

# Epidemiology of Acute Coccidioidomycosis with Erythema Nodosum\* (“San Joaquin” or “Valley Fever”)

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FROM its initial recognition in 1892<sup>1, 2</sup> until 1936 coccidioidal granuloma was deemed the sole manifestation of coccidioides infection. To most of us this granuloma was noteworthy because of the bizarre character of the causative fungus, *Coccidioides immitis*, its notorious clinical and pathological mimicry of tuberculosis, its 50 per cent fatality, and the fact that most of its recognized victims resided at some time in the southern (San Joaquin) half of the great Sacramento-San Joaquin Valley of California. However, its incidence was infrequent even in this endemic area. That the infection apparently never occurred in an inapparent or benign form escaped notice. Then came what Meyer<sup>3</sup> has called “the Renaissance” of our knowledge of coccidioides.

For at least fifty years the southern San Joaquin Valley has also been the site of a disease known locally as “San

Joaquin fever,” “San Joaquin Valley fever,” “valley fever,” “desert fever,” or “desert rheumatism.” Characteristically the illness consists of an influenzal-like initial phase followed in 2 to 18 days by the eruptive phase of erythema nodosum and less frequently erythema multiforme. The skin lesions are frequently associated with arthritis and conjunctivitis (often phlectenular). The eruption lasts from 6 days to 3 weeks and, as the lesions fade, pigmented areas remain for months. Recovery is practically invariable. The disease, so far as can be ascertained, was never described in the medical literature until 1936 when Gifford<sup>4-6</sup> and Dickson<sup>7-10</sup> established that this illness is really a benign form of coccidioides infection or “coccidioidomycosis.”

A cooperative field and laboratory study of “San Joaquin fever” was undertaken in the two counties where the incidence has been greatest. An attempt was made to interview and examine every person who had this illness. The organization of the field work has been described elsewhere.<sup>11</sup>

During the 17 months from December 7, 1937, to May 12, 1939, 432 patients of Kern and Tulare Counties were seen with erythema nodosum or

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NOTE: Supported by the Rosenberg Foundation, the study is in collaboration with the County Medical Societies, County and City Health Departments, medical institutions, welfare organizations and the large ranches of Kern and Tulare Counties. Especial appreciation is expressed to Dr. M. A. Gifford, Chief Assistant Health Officer of Kern County.



*terium tuberculosis* was found in 4 of the 11 with positive Mantoux tests, all of which were very severe. Since 95 per cent of the erythema nodosum of the region appeared to be caused by *Coccidioides*, it seemed more accurate to include the 15 unconfirmed cases than to exclude the entire group. Only 2 patients in the series had clinical pictures which were not clear-cut. They were included since they were the only patients who may have been suffering second attacks of "San Joaquin fever."

It did not seem justifiable to demand recovery of the fungus as criterion for inclusion. Many patients did not raise sputum. Even more had ceased to produce sputum by the time specimens were requested. Since 80 per cent of the patients did not see a physician until after the appearance of erythema nodosum, examinations were possible in only 225 (54 per cent). The sputum examinations consisted of cover slip examination, acid fast stain for *Mycobacterium tuberculosis*, culture and guinea pig inoculation. *Coccidioides immitis* was reported only when proved by animal inoculation and growth of the fungus. *Coccidioides* was recovered from 95 (42.4 per cent); 37 (16.5 per cent) were negative, while in 92 (41.1 per cent) the results were equivocal (cultures overgrown, animals died prematurely). Excluding these equivocal sputa, 72 per cent of the remaining 132 sputa were positive.

The diagnostic importance of the erythema nodosum was very apparent. The general nature of the pre-nodosum symptoms resulted in the usual diagnosis of "flu" by the victim or the physician if he was called. With more severe symptoms physicians diagnosed pneumonia frequently, lung abscess, typhoid fever, poliomyelitis and brain tumor. Severe pleurisy resulted in diagnosis of pyelitis, renal colic, gall bladder colic twice, fractured ribs twice (both treated under industrial compensation), and

appendicitis twice (both with appendectomies). A frequent rash ("toxic erythema") appearing 2 or 3 days after onset of symptoms was often misdiagnosed measles by physicians and laity.

