

*In smallpox surveillance, attention should be given to the hospital as a possible focus of infection. In addition to other situations reported in the literature, an outbreak is described which occurred in Kuwait where cases contracted the disease in hospital. The problem is discussed and the need for laboratory facilities to make a rapid diagnosis is emphasized.*

## **ROLE OF HOSPITAL IN SMALLPOX OUTBREAK IN KUWAIT**

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### **Introduction**

FROM February to May, 1967, a smallpox outbreak occurred in Kuwait which had been free from endemic smallpox for the past decade. A total of 41 cases and 19 deaths was recorded. In the outbreak, hospitals played a major role in disease transmission. Of 41 cases, at least 32 had a known close contact with unrecognized smallpox patients admitted to the hospitals.

This is similar to experiences in a number of smallpox outbreaks, including those in New York, 1947,<sup>4</sup> Bradford, United Kingdom, 1962,<sup>1</sup> Stockholm, Sweden, 1963,<sup>5</sup> and Espirito Santo, Brazil, 1967.<sup>3</sup> The role of hospitals as an amplifier of smallpox epidemics is frequently overlooked. This is a problem not only in smallpox-free areas but also in endemic areas. Described here is an additional episode in which hospital spread of smallpox was of epidemiological importance.

### **Background Information**

The state of Kuwait is situated on the western coast of the Gulf area. It has an area of 9,375 square miles, mostly desert, and a population of 460,000 that resides

mainly in the city of Kuwait and its suburbs. The smallpox incidence during the past decade in Kuwait is shown below:

Year	Cases	Year	Cases
1956	8	1962	1
1957	23	1963	—
1958	—	1964	—
1959	10	1965	—
1960	—	1966	—
1961	—	1967	41*

\* Outbreak described in this paper; first case imported from Pakistan.

Although Kuwait appears to have been free of endemic smallpox since 1957, it has constantly been exposed to the danger of reintroduction of cases due to its close communications with heavily endemic countries such as India and Pakistan.

The health services, particularly the curative medical service, are well developed. There are ten hospitals with a total of 2,877 beds—one per 160 inhabitants. Medical care is free of charge to all citizens. There are 467 physicians, nearly one for each 1,000 inhabitants. A routine smallpox vaccination program has been carried out through the health

service including 128 school clinics. Primary vaccination is compulsory.

### Introduction of Outbreak

*Case No. 1—Imported Case:* It was found in retrospect that the first case occurred in a Pakistani woman who arrived in Kuwait from Karachi by air on January 25, 1967. An outbreak of smallpox was, however, not suspected until March 18 when a case in the second generation was first diagnosed. Earlier cases were then uncovered through retrospective investigation.

The original case had a valid smallpox vaccination certificate for revaccination dated January 2, 1967, in Karachi. On February 10, 16 days after arrival in Kuwait, she developed a mild fever; on February 12, chickenpox was diagnosed and she was admitted to a general ward of the Fever Hospital. On February 18, she was discharged. Later investigation revealed that she had a few recent smallpox pock marks on her face, arms, and legs, thus substantiating the diagnosis and suggesting that the case was a modified one.

*Case No. 2—First Generation:* Case 2, a female 25 years of age, had been admitted to the hospital with a diagnosis of measles on February 13 and was discharged on February 22. Her bed was opposite that of Case 1. On February 25, after being discharged, she developed fever and on February 28, was again admitted to the Fever Hospital with a diagnosis of chickenpox. She stayed in the hospital until April 4, undiagnosed as smallpox. Her vaccination history is not known.

*Case No. 3—Second Generation:* Case 2 had a daughter of eight months who stayed with her in the hospital. When her mother's illness became severe, the baby was sent back to her home. The baby developed fever and was admitted to the Fever Hospital with a diagnosis of chickenpox. The exact date and the vaccination history are not known. After

admission, she stayed with her mother, Case 2, until April 4.

*Case No. 4—Third Generation:* On March 26, the 20-year-old aunt of Case 3, who had never been vaccinated, was taking care of Case 3 at home and developed fever. On March 31, she was admitted to the Fever Hospital with a diagnosis of chickenpox. On April 21, her diagnosis was changed to smallpox and she was transferred to the smallpox isolation ward in the same hospital.

