

# Tickborne Disease Risk and Perceptions Among Outdoor Workers in Hunterdon and Morris Counties, New Jersey

2022



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## ACKNOWLEDGEMENTS

*We are deeply grateful to Wind of the Spirit, Zufall Health Center, and the New Jersey Department of Health for their contributions to this assessment. We are especially grateful to the interview participants who gave us the time to help us understand local challenges and strengths, and to the outdoor workers who provided their time, knowledge, and insight to this assessment.*



# INTRODUCTION

Many outdoor workers face significant health and healthcare inequities in the United States. In endemic areas, they may also face a disproportionate burden of Lyme disease and other tickborne diseases due to time spent outdoors in tick habitat,<sup>1</sup> though occupational risk for tickborne diseases has not been well described for this group.<sup>2</sup> Existing literature of United States outdoor workers' exposure to ticks and prevalence of tickborne diseases (TBDs) has largely focused on forestry workers.<sup>3</sup> There is a gap in the literature that assesses outdoor worker risk in more vulnerable populations.<sup>3</sup> Specific populations of interest include agricultural, construction and landscaping workers as a large proportion of workers in these industries are Hispanic/Latine or foreign-born and often face more hazardous workplaces and systemic challenges in accessing health care resources in the United States.<sup>8,9</sup> Factors such as immigration status and language barriers may prevent immigrants and Hispanic/Latine persons from accessing government aid, legal assistance, and community-based health programs that could otherwise contribute to their overall health and wellbeing.<sup>4</sup> Taken together, the endemicity of tickborne diseases in certain parts of the United States,<sup>7</sup> the vulnerability of certain outdoor worker populations, and the lack of research about a potentially high-risk population necessitates a deeper understanding of TBDs in immigrant and Hispanic/Latine populations.

Lyme disease is the most common TBD in the United States and its incidence is increasing.<sup>5</sup> Lyme disease can cause significant morbidity when treatment is delayed, as may occur due to limited healthcare access.<sup>5</sup> Lyme disease in the United States is mainly caused by the bacterium *Borrelia burgdorferi sensu stricto*, and rarely, *Borellia mayonii*. It is transmitted to humans through the bite of infected blacklegged ticks.<sup>5</sup> Typical symptoms include a characteristic skin rash, fever, headache, and fatigue. If left untreated, infection can spread to joints, the heart, and the nervous system.<sup>5</sup> Lyme disease is diagnosed based on symptoms, physical findings (e.g., rash), and the possibility of exposure to infected ticks.<sup>5</sup> Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics.<sup>5</sup> Steps to prevent Lyme disease include using insect repellent and, removing ticks promptly, reducing tick habitat and other personal prevention practices.<sup>5</sup>

In addition to the bacteria that cause Lyme disease, some ticks can transmit a variety of other bacteria, viruses, and parasites.<sup>10</sup> Other TBDs occur less frequently in the United States and include diseases such as anaplasmosis, spotted fever rickettsiosis, ehrlichiosis, and tularemia.<sup>11</sup> TBDs are increasing in incidence, and they are being found in more regions of the United States than in past years.<sup>15</sup>

Lyme disease vaccines are expected to become available in the United States within the next several years. Successful vaccine implementation depends on identifying individuals and communities most likely to benefit from Lyme disease vaccination, which may include outdoor workers.



To help better understand the risks and perceptions of tickborne diseases among outdoor workers in an area with a high incidence of Lyme disease, a rapid community assessment was conducted. The rapid community assessment (RCA) methods developed by the Centers for Disease Control and Prevention (CDC) have been used to describe the effects of COVID-19 and attitudes toward COVID-19 vaccination in different communities in the United States.<sup>11</sup> These methodologies are well suited to assess the risk of TBD knowledge, attitudes, and practices regarding TBD prevention and a potential vaccine. This report describes the findings of a RCA conducted by NCFH and CDC to assess TBD knowledge, attitudes, and prevention practices, and attitudes toward a potential Lyme disease vaccine among outdoor workers in New Jersey's Hunterdon and Morris counties, an area that is highly endemic for Lyme disease. The rapid community assessment was entitled TIKSNOW (Tickborne Illness Knowledge and Support Needs for Outdoor Workers)

Hunterdon and Morris counties were selected as counties of interest because Lyme disease is endemic in these regions and because they employ a relatively high number of agricultural workers and landscaping workers in the state. Furthermore, research dating as far back as 1990 has found Lyme disease seroprevalence in a high-risk occupational group of outdoor workers in these counties.<sup>7</sup> The most recent Lyme disease surveillance data from the CDC is shown in Table 1.

**Table 1. Reported Lyme disease cases and incidence in Morris and Hunterdon counties, New Jersey**

County	Lyme Disease Cases (2019)	Incidence of Lyme Disease Cases per 100,000 persons (2019)
Morris	425	83.5
Hunterdon	339	263.1

Source: CDC Surveillance Data (14)

## METHODOLOGY

The TIKSNOW methodology included a mixed methods approach with both a quantitative and a qualitative component. RCA methodology includes a brief literature review of the topic of interest, analysis of existing data sources relevant to the community, planning discussions with key community experts, quantitative surveys, qualitative data collection, and presenting findings to community stakeholders. Data were collected through cross-sectional surveys at community sites, work sites, and housing sites. Qualitative data were collected through one-on-one key informant and in-depth interviews, and group interviews. The entire process required extensive collaboration among NCFH staff, federal CDC partners, the New Jersey Department of Health, and local healthcare and community based organizations such as Wind of the Spirit and Zufall Health Center.

# METHODOLOGY (CONT'D)

The RCA had two components, quantitative surveys and qualitative interviews. For the quantitative survey, we had a goal to survey 250-350 individuals, with the goal of 75% of the sample being outdoor workers and 25% being non-outdoor workers for comparison purposes. Furthermore, the aim was to achieve fairly equal proportions of outdoor workers employed in construction, agriculture, and landscaping industries (each comprising approximately 25% of the total sample). Outdoor workers were defined and identified using several criteria including reported employment industry, job tasks, and time spent working outdoors. Qualitative interviews were conducted with outdoor workers, employers, and key experts. Key experts included worker advocates that work in organizations that serve the Latine community in Hunterdon and Morris counties. The surveys were conducted over two weekends in 2022 (Oct. 13 –16 and Nov. 4 –6) at community, housing, and work sites. Surveys were administered verbally to workers, and included a verbal informed consent that

provided the potential participant with information about how the data would be used, the privacy of their data, the \$30 incentive for participating, and that they could withdraw from participation at any time. Interviews of workers and employers were conducted in-person during the survey data collection periods, while key expert interviews were conducted over the phone.

