

Public Health Then and Now

The Epidemiology of Milk-borne Scarlet Fever: The Case of Edwardian Brighton

JOHN M. EYLER, PHD

Introduction

At the opening of the twentieth century, England's Medical Officers of Health found the control of scarlet fever a constant but frustrating task. Over the previous two generations the mortality from this disease had fallen so dramatically that by the 1890s it was no longer a leading cause of death.¹ But it remained a very common childhood disease, one which could occur in explosive epidemics.² While scarlet fever was the focus of much public health effort, such preventive work was hampered by serious limitations of knowledge. Informed individuals might agree that the disease was communicable, but its cause remained obscure.³ Streptococci had been isolated from scarlet fever patients, but until the early 1920s, in particular with the work of George and Gladys Dick, the role, if any, which these bacteria played in scarlet fever was uncertain.

Consequently, in the period we are considering, physicians and health departments did not routinely employ bacteriological methods for diagnosis, screening, or for supervising isolation of scarlet fever. Cases were diagnosed solely from clinical signs and symptoms, especially from the scarlatinal rash and subsequent peeling skin. No one could be sure what relationship existed between cases which showed these classic signs and others without the telltale rash but having symptoms also found in scarlet fever: sore throat, malaise, feverishness, headache, and nausea. While the more perceptive officials recognized that mild or atypical infections played a role in spreading scarlet fever, no one appreciated the extent to which this was the case.⁴ Under these circumstances, the only available control strategies, isolation and disinfection, were doomed to fail.

The First Strategy: Notification, Isolation and Disinfection

Edwardian Brighton was a prosperous seaside resort of about 120,000 population. Its resort trade and boarding schools depended on the town's reputation for salubrity, and, as a result, the Town Council was quite willing to support efforts which promised to foster the public health. Its Sanitary Committee, the local health authority, maintained a large staff. Following the appointment of the town's

first full-time Medical Officer of Health in May of 1888,⁵ the Sanitary Department worked quickly to establish a comprehensive, modern program to control acute, infectious diseases such as scarlet fever. Measures to control milk-borne contagion were not part of the original strategy. It was only when the first scheme proved inadequate that infected milk was seriously considered.

The original control strategy began with the registration of infectious diseases. After some hesitation, fostered by fears of tarnishing the town's reputation as a health resort and by opposition from lodging-house keepers and local medical practitioners, the Town Council voted on January 15, 1891 to adopt the Infectious Disease (Notification) Act of 1889.⁶ This action meant that beginning on March 1, 1891, under penalty of law, the attending physician or responsible adult was to report to the local Medical Officer of Health every case occurring in Brighton of smallpox, Asiatic cholera, diphtheria, erysipelas, or any one of a list of fevers—among them: typhoid, typhus, enteric, relapsing, continued, puerperal, and scarlet.⁷

The health authorities visited every known case of reportable disease to gather information on the patient, inspect the premises, and give instruction on isolation and disinfection. Cases nursed at home might be visited by Sanitary Department employees regularly during illness and during the compulsory convalescent isolation. At the termination of illness, the health authorities required elaborate, troublesome, and expensive disinfection of the sickroom and its contents.

The law gave local authorities ample means to compel compliance. Individuals who knowingly exposed others to infection or who failed to report infectious diseases could be fined.⁸ The Brighton Sanitary Committee proved willing to act vigorously to enforce the law. It once traced and obtained the maximum fine against a visitor to Brighton who had returned to London by train with a child who had just been diagnosed in Brighton as suffering from scarlet fever.⁹ On another occasion when it learned of an unreported case of scarlet fever in a Brighton home, it voted to prosecute the housewife for failing to report the case and to serve her husband with orders for unusually thorough household disinfection.¹⁰ The wallpaper was to be stripped from the walls of every room in the house, the walls and ceilings of all rooms disinfected, the woodwork washed, and all clothing and bedding delivered to the Sanitary Department for disinfection.

The Medical Officer of Health (MOH) was also empowered to exclude from school scarlet fever patients as well as healthy children from houses where scarlet fever existed.¹¹ In addition, he might close schools entirely to control

Address reprint requests to John M. Eyler, PhD, Associate Professor of History of Medicine and Biological Sciences, University of Minnesota School of Medicine, Minneapolis, MN 55455. Dr. Eyler is a Visiting Associate Professor in the Department of History of Science at Harvard University during the 1985-86 academic year. This paper, submitted to the *Journal* December 26, 1984, was revised and accepted for publication December 6, 1985.

Editor's Note: See also related editorial p 494 this issue.

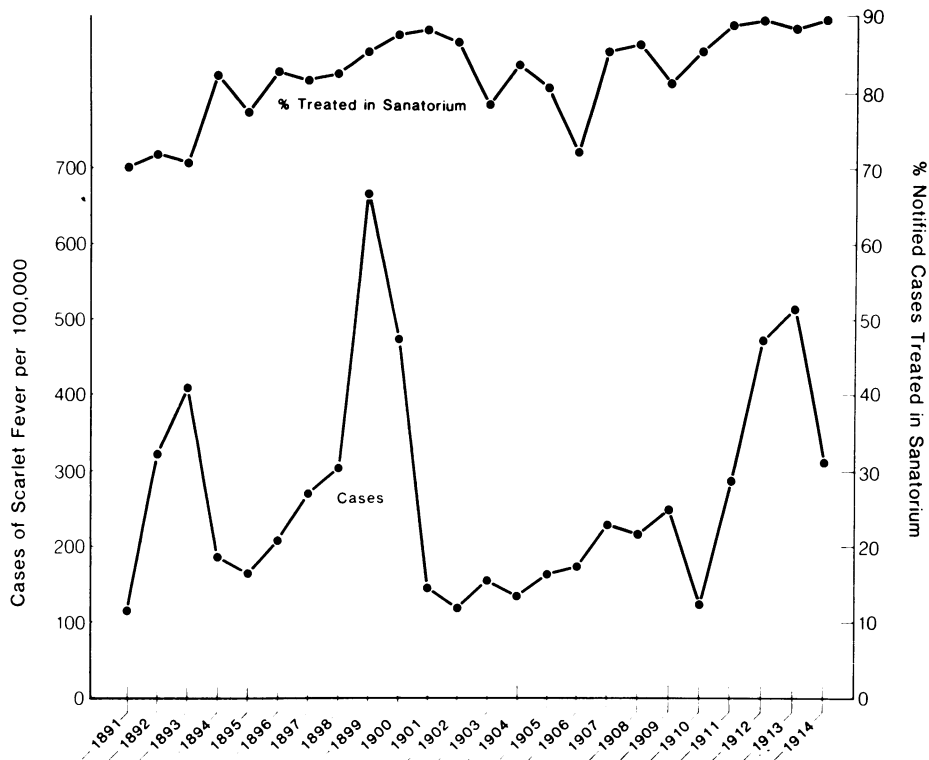


FIGURE 1—Scarlet Fever in Brighton.
Compiled from *Annual Report on the Health, Sanitary Condition, etc. of the County Borough of Brighton*, various years.

epidemics of childhood diseases such as scarlet fever. During 1888 and 1889, Brighton's new MOH visited every school in Brighton to establish a system of exchanging information with school authorities on known cases and on suspicious absences, so that infected children could be barred from school.¹² Despite such precautions, unrecognized cases attended school and caused school epidemics.¹³

Since many patients, perhaps all working class patients, could not be properly isolated at home, the Edwardians' greatest hope of controlling scarlet fever lay in hospital isolation. Faced with a smallpox epidemic in 1881, Brighton had hastily constructed an isolation facility on the edge of town near the parochial cemetery.¹⁴ Over the following decade, these temporary buildings had deteriorated badly. Moreover, their basic design proved inadequate to the more ambitious plans of the town's new Medical Officer of Health. Under prodding from this MOH and from the Borough Surveyor, the Town Council undertook to rebuild and expand Brighton Sanatorium. Between 1896 and 1905, an entirely new complex of modern masonry buildings was constructed capable of accommodating 160 patients in four separate ward blocks. The project was a major civil undertaking for which the corporation incurred debts in excess of £47,000.

Under existing law, persons suffering from dangerous infectious disease who were without means of proper domestic isolation could be removed to an isolation hospital on a magistrate's order.¹⁵ Such compulsory isolation was sometimes used in Brighton,¹⁶ but recourse to these methods was time-consuming and unpopular. The Sanitary Committee preferred to secure voluntary isolation by offering care that was free of charge and means tests and by making commitment more attractive by emphasizing the dangers of keeping

the sick at home. In December of 1891, it abolished fees formerly charged to residents.¹⁷ The Sanitary Inspector's visit to the homes of notified cases provided an opportunity to convince reluctant families to send their sick to the isolation hospital.

