as at once to suggest an examination of the throat. With the coming out of the rash the sickness, vomiting and purging ceased. The white spots on the throat are now seen to be sloughs and they come first usually in the angles above the tonsils. A degree of delirium/

delirium was present at night. The disease had no crisis but in general, if the patient were to recover, the amendment began on the third to the fifth day when the redness disappeared and the sloughs were cast off".

A similar condition to this was described by Cullen (1784) under the name of Cynanche Maligna and though admitting the similarity to scarlatina anginosa, he was of the opinion that the Cynanche Maligna was a separate disease mainly on account of its greater fatality.

Both Fothergill's "sore throat" and Cullen's "cynanche maligna" were later classified as scarlatina anginosa. "Dr. Fothergill in 1748 was the first to describe as a new and separate disorder, that dangerous form of the complaint which Cullen designates "cynanche maligna". The identity of this affection with genuine scarlet fever has been slowly established by subsequent observers". (Watson).

Towards the end of the century (1778) there occurred an outbreak of "throat disease" which is described by Withering and named definitely by him "scarlet fever and sore throat or scarlatina anginosa", and from this epidemic the modern history of scarlet fever is said to date. After describing the rash and desquamation he states that "the worst cases fell into delirium at the onset, had the scarlet rash on the first and second day and might die as early as the second day. If they survived the rash turned to brown and they would lie prostrate for several/

several days. Then occurs discharge from the nose or ears which continued for many days. When they do recover it is very slowly but they generally lie for a month or six weeks and die at length of extreme debility.

Willian (1786) describes an epidemic in London which appears to have been very fatal amongst children and in which the deaths took place between the seventh and eighteenth day of the fever. He also records that "scarlatina has become more frequent (1797) than any other infectious disease both in town and in many parts of the country, the disease generally occurring in its fatal form." and again (1799) - "scarlatina anginosa was very prevalent and proved fatal in many instances".

The writers of that time appear to have distinguished between the different varieties of "sore throat" and "scarlet fever". This Willan believed to have been merely a distinction between scarlatina simplex and scarlatina anginosa.

This type of scarlet fever appears to have continued until the beginning of the 19th century, when it is found occurring in Scotland and Ireland as well.

"In the year 1801, scarlet fever committed great ravages in Dublin and continued its destructive progress until 1802 but returned at intervals during 1803--4, when the disease changed its character. The epidemic of 1801--4 was extremely fatal, cases sometimes terminating in death as early as the second day". - (Graves).

After the year 1805 comes a period in all three countries - Scotland, England and Ireland, - during which the prevalence of this type of scarlet fever appears to have diminished and it is not until the year 1834 that another great outbreak of a fatal character is recorded. Again it is in Ireland: "the disease called scarlet fever assumed a benign type in Dublin soon after the year 1804 and continued to be seldom attended by danger until the year 1831 when we began to perceive a notable alteration in its character. We now began to hear occasionally of cases which proved unexpectedly fatal and of families in which several children were carried off. Still, it was not till the year 1834 that the disease spread far and wide assuming the form of a destructive epidemic. The severe cases were mixed with others of scarlatina simplex. The violence of the attack lay in the throat affection, the congestion of the brain or the irritability of the stomach and bowels, nausea, vomiting and diarrhoea being early symptoms as in the malignant sore throat with rash of a century before." (Graves).

Scarlet fever was prevalent also in Scotland and England about this time and until about the year 1875 was continuously present in its malignant form in all three countries. The last great fatal epidemic in Scotland occurred during the year 1874--5.

