ANALYZING THE RISKS AND BEHAVIORS OF HOME OXYGEN THERAPY FIRES AND SMOKING

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Abstract

This research paper attempts to investigate the factors contributing to people smoking while using home oxygen. There is a significant danger of fires when smoking while using oxygen. In both 2022 and 2023, the Nevada Fire Department responded to home oxygen therapy (HOT) fires involving two fire fatalities and two severe burn injuries. In both cases, authorities determined the cause of the fires to be smoking while using home oxygen. The Fall River, Massachusetts assisted-living facility fire on July 13, 2025, resulted in 10 fatalities sparking national attention to HOT fires. A preliminary report lists smoking and oxygen as a probable cause of the fire. Thus, this paper seeks to answer the following research questions:

1. To what extent are home oxygen users aware of the fire risks associated with smoking while using oxygen?
2. What psychological factors contribute to the continued behavior of smoking while using home oxygen?
3. How does a patient's perceptions of risk influence their behavior as it relates to smoking while using oxygen?

Through qualitative methods involving attempted interviews of 15 current smokers prescribed home oxygen, the research attempts to uncover human behaviors as it relates to smoking and oxygen use. This research between risk and behaviors could help define effective approaches to reduce HOT fires nationally.

The findings underscore individuals involved in this study hold an incorrect understanding of what happens when oxygen ignites or how quickly fires develop. The research participants predominantly believe their smoking behaviors while using oxygen present less risk than general fire risks anyone faces in their homes. This disassociation of risk, in such a

vulnerable health compromised population, speaks to the need for developing engineered safety solutions to reduce the fire risk that goes unrecognized by this population.

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CHAPTER 1. INTRODUCTION

In 2022 and 2023, the Nevada Fire Department responded to two fires involving home oxygen therapy (HOT), used for treating people with chronic obstructive pulmonary disease (COPD). Both oxygen-fed fires resulted in a fatality. The second fire also caused severe burn injuries to two family members living in the home with the decedent. In both cases, authorities determined the cause of the fires to be smoking while using home oxygen. On July 13, 2025, a HOT fire in a Massachusetts assisted-living facility claimed the lives of 10 people. These HOT fires and others occurring in the U.S. are under-reported and unrecognized as an emerging threat to the fire service.

Hot fires are different from ordinary fires involving smoking materials because of the role oxygen plays in supporting combustion. Even though oxygen is not flammable, it does accelerate combustion, creating a rapidly developing fire. This rate of fire growth should concern the fire service.

Fire departments routinely engage in prevention measures after a major fire. Those actions include updating the jurisdiction's fire code, increasing prevention education programs, and reviewing fire station staffing levels. Those reactive actions do not address the root cause of HOT fires primarily caused by behaviors related to smoking and oxygen use.

The U.S. Fire Administration has taken the lead for many years attempting to reduce the impact of smoking fires using a variety of approaches. These efforts include cessation programs, safety education messaging, and approaches aimed at denial of oxygen for patients who smoke. Questions of ethics in these patient care approaches and the effectiveness of these approaches serve as the basis for further research (Hall et al., 2006).

Oxygen supports combustion as one of the essential elements needed to make fire. Oxygen readily supports and rapidly enhances the size of a fire. The research will seek to understand what smokers who use home oxygen really know about the hazards associated with their smoking behaviors. Do psychological and nicotine dependence factors contribute to smoking while using oxygen? Understanding the social and environmental influences of why people smoke may provide clarity to help define the human behaviors associated with HOT fires in the U.S.

Background

Oxygen is a primary medical intervention for respiratory ailments such as chronic obstructive pulmonary disease (COPD), emphysema, chronic bronchitis, and pneumonia. Durable medical equipment (DME) providers deliver oxygen containers, tubing, and concentrators to private residences when prescribed by a physician. The Centers for Medicare and Medicaid Services require DME providers to complete a home safety assessment (Appendix A). Durable Medical Equipment providers serve as the first layer of oxygen safety education for patients.

The National Fire Protection Association (NFPA) report *Fires and Burns Involving Home Medical Oxygen* (Hall, 2023) found that 91% of fires involving home oxygen started with smoking materials or items related to smoking. According to Hall, those injured in HOT fires sustained more severe burns, had significantly higher rates of hospitalization, and suffered greater health complications. Even as smoking falls to the fourth leading cause of home fires, McGree's (2025) research shows smoking is now the leading cause of death in the U.S. In fact, 69% of cigarette related fire deaths from 2019-2023 occurred in a bedroom or living room. Both

of these locations are routinely equipped with oxygen equipment and furniture, which contribute to a fire's growth.

Combining cigarettes, oxygen use, furniture, and careless smoking increases the risk of having a home oxygen therapy (HOT) fire. A home oxygen user who smokes in the U.S. is 19 times more likely to die in a HOT fire compared to a home oxygen user in the U.K. (BPR Medical, Ltd., 2021). Their research suggests the highest risk of a home oxygen fire is located within the U.S.

The number of people who use home oxygen or who continue to smoke is the subject of debate within stakeholder groups. The most widely accepted figure from the American Thoracic Society estimates 1.5 million patients use home oxygen (Jacobs et al., 2018). Home healthcare experts suggest oxygen use changes daily based on short and long-term respiratory conditions. Industry healthcare experts believe a realistic percentage of people who smoke while using oxygen ranges between 6-25%, (J. Lewarski, email communication, July 29, 2025). Lewarski also reports 75% - 85% of smokers discontinue smoking once they are educated of the fire risk. By contrast, BPR Medical's survey of DME providers indicated as many as 50% of COPD patients, representing approximately 750,000 individuals throughout the U.S., continue to smoke.

The Safe Home Care project in Massachusetts conducted quantitative and qualitative analysis involving 1,249 home care aides. The results revealed smoking while using oxygen during home visits was the highest identified workplace hazard for care providers. The study revealed smoking while using oxygen occurred 9% of the time during all home visits (Galligan et al, 2015). This research should have served as a warning before the Gabriel House assisted-living fire occurred. The Massachusetts five-alarm fire claimed the lives of 10 people and quickly overwhelmed responding fire departments as three dozen residents needed help being

evacuated from the smoke ("Fall River Fire: Firefighters reflect on life-saving efforts in deadly blaze at Gabriel House," 00:01 – 07:33).

Smoking behaviors and oxygen use are continuously determined to be a direct cause of HOT fires. Even if the exact number of home oxygen users who smoke is uncertain, the trend is clear; HOT fires are increasing in scope and severity. This escalation places the fire service in a precarious situation, as rescues inside burning structures are becoming more frequent and a likely scenario upon arrival. As HOT fires become more frequent, the fire service has grown increasingly interested in understanding their causes.

Significance of the Study

The current National Fire Incident Reporting Systems (NFIRS) lacks the ability for fire departments to report a fire caused by smoking while using oxygen. Fire departments routinely list HOT fires as careless smoking. However, a fire involving smoking and oxygen puts the seat of the fire directly in the patient's face or clothing. HOT fires cause severe inhalation injuries, facial burns, or even death. The inability to differentiate between a home fire caused by a dropped cigarette and a fire fueled by oxygen is creating a vulnerability for the fire service as to what conditions they can expect upon entering a burning residence. "Firefighters must understand that HOT fires pose unique and serious risks. Due to the oxygen-rich environments, HOT fires can burn hotter, spread faster, and result in shorter times to flashover. Personal protective equipment can be more easily compromised" (Klas, 2025). This growing danger should concern all firefighters and fire officials tasked with extinguishing HOT fires.

The International Association of Fire Chiefs (IAFC) is particularly concerned with HOT fires due to the increased likelihood of rescue being required for people who are incapable of self-preservation during a fire. These are the most dangerous situations for firefighters. The lack

of visibility as to the extent of HOT incidents and their proximal cause is creating a gap in preparing our fire service to face overwhelming odds during HOT fires. Increasing the likelihood of performing a fire ground rescue at HOT scenes will have detrimental mental health and safety impacts on the fire service long-term.

As of November 2025, the IAFC HOT Fire dashboard has tracked 787 HOT fires, 446 civilian deaths, and 51 first responder injuries over a two-year period based on media reporting (*Home oxygen therapy (HOT) toolkit, n.d.).* Those figures are considerably higher than NFPA reports in their research of home medical oxygen fires. However, further research by Klas & Auber (2025), shows HOT fires in Michigan occurred 20 times more than reported to the state NFIRS system. The research compared the State of Michigan NFIRS data against hospital burn admissions from 2020 – 2023. This further highlights the lack of accurate data and points to the potential severity of home oxygen fires.

This paper seeks to identify factors contributing to HOT fires. It is easy to fall into a trap believing the public would have a general knowledge about the dangers of smoking while using oxygen. The onset of respiratory conditions caused by long-term smoking can cause confusion from the diminished oxygen levels needed for core brain functions. Research discussed later in this paper suggests hypoxemia resulting from COPD or other respiratory conditions could impair a patient's understanding of their actual fire risks involving oxygen.

