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RESEARCH ARTICLE

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Coccidioidomycosis outbreak among inmate wildland firefighters: California, 2017

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Abstract

Background: In California, state prison inmates are employed to fight wildfires, which involves performing soil-disrupting work. Wildfires have become more common, including areas where *Coccidioides*, the soil-dwelling fungus that causes coccidioidomycosis, proliferates. However, work practices that place wildland firefighters at risk for coccidioidomycosis have not been investigated.

Methods: On August 17, 2017, the California Department of Public Health was notified of a cluster of coccidioidomycosis cases among Wildfire A inmate wildland firefighters. We collected data through medical record abstraction from suspected case-patients and mailed a survey assessing potential job task risk factors to Wildfire A inmate firefighters. We described respondent characteristics and conducted a retrospective case–control investigation to assess coccidioidomycosis risk factors.

Results: Among 198 inmate firefighters who worked on Wildfire A, 112 (57%) completed the survey. Of 10 case-patients (four clinical and six laboratory-confirmed), two were hospitalized. In the case–control analysis of 71 inmate firefighters, frequently cutting fire lines with a McLeod tool (odds ratio [OR]: 5.5; 95% confidence interval [CI]: 1.1–37.2) and being in a dust cloud or storm (OR: 4.3; 95% CI: 1.1–17.4) were associated with illness. Two of 112 inmate firefighters reported receiving coccidioidomycosis training; none reported wearing respiratory protection on this wildfire.

Conclusions: Wildland firefighters who use hand tools and work in dusty conditions where *Coccidioides* proliferates are at risk for coccidioidomycosis. Agencies that employ them should provide training about coccidioidomycosis and risk reduction, limit dust exposure, and implement respiratory protection programs that specify where respirator use is feasible and appropriate.

KEYWORDS

California, *Coccidioides*, coccidioidomycosis, inmates, wildfires, wildland firefighters

1 | INTRODUCTION

Coccidioidomycosis (Valley fever) is an infectious disease endemic to the southwestern United States caused by spore inhalation of the soil-dwelling fungus *Coccidioides* spp. Approximately 97% of the US cases are reported in Arizona and California.[1] Although many infections are asymptomatic, approximately 40% lead to an influenza-like illness or pneumonia 1–3 weeks after exposure. Coccidioidomycosis can result in hospitalization and, in rare instances, the disease can disseminate or be fatal.[2]

In California, 7658 incident cases (19.3/100,000 population) were reported in 2017, the highest annual incidence in California since coccidioidomycosis became reportable in 1995.[3] Outdoor workers in high-incidence coccidioidomycosis areas are at increased risk, particularly when job tasks involve soil disturbance (e.g., excavation work) or when conditions are windy or dusty; outbreaks have been reported in these populations, particularly among construction workers.[4-10] In 2017, a total of 599 wildfires were reported in the five California counties with the highest coccidioidomycosis rates.[11] The California Department of Forestry and Fire Protection (CAL FIRE) and the California Department of Corrections and Rehabilitation (CDCR) jointly operate a Conservation Camp program for the approximately 3000–4000 state prison inmates who work as wildland firefighters.[12,13] These inmates are essential to wildland fire response, perform most of their work using hand tools, and are known as hand crews.[13,14]

In July 2017, five inmate firefighters became ill after responding to Wildfire A, a 4-day wildfire in one of the five California counties with coccidioidomycosis rates >50 per 100,000 in 2017; all later received coccidioidomycosis laboratory confirmation. On August 17, the California Correctional Health Care Services, which provides health care for state prison inmates, notified the California Department of Public Health (CDPH) and requested assistance. We investigated to identify additional cases and risk factors and possible prevention measures for coccidioidomycosis among inmate wildland firefighters.

2 | MATERIALS AND METHODS

2.1 | Survey development

During August–September 2017, we verified illnesses and conducted in-person, standardized interviews with the five inmate wildland firefighters with coccidioidomycosis initially reported to CDPH to identify potential risk factors. These interviews and discussions with CAL FIRE employees informed our understanding of common job tasks of inmate wildland firefighters and guided development of a self-administered survey.

