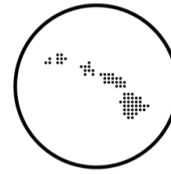


PUBLIC HEALTH REPORT

# INITIAL FINDINGS FROM THE MAUI WILDFIRE EXPOSURE STUDY

FEBRUARY 8, 2024





**MauiWES**



**UHERO Public Health Report  
Initial Findings from the Maui Wildfire Exposure Study**

*Six Months After the Maui Wildfires:  
Unresolved Health Needs and Continued Monitoring*

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## EXECUTIVE SUMMARY

Following the devastating wildfires from August 8-11, 2023, the Maui community has faced significant challenges in recovering from emotional, mental, and physical trauma inflicted. The fires left behind environmental hazards, including air pollution and toxic substances, posing additional long-term health risks. In response, we launched the Maui Wildfire Exposure Cohort Study (MauiWES), a grassroots initiative led by University of Hawaii, Manoa researchers Dr. Ruben Juarez of the University of Hawaii Economic Research Organization at the College of Social Sciences, and Dr. Alika Maunakea of the Department of Anatomy, Biochemistry and Physiology at the John A. Burns School of Medicine. This initiative, partnership with community-based organizations such as the Maui Medic Healers Hui and Roots Reborn Lahaina, and supported by seed funding from the Hawaii Community Foundation Maui Strong Fund, aims to recruit at least 1,000 individuals affected by the wildfires. Over at least ten years, the study will monitor, understand, and address the impacts on acute and chronic health and social conditions. Participants will contribute valuable data through a detailed questionnaire and health assessments, including biospecimen collection, to evaluate the short- and long-term health outcomes of potential hazardous substance exposures.

During the first two weeks of the study, from January 26-February 4, 2024, MauiWES recruited 224 participants affected by the wildfires. This first MauiWES report provides a summary of the demographic and social characteristics of individuals in the study to date and preliminary findings from this initial cohort.

### Key Findings

**General Social Impacts:** Only 24% of participants remain in their pre-wildfire homes. The majority, 65%, are in temporary homes, and 11% have moved to new permanent homes. The wildfires caused 58% of participants to lose their jobs. Currently, over half have found employment, but 24% are still jobless and searching. Additionally, 74% report a drop in their household income.

**Self-Reported Health Outcomes:** Almost half of the participants (49%) said their health is now worse than last year (prior to the wildfires). About 24% reported that they do not have steady access to medical care. Also, 13% reported that they do not have health insurance, much higher than last year's survey of Maui residents where only 1.7% reported being uninsured, similar to that reported statewide.

**Physical Health Assessment:** Over 20% of the cohort participants showed high blood pressure at the level of stage 1 and 2 hypertension, with 55% at pre-hypertension levels, indicating an overall proportion (~76%) of individuals at elevated risk for cardiovascular disease. Initial blood biomarker tests also indicated that 8-18% of participants may have compromised kidney function. Additionally, up to 74% of participants may be experiencing poor respiratory health, with 49% exhibiting signs of mild to severe lung obstruction, and 33% with compromised lung function linked to impaired tissue oxygenation. Study participants were provided a copy of their results immediately upon completion of enrollment. Those with abnormal levels of clinically-relevant health metrics were encouraged to seek professional medical care to confirm these assessments and obtain treatment if needed.

**Mental Health Assessment:** The MauiWES study suggests a significant rise in depression rates among its participants, with 55% exhibiting depressive symptoms. This is notably higher than the approximately 33% reported for both the general population statewide and specifically for Maui residents in a previous survey. Depression rates in the MauiWES cohort increased with age, peaking at 75% in those aged 50-59. This suggests the wildfires had a profound impact on the mental health of older residents, highlighting their vulnerability to psychological trauma during recovery. Additionally, the study found elevated levels of low self-esteem, with 34.6% of MauiWES respondents reporting this issue, far exceeding the 13-14% observed in the 2023 UHERO pre-wildfires survey. Low self-esteem was consistently high across all age groups in the MauiWES cohort, with notable peaks in the 30-39 and 70+ age groups. Moreover, 1.3% of participants reported recent suicidal thoughts, a slight increase from the state and Maui-specific rates in May 2023, underscoring the persisting mental health challenges in recovering from the wildfires.

**Food Insecurity:** Approximately 35% of surveyed households experienced very low or low food security, higher than the 23.7% and 20.5% observed in the earlier UHERO survey of Maui and State cohorts, respectively.

The notably higher prevalence of potential physical health problems among the affected population underscores the urgent need for early interventions to reduce exposures and prevent the onset of chronic diseases and mortality. This is particularly crucial for tackling respiratory conditions and mental health concerns, as well as improving access to healthcare services for uninsured individuals.

## INITIAL RECOMMENDATIONS FROM KEY FINDINGS

Based on the preliminary findings from the Maui Wildfire Exposure Cohort Study, the following recommendations emerge as major initial priorities to support those affected by the Maui wildfires in their recovery:

*Medical Care:* Given the significant frequencies of adverse health conditions observed in the cohort, there remains an urgent need to increase the capacity and support for medical care and accessible interventions, primarily regarding: (1) pulmonary health, (2) cardiovascular health, and (3) behavioral health.

*Housing Stability and Support:* Given that a significant portion of the population is in temporary housing or has relocated, policies should focus on providing stable, long-term housing solutions. This includes financial assistance, access to affordable housing options, and supportive services for those who have lost their homes or are unable to return to their pre-wildfire residences.

*Healthcare Access and Mental Health Services:* The increased rates of physical and mental health issues highlight the necessity for expanded healthcare services, even to those uninsured. Policies to improve insurance coverage and reduce healthcare costs for those affected by the wildfires can alleviate the burden on individuals with health issues, particularly for those with compromised respiratory and cardiovascular health.

*Environmental Health and Safety:* Addressing environmental hazards left by the wildfires is crucial. This includes clean-up efforts, monitoring air and water quality, and providing communities with resources to mitigate exposure to toxic substances. Public health campaigns to educate residents about potential hazards and protective measures are also vital.

*Health Monitoring and Registry:* Continuing and expanding the MauiWES initiative is important for monitoring the long-term health impacts of the wildfires. Ongoing research can inform future interventions and policies, ensuring they are evidence-based and tailored to the evolving needs of the community. Establishing a registry to monitor participants, particularly as they relocate, will enhance the ability to conduct future evaluations and implement targeted interventions. This system will provide a structured method to maintain contact information and track health outcomes, facilitating ongoing research and the delivery of support services as needed.

*Community-Based Support and Engagement:* Strengthening community networks and involving local organizations in recovery efforts can enhance resilience. Support for community-based initiatives like Maui Medic Healers Hui and Roots Reborn Lahaina can foster a sense of solidarity and provide culturally sensitive support.

## INTRODUCTION

Following the devastating wildfires of August 8-11, 2023, our Maui community is in the process of healing from persistent emotional, mental, and physical wounds. The aftermath of the fires has left behind a variety of environmental dangers, such as air pollution, toxic substances, and heavy metals. These hazards pose ongoing health risks to those affected, potentially leading to worsened health conditions over time. Without proper investigation, the full impact of these wildfires on the health and overall well-being of our Maui community including the potential for future illnesses resulting from exposure may remain unknown.

The Maui Wildfire Exposure Cohort Study, or MauiWES, is the most comprehensive study to date initiated to understand and mitigate the health and social impacts of the Maui wildfires. By joining this study, participants gain immediate insight into their personal health and contribute essential data that supports community resilience throughout the recovery phase. Engaging a wide array of partners led by the University of Hawaii Economic Research Organization and the John A. Burns School of Medicine with numerous community and health organizations, this study addresses a critical gap in knowledge about the effects of environmental hazards and socioeconomic challenges on the health of those affected by the wildfires. The focus lies on collecting data and biospecimens from at least 1000 residents impacted by the wildfires, providing vital insights into the short- and long-term health outcomes such as chronic diseases, mental health issues, and the broader social implications.

Our comprehensive questionnaire includes a variety of metrics from demographics, social support, food insecurity, wildfire impacts on their health, mental and physical health metrics. In addition, participants schedule an appointment to collect a variety of health measurements such as height, weight, blood pressure, and a spirometer readings to look at lung capacity. The survey also collects a urine sample to check on different health markers and heavy metals the participants may have been exposed to, and saliva and a cheek swab to measure chemical compounds and markers of health. Finally, participants contribute a small amount of blood to learn about their health more comprehensively, for instance by looking at substances in their blood that can cause inflammation. After we collect samples, the participants will get some initial quick results right there and get an explanation of what they mean. We'll also show the participants how to access their personal dashboard, where the participants can find all the information we've gathered and what to do next. Finally, participants receive \$100. The goal is to repeat this study yearly for at least ten years to monitor their health and inform interventions.

In the initial two weeks of our study, 224 participants have enrolled, offering an early glimpse into the health trends among this group. Despite the relatively small sample size, notable patterns are emerging, emphasizing the importance of prompt interventions for health concerns, particularly respiratory and mental health issues. Access to healthcare, particularly for those without insurance, has also emerged as a significant concern.

In addition to reporting data from the MauiWES cohort, when the same metric was available, we compared it with a sample from the UHERO Rapid Cohort (June 2023) as presented in the [UHERO Public Health Report: Shaping Health in Hawaii – The Influences of Poverty, Housing, and Food Insecurity](#). This allowed us to compare data of the MauiWES cohort with an unaffected “control” sample of individuals before the wildfires. In this report, our analysis included data from 1,575 adults in the broader state sample and 120 residents of Maui.