Of special concern is the CDC's prognosis that the fire service could be facing a sharp increase in the number of COPD cases as the baby-boomer generation grows older. "The cigarette industry began an aggressive marketing push to women in the late 1960's, and those boomer women are now showing chronic diseases like COPD as they age" (Gurnon, 2015, para. 9). Additional research will discuss the implications of nicotine addiction for HOT users who

continue to smoke despite the risks. “Only 10% of the 1.3 million smokers in the world are successful at cessation from smoking (Abdelkader et al., 2024). As with any addiction, the psychological factors influence the practicality of quitting.

People are most risk-averse when experiencing negative outcomes for their actions. So why do smokers continue to smoke if they risk a tragic fire? Perhaps smokers do not see negative outcomes from their smoking behaviors, which may give them a feeling of invincibility because they have not experienced a fire. Everyone has a different understanding and acceptance of perceived risk.

This paper will narrow the gap of understanding why people continue to engage in smoking behaviors with oxygen, which on the surface would seem unsafe and unwise. Creating a better understanding of why people smoke could produce targeted interventions that are more effective to mitigate the risk of home oxygen fires.

Problem Statement

The problem is that HOT fires are increasing in frequency and severity as indicated by the IAFC HOT dashboard. Without research offering a comprehensive understanding of how smoking and oxygen use contribute to fire development, individuals living in homes with HOT conditions will continue to face elevated fire risks. Once ignited, HOT fires spread rapidly to overwhelm firefighters and create immediate, life-threatening danger for everyone involved. Patients involved in HOT fires are more likely to require rescue. Performing a rescue of people within the area of fire origin is inherently dangerous. Fire ignition occurs in a hyper-oxygenated area that is proximal to the patient’s oxygen cannula. Once ignited, the fire can cause severe facial/inhalation burns that are immediately life threatening (Matthews et al., 2021). Clothing made from synthetic fibers becomes hyper-oxygenated from a patient’s continuous oxygen use

and is more susceptible to fire ignition risks. Fires occurring to an individual's face and chest will produce severe burn injuries.

To examine this problem on a manageable scale, this research will address smokers' knowledge of their own individual fire risks, psychological factors that contribute to continued smoking on oxygen, and how people who smoke perceive those risks. The review of existing literature and by conducting qualitative interviews of 15 individuals who currently smoke while using oxygen will form the basis for this research. Patients' knowledge, psychological factors, and perceptions of risk remain underexplored. This research does not discount other possible fire causes with oxygen use. Because cigarettes are the most common cause of home oxygen fires, it is logical to address a targeted approach focused on smokers who use oxygen.

Purpose Statement

The purpose of this research is to determine what factors contribute to people making the conscious choice to smoke while using oxygen. In doing so, the efforts will provide an informed basis from which to develop prevention messaging. By understanding the risks smokers are willing to take and assessing what smokers actually know about those fire risks could shed light on improving community risk reduction approaches aimed at home oxygen patients. Creating a better understanding of human behaviors related to smoking and oxygen use is critical to preventing future HOT fires. To what degree does money, family, shaming or smoking identity play into the decisions to continue smoking? The implications of this research may also extend to other smoking-related fires that do not involve oxygen use. Cigarettes play a major role in this country's fire problem. When compounded with oxygen use, this fire problem creates unnecessary risks for the fire service and public.

Research Questions

This study attempts to answer the following questions through qualitative methods of data collection. Interviews and review of prior scholarly research on this topic will be the primary means for obtaining information.

1. To what extent are home oxygen users aware of the fire risks associated with smoking while using oxygen?
2. What psychological factors contribute to the continued behavior of smoking while using home oxygen?
3. How does a patient's perceptions of risk influence their behavior as it relates to smoking while using oxygen?

It is important to note the revision of question #2 from earlier drafts reflects a wider spectrum of answers. The question initially was limited to nicotine addiction and invincibility factors. After literary review of existing research, addiction and the presumption that fires happen to other people (invincibility theory) were too narrow and did not account for other psychological factors of consideration. For instance, do reasons like stress, habit, boredom, fear of weight gain, companionship, or ritualism play into the decision to smoke while using oxygen? Does oxygen even factor into the decision to smoke or not smoke? For those reasons, a revision of question #2 allowed for broader research into the topic of individual psychological factors toward smoking.

Summary

The fire service has a growing fire problem that will predictably increase as baby boomers age. The increased incidents of oxygen and smoking create a unique fire challenge for the fire service. In HOT fires, the fire originates at the patient's face and clothing near their oxygen cannula. Rescuing people from fire is the most dangerous part of being a firefighter.

Oxygen, while essential for patients with COPD, increases the likelihood of fires and presents more risks for firefighters. The degree in which patients are aware of their risks and the driving factors influencing their conscious decision to smoke anyway is the basis for this research.

Moving forward, Chapter 2 will offer an overview of existing literature on the topics of public perception of risk and psychological factors related to smoking while using oxygen. Research into cognitive behaviors and barriers to cessation establish why people continue to smoke despite their risk of fire. Chapter 3 will outline the methods used to conduct the research addressing the research questions from Chapter 1. Chapter 4 will present the findings and results of those interviews. Finally, Chapter 5 will offer conclusions and recommendations for the research.

CHAPTER 2: LITERATURE REVIEW

Introduction

Chapter 1 highlighted the heightened risks of fires faced by individuals who continue to smoke while using HOT for pre-existing medical conditions. The existing literature reveals much of the healthcare discussions centered on the ethical challenges of providing care for persons who maintain unhealthy lifestyles. An abundance of research focuses on the negative health consequences associated with smoking long term. Research in the U.S. remains limited in examining smoking and oxygen use specifically related to its fire risks.

One recent combined research study from Sweden and Denmark surprisingly does not treat smoking as a primary contraindication to oxygen use. Instead, they indicated healthcare professionals need a systematic approach when it comes to treating patients with HOT who continue smoking (Ahmadi et al., 2024). The medical benefits from oxygen therapy for a wide array of pulmonary disease processes has proven to save lives. Providing care for a patient's medical condition (hypoxemia) superseded a focus based on a patient's smoking behaviors.

Contrary to the European study, much of the U.S. based research focuses on the challenges of successful smoking cessation programs. The American Burn Association released a series of peer-reviewed research documents related to burn injuries but did not directly address the psychological explanations of smoking. Notably, researchers have highlighted both the perceived pleasures of habitual smoking and the psychological burdens associated with this activity. Countless studies connect smoking to habit, stress relief, coping with depression, or managing negative emotions. Even more literature underscores the addictive, pleasure-seeking dimension of smoking. However, there remains a gap in research about the smoker's perceptions of risk when adding oxygen therapy to smoking.

The depth of this literature review comes from peer-reviewed publications, consultation with healthcare professionals, and references from existing scholarly works. This literature review attempts to examine how the presence of oxygen influences smokers' perceptions of risk or influences their behaviors in any measurable way. The most important outcome from this research is providing an informed basis from which to develop prevention messaging.

Existing Literature

There are several reoccurring themes in literature pertaining to risk perceptions and the habits associated with smoking in general. Existing literature generically addressed the increased fire risk attributed to smoking and oxygen use. However, the literature offers far less insight into what smokers actually understand about oxygen-related fire hazards or how those attitudes shape smoking behaviors. Two major research studies address the impact oxygen has on the perceptions of fire risk from a clinician's perspective.

Smoking and Oxygen

The *Safe Home Care* research project referenced in chapter one, involved quantitative and qualitative analysis defining home health care job hazards. Interviews from 1,249 private sector and self-employed home care workers gives this research particular weight for consideration due to its scope and size. The results of the study noted medical oxygen was present only 9 percent of all home visits, yet it ranked highest in perceived job hazard risks among home care providers. This underscores the significant risk that home healthcare workers place on smoking and home oxygen use. Fire concerns ranked highest over other job hazards involving blood borne pathogen exposure, back sprains from lifting, verbal or physical abuse, driving long distances, or falls with patients (Galligan et al., 2015). The research falls short of addressing patient perception of their own fire risk.

Home oxygen therapy remains the standard of care for patients who suffer from hypoxemia. Smoking is a contraindication to oxygen use because of the increased risk of burn injuries and home fires. Clinicians face difficult decisions, weighing the immediate survival benefits of HOT against the potential catastrophic fire risks when patients continue smoking. However, research conducted in both Sweden and Denmark indicates oxygen therapy offers too much benefit to withhold from patients, even if they smoke. A Swedish review of respiratory care practices emphasized, “HOT is one of the few treatments shown to improve survival in people with severe hypoxemia, unnecessarily denying patients the treatments due to smoking (that may be safely managed) could lead to an earlier death” (Ahmadi et al., 2024). This view contributes to the dichotomy of providing appropriate care for COPD patients who continue to smoke because they do face an increased risk of having a home fire.

This practice runs contrary to existing oxygen eligibility requirements of complete smoking abstinence. Much like organ transplant programs that mandate abstinence from smoking and alcohol consumption, practitioners attempt to manage this ethical dilemma of prescribing oxygen to a known smoker by setting stricter eligibility requirements. Ahmadi and colleagues (2014) challenged this approach, citing that smoking cessation is a process of repeated successes and failures. Withholding oxygen was akin to denying medical care. Sweden’s publicly funded healthcare system has developed a systematic framework to balance benefits and risks.

