

***Salmonella senftenberg* in the Sunderland area**

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In December 1963 a patient was found to be excreting *Salmonella senftenberg* in general hospital A (Ryhope) of 300 beds. From then onwards about 150 staff and patients of this hospital excreted the organism. In 19 of the 48 months from December 1963 to November 1967 at least one excreter was found. The longest spell free of one was 7 months; usually the clear spells were only 2 or 3 months. The experience during this time of the surrounding area was different both in other hospitals (two isolations from a population more than 5 times as great), in general practice (three isolations all connected with hospital A in a population less frequently sampled) and in public health (no isolations).

Salmonella senftenberg isolations in the hospital

The isolations are shown in Table 1.

By early 1965 one of us (D.A.L.) carrying out the bacteriology had noted the undue numbers of excreters. He was unable, however, to establish a clear connexion between them. In April some patients on ward 6 had mild intestinal upsets. They were examined and the staff of the ward and that of the general kitchen were examined also. *S. senftenberg* was isolated from two on this ward and one on another ward, but not from the kitchen staff. In May more mild illness led to an investigation of patients and staff on ward 12 and in the theatre. Many excreters were found. A connexion between the theatre and ward 12 seemed established and the outbreak appeared to be localized. Very soon, however, it was clear that this was not so and excreters were found in another ward and among the administrative staff. In June they were found in most departments of the hospital. Among the catering staff twelve excreters were now discovered. The regular staff of the pathology and radiology departments escaped completely; however, to the former was attached a cadet nurse and to the latter a temporary typist. These two alone of those employed in the two departments ate in the canteen and both excreted *S. senften-*

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Table 1. *Isolations of Salmonella senftenberg at hospital A and elsewhere in the Sunderland area*

		Hospital A				Total	Elsewhere
Month	Patients	Ward staff	Catering staff	Other staff			
1963	Dec.	2 (5, 7)	—	—	—	2	—
1964	Jan.	2 (7, 17)	—	—	—	2	—
	Feb.	—	—	—	—	—	—
	Mar.	—	—	—	—	—	—
	Apr.	—	—	—	—	—	—
	May	—	—	—	—	—	—
	Jun.	1 (6)	1 (6)	—	—	2	—
	Jul.	—	—	—	—	—	—
	Aug.	—	—	—	—	—	—
	Sept.	—	—	—	—	—	—
	Oct.	—	—	—	—	—	—
	Nov.	1 (3)	—	—	—	1	—
	Dec.	1 (7)	1 (2)	—	—	2	—
1965	Jan.	—	—	—	—	—	—
	Feb.	—	—	—	—	—	—
	Mar.	—	—	—	—	—	—
	Apr.	2 (6, 11)	1 (6)	—	—	3	—
	May	28 (6, 7, 12)	14 (6, 12)	—	10	52	—
	Jun.	30*	20†	12	17	79	—
	Jul.	—	—	—	—	—	—
	Aug.	—	—	1	—	1	—
	Sept.	—	—	1	—	1	—
	Oct.	—	—	1	—	1	—
	Nov.	—	—	—	—	—	—
	Dec.	1 (11)	—	3	—	4	—
1966	Jan.	—	—	2	1	3	—
	Feb.	1 (12)	—	—	—	1	2‡
	Mar.	—	—	—	—	—	—
	Apr.	—	—	—	—	—	—
	May	—	—	—	—	—	—
	Jun.	—	—	3	—	3	—
	Jul.	1 (12)	—	—	—	1	1§
	Aug.	1 (3)	—	1	—	2	—
	Sept.	—	—	—	—	—	1
	Oct.	—	—	—	—	—	—
	Nov.	—	—	—	—	—	—
	Dec.	—	—	—	—	—	—
1967	Jan.	—	—	—	—	—	—
	Feb.	—	—	—	—	—	—
	Mar.	—	—	—	—	—	1¶
	Apr.	1 (18)	—	—	—	1	—
	May	—	—	—	—	—	—
	Jun.	—	—	—	—	—	—
	Jul.	5 (10)	1 (10)	—	1	7	2**
	Aug.	—	—	—	—	—	—
	Sept.	—	—	—	—	—	—
	Oct.	—	—	—	—	—	—
	Nov.	—	—	—	—	—	—

Figures in parentheses indicate ward numbers.