Inmate wildland firefighters from CDCR operate in hand crews of one civilian captain and 15–17 inmates.[13,14] During an ongoing wildfire, crews cut or construct (i.e., dig) fire containment lines around the wildfire perimeter to stop the advancing fire in areas that

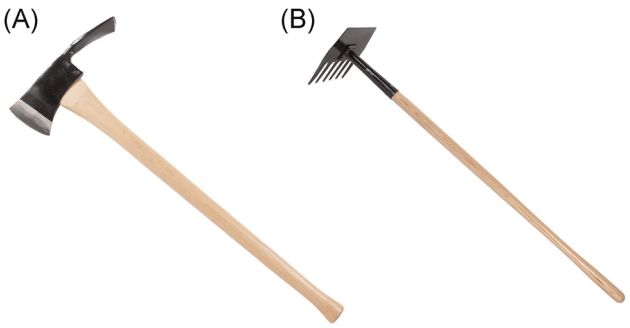

FIGURE 1 (A) Pulaski tool; photo credit: The Council Tool Co. (B) McLeod tool; photo credit: The Council Tool Co [Color figure can be viewed at wileyonlinelibrary.com]

are inaccessible to heavy machinery or fire engines. Fire lines must be wide enough to prevent fire spread and are made by clearing and removing vegetation down to bare soil using chainsaws and hand tools, including a Pulaski (axe-like tool), McLeod (rake-like tool; Figure 1A,B), and shovel.[13,14] Additional job tasks include what are known as mop-up activities (i.e., extinguishing or removing burnt materials after the fire has been controlled) and checking for hotspots (e.g., ensuring there are no smoldering areas). Hand crews often work in dusty conditions caused by dirt-disturbing job tasks, weather conditions, or working near heavy machinery. During an ongoing wildfire, inmate firefighters work 24-h shifts; during off-shift hours they reside in provisional fire camps.

To assess risk factors, the survey included questions about the frequency of performing specific job tasks, working in dusty conditions, following safety practices to reduce dust exposure on Wildfire A, and prior knowledge and training regarding coccidioidomycosis prevention. To find additional cases, the survey included questions about symptoms, the timing of onset, and self-reported coccidioidomycosis diagnosis. The survey was mailed with prepaid, addressed return envelopes during November 2017–January 2018 to inmate firefighters who had been deployed to Wildfire A and whose current locations and contact information were known. Surveys were mailed to nine Conservation Camps where inmates resided and then distributed to inmates by CDCR staff. To ensure confidentiality, surveys were sealed in envelopes by inmates before being returned to staff for mailing. For inmates who had been paroled, surveys were mailed to residential addresses provided by CDCR, when available. The survey was available in English language only; CDCR staff indicated that nearly all inmate firefighters spoke and read English.

Serologic testing all inmate firefighters for infection was not feasible. Medical record review was conducted only among those who self-reported a coccidioidomycosis diagnosis after Wildfire A.

2.2 | Case–control analysis

We classified survey respondents into case-patients and controls to conduct a retrospective case–control analysis. A case was defined as

either laboratory-confirmed (positive IgM or IgG coccidioidomycosis serology) or clinical coccidioidomycosis in an inmate wildland firefighter who worked on Wildfire A, with illness onset ≥1 week after Wildfire A started (July 2, 2017), and <1 month after it ended (July 5, 2017). Because not all inmate firefighters sought health care or were tested, we defined clinical coccidioidomycosis as self-report of ≥1 respiratory symptom (i.e., trouble breathing, cough, or chest pain) and ≥1 systemic symptom (i.e., fever, night sweats, fatigue, muscle or joint pain, headache, or rash).[5] To increase the specificity of the clinical case definition, we did not include symptomatic individuals who did not meet these criteria. Controls were defined as survey respondents who reported no symptoms. We excluded from the case–control analysis those who did not respond to questions about symptoms, reported previous coccidioidomycosis diagnosis, or reported symptoms but did not meet the case definition criteria for clinical coccidioidomycosis or timing of symptom onset, including those missing onset date (i.e., symptomatic noncases).

