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Valley Fever Awareness, Knowledge, and Perceptions: A Literacy Survey of Adolescents in Arizona

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ABSTRACT

Recently, the United States has seen an increase in the incidence and severity of the fungal Valley fever infection (Coccidiomycosis). As improved treatment methods and a vaccine develop, it continues to be important for those living in areas where Valley fever is common to be aware and knowledgeable about Valley fever to detect infection earlier. The scope of research investigating the public's awareness of valley fever in highly endemic areas has been limited. Including the public's perspective in the present literature of Valley fever is important that may help identify potential knowledge gaps to inform future awareness campaigns. With the recent increase in rare, disseminated Valley fever among adolescents and young adults in Arizona, it becomes important to evaluate the outreach and effectiveness of public health messages and education that have been implemented over the years among this population. The present observational study utilized electronic surveying which produced qualitative and quantitative data to evaluate adolescents' awareness, knowledge and perceptions of Valley fever. A sample of 210 adolescent high school students who attend school in Maricopa County were surveyed. The majority of participants indicated no knowledge of Valley fever, and uncertainties surrounding the disease were prevalent throughout participants' responses. Overall, this study found improving and increasing awareness messaging about Valley fever should be a priority for Arizona public health officials. Increased understandings of this disease among the public can promote their better health.

Introduction

Valley Fever (Coccidiomycosis) is a lung infection caused by the fungus Coccidioides, which grow in the soils of hot and dry environments. Disturbance of the soil such as wind or digging, circulates the microscopic spores of the fungus in the air (Centers for Disease Control and Prevention [CDC], 2021). When inhaled, the spores settle into the lungs of the organism and reproduce to form larger clusters of spores, producing pneumonia-like symptoms (Lauer, 2017). Valley fever (VF) is a major public health concern in the United States infecting humans and various animals such as house-hold dogs (Valley Fever Center for Excellence, 2021). The Coccidioides fungi are endemic, i.e. characteristic of a particular region or environment, to primarily the Southwestern region of the US (UC Davis Center for Valley Fever, 2017). Approximately 97% of cases reported in the US are from the Southwestern states of California and Arizona (Benedict, 2019). In Arizona, the fungus is present year-round, where nearly half to two thirds of all US cases are reported (Arizona Department of Health Services [AZDHS], 2017). Anyone who lives or visits in the state is at risk for breathing in the spores of the Coccidioides.

There are 3 forms of Coccidioidomycosis; acute pulmonary, the initial and severe lung infection, chronic pulmonary, a long-term lung infection, and disseminated infection, where infection spreads to other parts of the body. Acute pulmonary Coccidioidomycosis Presentations of acute pulmonary infection, otherwise known as Valley fever, can range considerably from person to person. Most infected individuals exhibit no symptoms of acute infection, while around 40% of individuals experience flu-like symptoms such as fever, headache, cough, difficulty breathing, skin rash, muscle aches, joint pain, night sweats, and fatigue for a few weeks to a few months (Cleveland Clinic, 2022). If left untreated, the unresolved lung infection can progress to severe forms of Valley fever, such as chronic

coccidiomycosis, around 5-10% of human cases progress to disseminated Valley fever, severe infection spreads from the lungs to other vital organs and may develop into potentially fatal infections such as meningitis (Cleveland Clinic, 2022). Disseminated Valley fever can develop in anyone, however adults aged sixty and older, pregnant women, Black and Filipino people, and immunocompromised individuals with weaker immune systems are at increased risk (CDC, 2019). Serious lung and disseminated infections are treated with antifungal medication that can last from 3-6 months to lifelong.

Because Coccidioidomycosis is caused by inhaling an environmental pathogen, it is very difficult to fully prevent against contracting it. Thus, awareness of the possibility of infection and early detection are the most important ways to prevent it from developing into serious forms and begin recovery. As researchers continue to learn more about Coccidioidomycosis to develop better detection, diagnostic testing, and a Valley fever vaccine, the public's awareness of the fungal disease in highly endemic states is vital to promote and monitor. While progress has been made in spreading awareness about Valley fever in Arizona, there remains a lack of research investigating the public's current awareness and perceptions since the implementation of past educational measures. A study evaluating the public's awareness and perspective of Valley fever is vital to provide grounds to evaluate and improve current and future educational measures.

