This paper presents a case study of the satisfactory results that can be obtained when local health departments communicate and cooperate with each other.

# Tuberculosis Outbreak in a Circus: Report of a Cooperative Investigation

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## Introduction

On April 3, 1970, the 46-year-old wife of a circus aerial performer was found to have active, far-advanced, pulmonary tuberculosis. A chronic cough and increasing weakness of two months' duration had prompted her to visit a physician in Washington, D.C., where the circus had been performing for three weeks. A chest X ray and sputum examination confirmed the diagnosis of tuberculosis. The patient was immediately hospitalized, the health department was notified, and an investigation was begun. Six local health departments in three states and the District of Columbia subsequently participated in a coordinated program of skin tests, chest X rays, and treatment. Five new cases were discovered, 111 skin-test reactors were identified, and 82 members of the circus company were started on isoniazid therapy.

## The Investigation

After the new, active tuberculosis case was reported, every member of the patient's family, all of whom traveled and lived with the circus, were given a 14 x 17-inch chest X ray. Her 22-year-old son and 3-year-old grandson had abnormalities consistent with active, minimally advanced tuberculosis and they, too, were hospitalized. (Table 1) The Washington, D.C., Department of Public Health then undertook a Mantoux tuberculin test (5 test units of PPD-S) survey of 250 circus employees. (Table 2) Seventy-four (30%) persons, eight of whom had a history of BCG vaccination, had skin test reactions of $\geq$ 10 mm induration (positive) and an additional 28 had reactions of 5-9 mm induration (doubtful—counted as negative). Sixty-two persons also had 70 mm chest X rays.

On April 10, the circus began a four-day engagement in Salem, Virginia. The Washington, D.C., Health Department forwarded a list of 78 circus employees who, either because of reactions to tuberculin or questionable 70 mm films, required 14 x 17-inch chest X rays. The Roanoke County Health Department took 23 such films and discovered three additional cases of pulmonary tuberculosis. (Table 1) Thirteen members of the circus company who were not available for skin testing in Washington were tested by the Roanoke County Health Department. (Table 2) Eight had positive reactions. The circus company planned to spend the next two weeks performing in Alabama's three largest cities, so the Bureau of Tuberculosis Control of the Virginia Department of Health sent these X-ray and skin-test reports to the Division of Tuberculosis Control at the Alabama Department of Public Health, which forwarded them to Mobile, the circus's first stop in Alabama. There, the Mobile County Health Department offered isoniazid to 82 employees who had had positive tuberculin reactions in the Washington or Roanoke

**Table 1—New Active Cases of Tuberculosis in Circus Personnel on Tour, U.S.A., 1970**

| Patient | Age | Sex | Patient history | TB diag. | Hospitalized From | Hospitalized To | Skin test | X ray | Culture | TB stage |
|---|---|---|---|---|---|---|---|---|---|---|
| A. N. | 46 | f | index case | 4/6/70 | 4/6 | 6/8 | none* | active TB | pos. | mod. adv. |
| P. N. | 22 | m | son of A. N. | 4/8/70 | 4/8 | 6/8 | none* | active TB | pos. | minimal |
| S. C. | 3 | m | grand child of A. N. | 4/8/70 | 4/8 | 4/17† | none | active TB | none | minimal |
| F. W. | 63 | m | circus laborer | 4/10/70 | 4/18 | 6/12 | 20mm | bilat. adenop. | neg. | mod. adv. |
| B. R. | 14 | m | cyclist | 4/10/70 | none | — | 20mm | left hilar adenopathy | none | minimal |
| W. F. | 37 | m | groom | 4/13/70 | 4/26 | 9/14 | 3mm | bilat. calcifications, and adenopathy | pos. | mod. to far adv. |

* BCG in March, 1968, and positive skin tests in July, 1968.
† Discharged against medical advice.

surveys and informed them of possible side effects. Sixty-eight persons accepted prophylactic treatment with 300 mgm of isoniazid daily. Most of the 14 who refused treatment were aerial performers who expressed concern about the mental and visual abnormalities that can accompany administration of isoniazid.[1]

The circus then proceeded to Montgomery, Alabama, where X rays were taken of the 15 employees whose equivocal skin tests in Washington indicated need for further study. No new cases were found, but 10 more tuberculin reactors began prophylactic isoniazid therapy. In addition, Mantoux skin tests were administered to 10 persons who had not been available for testing in Washington. Two days later, when the circus reached Birmingham, the Jefferson County Health Department read the tests and identified four new reactors, all of whom refused isoniazid therapy.