Brighton was unusually successful with this strategy. Average annual admissions rose from 311 in the last 10 years at the old sanatorium to 766 for the first 10 years at the new.¹⁸ For no disease was isolation more common than for scarlet fever. As Figure 1 shows, Brighton succeeded in isolating a high percentage of its registered scarlet fever cases. In 1891, the year in which notification of cases became compulsory, 70 per cent of notified cases were admitted to the sanatorium. Within three years, that figure exceeded 80 per cent and, during all but four years, remained between 80 per cent and 90 per cent until the outbreak of World War I—a remarkable record. Before 1900, only Birmingham and Huddersfield of the 33 largest towns had isolated a higher percentage of their scarlet fever cases.¹⁹ Such comprehensive public isolation both shows the vigor of municipal enterprise and reveals that public hospitals were now reaching quite far up the social scale for patients. The town, it seemed, was giving hospital isolation a fair trial.

At first, Brighton's MOH confidently declared this isolation an unqualified success. It was responsible, he claimed, for the decline in mortality from scarlet fever, or at least it was a contributing factor working in conjunction with a natural alternation of the disease strain to a milder form.²⁰ It might also be modifying the epidemic cycle of the disease in Brighton.²¹ But such unqualified optimism soon gave way to more sober reassessments. After a decade of intensive hospital isolation, he conceded that the prevalence of scarlet fever had not fallen as he had expected.²² I have constructed

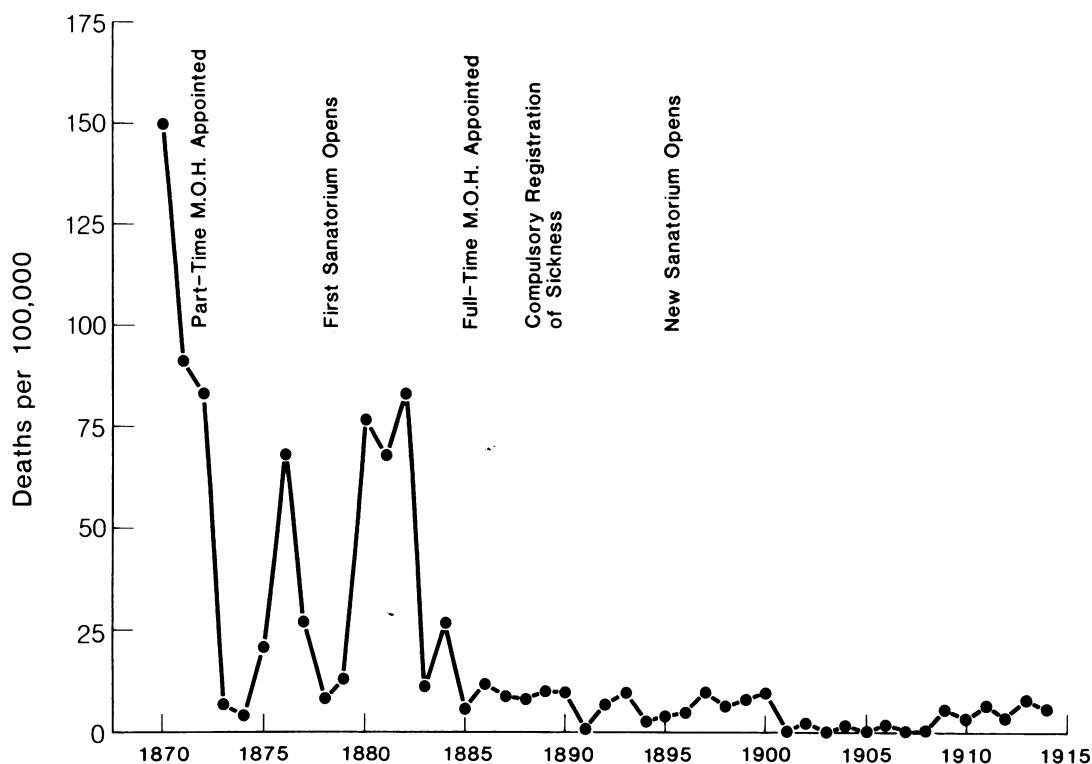


FIGURE 2—Scarlet Fever Mortality in Brighton.

Compiled from *Annual Report on the Health, Sanitary Condition, etc. of the County Borough of Brighton*, various years.

Figures 1 and 2 from the information contained in the MOH's annual reports. While they did not publish such graphs at the time, health authorities were aware that scarlet fever mortality had fallen prior to the initiation of organized public control programs and that even intensive hospital isolation did not prevent the occurrence of serious scarlet fever epidemics.

More troublesome to Medical Officers of Health was the course of individual cases in isolation hospitals. Cross-infection occurred in these institutions. In fact, a cynical Edwardian definition of an isolation hospital was "a place where a patient goes in with one infectious disease and catches all the rest."²³ Deaths following cross-infection might be justified as the cost of protecting the community, if hospital isolation definitely ended the chain of transmission. But it was at this point that serious doubts were appearing. By the mid-1890s, both the public and local authorities were more conscious of what were called return cases, i.e., cases apparently caused by patients recently returned from the isolation hospital. The MOH world was startled when a Birmingham family successfully sued for damages when it experienced several return cases, one of them fatal.²⁴ Every precaution was taken to prevent return cases, such as lengthening the period of isolation, separating convalescent from acute cases, and using baths and chemical disinfection of ears, noses, and throats.²⁵ Still the spectre of return cases hung over isolation hospitals.

In the opening years of the new century, strong critics of hospital isolation for scarlet fever appeared in the public health world.²⁶ They published statistical demonstrations showing that towns which isolated a high percentage of notified cases experienced morbidity, mortality, and case fatality rates for scarlet fever as high or higher than towns

which isolated lower percentages of cases or did not use hospital isolation at all. The critics also suggested that the aggregation of scarlet fever cases in hospitals produced a hospitalized strain of scarlet fever that was more virulent, more infective, and more likely to cause return or secondary cases. These critics were in the minority. The hospitals found many defenders who easily demonstrated fallacies in the critics' arguments.²⁷ Furthermore, the editors of the major professional journals sided with the hospitals' defenders.²⁸ Still the seeds of doubt had been sown.

Between 1900 and 1902, Arthur Newsholme, Brighton's MOH and an accomplished epidemiologist, offered several statistical demonstrations of the value of hospital isolation.²⁹ But he would eventually change his mind. In the middle 1920s, after he had retired from public service, he concluded that the need for isolation hospitals may have been exaggerated a generation earlier and that hospital isolation had not controlled scarlet fever.³⁰ It seems that by 1900 he recognized that hospital isolation would have to be supplemented by other means of prevention. It is probably in this frame of mind that he began to consider seriously what he had formerly only acknowledged as a remote possibility—that scarlet fever contagion could be transmitted by milk.

Epidemiology and the Prevention of Milk-borne Infection

We know for certain that even at the beginning of his career Newsholme knew of reports of milk-borne scarlet fever outbreaks.³¹ But with one exception there is no evidence that he paid much attention to this possibility before 1900. That exception was in December 1890 when he admitted to the sanatorium a scarlet fever case from Falmer, a small community northeast of Brighton.³² This patient was

the child of a cow handler on a farm that supplied milk to Brighton. Fearing milk transmission, Newsholme obtained from the farmer a list of his customers. Since among those customers Newsholme found no cases that he believed were attributable to infected milk, it is impossible to say how he would have responded to a milk-borne epidemic in the 1890s. But by 1900, faced with the realization that hospital isolation for scarlet fever was not living up to its promise, he became keenly interested in the role of milk. The fact that he identified four milk-borne epidemics between 1900 and 1906 makes one suspect that outbreaks caused by milk went undetected in Brighton in the 1890s. In dealing with these epidemics, the Brighton Sanitary Department soon developed efficient administrative measures to deal with milk-borne disease. One measure conspicuously absent from this arsenal was pasteurization. Like their American counterparts, British physicians and public health workers recognized that pasteurizing or sterilizing milk killed pathogenic microbes, but they feared that heating altered milk's nutritive value and made it less digestible by infants. We can sample these attitudes in a revealing and lengthy exchange of letters in *The Lancet* which was initiated by Clements Dukes, MD, FRS, physician to Rugby School and authority on diseases of children.³³ Dukes blamed boiled milk for cases of infantile scurvy and rickets and offered anecdotal accounts of sickly infants who thrived once they were taken off of boiled milk and put on a diet of pure unboiled milk. This exchange shows how rudimentary was the knowledge of nutrition as well as the great reluctance of many experts to tamper with a natural, basic food. As we will see, boiling milk was recommended only once during our four Brighton epidemics, and that recommendation was an emergency measure for private household use. The community milk supply remained unpasteurized in Brighton as in other British towns.³⁴ Brighton's milk supply was produced close to town and in the absence of refrigeration was delivered and consumed soon after production.