Literature Review

Growing Threat of Valley Fever

The annual incidence of Valley fever cases in the US rose by 760% from 1998 to 2011 and continues to increase. (CDC, 2013.). To provide probable explanations for this growth, climate models have demonstrated the impact of climate change on the spread of valley fever outward from endemic areas as the global climate warms and environments become hotter and drier (Gorris et al., 2019). With that, the number of persons at risk for severe valley fever illness is concerningly increasing. The most relevant patient population associated with symptomatic infection and disseminated Valley fever is older adults. Recently, states that have not been previously known to report VF cases have reported concerning hospitalizations of young and previously healthy individuals most notably Washington State, Kansas, Maryland, Michigan, and New York (Toda et al., 2019). A similar shift has been observed in Arizona where medical experts at Phoenix Children's Hospital are seeing double the number of Valley fever cases in children and young adults than last year (Wahl, 2024), suggesting the expansion of demographics at risk for developing serious forms of infection.

Advancing Research for Combatting Valley Fever

Valley fever, despite being a major public health concern in the United States, is rare on the national level, and as previously suggested, has historically been neglected as a priority for federally funded medical research since its first discovery Innes et al., 2017). Due to its presence in specific areas of the US, the disease has often been disregarded as a national problem with funding for research becoming overshadowed by other public health concerns including sexually transmitted disease, tobacco use, salmonella poisoning, whooping cough, and infectious diseases (Schmitt, 2012). As a result, and molecular and immune mechanisms underlying the infection are not well understood, and there is currently no effective Valley fever vaccine available to prevent VF infection. (National Institute of Allergy and Infectious Diseases [NIAID], 2022). The diagnosis and treatment of Valley fever is complex due to the range of Coccidiomycosis infection presentation in patients, from asymptomatic to chronic infection (Pathogenesis and evolving treatment article).

Increased severity of Valley fever infection is largely attributed to the misdiagnosis or lack of diagnosis of Valley fever (Valley Fever (Coccidioidomycosis) Awareness, 2023). Valley fever is often mistaken for other common

respiratory illnesses such as the flu, pneumonia, or tuberculosis upon examining lung CT scans (Chang, 2008). Delays in diagnosis can lead to worsening of symptoms and lead to the unnecessary use of inappropriate medications for the fungal infection such as antibacterial drugs (Pu, 2021). Consequently, Valley fever can develop into a more life-threatening illness, while substantially increasing economic burdens on patients and their families (Grizzle, 2021), all highlighting the need for more rapid and accurate testing procedures to improve hospitalization rates and patient outcomes.

Current developments in the evolving treatments for valley fever strive to quicken the recovery time in patients to find more efficient alternatives, with current medication consisting of 3-6 months to lifelong antifungal medication. A VF vaccine and more rapid testing to diagnose the disease are currently undergoing development to become available to the public by prominent institutions including the NIAID, University of California Los Angeles, California based Kern County's Valley Fever Institute, the UC Davis Center for Valley fever, and the Valley Fever Center for Excellence in Tucson, Arizona.

Public Awareness of Valley Fever

Following a sudden increase in VF cases in 2006, public health researchers at the Arizona Department of Health Services surveilled Valley fever patients in the Phoenix metropolitan area to explore the relationship between disease awareness and health outcomes. Their findings that a urge the importance of public and provider education as it improves early recognition and diagnosis and treatment of the disease (Tsang et al., 2010). Thus, the consensus surrounding prevention methods for Valley fever is that awareness among healthcare providers and the general public is the most important way to recognize the signs and symptoms of Valley fever that can then lead to the proper diagnosis and treatment plan.