* Wards 2, 4-7, 11, 12, 14 and 18.

† Wards 2-5, 7, 11, 14, 17 and 18.

‡ Mother and baby at hospital B.

§ Husband of one of staff of hospital A

|| From septic tank at home of one of staff of Hospital A.

¶ Child in Hospital C. ** Relatives of Staff at Hospital A.

berg. The finding of these two excreters strengthened the view that such widespread involvement of the hospital could only result from dissemination by the kitchen. The hospital was closed as far as possible, and was gradually reopened throughout July, the last ward being opened in August. The kitchen meanwhile was closed on 5 June and reopened on 5 July. During this period food was brought in from outside.

About four-fifths of the patients and staff excreting the organism in May and June, and indeed at all times since December 1963, were wholly without symptoms. Most of the remainder were mildly ill. There were no deaths attributable solely to the infection but it is possible that the lives of a few very ill patients were shortened.

Throughout the rest of 1965 excreters continued to be detected in the catering staff. A single patient was also found to be excreting the organism. This pattern of detection continued until August 1966 but from then until April 1967 no more excreters were found. This was in spite of the continuing examination of the catering staff. During this period a comparable number of samples was obtained from other staff. None yielded *S. senftenberg*.

In July 1967 there was a party on ward 10 and some illness in patients, but samples were negative; 12 days later seven excreters of *S. senftenberg* were discovered. One of them was the ward maid, another a corridor cleaner friendly with her, both were ill.

Salmonella senftenberg isolations elsewhere

Isolations other than in the hospital are shown in Table 1 for the period since December 1963. Before that time *S. senftenberg* had been isolated in the Sunderland area in 1952 from an excreter of *S. paratyphi B*. It had been isolated from animal feeding stuff from a factory about 3 miles north of the hospital in October 1962 and June 1963. The factory had supplied feeding stuffs to a farm very near and towards the south-west of the kitchen hut of the hospital, but did not do so after December 1963. A mother and her baby excreted the organism during her lying-in period in February 1966 in hospital B. The obstetricians at the hospital are on the staff of hospital A. Neither was excreting *S. senftenberg*. In March 1967 a child in hospital C excreted the organism. No connexion could be established with hospital A. He lived in Boldon U.D., the district of the isolation of 1952.

One of the catering staff at hospital A continued to excrete the organism for a long time. Once amongst numerous attempts it was isolated from her husband. It was also isolated from the overflow from the septic tank at her home in September 1966.

In July 1967 the illness of the corridor maid and her husband during the time of the episode on ward 10 followed a meal of cold chicken cooked the day before and stored over a warm night in the larder of their home. Both of these fit adults were severely ill and it is probable that they had a large dose of organisms from the chicken; this maid had previously excreted *S. senftenberg* on two occasions in May and June 1965 but was not ill. Her friend the maid of ward 10 was also seriously ill at the same time with *S. senftenberg* in the stool, 7 days later a positive stool was obtained from her daughter.

Thus the *S. senftenberg* in the husbands of two of the hospital employees, the daughter of one and the overflow from the septic tank was related to the incidents in hospital A.

Not only were there only seven isolations of *S. senftenberg* from sources other than hospital A from December 1963 to March 1967 but the organism, if brought home by patients or staff, did not usually spread. One incident was noteworthy. The mother of one of the kitchen staff at A worked in the kitchen of hospital D. She and her family were examined repeatedly, but though her daughter continued to excrete *S. senftenberg* it was never isolated from the rest of the family.