*Case No. 5—The First Recognized Case, Second Generation:* During the period in which Case 2 was in the hospital, i.e., February 28 to April 4, Case 5, a 21-year-old woman, never vaccinated, was admitted to the same ward as Case 2, with a diagnosis of influenza. She stayed in the hospital for the period from March 1 to 7. On March 13, after her discharge, she developed a fever and on March 16 was readmitted to the Fever Hospital with a diagnosis of chickenpox. On March 18, smallpox was suspected and, on March 25, she died. This was the first case to arouse the suspicion of the hospital staff. A specimen was sent to the United Kingdom where laboratory diagnosis confirmed that the woman had smallpox.

### Spread of the Disease

Unrecognized smallpox cases were present in the Fever Hospital from February 12 to March 18 when Case 5 of the second generation was first suspected to have smallpox. Consequently an outbreak of hospital-associated cases occurred in the Fever Hospital, forming the first epidemic wave from April 2 to April 10. This crop of cases is regarded as third generation cases. Two cases of unknown source of infection were included in this generation (Figures 1 and 2).

After this first wave of the epidemic, unrecognized cases of the third generation, which were still present in the Fever Hospital, caused a second epidemic wave

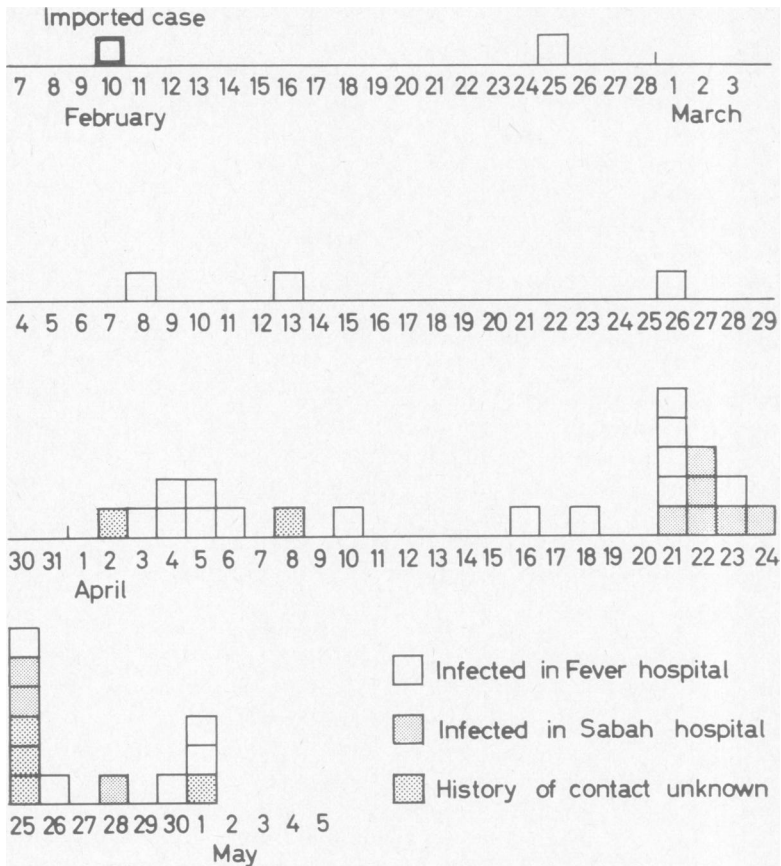


Figure 1—Epidemic curve by date of onset, Kuwait smallpox outbreak

of hospital-associated cases. Also, one unrecognized case of the third generation was transferred from the Fever Hospital to the Sabah Hospital (general hospital in Kuwait) and again produced hospital-associated cases in the Sabah Hospital. This crop of cases, between April 16 and May 1, is regarded as fourth generation cases. Four cases of unknown source of infection were included in this generation.

Thus, two hospitals in Kuwait played a major role on the spread of the disease in this outbreak. Further details, according to the generation of cases, are provided below.

*Third Generation:* Ten cases occurred

during this generation, including Case 4 (noted above). Seven of these resulted from contact with cases in the Fever Hospital. All had been admitted while undetected. Cases 2, 3, and 5 were hospitalized there. Considering that Case 5 was the most severely and recently ill, it is probable that this case was the main source of infection. Of these seven cases, five were not vaccinated, the vaccination history of the remaining two was not known.

The source of infection of two cases in this generation, an unvaccinated 23-year-old traffic policeman and a three-year-old unvaccinated boy, is not clear. The former had not been previously admitted

to the Fever Hospital; the latter had been admitted previously but had been discharged 23 days before the onset of smallpox.

Thus, of the ten cases in this generation, at least eight resulted from hospital contact.