The first of the milk-borne epidemics that Newsholme recognized began in early January 1900.³⁵ During the month, scarlet fever was registered in several parts of town. By the twenty-third, Newsholme became suspicious that milk might be involved, for on that day four cases were registered, one of them the child of a milk vendor or dairyman Newsholme identified simply as "A". Newsholme at first concluded milk was contaminated by the vendor. "A" left the cleaning of his milk cans, Newsholme discovered, to two small boys who did the job carelessly. The MOH issued a letter to all vendors urging special care in washing and scalding milk containers and warning them to be certain no one suffering from sore throat or suspicious illness was permitted to handle the milk. Around this time, Newsholme sought the source of milk for the households in which scarlet fever had been reported and found four other cases reported among "A's" customers, one on the twenty-third and one each on the tenth, the twelfth, and the twentieth. On the twenty-fourth, he warned "A" that if any further cases appeared among his customers, the Sanitary Department might prohibit the sale of his milk. During that day three such cases were reported.

By this time, however, Newsholme was looking further afield. Inquiries among the town's dairies and a search in the registration records showed that Farm "X", in reality the Varndean Farm in Patcham,³⁶ just north of Brighton, supplied milk not only to dairy "A" but also to two other dairies: "B" and "C". By the evening of the twenty-fourth,

six cases were known to be customers of Dairy "B" and another two of Dairy "C". On the twenty-fifth, Newsholme took decisive action. In the morning he telegraphed Farmer "X", William King of the Varndean Farm, asking King to delay delivery of his morning milk. The telegraph was not delivered promptly, so on his way to the Varndean Farm Newsholme met the cart bringing the milk to town. He had some trouble convincing the carter to return with him to the farm. He then struck a deal with King to purchase for five days his milk at one shilling a gallon, so that it could be destroyed. That generous rate of compensation was three times what would be paid to farmers in subsequent episodes. Twice a day for these five days, the Sanitary Inspector who supervised the town's abattoir called at the farm to oversee the destruction of the milk.

On his first visit, Newsholme also inspected the farm and examined the farm hands. He found that one cow handler had peeling skin on his hands, feet, and thighs and learned that this man had been absent from work from the first to the sixth with what was described as a sore throat and a severe cold. This employee was sent to the Brighton Sanatorium even though the farm was outside of town. Further inquiries led Newsholme to suspect that the infection had been introduced into the farm by a boy who had fallen ill with scarlet fever on December 8, in neighboring town "H", probably Hove, and who, on the eleventh, had been brought to a house two hundred yards from Varndean Farm to be nursed through the illness. There was regular contact between the house and the farm staff since the farm supplied milk to this house.

Newsholme also asked King to remove his cattle from the shed in which the infected man had fed and milked them. The Sanitary Committee met later on the twenty-fifth to approve the action its MOH had taken. The milk was destroyed as arranged, but as the days passed and it became clear that King was not going to remove the cows from the shed, Newsholme decided to put the cumbersome legal machinery into action to ban further sale of King's milk in Brighton under section four of the Infectious Disease (Prevention) Act of 1890.³⁷ On the twenty-ninth, he obtained an order from a Justice of the Peace that permitted him to make a formal inspection of the farm. On the thirtieth, the last day on which the milk was to be destroyed by prior agreement, the Sanitary Committee met again in special session and approved a notice to be served on King. At this point the farmer's resistance broke and he removed his cows. The last cases of the epidemic were reported on the second of February.

This was a small outbreak consisting of only twenty-six cases definitely attributable to infected milk. Figure 3 is Newsholme's reconstruction of the epidemic. In comparison to their action in 1905 and 1906, the health authorities acted slowly and inefficiently in 1900. The Sanitary Committee and its MOH were finding their way. But the epidemic of 1900 alerted them to the possibility of milk-borne infection, and it seems to have conditioned their responses to subsequent outbreaks. Newsholme had seen the necessity of being able to identify the precise source of a family's milk. Since many dairies got their supply from several farms, he began informally to ask dairymen to earmark their sources and to keep separate milk from different farms on delivery routes so that the supply to individual households could be precisely identified.³⁸ From the first, Newsholme recognized the importance of stopping the suspect milk supply more promptly than could be done by condemnation and legal prohibition.

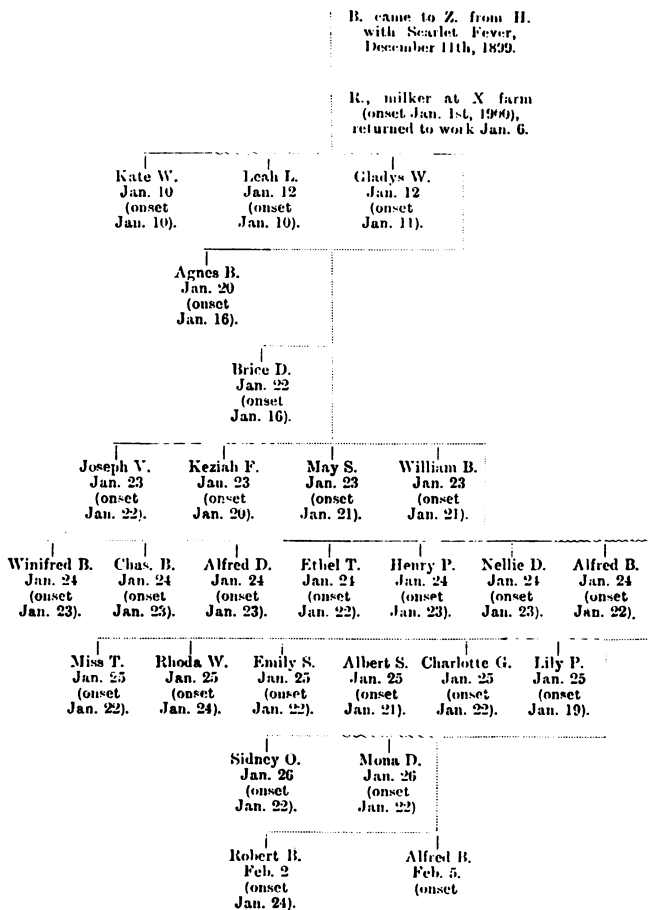


FIGURE 3—Scarlet Fever Cases Connected with Milk from Farm X, 1900. SOURCE: Newsholme: *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1900*, p 24.

The solution was the informal purchase agreement permitting the Sanitary Department to destroy the milk. But William King's recalcitrance had shown that it was desirable to begin legal proceedings, at least the first step, the obtaining of an order permitting an inspection of the premises. The MOH then had much more leverage in dealing with the farmer. It was an advantage Newsholme sought in subsequent epidemics.

The administrative response pieced together in 1900 was perfected in the third and fourth epidemics Newsholme recognized, those of 1905 and 1906. We will consider the second epidemic, the one of 1901, a bit later. The 1905 outbreak began on July 12 while Newsholme was on his annual vacation.³⁹ Six cases began on the twelfth or the thirteenth in different parts of town. The Deputy MOH, Thomas Barrett Heggs, a recent Aberdeen MD and Cambridge DPh, could find no factor common to the cases other than milk from Dairy "X", the South Coast Dairy Company. This was a large retailer that bought its milk from 13 farms and distributed 900-1,300 gallons a day through five shops and deliveries of 33 carriers calling at customers' homes three times each day. It might have seemed a hopeless task to try to find where or how the milk had been infected. Fortunately, the dairy's manager had followed Newsholme's earlier advice and earmarked his supplies, so he could specify the source of milk delivered to each of the first six cases on each delivery round. Figure 4 is the table

CASE.	No. OF MILK CARRIER	July 8th.	July 9th.	July 10th.	July 11th.	
1. (Onset 12th)	No. 21	A	C	A	D	1st round.
		B	B	B	B	2nd round.
		A	C	A	D	3rd round.
2. (Onset 12th)	No. 16	D	B	E	F	1st round.
		B and A	B and A	B and A	B and A	2nd round.
		A	A	A	A	3rd round.
3. (Onset 13th)	No. 3	E	B	F	A	1st round.
		B	B	B	B	2nd round.
		D or C	D or C	D or C	D or C	3rd round.
4. (Onset 11th or 12th)	No. 12	E	A	E	D	1st round.
		B	B	B	B	2nd round.
		D or C	D or C	D or C	D or C	3rd round.
5. (Onset 13th)	No. 19	D	G	E	A	1st round.
		D or C	D or C	D or C	D or C	2nd round.
6. (Onset 12th)	No. 21	A	A	A	A	1st round.
		D or C	D or C	D or C	D or C	2nd round.