During the 18th and 19th centuries the mortality from this disease amongst children is a constant feature, but probably in those days caused no great comment owing to the prevalence of epidemics of other infectious diseases. In dealing with/

with the mortality from this disease amongst the children of Glasgow the late Dr. J. B. Russell has written: "Were there no epidemic diseases in the beginning of the 19th century but typhus, smallpox and cholera? So soon as registration enables us to ascertain the full facts we find epidemics of scarlet fever, measles and whooping-cough mixed up with those of the major infectious diseases competing closely with them in their contribution to the tale of deaths and no doubt rivalling them in the bulk of disease existing at one time. In the twenty years (1855--74) the number of deaths from scarlet fever was 11,377, from typhus 10,365. In those twenty years the death-rate from scarlet fever on four occasions exceeded 2,000 per million, and on only 3 occasions in typhus. The highest death-rate attained by typhus was 2749 per million in 1865 whereas the maxima of scarlet fever was 2906 in 1863 and 3358 in 1874. Compared with smallpox, scarlet fever had, in eleven of these twenty years, shown a mortality exceeding 3 figures per million, smallpox in only 1. It is evident, therefore, that even in the heroic age of epidemics, if the infectious diseases of children excited no popular remark and led to no organised interference, it was not because they did not exist. or, though existing, were not deadly. They were diseases of children. That was the reason and a sufficient one."

In the year 1874 the total deaths from scarlet fever in Scotland amounted to 6321 and in the year 1875 amounted to 4720. These two years give the greatest number of deaths in/

in comparison with any other two years since the registration of deaths came into force. The total deaths from the disease had never fallen below three figures from the year 1855 when registration commenced until the year 1885 when they numbered 944. With the exception of a slight rise in the year 1886--87 the decline in the number of deaths has progressed steadily until, in the year 1918, the lowest number of deaths yet recorded was reached - viz., 168.

With regard to the prevalence and fatality of the disease few figures are available until compulsory notification of infectious disease was instituted. Since then, however, it will be seen that the fatality rate has shown a definite decline in conjunction with the decline in the mortality rate. Where notification was earliest in force the decrease in the fatality rate is best seen. In Edinburgh, where notification was first in force in this country, in 1880 the fatality rate of scarlet fever was 17.8 per 100 cases, while in 1920 it had dropped to .9 per 100 cases.

Variations in the mortality rate are caused by variations in the morbidity rate and in the fatality rate. By the morbidity rate is judged the prevalence of the disease and by the fatality rate the type of the disease is judged. In showing that, in both urban and rural districts, there is a close connection between the decline in the mortality rate and this decline in the fatality rate, - which would represent a/

a change to a more benign type of disease, I have taken a few of the larger Burghs as examples of urban districts and the County of Lanark (non-burghal) as a rural district. For the purposes of administration the County is divided into three Wards. viz., Lower Ward, population 29,932, area 24,669 acres; Middle Ward, population 218,789, area 186,327 acres; Upper Ward, population 46,701, area 327,013 acres. As it may not be strictly accurate to describe the county area as a rural district, as several small towns are contained in it, I have added figures relating to the Upper Ward district which is the most rural district of the county.

In considering the question of the association between the decline in the mortality rate and the decline in the fatality rate, the mortality, prevalence and fatality of the disease will be considered separately.

Mortality. - In the year 1874 the mortality rate of scarlet fever reached its maximum in Scotland being 186 per 100,000 of the population. Since then it has shown a steady decrease which is one of the outstanding features in connection with the progress of the disease. During the latter half of the 19th century the years of greatest mortality in this country were as follows: -

| Years. | Deaths. | Death-rate per<br>100,000. |
|--------|---------|----------------------------|
| 1859   | 3614    | 126                        |
| 1863   | 3413    | 115                        |
| 1864   | 3411    | 113                        |
| 1869   | 4680    | 147                        |
| 1870   | 4365    | 135                        |
| 1874   | 6321    | 186                        |
| 1875   | 4720    | 137                        |

Table 1 shows the average annual mortality rate for quinquennial periods from 1871 to 1920 for (1) Scotland and (2) England and Wales.