TIKSNOW is a mixed-methods RCA with adults aged 18 years or older who were living or working in Hunterdon County or Morris County, New Jersey. The assessment aimed to evaluate the risk of TBD; knowledge, attitudes, and practices regarding TBD prevention; and acceptance of a potential Lyme disease vaccine among Hispanic/Latine and immigrant outdoor workers. This assessment focused on Latin American or Caribbean immigrants. United States-born workers were not excluded, but recruitment strategies focused on reaching Latin American or Caribbean immigrants due to: 1) a dearth of information about tickborne diseases in these populations, 2) their higher likelihood of being employed in outdoor occupations, and 3) their higher likelihood of experiencing poor housing conditions, lack of access to healthcare, and other structural factors that can increase risk of TBD exposure and severe outcomes. Additionally, to be eligible, the participant must have worked for at least month in New Jersey or another Lyme-endemic area during April-July of 2022. A descriptive analysis of survey data was conducted. All survey variables were analyzed, but only a selected number are reported in this publication. All data were analyzed using R.

The findings provide a basis for public health action to address potential disease disparities and may enable health care providers and public health practitioners to better target and deliver health care services to communities at risk for Lyme disease and other TBDs, including prevention messaging, testing, treatment, and vaccination. These findings also highlight the importance of TBD prevention practices in the workplace and the role of employers in addressing TBDs as a workplace hazard.

Figure 1: Map of counties selected for survey administration



# KEY FINDINGS

*A total of 259 quantitative surveys were completed in-person in Morris and Hunterdon County, New Jersey over two weekends in October and November 2022. Eleven qualitative interviews were conducted, including five in-depth interviews with outdoor workers, two in-depth interviews with employers, and four key expert interviews with local experts or representatives of organizations serving Hispanic/Latine outdoor workers. All surveys and interviews were conducted in English, Spanish, or Mam.*

## DEMOGRAPHICS

The respondents surveyed were more often male (81%), with a median age of 40 years. More than four-fifths (86%) of respondents identified as ethnically Hispanic/Latine. Most respondents were born in Central America (63%). The median number of years spent in New Jersey was six among all respondents, and the median number of years spent in the United States among foreign-born respondents was five.

Nearly one in seven respondents (15%) identified as racially or linguistically Indigenous, and Indigenous respondents reported speaking Nahuatl, Mam, and K'iche'. All of these respondents also spoke Spanish.



Table 2: Demographics

Characteristic	N = 259 <sup>1</sup>
<b>Age Groups</b>	
18-25	40 (15%)
26-54	179 (69%)
55+	40 (15%)
<b>Sex<sup>2</sup></b>	
Female	46 (18%)
Male	209 (81%)
<b>Ethnicity<sup>2</sup></b>	
Hispanic/Latine	224 (86%)
Not Hispanic/Latine	25 (10%)
<b>Race</b>	
White	46 (18%)
Indigenous	24 (9%)
Black	10 (4%)
Multiracial <sup>3</sup>	6 (2%)
Asian	2 (1%)
Other:	
<i>Hispanic/Latine</i>	75 (29%)
<i>Mestizo</i>	32 (12%)
<i>Moreno/a</i>	6 (2%)
No answer	26 (10%)
I don't know	32 (12%)
<b>Birth Place</b>	
Honduras	93 (36%)
Guatemala	60 (23%)
Mexico	24 (9%)
Colombia	21 (8%)
Ecuador	12 (5%)
Other	19 (7%)
El Salvador	11 (4%)
USA	12 (5%)
<b>Languages Spoken</b>	
Spanish	243 (94%)
English	110 (42%)
Mam	8 (3%)
K'iche'	8 (3%)
Nahuatl	1 (<1%)
<b>Years of schooling</b>	6 (4, 12)
<b>Years in New Jersey</b>	6 (2, 16)
<b>Years in U.S.</b>	5 (1, 15)
<b>Racially or linguistically indigenous<sup>4</sup></b>	39 (15%)

<sup>1</sup> n (%); Median (IQR)

<sup>2</sup> Response categories of <5% of sample were omitted

<sup>3</sup> Respondents who selected more than one race were included in the "Multiracial" category

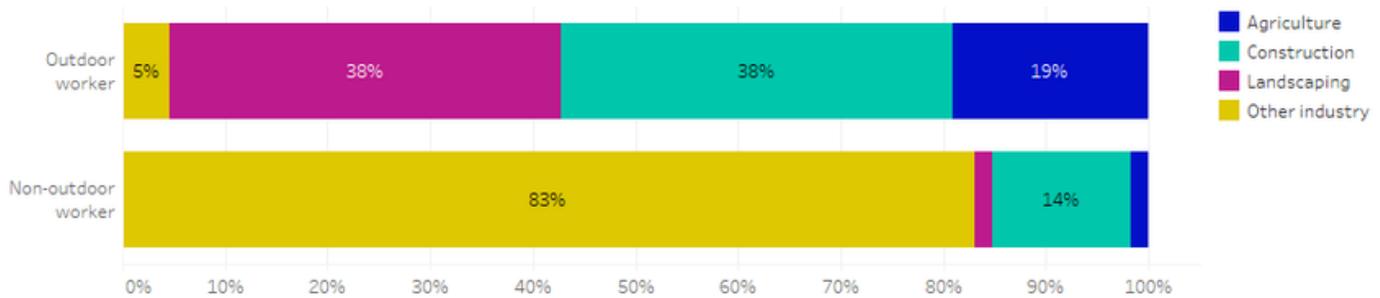
<sup>4</sup> Following the National Agricultural Workers Survey (NAWS) convention, NCFH created a composite metric to identify Indigenous respondents, utilizing a combination of responses

# BREAKDOWN OF WORKERS BY INDUSTRY

Participants were categorized as outdoor workers (75%; n = 194) if they worked outdoors at least one month between April and July 2022 and their main job was mostly done outdoors. Non-outdoor workers (23%; n = 59) worked at least one month between April and July 2022, but their main job was not done outdoors. Respondents who had missing data for the questions used to classify outdoor/non-outdoor worker were classified as "Other workers" (2%; n = 6).