As has been mentioned, only 20 per cent of the patients sought medical aid before the erythema nodosum. These lesions frightened them sufficiently to go to their physicians. Only rarely did the physicians fail to diagnose the erythema nodosum. However, erythema multiforme twice resulted in diagnoses of eczema and six times in those of smallpox.

On the other hand, popularization of the diagnosis threatened to make symptoms of fever and malaise into "San Joaquin" as frequently as they do "flu" in most localities. Patients were diagnosed "San Joaquin fever" when they were suffering from acute appendicitis, lead poisoning (colic), smallpox, and syphilis (secondaries). As noted above, 11 patients supposedly suffering from "San Joaquin fever" had erythema nodosum due to tuberculosis.

None of the 432 patients of this service have developed coccidioidal granuloma or other serious sequelae up to the present time.

#### INCUBATION PERIOD

Two patients provided exact incubation periods and another to within 2 days. The first was a laboratory infection<sup>7, 8, 10</sup> in which Dr. H. D. Chope, then a medical student, accidentally inhaled a massive dose of coccidioides spores and 9 days later had his onset of what is now recognized as "San Joaquin fever." Another perfect incubation period was in a San Francisco housewife who stayed one night in a Valley town and developed "San Joaquin fever" 13 days later. The third patient had an incubation period between 14 and 16 days. By questioning patients as to their movements other incubation

periods were bracketed as follows: several patients had been in the Valley only 22 days, others 21, 19, 15, 11, and 8 days, respectively. Patients who had left the Valley and had onsets elsewhere were more difficult to locate, but 2 of these minimal incubation periods were 9 and 14 days. The incubation periods ranged between 1 and 3 weeks, probably falling most frequently around 2 weeks.

#### RELATION OF COCCIDIOIDIN SENSITIVITY TO ERYTHEMA NODOSUM

The association of erythema nodosum with tuberculosis is well known, as exemplified by the epidemic which Brandon and his associates reported.<sup>13</sup> For 30 years the Scandinavians have presented convincing evidence in support of this etiological relationship. Wallgren, one spokesman of this group, stated<sup>14</sup> that while 95 per cent of the Swedish erythema nodosum is associated with tuberculosis, it is really the manifestation of nonspecific allergy. During the primary infection when the tuberculous allergy is first established, sensitivity to tuberculin is maximal. This hypersensitivity is held responsible for the appearance of the erythema nodosum.

Now another chapter has been added to the coccidioidomycosis mimicry of tuberculosis. Coccidioidin tests made during this study were in complete accord with the theory expressed by Wallgren. The development of the coccidioidin sensitivity also evidenced the specificity of the reaction. We had many patients with records of negative coccidioidin reactions from 1 month to 1 year prior to the "San Joaquin fever." Even more significant were the first 5 patients in Table 1 with coccidioidin reactions which were negative in the initial phase of their illness and positive after erythema nodosum appeared.

The last 2 patients of Table 1, though they did not develop erythema nodosum

and therefore were not included in the series of 432, provide accurate information regarding the onset of coccidioidin sensitivity. From both *Coccidioides* was recovered.

TABLE 1  
*Time Intervals between Clinical Onset, Erythema Nodosum Coccidioidin Reactions in Certain Cases of Acute Coccidioidomycosis*

Patient	Period in Days from Onset Until:		
	Negative Coccidioidin	Erythema Nodosum	Positive Coccidioidin
J.C.B.	2	17	19
O.G.	3	11	12
J.A.J.	8	15	20
A.S.	10	18	20
J.W.	17	21	40
J.D.	—	3	3
T.Y.*	—	6	4
B.B.*	—	10	8
A.C.*	—	12	6
M.M.*	4, 9	13	11
R.R.†	11	—	14
E.B.†	1 (or 2)	—	2 (or 3)

\* Note positive coccidioidin prior to erythema nodosum.