TABLE 1.

| Period: | SCOTLAND:                   | ENGLAND & WALES:            |
|---------|-----------------------------|-----------------------------|
|         | Mortality Rate per 100,000. | Mortality Rate per 100,000. |
| 1871-5  | 106                         | 76                          |
| 1876-80 | 53                          | 68                          |
| 1881-85 | 35                          | 44                          |
| 1886-90 | 22                          | 24                          |
| 1891-95 | 20                          | 18                          |
| 1896-00 | 18                          | 13                          |
| 1901-05 | 9                           | 12                          |
| 1906-10 | 9                           | 9                           |
| 1911-15 | 13                          | 6                           |
| 1916-20 | 6                           | 3                           |

In Scotland, during the above period, the average annual mortality rate shows a steady decrease with the one exception of a slight rise in the period 1911--15, the rates for the individual years being as follows:-

|                                 | 1911. | 1912. | 1913. | 1914. | 1915. |
|---------------------------------|-------|-------|-------|-------|-------|
| Mortality Rate:<br>per 100,000. | 9     | 9     | 12    | 17    | 20    |

In comparing the average annual rate of the period 1871--75 with that of the period 1916--20, it will be seen that there is a reduction in the average annual mortality rate amounting to 94 per cent.

The districts into which Scotland was divided by the Registrar-General for registration purposes was first, town, mainland rural and insular rural districts. In 1871 the town/

town districts were divided into principal, large and small towns making five divisions altogether, while in 1911 the divisions were re-arranged into Larger and Smaller Burghs and County Districts. This latter grouping enables one to follow the decline in the mortality rate to some extent in urban and rural areas.

Table 2 shows the average annual mortality rate per 100,000 in quinquennial periods from 1871 to 1920 for the various Districts of Scotland:

TABLE 2.

| <u>Period:</u> | <u>Town Districts.</u> |               |                        | <u>Rural Districts.</u>  |                 |
|----------------|------------------------|---------------|------------------------|--------------------------|-----------------|
|                | <u>Principal.</u>      | <u>Large.</u> | <u>Small.</u>          | <u>Mainland</u>          | <u>Insular.</u> |
| 1871-- 5       | 142                    | 126           | 115                    | 64                       | 26              |
| 1876--80       | 50                     | 74            | 65                     | 42                       | 12              |
| 1881--85       | 47                     | 42            | 39                     | 17                       | 6               |
| 1886--90       | 30                     | 20            | 21                     | 15                       | 6               |
| 1891--95       | 26                     | 20            | 18                     | 13                       | 6               |
| 1896--00       | 21                     | 19            | 18                     | 12                       | 5               |
| 1901--05       | 10                     | 10            | 8                      | 7                        | 4               |
| 1906--10       | 9                      | 11            | 7                      | 5                        | 3               |
|                | <u>Larger Burghs.</u>  |               | <u>Smaller Burghs.</u> | <u>County Districts.</u> |                 |
| 1911--15       | 16                     |               | 11                     | 11                       |                 |
| 1916--20       | 7                      |               | 5                      | 5                        |                 |

The decline in the mortality is seen to commence in the period 1876--80, and in comparing that period with the previous 5 years, the reduction in the mortality in each of the districts is marked being greatest in the principal towns. A similar reduction in the mortality is seen in comparing the period 1916--20 with the period 1911--15, the reduction in each of the divisions being over 50 per cent but greatest in the Larger/

Larger Burghs, the decrease being equal to a reduction of 56.2 per cent.

Table 3 shows the average annual mortality rates per 100,000 for quinquennial periods from 1871 to 1920, for 3 of the Larger Burghs and the County of Lanark:-

TABLE 3.

| <u>Period:</u> | <u>Glasgow.</u> | <u>Edinburgh.</u> | <u>Dundee.</u> | <u>County of Lanark.</u> | <u>Upper Ward.</u> |
|----------------|-----------------|-------------------|----------------|--------------------------|--------------------|
| 1871-75        | 145             | 145               | 158            | -                        | -                  |
| 1876-80        | 52              | 59                | 28             | -                        | -                  |
| 1881-85        | 66              | 47                | 14             | -                        | -                  |
| 1886-90        | 38              | 23                | 33             | -                        | -                  |
| 1891-95        | 36              | 24                | 6              | 20                       | 15                 |
| 1896-00        | 24              | 23                | 15             | 24                       | 22                 |
| 1901-05        | 11              | 9                 | 4              | 12                       | 9                  |
| 1906-10        | 12              | 11                | 15             | 11                       | 7                  |
| 1911-15        | 17              | 11                | 11             | 14                       | 11                 |
| 1916-20        | 6               | 8                 | 3              | 8                        | 6                  |