It is known that awareness of epidemic diseases, especially through the dissemination of information from person to person and through public health communications plays a crucial role in combating and managing disease (Funk et al., 2009). Researchers, clinicians, and public health officials in Arizona and California have been implementing various media messaging strategies targeted toward the public to learn about the disease, especially following a rise in Valley fever cases to epidemic levels in the years 2016 and 2017 (AZDHS, 2017). The California and Arizona departments of health have spread this information through campaigning on online websites, holding official awareness weeks, and displaying informational videos, relevant statistics, poster-images, and brochures/fact-sheets. Important messaging about the common signs and symptoms, associated health-related and economic burdens, populations at increased risk for severe infection, and threat of increased wind activity/dust storms advocating residents to implement the use of masks and staying inside (AZDHS, 2017).

Especially given the recent increases in Valley fever cases among younger people, it remains important to assess that current public education tactics are working. Research involving direct surveying of the Arizona public's knowledge, awareness, and perceptions of Valley Fever using in-depth questionnaire processes necessary to their knowledge and perceptions of Valley fever has not been investigated in the state of Arizona. Influential to the present study's methodologies and purpose is the 2016-2017 surveillance of general Valley fever awareness among the older adult population in California, which initiated a state-wide awareness campaign in 2020 (Hurd-Kundeti, 2020). Currently there are no studies that have surveyed adolescents and young adults. Thus, this study aims to address the question: With increased Valley fever messaging in Arizona, where do adolescents' awareness, knowledge, and perceptions of Valley fever currently lie? Evaluating the Valley fever literacy in a high incidence region of Arizona is an important step in gaining novel information to improve current and future measures of promoting the awareness of Valley Fever.

Materials and Methods

Background

This study was designed as an observational study with a mixed-methods approach. Both quantitative and qualitative data were utilized to provide comprehensive data to identify and evaluate general knowledge gaps and personal perceptions. An online electronic survey was distributed to adolescents ages 13-19 attending school in a high school district located in Maricopa County, one of 3 counties reporting 94% of Arizona's Valley fever cases. The utilization of a 5–10-minute survey allowed for effective and efficient data collection of a relatively large sample of people and maintained consistency as the Microsoft Forms service used to distribute the survey was already in use by school campuses.

Sample Size Calculation

Using the online Qualtrics sample size calculator (Qualtrics, 2023), an estimated sample size of 196 was calculated based on a confidence level of 95% and a margin of error of 7% out of a total high school student population of 367,150.

Procedure/Ethics

Approval for this study was obtained from University High School's IRB Ethics Committee. All potential participants parents of minors were required to complete the online consent form detailing the study context and the respective role and rights of participants. The anonymous study survey could only be accessed once the consent form was submitted, and participation was voluntary. There was no compensation. Data confidentiality of personally identifiable information provided by participants and parents during the consent process, including name and email was ensured. Participants were debriefed at the end of the survey upon submission about the broader purposes of the study and were provided online information from the official CDC Valley fever Fact Sheet to help spread awareness and encourage them to learn more about Valley fever.

Design

The 20-question survey invited both closed-ended responses and one open-ended response for participants to voice their knowledge and experiences/perceptions about VF. The survey had 3 sections: demographic information, knowledge-based questions, and perceptions. The survey was not targeted toward any particular high-school grade level, race, ethnicity, or gender.

Demographic Questions

The survey asked participants to indicate their age, grade level, as well as their length of residence in Arizona, which was characterized from 'Less than 1 year' to 'Over 10 years'. Length of residence was asked to better characterize the experiences of the sample of participants taking the survey to provide explanations for potential increased exposure to Valley fever and public media messaging, an overarching assumption being that the longer they lived in Arizona, the more likely they would be aware of VF.

Knowledge-Based Questionnaire

The purpose of the first question of the Knowledge-based section to gauge general awareness of Valley fever by asking participants to indicate whether they have heard of Valley fever by choosing an option between "Yes" or "No." Participants who indicated that they had heard of VF were able to then respond to the VF knowledge questionnaire. This included 10 knowledge-based multiple-choice questions that asked participants about various aspects of Valley fever,

which yielded in depth data to characterize the extent to which participants are knowledgeable about VF. A total of 10 questions were asked about 5 categories regarding VF: 1) mode of transmission; 2) nature of the disease; 3) severity of infection; 4) vulnerable groups and 5) vaccine availability. The design of these questions was adapted from existing disease literacy questionnaires used by researchers studying Rift Valley Fever in Uganda (de St. Maurice, 2018) and adapted to this study's focus on Valley fever. Questions that asked about vulnerable groups primarily focused on age groups to assess participants' understanding of their own risk of contracting VF as adolescents, as well as the risk for other age groups in their surroundings. Each of these questions had dichotomous answer choices of "Yes", "No" and "Unsure", which helped to obtain simple and objective data.