An additional study by Ahmadi et al., (2024), further examined the topics of HOT treatment effectiveness, differences in potential fire risk using oxygen concentrators versus portable oxygen cylinders, and current criteria for withholding oxygen treatment all together. There was no evidence to show oxygen treatment offered a dramatic benefit for patients with mild to moderate COPD. Eliminating those low-risk patients from receiving home oxygen

automatically eliminated their risks from home oxygen fires. The increased medical monitoring of these lower acuity patients showed no deterioration to their health by withholding medical oxygen.

Second, the use of home oxygen concentrators compared to oxygen cylinders storing compressed oxygen showed promise in reducing home fire risks. Unlike concentrators, cylinders present an explosion hazard when exposed to flame impingement. This is one example of an engineered solution that reduced overall fire risks.

Finally, healthcare practitioners participating in the Sweden study managed smoking and oxygen use by monitoring the patient's ability to understand their risks. They also provided increased fire prevention education to smokers so they could manage their addiction with cessation as the goal.

Unfortunately, this study fell short of measuring if those efforts prevented HOT fires. Factors such as impaired decision-making, dementia and an evaluation of a patient's previous fire events served as criteria for evaluating if continued oxygen use was appropriate (Ahmadi et al., 2024). Sweden's systematic evaluation approach for managing smoking and oxygen offers physicians a solution addressing the ethical dilemma of providing appropriate care for persons with unhealthy lifestyles.

Denmark has taken an even less restrictive approach. They do not view smoking as a contraindication towards long-term oxygen therapy (LTOT) use. "The incidence of burn injuries during LTOT is reported 85/100,000 person-years in Sweden (where smoking is a strong contraindication) compared with 170/100,000 person-years in Denmark (where smoking is allowed in some patients during LTOT)," (Tanash et al., 2017). Regardless of the perspective, all practitioners preferred continuous efforts towards smoking cessation to improve patient health

outcomes and lower their home fire risks. While both approaches rely heavily on practitioner judgment, they highlight the ongoing need for research into patients' own knowledge, risk perceptions, and decision-making around smoking and oxygen use in the home.

Risk Perception

Answering the question *why do people smoke while on oxygen* often leads to the same explanations as asking *why people smoke* in general. Much of the existing literature focuses on the latter, with little emphasis on oxygen use. Research recognizes nicotine addiction, social factors, and psychological components as the primary drivers of smoking. However, much of the focus on smoking addresses health consequences based upon "epidemiological research" and "social surveys" (Heikkinen et al., 2010). Health consequences do not play as large of a factor in deciding to smoke, as one would logically assume.

Research examining the acceptance of smoking risks suggest that health consequences alone rarely motivate cessation. In fact, the opposite is true. For example, individuals with respiratory symptoms reported that such conditions were not sufficient reason to quit smoking. Many smokers reported feeling "alienated and unworthy of smoking cessation support" as they regarded their disease as "self-inflicted" (Eklund et al., 2010). Most linked smoking dangers to cancer and demonstrated less knowledge of COPD. Others attributed illness to simply having "bad luck," while distancing smoking as the direct cause of their current health conditions (Bethea et al., 2015). People who smoke are not immune from added health issues that often relate to the frequency of their smoking habits.

It appears most people cannot identify the most prevailing health issues related to smoking. Weinstein (1999) conducted early research finding people did not list smoking as the most important cause of cardiovascular disease. Despite his focus on understanding risk,

"decisions and behavior are not determined by knowledge alone" (Weinstein, 1999). This research 25 years earlier than Bethea and his colleagues concluded, "whether it is smoking, lead poisoning, alcoholism, cancer, or stroke, it cannot be presumed people know what illnesses will result" (Weinstein, 1999). It begs the question, if smokers are not able to list the most severe health effects from smoking, how can they make informed decisions on the risks associated with smoking?

The existing literature suggests health messages do not resonate with smokers and does not influence their perception of risk. Instead, an underlying theme emerges that many smokers view their health outcomes as inevitable or predestined. The perceptions of trustworthiness and personal experience carry more weight than empirical findings or government-led public health campaigns.

The most recent example of evaluating trust in government public health messaging occurred during the COVID-19 pandemic. In a study of 57 countries with more than 100,000 participants, Rieger & Wang (2022) found that individuals who were factually educated about COVID-19 expressed greater trust in government actions, while those with lower education levels often distrusted government responses. This issue of trustworthiness still plays out today with vaccination effectiveness since the Covid-19 pandemic. Trustworthiness in the government remains a central theme for many health issues including smoking.

Education has direct connections to socioeconomic status, which in turn has a direct association with smoking prevalence. Rieger & Wang also link low education to an increase in supporting conspiracy theories that aligned with political affiliation. Across all groups, extensive media coverage contributed to diminished perceptions of government trustworthiness. To the point, a cross-section survey of 1,024 adult smokers saw a 33% increase in cigarette smoking

and a 23% increase in E-cigarette use during COVID-19 (Kalkhoran et al., 2022). Those surveyed cited stress and fear during the pandemic as the leading contributor towards increased smoking. Smokers in this study did recognize the perceived health risk that smoking played into the ability to recover from COVID-19. In fact, 95% of those surveyed attempted to quit smoking during COVID-19 (Kalkhoran et al., 2022). That assumes the health impact of a Covid-19 diagnosis had a direct connection to a smoker's perception of recovery.

Research highlights the *risk perception paradox* as a way to explain the seemingly illogical decision-making process of smokers. On one hand, smokers accept the personal risks associated with tobacco use. Yet, during uncertain events, such as a worldwide pandemic, the survey data showed smokers actually increased their cigarette consumption, even while recognizing the need to quit. This phenomenon occurs when individuals consciously accept risks but fail to adjust their behavior to reduce or prevent further harm. As Rickard (2014) notes, people tend to "dread less the risks they perceive as controllable and those that are stable or predictable in outcome." Controllability and stability, therefore, are central reasons why individuals continue tolerating certain risks. For smokers who already perceive their health outcomes as inevitable and who struggle with nicotine dependence, smoking represents a voluntary act (controllability) that reliably delivers a sense of pleasure (stability). This dynamic underscores the complexity of behavior modification when it comes to smoking cessation and risk acceptance.

Smoking and Behavior Support

Shifting the focus from smoking initiation to smoking cessation produced considerably more literature on this topic. While cultural beliefs and experiences influence decisions to stop smoking (Rickard, 2014), it is often negative experiences that strongly reinforce behavior

change. Kaushal & Rhodes (2015), for example, studied new gym members and found the degree of negative experiences determined whether individuals quit or maintained their membership. In comparison to smoking behaviors, they concluded the greater level of negative experiences; the more likely individuals were to discontinue the behavior.

Early studies by Slovic (1997) originally affirmed that people evaluate risk acceptance in highly subjective and experience-based approaches. For instance, if a smoker suffers only a minor facial burn while smoking on oxygen, they may not change their behavior because the injury seems insignificant compared to the pleasure achieved through smoking. Yet for others, the same incident, if requiring medical attention, can serve as a wakeup call that triggers long-term behavior change. These contrasting responses highlight the influence psychological factors have on cessation success.

A qualitative study involving 136 Chinese smokers with COPD found that many of those surveyed have repeatedly attempted to quit and failed. Common misconceptions, such as the idea that quitting abruptly could be dangerous or that the withdrawal symptoms are unbearable made cessation more difficult (Zhang et al., 2022). For these individuals, Zhang and colleagues noted the greater challenge to cessation involved overcoming deep-rooted social and psychological barriers. The battle between psychological needs and willpower ultimately decides success or failure at quitting. Psychological needs routinely trumped willpower.

Additional studies looked at why people stopped smoking and found individuals were more inspired to quit when they perceived their habit might cause harm to other family members, particularly children (Bethea et al., 2015). This study found public health campaigns that used real-life stories of smoking's impact on family members were more effective than generic health warnings. The influence of trusted individuals is another reoccurring theme in cessation success.

A qualitative study in Australia involving 33 patients with COPD revealed attempts to stop smoking were spontaneous. The attempts were more successful when family, friends or the individual's personal physician were involved. Reported reasons for relapse included "boredom, low mood, strong smoker identity, social reinforcement, cravings, irritability, hunger, and weight gain" (Vuong et al., 2016). Similarly, Schofield et al. (2007) found in a study of 22 older COPD patients, cessation attempts were more effective when influenced by encouragement rather than the fears of worsening health conditions. The collective research emphasizes developing a strong support system is critical to long-term smoking cessation.

Research published in the Journal of the American Medical Association (JAMA), revealed, "Approximately 34 million people in the US smoke cigarettes" and "70% of people who smoke cigarettes want to quit smoking" (Rigotti et al., 2022). The study showed successful cessation accounted for an additional 10 years of added life for individuals. Rigotti and colleagues shared, counselling and pharmacology interventions used in conjunction together accounted for a 15.2% success in smoking cessation. The success rate increased depending on the type of nicotine replacement medication used. The research concludes the vast majority of smokers do want to quit. However, risk perception, individual health concerns, and even government messaging plays only a minor part in the decision to quit smoking. It takes sound treatment strategies and supportive networks to stop smoking, especially when the efforts and influence of the tobacco industry seeks to keep users addicted to their products. Family influences play a considerable part in successful cessation efforts.