We conducted two sensitivity analyses. In the first, we classified symptomatic noncases as controls. In the second, we classified these individuals as case-patients if they met the criteria for timing of symptom onset; those who did not were excluded from the analysis.

2.3 | Data analysis

Several questions related to the frequency of work activities and safety practices were measured with a Likert scale. To increase cell sizes and thus our ability to make statistical comparisons, we collapsed responses to questions regarding the frequency of work activities and respirator use to "frequently" ("all of the time" or "most of the time") and "infrequently" ("sometimes," "rarely," or "never"). We collapsed responses to questions regarding the frequency of dust exposure and soil wetting to "frequently" ("most of the time" or "several times") and "infrequently" ("a few times," "rarely," or "never").

We used logistic regression to assess associations between each risk factor and coccidioidomycosis case status, and calculated odds ratios (ORs) and 95% confidence intervals (CIs). When necessary, we accounted for cell size using exact logistic regression. All analyses were conducted using SAS®, version 9.4 (SAS Institute Inc.).

3 | RESULTS

3.1 | Survey responses

In total, 198 male inmates from nine Conservation Camps were deployed to Wildfire A during July 2–July 5, 2017. We conducted in-person interviews with the five laboratory-confirmed case-patients and mailed surveys to the remaining 124 inmate wildland firefighters who were still incarcerated and 45 of 69 paroled with known addresses. In total, we attempted to contact 174 (88%) firefighters; 112 (64%; 109 incarcerated and three paroled) responded, representing

TABLE 1 Characteristics, job activities, safety practices, and knowledge and training among inmate wildland firefighters responding to Wildfire A—California, July 2017 (*N* = 112)

Characteristics	No./total no. (%) or median (IQR)
Male	112/112 (100)
Age (years)	30 (25–36)
Race/ethnicity	
White	19/101 (19)
Black	25/101 (25)
Hispanic/Latino	55/101 (55)
Other	2/101 (2)
Smoker	
Never	49/99 (50)
Current or former	50/99 (50)
Frequently performed the following job tasks on Wildfire A[a]	
Hot lining (working on frontline near active flames)	15/90 (17)
Cutting line (cutting containment lines around a fire; using tools to clear vegetation to bare soil)	72/102 (71)
Using a Pulaski tool	32/79 (41)
Using a McLeod tool	36/79 (46)
Using a shovel	16/69 (23)
Tossing dirt in the air	46/98 (47)
Mopping up (extinguishing or removing burnt material after fire has been controlled)	68/104 (65)
Mixing ash with dirt	59/100 (59)
Checking for hotspots (eliminating smoldering areas so new fires will not start)	73/103 (71)
Frequently in the following conditions on Wildfire A[b]	
In an area with smoke from fires	75/105 (71)
In a dust cloud or storm	23/104 (22)
In dusty conditions created by heavy machinery	32/105 (31)
In dusty conditions in a vehicle with open windows going to or from fire	51/105 (49)
Frequently performed the following personal safety practices on Wildfire A[a]	
Changed out of work clothes and shoes immediately when returning to the fire camp	41/94 (44)
Showered immediately when returning to the fire camp	39/94 (42)
Wore respirator	0/103 (0)
Reported the following knowledge and training	
Heard of Valley fever	68/95 (72)
Was told firefighting may increase risk of getting Valley fever	15/102 (15)
	2/91 (2)

TABLE 1 (Continued)

Characteristics	No./total no. (%) or median (IQR)
Received training about Valley fever while working as wildland firefighter	

Note: Denominators for each response differ, as some respondents did not answer certain questions.

Abbreviation: IQR, interquartile range.

[a]Frequently = All of the time or Most of the time; Infrequently = Sometimes, Rarely, or Never.

[b]Frequently = Many times or Several times; Infrequently = A few times, Rarely, or Never.

57% of inmates deployed to the Wildfire A. Median age was 30 years (interquartile range: 25–36 years); 55% were Hispanic/Latino, 25% were black, and 19% were white (Table 1).