From these figures it will be seen that the mortality from scarlet fever has declined in both town and rural districts. Referring to Table 1, and comparing the period 1916--20 with the period 1871--75, it will be seen that in Scotland there has been a reduction of 94 per cent in the average mortality rate. As the greatest percentage of deaths from this disease occurs amongst children under 5 years of age, one can realise what a great saving in child life such a reduction in the mortality has brought about.

In dealing with a smaller number of cases, as in a rural district, it often happens that the mortality of the disease disappears entirely as is seen from the following figures:

Upper Ward District:

| <u>Year.</u> | <u>Cases.</u> | <u>Deaths.</u> |
|--------------|---------------|----------------|
| 1906         | 123           | Nil.           |
| 1917         | 73            | Nil.           |
| 1920         | 163           | Nil.           |

Prevalence. - It is only since compulsory notification of infectious disease commenced that accurate figures as to the prevalence of the disease are available, and it is difficult as yet to make any definite statement as to the decline of the mortality rate in relation to any decline in the prevalence of the disease. In the country of Norway where notification has been longest in force, it has been stated that a slight decrease in the prevalence of scarlet fever has been noticed. Prior to notification becoming compulsory, few local authorities possessed any means of ascertaining definitely the prevalence of the disease. In Edinburgh, however, notification began in the year 1880.

In cities the disease seldom dies out altogether but in rural districts it may disappear for considerable periods of time, many parishes, and even small villages, remaining free from infection for a number of years, as in the case of the village of Douglas Water.

Table 4 shows the average annual number of notifications for quinquennial periods from 1891 to 1920: -

TABLE 4.

|            | <u>1891-5.</u> | <u>1896-00.</u> | <u>1901-5.</u> | <u>1906-10.</u> | <u>1911-15.</u> | <u>1916-20.</u> |
|------------|----------------|-----------------|----------------|-----------------|-----------------|-----------------|
| and        | -              | *21639          | 12843          | 17222           | 23420           | 13320           |
| les        | -              | * 7473          | 4313           | 5164            | 7427            | 4043            |
|            | -              | *14166          | 8530           | 12058           | 15993           | 9277            |
| W          | 3870           | 3639            | 2080           | 2910            | 4447            | 2739            |
| burgh      | 1733           | 1869            | 1004           | 1425            | 1532            | 1178            |
|            | 264            | 509             | 250            | 785             | 788             | 308             |
| of         |                |                 |                |                 |                 |                 |
| k. @       | 1511           | 1606            | 932            | 1386            | 1682            | 1149            |
| Ward. @    | 299            | 326             | 187            | 235             | 263             | 156             |
| ster. 1874 |                | 1810            | 2205           | 2945            | 3026            | 1676            |

\* Period of three years.

@ Period of four years.

Notifications of scarlet fever are available for Scotland as a whole, divided into county and burgh districts, since the year 1898.

In the above Table the rise and fall of the prevalence of the disease can be noticed. Table 5 shows the average annual notifications for two periods of 15 years: -

TABLE 5.

|                      | <u>1891--1905.</u> | <u>1906--20.</u> |
|----------------------|--------------------|------------------|
| Glasgow.             | 3196               | 3366             |
| Edinburgh.           | 1536               | 1378             |
| Dundee.              | 341                | 627              |
| County of<br>Lanark. | 1338               | 1406             |
| Upper Ward.          | 269                | 218              |
| Manchester.          | 1963               | 2549             |

Table 6 shows the average annual notifications in Scotland for two periods of 10 years: -

TABLE 6.

|          | <u>1901--10.</u> | <u>1911--20.</u> |
|----------|------------------|------------------|
| Scotland | 15032            | 18370            |
| Counties | 4738             | 5735             |
| Burghs   | 10294            | 12635            |

In Tables 4 and 5 the town of Manchester has been added for the sake of comparison as being a town outwith Scotland.