The Influence of Tobacco

Public opinion for the tobacco industry declined when internal documents revealed the industry manipulated nicotine levels to keep smokers addicted (Truth Initiative, 2019). This

product manipulation scandal sparked calls for government oversight of the industry. "The tobacco and nicotine industry (TNI) profits from addiction, disease, and death, disproportionately impacting Indigenous populations. These harms are embedded in ongoing colonial histories, slavery, and racialized exploitation, targeting communities through predatory marketing, product availability, and policy manipulation," (Maddox & Bradbrook, 2025).

The reduced ignition propensity (RIP) cigarette was the next development. RIP cigarettes became law in all 50 states. Policy advocates thought the RIP cigarette would reduce home fires. However, the product altered the consumer's smoking experience. Smokers who were accustomed to cigarettes that remained lit when idle now encountered a product that extinguished without constant inhalation. The RIP required more work to keep lit (Baker et al., 2016). The manipulation of nicotine levels and RIP cigarettes opened the door for the Food and Drug Administration (FDA) to regulate tobacco products.

Public policy measures drove cigarette prices sharply upward. Rising prices contributed to smoking cessation, as financial burdens became an additional motivator to quit (Bethea at al., 2015). It is difficult to predict without further research what percentage of smokers will continue to pay the price, whatever it is. This researcher conducted an informal poll with five smokers of opportunity who indicated $10 per pack is the price point in which they would quit smoking. While the smokers were random encounters, it shows some indication price does influence behavior. The tobacco industry knows this fact all too well.

The tobacco industry continues to redefine nicotine distribution in an effort to address the stigma of producing combustion products. "Big Tobacco is waging a campaign to try to transform itself into "New Tobacco," with offers of non-combustion tobacco product alternatives and claims that the industry can be part of the "public health solution" to end smoking" (Truth

Initiative, 2019). These products may reduce U.S. fires but the health concerns remain. It is too early to determine the impact of vapes on fire rates in the U.S., or its impact on home oxygen use.

The Dai et al., study involving 3,431 surveys finds adult smoking prevalence in the United States measured from 1990 to 2020 showed a 40% decline based on the survey results and data collected from the *Global Burden of Disease* (GBD) study (2022). "Conversely, there has been little decline in smoking in most low and middle income countries (LMICs) with over half of all men continuing to smoke in large populations in Asia (China, Indonesia), as well as the Pacific Islands" (Dai et al., 2022). This study found a direct connection exists between wealth, higher education, and the reduction of smoking. Participation in higher education correlated to lower smoking rates over time (Drope et al., 2018). The research by Dai et al., and Drope et al., strengthens the connection between smoking and poverty, especially in low to middle-income countries.

Synthesis of the Existing Literature

It is readily apparent during a review of existing literature that smoking in conjunction with oxygen has not been the subject of direct research. As outlined in chapter one, the emergence of HOT fire events represent a new area of concern for the fire service. The most significant finding from this review is the absence of research on how smokers perceive their own risk while using medical oxygen.

Research by Galligan et al., Ahmadi et al., and Tanash et al., addressed perceptions of fire risk involving oxygen from a practitioner's point of view. Galligan and colleagues examined work place hazards perceived by home health care workers. While oxygen use occurred only 9%

of the time, it ranked the highest in safety concerns. This exceeded more common workplace hazards, such as falls, assaults, or blood-borne pathogen exposure.

Ahmadi and colleagues studied practices in Sweden and Denmark finding healthcare systems in those countries approach HOT provisions through a structured framework that considers patient decision-making capacity. The approach emphasized the importance of providing oxygen to patients despite their smoking habits. The lack of research pertaining to smoker's perception of risk highlights the need for additional research on this issue.

Another central theme that emerged was the limited impact health messages have on smokers. Such messages fail to resonate with smokers and rarely contribute to a change in behavior. Instead, many smokers view their health outcomes as inevitable or predestined. The individual smoker often attributed the worsening of their disease to mere "bad luck," as documented by Heikkinen et al., Eklund et al., and Bethea et al.

Across twenty-five years of research, little has changed in how smokers fail to draw a direct connection between their health conditions and smoking. The fatalistic view smoker's hold contributes to the difficulty they have in quitting (Zhang et al., 2022). Much of the literature indicates smokers do want to quit. Even if smokers do not realize the initial health benefits of quitting, Rigotti and colleagues (2022) pointed out smokers could add a decade to their lives simply by quitting. The health implications of smoking are well researched and documented in existing literature.

The challenges of achieving successful smoking cessation, as highlighted by Bethea et al., Zhang et al., Schofield et al., Rigotti et al., and Vuong et al., underscore the uphill struggle smokers face when attempting to quit abruptly. Evidence consistently shows long-term success is

more likely when individuals pursue cessation with a deliberate plan and a strong support network.

More recently, Maddox & Bradbrook (2025) have shifted attention directly aimed at the tobacco industry. Research from 1998 to 2008 documented the industry's predatory practices designed to entrench nicotine dependence and sustain smoking as both a behavior and addiction. The literature from that period is extensive. However, research from 2009 through 2020 explaining smokers' cognitive decision-making or their acceptance of risk remains notably limited. The same holds true with smoking and oxygen use as well. Finding any scholarly works to address the risk perceptions of smokers using oxygen proved difficult, if not impossible. Perhaps the overall lack of awareness on this issue contributed to the lack of previous research.

Summary

The literature reveals a notable gap in understanding why smokers accept the risk of smoking while using medical oxygen. Much of the early 2000s research aligned with the growing pressures to regulate the tobacco industry and reduce smoking in the United States. Studies that are more recent shifted to explain why smoking cessation is difficult to accomplish. Yet, none directly examine whether smokers perceive an elevated risk of fire when smoking on oxygen. This absence suggests that smokers themselves may be the most reliable source for answering the research questions presented in Chapter 1. While the existing literature helps clarify who smokes and why cessation is so challenging, it fails to establish how the presence of oxygen influences a patient's perception of risk.

CHAPTER 3: METHODOLOGY

The following sections outline the recruitment efforts used to obtain a sample population, the qualitative instrument employed, and the procedures for interpreting the collected data. Because human subjects are involved in this research, a review of the Department of Health and Human Services (HHS), Human Research Protection Foundational Training occurred prior to beginning any recruitment efforts. The review assured the research methodology met the principles of respect, benevolence, and justice required of the HHS *Common Rule* on protecting human subjects in research (Retrieved September 29, 2025, from https://www.hhs.gov/sites/default/files/ohrp-hrpf-lesson-1-english.pdf).

Recruitment of participants began with an email request distributed to state and local fire chiefs, fire marshals, and EMS groups. Interested respondents could call or email to participate in this research project. At the same time, permission to recruit study participants inside two Iowa casinos resulted in their security staff requesting a sample of the questions from Appendix C. Both casinos ultimately denied the request citing the research would disrupt the customer experience at the casino.

Active recruitment of study participants also included social media advertising through the City of Nevada (Iowa) Facebook page (Appendix D), direct telephone outreach to nursing directors at local long-term care facilities, local hospital emergency department physicians, durable medical equipment (DME) providers, and requests for assistance from pulmonologists and social workers affiliated with a regional independent living home for retired Veterans. The recruitment reached a statewide distribution.

Three random qualifying subjects (subjects 4, 5, & 6) completed interviews in Las Vegas at a casino during an opportunist work related travel event. This was an opportunity to expand

the research data to a different region outside Iowa. Each recruitment effort offered access to participants from a varied background. The recruitment goal included finding qualifying people who live in a residence or who moved from a care facility to a residence after rehabilitation.

As outlined in Chapter 1, the purpose of this study focused on creating a better understanding of the factors contributing to a person's conscious choice to smoke while using oxygen. Exploring the risks smokers are willing to take and understanding what they actually know about fire hazards could contribute to gaining broader knowledge on this topic.

Human subject research is essential to achieving these objectives. Data collection for this study consisted of individual interviews with qualified participants, followed by content analysis to evaluate findings. Engaging a small sample of people who both smoke and use oxygen offers valuable insight into how this target population perceives and interprets fire risk.

Research Design

This study employed qualitative inquiry to explore the extent to which people who smoke while using home oxygen are aware of their fire risks. Smoking is a deeply personal behavior with overall negative public perceptions. When compounded by health issues directly attributed to smoking, many individuals feel embarrassment or shame. The progression of illnesses to the point of requiring home oxygen further intensifies the physiological dependence on nicotine. Capturing the smoker's experiences using the Phenomenology Model, helps understand the *lived experience* of the individual. "Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (Merriam & Tisdell, 2016, p. 30). This research study will capture personal experiences from people who smoke and are on oxygen.

The most appropriate qualitative model for this study is the Phenomenology Model because it focuses on the lived experiences of participants. Using semi-structured interview questions allows researchers to explore participant's perspectives in depth. This approach allows for replication of this research. Interviewing, observing, and analyzing are processes used to qualitative framing of the meaning participants attach to their behaviors and risks. Likewise, according to Merriam & Tisdell (2016), interviewing qualified participants serves as the most effective way to make substantive change when researching a problem that affects human experiences. In future studies the use of similar data analysis metrics could provide replication of this study on a larger scale. Qualitative research takes place in the participant's "natural environment" rather than collecting data using quantitative tools like an "inanimate testing instrument" (Creswell & Creswell, 2018). It is critical the design of interview questions avoids adding bias to the outcomes.