Perceptions Questions

3 questions of the survey asked participants about their perceptions and experiences relating to Valley fever. One multiple-choice question asked participants about where they first heard/learned of Valley fever, intended to gauge the outreach of public messaging for VF. One question asking participants whether they think Valley fever exists was included to evaluate continuities or changes from previous findings that the public perceives VF as a mythical disease (Gaab, 2015). The inclusion of one free response question invited participants to type a short answer about what they know about VF prevention methods and personal experiences with Valley fever, i.e. contracting VF, having known a person or pet with VF, a discussion with a healthcare provider, etc. This yielded a nuanced range of answers to help characterize where participants' current understandings towards VF lie and what experiences may have influenced those understandings.

Data Analysis

Knowledge-Based Questionnaire

Quantitative analysis was used to quantify the 10 multiple choice knowledge-based questions on a 10-point scale. Correct responses to knowledge-based questions received "1" point and incorrect responses received "0" points. Once the number of participants selecting correct answer choices for each multiple-choice question were gathered and tallied in a private excel spreadsheet. Individual participant's calculated knowledge scores were categorized into three levels of knowledge: poor knowledge (0-3 points), intermediate knowledge (4-6 points), and good knowledge (7-10 points). This method of data analysis has been used in the literature by researchers studying other prevalent diseases such as COVID-19 during the global pandemic (Olaimat et al., 2020). Further, specific question and frequency of answer choices were further assessed for significant patterns within their respective knowledge categories. Utilizing frequency scores allowed for a comprehensive and comparable assessment of individual knowledge levels of VF.

Perceptions Questions

As mentioned previously, participants' response to the free response question focusing on experiences and perceptions of Valley Fever yielded qualitative results and were analyzed through thematic analysis to break down short answer responses. Themes that emerged from participant's typed answers were categorized by similarities in participant perspectives and the number of participants falling under each category were tallied and frequency for each theme and key terms associated with each theme was determined and categorized based on the premise of the question. This is later discussed in the results section. This structure of analysis allowed for comparable data among participants while providing significant findings from participants' personal answers.

Results

Participant Demographics

A total of 210 adolescents aged 13-19 years living in the Tolleson school district of Arizona were surveyed in this study. 85% of participants reported that they live in Maricopa County, one of 3 counties where 94% of Arizona Valley fever cases are reported and the youth represent a quarter of the population (*U.S. Census Bureau QuickFacts: Maricopa County, Arizona*, 2023).

Table 1. Participant Demographics

Age group	Total Number
13-15 years	101
16-18 years	104
19 years	2
County of Residence: Maricopa County	180
Total Number	210

Note. Some participants chose the "Prefer not to say" option in response to demographic questions

General Awareness of Valley Fever

The majority of participants (n=151/210) indicated no awareness of VF, with only 59/210 participants reporting they have heard of Valley fever (Table 2). No particular age group had increased levels of awareness of VF. Further, an inconsistent correlation was observed between length of residence and increase in awareness of VF. As years of Arizona residence increased, the number of participants indicating both awareness and the lack of awareness increased, revealing that increased length of residence in Arizona may not be a factor contributing to a general increased awareness of Valley fever as previously assumed. Table 2 lists the

Table 2. Participant Awareness of Valley fever and Reported Years of Residence in Arizona

How long have you been living in Arizona?	Have you ever heard of any of the terms "Coccidioidomycosis" or "Valley fever?" (Yes)	Have you ever heard of the term "Valley fever?" (No)
Less than 1 year	1	1
1-3 years	5	5

4-6 years	4	21
7-9 years	4	9
Over 10 years	44	113
Total	59 (28%)	151 (72%)

Note. Some participants (n=4) chose the "Prefer not to say" option in response to questions

Among 210 participants surveyed, the 151 participants who responded "No" to indicate they have not heard of Valley fever were not able to proceed to the knowledge and perceptions sections of the survey. Thus, the other 59 respondents were included in the analyses of these two sections.