Most respondents reported frequently performing job tasks while working on Wildfire A of checking for hotspots (71%), constructing a fire line using hand tools (71%), mopping up (65%), and mixing ash with dirt (59%; Table 1). Approximately half (49%) of the respondents reported frequently being in dusty conditions while in a vehicle with open windows traveling to or from Wildfire A. Forty-four percent reported frequently changing out of work clothes and shoes immediately when returning to the fire camp, 42% reported frequently showering immediately when returning to the fire camp, and none reported wearing a respirator while responding to Wildfire A or ever being respirator fit-tested. Although most (72%) respondents had heard of coccidioidomycosis, only 15 (15%) reported being told that wildland firefighting may increase risk for infection, and two (2%) reported receiving training about knowledge and prevention of coccidioidomycosis.

3.2 | Case finding and clinical characteristics

The survey identified five additional inmate firefighters with clinical coccidioidomycosis, one of whom reported laboratory confirmation that was verified by medical record review. In total, we identified 10 cases (six laboratory-confirmed and four clinical), an attack rate of 9% among survey respondents (10/112). Among the 10 case-patients, illness onset dates were July 10–August 1, 2017 (Figure 2). Commonly reported symptoms included cough, muscle or joint pain, feeling weak, fever, fatigue, night sweats, weight loss, trouble breathing, chest pain, and headache (Table 2). Five case-patients were diagnosed with pneumonia, one with meningitis, and one with respiratory failure requiring mechanical ventilation. Two case-patients were hospitalized (range: 7–19 days); none died. Six case-patients reported missed work days; at the time of survey completion, four had missed 2 months of work and were not healthy enough to return.

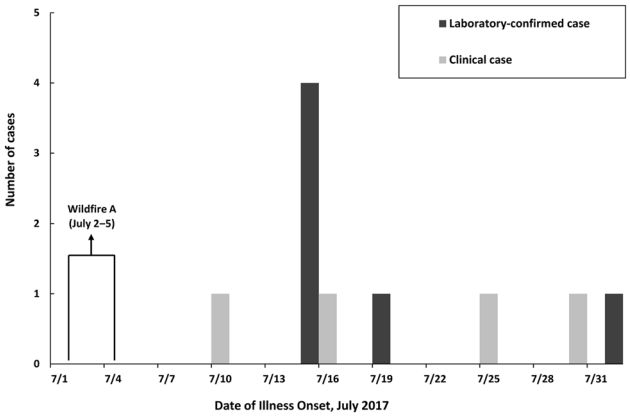

FIGURE 2 Illness onset of laboratory-confirmed and clinical coccidioidomycosis among inmate wildland firefighters responding to Wildfire A—California, July 2017 (n = 10)

3.3 | Case–control analysis

Forty-one survey respondents were excluded, including 27 who reported symptoms but did not meet case definition criteria, 13 who did not answer symptom questions, and one who reported previous coccidioidomycosis diagnosis. Comparing the 10 case-patients with 61 asymptomatic controls, median age was similar (Table 3). More case-patients (70%) reported smoking than controls (41%), but no

TABLE 2 Clinical characteristics among coccidioidomycosis case-patients (n = 10)

Characteristics	Cases (n = 10)[a]; no. (%)
Symptoms	
Cough	9 (90)
Muscle or joint pain	9 (90)
Weakness	9 (90)
Fever	8 (80)
Fatigue or tiredness	8 (80)
Night sweats	7 (70)
Weight loss	6 (60)
Trouble breathing	6 (60)
Chest pain	5 (50)
Headache	5 (50)
Rash or skin lesions	0 (0)
Received pneumonia diagnosis	5 (50)
Received meningitis diagnosis	1 (10)
Suffered respiratory failure	1 (10)
Hospitalized	2 (20)
Died	0 (0)
Missed work	6 (60)

[a]Six case-patients had laboratory-confirmed infection.

significant association between smoking status and coccidioidomycosis was found (Table 3).

Case-patients were more likely than controls to report frequently constructing fire lines with a McLeod tool (70% vs. 29%; OR: 5.5; 95% CI: 1.1–37.2) and frequently tossing dirt in the air (70% vs. 35%; OR: 4.3; 95% CI: 0.9–28.8), although the latter finding did not reach statistical significance (Table 3). Fifty percent of case-patients versus 19% of controls reported frequently being in a dust cloud or storm (OR: 4.3; 95% CI: 1.1–17.4). All 10 case-patients (100%) reported at least one of these three risk factors, compared with 27 controls (44%).