Other research design models have applicability to this problem. For instance, Grounded Theory would be appropriate if this research intended to develop a new theory on why people engage in risky behaviors despite their awareness of danger. To some degree, that valid question deserves answers. However, the Grounded Model presumes that smokers who use oxygen are inherently aware of the danger to themselves. Assumptions such as this introduce researcher bias and risks shaping survey questions that fit a preconceived notion of what smokers *should* believe rather than allowing their own experiences to emerge.

Thematic Analysis is another partially applicable qualitative model for consideration. Thematic Analysis involves the process of coding themes and patterns. When applied to smoking and oxygen, it is reasonable to assume several themes could arise from the research. Assuming smokers are addicted to nicotine and therefore cannot stop smoking supports the notion they are

inherently at risk of a fire event at some point. The error in taking a Thematic Analysis approach to this research study stems from the fact it seems anecdotal and not able to produce quantifiable outcomes. Not everyone who smokes while using oxygen experiences a home fire. Thematic Analysis is presumptive and inherently unable to measure the degree of individual risk awareness. The validity of the selected interview questions support the Phenomenology Model's use.

Population and Sample Size

The study population was limited to 15 random adults who met the following criteria: 1) Participants had a history of smoking or were current smokers; 2) participants had smoked while using prescribed home oxygen therapy; and 3) participants lived in a residence not associated with nursing care. There were no other parameters set for participant selection, although 100 percent of the participants identified as also having a COPD diagnosis, which they attributed to smoking

A convenience sample of this size was determined to be the most feasible given the constraints of the study. The research required completion within 180 days, which limited the time for broader recruitment. Access to a larger participant pool was also restricted because healthcare providers, who have the most direct knowledge of and access to qualifying participants, are prohibited by HIPPA from releasing such information. Expanding the geographic scope of recruitment was not feasible due to the absence of funding to support travel to other states with higher rankings of COPD prevalence.

According to the American Lung Association (2021), all 50 states except Minnesota, Pennsylvania and Rhode Island have higher COPD prevalence among females than males. The female participants in this study align with the baby-boomer generation that the tobacco industry

heavily targeted in the late 1960's and 1970's. That 47 states show higher COPD rates among women underscores the effectiveness of those marketing strategies in creating long-term nicotine dependence among baby-boomer females. This is a trend also reflected in this study. States with the highest COPD rates (Table 1) were not included in this survey because of the previous mentioned limitations. Travel to other higher-ranking COPD states was not possible within the constraints listed above.

Table 1.
Top 12 COPD Prevalence Rates and Counts by State and Gender, 2021

	Male		Female		Total	
State	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**
West Virginia	11.8	82,300	14.4	103,900	13.1	186,200
Kentucky	9.8	166,800	12	214,900	10.9	381,700
Tennessee	9.7	254,600	11.1	311,100	10.4	565,700
Arkansas	8.6	97,600	10.5	125,600	9.6	223,200
Alabama	8.6	161,900	10.1	207,500	9.4	369,400
Mississippi	7.6	82,500	10.4	122,400	9.1	204,900
Maine	8.1	43,600	9.8	56,200	9	99,900
Louisiana	8.5	144,500	8.9	163,700	8.7	308,200
Ohio	7.6	340,300	9.5	452,900	8.6	793,200
Indiana	7.4	188,300	9.5	256,200	8.5	444,400
Missouri	6.6	153,500	10.4	255,600	8.5	409,000
Oklahoma	6.6	98,500	8.9	136,800	7.8	235,300

Reference: https://www.lung.org/research/trends-in-lung-disease/copd-trends-brief/data-tables/copd-prevalence-rates-by-state-gender

Since initial efforts to recruit participants fell short of expectations, second efforts included outreach to large apartment management companies, fire chiefs, local hospital respiratory therapists, Emergency room physicians, and durable medical equipment providers. The City of Nevada posted the recruitment flyer (Appendix D) in the *Our Nevada* magazine, a publication reaching all 7,000 residents of the community.

Rotech, a national DME, in Marshalltown, Iowa, suggested HOT patients are not easily accessible in public. People with chronic COPD are mostly homebound people. Without personal knowledge of their residence or family member encouragement to participate, accessing large numbers of people who smoke while on home oxygen is difficult at best unless conducted in a clinical setting. This underscores the significant complexity faced by the fire service in addressing HOT fires. Identifying patients who use home oxygen remains a considerable challenge unless an emergency response brings their condition to light.

Instrument

The instrument used for this research consisted of 13 interview questions addressing three areas related to the research questions from Chapter 1. The areas of interview focused on *Awareness* factors (four questions), *Psychological* factors (five questions), and *Perceptions of Risk* factors (four questions).

Assistant Professor of Surgery from Stanford University, Dr. Clifford Sheckter, and Senior Research Associate from John Hopkins Center for Injury Research and Policy, Elise Omaki validated the instrument questions. These subject matter experts serve on the HOT working group for the Fire and Life Safety Section (FLSS) within the International Association of Fire Chiefs (IAFC). They are actively researching engineered solutions to reduce home oxygen fires. Dr. Sheckter and Ms. Omaki provided word-formatting changes to the original questions to limit the chance of social desirability bias. This is a bias where a respondent tells the researcher what they think the researcher wants to hear as the respondent continues to engage in risky behaviors they know are dangerous. The subject of smokers being truthful about their current smoking practices has come up frequently during this process.

Because smoking is a deeply personal behavior, ethical considerations were necessary when asking participants about their past smoking habits, particularly to those who indicated they recently quit smoking. The use of open-ended psychologically oriented questions provided participants with flexibility to respond in ways that felt comfortable to them. This minimized discomfort or stress for those involved in current cessation efforts. The interview questions used during this process address research gaps pertaining to a smoker's overall perception of risk while prescribed home oxygen as discussed in Chapter 2.

Awareness Factors

The goal of this series of interview questions focuses on oxygen safety. The section assesses the participant's baseline knowledge of how oxygen reacts to a flame source. The questions focus on oxygen's ignitability and if the participant understands how difficult or easy oxygen can ignite. These questions speak to the effectiveness of existing requirements to advise patients of risks associated with oxygen use in the home.

Question #1: Do you think it is possible to start a fire with a cigarette used in close proximity to oxygen?

Developing an individual's presumption of risk is dependent upon examining their existing knowledge. The purpose of this question assesses the participants' understanding of what occurs when oxygen and a cigarette are in close proximity. While it may appear obvious to most that a fire could ignite, the reality is that unless an individual has personally experienced or witnessed such an event, they may not truly comprehend their hazard. The lack of actual knowledge can affect a person's perception as to the degree of their risk.

Question #2: Can you explain how oxygen tubing ignites when exposed to a source of fire ignition?

This question assesses the participant's knowledge about oxygen characteristics in close proximity to sources of ignition. Because the interview primarily assesses the risks associated with smoking and oxygen use, this question gathers the participant's direct knowledge and experience as it relates to the ease of oxygen ignition. In other words, do participants know what will happen if fire and oxygen combine?

Question #3: Have you received any education (informal or formal) about the type of risks associated with smoking while using oxygen.

Oxygen safety education is required at the time of oxygen delivery according to the Centers for Medicare and Medicaid Services supplier standards. See CMS DMEPOS rules: https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-B/part-424/subpart-D/section-424.57. To what degree do participants know about the oxygen safety training they received?

Question #4: Where did you gain your knowledge of those risks you explained?

The durable medical equipment provider is required to educate patients about oxygen risks associated with smoking and oxygen use. Do participants know who provided their initial safety education about oxygen use in the home?

Psychological Factors

Previous research indicates that psychological factors about smoking behaviors plays a significant role in an individual's home fire risk. The interview questions in this portion of the instrument explore behaviors specifically related to smoking. Studies consistently show the vast majority of smokers express a desire to quit. However, this section of inquiry presented one of the most ethically sensitive challenges of the study. Questioning participants' past attempts to quit or their reasons for resuming smoking could seem judgmental if phrased inappropriately. It

is important to ensure that all questions remain open-ended, allowing participants to respond freely and without pressure.

Many smokers report feeling stigmatized or villainized by society because of their smoking behavior. Conducting meaningful and in-depth research on smoking practices necessitates navigating these uncomfortable discussions with care and respect. Holding face-to-face interviews allows the participant to see the tone and empathy of the interviewer. Researchers must be cognizant of these facts to be effective.

Question 5: In your own words, describe why you smoke and for how many years?

This question determines the reasons contributing to why a person smokes. Understanding *the why* could provide valuable insight for healthcare workers to support cessation. Prior research shows a connection to some psychological reason or reasons people smoke. The length of time a person smokes has health implications affecting the pulmonary system of the body requiring home oxygen.

Question 6: Was there a period of time when you quit smoking? Why or what reason would you give for returning to smoking?