In future reports, we will update these and other metrics as the cohort increases to offer a more thorough understanding of the complex ways in which the wildfires have affected the health of Maui residents.

## GENERAL SOCIAL IMPACTS

*Only 24% of participants remain in their pre-wildfire homes. The majority, 65%, are in temporary homes, and 11% have moved to new permanent homes. The wildfires caused 58% of participants to lose their jobs. Currently, over half have found employment, but 24% are still jobless and searching. Additionally, 74% report a drop in their household income.*

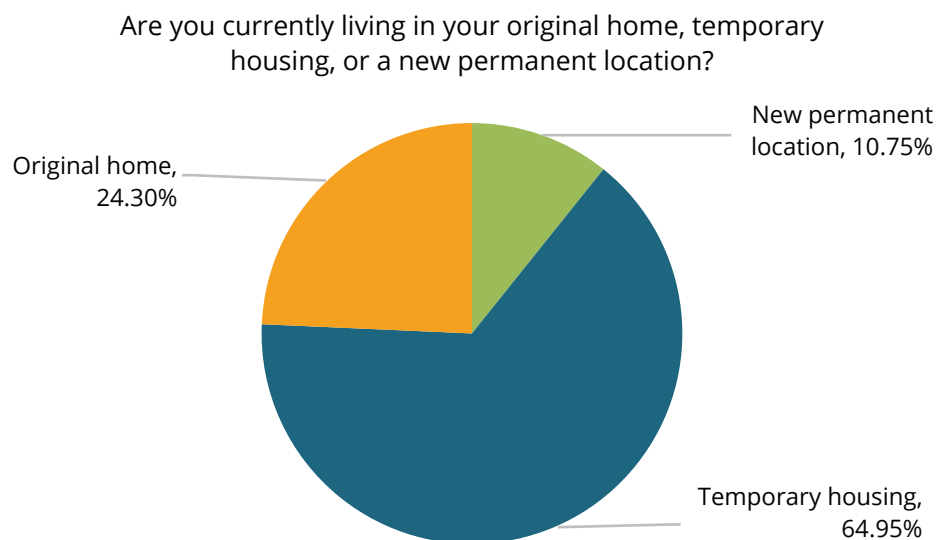
## Housing

The housing situation for participants in our study paints a stark picture of the wildfire’s impact but also the strategy used to recruit individuals. Only about one in four participants, or 24.3%, have managed to stay in their homes as they were before the wildfires struck. This indicates a relatively small portion of the affected population has been able to maintain their living situations without disruption, suggesting the fires caused significant displacement.

A significant majority, 65%, now find themselves in temporary housing solutions. This high percentage reflects the extensive nature of the displacement, with many individuals and families likely facing uncertainty about their long-term living arrangements. Temporary housing can range from shelters, hotels, rentals, to staying with family or friends, often leading to instability and stress.

Furthermore, 10.7% of participants have transitioned into new permanent homes since the wildfires. This shift might represent a positive step towards stability for some, but it also underscores the permanence of the change the wildfires have imposed on their lives. For many, moving into a new permanent home post-wildfire might have involved significant emotional and financial challenges, including the loss of community, familiar surroundings, and potentially grappling with the scarcity of affordable housing options.

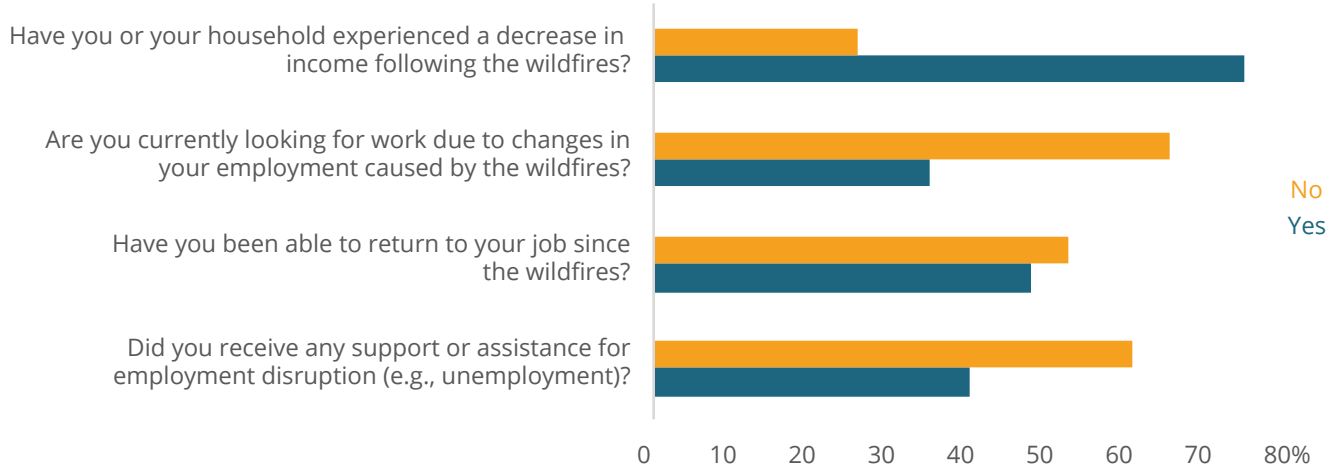
These findings highlight the widespread and profound impact of the wildfires on housing stability, with a clear need for supportive measures and policies to aid those affected in finding stable, long-term housing solutions.



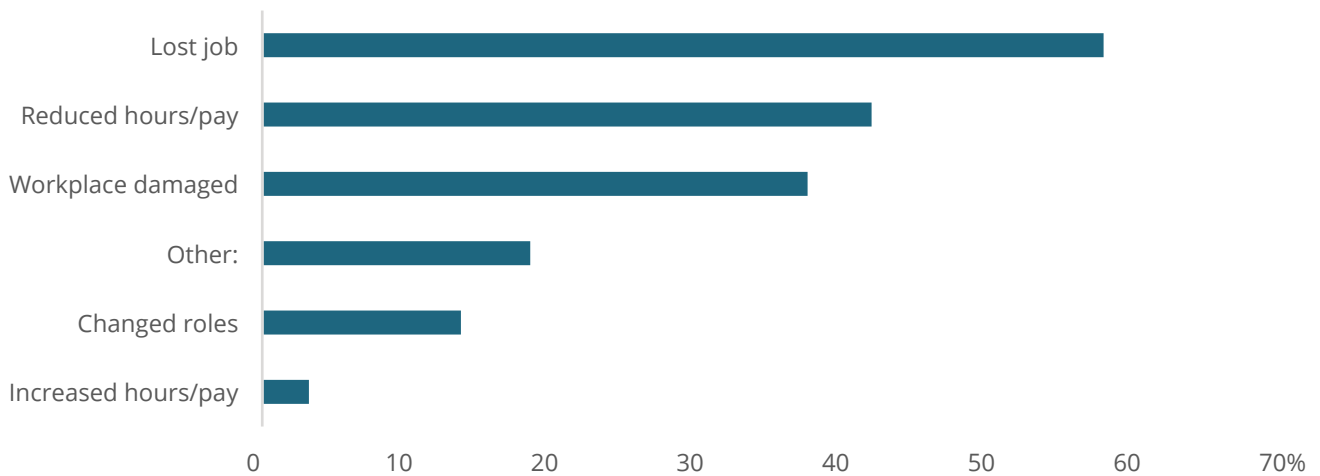
## Employment

The wildfires have significantly affected many households, with job loss being a major socioeconomic consequence. In the MauiWES cohort, approximately 58% of households had at least one person who either lost their job or had a family member lose their job due to the wildfires. Currently, only about 54% of the people in our study are employed, while nearly 24% are actively seeking employment. Almost half of the cohort (48%) have been unable to return to work since the fires. Furthermore, around 75% of individuals report a reduction in household income following the wildfires. Notably, 60% of participants have not received any form of assistance or support to cope with the disruption to their employment, highlighting a significant gap in the support system for those impacted by the wildfires.