In the first sensitivity analysis (10 case-patients and 88 controls), most effect estimates were attenuated, and none were statistically significant. In the second sensitivity analysis (12 case-patients and 61 asymptomatic controls), only the association with frequently being in a dust cloud or storm remained statistically significant.

4 | DISCUSSION

After a wildfire in an area with known *Coccidioides* proliferation, a coccidioidomycosis outbreak occurred among hand crew firefighters performing dirt-disturbing activities, some of whom had severe complications, including meningitis and respiratory failure. We found specific work practices associated with illness and a widespread lack of coccidioidomycosis training. In California, as both length and severity of the fire season is likely increasing,[15] coccidioidomycosis risk among wildland firefighter hand crews performing similar work is likely to continue. Thus, providing wildland firefighters with a better understanding of their coccidioidomycosis risk and how to reduce risk is imperative.

Previous coccidioidomycosis outbreaks among California wildland firefighters have been reported. One occurred among 22 wards of a California Youth Authority facility that responded to a wildfire in Kern County in July 2000; job duties consisted of wards following bulldozers and putting out hotspots, and fire captains reported large amounts of dust in the air.[16] Another study reported that the *Coccidioides immitis* positivity rate was 6% among Los Angeles County juvenile offenders placed in 10 work camps responding to wildfires during a 5-month period in 1965.[17] Notably, both of these populations were correctional institution inmates, and most CAL FIRE hand crews are composed of inmate firefighters. Noninmate CAL FIRE wildland firefighters usually work in crews that primarily use fire engines, bulldozers, or aerial resources (e.g., helicopters), so the risks may be different, although they may also use hand tools at times.[14]

TABLE 3 Comparison of coccidioidomycosis case-patients to asymptomatic controls among inmate wildland firefighters ($N = 71$)

Characteristic	Controls ($n = 61$)	Case-patients ($n = 10$)[a]	OR (95% CI)[b]
Age (years); median (IQR)	29 (25–36)	31 (27–35)	1.0 (0.9–1.1)
	No./total no. (%)	**No./total no. (%)**	
Smoker			
Never	34/58 (59)	3/10 (30)	Ref
Current or former	24/58 (41)	7/10 (70)	3.2 (0.7–21.4)
Frequently performed the following job tasks[c]			
Cutting line	38/58 (66)	8/10 (80)	2.1 (0.4–22.0)
Using Pulaski tool	17/53 (32)	4/10 (40)	1.4 (0.3–6.9)
Using McLeod tool	16/55 (29)	7/10 (70)	5.5 (1.1–37.2)
Using shovel	8/53 (15)	3/10 (30)	2.4 (0.3–13.6)
Tossing dirt in the air	19/55 (35)	7/10 (70)	4.3 (0.9–28.8)
Worked in the following conditions frequently[d]			
In a dust cloud or storm	11/58 (19)	5/10 (50)	4.3 (1.1–17.4)
In dusty conditions created by heavy machinery	18/59 (31)	3/10 (30)	1.0 (0.1–4.9)
In dusty conditions in a vehicle with open windows going to or from fire	30/59 (51)	7/10 (70)	2.2 (0.5–14.7)

Note: Denominators for each response differ, as some respondents did not answer certain questions.

Abbreviations: CI, confidence interval; IQR, interquartile range; OR, odds ratio.

[a]Six case-patients had laboratory-confirmed infection.

[b]Calculated using exact conditional logistic regression to account for small cell sizes, where appropriate.

[c]Frequently = All of the time or Most of the time; Infrequently = Sometimes, Rarely, or Never.

[d]Frequently = Many times or Several times; Infrequently = A few times, Rarely, or Never.

These outbreaks among wildland firefighters are likely due to substantial dirt-disturbance, which has been demonstrated in other coccidioidomycosis outbreaks occurring primarily among construction workers. The 2017 outbreak that we describe here occurred on a wildfire in a remote area where *Coccidioides* proliferates, with steep terrain not easily accessible by heavy equipment. Firefighter hand crews were essential to fire containment and control, demonstrating the unique risks associated with their job tasks.