The efforts individuals make to quit smoking, along with the reasons they relapse, reveal the overall difficulty of sustaining cessation. This question explores the degree to which the participants attempted to stop smoking. It also helps discover the reasons people return to smoking. Understanding the underlying causes of relapse could contribute to future more effective cessation strategies.

Question 7: Can you stop smoking? Why or why not?

This question explores the addiction component of nicotine dependence. Individuals who are addicted to nicotine may openly acknowledge their inability to stop smoking. Observational

data, including body language and nonverbal cues, provide valuable insight if participants genuinely believe their verbal responses. If participants cannot stop smoking despite repeated efforts, the data from this question could indicate other solutions outside of human willpower need to be developed.

Question 8: What challenges would you have in order to stop smoking while using oxygen?

This research seeks to determine whether smoking influences or controls the daily behaviors of participants. Smoking when combined with oxygen use is inherently dangerous. Understanding the challenges that prevent individuals from stopping this behavior is critical. If participants recognize the factors that sustain these risky behaviors, it may indicate targeted solutions are achievable to stop this behavior.

Question 9: Since starting home oxygen, has your smoking behavior changed? (Frequency, # of cigarettes smoked in a day, location where you smoke).

The responses to this question provide insight into how smokers perceive their level of risk. When individuals take actions such as turning off the oxygen concentrator, smoking outside the home, or removing the nasal cannula before smoking, it suggests they recognize some degree of personal danger. These behaviors indicate an awareness of risk distinct from smoking without oxygen use. However, this question does not evaluate whether such actions are actually effective in reducing the likelihood of a fire.

Perception of Risk

The psychological factors above addressed individual behaviors associated with smoking. Question #9 examines observable actions that may indicate whether an individual perceives a risk when smoking around supplemental oxygen. Questions 10 through 13 further explore how

participants evaluate home fire risks in general, compared to behaviors directly linked to smoking.

This set of questions considers whether oxygen use or the act of smoking plays any role in a person's perception of risk. People who engage in unsafe behavior justify the action or downplay its impact. Do participants recognize a risk with smoking and oxygen use?

Question 10: On a scale from 1-10 (1 =very low risk to 10 =very high risk) how likely are you to experience a home fire in general (not attributed to smoking and oxygen)? Why do you have that belief?

The intent of this question is to assess a baseline perception of the participant's risk level experiencing a home fire excluding oxygen and cigarettes as a primary cause. The baseline is a good comparison to question #11 that is similar but specific to smoking and oxygen. The score of one is extremely unlikely with a score of five being moderately likely, while a score of 10 implies an imminent risk of a home fire.

Question 11: Using the same scale 1-10, how likely are you to experience a fire related to smoking and oxygen? Why do you have that belief?

In comparison to question 10, this question reveals the difference in perceived overall home fire risk versus a perception of fire risk specifically attributed to smoking and oxygen. Do people who smoke perceive a higher risk from smoking and oxygen use than normal everyday risks? This question goes to the heart of this research by answering questions about the level of perceived risk from the act of smoking while using home oxygen.

Question 12: Do you consider the consequences of a home fire from smoking and oxygen use including injury to yourself and everyone in the home?

Forming a perception of risk is grounded on the premise individuals consciously consider the potential outcomes of specific events. Rickard (2014) emphasizes the perception of risk and the attribution of responsibility for accidents depend on deliberate and reflective thought. Logically, individuals who have previously experienced a home fire would be more likely to contemplate the possible consequences of future fire.

Question 13: What factors do you consider for forming your perception of the risk of fire from smoking while using oxygen?

The intent of this question helps determine whether participants' sense of risk is shaped by knowledge, lived experiences, or cognitive biases such as normalization of risk or optimism. Ultimately, this question seeks to uncover the basis of each participants' thought process in defining danger. By comparing the participant responses, researchers can see if some underestimate or rationalize their actual perception of true risks.

The design of the questions allowed participants to share their perspectives to the extent they felt comfortable. This enabled the collection of additional qualitative insights beyond those directly solicited. The semi-structured yet open-ended format created an environment of comfort and psychological safety. This helped reduce participant stress during the interview process. This approach encouraged honest responses from participants.

Research Process

Any adult who smokes and uses home medical oxygen qualifies to participate in this research project. The intent to find people who live in a residence not controlled by 24-hour nursing care received priority in interviews. Living in a care facility presents a controlled environment that could likely skew the perception of a smoker's actual risk since care facilities

are non-smoking. They offer outside smoking areas that while dangerous to smokers who use oxygen; they do not present the dangers similar to smoking in a residence.

Recruitment efforts to locate participants were arduous and did not produce the extent of participants anticipated. In fact, finding most of the participants occurred by chance through public encounters, other fire department referrals, and through referrals built upon the professional relationships established with apartment management companies. To say locating these participants was difficult would be an understatement. HIPPA requirements restricted physicians, durable medical equipment providers, and respiratory therapists from sharing their identity and access to these patients. Participants of this research signed a waiver of release to collect their experiences and stories.

Interviews captured participants in their own chosen setting to provide comfort and openness. Most of the time the interview took place at the residence with some exceptions occurring in a casino. Gender was not included as a criterion for participant selection; however, it was noteworthy that the majority of respondents were female. After establishing rapport and explaining the purpose of the study, participants responded to the interview questions read verbatim without offering additional clarification or interpretation. This intentional design method prevented researcher bias and ensured the participant responses reflected their own perspectives and experience without external influence.

The purpose of analyzing the interview responses served to identify recurring themes using content analysis. The tabulation of each participants' answers allowed for a person-by-person review of how participants answered each question. A transcript of the interview immediately followed the participant's interview session. This approach allowed patterns to

emerge in both similarities of answers and more importantly differences in how a person answered a question compared to other subjects.

The open-ended nature of the questions helped to explain those differences. Questions #10 & #11 when coded allowed for the development of a side-by-side comparison of home fire perceived risks (Table 3). For example, the score from a participant on their perception of general home fire risks versus the score of home fire risk tied to smoking and oxygen use, shares incredible insight into the thought processes of the participants. All 13 questions were important towards developing central themes to answer the research questions.

Ethical Considerations

The ethical perspective of this research presents substantial implications and demands careful consideration. Above all, the research participants represent a vulnerable population characterized by frail health. The COPD diagnosis is the result of long-term decision making that was largely self-induced. The cumulative health damage from decades of tobacco uses ultimately served as a qualifying factor for inclusion in this study. Notably, two individuals who met inclusion criteria died before their interview. One individual died from a medical emergency and the other from a house fire caused from smoking while using oxygen. This speaks to the urgent concern and sensitivity of researching the HOT issue.

In a 2021 survey of 100 durable medical equipment providers, 11% of the providers personally knew of a patient they serviced who died from a fire while smoking on oxygen. In the same survey, 36% knew of a patient burned while smoking on oxygen (BPR Medical, 2021). In 2025, a similar repeat survey with 407 respondent DME providers (Appendix E) reported almost identical percentages of fatalities (11%) and burn injuries (36%). It is shocking that 46% of

surveyed medical equipment providers are aware of a fatality or burn injury to their patients on home oxygen.

During the initial stages of data collection, a central theme emerged that individuals who had quit smoking multiple times were back to the habit with minimal prompting. Exposure to cigarette smoke or experiencing a period of heightened stress caused relapse. Several participants reported a single cigarette was all it took to resume smoking. This raised important ethical concerns that asking participants about their smoking habits carried a potential risk of acting as a psychological trigger, possibly prompting relapse following the interview. To mitigate this concern, the sequence of questioning helped shift the emphasis from questions #5 and #6 towards the overall focus centered around how home oxygen contributes to fire risk.

Finally, omitting participant personal identifying information (PII), such as names, addresses, or other things that could possibly identify individuals of the study helped to ensure confidentiality. Each participant signed an informed consent waiver, which is securely stored and not available for public release. Each participant received a number (e.g., Subject 1, Subject 2) to maintain anonymity through the research process. These measures ensured adherence to the principles of *Respect for Persons*, *Beneficence*, and *Justice* as outlined in the *Belmont Report* (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979).

Summary

The research methodology used to support the qualitative research process consisted of thirteen semi-structured questions. The questions included the following areas of research focusing on awareness factors, psychological factors, and perceptions of risk. The research

instrument described above facilitated face-to-face interviews with an intended sample size of 15 participants.

The research questions being reviewed and validated by research experts, Dr. Sheckter and Ms. Elise Omaki added credibility to the data collection. Their comments helped minimize the risk of *social desirability bias* by restructuring some of the original questions to assure rapport building questions set the tone of the interview before more personal questions were presented. Question sequencing helped assure participants answered questions in what appeared to be a truthful manner.

The research process established participant criteria requiring individuals who smoke, reside independently in a home environment, and use home oxygen therapy. By coincidence, all participants had a chronic obstructive pulmonary disease (COPD) diagnosis. Participant selection occurred randomly, and individuals were not aware of one another's participation in the study.

Recruitment presented significant challenges, not due to the lack of qualifying individuals, but rather because potential participants were often in frail health as they managed their COPD on a daily basis. As such, many participants are home bound with limited outside public engagement. The cancellation of two interviews occurred following the death of two participants prior to their scheduled interview dates. These events underscore the vulnerability and poor health status of individuals who continue to smoke despite a COPD diagnosis.