Among outdoor workers, construction and landscaping industries had the largest representation with 38% each, followed by agriculture with about one in five (19%). The majority of non-outdoor workers did not work in construction, landscaping or agriculture (83%). However, 14% of non-outdoor workers worked in the construction sector.

Figure 2: Industries by type of worker (n = 259)



Outdoor workers (n = 194), Non-outdoor worker (n=59), Other worker (n =6; not shown)

Table 3: Worker types and industries

Characteristic	N = 259 <sup>1</sup>
<b>Worker type</b>	
Outdoor worker <sup>2</sup>	194 (75%)
Non-outdoor worker <sup>3</sup>	59 (23%)
Other worker <sup>4</sup>	6 (2%)
<b>Industry</b>	
Agriculture	38 (15%)
Construction	83 (32%)
Landscaping	77 (30%)
Other	61 (24%)

<sup>1</sup> n (%).

<sup>2</sup> Respondents were categorized as outdoor workers if their main job was outdoors and if they met specific criteria for estimated days and hours spent outdoors on average during tick season.

<sup>3</sup> Respondents were categorized as non-outdoor workers if they did not meet the above criteria.

<sup>4</sup> Respondents were categorized as other workers if they had missing responses for 1 or more questions.



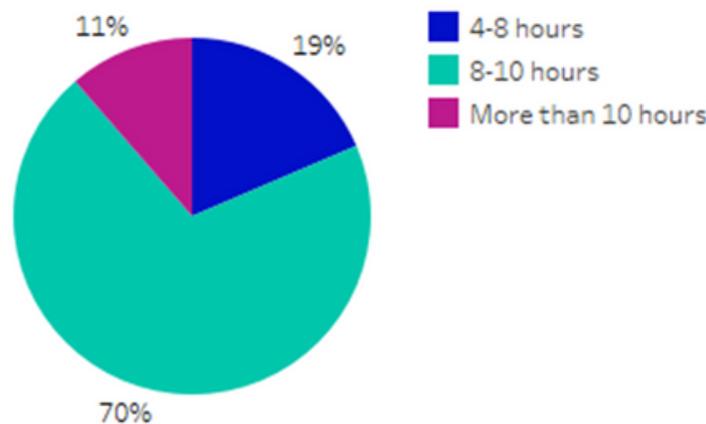
# TIME SPENT OUTDOORS AMONG OUTDOOR WORKERS

Among outdoor workers, 70% worked outdoors an average of 8-10 hours per day, while 11% worked outdoors more than 10 hours a day during the reported time frame (April - July 2022). The majority (73%) of outdoor workers spent April through July of 2022 working outdoors, and working five or more days per week (77%).

Table 4: Time spent outdoors among outdoor workers

Characteristic	N = 194 <sup>1</sup>
<b>Months worked outdoors between April and July</b>	
1 month	8 (4%)
2 months	21 (11%)
3 months	24 (12%)
All 4 months	141 (73%)
<b>Average days worked outdoors per week during the summer</b>	
1-2 days	5 (3%)
3-4 days	39 (20%)
5 days	76 (39%)
6-7 days	74 (38%)
<sup>1</sup> n (%)	

Figure 3: Average hours worked during the summer among outdoor workers (n = 194)



# TICK BITE PREVENTION PRACTICES AMONG OUTDOOR WORKERS

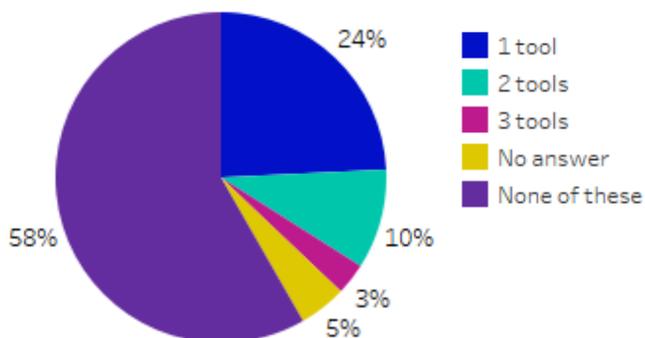
Outdoor workers engaged in various behaviors that could protect against tick bites. A majority of workers showered after work (72%) and wore long sleeves shirts and pants during work (75%). About half of outdoor workers (47%) wore insect repellent while about two out of five (43%) of outdoor workers checked their body for ticks after work. Nearly one third (30%) of outdoor workers avoided brushy or wooded areas and 10% of outdoor workers wore insecticide-treated clothing .

Relatively few outdoor workers reported that their employer provided tools to reduce their TBD risk. Fifteen percent of outdoor workers reported that their employer provided information on how to avoid tick bites, while one-third (31%) reported that their employer provided insect repellent. More than half of outdoor workers said they did not receive any resource to reduce TBD risk from their employer (58%), while 24% reported receiving only one resoruces to reduce TBD risk from their employer..

**Table 5: Prevention practices that may reduce TBD risk among outdoor workers**

Characteristic	N = 194 <sup>1</sup>
<b>Behaviors that may reduce TBD risk<sup>2</sup></b>	
Wears insect repellent	91 (47%)
Wears long sleeve shirts and pants	146 (75%)
Showers after work	140 (72%)
Checks body for ticks daily after work	84 (43%)
Avoids brush or wooded areas	59 (30%)
Wears insecticide-treated clothing	19 (10%)
<b>Employer provided TBD prevention tools<sup>2</sup></b>	
Does not provide any tools to prevent tick bites	113 (58%)
Insect repellent	61 (31%)
Information to avoid tick bites	29 (15%)
Worksite showers	24 (12%)
Provides some other tool to prevent tick bites	7 (4%)
<sup>1</sup> n (%)	
<sup>2</sup> Respondents could select multiple options	

**Figure 4: Employer-provided tools that may reduce TBD risk among outdoor workers (n = 194)**



*Tools included: insecticide-treated clothing, on-site showers, insect repellent, or other.*

Protection against TBDs was discussed among all qualitative interviewees. One common theme discussed by all three interviewee groups was how workers generally already engage in some practices for tick bite prevention due to other occupational practices, such as protecting themselves from sun exposure. Interviewees mentioned that the standard attire for outdoor work includes wearing long sleeves, long pants, closed-toe shoes, and head coverings. In lieu of additional actions, these precautionary measures are commonly recommended for tick bite prevention. Another common practice among outdoor workers that inadvertently protects them from TBDs is to shower as soon as they arrive home after being outside (72%). However, less than half (43%) of outdoor workers reported that they check their body for ticks after being outdoors.