*Fourth Generation:* Twenty-five cases occurred during this generation. The cases consisted of persons infected in the Fever Hospital as well as at the Sabah Hospital and a few cases of which the source of infection is not clear.

*1. Cases Infected in the Fever Hospital:* Case 4, an unrecognized smallpox

case, stayed in the hospital from March 31 to April 21. Also, during this period, the cases of the first epidemic wave were being admitted. Twelve patients, who had been admitted to the hospital with other diseases during this period subsequently developed smallpox. Of these 12 cases, 3 had not been vaccinated; 6 were vaccinated only during the incubation period; 1 had been revaccinated 6 months previously. However, it was not known whether this revaccination was successful although a primary vaccination scar was seen on the arm. The vaccination history of the remaining 2 is

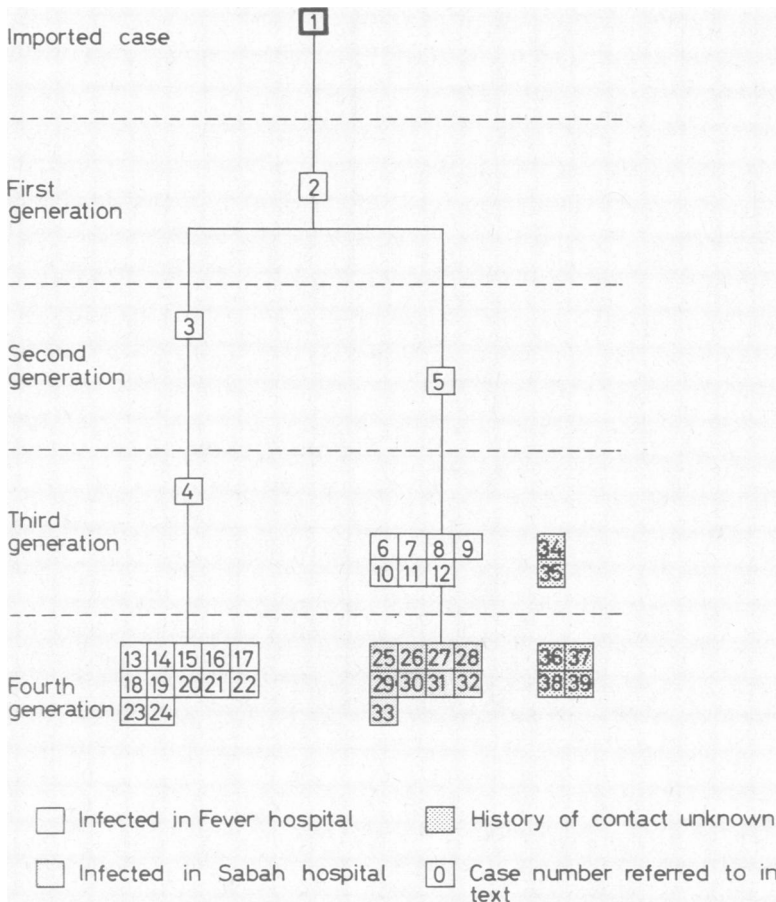


Figure 2—Smallpox transmission in Kuwait outbreak

not known. The case with a mild attack, revaccinated 6 months previously, a 20-year-old female nurse, cared for patients in the smallpox ward. This was the only case among the hospital staff in this outbreak.

2. *Cases Infected in the Sabah Hospital:* Among the cases in the third generation was an 11-month-old unvaccinated boy who had developed fever on April 5 and had been referred to the Fever Hospital on April 8, with a diagnosis of leukemia and then to another hospital where a diagnosis of drug allergy was made. Finally, on April 9, he was admitted to the Pediatric Department of Sabah Hospital. He died on April 14 and at that time smallpox was first diagnosed. Nine patients who were hospitalized in the pediatric ward during his period of hospitalization subsequently developed smallpox. Of these nine cases, three had not been vaccinated, five were vaccinated only during the incubation period; the vaccination history for one was unknown.

3. *Cases in Which Infection Source Is Unknown:* During the fourth generation, four cases were diagnosed, none of which had a definite history of contact with patients either in the Fever Hospital or in the Sabah Hospital. Three cases had previously been admitted to the Fever Hospital, but had been discharged more than one incubation period previously. No family contact was involved in these four cases.

Thus, of 25 cases during the fourth generation of cases, at least 21 were as a result of hospital contact.