DISCUSSION

There was little evidence of spread from person to person except in the hospital wards. After the hospital and kitchen had been closed, a new cleaner in the kitchen was found to be excreting *S. senftenberg* a week after arrival, which indicated a continuing source of infection in the kitchen.

One of us (P.B.C.), responsible for the hygiene of the kitchen, was persuaded during the survey of the kitchen in 1966 that lapses had been tolerated. Utensils, particularly meat knives, were old with split handles. The surface of the mobile table used for cutting meat and poultry was constructed of wood with deep fissures. Sponges were found on wash-hand basins and kitchen sinks for cleaning purposes. A can opener and slicing machine showed signs of hurried attention when last used. Cold-storage space was limited. A significant factor was the expanse of window facing the south-west, about 200 yards from a farmyard where feeding-meals for animals were compounded in an open shed. *S. senftenberg* is commonly found in various feeding-meals and much dust emanates from the machine during the process of grinding up grains and of compounding mixes. The kitchen of the hospital is converted from a ward hut and holes in the roof indicated where lights had been removed. However, samples of dust from the roof space and various other sites were never found to contain *S. senftenberg*.

The other factor considered as a source of the infecting agent was the poultry supplied to the hospital. The supplier obtained birds from two farms where there had been infection due to *S. senftenberg* in poultry (Hobbs & Hugh-Jones, 1969) *S. senftenberg* was isolated from litter sampled on two occasions from a turkey brooder house on a third farm 13 and 14 months after outbreaks of salmonella infection due to *S. senftenberg* had occurred.

The same supply of birds was used for two other hospitals in the group without ill effect. Nevertheless careful inquiry about the method of cooking turkeys—for example, in the affected hospital—indicated that rather short times at moderate temperatures were used in the ovens. In some instances incidents appeared to follow the introduction and preparation of turkey.

When the excretion of *S. senftenberg* was at its height, many symptomless excreters were found in the kitchen. It is probable that the food handlers and cleaners were infected from sources in the kitchen. The infection might have come from trolleys and waste foods passing from the wards to the kitchen for cleaning;

but since none of the returned food is likely to have been eaten by the kitchen staff such routes of spread would have given only very small doses of the organism. *S. senftenberg* is unlikely to cause infection in small doses, as shown by its absence in the general population, including the families of patients, and in other hospitals. It is more likely that there was a build-up of infection in the environment of the kitchen and in the foods going out from the kitchen in May and June 1964.

The reappearance of *S. senftenberg* from time to time in excreters was a puzzling feature. The differences between intermittent excreters and reinfection was difficult to assess. Those with positive stools were banned from the kitchen until six consecutive negative samples were obtained.

The invasion of this hospital by *S. senftenberg*, an organism of apparently low virulence, was most unusual. Although there were few deaths associated with it, nevertheless it caused much inconvenience to both hospital staff and patients. In particular, the training of nursing staff was interrupted and some careers disrupted.

It is suggested that the source of salmonellosis in hospitals should not only be sought for in the human population of the hospital but also in the bulk purchases of meat, poultry and other foodstuffs. Methods of preparation and the thoroughness of cleaning procedures may decide the fate of the organisms in the kitchen environment.

SUMMARY

Salmonella senftenberg was isolated from 168 patients and staff of a general hospital whereas it was isolated from only seven other sources (four of which were unquestionably associated with the hospital) in the surrounding area during the same period. It was isolated in the hospital in 19 of the 48 months of the period. Two clear-cut episodes were recognized against a background of sporadic isolation. Four-fifths of the patients and staff excreting the organism had no symptoms. Only two are known to have been severely ill, though in some patients very ill for other reasons life may have been shortened a little.

The original source of the organism, whether from the farm or from raw materials such as meat or poultry, was not found.

REFERENCE

- HOBBS, B. C. & HUGH-JONES, M. E. (1969). Epidemiological studies on *Salmonella senftenberg*. I. Relation between animal foodstuff, animal and human isolations. *J. Hyg., Camb.* **67**, 81.