Our investigation is the first to assess specific job tasks that may put wildland firefighter hand crews at increased risk for coccidioidomycosis. We found that being in a dust cloud or storm and conducting the dirt-disturbing activities of tossing dirt in the air and cutting fire line with a McLeod tool, and not the shovel or the Pulaski, were associated with illness. Tossing dirt in the air may be performed while digging fire lines or extinguishing hotspots with various hand tools. If wildland firefighters are cautioned against this practice or advised to stay upwind of soil disturbance, exposure to soil and dust containing *Coccidioides* might be decreased. The McLeod tool is used to scrape the fire containment line to expose soil after vegetation is removed by other hand tools, and possibly generates more dust than other tools (e.g., Pulaski). Wildland firefighters should be aware of the risk and understand how to reduce dust exposure when using the McLeod tool or other tools in a similar manner. Being in a dust cloud or storm may indicate the presence of airborne dust that was generated by wildland firefighting activities, wind, or both. However, we were unable to further distinguish the specific cause of the dusty conditions reported. This finding is similar to other outbreak investigations among solar farm construction workers, where frequently being in a dust cloud or storm was the strongest predictor of coccidioidomycosis.[5]

Despite their occupational risks for exposure to *Coccidioides*, inmate wildland firefighters did not wear respiratory protection during firefighting activities nor were they instructed to do so. Most did not remove dusty clothing and shoes or shower immediately upon returning to the fire camp; these practices could help prevent further exposure to *Coccidioides* after the work shift ends. Further, most hand crew firefighters were unaware that their jobs could increase coccidioidomycosis risk and received no training about recognizing symptoms or how to prevent exposure through dust control.

Our investigation had multiple limitations. First, because of logistical challenges during an active wildfire season, surveys were mailed 4–6 months after Wildfire A, which could have resulted in missed cases because of our inability to reach some parolees, difficulties recalling symptoms and exposures, and potential recall bias if case-patients remembered their exposures differently than controls. Second, there is a possibility for selection bias, if those with knowledge of coccidioidomycosis or those who were symptomatic were more likely to respond, which could result in an overestimation of the attack rate. It is also possible that individuals who were ill were less likely to respond or that those with mild or asymptomatic illness were not classified as clinical cases, which could result in an underestimation of the attack rate. We used a highly specific case definition to increase the likelihood that clinical cases were true coccidioidomycosis cases, and we required controls to be asymptomatic, resulting in the exclusion of symptomatic noncases from the case–control analysis. Sensitivity analyses that included these individuals as controls biased associations toward the null, likely due to outcome misclassification. It is possible that some of these individuals were actually cases with mild symptoms or with missing symptom onset date; those who met the onset date criteria were additionally classified as case-patients in further sensitivity analyses, where only the association with frequently being in a dust cloud or storm remained. The response rate among parolees was lower than among inmates; however, there is no reason to believe that parolees and inmates had different exposures or outcomes. Logistically, serologically testing all firefighters was not feasible. Because of the limited number of cases, estimates lacked statistical precision, which precluded our ability to perform more robust multivariable analyses.

As a result of this investigation, CDPH issued multiple prevention recommendations for wildland firefighters using hand tools, taking into consideration the industrial hygiene hierarchy of controls.[18] Eliminating or substituting *Coccidioides* is not possible, so engineering controls would be the most effective strategy, followed by administrative controls. Personal protective equipment (i.e., respirators) is considered the least effective control measure and should not be used in place of other more effective control strategies. Agencies deploying wildland firefighters to areas where *Coccidioides* proliferates should minimize dust exposure when possible by wetting soil near areas of active digging (engineering control), instructing firefighters to stay upwind while performing firefighting activities (administrative control), and minimizing hand crew use when tasks could be performed by other personnel (administrative control) using heavy machinery in which operators are protected by enclosed cabs with regularly maintained air conditioning and filtration systems (engineering control). Vehicles transporting firefighters to and from fires on dirt roads should have windows closed and air conditioning on recirculation mode (engineering control). Firefighters should be made aware that dust on their clothes, shoes, and skin could contain *Coccidioides* and may continue to be a risk after returning to the fire camp. Employers should implement procedures that support proper storage and cleaning of dusty gear and changing into clean clothes as soon as possible. Additionally, agencies should locate fire camps and tents upwind and away from dust sources (administrative control).