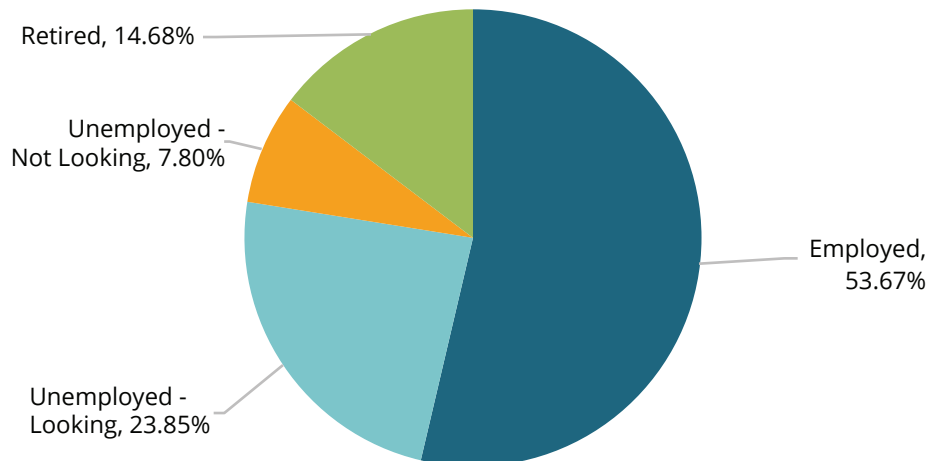
### Employment Effect of Wildfires



### In what way has your job or your family's job been affected?



### What is your current employment status?

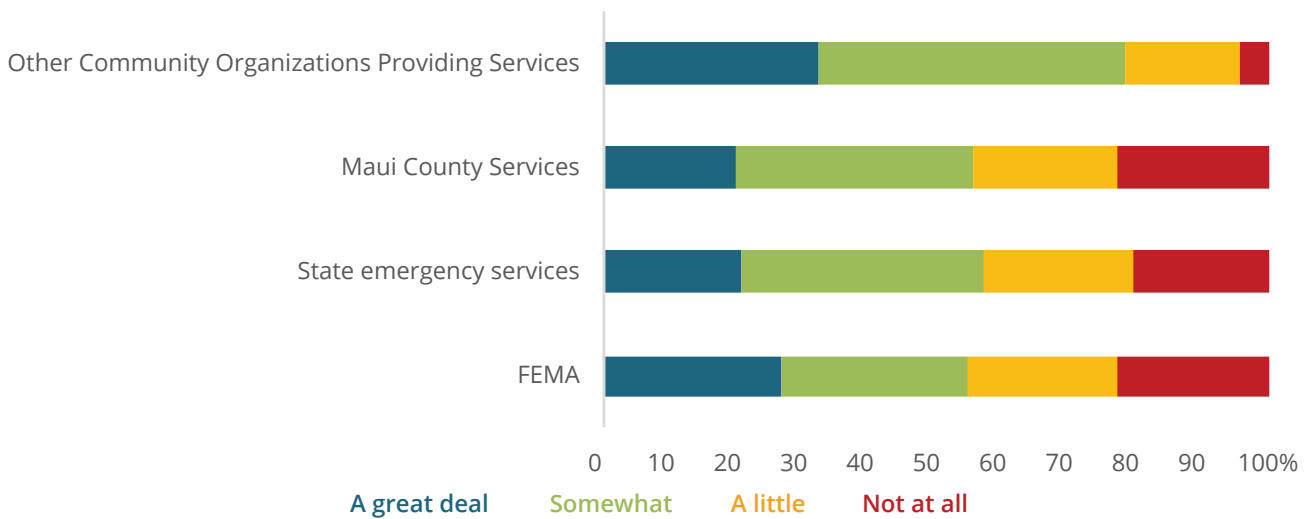


**Access and Trust**

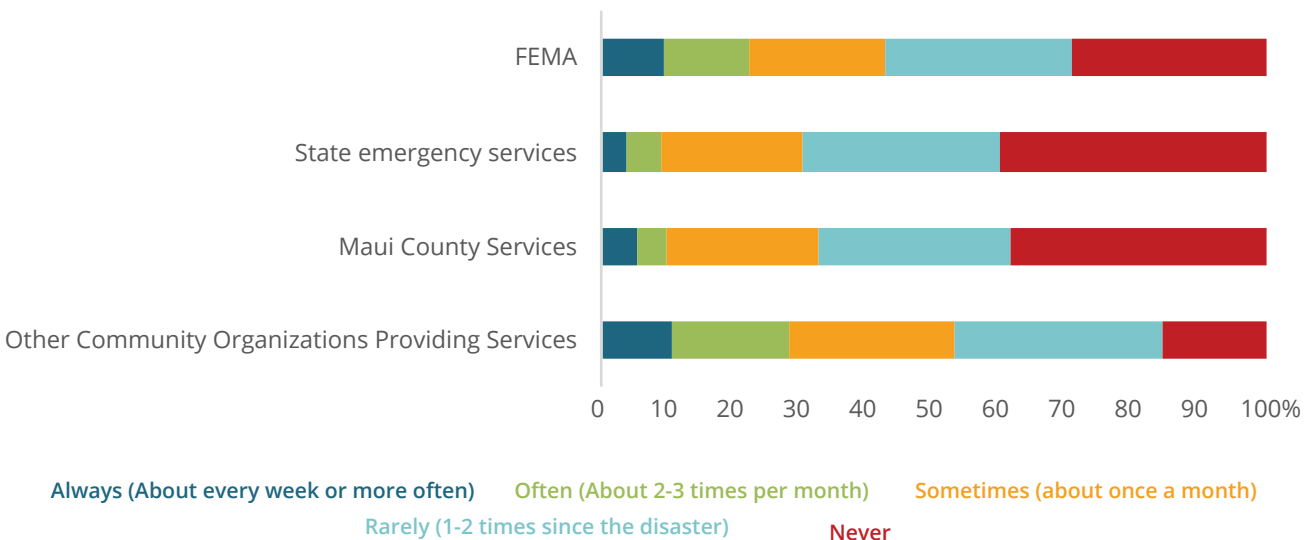
*MauiWES participants trust and use community organizations more than FEMA or local government services for wildfire aid, underscoring key roles grassroots organizations play in Hawaii’s disaster response.*

The MauiWES cohort so far reveals that participants have a greater level of trust in and utilization of services offered by community organizations compared to those provided by FEMA, State Emergency Services, and Maui County services. This observation underscores the vital role that local community groups play in disaster response, particularly in the context of the wildfires. The consistent level of trust and engagement with these community-based services, as opposed to the relatively uniform perception of state and federal emergency services, suggests that community organizations may offer a more effective and trusted avenue for delivering support to those affected by the wildfires. This insight highlights the potential for leveraging local networks and resources to enhance the responsiveness and effectiveness of disaster relief efforts, ensuring that aid reaches those in need in a manner that aligns with the community’s preferences and expectations.

How much do you trust the following agencies in their disaster response?



How often have you used the services provided by these agencies in the aftermath of a disaster?





## GENERAL HEALTH IMPACTS

*Almost half of the participants (49%) said their health is now worse than last year (prior to the wildfires). About 24% reported that they do not have steady access to medical care. Also, 13% reported that they do not have health insurance, much higher than last year's survey of Maui residents where only 1.7% reported being uninsured, similar to that reported over the state.*

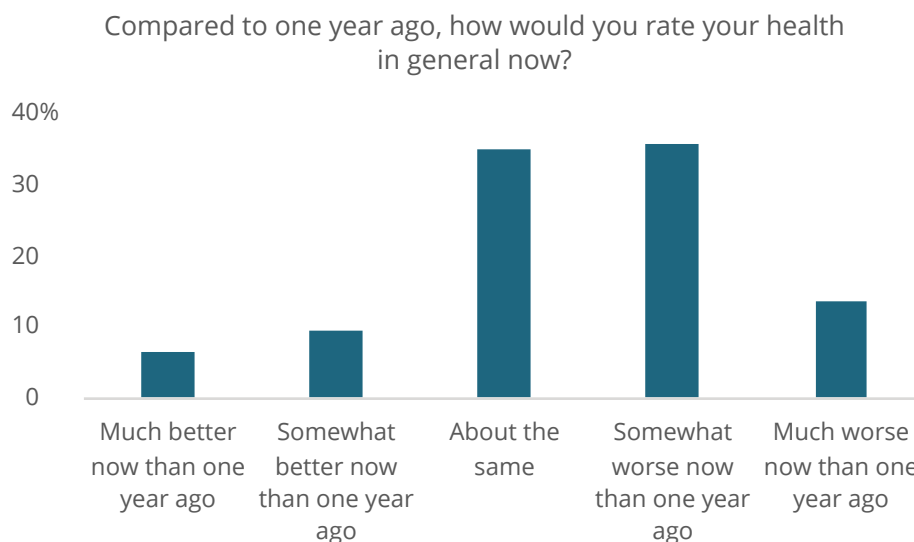
### Self-reported Health Assessment Pre- and Post-wildfires

In assessing the long-term health impacts of the wildfires on individuals, our study sought to understand how the health of participants had changed over the past year. We prompted participants of MauiWES to compare and self-report their current health status to that from one year prior. Alarmingly, nearly half of the individuals surveyed indicated a decline in their health, with 49.0% stating that their general health was somewhat or significantly worse than it was a year ago. This suggests a considerable negative impact, potentially attributable to the environmental and psychological aftereffects of the wildfires.

A sizable portion, roughly one-third (35.1%), perceived no change in their health, maintaining the same level as the previous year. This could imply a resilience to the short-term health effects of the wildfires or a delay in the onset of symptoms.

Only a minority of respondents reported improvements in their health since the wildfires, with 9.3% feeling somewhat better and an even smaller group, 6.5%, believing they are much better off health-wise compared to the previous year. These improvements could be due to various factors, including recovery from initial wildfire-related health issues, positive lifestyle changes, or even the psychological benefit of overcoming a crisis.

These findings highlight the varied health trajectories following a significant environmental disaster and underscore the need for ongoing health monitoring and support for affected communities. It is critical to investigate the factors contributing to health deterioration among the majority, as well as those that might be supporting resilience or recovery in others, to better tailor public health interventions and support systems for future incidents.