† Never developed erythema nodosum.

The other patients in Table 1 demonstrate that sensitivity had been established prior to the eruption. One patient, Mrs. M.M., provided a complete picture of this sensitivity relationship. Her coccidioidin reaction became positive between the 9th and 11th days of her illness and erythema nodosum developed on the 13th day. *Coccidioides* was recovered from her sputum collected on the 4th day.

Thus sensitivity may be established from 2 to 17 days after the onset of symptoms, probably generally between 1 and 2 weeks. If erythema nodosum does develop, it appears shortly thereafter.

The hypersensitivity which characterizes patients with erythema nodosum was first noted by Gifford.<sup>4</sup> Dickson<sup>8, 10</sup> subsequently made similar observations. Only 0.1 mg. of our coccidioidin occasionally caused vesiculation in "valley fever" patients.

Ernberg<sup>15</sup> reported recurrences of

tuberculous erythema nodosum after violent tuberculin reactions. Kessel<sup>16</sup> had a similar experience with coccidioidin in a convalescing "San Joaquin fever" patient. None of our patients were known to have had similar relapses. Twice multiform lesions on the margins of the palms flared up after severe coccidioidin reactions and frequently such reactions developed satellite vesicles which resembled the original lesions.

DURATION OF SENSITIVITY TO COCCI-  
DIOIDIN—SECOND ATTACKS OF  
"VALLEY FEVER"

The fact that tuberculous erythema nodosum rarely recurs may be the consequence of two factors: (1) the usual retention of the specific allergy; (2) the apparent association of the requisite hypersensitivity with the change from negative to positive reaction. The rare "post primary" type of tuberculous erythema nodosum has been explained<sup>15, 17</sup> as the result of loss of allergy after some acute infection (e.g., measles or whooping cough). The return of allergy then has the effect of the primary infection in promoting hypersensitivity.

Again the analogy with "San Joaquin fever" seems to hold. Only one or two of the Kern and Tulare County doctors had ever diagnosed two attacks of "San Joaquin fever" in the same patient. It should be recalled that the diagnostic criterion of "valley fever" has been erythema nodosum and that during this study 21 patients were observed suffering erythema nodosum due to causes other than coccidioidomycosis. Two attacks of these skin lesions might well have different causes.

To ascertain the duration of the skin sensitivity, 0.1 mg. coccidioidin tests were performed on apparently healthy volunteers who previously had experienced clinically typical "San Joaquin fever." The reactions of these patients were strongly positive. One, tested 21

years following her erythema nodosum gave a reaction of 48 mm. However, these persons lived in the endemic area and could have maintained their allergy by reinfections. Fortunately, our colleague, Dr. H. D. Choep, who had coccidioidomycosis in 1929, has had no possible contact with the fungus since 1932. In 1938, 9 years after his known infection and 6 years after any contact with *Coccidioides*, he had his first, and doubtless last, coccidioidin test. For with only 0.1 mg. of coccidioidin the resultant erythema and induration measured 60 x 80 mm. and the vesicle which subsequently necrosed measured 15 x 17 mm. Evidently the allergy is of long duration. The findings of Cox and Smith<sup>18</sup> indicate that the fungus remains walled off in some focus.

This permanence of the coccidioidin reaction probably explains why only 2 of the 432 patients may have had two attacks of "valley fever." One patient probably had "valley fever" in 1939. Her history indicated a previous attack of erythema nodosum in 1937. However, we cannot be certain that her previous illness was acute coccidioidomycosis since neither sputum examinations nor coccidioidin tests were made at that time.

In 1937 the second patient had typical "valley fever" proved by recovery of the fungus. Her illness 10 months later appears to have been "valley fever" although the story is not absolutely clear-cut and she raised no sputum which could be examined for *Coccidioides*.

Even if these two are deemed bona fide second attacks, the ratio of second to first attacks would only be 1:200. "Post primary" erythema nodosum of coccidioidomycosis is at least as infrequent as is that of tuberculosis.