In considering these Tables, (4, 5 and 6), it may be said that there is no definite evidence of a decrease in the prevalence of scarlet fever.

Increased prevalence of the disease, however, usually carries with it increased mortality, and though this may be the rule, there are always exceptions to it. Table 7 shows the mortality rate per 100,000, morbidity rate per 10,000, and the fatality rate per 100 cases.

TABLE 7.County of Lanark:-

| <u>Y E A R.</u> | <u>Mortality Rate</u><br><u>per 100,000.</u> | <u>Morbidity Rate</u><br><u>per 10,000.</u> | <u>Fatality Rate</u><br><u>per 100 Cases.</u> |
|-----------------|--|---|---|
| 1919.           | 8  | 35  | 2.1.  |
| 1920.           | 5  | 55  | .9.   |

Upper Ward District:-

|       |   |    |      |
|-------|---|----|------|
| 1919. | 7 | 32 | 2.1. |
| 1920. | - | 35 | -    |

Dundee:-

|       |    |    |      |
|-------|----|----|------|
| 1914. | 16 | 46 | 3.5. |
| 1915. | 12 | 69 | 1.7. |

Glasgow:-

| <u>Y E A R.</u> | <u>Mortality Rate<br/>per 100,000.</u> | <u>Morbidity Rate<br/>per 10,000.</u> | <u>Fatality Rate<br/>per 100 Cases.</u> |
|-----------------|--|---------------------------------------|---|
| 1896            | 20                                     | 38                                    | 5.2                                     |
| 1897            | 19                                     | 41                                    | 4.4                                     |

From these figures it will be seen that there is an increase in the prevalence of the disease but a decline in the mortality. It will be noted, too, that along with the decrease in the mortality rate, there is a definite decrease in the fatality rate.

Table 8 (next page) compares the average annual morbidity rate with the average annual mortality rate for quinquennial periods from 1891--1920.

From this Table it will be seen that there is no constant relation between them and that they appear to be quite independent of each other. A definite increase in the prevalence of the disease may occur with a definite reduction in the mortality while a decrease in the morbidity rate may be accompanied by an increase in the mortality rate.

Fatality. - By the fatality rate is judged the type of the disease whether mild or severe and it will be seen from the following Table that in the general average annual fatality, there has been a steady decrease. The fatality rate can only be calculated since the beginning of compulsory notification.

Table 9 shows the average annual fatality rate for quinquennial periods 1891--1920: -

| Period. | Scotland. |      | Glasgow. |      | Edinburgh. |      | Dundee. |      | County of Lanark. |      | Upper Ward. |      | Manchester. |      |
|---------|-----------|------|----------|------|------------|------|---------|------|-------------------|------|-------------|------|-------------|------|
|         | M.R.      | D.R. | M.R.     | D.R. | M.R.       | D.R. | M.R.    | D.R. | M.R.              | D.R. | M.R.        | D.R. | M.R.        | D.R. |
| 1891-5  | -         | -    | 59       | 36   | 53         | 24   | 16      | 6    | *68               | *20  | *76         | *18  | 36          | 26   |
| 1896-00 | *49       | *18  | 50       | 24   | 59         | 23   | 30      | 15   | 65                | 24   | 82          | 22   | 33          | 20   |
| 1901-05 | 28        | 9    | 27       | 11   | 30         | 9    | 15      | 4    | 36                | 12   | 45          | 9    | 40          | 19   |
| 1906-10 | 36        | 9    | 36       | 12   | 44         | 11   | 46      | 15   | 48                | 11   | 55          | 7    | 47          | 16   |
| 1911-15 | 49        | 13   | 46       | 17   | 48         | 11   | 48      | 11   | 58                | 14   | 60          | 11   | 42          | 12   |
| 1916-20 | 27        | 6    | 25       | 6    | 38         | 8    | 18      | 3    | 40                | 8    | 35          | 6    | 22          | 4    |

M.R. = Average annual Morbidity Rate.