Participants were prompted to evaluate their overall health status on a scale from “Poor” to “Excellent”. Compared to the most recent UHERO Rapid Health Survey from June 2023, before the wildfires, participants in this survey impacted by the wildfires ranked their health lower on average. Only 6.5% of respondents in this survey rated their own health as excellent, compared to 11.1% of those in the state-wide survey. 23.3% reported their health as very good (15.5 percentage

points lower than UHERO), 43.3% as good (8.7 percentage points higher than UHERO), 20.5% as fair health (7.5 percentage points higher than UHERO), and 6.51% as poor (4 percentage points higher than UHERO). Overall, the respondents were much less likely to indicate excellent or very good health compared to the statewide survey.

In general, would you say your health is:

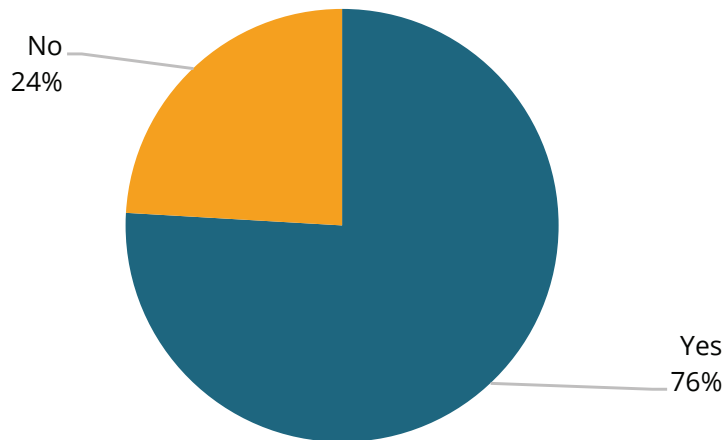


### Access to Health Insurance

Our survey revealed a concerning figure: approximately one-quarter of the participants, precisely 24.1%, disclosed that they lack regular access to medical care. This statistic reflects a substantial portion of the population potentially without timely healthcare services, preventive care, or management of chronic conditions, which can have serious implications for their long-term health outcomes, especially in the aftermath of a disaster like the wildfires.

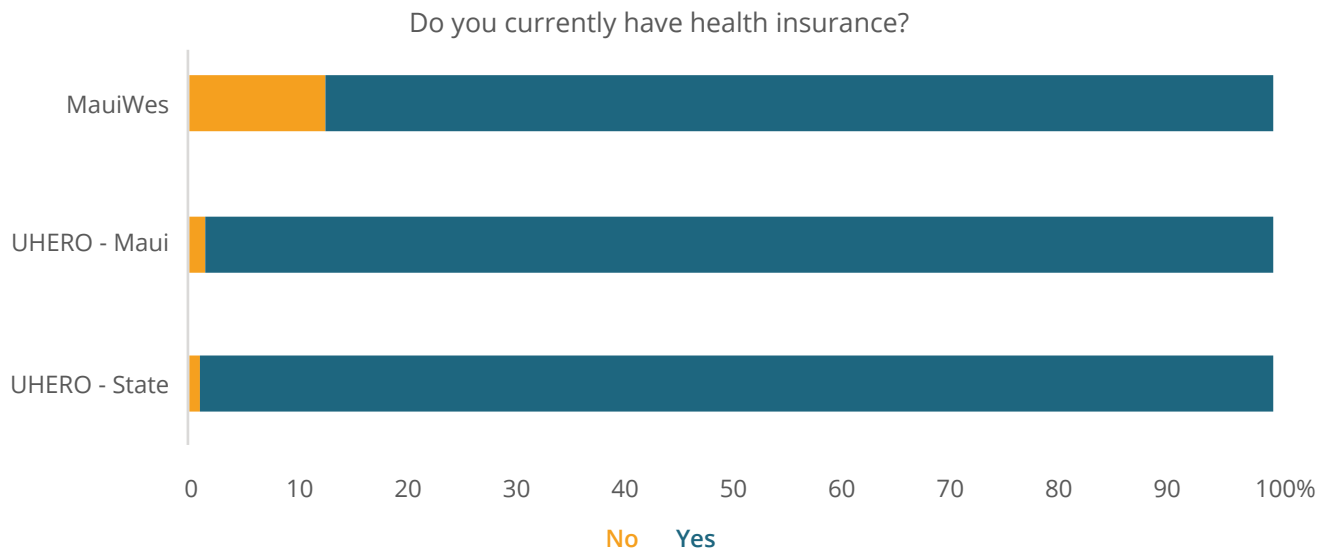
The fact that nearly a quarter of the population is underserved in terms of healthcare access warrants attention from policymakers, healthcare providers, and community leaders. It is essential to understand and address the barriers faced by this segment, which may include financial constraints, lack of insurance, limited healthcare facilities, or other socioeconomic factors. Addressing these issues is vital to ensure that all individuals have the opportunity to achieve optimal health outcomes and resilience in the face of environmental and public health challenges.

Do you have regular access to medical care?



Almost a quarter of the individuals surveyed, 24.1% to be exact, indicated that they lack consistent access to medical care. In contrast, the majority of those surveyed, or 75.9%, reported that they do have regular access to healthcare services.

### Do you currently have health insurance?



In contrast to a broader statewide survey, participants in the MauiWES study reported significantly lower rates of health insurance coverage. Specifically, 12.74% of the MauiWES respondents indicated that they are presently without health insurance. This figure starkly contrasts with the data from the previous year’s statewide survey, where only 1.2% of the entire state sample reported being uninsured. Furthermore, when isolating the data to just those from Maui in the statewide survey, the uninsured rate was still considerably lower at 1.67%. This disparity highlights a notable gap in health insurance coverage among the MauiWES study participants compared to the broader state population, pointing to potential issues of accessibility and affordability of health insurance within this group.

## PHYSICAL HEALTH

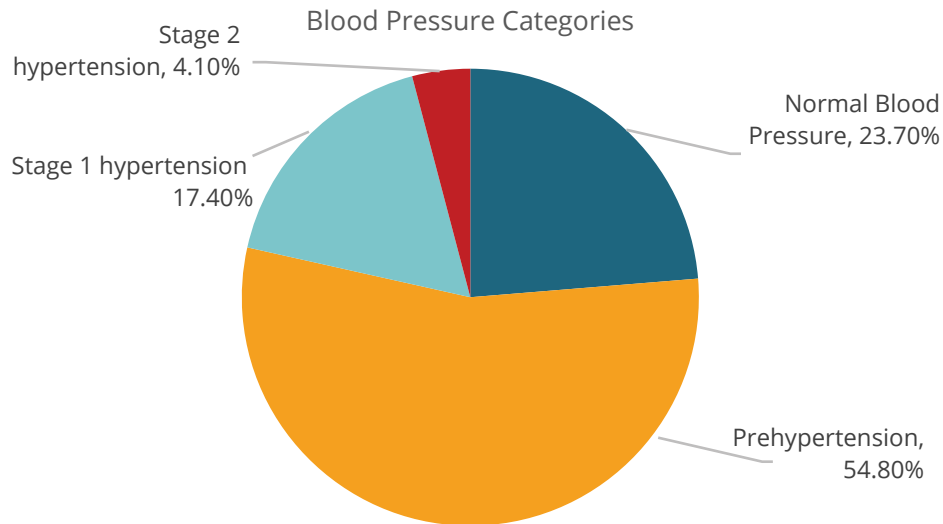
*Over 20% of the cohort participants showed high blood pressure at the level of stage 1 and 2 hypertension, with 55% at pre-hypertension levels, indicating an overall proportion (~76%) of individuals at elevated risk for cardiovascular disease. Initial blood biomarker tests also indicated that 8-18% of participants may have compromised kidney function. Additionally, up to 74% of participants may be experiencing poor respiratory health, with 49% exhibiting signs of mild to severe lung obstruction, and 33% with compromised lung function linked to impaired tissue oxygenation.*

A multi-component assessment of health was performed for each participant on-site, which included cardiovascular, kidney, and lung function. The primary biometric tests included height/weight measurements, readings of blood pressure and pulse, spirometry measurements, and blood tests for specific biomarkers and chemistries. In this report, we summarize the initial frequencies of healthy and unhealthy readings from each of these tests within the MauiWES cohort. Note that indeterminate values listed indicated those with incomplete or failed tests.

### Cardiovascular Health Assessment

From each participant, blood pressure readings to examine hypertension status were meticulously measured as a key indicator of cardiovascular disease risk. Following standardized protocols for precision and consistency, participants were seated and given time to relax, minimizing the potential impact of recent physical activity or stress on their blood pressure. A well-calibrated sphygmomanometer, tailored to each individual with the correct cuff size for their arm

circumference, ensured that the readings were as accurate as possible. These readings were then classified into one of four categories, from normal to stage 2 hypertension based on standard American Heart Association (AHA) cutpoints, providing a general assessment of cardiovascular health.



### Kidney and Lung Health Assessment

In addition to cardiovascular health, preliminary health metrics were obtained using the iStat system by Abbott, which involved a simple blood collection from participants from venipuncture. The blood samples were then analyzed on-site using two specific cartridges: CG4+ for blood gasses and electrolytes, and CHEM8+ for a comprehensive blood chemistry and biomarker profile. This process was quick, allowing for immediate results. Participants were informed of their results shortly after testing, ensuring they were aware of their health status. The procedure was conducted with care to ensure participant comfort and safety, and all materials were disposed of safely following the tests. In this report, we list a few salient metrics relevant to renal and pulmonary function, the latter of which was independently assessed using spirometry with the EasyOne® Air spirometer.