*"I'm always constantly seeing them wearing long pants, long sleeves. We do give out at times long sleeve shirts that are completely white for them to wear, to wear hats. That's mainly, I guess, just the cover from the sun."*

*—Key expert*

*"Utilizar camisetas manga larga, pantalones largos, también medias largas para evitar, por ejemplo, cuando hay que cortar árboles o acostarme en el césped o algo así."*

Translation: "Use long sleeved shirts, long pants, also long socks to avoid, for example, when having to cut a tree or laying on the grass, or something like that"

*— Outdoor Worker*

## EXPOSURE TO TICK HABITAT AMONG ALL WORKERS

There were varying degrees of additional occupational tick exposure risk among all workers. Among all respondents, almost two thirds (62%) spent time in a grassy area while at work, while slightly over one half of workers (54%) spent time in grassy area during breaks while at work. Both of these may increase the likelihood of a tick encounter.

Of non-occupational exposures, almost all (95%) respondents lived in a house or apartment, with 46% spending time in a grassy area near their home and 29% spending time in their backyard. Moreover, 58% percent of workers reported spending time in a park recreationally. When engaging in recreational activities, 57% of respondents reported taking a shower afterward and 51% reported wearing long sleeve shirts and pants while outside.

# TICK AND LYME DISEASE KNOWLEDGE AND ATTITUDES

Although Lyme disease is highly endemic in New Jersey, knowledge of ticks and Lyme disease was limited among outdoor workers surveyed. Among survey respondents, four in five (80%) respondents had knowledge that ticks spread diseases and 37% were “very concerned” about tickborne diseases (see Table 6). However, only 22% of respondents had heard about Lyme disease. Key experts and employer interviewees mentioned that tick knowledge may also be influenced by workers’ previous knowledge from their home country. Given that the majority of the population in this sample is from countries where Lyme disease is not endemic, they may know and recognize ticks, but have limited knowledge about risk factors for disease transmission and TBDs.

*“De lyme? La escuché una vez cuando leí que genera como una infección interna en la sangre y además hinchazón y picazón y ardor en la piel.”*

*Translation: “About Lyme? I heard one time that it gives an internal infection in the blood and also swelling, and itchiness and stinging on the skin.”*

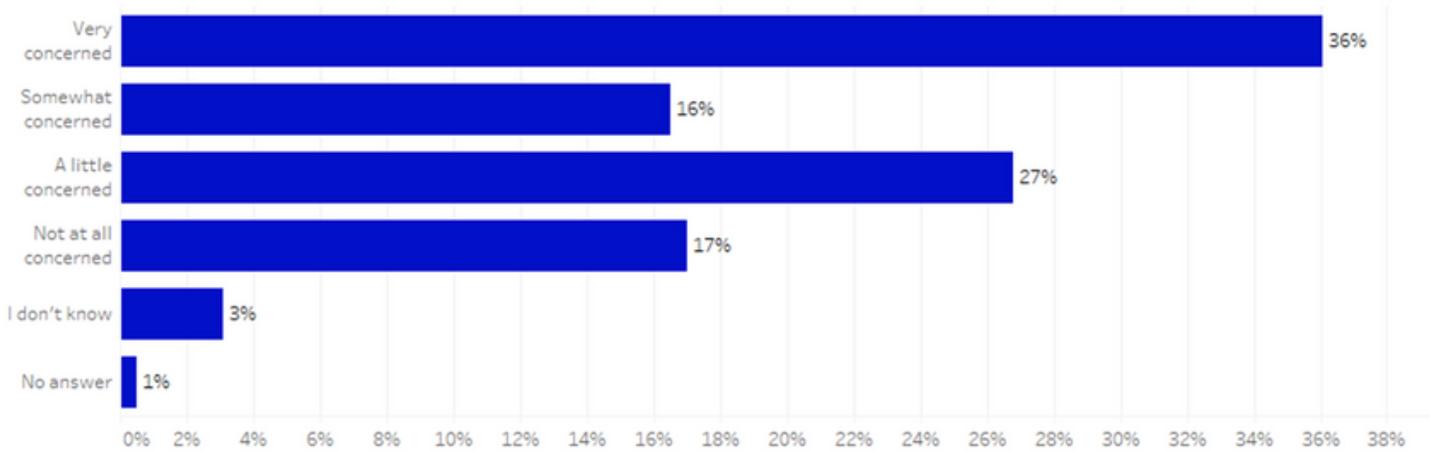
*— Outdoor Worker*

**Table 6: Tick & Lyme disease knowledge and attitudes among all workers**

Characteristic	N = 259 <sup>1</sup>
<b>Knows that ticks spread diseases</b>	
No	48 (19%)
Yes	208 (80%)
<b>Level of concern for tickborne illnesses</b>	
Very concerned	97 (37%)
Somewhat concerned	47 (18%)
A little concerned	66 (25%)
Not at all concerned	41 (16%)
No answer	2 (1%)
<b>Heard about Lyme Disease</b>	
No	200 (77%)
Yes	56 (22%)
<sup>1</sup> n (%)	