D.R. = Average annual Mortality Rate.

- \* Scotland - Period of 3 years.
- \* County of Lanark - Period of 4 years.
- \* Upper Ward - Period of 4 years.

TABLE 9.

|                   | <u>1891-5.</u> | <u>1896-00.</u> | <u>1901-05.</u> | <u>1906-10.</u> | <u>1911-15.</u> | <u>1916-20.</u> |
|-------------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Scotland          | -              | *3.6            | 3.0             | 2.2             | 2.7             | 2.1             |
| Glasgow           | 6.0            | 4.8             | 4.1             | 3.3             | 3.6             | 2.4             |
| Edinburgh         | 3.4            | 3.1             | 3.0             | 2.5             | 2.2             | 2.1             |
| Leith             | 3.2            | 4.0             | 2.2             | 2.7             | 2.4             | 1.4             |
| County of Lanark. | *2.9           | 3.7             | 3.5             | 2.3             | 2.3             | 2.1             |
| Upper Ward        | *2.2           | 2.7             | 2.1             | 1.2             | 1.8             | 1.5             |
| Westminster       | 7.2            | 5.9             | 4.7             | 3.7             | 2.7             | 1.7             |

\*Scotland - Period of 3 years.

\* County of Lanark - Period of 4 years.

\* Upper Ward - Period of 4 years.

In the figures for Scotland as a whole a slight rise in the average annual fatality rate is seen in the period 1911-15 similar to the increase in the average annual mortality rate for the same period.

In 1881 the fatality rate in Edinburgh was 13.4 per 100 cases and in Glasgow in 1891 was 6.6 per 100 cases, while in 1920 the respective rates were .9 and 1.6 per 100 cases.

The following figures show the decrease in the average annual fatality rate in Edinburgh for four decennial periods:-

|            | <u>1881-90</u> . | <u>1891-00.</u> | <u>1901-10.</u> | <u>1911-20.</u> |
|------------|------------------|-----------------|-----------------|-----------------|
| Edinburgh. | 4.7              | 3.2             | 2.7             | 2.1             |

In considering the fatality, the fatality of hospital cases must be taken into account. In recent years hospital isolation/

isolation has been more and more practised. At the present time the number of cases of scarlet fever treated in hospital in Glasgow is almost 95 per cent of the cases notified, while in London approximately 85 per cent of the notifications are removed to hospital. In the County of Lanark hospital accomodation is more limited than in the cities but the same decrease in the fatality is noticeable. Table 10 shows the average annual fatality in hospital in Glasgow and the County of Lanark for quinquennial periods 1891--1920, while figures for the city of London are added for comparison:-

TABLE 10.

|                   | <u>1891-5.</u> | <u>1896-00.</u> | <u>1901-05.</u> | <u>1906-10.</u> | <u>1911-15.</u> | <u>1916-20.</u> |
|-------------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Glasgow           | 6.0            | 4.6             | 4.0             | 3.2             | 3.4             | 2.2             |
| County of Lanark. | -              | *4.0            | 3.6             | 2.2             | 2.7             | 2.5             |
| London.           | 5.9            | 3.6             | 3.4             | 2.6             | 1.6             | 1.4             |

In the period 1911-15 the above figures for Glasgow and County of Lanark again show a slight increase similar to the increase in the same period in the previous Table.

Before accepting the decrease in the hospital fatality it has to be remembered that the decrease in the fatality might be influenced by a reduction in the number of cases under 5 years of age, the mortality in children under 5 years being the greatest of any age period. Table 11 shows the total admissions, the number of admissions under 5 and the hospital fatality per 100 cases. These figures have been obtained from the Reports of the Metropolitan Asylums Board.

|      | <u>Admissions.</u> | <u>Number under 5.</u> | <u>Percentage of Cases under 5.</u> | <u>Hospital Fatality.</u> |
|------|--------------------|------------------------|-------------------------------------|---------------------------|
| 1--2 | 29042              | 9308                   | 32.3                                | 3.6                       |
| 2--4 | 21500              | 7674                   | 35.6                                | 3.2                       |
| 5--6 | 34891              | 11824                  | 33.8                                | 3.0                       |

From these figures it would appear that the decline in the fatality appears to be independent of the proportion of cases under 5 years contained in the total admission.