**Creatinine:** Creatinine is a waste product produced by muscles from the breakdown of a compound called creatine. It is primarily filtered out of the blood by the kidneys and excreted from the body through urine. Creatinine levels in the blood can serve as a reliable indicator of kidney function. The importance of creatinine as an indicator of kidney health lies in its relationship with glomerular filtration rate (GFR), which is a measure of how well the kidneys are filtering waste from the blood. When kidney function is impaired, the clearance of creatinine from the blood is reduced, leading to an increase in blood creatinine levels. Thus, elevated levels of creatinine in the blood can signify decreased kidney function or kidney damage. Elevated creatinine levels among participants post-wildfire could indicate acute kidney injury or exacerbation of pre-existing kidney conditions due to factors such as smoke exposure, dehydration, or stress, among others. Although the majority (82.6%) of MauiWES participants exhibited normal levels of creatinine, 8.2% had abnormally high levels potentially indicative of kidney disease. Those with high levels were encouraged to seek follow up care.

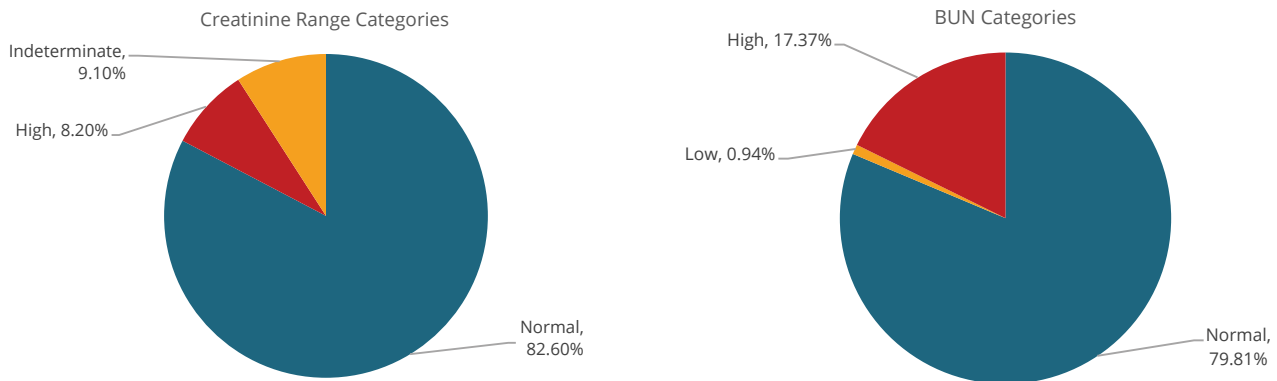
**Blood Urea Nitrogen (BUN):** Blood urea nitrogen (BUN) is a measure of the amount of nitrogen in the blood that comes from the waste product urea. Urea is formed in the liver as a result of protein metabolism and is normally excreted by the kidneys. Elevated levels of BUN in the blood can indicate impaired kidney function, dehydration, or other medical conditions affecting the kidneys.

BUN levels are influenced by factors such as dietary protein intake, liver function, and hydration status. When kidney function declines, BUN levels tend to rise because the kidneys are less efficient at filtering urea from the blood and excreting it in the urine. Therefore, elevated BUN levels can be a sign of decreased kidney function or kidney damage.

BUN is often measured alongside creatinine, previously described in this report. While both BUN and creatinine

can provide valuable information about kidney health, they have different sensitivities and specificities. BUN levels can be affected by factors such as diet and hydration status, while creatinine levels are more specific indicators of kidney function.

Elevated BUN levels beyond the normal range were observed in 17.7% of MauiWES cohort participants, potentially indicating kidney issues or dehydration.



**Lactate:** Lactate, also known as lactic acid, is a byproduct of anaerobic metabolism, meaning it is produced when the body breaks down glucose for energy in the absence of oxygen. An increase in lactate production is typically caused by impaired tissue oxygenation, either from decreased oxygen delivery or a disorder in oxygen use. High levels can be an indicator of severe lung disease, respiratory failure, or pulmonary edema. A significant proportion of the initial MauiWES cohort (42.5%) exhibited high levels of blood lactate, with 47.5% within the normal range. Those with high levels were encouraged to seek follow up care.

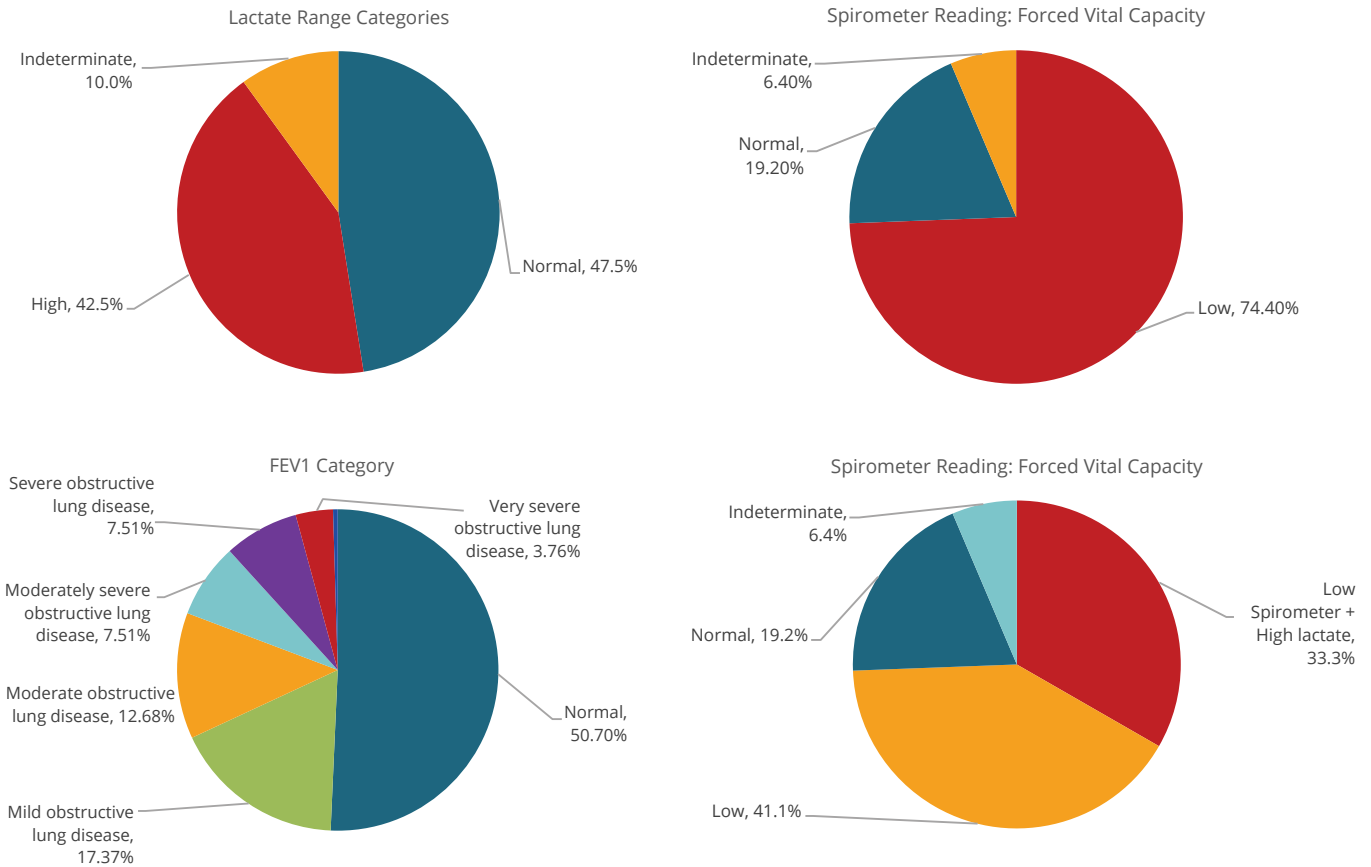
**Spirometry Measurements:** Pulmonary function tests are breathing tests to understand how well an individual is able to move air in and out of their lungs. Spirometry is the most common test and measures how much and how fast one can move air into their lungs. Spirometry can be used to indicate potential respiratory conditions like asthma or chronic obstructive pulmonary disease (COPD). Wildfire smoke has high concentrations of particulate matter and irritants and can lead to compromised lung function and exacerbate pre-existing respiratory conditions. Spirometry provides a number of pulmonary function measurements including forced vital capacity (FVC) and forced expiratory volume (FEV), which we report here. Importantly, when paired with spirometry measures of lung function, blood lactate levels as noted above may confirm respiratory conditions.

**Forced Vital Capacity (FVC):** FVC corresponds to the total amount of air an individual can forcefully exhale after taking a deep breath. It is an important measure of how well an individual’s lungs work. FVC readings outside the normal range may indicate compromised lung function. The majority (74.4%) of MauiWES cohort participants exhibited low FVC levels outside the normal range. Those with these abnormally low FVC levels were encouraged to seek follow up care.

**Forced Expiratory Volume in 1 Second (FEV1):** FEV1 quantifies the volume of air expelled in the first second of a forced exhale during the spirometry reading. This metric is crucial for assessing potential airflow obstruction. Decreased FEV1 may indicate conditions like asthma or COPD. Nearly half of all MauiWES participants showed FEV1 readings indicative of obstructive lung disease, with varying levels of severity: 17.4% at mild, 12.7% at moderate, 7.5% at moderately severe, 7.5% at severe, and 3.8% at very severe obstructive lung disease.