SOURCE AND MODE OF TRANSMISSION

Most investigators have deduced that coccidioides infection is generally ac-

quired by the inhalation of the fungus.<sup>5-10, 12, 19-22</sup> In our department 3 laboratory infections proved by recovery of the fungus and 15 others indicated by positive coccidioidin reactions, must have been acquired by inhalation. There is no evidence that the insects, animals, food and water of the San Joaquin Valley could have affected these San Franciscans. Moreover, the sporadic incidence ruled out contact infection.

The field investigation gave additional evidence that the acute infection does not pass from person to person. Only 98 of the 432 patients did not share a bed with at least 1 other member of the family, and 34 patients slept with 4 or more other people. However, only 3 patients had onsets within the possible period of incubation of family infection (2 after a 3 week and 1 after a 5 week interval). On the other hand, 17 patients of this series had slept with other members of the family while the latter had suffered more remote attacks. One boy slept with his 2 older brothers who had "valley fever" 1 and 2½ years before his attack. The fact that these 17 patients ultimately developed the disease established their susceptibility. The fact that they did not acquire the primary infection of coccidioidomycosis from their bedfellows during any conceivable incubation period indicated that the *Coccidioides* spherules did not pass from man to man. It seems justifiable to conclude that the endosporulating spherules of *Coccidioides* which oc-

cur within the animal host and are found in the sputum are rarely if ever infectious. Responsibility lies with the chlamydospores characteristic of the fungus in nature and readily adapted to widespread dissemination.

Where the fungus grows has not as yet been established. Certain factors must restrict its distribution despite the fact that it will grow on many simple substances.<sup>23, 24</sup> Indeed, *Coccidioides* was recovered from soil near Delano by Stewart and Meyer.<sup>25</sup> However, even this discovery did not indicate whether the soil provides the culture medium or merely acts as a means of dissemination. Individual case histories and seasonal distribution emphasize the importance of dust.

#### SEASONAL DISTRIBUTION

The monthly distribution of the "San Joaquin fever" onsets is presented in Table 2 and Figure 2. The field visits began December 7, 1937, but not until the middle of January, 1938, were all of the physicians visited. Therefore comparison of monthly onsets should begin with January, 1938.

We observed that the seasonal incidence was well defined. It followed the climate and the agricultural activities after a lag of 1 to 3 weeks corresponding to the incubation period. The wet season with little field work showed fewest cases. In 1937 the rains began on December 8. Even the incomplete tabulation of cases for the last month

TABLE 2  
Seasonal Distribution of San Joaquin Valley Fever Onsets  
Kern and Tulare Counties

Year Month	First Half	Second Half	Total	Year Month	First Half	Second Half	Total
November, 1937	—	9	9	August, 1938	22	30	52
December, 1937	10	10	20	September, 1938	18	23	41
January, 1938	5	5	10	October, 1938	35	30	65
February, 1938	7	7	14	November, 1938	20	23	43
March, 1938	6	2	8	December, 1938	24	10	34
April, 1938	3	6	9	January, 1939	6	5	11
May, 1938	4	7	11	February, 1939	6	5	11
June, 1938	8	13	21	March, 1939	10	16	26
July, 1938	20	16	36	April, 1939	5	5	10

and a half of 1937 demonstrated a much higher incidence than occurred in the subsequent winter and spring. The local physicians all declared that the 1937 "valley fever" season ended in December. Particularly striking is the comparison between wet 1938 and dry 1939. The heavy winter rains of both years began at approximately the same time and the incidence for January and February of both years was nearly the same. However, at the end of February and the forepart of March, 1938, heavy floods occurred. In 1939 the rains ceased after February 8 and drought developed. While wet 1938 had 8 March cases, dry 1939 had 24. In late March, 1939, rain finally came and April produced only 10 onsets. As Figure 2 indicates, with the advent of the spring and early summer the dry weather and field work (potato digging, cotton chopping and fruit picking) were associated with progressively increased incidence of