FIGURE 4—Analysis of the Source of the Dairy Milk Supplied to the First Six Cases of Scarlet Fever, July 1905 (Initials of farm whose milk was delivered on days indicated) SOURCE: Newsholme: *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1905*, p 19.

Newsholme later prepared showing this information. Only one source, "A", had supplied all six cases. Source "A" in reality consisted of two farms whose milk was mixed before delivery. On July 15, Heggs visited both in the company of the dairyman who, by contract, had the right to inspect the farms from which he bought milk. On the farm of Ely Stay, Singleton, there was no evidence of suspicious illness. On Horace Stay's farm at West Dean, however, 10 recent or ongoing cases of scarlet fever were discovered. The first case on the farm had apparently been acquired at the village school in West Dean where a scarlet fever outbreak was in progress, and this first farm case preceded the first case in Brighton by four or five days. Heggs arranged to purchase for destruction the farm's milk. This time only four pence per gallon was offered, a sum that was only partial compensation. At the Brighton Sanitary Committee meeting of July 19, the Committee agreed to continue such payments as long as the MOH and Town Clerk thought necessary, and under threat of an order prohibiting the sale of his milk, Stay agreed to accept this partial compensation.

On Monday morning July 17, Heggs, armed with a magistrate's order, made a formal inspection of the farm in the company of Allan Gordon Russell Cameron, MOH of the West Sussex Combined Sanitary Districts in which the West Dean Farm was situated, and J. H. Lockwood, a Brighton veterinarian. Lockwood found the cows in good health except for a scabby ulcer on one cow's teat. Cultures were made but no streptococci found. Cameron and Heggs set in motion action to control infection on the farm. The sick were removed to the fever hospital at Westborne, all contacts

between the farm and the village forbidden, and disinfection begun of the homes of the sick and of farm buildings. A Sanitary Inspector was posted at the farm until August 1 to supervise these arrangements as well as the destruction of milk. Since other farms in the neighborhood also supplied milk to Brighton, the medical officers watched for suspicious cases among the employees of those other farms.

This outbreak was also a small one. No more than 20 cases could be linked to the milk from West Dean Farm. The last of these began on the sixteenth. When Newsholme returned, there was nothing to do but harvest whatever lessons could be gleaned. He pointed out how remarkable it was to be able to pinpoint the source of infection after only six cases had been registered. This early detection allowed prompt action which ended the epidemic. But without an earmarking of milk supplies, this immediate and discriminating response would have been impossible. On November 24, 1905 he issued a circular letter to the town's milk vendors making explicit what had been previously implied; their cooperation would ensure his efforts to protect their business.⁴⁰ He reminded them that under a private act, the Brighton Improvement Act of 1884, milk vendors could be compelled to supply lists of their customers to the MOH, and the entire supply from a dairy could be halted to control infection. Even if the sale of milk were not prohibited, an investigation among all the dairy's customers would certainly damage business. That threat issued, Newsholme offered a way out. If each dairy would keep a careful record of the customers served with milk from each farm, in the event that suspicions were ever raised of infection, it might be necessary to only stop the milk supply from one farm and this could be done without adverse publicity.

By the time of the 1906 outbreak, the MOH had acquired sources of information about both scarlet fever cases and about the origins of domestic milk supplies. The 1906 epidemic was the largest of the four we will consider, and it elicited the most vigorous action by the health authorities.⁴¹ This outbreak was also epidemiologically more complex than those for 1900 and 1905, in part because cases of scarlet fever, a notifiable disease, and of sore throat without rash, a non-notifiable condition, occurred. On October 15 Newsholme received notification of two cases of scarlet fever. Routine visitation revealed that both cases were from households served by Dairy "A", King's Dairy, Powis Road. Newsholme's suspicions were raised when several throat swabs for diphtheria were submitted to the hygienic laboratory about this time. None proved positive for diphtheria, but might they not be from scarlet fever cases whose symptoms so often resembled those of diphtheria? Newsholme did not try to culture streptococci from these throats. There was no compelling reason to do so, since, as we have seen, scarlet fever was not definitely linked to these organisms until the 1920s. Instead, he telephoned the manager of King's Dairy and learned that these cases of sore throat were also customers of that dairy.

Anticipating trouble, Newsholme privately asked medical practitioners to report cases of suspicious sore throats to him and to advise patients to boil their milk. On the following day, the sixteenth, Newsholme learned of additional cases of sore throat among the customers of King's Dairy. The dairy's manager was able to specify which of the two farms in his supply had furnished the milk for the infected households. On the same day, Newsholme learned of an outbreak of scarlet fever and sore throat in a boarding school. The source of infection at the school was later attributed to the

same farm, and the episode proved to be a crucial one in tracing the infection.

By the seventeenth, 12 cases of scarlet fever and 31 cases of sore throat were known to the MOH. Being quite certain of the source of the epidemic, Newsholme put the now familiar machinery in motion. The milk from Farm "B", King's Farm, Preston, was purchased at four pence per gallon and destroyed, cattle and farm residents were examined, disinfection begun, and a Sanitary Inspector stationed at the farm to supervise this preventive work.

The farmer must have been overwhelmed and intimidated by public authority.⁴² Since his farm was in West Sussex and his milk sold in both Brighton and Hove, he came to the attention of three Medical Officers of Health: Newsholme, Cameron, and Augustine Griffith, MOH of Hove. The Medical Officers of Health for West Sussex and Hove both visited the farm three times during the two weeks the milk was being destroyed. In addition the cattle were inspected three times by outside experts—two veterinarians and the Superintendent of the Brighton Abattoir. These examinations revealed no signs of the Hendon cow disease, which, as we shall see, some authorities believed caused human scarlet fever via milk. But in the aftermath of this scrutiny, the farmer decided to have four cows slaughtered. Two presented signs of tuberculosis. The other two had injured themselves in swallowing sharp objects. He also sold two other cows which the veterinarians had advised him to isolate from the rest of the herd, because they had abscesses of the udder. This time no attempt was made to culture streptococci from these abscesses as had been attempted in 1905. The farmer was compliant in other ways as well. When the second week of his quarantine was drawing to a close, he asked the resident sanitary inspector for suggestions of how he could improve his operation. Given seven recommendations dealing mainly with the cleanliness of hands, utensils, and clothing, he proceeded to put these suggestions into operation. The episode had cost him dearly. His only compensation beside the four pence per gallon he received for his milk was a copy of Newsholme's unpublished report to the Sanitary Committee in which he found compliments for his cooperation and cleanliness and expressions of regret over the anxiety and financial loss he had experienced.⁴³

Despite this rigorous supervision, the health authorities were unable to determine how the milk had been infected. Three possibilities were taken seriously.⁴⁴ When the farm was first inspected, a milkman's family, the Turner family, was banned from the cowsheds when two illnesses were discovered among its members. A Turner child had been taken to the Hove Sanatorium in late July suffering from what was thought to be scarlet fever. This diagnosis was thrown into question two or three weeks later when she developed a severe and unmistakable case of scarlet fever. The question then became: was the initial diagnosis wrong and scarlet fever contracted in the institution, or was the unambiguous episode a relapse? Neither MOH could be sure. This first child was still in the sanatorium when the Brighton 1906 epidemic began. In the meantime, the family had visited the sanatorium seeing the sick child through a glass divider. On September 2, a second child in the family became ill following one of these visits. A local doctor was called who did not think the second case was scarlet fever, in part because five weeks had intervened between the two cases. As a precaution, this second child was kept indoors for two weeks and the father suspended from milking for a few days. After the farm came under suspicion, both father

and second child were examined again and no definite signs of scarlet fever found.

A second possibility was a father and son who were found during the epidemic to have peeling skin on their feet. The Medical Officers of Health for West Sussex and for Hove believed them to be scarlet fever convalescents and had them sent to their home in Preston. Two private practitioners and Newsholme later examined these men and found no evidence of disease. A final possibility emerged when the child of another farm hand on the King Farm who lived in Hove was diagnosed as having scarlet fever and was taken to the Hove Sanatorium. Since the child had drunk no milk from the King Farm, Newsholme wondered if the father had had an undetected case even though he claimed to have never been ill.

In trying to explain the origin of the epidemic, the medical officers were obviously hampered by their limited understanding of the etiology of scarlet fever and by the absence of a definitive means of diagnosis. It was perhaps the failure in the search for origins that encouraged Newsholme to weigh more carefully the circumstantial evidence implicating the King Farm's milk. His accounts of the 1906 epidemic offer more thorough epidemiological analysis than he provided for the epidemics of 1900 and 1905. In this epidemic, he recognized that the notified cases of scarlet fever told only part of the story, and from the first he sought information on cases of sore throat. Since sore throat was not a notifiable condition, he had to seek his information from informal sources. During the height of the epidemic, October 8 to October 22, he learned of 99 cases of sore throat privately from physicians or as the result of negative cultures from throat swabs taken for suspected diphtheria. After rumors had begun to circulate that the milk from King's Dairy was spreading disease, the Sanitary Department was bolder about contacting the dairy's customers. Sanitary Inspectors conducted a house-to-house survey among these customers and found 104 additional cases of sore throat. Although mention of infected milk was never made in the newspapers, Newsholme and his staff spent much time assuring those who inquired that the milk from King's Dairy was now safe.⁴⁵ The MOH was always considerate of the town's commercial interests.