Spirometry readings outside the normal range could be due to technical issues while testing, a reason that repeated measures are taken from each participant. Given this potential limitation for an accurate assessment of respiratory health, we combined the blood biomarker of impaired tissue oxygenation, lactate, with FVC. This approach showed that although 41.1% of participants with low FVC readings had normal levels of lactate, 33.3% exhibited both low FVC and abnormally high lactate levels. These results indicate the high likelihood that approximately 1/3rd of the MauiWES cohort participants

may be experiencing compromised lung function that impairs tissue oxygenation. Those with abnormal levels of both FVC and lactate were encouraged to seek follow up care.



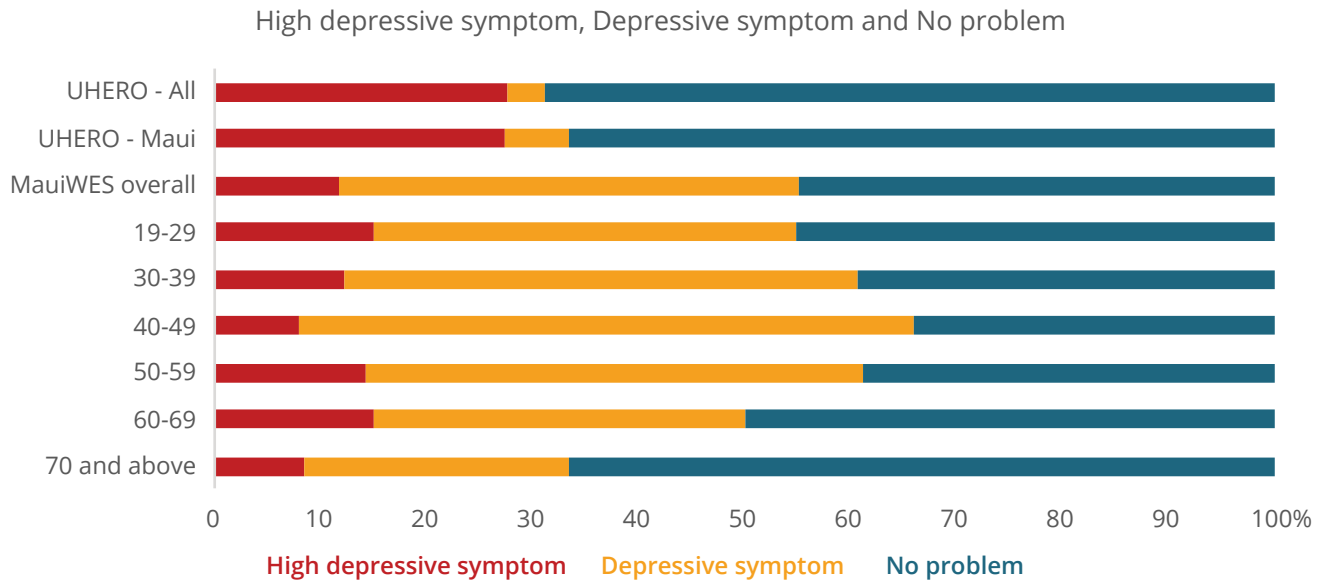
## MENTAL HEALTH ASSESSMENT

### Depression

*The MauiWES study suggests a significant rise in depression rates among its participants, with 55% exhibiting depressive symptoms. This is notably higher than the approximately 33% reported for both the general population statewide and specifically for Maui residents in a previous survey. Depression rates in the MauiWES cohort increased with age, peaking at 75% in those aged 50-59. This suggests the wildfires had a profound impact on the mental health of older residents, highlighting their vulnerability to psychological trauma during recovery.*

We evaluated the prevalence of depression using the 10-item Center for Epidemiological Studies-Depression (CES-D) scale. This scale asked respondents to quantify the frequency of various depression-related symptoms they had experienced over the past week, including restless sleep, poor appetite, and feelings of loneliness. The CES-D scale provides a maximum total score of 30: a total score below 10 is considered normal, scores between 10 and 20 indicate symptoms of depression, while scores exceeding 20 suggest severe depressive symptoms.

The MauiWES cohort displayed a significantly higher occurrence of depression, with 55% showing depressive or highly depressive symptoms. This is a marked increase from the prior statewide survey where only 31% of the overall



respondents and 33% of Maui residents reported such symptoms. Interestingly, in the statewide survey, the prevalence of depression was highest in the 19-49 age group, at 38%, and tended to decrease in older age groups. However, within the MauiWES cohort, the trend was the opposite; depression rates escalated with age, reaching a peak of 75% in individuals aged 50-59. Although preliminary, the rise in mental distress among the older population within the MauiWES group speaks volumes about the profound psychological impact the wildfires may have, particularly on the older residents. The data suggests that the older demographic may be more vulnerable to the long-term emotional and mental health consequences of such traumatic events. While the prior UHERO sample had higher rates of high depressive symptoms, there was still a much larger share with no depressive issues in the sample not impacted by the fire.

### Self-esteem

*Approximately 34.6% of the participants reported low self-esteem, a figure much higher than our findings from 2023 surveys. Self-esteem is highly sensitive to personal circumstances, leading to the drastically higher rate seen across age groups for those in the MauiWES survey who were impacted by the wildfires, and surveys before the fires. Compared to the third of individuals with low self-esteem in the MauiWES survey, only 13% in last summer's statewide survey had low self esteem, and a similar figure of 14% for those living on Maui.*

Self-esteem was assessed using the Rosenberg Self-Esteem Scale, a 10-item scale that measures both positive and negative self-perceptions. Basic descriptive statistics were compiled, and the outcomes compared with those of Spring and Fall 2022, as presented in the subsequent figures.

The MauiWES results greatly differ from the findings from the statewide survey in 2023 before the wildfires. Approximately 34.6% of respondents reported low self-esteem, while less than 1% indicated high self-esteem. In the UHERO 2023 survey, only 13% of participants were found to have low self-esteem, almost the same that was seen for Maui residents in the UHERO sample (14%). For the UHERO sample, low self esteem appeared to decline with age, with the highest rate being for those aged 19-29 (21%). In contrast, the MauiWES group saw rates above 30% for every age group, with the highest rates among those 30-39 and 70 or above, at 40% and 58.3%, respectively.

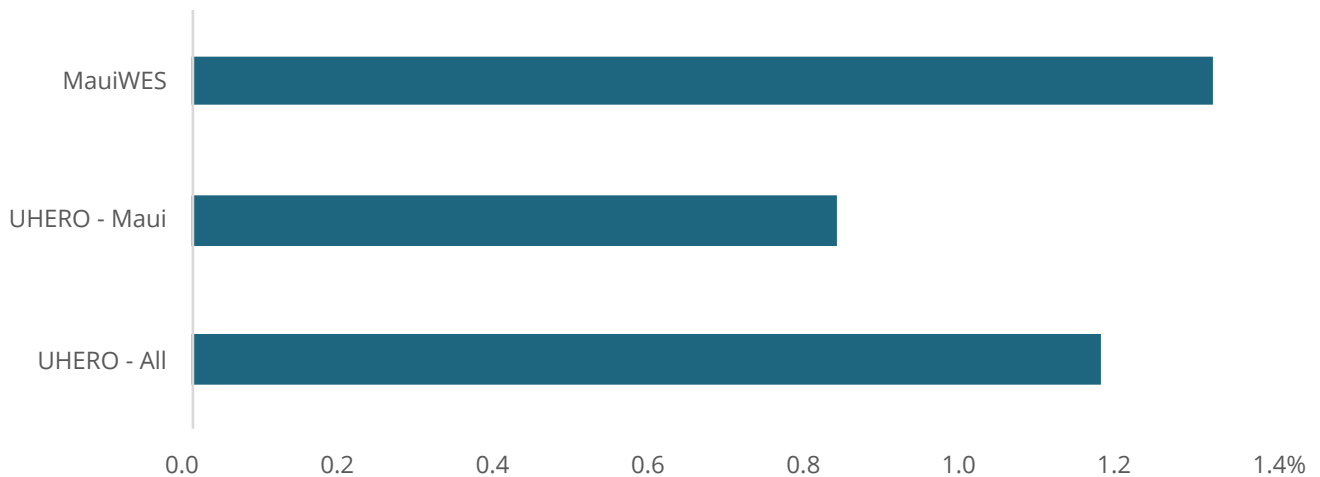


### Suicidal ideation

*1.3% of respondents had contemplated suicide in the past month, marking an increase compared to previous findings in May 2023 among the entire state (1.2%) and those in Maui (0.8%).*

We surveyed respondents about whether they experienced suicidal ideation during the past month. Overall, 1.3% of survey respondents contemplated suicide during the past month, which is slightly higher than the 1.2% of statewide respondents in May 2023 and 0.8% of those respondents living on Maui.