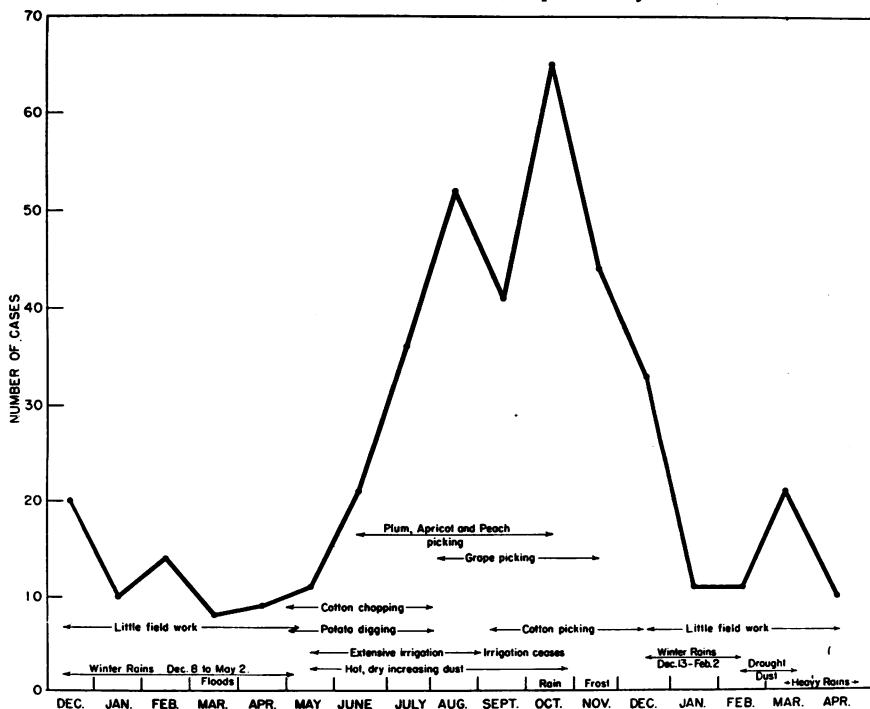
coccidioides infection. In the hot summer and fall, irrigation ceased and dust became exceedingly heavy. Then the peach, grape, and cotton picking brought thousands into the fields and "San Joaquin fever" reached its peak in October. After light fall rains the incidence reduced but did not become minimal until after real winter arrived.

The evidence of this seasonal distribution supports the inhalation route with dust as the medium of dissemination for *Coccidioides* chlamydozoospores. One conceivable objection is that some onsets do occur in the wet season. However, in the lower San Joaquin Valley, even a few hours after heavy rains, wind will raise dust.

#### PREDILECTION FOR SPECIAL GROUPS

Because 87.5 per cent of the patients came to the region since the last census, no rates for different localities could be calculated. Similarly, age specific rates

FIGURE 2—Seasonal distribution of "San Joaquin Valley Fever" onsets



would be meaningless. Patients' ages ranged from 15 months to 69 years. Table 3 shows that approximately one-quarter of the cases were in the 10-19 year group and even more in the succeeding decade. The high proportion in the younger ages is doubtless the consequence of the age distribution of the non-immune newcomers.

TABLE 3  
*Age Distribution of San Joaquin Valley Fever Patients  
Kern and Tulare Counties  
November, 1937, to May, 1939*

Age	Number	Percentage of Total
0-9	45	10.4
10-19	110	25.5
20-29	119	27.5
30-39	76	17.6
40-49	49	11.3
50-59	24	5.6
60-69	9	2.1
Total	432	100.0