### Age, Sex, Vaccination History and Deaths (Table 1)

Of 39 cases for which data are available, 21 cases were under the age of 4, 6 were between 5 and 9, and 12 over 15. The number of cases was similar in both sexes. Only 8 cases had been previously vaccinated and 23 had no vaccination history at the time of exposure. The case fatality rate reached 38 per cent.

### Laboratory Confirmation

Confirmation by virus isolation was obtained in the following cases: *Case 5*, the main source of the first epidemic wave; *Cases 15 and 16*, who were infected in the Fever Hospital; *Case 27*, infected in the Sabah Hospital during the second epidemic wave; and *Case 34*, which resulted from an unknown source of infection. The Public Health Laboratory, London, and the Research Institute of Virus Preparations, Moscow, performed the testing.

### Control Measures

Immediately after Case 5 was suspected as smallpox on March 18, the health authorities started intensive con-

Table 1—Cases by age, sex, vaccination history and death

Age (year)	Sex			Vaccinated before exposure			Deaths
	Male	Female	Total	Yes	No	Unknown	
0-4	11	10	21	—	14	7	7
5-9	2	1	3	2	1	—	3
10-14	3	—	3	—	3	—	3
15 and over	4	8	12	6	5	1	2
Total	20	19	39	8	23	8	15

trol measures. The hospitals where smallpox occurrence was suspected were placed under close surveillance. Patients were vaccinated. Detection and reporting of suspected cases were intensified through publicity. In the hospital, a diagnostic panel was formed for screening the suspected cases. All houses where cases were reported after discharge from the hospital were visited. Contacts were vaccinated and placed under surveillance. The mass vaccination campaign was initiated by the application of tally sheets, simplification of vaccination technique, intensive health education, public relations, and the like. By the middle of April, over 360,000 vaccinations had been performed, which is equivalent to 80 per cent of the total population of Kuwait.

### Discussion

Millar reviewed the role of hospitals in smallpox epidemics and summarized his findings as follows: from 1962 to 1963, there were 222 cases of indigenous smallpox in Germany, United Kingdom, Sweden, and Poland. Of these 222 cases, at least 96 (43%) acquired the disease as a result of hospital contact.<sup>2</sup> In the Kuwait outbreak, the first recognized case was in the second generation, but a case of the third generation stayed in the hospital still undetected. The first recognized case was in the first generation in the Bradford episode<sup>1</sup> and in the second generation in the Swedish episode.<sup>5</sup> Thus, delayed diagnosis of smallpox was the cause of infection in the hospitals. Furthermore, it should be noted that when cases of the first or second generation were uncovered, susceptible contacts were already in the incubation period. More recently, in a hospital in Espirito Santo, Brazil, a smallpox outbreak occurred in which a hospital presented a continuous source of infection from January to October, 1967.<sup>3</sup> This last episode indicates that hospital transmission of

smallpox is also a problem in endemic areas.

In smallpox surveillance activities, attention should be paid to the possible role of the hospital as a focus of infection. Investigation of the history of smallpox cases related to previous hospitalization would be useful. Hospital staffs generally should maintain a high index of suspicion and should keep their immunity by vaccination at proper intervals. If the occurrence of smallpox is suspected in a hospital, all possible contacts should immediately be vaccinated and placed under close surveillance. The importance of this measure is emphasized particularly in endemic countries.

In Kuwait, when the smallpox outbreak occurred, there were also epidemics of chickenpox and measles. Many patients with a variety of rashes as well as many with fever only were brought to the Fever Hospital at a relatively early stage of their illness, normally from two to three days after the onset of disease. There were several cases of generalized vaccinia. Clinical diagnosis was a problem to determine appropriate action and this emphasized the importance of laboratory facilities for quick diagnosis in a country where smallpox may be imported.

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## White House Conference on Children Coming Up

Educators, physicians, social scientists, administrators, and professionals in law and communications are among the 48 experts appointed to serve as chairmen and vice-chairmen of 24 forums that will comprise the White House Conference on Children, Washington, D. C., December 13 to 18. The 16-member forums will explore issues affecting children up to 13 years of age, and submit reports and recommendations to the 4,000 conference delegates. A multidisciplinary approach will be used to examine such areas as learning; parents and families; communities and environments; and laws, rights, and responsibilities—as they concern children from all socioeconomic and ethnic backgrounds and from rural, urban, and suburban environments.

A separate conference to explore issues of concern to youth—persons between 14 and 24—will be held in Washington, D. C., late in February, 1971. (White House Conference on Children and Youth, P.O. Box 19, Washington, D. C. 20044.)