By the time the circus had completed its tour of Alabama, 78 of the 86 skin-test-positive employees had accepted a three-month supply of isoniazid, and two of the three persons with new cases diagnosed in Roanoke had been hospitalized. The states through which the circus would travel during the next three months of its tour received from the Alabama Department of Public Health a list of all 86 positive reactors, including those who had declined isoniazid and would therefore require periodic chest X rays.

On July 23, three months after the investigation was completed in Alabama, the circus arrived in Houston, Texas, for a three-week stand. The Houston Department of Public Health undertook a follow-up investigation. The Communicable Disease Division skin-tested circus personnel who had had negative or equivocal reactions to tuberculin three months earlier and were still traveling with the circus. There were 25 positive reactors, 22 of whom had been negative in April. The conversion rate was 19 per cent. (Table 2) A second three-month supply of isoniazid was issued to 60 persons who had continued with chemoprophylaxis prescribed in Alabama in April. Eighteen circus employees, several of whom were aerial performers, had stopped taking the drug; most mentioned dizziness or visual changes when asked why. Chest X rays were taken of the 25 newly-discovered positive reactors, the eight previously positive reactors who had refused chemoprophylaxis in April, and 11 of the 18 employees who had stopped taking isoniazid after leaving Alabama. No new cases were discovered. Four of the five hospitalized employees had rejoined the circus by this time and were also X rayed. All four were continuing to recover satisfactorily. Of the 25 reactors identified in Houston, only four agreed to take isoniazid. This reluctance to take isoniazid was apparently due to the reports of adverse effects from the 18 employees who had stopped using the drug.

## Mode of Spread

Contact histories of the six patients (Table 1) do not suggest that this outbreak was a common-source epidemic. Although there can be little doubt that the son and grandson of the 46-year-old woman contracted their disease from her, there is little evidence that the other three patients had prolonged enough or intense enough exposure to result in transmission of tuberculosis. It seems probable that the three patients who were not members of this woman's family were incidentally discovered in the investigation of the first three cases.

Compared with the daily activities in school and military service, which have provided excellent opportunities to study tuberculosis transmission,[2-5] circus activity is much less consistent. It was difficult in the circus community to determine contact histories and patterns. It seems unlikely, however, that the 46-year-old woman's disease accounted for a very large proportion of the 111 tuberculosis infections among members of the circus company. She was a retired aerialist and had relatively little contact with anyone except her family and close friends. The 37-year-old groom was more likely than the woman to have infected a significant number of fellow employees.

## Conclusion

The circus community's tuberculosis case rate (24.0 per 1,000) was more than 100 times greater than the 1969 national rate (0.194 per 1,000).[6] The circus employees'

**Table 2—Investigation of Circus Tuberculosis Outbreak by City**

| City | Date | Skin test results | | | | X ray results | | | | INH | New | Hosp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pos. | Neg. or equiv. | Total | % pos. | Pos. | Neg. | Equiv. | Total | started | cases | cases |
| Washington, D.C. | 4/5/70 | 74 | 176 | 250 | 30 | 3 | 61 | 1 | 65* | 0 | 3 | 3 |
| Roanoke, Virg. | 4/13/70 | 8 | 5 | 13 | 62 | 3 | 18 | 2 | 23 | 0 | 3 | 0 |
| Mobile, Ala. | 4/18/70 | — | — | — | — | — | — | — | — | 68 | 0 | 1 |
| Montgomery, Ala. | 4/22/70 | — | — | — | — | 0 | 15 | 0 | 15 | 10 | 0 | 1 |
| Birmingham, Ala. | 4/24/70 | 4 | 6 | 10 | 40 | — | — | — | — | 0 | 0 | 0 |
| Subtotal | | 86 | 187 | 273 | 32 | 6 | 94 | 3 | 103 | 78 | 6 | 5 |
| Houston, Texas | 8/11/70 | 25† | 89 | 114 | 22 | 0 | 40 | 0 | 40 | 4†† | 0 | 0 |
| Total | | 111 | 276 | 387 | 29 | 6 | 134 | 3 | 143 | 82 | 6 | 5 |

* 70 mm except for 3 new cases, who had 14 x 17-inch films taken.