Participant Knowledge of Valley Fever

Of the 59 participants indicating awareness of VF, the average knowledge score was a 40% (4/10 questions answered correctly). 29 participants showed poor knowledge of VF answering only 0-3 questions correctly. Only 9 participants showed good knowledge of VF, answering 7-10 questions correctly. The categorized knowledge scores are depicted in Figure 1 below.

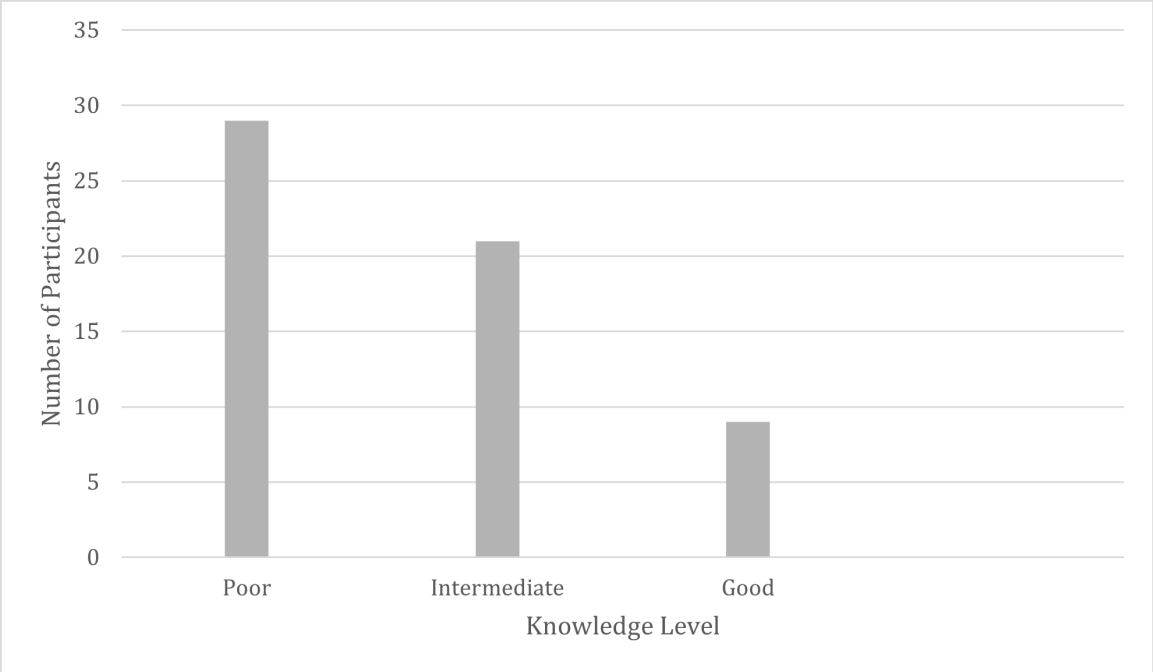

Figure 1. Participant Valley Fever Knowledge Scores. Note. Scores were categorized as follows: Poor: 3 questions correct, Intermediate: 4-6 questions correct, Good: 7-10 questions correct

Within participants' answers to the questionnaire, there was an apparent lack of understanding surrounding certain aspects about VF. Table 3 below shows the frequency of incorrect answers to each multiple-choice knowledge

question in number participants and percentage of total, as well as each questions' associated knowledge category (mode of transmission, nature of infection, vulnerable groups, severity of infection, and vaccine availability). Participants' specific answers are further discussed later.