Newsholme studied the occurrence of both scarlet fever and sore throat. In searching for the origin of the outbreak, he thought he could rule out personal infection of each case and contamination of milk off the farm. Cases had occurred, after all, in geographical isolation and among families served by several milk carriers. A comparison of the morbidity among those who consumed milk from King's Dairy and those who did not suggested forcefully that this milk was the vehicle of infection. During October, there were 38 cases of scarlet fever or 5.0 cases per 100 families among the customers of King's Dairy. Contemporarily, there were only 17 cases or .06 cases per 100 families among town residents whose milk was not supplied by King's Dairy. For sore throat, the figures were 215 cases or 28.5 per 100 families for customers and 27 or .10 per 100 families among other residents.⁴⁶ Newsholme recognized that the latter comparison was not really fair, since the Sanitary Department had tried much more vigorously to locate sore throats among families known to obtain their milk from King's Dairy than among other families.

Newsholme also recognized that the onset and progress of a scarlet fever epidemic should depend on whether the infection was conveyed in milk or from person to person. If

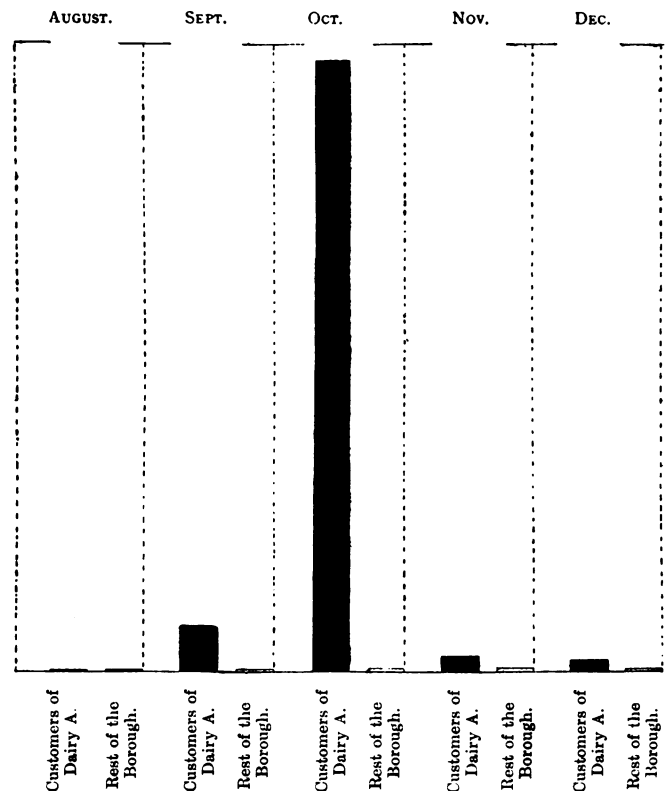


FIGURE 5—Relative Incidence of Scarlet Fever and Scarlatinal Sore Throat in Every 100 Houses among Customers of Dairy A vs Rest of the Borough. SOURCE: Newsholme: *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1906*, p 54; and *Public Health 1906-07*; 19:762. Reproduced with permission.

the microbe responsible for scarlet fever grew in milk producing its "poison," the onset of a milk-borne epidemic ought to be explosive and the incubation period of cases short.⁴⁷ The 1906 epidemic certainly had an explosive beginning. Figure 5 is Newsholme's illustration of the explosive nature of the outbreak and the relative differences in morbidity in the two groups of residents. Dairy A is King's Dairy.

Implicating King's Farm, Farm "B", epidemiologically was more difficult because it was only one of two suppliers of King's Dairy. The other was identified only as Farm "T" in Salisbury. The picture was further complicated by the sale of a small amount of milk from King's Farm to another vendor, Illman's, identified in the published literature as Dairy "U". Figure 6 shows how Newsholme demonstrated the role played by milk from King's Farm by comparing the number of cases of scarlet fever and sore throat among families served with milk from each of these three sources on both daily delivery rounds. Figure 7 in turn is his tabular representation showing how the registered cases were distributed according to the milk supply.

At first, the manager of King's Dairy was certain that the information on which this reconstruction was based was accurate. He later admitted that milk from Farm "T" was occasionally distributed on rounds usually served only with milk from the King Farm. This confession weakened Newsholme's demonstration, but Newsholme remained confident in his conclusions. The fact that new cases ceased appearing when the supply of the suspect milk was ended was confirming evidence. He found similar support in the

Milk Supplies.						Total Cases.
	B. B.	B. B. (occasionally T.)	B. T.	U. (i.e. B. in part).	T. T.	
1st List of Cases ...	5	0	11	1	0	17
2nd " " " ...	13	0	15	5	0	33
3rd " " " ...	34	9	54	5	0	102

FIGURE 6—Distribution of Cases of Scarlet Fever and Sore Throat According to Source (Initials) of Milk Supply
SOURCE: Newsholme: *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1906*, p 57; and *Public Health, 1906-07*;19:765. Reproduced with permission.

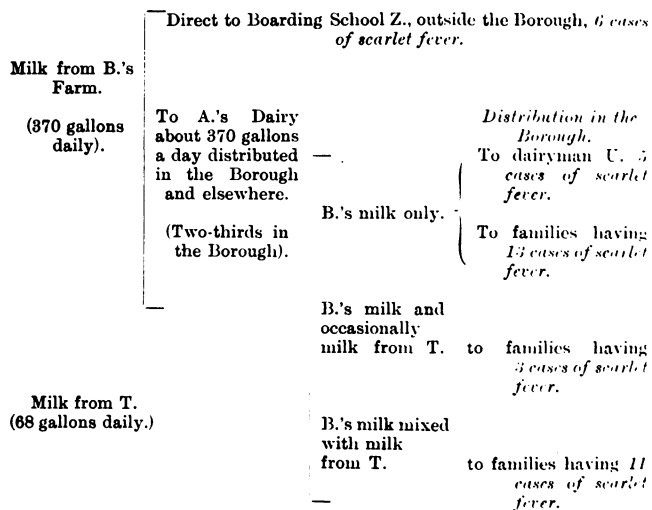


FIGURE 7—Distribution of Registered Scarlet Fever Cases According to Milk Supplier
SOURCE: Newsholme: *Annual Report on the Health, Sanitary Condition, etc. of the County of Brighton for the Year 1906*, p 58; and *Public Health 1906-07*; 19:766. Reproduced with permission.

experience of a number of families or institutions receiving King Farm's milk where cases occurred among those who drank the milk unboiled, while those who either did not consume the milk or only drank it boiled escaped infection. He also believed he had found a "control experience" in the outbreak at boarding school "Z".⁴⁸ Here, between October 13 and 19, six cases of scarlet fever and four of sore throat occurred among the 45 resident students. All cases occurred among those who drank raw milk. Those who took milk only after it had been heated escaped infection. With the intent of ensuring a pure supply of milk by preventing adulteration in transit, the Head Master had arranged for the delivery of milk from King's Farm in a padlocked can. There seemed to be no grounds for suspecting that the milk had been mixed or contaminated in transit. Furthermore, circumstances seemed to exclude personal infection as the outbreak's cause. The students' movements were well known. The first case had been very carefully isolated. The 10 cases occurred in three dormitories, the second case appearing in a different dormitory than the first. Finally, these cases occurred at the same time as a large number of cases were occurring in Brighton among families who drank the same milk. There seemed, in short, no reasonable grounds for doubting that milk from King's Farm spread the infection, although it had

proven impossible to determine how the milk had been infected.

