Coccidioidomycosis in Arizona: Increase in Incidence from 1990 to 1995


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The number of cases of coccidioidomycosis (incidence) reported to the Arizona Department of Health Services increased from 255 (7.0 per 100,000 population) in 1990 to 623 (14.9 per 100,000 population) in 1995 ($P < .001$). Four counties in the south central region of the state, which contained 80% of the state’s population, had the largest increase and accounted for 95% of all cases in 1995. Cases in persons aged 65 years or older and men were reported more frequently (for both, $P < .001$). During 1995, 890 patients were discharged from Arizona hospitals with a diagnosis of coccidioidomycosis. Rates of hospitalization were greater among persons aged 55 years or older, men, and African-Americans (for all three, $P < .01$). Of the hospitalized patients, 48 died, and 12 (25%) of these patients had a concurrent diagnosis of human immunodeficiency virus infection. These data demonstrate that coccidioidomycosis is a growing health problem in Arizona.

Recently, there was a marked increase in the number of cases of coccidioidomycosis, a fungal disease prevalent in the western United States, that were reported to the Arizona Department of Health Services [1]. In this report, surveillance and death certificate data were used to further describe the increase in reported cases of coccidioidomycosis in Arizona from 1990 through 1995, as well as to identify high-risk groups and to identify factors related to the increase. In addition, Arizona hospital discharge data from 1995 were analyzed to provide a more complete picture of the impact of coccidioidomycosis in Arizona.

Methods

Surveillance data were compiled from the Arizona Department of Health Service (ADHS) General Communicable Disease Reporting System. Before 1994, the ADHS relied solely on physician-based diagnosis for reporting of cases of coccidioidomycosis. Since 1994, a surveillance case definition requiring the presence of clinically compatible symptoms and laboratory evidence of infection was used [2]. Death certificates were also reviewed from 1990 through 1995.

The impact of coccidioidomycosis on hospitalizations during 1995 was determined by using the Arizona Hospital Discharge Database, which documents the discharge diagnoses for persons admitted to all nonfederal hospitals in Arizona by means of the ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification). Cases of coccidioidomycosis were identified as those with codes from 114.0 to 114.5 and 114.9.

Population projections were produced by using the State of Arizona Demographic Cohort-Survival Projections Model. Incidence data reflect the date of report to the ADHS and were calculated by means of the 1990 census data adjusted to reflect the estimated population growth in the state. To assess the impact of the time of year on the number of cases of coccidioidomycosis, the data were also analyzed by using the date of diagnosis, rather than the date of report to the ADHS.

The $\chi^2$ test was used to compare differences in proportions among categorical variables. Yates’ correction was used when the $df$ was 1. A $P$ value of $< .05$ was considered to be statistically significant [3].

Results

ADHS Surveillance and Death Certificate Data

From 1980 through 1989, the annual number of cases of coccidioidomycosis reported to the ADHS remained stable, with a median of 211 cases reported each year (range, 191–342 cases). From 1990 through 1995, the annual number of reports increased from 255 to 623, with a concomitant increase in incidence from 7.0 to 14.9 per 100,000 population ($P < .001$).

Data on the incidence of coccidioidomycosis per 100,000 population for the years 1990 and 1995 that are based on sex and age are displayed in table 1. Although there were significant increases in the incidence of coccidioidomycosis for both males and females over these years, cases of coccidioidomycosis in men were significantly more likely to be reported in both 1990 and 1995. In addition, the incidence of coccidioidomycosis
Table 1. Incidence of coccidioidomycosis in Arizona during the years 1990 and 1995 on the basis of the sex and the age of the subjects.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1990</th>
<th>1995</th>
<th>P value*²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>8.2</td>
<td>19.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Female</td>
<td>5.7</td>
<td>10.6</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤24</td>
<td>2.2</td>
<td>3.3</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>≥25–64</td>
<td>7.9</td>
<td>17.7</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>≥65</td>
<td>14.6</td>
<td>34.0</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

* Based on the χ² test.
² Differences between years.
³ Differences between groups.

The incidence of hospitalization with a diagnosis of coccidioidomycosis during 1995 was 26.7 among men compared with 16.0 among women (P < .01). This incidence among white, non-Hispanic patients was 23.8; it was 12.2 among white, Hispanic patients and 66.8 among African-Americans (P < .001).

Of the 1,074 patients whose hospitalizations were associated with coccidioidomycosis in 1995, 456 (42.5%) were discharged with a diagnosis of primary pulmonary coccidioidomycosis; 235 (21.9%), with progressive disseminated coccidioidomycosis; 122 (11.4%), with chronic pulmonary infection; and 64 (6.0%), with coccidioidal meningitis. The remaining 18.2% of hospitalizations were associated with a variety of other types of coccidioidomycosis. Coccidioidomycosis represented the increased by 133% among persons 65 years of age or older from 1990 through 1995, while the number of Arizona residents aged 65 years or older who lived in the state increased only by 22%.

The impact of coccidioidomycosis in Arizona from 1990 through 1995 was not geographically uniform. In four counties (Maricopa [metropolitan Phoenix], Mohave, Pima [metropolitan Tucson], and Pinal, which collectively contained >80% of Arizona’s population in 1995), there were marked increases in the number of cases reported between 1990 and 1995. These four counties accounted for 95% of all cases of coccidioidomycosis in 1995.