Table 3. Frequency of Incorrect Responses to Knowledge-Based Survey Questions

Category	Questions	Frequency for Incorrect Answers (% of total (n=59))
Mode of Transmission	How do you think Valley fever is spread/transmitted?	n = 45, 76%
Nature of Infection	What do you think are the potential symptoms of Valley fever?	n = 47, 80%
Vulnerable Groups	What age groups do you think can get Valley fever?	n = 51, 86%
Vulnerable Groups	Do you think there are certain age groups that are at higher risk for getting Valley fever?	n = 22, 37%
Vulnerable Groups	Do you think Valley fever can affect humans and animals?	n = 22, 37%
Severity of Infection	What do you think is the longest that an organism can be infected with valley fever?	n = 49, 83%
Severity of Infection	Do you think Valley fever has the potential to be severe/cause death?	n = 22, 37%
Vaccine Availability	Do you think there is a vaccine to prevent against Valley fever?	n = 45, 76%

Participant Perceptions of Valley Fever

Sources of Information

Participant's answers to where they first heard of Valley fever are listed in descending order in Table 4 below. This again aimed to gauge the outreach of public awareness campaigns.

Table 4. Participant Reported Source of Information for VF

Preliminary Source of Information	Number of Participants
Family member	28
School media	27
Peer/friend	25
School	15
Healthcare Provider	14
Online Articles/Forums	10
Awareness Campaign/Project	5
News	2

Existence of Valley Fever

Participant answers to their perception of the existence of VF are shown in Figure 2, where participants answered "Yes" "No" or "Unsure" upon being asked whether they think VF is a real threat/disease.

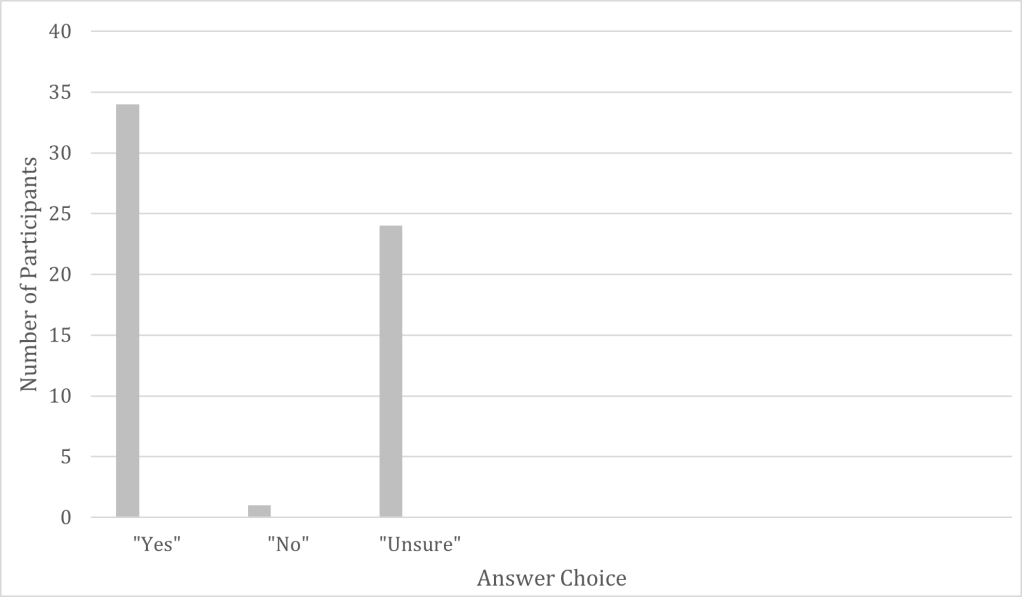

Figure 2. Do you believe Valley fever exists?

Experience and Knowledge of Preventative Action

44 participants chose to respond to the free response question which entailed two question categories: knowledge of VF prevention and protection, and any experiences with VF. In total 6 key terms/phrases emerged from all responses. These key terms and phrases, their question category, and frequency from participants' responses pertaining to these two question categories are listed in Table 5 below.

Table 5. Emerging Themes Within Content Categories of Free-Response Question

Question Category	Key Term/Phrase	Frequency (% of total, n=44)
VF Prevention Methods	Vaccine	n= 2 (4.5%)
VF Prevention Methods	Epidemic practices, i.e. masks, isolation, hygiene	n= 7 (16%)
VF Prevention Methods	Dust, i.e. dust storms, staying away from dusty areas	n= 4 (9%)
VF Prevention Methods	Uncertain	n= 30 (68%)
Experiences with VF	Dog with diagnosis	n= 3 (7%)
Experiences with VF	Family member with diagnosis	n= 4 (9%)

From these emerging key terms, details about specific participant responses are highlighted below.