The Sanitary Department responded to the 1906 epidemic with speed and efficiency. Two previous epidemics, both smaller in scale and more transparent in origin, had helped the health authority fashion a preventive strategy. The complexity of the 1906 epidemic also encouraged more thorough epidemiological analysis. Epidemiology was called on to supply some of the links clinical experience and laboratory investigation had not yet forged. It was probably the 1901 epidemic, the epidemic we have not yet considered, that prepared Newsholme for the complex investigation he undertook in 1906. The 1901 epidemic is of historic interest primarily because of its influence on Newsholme's thinking. Newsholme recognized too late to intervene effectively that a milk-borne epidemic was in progress, and only minimal preventive action was taken. Perhaps for that reason no special mention was made of the epidemic in the usual administrative records: the unpublished Proceedings of the Sanitary Committee or in Newsholme's published *Annual Report*. After the outbreak Newsholme was able to reconstruct what had probably happened, and he published his results as an epidemiological paper in the *Journal of Hygiene* for 1902.⁴⁹

Scarlet fever cases were notified to the MOH in a narrow but steady stream throughout the period we are considering. It was, in fact, not always easy to be certain when a milk-borne epidemic began. This was especially true in 1901, when the outbreak was already six weeks old before Newsholme detected it. On December 9, three cases were reported to him, and each, it was learned, belonged to households consuming milk from Dairy "P". A check through recent notifications showed that three other recent cases had occurred among families served with "P's" milk. Dairyman "P" supplied to Brighton 270 to 290 gallons per day from his own farm and another 64 gallons acquired in small quantities from seven other farms. No records were kept of which milk was delivered to individual households. Newsholme was only able to locate the probable source of infection by a chance occurrence. As would happen again in 1906, one family in which a case of scarlet fever occurred was served by Dairy "P" and received its milk supply in a padlocked can directly from "P's" own farm. Since it was most unlikely that more than one source would be infected simultaneously, suspicion fell on milk from "P's" farm. When Newsholme visited the farm, however, he could locate no illness he could definitely call scarlet fever. Three suspicious cases of sore throat had occurred in three farm families living in cottages near the cow sheds, and he

arranged to have those families barred temporarily from contact with the cattle or the cowsheds. This precaution was taken on December 9 or 10,⁵⁰ but the last case registered in this outbreak had begun on the fifth.

It is thus uncertain whether Newsholme's action had any effect on the course of the epidemic. But suspicion of milk from Dairy "P" did allow him to discover what he had missed during the previous weeks and to reconstruct an epidemic formerly lost in the defects of registration and the uncertainties of diagnosis. Specifically he discovered that outbreaks at two schools in October and November were probably also due to the same milk supply. These cases had not been considered in the domain of the Sanitary Department because they consisted primarily of sore throat, probably streptococcal sore throat, a non-notifiable disease.

The larger outbreak, whose cases Newsholme labeled Group B, occurred in Miss "C's" boarding school between October 29 and November 21.⁵¹ During those weeks, 14 of 19 boarding students, two of six teachers, and two of four servants suffered from severe sore throat. On November 7, the hygienic laboratory received three throat swabs from a medical practitioner who attended the members of Miss "C's" school and who probably suspected diphtheria. Newsholme informed the practitioner that streptococci had been cultured from the swabs. As MOH, he was not expected or empowered to do more. He heard nothing further about the episode until he received a letter from this practitioner on December 17 describing the cases he had encountered at the school. Since by this time Newsholme had traced cases of scarlet fever in town to milk from "P's" farm, and since he held some suspicion that sore throat without rash and scarlet fever were related, he interviewed Miss "C" and obtained information on the series of sore throats in the school. Only two of the afflicted children had had a rash, and that had been very slight.

When he asked about the school's milk supply, Newsholme was disappointed to learn that the milk was not from Dairy "P". He eventually found, however, that the first case, an 11-year-old girl, spent her weekends at home where she drank milk from Dairy "P". When she fell ill at school on Tuesday, October 29, she was first laid on a bed on one of the rooms on the first floor. The next two cases occurred among students who slept in that bedroom. Newsholme was able to show how the infection was probably spread from person to person throughout the school. The outbreak, in his opinion, consisted of one primary case acquired from infected milk, and 17 secondary cases.

The second school outbreak, cases labeled Group A, began in Miss "S's" day school between October 29 and November 18.⁵² One case of scarlet fever and five cases of sore throat occurred among 16 pupils. Newsholme learned of this episode only on November 25 when a physician consulted him about the case of scarlet fever which had begun on November 16 but which the physician had been unable to diagnose definitely as scarlet fever. No suspicion of milk-borne infection was raised until later. Newsholme subsequently found that seven children at this school drank unboiled milk from Dairy "P" every morning. Among those seven, two cases of sore throat and the one case of scarlet fever occurred. But two cases of severe sore throat and one slight sore throat also occurred among the nine pupils who drank no milk at school. This discovery first seemed to undermine the milk hypothesis until Newsholme ascertained that the two children suffering from severe sore throat drank milk from Dairy "P" at home. The third case, the slight sore

throat, was the first in the outbreak. Newsholme concluded it must have been an ordinary sore throat unrelated to the milk supply or to the other cases.

The 1901 outbreak was more complicated than the other three Newsholme encountered as MOH. Cases appeared over a much longer period of time and took different clinical forms. He concluded that milk on "P's" farm must have been intermittently infected over a six-week period.⁵³ He hypothesized at least three separate contaminations, because the cases attributed to infected milk fell into three groups: those beginning from October 29 to November 6 had symptoms resembling influenza and sore throat; those beginning from November 12 to November 18 had severe sore throats like those from which streptococci had been cultured; and those beginning from November 30 to December 6 were easily identified as scarlet fever. Figure 8 is Newsholme's attempt to associate cases among milk customers to antecedent cases on the farm. In this illustration, Group "C" consists of cases of scarlet fever among town customers which first alerted him to milk-borne infection. This reconstruction led him to believe that there must have been an earlier case of sore throat among those intimately associated with the milking which his visit to the farm had not discovered.

Newsholme found remarkable the low incidence of cases among those consuming the infected milk. Excluding secondary infections, only 16 cases of scarlet fever and sore throat occurred in a large milk supply over a period of six weeks. Certainly the milk carried only a small amount of infective material. But most significant was the fact that many of the cases did not exhibit the characteristic scarlet fever rash. Newsholme believed that he was dealing with only one infection, not two, and concluded that "infected milk may carry the scarlatinal contagium in such an attenuated form or in such a minute amount that it is not capable of causing all the phenomena of scarlet fever."⁵⁴ We see here that he regarded the anomalous sore throats as scarlatinal, i.e., produced by the scarlet fever contagium in weaker form or lesser quantity. Both sorts of cases might, in other words, harbor the same infective material. This was a sobering thought for it suggested that the diagnosis of scarlet fever and its control might be more difficult than had been assumed.⁵⁵ It was an important recognition. Newsholme was not caught unprepared in 1906, as he had been in 1901. When sore throats appeared concurrently with scarlet fever he now took the former seriously from the first. He also recognized that it was desirable for the MOH to be informed about cases of sore throat.⁵⁶ There were probably many scarlatinal sore throats that escaped detection. When those occurred among milkers or cow handlers, milk might be infected for a much longer period than had previously been supposed.

If we pause for a moment to survey the territory we have covered, we can see that one of the most serious obstacles to the prevention of scarlet fever was the ignorance of the role of the streptococcus and the differences among strains of this microorganism. That knowledge would have made diagnosis easier and more certain.

- It would have clarified the uncertain relationships between scarlet fever and cases with similar symptoms but no rash.

- It would have made isolation more effective by providing criteria for determining when convalescents could be released from home or institutional isolation.

- It would have provided another, more direct, means of identifying infected milk.

PUBLIC HEALTH THEN AND NOW

Cases on P.'s farm	Group A (Oct. 29)	Group B Oct. 29	Group C	Cases on P.'s farm	Group A Nov. 13...	Group B Nov. 18	Group C
Oct. 30					Nov. 16		
Nov. 2		Secondarily infected cases		(scarlet fever)	Nov. 18		
(?) ,, 4		Nov. 4				Nov. 18	Nov. 18 (scarlet fever)
	Nov. 6	,, 5		Nov. 30			Dec. 2 (do.)
		,, 6					,, 3 ,,
		,, 6					,, 4) ,,
		,, 8					,, 4] ,,
		,, 9					,, 5 ,,
		,, 9					,, 6 ,,
		,, 9					,, 6 ,,
		,, 10					(in another sanitary district)
(?) Nov. 11		,, 11					
		,, 12					
		,, 12					
		,, 12					
		,, 12					

FIGURE 8—Newsholme's Attempt to Associate Cases among Milk Customers to Antecedent Cases on the Farm, by Dates of Onset
SOURCE: *J Hygiene* 1902: 2:162. (Reprinted with permission of Cambridge University Press.)⁴⁹

● It might have provided additional argument for the routine pasteurization of milk, a precaution Newsholme never advocated at Brighton but later supported fully.⁵⁷

● And it might also have encouraged health authorities to take more seriously a possibility that received only perfunctory attention in Brighton, the bovine origin of human streptococcal infection.

It is ironic that despite the limitations of etiological knowledge, both streptococci and cattle disease figure, if briefly, in discussions of these scarlet fever outbreaks. Suspicions had been raised. We have seen that three throat swabs submitted for the diagnosis of diphtheria in 1901 revealed the presence of streptococci. Yet the Sanitary Department at Brighton made no attempt to culture these organisms in other cases of sore throat or scarlet fever. When throat cultures proved negative for diphtheria in the first cases in the 1906 epidemic, Newsholme did not attempt to culture streptococci from the same throats. Instead he regarded these cases as suspicious of scarlet fever and sought confirming evidence in his data on the milk supply and in other notifications of infectious cases.