Cases analyzed by the date of diagnosis rather than the date of report to the ADHS are shown in figure 1. More cases were diagnosed during the fall (months of October through December) of 1992 than during any other time, but no other seasonal variation was apparent. To assess whether climate may have played a role in the increase in the number of cases, the average quarterly rainfall for Maricopa County, which accounted for 62% of all cases reported, was also examined. As shown in figure 1, no clear relationship between cases and rainfall was discernible.

Analysis of Arizona death certificate data revealed that, during 1990 through 1995, coccidioidomycosis was listed as the underlying cause of death for 162 persons, and the annual number of deaths due to coccidioidomycosis increased significantly from 21 in 1990 to 48 in 1995 (P = .008).

Analysis of 1995 Hospitalization Data

During 1995, a total of 890 patients were hospitalized with a diagnosis of coccidioidomycosis (overall hospitalization rate, 21.3 per 100,000 population). The incidence of hospitalization increased by age and was 4.3 among patients younger than 25 years of age, 22.7 among those 25 to 54 years of age, and 46.9 among those 55 years of age or older (P < .001). The incidence of hospitalization with a diagnosis of coccidioidomycosis during 1995 was 26.7 among men compared with 16.0 among women (P < .01). This incidence among white, non-Hispanic patients was 23.8; it was 12.2 among white, Hispanic patients and 66.8 among African-Americans (P < .001).

Figure 1. Number of cases of coccidioidomycosis reported by date of diagnosis to the Arizona Department of Health Services (A) and rainfall in inches for Maricopa County from 1990 through 1995 (B). Data are shown in quarterly intervals: W = January to March; Sp = April to June; Su = July to September; and F = October to December. Data on the number of cases from the fall of 1995 are incomplete.
primary diagnosis for 52% of the hospitalizations. The median time of hospitalizations for patients with a diagnosis of coccidioidomycosis in 1995 was 6 days (range, 0–87 days). Direct hospital charges for these admissions totaled $26.8 million, with a median charge per hospitalization of $14,292 (range, $797 to $343,196).

Among the 1,074 patients with coccidioidomycosis-related hospitalizations in 1995, 48 (4.5%) died. Comorbid noncoccidioidal diagnoses for these 48 deceased patients included HIV infection (12 patients), chronic pulmonary disease (10), malignancy (9), renal disease (6), chronic heart disease (5), diabetes mellitus (5), allogeneic organ transplants (4), hepatic cirrhosis (4), and cerebrovascular accidents (2).

Because HIV infection was the single most common noncoccidioidal diagnosis for the 48 patients who died in the hospital in 1995, further analysis was performed. In 1995, a total of 1,048 patients were hospitalized in Arizona with a diagnosis of coccidioidomycosis. Of these patients, 109 (10.4%) also had a diagnosis of coccidioidomycosis, and 12 (11.0%) of these patients died. In comparison, only 36 (4.6%) of 781 patients with a diagnosis of coccidioidomycosis who did not have known HIV infection died during hospitalization ($P < .01$).

Discussion

These data demonstrate a striking increase in the number of cases of coccidioidomycosis that were reported to the state health department over a recent 5-year period in Arizona. The increase in the number of cases occurred for all age groups and for both men and women, but the impact fell predominantly on older adults and men. Older age and male sex have been previously noted to be associated with an increased risk of symptomatic coccidioidal illness [4–7]. The number of individuals aged 65 years or older who lived in Arizona increased by more than one-fifth during the time of study. On the basis of this finding, the most likely explanation for the increase in the number of cases of coccidioidomycosis that were reported during the time of the study was an influx into the state of older nonimmune individuals who were susceptible to acute infection and more likely to manifest symptomatic illness.

Perhaps as striking as the overall increase in the number of reported cases was the number of patients discharged from Arizona hospitals with a diagnosis of coccidioidomycosis. In the same pattern as reported for active cases, a disproportionate number of elderly and men had coccidioidomycosis-related hospitalizations. When deaths during hospitalization were examined, the most common noncoccidioidal diagnosis was HIV infection. This finding highlights the magnitude and the severity of coinfection with HIV and *Coccidioides immitis* in the area where coccidioidomycosis is endemic, an association that has been previously noted [8–10].

Changes in climatic conditions have been associated with outbreaks of coccidioidomycosis in California [6, 11]. In Arizona, a bimodal peak in the number of cases of coccidioidomycosis during the year has been observed [12], corresponding to dry periods between the winter and summer rainy seasons [13]. However, no apparent association between the increase in the number of cases and rainfall or season was seen in this study.

The costs of coccidioidomycosis for the state were high. During 1995, direct hospitalization charges alone exceeded $25 million, and nearly 50 deaths occurred. The fact that more persons were hospitalized with a diagnosis of coccidioidomycosis in Arizona during 1995 than were cases reported to the state indicates a marked degree of underreporting. On the basis of this finding, the human and financial impact of coccidioidomycosis in Arizona during 1995 than were cases reported to the ADHS made coccidioidomycosis a laboratory-reportable condition in April 1997. Clinical and reference laboratories are now required to report positive laboratory findings for *C. immitis* to the state health department.

References