It may be said, therefore, that there has been a steady decrease in the average general fatality rate as well as in the average hospital fatality rate.

In Table 12 the average annual mortality rates and the average annual fatality rates are compared in quinquennial periods from 1891 - 1920, - (next page).

In this Table and in previous Tables the mortality rate for the Upper Ward District has been raised to "per 100,000" for the sake of comparison.

From this Table it would appear that the decline in the average mortality rate is very closely connected with the decline in the average fatality rate.

CONCLUSION. - From the figures of mortality it is seen that there has been a marked decrease in the average mortality rate. From the figures relating to the prevalence of the disease it has been seen that there is little or no evidence of any decrease in the number of cases of scarlet fever.

In comparing the average mortality rate with the average morbidity/

1916-20.      1911-15.      1906-10.      1901-05.      1896-00.

|                  | D.R. | F.R. |   |     |
|------------------|------|------|------|------|------|------|------|------|------|------|---|-----|
| Scotland         | -    | -    | *18  | *3.6 | 9    | 3.0  | 9    | 2.3  | 13   | 2.7  | 6 | 2.2 |
| Glasgow          | 36   | 6.0  | 24   | 4.8  | 11   | 4.1  | 12   | 3.3  | 17   | 3.6  | 6 | 2.4 |
| Edinburgh        | 24   | 3.4  | 23   | 3.1  | 9    | 3.0  | 11   | 2.5  | 11   | 2.2  | 8 | 2.1 |
| Dundee           | 6    | 3.2  | 15   | 4.0  | 4    | 2.2  | 15   | 2.7  | 11   | 2.4  | 3 | 1.4 |
| County of Lanark | *20  | *2.9 | 24   | 3.7  | 12   | 3.4  | 11   | 2.3  | 14   | 2.3  | 8 | 2.1 |
| Upper Ward       | *18  | *2.2 | 22   | 2.7  | 9    | 2.1  | 7    | 1.2  | 11   | 1.8  | 6 | 1.5 |
| Manchester       | 26   | 7.2  | 20   | 5.9  | 19   | 4.7  | 16   | 3.7  | 12   | 2.7  | 4 | 1.7 |

\* Scotland - Period of 3 years.

\* County of Lanark - Period of 4 years.

\* Upper Ward - Period of 4 years.

D.R. = Average annual Mortality Rate.

F.R. = Average annual Fatality Rate.

morbidity rate, these rates appear to be quite independent of each other.

From the figures relating to the fatality of the disease it is seen that the decrease in the average fatality rate is closely connected with the decrease in the average mortality rate. As the variations in the mortality rate are caused by variations in the morbidity rate and fatality rate, and as it has been seen that the prevalence has varied little, while the average fatality rate has decreased definitely in conjunction with the decrease in the average mortality rate it would appear that the greatest effect in the decrease of the average mortality rate has been due to a decrease in the average fatality rate, i.e., the mortality from the disease has diminished, being due to a change to a more benign type of disease as at present prevailing. Thus, from these figures, is realised a fact which coincides with clinical experience of the disease.

The causes of the decreased fatality are more difficult to determine. The practice of hospital isolation and in the institution of preventive measures against the spread of the disease, along with increased immunity to the disease; all no doubt have assisted in the decline of the fatality. Improved sanitation is also mentioned as a factor but even in the present day, as in the fatal epidemics of the past, the fatal cases occur alike in the presence of good or of indifferent surroundings.

Along with the decline in the mortality the decrease in the fatality is an outstanding feature in the progress of the disease. While/

While there may have been frequent irregularities in its decline in individual years, the general downward tendency has been steady and considerable.

Another outstanding feature of the disease is that this decline in the fatality has occurred without the intervention of any specific treatment as in the case of diphtheria.

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