Vaccine: 2 participants cited the practice of getting vaccinated to prevent VF infection, however also indicating uncertainty if there is a VF vaccine.

Epidemic Practices: Several participants cited masks and hygiene practices as potential aspects of preventing VF infection. Interestingly, a few of these responses incorporated references to the COVID-19 pandemic occurring between the years 2020-2023, with one participant describing "Similar to COVID procedures can be taken" (Anonymous), and another describing "...taking similar processes used during epidemics" (Anonymous). Similarly, others answered, "Frequently and properly washing your hands, keep distance with people, wear masks when sick, keep frequently touched things clean such as tables and doorknobs" (Anonymous), "Staying away from people and things infected" (Anonymous), and "Hygienic practices" was commonly cited as part of VF prevention as well.

Dust Storms: 4 participants mentioned avoiding dust, dust storms, and soils/sand to prevent VF, as well as the use of respiratory protection such as masks. For example, one participant described, "Respiratory protection such as masks when dirt and dust pick up from outside" (Anonymous), and another described "By staying away from being outdoors when it gets dusty outside or when there's a dust storm" (Anonymous).

Uncertainty: There was a prominent theme of uncertainty among respondents, with 30 participants voicing similar ideas that they had only "Vaguely heard of it" or repeating phrases such as "I'm not sure/certain" and "I don't even know", as well as many using question marks or words such as "maybe" or "I think."

Dog or Family Member with VF Diagnosis: 3 participants described that their or a family member's dog currently has Valley fever. One participant described in detail,

"A family member's dog has been diagnosed for Valley fever and has taken medication for this diagnosis for about 2 years. When we tried to take the dog off the medication, the symptoms (low energy, weight loss, and coughing) would reappear and dramatically affect the dog's health negatively" (Anonymous).

4 participants also mentioned that one of their family members was diagnosed with Valley fever, although not much elaboration was provided.

Discussion

The purpose of the present study was to comprehensively assess the current awareness, knowledge, and perceptions of Valley fever among adolescents living in a highly endemic region of Arizona. As supported by the quantitative and qualitative findings from the knowledge and perception-based portions of the survey, this study found a concerning low awareness and knowledge of Valley fever among the adolescent population of Arizona, as well as an overarching uncertainty in the perceptions of the disease, highlighting a need to improve the Arizona public's understanding of the disease.

Participant Awareness and Knowledge of Valley Fever

With only 28% of participants (n=59) hearing of Valley fever in the area (Table 2), there was a low awareness level of Valley fever among the participants. The majority of those participants demonstrated a low extent of knowledge of Valley fever with nearly 50% of participants (n=29) scoring a low knowledge score between 0-3 points (Table 3).

The specific frequencies of incorrect responses to knowledge questions communicated that most of the participants who were aware of VF had low understandings of specific aspects of VF. More than 70% of these 59 participants incorrectly answered questions regarding VF mode of transmission, potential symptoms, at risk age groups, length of infection, and the availability of a vaccine. As shown in Table 3, 80% of participants (n=47/59) incorrectly identified potential symptoms of VF. Among these answers, commonly cited incorrect symptoms were that dehydration and dry skin were symptoms of VF. 86% of participants incorrectly identified age groups at risk for contracting VF in Arizona (Table 3), with most of them indicating that they do not think adolescents can contract VF. This is similar to findings that a large amount of the older adult population did not think they were at risk for contracting VF (Hurd-Kundeti, 2020). Among participants who answered knowledge questions and scored relatively well, a common misconception was the potential length of infection, an important aspect of Valley fever's symptoms that sets it apart from other common respiratory illnesses, which was often underestimated to last 1 week or less, compared to the correct answer of more than 6 months to lifelong. There was an apparent misconception regarding mode of transmission of VF, with many of the 76% of participants incorrectly characterizing Valley fever as an infectious disease spreading through 'contact with infected person/thing.' This finding highlights that many participants did not know that VF is an environmental pathogen, a crucial aspect to detecting and combating the fungal disease.