CAL FIRE reported having a respiratory protection program for civilian wildland firefighters that included medical clearance, fit testing, and training to use particulate respirators, and having respirators available at fire camps. However, at the time of this investigation, the agency did not have a policy requiring or encouraging respirator use during active firefighting for protection against *Coccidioides*, and CDCR inmate wildland firefighters were not included in a respiratory protection program.[19] CDPH recommended that CAL FIRE explore developing a policy on respiratory protection

use by civilian and inmate wildland firefighters in high-incidence coccidioidomycosis areas. We suggested a pilot test to evaluate the feasibility of respirator use when wildland firefighters were away from active burning but performing specific soil-disturbing tasks (e.g., using the McLeod tool, digging) or in dusty areas; to our knowledge, this recommendation has not been pursued. Firefighting agencies have legitimate concerns regarding the use of respiratory protection on wildfires, including the strenuous and emergency nature of the work, potential flammability, and need for compatibility with other protective equipment worn. Given the multiple particulate respiratory hazards to which wildland firefighters may be exposed, we support future research and product development efforts that would make progress toward the feasible and effective use of respiratory protection in wildland firefighting.

CDPH recommends that all wildland firefighters working in areas where *Coccidioides* proliferates receive comprehensive coccidioidomycosis education at the time of initial employment, annually, and during safety deployment briefings, and that all trainings should be equivalent for inmate and civilian wildland firefighters. Trainings should highlight potential coccidioidomycosis risk, particularly when performing or in the vicinity of dirt disturbance and should educate wildland firefighters about high-incidence coccidioidomycosis areas and how to reduce dust exposure. Coccidioidomycosis is often underdiagnosed, in part, because of a lack of provider awareness, and patients who have knowledge of the illness may receive a diagnosis earlier.[20] Wildland firefighters should be also be trained on coccidioidomycosis signs and symptoms and how to report symptoms to supervisors so that they may be promptly evaluated by a healthcare provider. In California, providers must report any cases to the local health jurisdiction, and employers are required to report any hospitalized patients to California Division of Occupational Safety and Health.

5 | CONCLUSIONS

Wildland firefighters performing dust-generating activities, such as those identified in this investigation, in areas where *Coccidioides* proliferates are at increased risk for coccidioidomycosis. This is concerning given that more wildland firefighters may be needed to respond to the increasingly severe wildfires in the United States, and limited information may be provided to these workers, especially if they are deployed from an area where coccidioidomycosis is uncommon. Illness risk factors identified in this investigation included being in a dust cloud or storm and specific dirt-disturbing job tasks, including digging a fire line with a McLeod tool and tossing dirt in the air. Despite challenges inherent in implementing control measures on active fires, agencies deploying wildland firefighters to high-incidence areas should train them on coccidioidomycosis symptoms, risk for illness from wildland firefighting, and risk reduction. Employers should limit dust exposure when possible and implement respiratory protection when feasible.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

John D. Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

AUTHOR CONTRIBUTIONS

Rebecca L. Laws, Seema Jain, Gail Sondermeyer Cooksey, Janet Mohle-Boetani, Jennifer McNary, Robert Harrison, Bruce Leistikow, and Barbara L. Materna conceived the study and gathered data. Rebecca L. Laws, Seema Jain, Gail Sondermeyer Cooksey, Janet Mohle-Boetani, and Barbara L. Materna performed analyses and drafted the manuscript. All authors interpreted the data. All authors revised the manuscript critically for important intellectual content, approved the final version for publication, and agree to be accountable for all aspects of the work.

ETHICS APPROVAL AND INFORMED CONSENT

The California Health and Human Services Agency's Committee for the Protection of Human Subjects determined that this investigation was nonresearch public health practice. CDC reviewed this study for human subjects' protection and deemed it to be nonresearch.

DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention.

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