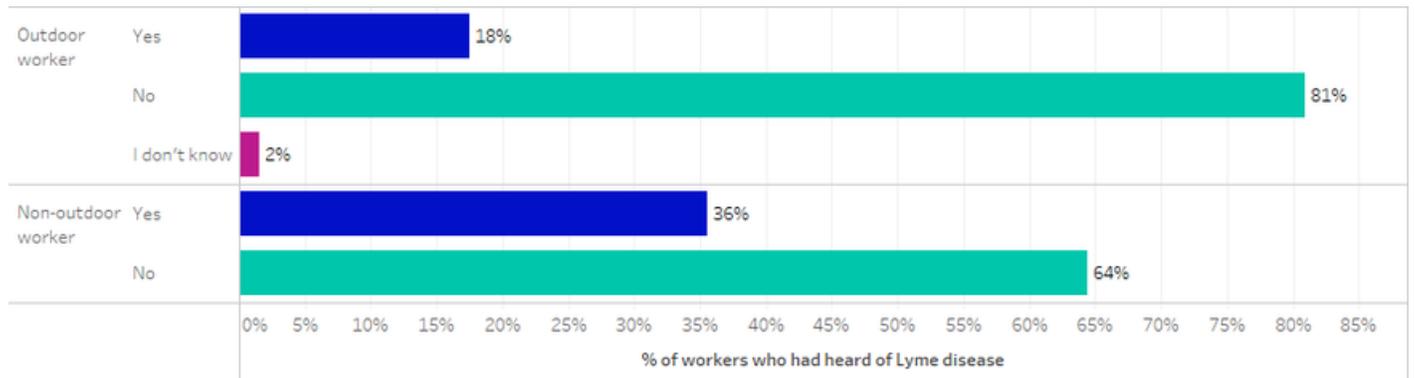


Figure 5: Level of concern about TBD among outdoor workers (n = 194)



Eighty percent of workers in both groups reported that they knew that ticks can spread disease, but differences were observed in their knowledge of Lyme disease specifically. Among outdoor workers, 18% had heard about Lyme disease, compared to 36% of non-outdoor workers.

Figure 6: Knowledge of Lyme disease by worker type (n = 253)



Outdoor workers (n = 194), Non-outdoor worker (n=59)



# TICKBORNE DISEASE PREVENTION TRAININGS

Respondents were asked if they had received TBD prevention training and information on (1) how to prevent tick bites, (2) what to do if they find a tick attached to their body, (3) when to seek medical care after a tick bite, and (4) general information about TBDs. Only one fifth of respondents (20%) reported receiving at least one of these types of information from any source, such as a health care provider, community organization, employer, or others. Less than 5% of all respondents had received information in all four topics (3%). All workers that had received information in all four topics received them in their preferred language (3%). Two-thirds of all workers had not received any type of health and safety training from their current employer.

These findings in the survey were also highlighted in the qualitative interviews. Employers stated that they do not have tick-related safety procedures as they have not had issues with ticks while at work. However, one employer mentioned that if they did find a worker to have a tick, they would recommend to the worker to remove it and see a doctor. Key experts stated the standard procedure is highly dependent on the employer. Furthermore, as noted by key expert interviewees, many of the workers are day laborers who may change employers often. This often leads to information and safety training gaps in general, including trainings regarding TBDs.

*“You know, I would think it’s [tick training and protocol] probably very individualized and depending on who their boss is... and some of these you have to keep in mind, too, like some of the people that were in those positions are really day laborers.”*  
 – Key expert

**Table 7: TBD prevention trainings received from any source and general health/safety trainings received from employers**

Characteristic	N = 259 <sup>1</sup>
<b>TBD prevention trainings received from any source<sup>2</sup></b>	
Received TBD prevention training addressing at least one topic	51 (20%)
Received TBD prevention training addressing all four topics	8 (3%)
Received TBD prevention trainings addressing all four topics in preferred language	8 (3%)
<b>Received general health and safety trainings from employer</b>	
No	170 (66%)
Yes	82 (32%)
I don’t know/no answer	7 (3%)
<sup>1</sup> n (%)	
<sup>2</sup> Topics including preventing tick bites, finding a tick attached to the body, seeking medical care after a tick bite, and general information about tickborne diseases	



# TICK ENCOUNTERS AND OUTCOMES

Among all survey respondents, 22% (n=59) reported having a tick encounter, defined as finding one or more ticks crawling on clothing or body or directly attached to body in 2022. One-tenth of all respondents (11%) reported having found one tick attached or crawling on their body or clothing, 8% had found two to five ticks, while 3% had found more than five ticks. Of the 59 respondents with tick encounters, 46% involved one or more ticks being directly attached to the body.

Outdoor workers who participated in qualitative interviews had limited experiences with ticks and Lyme disease. Concern about ticks and TBD risk was a common theme mentioned by workers. This concern stemmed from experiences they themselves or those they knew had due to previous inexperience or lack of knowledge about proper procedures of what to do if a tick was found attached to their bodies and proper tick removal techniques. One worker even noted that they had developed anxiety surrounding working outside and potential tick encounters without proper protective measures.

*“Yo cogí un miedo de trabajar afuera simplemente. Aunque gano poco, tu sabes, adentro no me importaba el trabajo que me dieron. Pero yo me salí del trabajo en la grama simplemente por el problema que yo pasé de la garrapata.”*

*Translation: “I started to feel afraid of working outside. Even though I don’t earn much, you know, inside, I didn’t care about the job they gave me. I left landscaping work simply for the issue that I had with ticks.”*

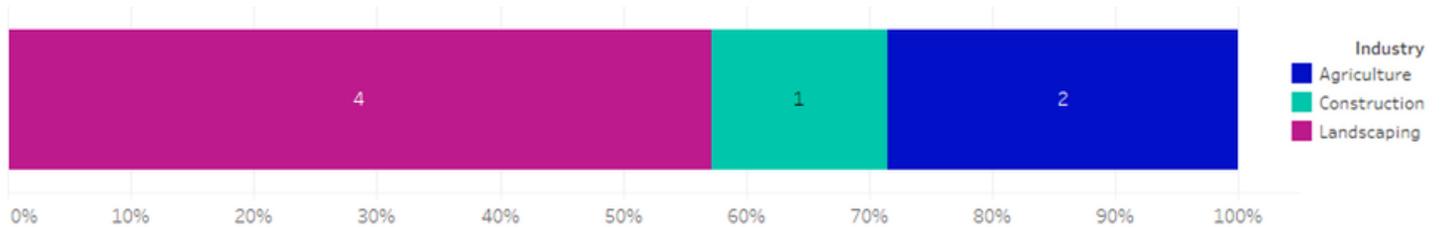
*- Outdoor worker*

Table 8: Tick encounters in past 12 months

Characteristic	N = 59 <sup>1</sup>	N = 194 <sup>1</sup>	N = 259 <sup>1</sup>
Number of ticks found crawling or attached to body/clothing <sup>2</sup>	Non-outdoor workers	Outdoor workers	Total workers
One or more ticks <sup>3</sup>	8 (13%)	51 (26%)	59 (23%)
None	51 (86%)	141 (73%)	197 (76%)
<sup>1</sup> n (%)			
<sup>2</sup> Excludes three respondents who selected “I don’t know” or “No answer”			
<sup>3</sup> Includes the following responses: “One tick”, “2-5 ticks”, and “More than 5 ticks”			

Three percent (3%; n=7) of respondents reported ever being diagnosed with a TBD, all of whom were outdoor workers. The majority of those diagnoses were of Lyme disease (86%), while one of the respondents did not remember which TBD they were diagnosed with. Of those seven respondents diagnosed with a TBD, 57% were landscapers.