The interview question sequence provided careful consideration to avoid emphasizing sensitive questions that were more personal to the participants. The questions were read verbatim with no variations or explanations provided to participants to avoid bias. Coding and tabulating the responses from all participants helped develop several themes related to the initial research

questions. The answers provided directly contributed towards increasing the knowledge about individuals' perceptions of risk while smoking and using oxygen.

Ethical considerations focused around the vulnerability of the participant sample population. Questions whether this research could trigger those in cessation was of real concern to this researcher. The collected data suggests smokers involved in cessation attempts routinely relapse from minor triggers. Could discussing the reasons participants smoked act as a trigger causing them to relapse?

This research treated all data as strictly confidential with identifying information removed to protect those involved. One of the biggest challenges for this research involved the fact health care providers knew the location of their patients but could not share that information due to HIPPA federal healthcare rules. Following established healthcare rules made access to participants more difficult. Treating participants with compassion and obtaining informed consent to participate in this research helped overcome initial ethical dilemmas.

CHAPTER 4: STUDY RESULTS

Recruiting an adequate sample of participants proved challenging throughout the study. The disease process of COPD significantly limited mobility for most of the participants. This reduced their ability to engage in research activities outside their residence. Additional observations during the interviews revealed the participants had limited mobility, fragile health conditions, lived in apartments or mobile homes, and would classify themselves in the lower tier of wealth. This is very consistent with previous findings of existing literature reviews on the topic. Recruitment of participants almost became a word of mouth campaign to find an adequate sample pool. Participants #4, #5, & #6 were the exception as they were located in an out of state casino. These were the only participants located in a public place away from their residence.

Introduction- Demographics of the Participants

Additional more robust networking and word-of-mouth recruitment helped locate the final participants. This added to the random nature of the study and limited researcher bias since the researcher had no prior personal knowledge of the participants. This smaller sample group of participants allowed for a more detailed analysis of participant experiences and perceptions.

The sample population (Table 2) is 15 participants listed by participant number. Table 2 lists their gender, age, how many years the participant smoked, and the state where they reside. A subset of three participants lived in Las Vegas, Nevada. A completely random walk-up request of the Las Vegas participants inside casino New York - New York was successful in garnering their participation in this research.

An Iowa fire chief referred participant #7 & #8. A home health nurse referred participant #9 after seeing the request on the City of Nevada Facebook site. Other than these direct referrals,

the remaining participants were located after returning home from prior medical events requiring hospitalization.

In other words, social media recruitment efforts produced negligible results. Although all local participants were aware of the department's social media request for smokers who use home oxygen, none proactively contacted the researcher themselves. Instead, each participant expressed a willingness to help once identified. This pattern reinforces a broader challenge previously discussed about the largely hidden presence of individuals who smoke while using home oxygen within communities across this country.

Table 2
Gender, Age, Smoking Demographics

Subject Number	Gender	Age	Years of Smoking	Location
1	Male	78	58	Iowa
2	Female	74	57	Iowa
3	Male	65	40	Iowa
4	Male	39	10	Las Vegas
5	Female	70	52	Las Vegas
6	Female	61	30	Las Vegas
7	Male	91	75	Iowa
8	Female	73	35	Iowa
9	Female	73	30	Iowa
10	Female	56	32	Iowa
11	Male	66	40	Iowa
12	Female	63	50	Iowa
13	Female	84	60	Iowa
14	Female	Died before interview	Medical event	
15	Male	Died before interview	Home Fire	

Note: The subjects of this research voluntarily participated in this study. This table represents a snapshot of gender, age, and smoking history of those interviewed.

The median age for the five (5) male participants was 67.8 years old. The male participants smoked an average of 40 years (with Participant #7 being an outlier due to having smoked 75 years, which is significantly more than the sample group). The median age for the

eight female participants was 69.3 years old. The female participants smoked an average 43 years. The oldest participant was 91 years of age and smoked for 75 years while the youngest was 39 and smoked for 10 years. All participants had a diagnosis of COPD requiring home oxygen therapy. Participants 1-13 answered all interview questions listed in Chapter 3.

It is appropriate in this section to address the circumstances surrounding participants #14 and #15. Both had scheduled appointments but died prior to their participation in the research study. Participant #14 died in the hospital from an acute medical event prior to the scheduled interview. Participant #15 died in a home fire after returning home from a recent hospitalization. The fire cause determination was careless smoking while using home oxygen. The loss of two individuals representing 13% of the sample population underscores the profound vulnerability of this population.

The entire collection of participants shared stories of on-going health concerns. Sadly, this population of individuals who smoke while using oxygen face an increased likelihood of morbidity and mortality due to the effects of their disease processes and their continued risky fire-related behaviors. To protect the identities of Participants #14 and #15 from outside media coverage, the location where participants #14 and #15 residences are blank in Table 2.

Research Results

The research instrument proved effective in gathering the depth of data needed to address the initial research questions. These questions centered on three core areas of research focus: gathering participants' awareness about their individual home oxygen fire risks, understanding the psychological factors contributing to smoking while using oxygen, and discovering the participant's behaviors based upon their individual perceptions of risk. The research helps weave

a connection between awareness, psychology, and behaviors among those individuals who smoke while using home oxygen.

To what extent are home oxygen users aware of the fire risks associated with smoking while using oxygen?

Eleven participants believe it is not easy to start a fire with a cigarette in close proximity to oxygen. Those participants did say it was possible but thought it took more than placing a cigarette next to the flow of oxygen from the cannula. It is noteworthy the three participants from Las Vegas were the only participants to question the possibility of starting a fire with a cigarette. Participant #6 said, "You have to be closer than a foot away from oxygen for anything to happen."

When asked to explain how oxygen tubing ignites when exposed to fire, eight participants believe oxygen will explode. Participant #9 believed 4 feet is the safety zone where nothing will ignite, even if oxygen is present in the room. Participant #6 (Las Vegas) said, "It is not possible to ignite oxygen tubing with a cigarette; it would take a lighter or candle for anything to happen."

Participants attribute previous experience, past employment, followed by exposure to HOT smokers as the leading source where they received their education pertaining to smoking and oxygen risks. Participants #1, #2, #7, #11, and #12 indicated a physician or a durable medical equipment provider provided education on fire risks about oxygen. In fact, #2, #7, and #11 specifically said the oxygen tank provider "gave them a book to read about oxygen." However, the participants indicate they have not read the book yet.

Participants, when asked, indicated they gained their knowledge about the risks associated with smoking and oxygen use primarily from family experiences. Participant #9

indicated both parents smoked while using oxygen. Participant #4 previously lived with roommates who smoked while using oxygen and subsequently had a home fire. Employer safety classes and fire department prevention messaging attributed to 45% of participant's knowledge base on oxygen risks.

An emerging central theme appeared that most of the participants could not articulate how oxygen ignites, what happens when it does ignite, and how they know what they know about fire risks from smoking and oxygen use. Very few individuals remember any specific safety rules pertaining to oxygen. This reinforces the notion the current practices mandating oxygen fire safety education are not effective in their current form of delivery.

What psychological factors contribute to the continued behavior of smoking while using home oxygen?

Johnny Carson, Rod Sterling from the Twilight Zone, the Marlboro Man, and Virginia Slims get credit for why Participants #1, #11, #3, and #2 started smoking. As Participant #1 explained, "It was a pro-smoking culture and a pack of smokes rolled up in your sleeve was either Camel or Marlboro cigarettes. An individual's cool factor depended on which brand you smoked." Participant #2 started smoking when she first heard the slogan, *"You've come a long way, Baby,"* famously used by Virginia Slims cigarettes in 1968 as part of the tobacco industry's efforts to attract women smokers. "It was empowering to smoke a thinner cigarette than what men smoked," says Participant #2. There was a consistent level of youthful excitement detected as participants recounted their smoking stories.

Two people started smoking to lose weight (Participants #2 and #10). Both reported addiction and minimal if any lost weight. The largest majority of participants said they smoke because it reduces their stress, it relaxes them, or they simply enjoy smoking. Participant #13

said, “For 60 years, I still enjoy the culture of having coffee and a good smoke every morning.” Participant #3 shared a common sentiment, “It was the cool thing to do back then.”

Participant #12 was the youngest individual to start smoking at the age of 13. “Hard to believe 50 years ago, some girls in the church parking lot asked me if I wanted a cigarette and I have been smoking them ever since.” All it took was one cigarette to develop an addiction, a common theme heard from most of the participants. Participant #12 reported pretending to smoke candy cigarettes as a child and when her mother was not watching, she would attempt to light them with a lighter.

When it comes to family tradition, Participant #13 indicated she would light her father’s pipe as a child and liked the smell of the tobacco. Participant #7 is the oldest participant in age and smoking history. Participant #7 started smoking when his father gave him his first cigarette at the age of 16. Participant #4 smoked marijuana with his parents as a teen and continues to smoke cigarettes he finds off the Las Vegas streets. Participant #4 attributed his COPD diagnosis to smoking *bad weed* and not from smoking cigarettes. Of the sample population interviewed, only two participants (#13 and #10) had regrets over smoking. Both repeated the same phrase almost word for word, “I wish I had never picked up that first cigarette; that was all it took.”