† Twenty-two of these 25 had been negative in April; the conversion rate is 19%.

†† A second 3-month supply of INH was issued to 60 individuals who had continued with chemoprophylaxis prescribed in April. Eight reactors had refused to begin INH, and 18 others had discontinued their INH before reaching Houston.

tuberculin reactor rate of 29 per 100 was three times as high as the U.S. Public Health Service estimate of the national rate (10 per 100).[7] Members of the circus company were at extraordinary risk of contracting tuberculosis. The presence of six active cases in a community of 250 constitutes a tuberculosis outbreak of epidemic proportions. The principal significance of the investigation, however, lies not in the skin-test and X-ray data accumulated, but in the exemplary cooperation among six health departments. No other reported investigation of a tuberculosis outbreak has involved so many health departments in a common effort. Reactors who were identified in Washington, D.C., and Roanoke, Virginia, were treated in Mobile and Montgomery, Alabama; two patients whose illness was diagnosed in Roanoke obtained hospitalization from Alabama health departments; persons who had negative or equivocal reactions when skin-tested in April were tested again three months later in another state. The Houston (Texas) Health Department also renewed the isoniazid supplies of previously positive reactors who had accepted prophylaxis and obtained chest X rays of those who had not. The cooperation of six health departments thus permitted adequate investigation of a tuberculosis outbreak, provided prophylactic treatment to 82 infected persons, and identified and hospitalized 5 persons who had active tuberculosis.

## References


1. Weinstein, L. Drugs used in the chemotherapy of leprosy and tuberculosis. In: The Pharmacological Basis of Therapeutics, ed. 4. New York: Goodman and Gilman, 1970, p. 1327.
2. Bates, J. H.; Potts, W. E.; and Lewis, M. Epidemiology of primary tuberculosis in an industrial school. New Eng. J. Med. 272:714-717, 1965.
3. Rogers, E. F. H. Epidemiology of an outbreak of tuberculosis among school children. Public Health Reports 77:401-409, 1962.
4. Ochs, C. W. The epidemiology of tuberculosis. JAMA 179:247-252, 1962.
5. Darney, P. D. and Clenny, N. D. Tuberculosis Outbreak in an Alabama High School, JAMA, 216:2117-2118, 1971.
6. The Project Years 1961-1969: Tuberculosis Program Reports. U.S. Dept. HEW, Public Health Service, Center for Disease Control, Tuberculosis Branch, December 1970, p. 5.
7. Edwards, P. Q. Address to the 20th Conference of the International Union Against Tuberculosis, New York, Sept. 4, 1970.


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## Placement Service at Centennial Meeting was Very Successful

The predictions which had been made for a very successful Employment Placement Service are being borne out in "early returns" from the New Jersey staff who provided the service during the Centennial Meeting:

- 536 employment applications were filed;
- 297 employers placed 501 job orders listing 985 positions available;
- 1,427 messages were exchanged through the Placement Service message centers;
- 944 on-site interviews were conducted between employers and applicants in the Placement Center in Convention Hall.

William Norcross, of the New Jersey State Training and Employment Service, who headed the operation for APHA in Atlantic City last month, said that the interest and participation by attendees at the Annual Meeting exceeded his expectations. He said that he and his staff encountered very few problems or difficulties in coping with the large number of people using the placement service. Twelve professional personnel staffers assisted Norcross during the four and one-half days the Placement Service was conducted.

Norcross said that he planned to contact each employer who used the Service in a follow-up effort to determine the final results of their contacts with applicants, and would send a further report to APHA on those findings.

He also plans to make his report available, for planning purposes, to the employment service personnel in California who will have responsibility for this function at the San Francisco meeting next year.