Figure 7: Diagnosed with a TBD by industry (n = 7)



Survey respondents that had never found a tick attached or crawling on their body or clothing were asked about their health care seeking behavior if they were to find a tick attached to their body. Three in five (59%) of these respondents stated that they would seek a healthcare provider if they were to find a tick attached to their body, while one-fifth (22%) stated that they were unsure, or it would depend. Respondents were then asked if they would seek healthcare if they developed a rash after a tick bite. The majority of respondents (92%) stated that they would seek healthcare if they developed a rash after a tick bite.

Although the majority of respondents said they would seek healthcare, key expert interviewees mentioned a lack of transportation, financial barriers, and language barriers as issues that may inhibit someone from seeking care when needed. Multiple key experts stated that many in the community face illiteracy, which complicates clinic visits and intake if there is no one that can help verbally communicate with the patient to help them complete the necessary forms during their visit. Another key expert noted that some of the Latine adult community in the area did not have a medical home. This in turn may affect health seeking behavior in general, including seeking health care after a tick bite.

*“So 100 percent the number one barrier is transportation, we're a very rural county. We don't have any public transportation here at all. The only thing we have is Uber and Lyft...It's the biggest problem. I mean, and it's expensive. So if you want to take a taxi from one part of the county to another part of the county, that could be \$30 each way.”*  
- Key expert

**Table 9: Attitudes regarding potential tick encounters among participants with no tick encounters in past 12 months**

Characteristic	N = 200 <sup>1</sup>
<b>If found tick attached to body, would seek healthcare provider</b>	
I don't know or depends	45 (22%)
No	37 (18%)
Yes	118 (59%)
<b>If rash developed after tick bite, would seek medical care<sup>2</sup></b>	
No	10 (5%)
Yes	183 (92%)
<sup>1</sup> n (%) Includes respondents that reported they had not found a tick attached or crawling on their body or clothing, didn't know, or did not answer.	
<sup>2</sup> Response categories of <5% of sample were omitted	

## ACCEPTANCE OF A FUTURE LYME DISEASE VACCINE

When it comes to acceptance of a potential Lyme disease vaccine, the majority (67%) of respondents stated that they definitely (n=109 ; 42%) or probably (n=65 ; 25%) would get the vaccine (see Table 10). A few stated that they were unsure about whether they would get the vaccine (11%), while 15% said they would definitely not get the vaccine and 4% said they probably would not get the vaccine.

Respondents who did not say they would definitely get the Lyme disease vaccine (n=150) were asked about their perception if it was highly recommended to them by a health care provider or their employer. If the Lyme disease vaccine was highly recommended to them by a healthcare provider, 18% of these respondents would definitely get the vaccine and 32% would probably get the vaccine (see Table 11 for aggregated results). The breakdown of a Lyme disease vaccine acceptance is similar if highly recommended by their employer, with 16% saying they would definitely get the vaccine and 33% saying they probably would the vaccine (see Table 11 for aggregated results). Close to one-fourth of these respondents said they would definitely not get the vaccine, even if the vaccine was recommended by a healthcare provider (27%), or if it was recommended by their employer (26%) (see Table 11 for aggregated results).

**Table 10: General Lyme disease vaccine acceptance**

Characteristic	N = 259 <sup>1</sup>
<b>Level of interest in potential Lyme Disease vaccine</b>	
Definitely or probably would get the vaccine	174 (67%)
Not sure about getting the vaccine	28 (11%)
Definitely or probably would not get the vaccine	49 (19%)
No answer	5 (2%)
<sup>1</sup> n (%)	

**Table 11: Lyme disease vaccine acceptance if recommended by healthcare provider or employer**

Characteristic	N = 150 <sup>1</sup>	N = 150 <sup>1</sup>
	If vaccination were recommended by healthcare provider	If vaccination were recommended by employer
Definitely or probably would get the vaccine	75 (50%)	74 (49%)
Not sure about getting the vaccine	20 (13%)	17 (11%)
Definitely or probably would not get the vaccine	47 (31%)	48 (32%)
I don't know	3 (2%)	5 (3%)
No answer	5 (3%)	6 (4%)

<sup>1</sup> n (%). Excludes 109 respondents who initially reported “Definitely would get the vaccine” (Table 10).