Newsholme was familiar with the large literature which demonstrated that scarlet fever could be conveyed by milk.⁵⁸ That literature continued the novel claims of William H. Power and Emanuel Klein at the Local Government Board that in 1885 they had traced an outbreak of human scarlet fever through milk to diseased cattle on a farm in Hendon and found the streptococci to be the responsible organism.⁵⁹ Klein's hypothesis received an unsympathetic reception in the scientific and public health community.⁶⁰ Newsholme's suspicion even found confirmation in an expert text on the bacteriology of milk published in 1903.⁶¹ During the milk-borne epidemics in these years, most health authorities sought the origin of outbreaks in antecedent human cases. Veterinary consultation at Brighton, the unsuccessful attempt to culture streptococci from an ulcer on a cow's udder on the West Dean Farm in 1905, and the examination of the herd on the King's Farm for signs of the Hendon cow disease

in 1906 are isolated examples. Their negative results merely reinforced prevailing attitudes.

Our appreciation of the Edwardians' limitations of knowledge should not blind us to what was achieved during those years. Disappointment with results of a rigorous program of isolation and disinfection led the Sanitary Department to turn to transmission by milk. Soon a practical administrative response to milk-borne scarlet fever was devised which used compulsory notification of scarlet fever cases and occasional voluntary notification of sore throat and voluntary earmarking of milk supplies as means of surveillance. Newsholme's epidemiological studies confirmed suspicions that some cases of severe sore throat and scarlet fever were related and suggested that the prevailing strategy of combating scarlet fever by notifying and isolating only cases with all the classic signs of scarlet fever was flawed. Until precise etiology was determined, however, preventive work had to remain in that pragmatic but uncertain state.

ACKNOWLEDGMENTS

This research was supported by National Institutes of Health Grant LM03765 from the National Library of Medicine.

FOOTNOTES, REFERENCES

1. For a summary of national mortality trends, see Great Britain, *Annual Report of the Registrar General*, 1900, 63:cii-ciii. After 1892, when notification of cases of the chief infectious diseases became compulsory in Brighton and the town's vital statistics are hence more accurate, the annual mortality from scarlet fever during Newsholme's tenure never exceeded 10 per 100,000. By contrast, the rates for tuberculosis for these years never fell below 135 per 100,000 and the rate for diarrhea was routinely and often much in excess of 35 per 100,000. Arthur Newsholme, *Annual Report on the Health, Sanitary Condition, etc. of the County Borough of Brighton for the Year 1907* (Brighton, 1908), pp 8, 15, and 18, hereafter cited as Newsholme, *Annual Report*. See also Newsholme, *Annual Report, 1906*, p 21.
2. In the years 1892 to 1907, registered scarlet fever morbidity in Brighton fluctuated markedly, varying from an annual low of 117 per 100,000 in