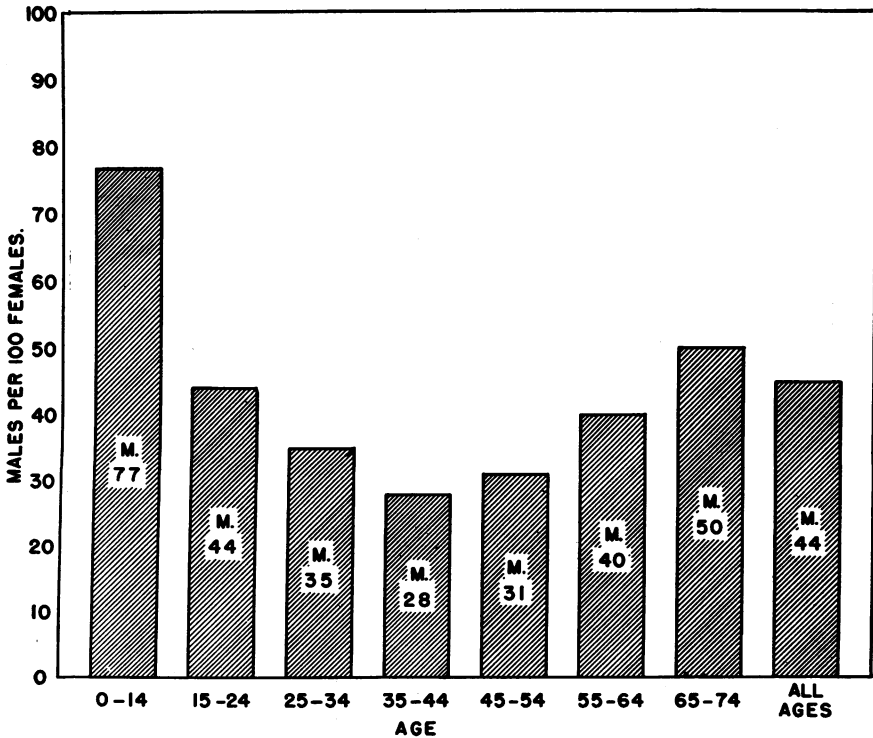
TABLE 4  
*Sex Distribution of Valley Fever Patients by Age and Ratio of Males to 100 Females  
Kern and Tulare Counties, 1937-1939*

Age	Number		Males per 100 Females
	Males	Females	
0-14	44	57	77
15-24	31	70	44
25-34	28	80	35
35-44	15	53	28
45-54	9	28	31
55-64	4	10	40
65+	1	2	50
Total	132	300	44

Table 4 shows that one-third of the male cases were under 15 and that thereafter the proportion diminished steadily. However, only one-fifth of the females were in the school group and the proportion increased for two decades before diminishing.

The predilection for females is noteworthy. It is in line with the experience

FIGURE 3—Sex Distribution of Valley Fever Patients by Age and Ratio of Males to 100 Females—Kern and Tulare Counties, 1937-1939





in tuberculous erythema nodosum. Under the age of 15 (Figure 3), the ratio of 8 males to 10 females was not striking. However, from puberty to menopause the females greatly outnumbered the males. In the fifth decade there were only 2 males per 10 females although here the numbers were small. For the entire group there were only 4 males to 10 females. On the other hand in coccidioidal granuloma this ratio is reversed: 40 to 70 males per 10 females.<sup>5, 26</sup>