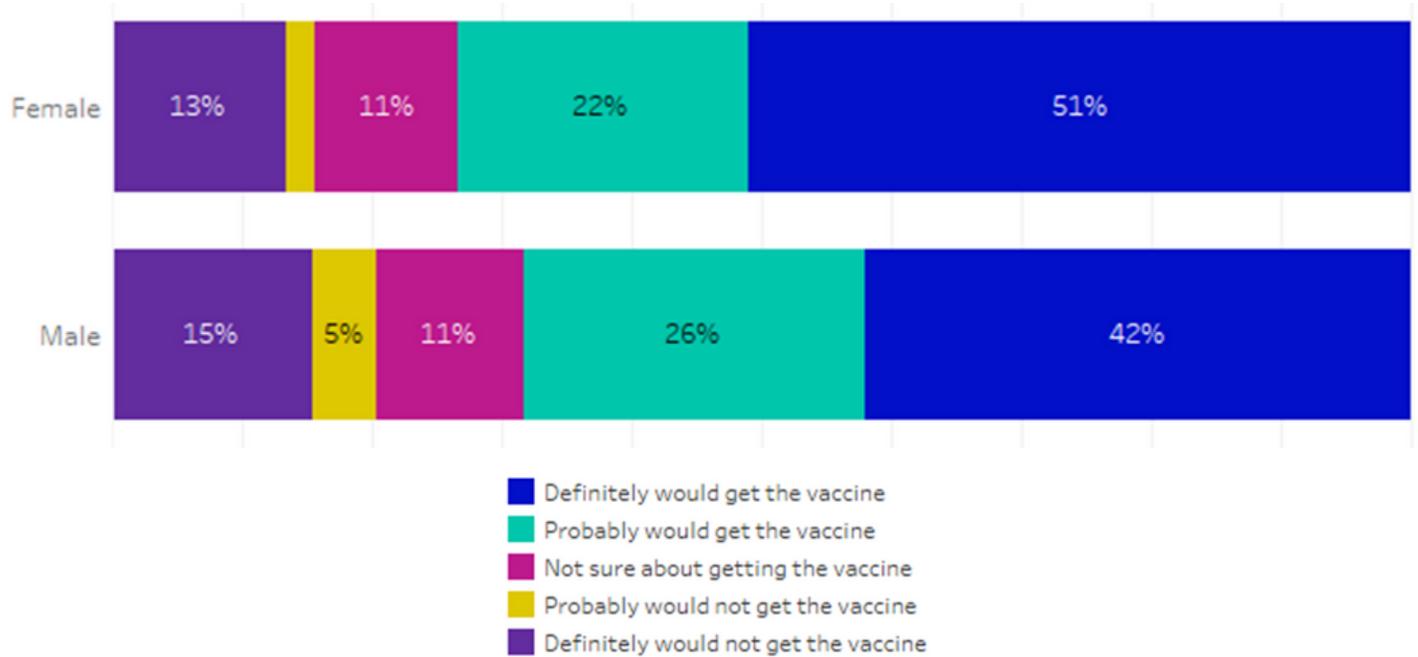
Outdoor workers who participated in qualitative interviews seemed enthusiastic and supportive of a Lyme disease vaccine. Outdoor worker interview participants noted specifically that they would trust information given to them by their employer or if they do have a medical home, from their doctor regarding the Lyme disease vaccine. Key expert interviewees noted that in order to effectively distribute and have Lyme disease vaccine uptake in this population similar strategies used for the COVID-19 vaccine would be fruitful, such as providing vaccines at worksites or in community spaces. Key experts also mentioned that special attention would need to be given to address transportation barriers, and health education and outreach in the preferred methods and language of the community would be critical.

*“So, it all depends on the approach. I will say that people like to wait and see what happens. Let somebody else take the risk for me. And if that person is doing good, ok, then I may. The other person, I'm thinking more like once the vaccine is out, let it happen, probably [wait] a couple of years, and then I may take it. It's hard for people to take the vaccines, because if they don't have a medical home or somebody to call a doctor and they don't get a medical, a physical in four or five years or even before coming here, and they have been here for 25 years.”*

— Key expert

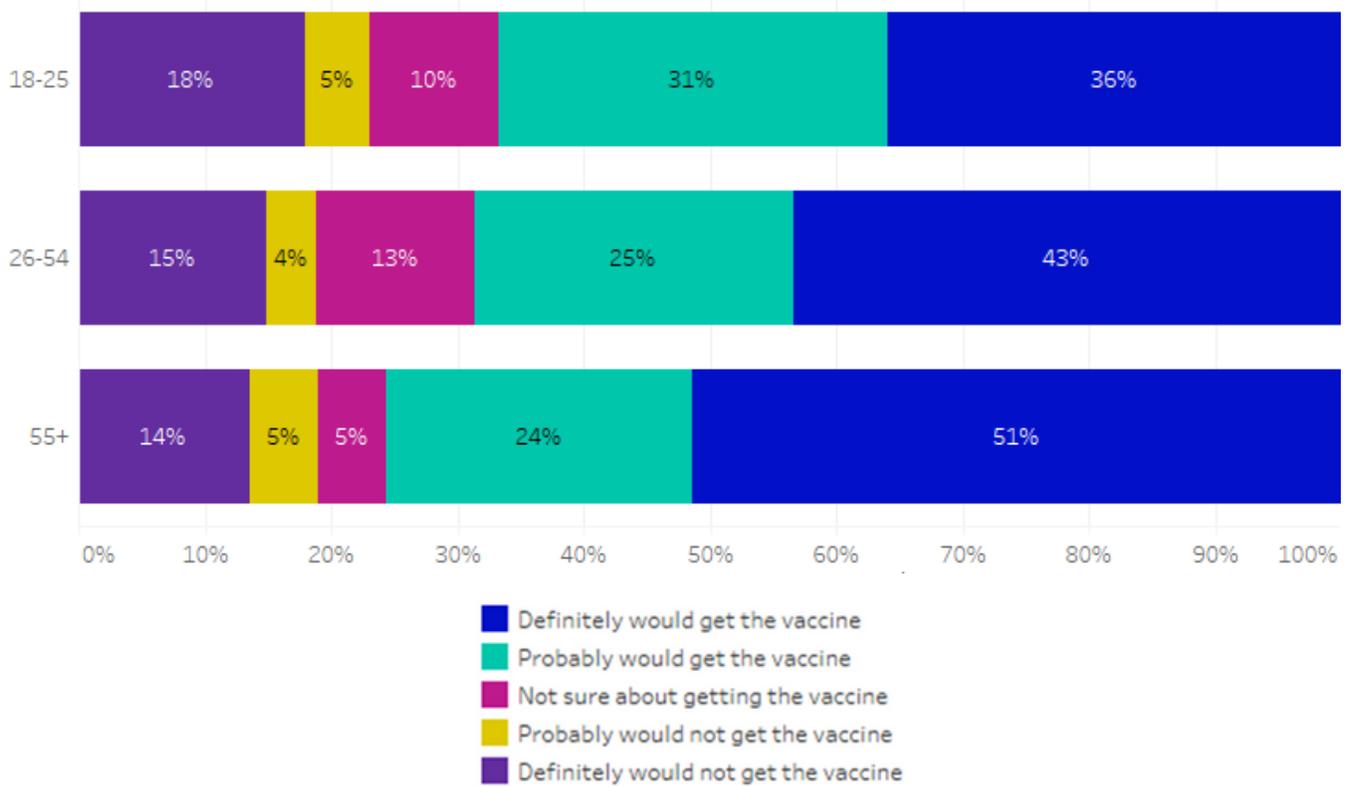


Figure 8: Lyme disease vaccine acceptance level by sex (n = 259)



Female (n = 46), Male (n = 209)

Figure 9: Lyme disease vaccine acceptance level by age group (n = 259)



18-25 years (n = 40), 26-54 years (n = 179), 55+ years (n = 40)

# SOURCES OF HEALTH INFORMATION

Survey respondents were asked where they generally access health information. The most common sources were health care providers (36%) and family or friends (23%) among all survey respondents. Media outlets and social media platforms were also common sources of health information. Twenty-one percent of respondents reported getting general health information from television, 20% from Facebook, and 16% from YouTube.