Participant Perceptions of Valley Fever

Like previous studies, there was a prevalent uncertainty about the true existence of VF (Gaab, 2015), with as many as 40% of participants aware of the term 'Valley fever' indicating they were unsure if Valley fever exists (Figure 2). This uncertainty emerged in many participants' answers to knowledge-based questions and continued to arise across participants' typed answers, where 68% of participants choosing to answer the free-response question voiced uncertainty in their response (Table 5).

Surprisingly, awareness campaigns or projects were the least commonly cited source of information for VF, with only 5/29 participants choosing it. This suggested that awareness campaigns have not been reaching as many people as planned. Most participants received their knowledge about Valley fever from friends, family, or social

media, with a family member being the most cited source of information (n=28/59). A possible explanation for this is that these can be seen as more accessible sources of information for Valley fever, as adolescents are often surrounded by their family, friends, and social media platforms.

Typed responses to the free-response question provided explanations for participants' knowledge and perceptions of Valley fever. Influential in participants' scores in VF knowledge and understandings of preventative action were their personal experiences. Participants who talked about their personal experiences with valley fever in relation to Valley fever in dogs showed greater understanding of the disease through increases in VF knowledge scores. They were more knowledgeable about Valley fever in dogs than in humans, and vice versa, and more knowledgeable about the severity of infection, lack of vaccination, and threat of Valley fever. Those who were aware of the threat of valley fever in the knowledge-based section knew of accurate prevention methods in their typed responses to the free response question, i.e., citing the use of respiratory protection such as masks. These findings highlight the importance of the recognition of Arizona residents' risk for contracting VF in promoting confidence in handling the threat of VF through informed preventative action.

Conclusions, Implications for Public Health Practice, and Future Research

The current lack of awareness and knowledge of Valley fever, as well as general uncertainties voiced by this studies' participants brings to light potential shortcomings in the outreach and effectiveness of Valley fever awareness campaigns and messaging in the state of Arizona, and especially Maricopa County, where the majority (85%) of participants were from, and a consequent need for more funding to increase and improve current campaigning tactics. Arizona public health officials may consider implementing new strategies into their awareness campaigns, specifically a more active effort to warn the public of VF rather than arguably static campaigning through online websites and displaying of posters, where many people may not pay attention. This can include using more open dialogue through use of more easily accessible sources of information such as social media, highway billboards, and radio talks, to engage the public to care more about the disease (Innes et al., 2017).

The past few decades have continued to see periods of epidemic levels of VF cases, a trend that will only continue and threaten more people living in the US. With an estimated population of more than 4 million residents, Maricopa County is the largest and fastest growing county in Arizona, accounting for nearly half of the state's cases, around 5,000 out of 10,000 as of 2023 ("Valley Fever," 2024). The recognition of VF and its key characteristics among all populations living in this area is crucial for enabling preventative action and management practices and ultimately better equipping these populations to combat the fungal disease as new technologies such as rapid diagnostic testing, treatments, and vaccines continue to develop. Thus, as well as including the perspective of adolescents in the current literature, future research should aim to include perspectives of other populations at higher risk for contracting valley fever such as older adults and outdoor workers in construction and farming, as well as those at increased risk for developing disseminated Coccidioidomycosis such as pregnant women, Black and Filipino people, immunocompromised individuals in order to develop measures to address these populations' specific needs. Researchers should also assess the level of awareness of populations living in the Pinal and Pima counties of Arizona in addition to Maricopa County, as they also report high rates of Valley fever in the state.

Limitations

The results of this study were subject to several limitations. The sample of 210 participants is relatively small compared to the total adolescent population of the state of Arizona. The data was collected from a convenience sample of high schoolers in the surrounding school district under a restricted amount of time, thus the results of this study may not represent the population as a whole. Further, this study also did not account for differences in socioeconomic factors that may influence individuals' experiences with Valley fever in their local community and households beyond

what was concluded from this study. The similar investigation conducted on older adults in California studied a very large cohort size of 2837 participants (Hurd-Kundeti, 2020), and thus yielded more generalizable and applicable results. Additionally, all the data generated from the methods of this study were self-reported by its participants. Thus, it is difficult to guarantee the truthfulness of participants' responses to the survey.

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