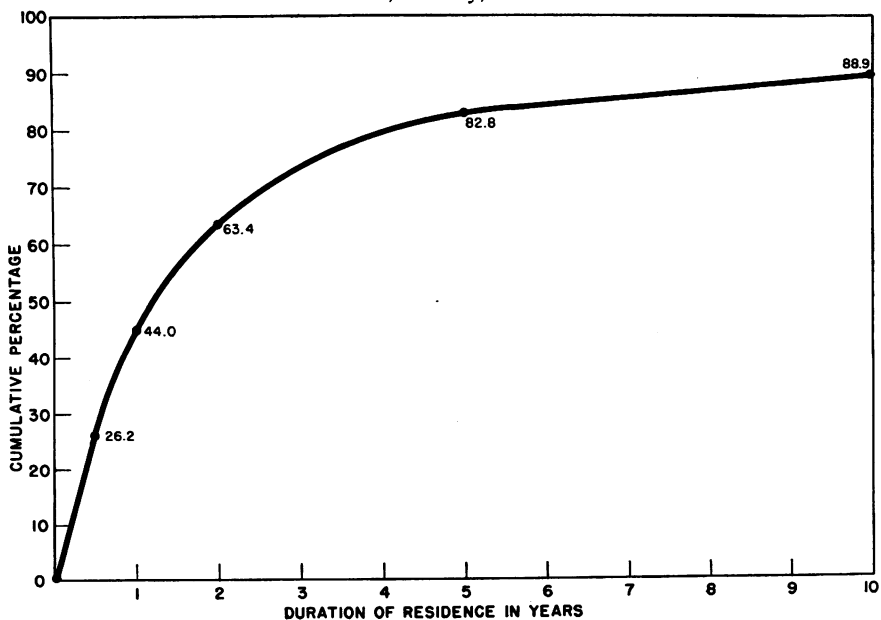
The rarity of coccidioidal granuloma in "San Joaquin fever" patients is further emphasized in the racial distribution of the patients. Again population statistics for specific rates are not available. None of the 432 patients were Negroes, only 2 were Filipinos, and 2 were Japanese. The local physicians said that their experience was similar. This exceedingly small incidence of benign "valley fever" stands in contrast with the predilection of coccidioidal granuloma for Negroes and Filipinos.<sup>5, 6</sup>

Gifford<sup>5</sup> estimated that the Negro coccidioidal granuloma death rate of Kern County has been 23 times the white rate, and that for the Filipino 170 times the white. This difference could not be accounted for by occupation nor by better housing, nutrition, or sanitation. On the contrary, the whites have equally extensive occupation exposures.

Moreover, as most of the Filipinos live on large ranches, they have good bunk houses and are well fed. The well publicized poor housing and malnutrition of the migrant whites did not result in much granuloma.

Adverse social and economic conditions had no detectable influence on development of "valley fever." While most patients were underprivileged migrants, many were in relatively good circumstances and some well to do. One's impression was that they represented a cross-section of the newcomers, for the feature in common was recent arrival in the San Joaquin Valley.

FIGURE 4—Length of residence in San Joaquin Valley expressed as cumulative percentage of all 432 Valley Fever Patients of Kern and Tulare Counties, seen from December, 1937, to May, 1939



DURATION OF RESIDENCE

This predilection for newcomers is noted in Table 5 and Figure 4. Nearly half the "San Joaquin fever" patients had been in the Valley less than 1 year, and two-thirds less than 2 years. Only one-ninth had resided in the Valley 10 years or more.

oil. At the onset of the study several West Side physicians prophesied that they alone would keep the epidemiologist busy since each saw 50 or more "desert rheumatism" patients annually. However, the 14 West Side physicians reported 13 patients, while all of the Kern County doctors saw only

TABLE 5

*Length of Residence in San Joaquin Valley of Kern and Tulare County Valley Fever Patients Seen from December, 1937, to May, 1939*

Total Number of Cases = 432

	Per cent of Total	Cumulative Percentage
Under 6 months.....	26.2	
6-12 months . . . . .	17.8	
1 year . . . . .	19.4	
2- 4 years . . . . .	19.4	
5- 9 years . . . . .	6.1	
10 years and over.....	11.1	
Total . . . . .	100.0	
		Under 1 year . . . . . 44.0
		Under 2 years . . . . . 63.4
		Under 5 years . . . . . 82.8
		Under 10 years . . . . . 88.9
		All . . . . . 100.0

The birth states of the patients (Table 6) confirm these figures. There were only two-thirds as many "Native Sons and Daughters" as "Oakies." One-half the patients had been born in Oklahoma, Arkansas, and Texas.