Respondents were also asked who and what were trusted sources of health information (only the answers from outdoor workers are reported; see Table 12). Among outdoor worker respondents, the most trusted source of health information was healthcare providers, with 37% of respondents trusting the information from healthcare providers. Other sources of trusted health information were family and friends (27%) and the New Jersey Department of Health (24%). Nineteen percent (19%) of respondents stated that they trusted the health information provided to them by their employer. In terms of media outlets and social media platforms, 20% trusted the health information coming from television and 16% trusted the health information from Youtube.

In qualitative interviews, community outreach was discussed frequently by key experts, employers and even some outdoor worker participants as a key strategy in providing health education and information to the community. Key experts stated that the best way to reach the community about ticks and Lyme disease is through repeated on-the-ground verbal and visual communication. Agricultural employer interviewees noted that they prefer outreach from organizations that they trust in the community that create relationships with them or are recommended by farm bureau or extension offices instead of unknown third-party organizations.

*“I think outreach needs to come from sources that farmers trust, and I think they trust a cooperative extension and I think they trust Farm Bureau. So, I think that when you have a third- party provider, you know, advocating it, there's always that sense of caution.”*

*— Employer*

*“You need be out there. You need to let the people know you. Once they know you and they trust you, then you can talk and advice and suggests for them to do this or do that.”*

*— Key expert*



**Table 12: Trusted sources of health information among Outdoor Workers**

Characteristic	N = 194 <sup>1</sup>
<b>Trusted Sources of Health Information<sup>2</sup></b>	
Healthcare provider	72 (37%)
Family or friends	53 (27%)
NJ Department of Health	46 (24%)
TV	39 (20%)
Employer	37 (19%)
Youtube	32 (16%)
Websites	22 (11%)
Community org	16 (8%)
Facebook	15 (8%)
Radio	10 (5%)
WhatsApp	10 (5%)
Instagram	9 (5%)
Tiktok	4 (2%)
<sup>1</sup> n (%)	
<sup>2</sup> Respondents could select more than one response.	

# LIMITATIONS

Although survey respondents were identified through a stratified random selection of sites, individual respondents were not randomly selected for surveys. Survey respondents should not necessarily be viewed as a representative sample of all outdoor workers in the counties, but rather as a non-random sample that captures information from the diverse populations of outdoor workers in Hunterdon and Morris counties. All survey data are self-reported and are subject to recall bias. The data in this assessment are cross-sectional and only represent a brief snapshot in time. The survey was only available in English and Spanish, with interpretation into Mam.

# DISCUSSION

Lyme disease has been found to be endemic in New Jersey, with an incidence of 28.9 cases per 100,000 individuals in 2020. While there have been studies that assess TBD risk, knowledge and attitudes among the general population and some industry sectors, there has been limited knowledge concerning immigrant and Hispanic/Latine outdoor workers.



# DISCUSSION (CONTINUED)

The findings from this survey suggest that outdoor workers are at increased risk for tick encounters. This assessment suggests that outdoor workers in northern New Jersey may have an increased risk of TBDs: 26% of outdoor workers reported finding one or more ticks on their body or clothing during the past 12 months, compared to 13% of non-outdoor workers. This assessment found that there are differences in the frequency of tick encounters among outdoor workers in different industries. While in general, all outdoor workers had frequency of tick encounters compared to non-outdoor workers, those working in the landscaping industry had the highest frequency of tick encounters among all workers. Landscapers would benefit from additional targeted campaigns regarding TBDs prevention measures and more employer and community support.

Four in five (80%) outdoor workers knew ticks spread disease, however fewer than one in five (18%) had heard of Lyme disease. Despite being in an endemic area and working outdoors, only 15% of respondents recalled ever receiving tick bite prevention information from their employers in New Jersey, and most outdoor workers (55%) were “somewhat” or “very” concerned about TBDs. As noted by employers and key experts during qualitative interviews, many workers were familiar with ticks from their country of origin. However, TBDs are not endemic in their country of origin and therefore workers may not have enough relevant information about ticks in the U.S to properly prevent TBDs. Based on these findings, TBD education campaigns and trainings need to be provided to outdoor workers. Public health officials and community-based organizations could collaborate with employers in outdoor industries to meet the gap in training needs by providing evidence-based and culturally competent trainings to workers on preventing TBDs. Community-based educational campaigns would also benefit others who may not be reached by workplace trainings, such as highly migratory workers and those who work as day laborers. It was noted through qualitative interviews that many outdoor workers in these counties of New Jersey are day laborers and may frequently change employers, making workplace trainings less accessible for these workers. When developing both workplace and community-based educational campaigns, it is important to consider the languages spoken by outdoor workers, and to intentionally consider distributing this information where the community gathers and feels comfortable to ask questions about the information provided.

Since Lyme disease vaccine is expected to become available in the United States within the next several years, a successful vaccine rollout depends on identifying individuals and communities that are at highest risk in counties where Lyme disease is endemic. The Lyme disease vaccine has the potential to reduce morbidity and improve the health outcomes of outdoor workers, but the diversity of such a population requires culturally responsive outreach, education, and vaccine delivery efforts. As noted by qualitative interviewees, to ensure success in the implementation of a Lyme disease vaccine, lessons learned from the COVID-19 vaccine rollout are important to consider. One aspect is for public health officials to begin laying the groundwork for the vaccine implementation through culturally adapted education efforts via trusted sources of health information such as healthcare providers, employers and community-based organizations. This can be tied with the general education campaign about TBDs training and prevention methods to outdoor workers. As with the COVID-19 pandemic, once the vaccine is ready it is important to ensure easy access to the vaccine by hosting vaccine clinics in partnerships with businesses and community sites outdoor workers visit, as well as collaborating with employers for on-site vaccination clinics.

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Disclaimer: This publication was supported by the Centers for Disease Control and Prevention of the United States Department of Health and Human Services (HHS) as part of a financial assistance award totaling \$108,150 with 100 percent funded by CDC/HHS. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by CDC/HHS, or the United States Government.