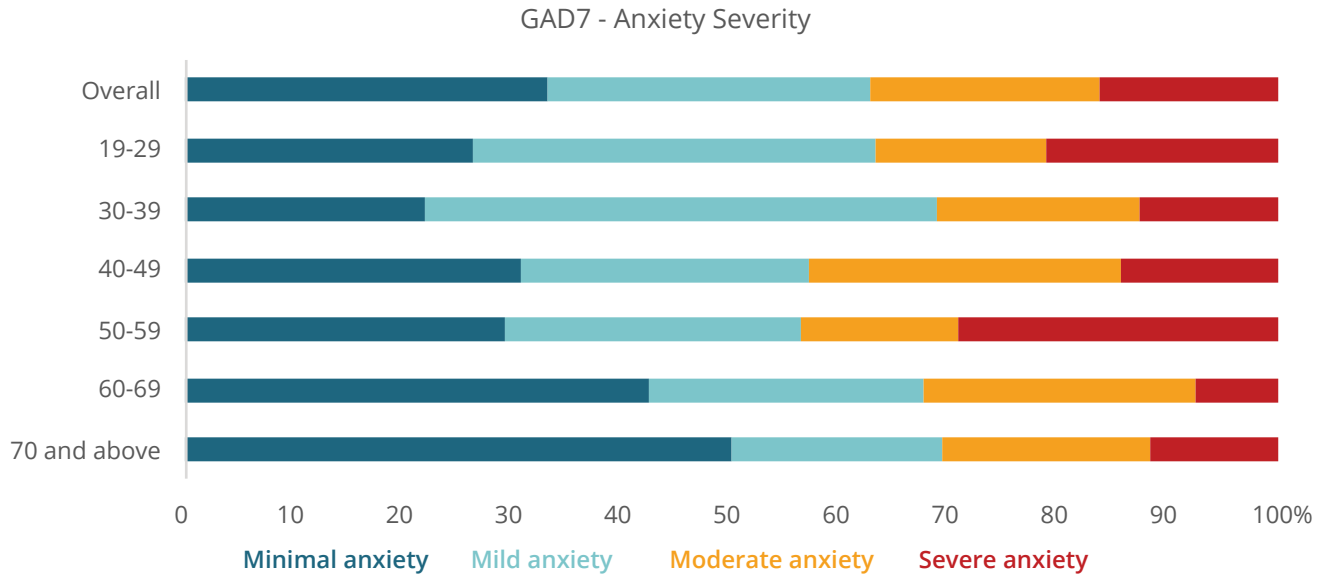
During the past month, did you ever seriously consider attempting suicide?



### Anxiety

Anxiety levels among the participants were evaluated using the Generalized Anxiety Disorder 7-item (GAD-7) scale. This is a self-administered questionnaire that is widely recognized for its efficiency in screening for anxiety and assessing its severity. Participants were asked to reflect on their experiences over the past two weeks and respond to seven questions, each describing a common symptom of generalized anxiety disorder. They rated the frequency of these symptoms on a scale ranging from 0 (not at all) to 3 (nearly every day). The sum of these scores then provided an overall anxiety score that could range from 0 to 21. Higher total scores indicated more severe anxiety symptomatology. This method allows for a quick assessment of anxiety levels and helps to identify individuals who may need further evaluation or intervention for anxiety disorders.



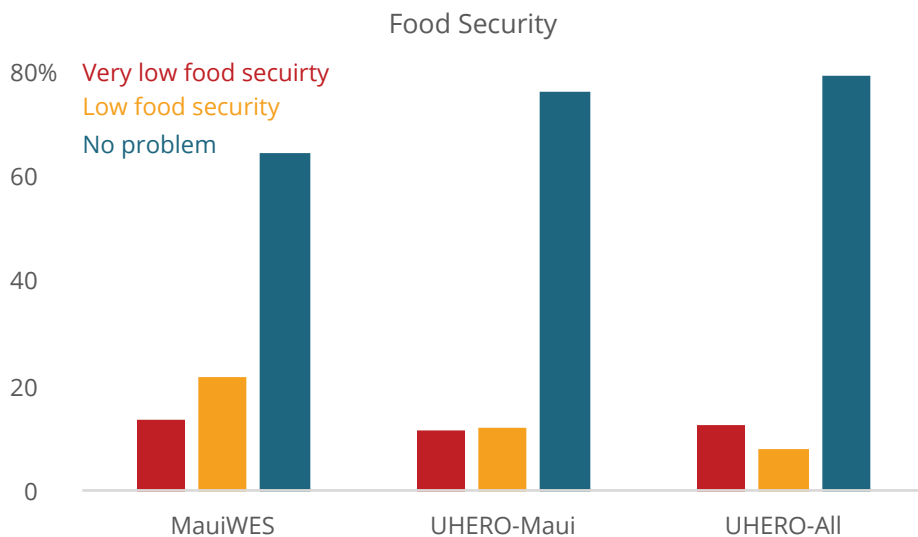


### Food security

*Approximately 35% of surveyed households experienced very low or low food security, higher than the 23.7% and 20.5% observed in the UHERO Maui and State cohorts, respectively.*

To assess food insecurity, we utilized the Six-item Food Security Scale created by the National Center for Health Statistics. This scale assigns scores from zero to six, with a score of zero to one indicating no food security issues. Scores from two to four signify low food security, while scores of five and six indicate very low food security.

Our findings show that approximately 35% of households fell into the categories of very low or low food security. This compares to 23.7% and 20.5% of households identified as having low food security in the UHERO Maui and UHERO State cohorts, respectively.



## DESCRIPTION OF SURVEY RESPONDENTS AND METHODOLOGY

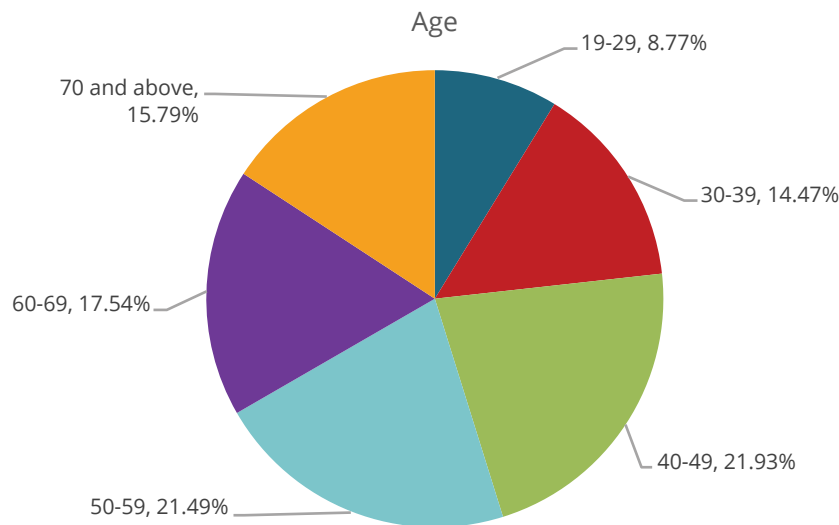
For this study, adult participants from Maui were recruited with the assistance of local community organizations such as Roots Reborn and Maui Medic Healers. Interested individuals were invited to attend recruitment events hosted at the Royal Lahaina Resort in Lahaina and the J. Walter Cameron Center in Wailuku.

Study data were derived from 224 adult volunteers who had been affected by the wildfires on Maui. They took part in MauiWES from January 26th to February 3rd, 2024. Although the data collected is invaluable, it is important to understand that it was obtained from a convenience sample, which means it might not represent the entire population affected by the wildfires.

Health measurements were recorded by trained staff using various methods. For saliva samples, participants were instructed to spit into a tube, close it securely, and then shake it. For buccal swab samples, participants gently rubbed the inside of their cheek with a swab. Urine samples were self-collected by the participants using a sterile cup, ensuring they did not touch the inside of the cup. Blood samples were taken by certified personnel using a Safety-Lok Blood Collection set. i-STAT Chem8+ and CG4+ were also performed. The i-STAT Chem8+ is a point of care that measures key blood chemistry levels, including electrolytes, enzymes, and gasses, to provide a broad overview of metabolic functions. The i-STAT CG4+ is useful for the diagnosis and treatment of lactic acidosis and hyperlactatemia. Lastly, lung function was assessed with a spirometer device known as the EasyOne Air; each participant performed the test at least three times, and the best reading was recorded. Participants were provided their results when ready.

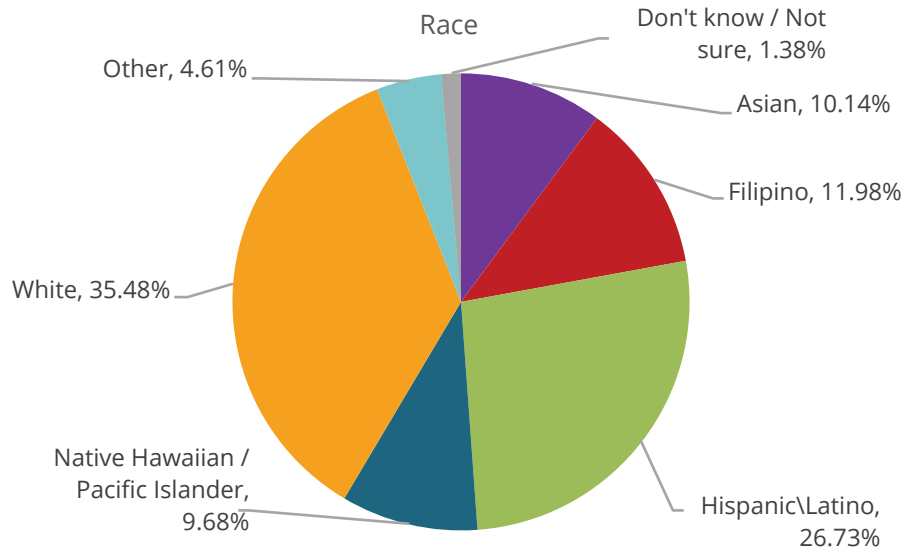
### Age distribution

The report features a diverse age range of participants, with a strong representation from those aged 30 and above. Notably, there's a higher proportion of older individuals in our study compared to the general population of Maui, indicating a slightly enriched presence of senior participants in the study.