21 West Side "desert rheumatism" patients.

TABLE 6

*Birth States of Kern and Tulare County Valley Fever Patients Seen from December, 1937, to May, 1939*

Total Number of Cases = 432

State	Per cent of Total
California . . . . .	18.1
Oklahoma . . . . .	27.5
Arkansas . . . . .	12.5
Texas . . . . .	11.8
Other Southern States.....	8.1
Other states and foreign.....	22.0
Total . . . . .	100.0

It then appeared that when the oil fields were being rapidly developed 10 to 20 years ago and the population was new to the region, the disease was as common as the doctors claimed. Of recent years in the West Side the industry has stabilized so the newcomers have been few. The cases of "desert rheumatism" are now infrequent since most of the inhabitants have already experienced their infections.

EXTENT OF COCCIDIOIDOMYCOSIS

These data were further evidence that the erythema nodosum of "San Joaquin fever" occurred in the primary infection of *Coccidioides immitis* and indicated that the infection was acquired after brief residence. The two conclusions were supported by the experience on the West Side. This western section of Kern County is very rich in

In an extensive coccidioidin testing program in Kern County schools, Gifford and her associates<sup>6</sup> found that over half of 2,718 school children gave positive reactions. The percentage rose progressively from 17 per cent with Kern County residence under 1 year, to 77 per cent with residence of 10 years or more. In Maricopa on the West Side, 143, or 84 per cent, of those tested were reactors but most of these children were born in the region.

Within the past 5 years thousands of

migratory workers have swarmed into the floor of the Valley. As these newcomers acquired their *Coccidioides* infections, perhaps 1 in 20\* developed erythema nodosum. The 432 "San Joaquin fever" patients must have represented fully 8,000 to 10,000 new infections with *Coccidioides immitis*. If no new groups appear, the experience on the West Side should be repeated on the Valley floor. Eventually most of the inhabitants of the region will undergo an infection with *Coccidioides*. During the next 10 years, the number of "valley fever" cases should diminish rapidly and the proportion of cases in children steadily rise. Thus the economic and sociological dislocations responsible for the mass migration of this period have provided the bases of this study.

#### SUMMARY

1. An investigation was made of 432 patients with "San Joaquin fever," "valley fever," or "desert rheumatism" in Kern and Tulare Counties during the 17 months beginning December, 1937. All recovered without sequelae.

2. This disease, characterized by influenza-like prodromes followed by erythema nodosum with or without erythema multiforme, was frequently confused with such communicable diseases as influenza, pneumonia, tuberculosis, measles, and smallpox, and occasionally even with poliomyelitis, typhoid fever, and syphilis.

3. The incubation period ranged between 1 and 3 weeks, probably most frequently requiring 2 weeks.

4. Sensitivity to coccidioidin, a product of the causative fungus, *Coccidioides immitis*, was established in from 2 to 17 days after onset of symptoms, generally in the second week of the illness.

5. The erythema nodosum was associated with the hypersensitivity of freshly acquired allergy. This allergy, apparently like tuberculin sensitivity, was of long duration. Consequently, second attacks of "San Joaquin fever" were very rare (not more than 2 in this series).

6. Coccidioidomycosis with erythema nodosum was rarely if ever contact infection. The endosporeulating spherules of *Coccidioides* occurring in man and animals did not pass directly from host to host. Apparently, the disease was acquired by inhalation of the chlamydo-spores.

7. The seasonal incidence corresponded to the climate and the agricultural activities, with the peak in the dusty fall and the ebb in the wet winter.

8. The benign "valley fever" was most common among white females in contrast with coccidioidal granuloma which is known to be especially prevalent among dark-skinned males.

9. Nearly half the patients had resided in the San Joaquin Valley less than 1 year, while only one-ninth had been in the region 10 years or more. The predilection for newcomers corresponded with the distribution by length of residence of coccidioidin sensitivity.

10. Eventually most of the inhabitants of the region undergo an infection with *Coccidioides*. As not more than 5 per cent of those infected develop erythema nodosum, this series represented between 8,000 and 10,000 attacks of coccidioidomycosis.

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\* Out of 143 Maricopa reactors only 4 gave a history of "desert rheumatism" and of 76 Porterville High School reactors, Campbell<sup>27</sup> found only 1 who had experienced "valley fever," or a total of 2.2 per cent in 219.

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