- 1902 to a high of 667 per 100,000 in 1899. The average annual rate for the period was 254 per 100,000. Newsholme, *Annual Report*, 1907, p 8.
3. For representative contemporary accounts, see A. Wynter Blyth, *A Manual of Public Health* (London, 1890), pp 380-395; Arthur Newsholme, *Hygiene: A Manual of Personal and Public Health* (London, 1884), pp 365-367; and F. Foord Caiger and Leonard S. Dudgeon, Scarlet fever, in: Thomas Clifford Allbutt and Humphry Davy Rolleston (eds): *A System of Medicine*, 2nd ed. (London, 1906), II:410-474. A useful and concise, although historically unsophisticated, summary of the development of knowledge of scarlet fever is found in Arthur L. Bloomfield, *A Bibliography of Internal Medicine: Communicable Diseases* (Chicago: University of Chicago Press, 1958), pp 108-126.
 4. See for example, Arthur Newsholme, *The Role of "Missed" Cases in the Spread of Infectious Diseases* (London and Manchester, 1904).
 5. *Sussex Daily News*, May 18, 1888, p 3.
 6. Brighton, *Proceedings of the Town Council*, hereafter cited as *Proc Town Council*, January 15, 1891, pp ii; *Sussex Daily News*, January 16, 1891, p 3; and Newsholme, *Annual Report*, 1891, p 7. In 1889, the Town Council had voted against adoption of the act, see Brighton, *Proceedings of the Sanitary Committee*, September 26, 1889, 7:42-50 and *ibid.*, November 21, 1889, pp 111-112. These are manuscript records housed in the East Sussex Record Office, Lewes, and are hereafter cited as *Proc San Comm*. Concern for Brighton's reputation is apparent in the Sanitary Committee's eight-year refusal to cooperate in a voluntary scheme coordinated by the Local Government Board for sharing registration data between cooperating towns. See *Proc San Comm*, February 26, 1891, 8:129-130; *ibid.*, February 27, 1896, 13:298-299; and *ibid.*, August 10, 1899, 16:387-388.
 7. For terms of the act, see Great Britain, *Statutes at Large*, 52 & 53 Vict. c. 72 (1889).
 8. Great Britain, *Statutes at Large*, 38 & 39 Vict. c. 55 (1875), Public Health Act, sect. 126 and 128.
 9. Newsholme, *Annual Report*, 1891, p 7.
 10. *Proc San Comm*, January 25, 1900, 17:99; and *ibid.*, February 1, 1900, p 106.
 11. George Buchanan, Memorandum on school-closure and exclusion from school of particular scholars, as means for controlling spread of infectious disease, *Annual Report of the Medical Officer of the Local Government Board*, 1883; 13:90-95. Hereafter cited as *A.R.M.O.L.G.B.*
 12. Newsholme, *Annual Report*, 1889, pp 18-19. See also *Proc San Comm*, December 29, 1892, 10:76; *ibid.*, October 14, 1897, 15:104; and Newsholme's comments in the discussion of his paper, A National System of Notification and Registration of Sickness, *JR Statist Soc*, 1896, 59:35.
 13. See, for example, an account of an 1897 epidemic in a board school, Newsholme, *Annual Report*, 1897, pp 26-27.
 14. For brief published accounts of the early history of the Brighton Sanatorium, the present Bevendean Hospital, see: Francis J. C. May and Arthur Newsholme, *A General Description . . . of the History of Isolation Accommodations provided for the Borough, with a more Detailed Account of the Improved Accommodation now provided by the Corporation* (Brighton, 1898); and *A Short Description of the Borough Sanatorium Intended for the Use of Delegates* [to the Brighton Sanitary Congress] (Brighton, 1910).
 15. Great Britain, *Statutes at Large*, 38 & 39 Vict. c. 55 (1875), Public Health Act, sec. 124-126. Also Edward C. Seaton, Memoranda for local arrangements relating to infectious disease, *A.R.M.O.L.G.B.*, 1876, 6:313.
 16. In December 1890, the MOH removed a child suffering from scarlet fever to the sanatorium against the parent's wishes under Section 124 of the Public Health Act, 1875. *Proc San Comm*, December 11, 1890, 8:49.
 17. *Proc Town Council*, December 14, 1891, p vii.
 18. Information on admissions for 1897 and earlier is obtained from May and Newsholme, *General Description*, p 17. For succeeding years, see Newsholme's annual summaries in Newsholme, *Annual Report*, 1898, p 47; *ibid.*, 1899, p 64; *ibid.*, 1900, p 85; *ibid.*, 1901, p 56; *ibid.*, 1902, p 75; *ibid.*, 1903, p 38; *ibid.*, 1904, p 68; *ibid.*, 1905, p 54; *ibid.*, 1906, p 26; and *ibid.*, 1907, p 24.
 19. C. Killick Millard, The influence of hospital isolation in scarlet fever. *Public Health*, 1900-01, 13:493.
 20. See for example Newsholme, *Annual Report*, 1892, p 10; *ibid.*, 1894, pp 21-22; and *ibid.*, 1895, pp 12-13.
 21. *ibid.*, 1890, pp 12-13.
 22. The utility of isolation hospitals in diminishing the spread of scarlet fever. *J Hygiene*, 1901, 1:145.
 23. Quoted in A. Means Fraser, Is the hospital isolation of scarlet fever worth while? *Public Health*, 1903-04, 16:211.
 24. The case was *Kegan v. The Mayor and Corporation of Birmingham*, 1896. See *Public Health*, 1895-96, 8:244-245. For MOH discussion of the case, see J. Wright Mason, Secondary and return cases of scarlatina, *Public Health*, 1897-98, 10:221; and C. Killick Millard, The etiology of 'return cases' of scarlet fever. *Br Med J*, 1898, 2:614.
 25. For a summary of practices and recommendations see Mason, "Secondary and return cases," pp 220-221. For a description of these procedures at Brighton, see Arthur Newsholme, Protracted and recrudescing infection in diphtheria and scarlet fever, *Med-Chir Trans*, 1904, 87:551 and 555; or in *Public Health*, 1903-04, 16:692 and 695; Newsholme, *Annual Report*, 1895, p 44; and *ibid.*, 1901, p 25. The so-called bathing-out procedure is described in Millard, Etiology of 'return cases', p 616.
 26. There is a large literature on this subject on which I am preparing a separate article. See for example C. Killick Millard, The hospital isolation of scarlet fever: some points of uncertainty, *Public Health*, 1901-02, 14:285-294; Millard, Influence of hospital isolation, pp 462-493; and Fraser, pp 206-219. See also the exchanges of Edward Dean Marriott, A. J. Tonkin, and the editors of *The Lancet in Lancet*, 1900, 2:1661-1662, 1759-1760, 1835-1836, 1921-1922; and *ibid.*, 1901, 1:135 and 357.
 27. James Robert Kaye, Scarlet fever: how far do statistics prove or disprove the utility of hospital isolation, *Public Health*, 1901-02, 14:449-464; and A. J. Tonkin, Isolation hospitals, *Lancet*, 1900, 2:1835-1836.
 28. See for example the editorial introducing papers by Millard and Kaye and the editors' position in subsequent correspondence, *Public Health*, 1901-02, 14:445-448, 563-565, 675-676. Likewise see the position adopted by the editors in the debate in the pages of *The Lancet; Lancet*, 1900, 2:1661-1662 and *ibid.*, 1901, 1:663. *Public Health* published an issue devoted to this question whose contributors defended the hospitals while suggesting improvements in their management, *Public Health*, 1904-1905, 17:343-398.
 29. Newsholme, *Annual Report*, 1900, pp 18-21; *ibid.*, 1901, pp 22-24; and *ibid.*, 1902, pp 22-25. See also Arthur Newsholme, The epidemiology of scarlet fever in relation to the utility of isolation hospitals, *Trans Epidemiol Soc Lond*, 1900-01, n.s. 20:48-69; and Arthur Newsholme, The utility of isolation hospitals in diminishing the spread of scarlet fever. Considered from an epidemiological standpoint, *J Hygiene*, 1901, 1:145-152.
 30. *Social and Public Health Problems*, new ed. (London: George Allen & Urwin, Ltd., 1923), pp 433-434. See also, Arthur Newsholme, *Fifty Years in Public Health: A Personal Narrative with Comments* (London: George Allen & Urwin, Ltd., 1935), p 183.
 31. Newsholme, *Hygiene* (1884), p 366.
 32. *Proc San Comm*, December 11, 1890, 8:50-51.
 33. *Lancet*, 1901, 1:1859-1860; *ibid.*, 1901, 2:49-51, 101-103, 169-170, 227-228, 536-538; *ibid.*, 1902, 1:1358, 1561-1562; *ibid.*, 1903, 1:331 and 398.
 34. For the London milk supply, see M. W. Beaver, Population, infant mortality and milk, *Pop Stud*, 1973, 27:251-252.
 35. For accounts of the 1900 epidemic, see Newsholme, *Annual Report*, 1900, pp 22-27; *Proc San Comm*, January 25, 1900, 17:100-101; *ibid.*, January 30, 1900, pp 102-103, and *ibid.*, February 8, 1900, p 125.
 36. In his published works, Newsholme does not identify individuals, farms, or dairies by name. These names can usually be found in the unpublished sections of *Proc San Comm*.
 37. Great Britain, *Statutes at Large*, 53 & 54 Vict. c. 34 (1890).
 38. Newsholme, *Annual Report*, 1905, p 18; and *Proc San Comm*, August 10, 1905, 22:200-201.
 39. For descriptions of this episode see Newsholme, *Annual Report*, 1905, pp 18-21; *Proc San Comm*, July 19, 1905, 22:162-167; *ibid.*, July 24, 1905, pp 182-184; *ibid.*, August 10, 1905, pp 200-202; and *ibid.*, August 31, 1905, p 217.
 40. This letter is reprinted in Newsholme, *Annual Report*, 1905, pp 20-21.
 41. For accounts of the outbreak see: Newsholme, *Annual Report*, 1906, pp 48-63; *Proc San Comm*, October 17, 1906, 23:186-190; *ibid.*, October 22, 1906, p 201; *ibid.*, October 29, 1906, pp 203-224; and *ibid.*, November 15, 1906, pp 241-247. The section in the *Annual Report* was republished as a separate article: Arthur Newsholme, On an outbreak of scarlet fever and scarlatinal sore throat due to infected milk, *Public Health*, 1906-07, 19:756-772.
 42. Information on the measures taken on the farm is best obtained in a special report by Arthur Ward, Sanitary Inspector, in *Proc San Comm*, November 15, 1906, 23:241-247.
 43. *ibid.*, October 29, 1906, pp 223-224.
 44. For the fullest explanation see *ibid.*, pp 220-222.
 45. I have searched the *Brighton Gazette* from October 14 to November 15, 1906 and the *Sussex Daily News* from October 24 to November 30, 1906 without finding mention of the milk-borne epidemic. For an example of a more persistent contemporary inquirer, see W. Cooper's letters to the Sanitary Committee: *Proc San Comm*, November 29, 1906, 23:261-266 and *ibid.*, January 10, 1907, 23:295-296.
 46. Newsholme, *Annual Report*, 1906, pp 51 and 53.
 47. Newsholme, *Annual Report*, 1906, p 48. This discussion of the characteristics of milk-borne epidemics should be compared to a more comprehensive one to which Newsholme did not refer in Harold Swithinbank and George Newman, *Bacteriology of Milk* (London: John Murray, 1903), pp 262-278.

48. Newsholme, *Annual Report*, 1906, pp 58–59.
49. Arthur Newsholme, On an outbreak of sore throats and of scarlet fever caused by infected milk, *J Hygiene*, 1902, 2:150–169. (Reprinted by Cambridge University Press, New York, NY.)
50. Newsholme's account is uncertain about this date. See *ibid.*, pp 158 and 160.
51. *Ibid.*, pp 151–155 and 160–161.
52. *Ibid.*, pp 150–151 and 161–162.
53. *Ibid.*, pp 161–163.
54. *Ibid.*, p 165.
55. *Ibid.*, p 168.
56. *Ibid.*, pp 165 and 169. For his ideas about reform of the registration system, see Arthur Newsholme, A national system of notification and registration of sickness, *J R Statist Soc*, 1896, 59:1–28.
57. Newsholme, *Fifty Years in Public Health*, pp 176–177.
58. By 1881 there had been reports of at least 15 outbreaks of scarlet fever attributed to infected milk. See Ernest Hart, The influence of milk in spreading zymotic disease, *Trans Int Med Congress*, (London, 1881), IV, 528–539. For evidence that Newsholme was familiar with this literature, see Newsholme, Outbreak of sore throats, *J Hygiene*, 1902:165–168.
59. For the work of Klein and Power, see: *A.R.M.O.L.G.B.*, 1885, 15:73–89 and 90–99, and On the relation between milk-scarlatina in the human subject, and disease in the cow, *Practitioner*, 1886, 37:61–80 and 143–160.
60. For information on this controversy, I am indebted to my colleague Leonard G. Wilson for sharing with me a draft of a chapter, Scarlet fever and the Hendon cow disease, in a forthcoming book about research on streptococcal disease. See also Blyth, *Manual*, pp 391–394.
61. Swithinbank and Newman, *Bacteriology of Milk*, pp 282–289.

AHA Issues Policy, Statement on Caring for Patients with Chronic Mental Illness

The American Hospital Association recently released its *Policy and Statement on Caring for Patients with Chronic Mental Illness*, which was developed by AHA's Section for Mental Health and Psychiatric Services and approved by the AHA House of Delegates in February.

The policy recognizes the responsibilities of general hospitals, private psychiatric hospitals, and public mental hospitals—as key components in the health care delivery system—to “provide comprehensive health care services within available resources to patients with chronic mental illness. . .” It estimates that only 7 per cent of the 2 million chronically mentally ill patients in the US are in mental hospitals, and describes the community support system necessary to their survival and improvement. Specific health care needs include general health care and psychiatric treatment programs, including emergency care, acute and extended inpatient services, partial hospitalization programs, and outpatient services.

Copies of the *Policy and Statement on Caring for Patients with Chronic Mental Illness* (cat. #151724) are available on a prepaid basis from AHA Services, Inc., P.O. Box 99376, Chicago, IL 60693. Cost is \$1.40 to AHA members and \$1.75 for nonmembers.