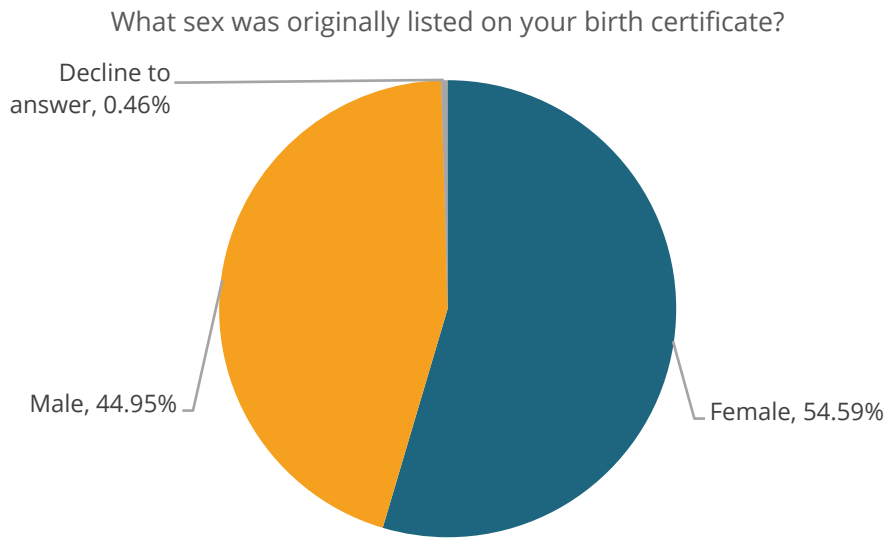
### Race/Ethnicity distribution

Below, we provide an overview of the racial and ethnic makeup of our survey participants, based on their self-reported information. When participants identified with more than one race or ethnicity, they were asked to choose the one they felt most aligned with. Notably, our survey successfully included a significant proportion of Hispanic respondents (27%), a group that is often underrepresented in Hawaii's research cohorts. Additionally, over 35% of our participants identified as White, 10% as Native Hawaiian, 12% as Filipino, and another 10% as non-Filipino Asian, including Japanese, Chinese, Korean, among others.



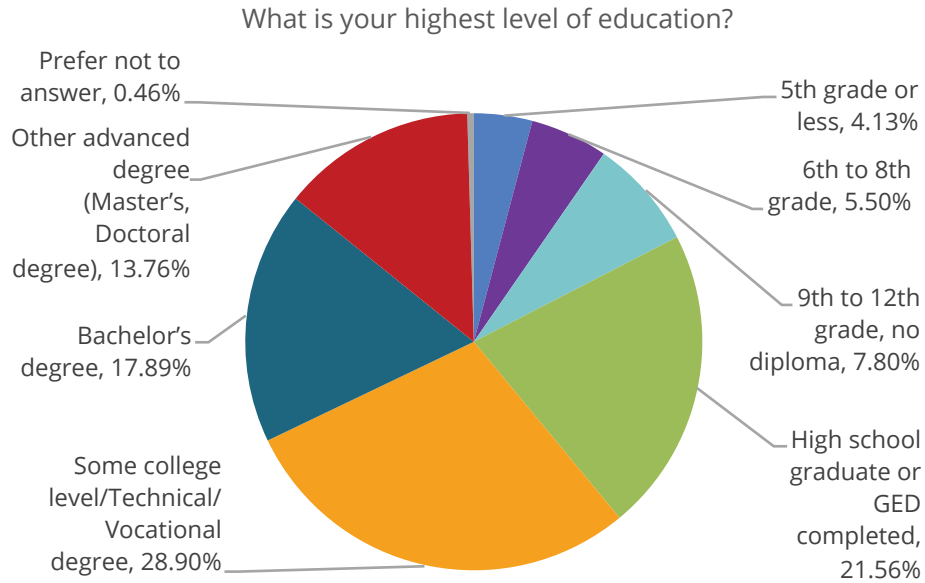
**Gender distribution**

In our study, 54.6% of the participants identified as female, 45% as male, and 0.5% either identified as another gender or chose not to disclose their gender identity.



**Education distribution**

The survey successfully included a wide range of educational backgrounds, particularly highlighting individuals without a high school degree. This includes 4.1% of participants who completed 5th grade or less, 5.5% who finished between 6th and 8th grade, and 7.8% who went through 9th to 12th grade but did not obtain a General Educational Development degree (GED). Additionally, the survey encompassed 21.6% of respondents with a GED, 28.9% who attended some college, and 17.9% who earned a college degree.



## LIMITATIONS

The data used in this study were gathered from a convenience sample of 224 adults residing in Maui who were impacted by the wildfires and participated in the MauiWES study between January 26th and February 3rd, 2024. While this data provides valuable insights, several limitations must be acknowledged.

Firstly, the sample is not broadly representative of all individuals affected by the wildfires, as it comprises participants who were available to attend our recruitment events and/or had connections to our community partners. This self-selection bias means the findings may not fully reflect the wider affected community's experiences and needs.

Secondly, the reliance on self-reported data introduces the possibility of bias, with participants potentially offering responses they perceive as more socially acceptable rather than their true experiences or behaviors. This issue is inherent in survey-based research and can lead to discrepancies between reported and actual circumstances.

Thirdly, the current dataset represents a relatively small fraction of the broader population affected by the wildfires. Although it provides important initial insights, it is not exhaustive of the myriad issues faced by the community. As the study progresses and partnerships with more community organizations are forged, the participant base will become more diverse, enhancing the representativeness of the data.

Additionally, participants may hesitate to disclose information on sensitive topics such as certain health behaviors, health outcomes, and socioeconomic factors due to fear of stigma, particularly concerning issues like mental health. This reluctance can lead to underreporting or misreporting, especially among specific demographic groups, further complicating data accuracy.

Lastly, the current analysis of the data is primarily descriptive and does not infer causality. The study's cross-sectional nature at this stage limits the ability to draw direct connections between the wildfires and specific health outcomes. However, as the study evolves into a longitudinal research project, it will provide more robust evidence on the causal impacts of the wildfires on the community's health.

Despite these limitations, the data collected in MauiWES represents some of the most comprehensive information currently available regarding the ongoing health challenges faced by Maui residents in the aftermath of the wildfires. As the study expands and matures, it will offer increasingly valuable insights into the long-term effects of such disasters on affected populations.

## ACKNOWLEDGMENTS AND SUPPORT

We are grateful for the support provided by the Hawaii Community Foundation Maui Strong Fund Grant, which enabled the initiation of MauiWES, supported the gathering of this data, and facilitated the creation of this report.

The recruitment of participants would not have been possible without the strong support at recruitment events of the [Maui Medic Healers Hui](#) and the [Roots Reborn](#) team. Special thanks to Noelani Ahia, Nikima Glatt, Keisa Liu, Lonaka Petines, and Veronica Mendoza Jachowski, Genesis Gil, Stephanie Villalobos, and AnnDionne Selestin for their continuous support.

We also thank the Scientific and Community Advisory Boards who helped to refine the study design and logistics.

It is important to note that the opinions and findings presented in this report are solely those of the authors and do not necessarily reflect the views of the Hawaii Community Foundation, our community partners and Scientific and Community advisory boards.

**MauiWES Staff supporting recruitment and data analysis:** Amada Torres, Austin Derderian, Binh Le, Brennan Yoshiro Yamamoto, Bryan Cole Suechting, Connor Kamaehu Coelho Slavens, Krit Phankitnirundorn, Lesley Kealani Umeda, Nina Picher Allan, Nicole Siegal, Noelle Claudine Rubas, Rafael Aniu Peres-David, Riley Kauilani Wells, Rosa Hyoyeun Lee, Samia Valeria Ozorio Dutra.



### Community Partners

This report would not have been possible without the support of the Maui Medic Healers Hui and Roots Reborn who have been unconditionally supporting the recruitment of participants. In addition, the Healthy Mothers Healthy Babies Coalition of Hawaii and the Hawaii Department of Health Public Health Nurses supported the testing of lead for participants. We also acknowledge other partners who have been directing study participants including:

American Lung Association, Hawaii Integrated Analytics, Hawaii Healthcare Hui, Papa Ola Lokahi, UH Maui College - CTAHR, University of Hawaii Cancer Center and the College of Social Sciences Health Policy Initiative.

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  - Malia Purdy - Hui No Ke Ola Pono
  - Alejandra Ramirez - UH Maui College
  - Dr. Don Sand, DDS - Hawaii Oral Health Coalition

## SUPPORT MAUIWES

The Maui Strong Fund from the Hawaii Community Foundation partially sponsors MauiWES but we remain significantly underfunded to meet our recruitment and analysis goals. Our objective is to broaden our impact, reaching a wider segment of the affected population and first responders. To accomplish this, we are actively seeking new partners. If you are interested in contributing to this important grassroots community study, we invite you to connect with our leadership team or make a donation through the following fund at the University of Hawaii Foundation:

The University of Hawaii Foundation

UHERO Maui Wildfire Exposure Study

Fund #130-4190-4

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