All participants except #12 report multiple attempts to quit smoking, which is consistent with previous literature on the topic. However, those experiencing the longest period of smoking cessation stated they quit *cold turkey*. This is contrary to the findings in previously reviewed literature.

Participant #13 said, “I just made up my mind to quit cold turkey. Well, I did it after I finished the pack of cigarettes in my glove box. I did not want them to go to waste after all.” This

reflects a consistent pattern that smokers place a strong attachment to cigarettes. An attachment that holds smokers powerless as they struggle against their own willpower.

Participant #7 quit several times. After experiencing stress attributed to their family, Participant #7 “I just wanted one” cigarette. Unfortunately, he found a pack of cigarettes on the side of the road and could not drive by them. “It was a sign to me that I should keep smoking and it made me feel better.” Based on the current cost for a pack of cigarettes, one has to wonder if finding a full pack of cigarettes on the side of the road was from someone else trying to quit smoking.

In all cases in which cessation attempts were unsuccessful, participants attributed their return to smoking to seemingly minor triggers. The smell of cigarettes at a job site, rising anxiety, habitual patterns like smoking when the phone rang, or sudden periods of stress were causes listed for an individual’s relapse.

Participants report undertaking some level of fire prevention activity now that they use home oxygen while continuing to smoke. Twelve of the thirteen participants engaged in some form of prevention behaviors. Common steps were smoking less, turning off the flow of oxygen, smoking outside the home, or outright cessation. Only participant #6 indicates nothing has changed from preexisting smoking habits. Participant #3 indicated they use nicotine patches to lower the number of cigarettes they smoke. They also installed new smoke alarms and stated they do not smoke around their oxygen concentrator. However, #3 says, “I won’t quit smoking 100%. Why would I give up something I enjoy?”

Stress was a common reason for participants to relapse from cessation efforts. It remains fascinating the value participants place on a pack of cigarettes. It is also interesting the hold smoking has over the participant’s lives given their compromised health conditions requiring

home oxygen. Imagine the degree of addiction it takes to stop your car upon seeing a pack of cigarettes on the side of the road. Consistently, almost all participants had attempted to quit smoking. Yet, very few could share success stories from having beaten their addiction.

How does a patient's perceptions of risk influence their behavior as it relates to smoking while using oxygen?

The questions in this section of the instrument tool were the most valuable means to understand the smokers' perceptions of risk. For any individual, it would seem the behavior of smoking while using oxygen would present an elevated risk to experience a home fire. All of the previously mentioned components of the fire triangle are present. Smoking while using home oxygen combines the essential fire ingredients of heat, fuel, and oxygen in one place in close proximity to each other. Questions 10 and 11, speak directly to general home fire risks and the perceived risk participants placed on their actions of smoking while using home oxygen.

Question 10 reads, *on a scale from 1-10 (one equaling a very low risk to 10 equaling very imminent risk), how likely are you to experience a home fire in general (not attributed to smoking and oxygen)? Why do you have that belief?* The question seeks to gather a baseline presumption of what the participants believe their everyday home life presents in terms of experiencing a home fire. Scores ranged from 0-6 (even though zero was never an option). The total scores provided by the 13 participants averaged 2.5 on the 1-10 scale. This is a common belief people hold that fires happen to other people, not themselves.

Participant #4 felt safe but rated their risk a three because other people routinely stay in their home. Participant #4 clarified, "I feel very safe from fire when no one is staying in my home." While answering this question, participants cited things like old circuit breakers, other guests, and poor conditions of rental properties.

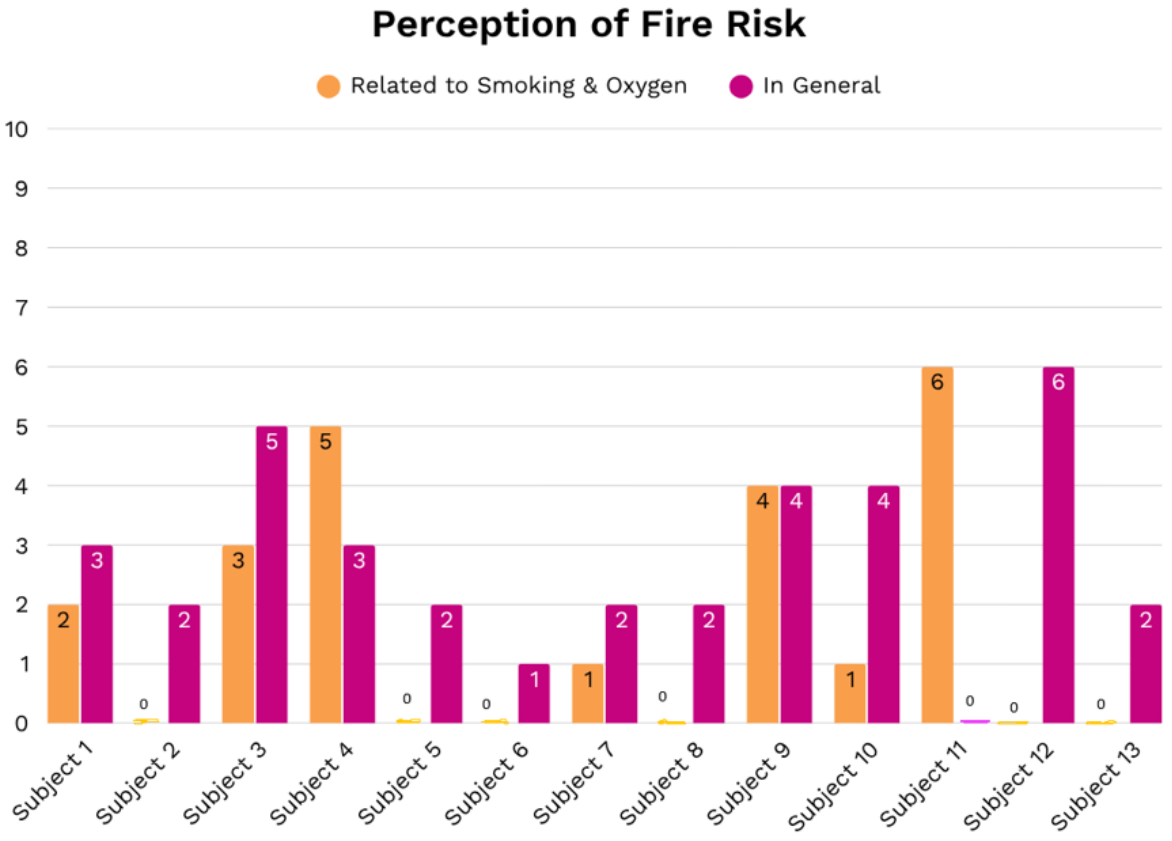
To contrast, question 11 asks, *using the same scale 1-10, how likely are you to experience a fire specifically related to smoking and oxygen? Why do you have that belief?* While only considering smoking and oxygen as the cause of a potential home fire, the average score was 1.6. The results indicate the participants perceive a lower hazard from smoking while using oxygen than general everyday life in their home.

Figure 1 shows the results in a side-by-side comparison of all thirteen of the participants. The left column (orange) reflects the participant's perception of experiencing a home fire caused by smoking and oxygen use. The right column (magenta) reflects the participants' perception of experiencing a home fire in general. The conclusions drawn from these two questions suggests all but two participants do not perceive an increased fire risk from smoking while using home oxygen.

Six participants (46%) ranked their risk of experiencing a home fire caused by smoking and oxygen use at zero (0). Even though zero was not a valid option in the 1-10 question, it is noteworthy as to the deep-seated conviction of those participants. Smoking and oxygen use is inherently dangerous yet almost half the participants rated their risk at zero. The participants pondered noticeably longer attempting to rank their general fire risk while sharing their ranking from smoking on oxygen without hesitation. More surprising, the same participants rated their general risks higher than their risk of smoking while using oxygen.

Participants #4 and #11 were the only participants who recognized their own risks are elevated from smoking compared to an overall general home fire risk. Comparing Participants #4 and #11 against the remaining sample pool, nothing stands out as different from the experiences others list. Participant #11 openly acknowledged the increased risk associated with smoking. The fear from a cigarette butt falling out of an ashtray concerned Participant #11.

Figure 1
Perception of Fire Risk



Participants #4 and #11 were acutely aware of the dangers smoking has in terms of causing fires. They fell short of attaching oxygen as a contributing factor to a possible fire's origin in their home. They acknowledged the dangers of smoking as a home fire risk, but did not consider the addition of oxygen as a contributing factor with a cigarette as a reason for a home fire.

Participant #5 is the only participant of the sample group who professes a hypervigilance when it comes to thinking about the consequences of a home fire, yet they scored their own risks low. The experience of living through a home fire as a child has caused Participant #5 to think more about home fires. Participant #9 says they did not consider the consequences of a home fire at all, but they too vaguely recalled an incident where two distant relatives died in a home fire.

The rest of the participants indicated they do not think about home fires. Out of the thirteen participants, four had some connection to a home fire involving the death of a family member or other close relative. Surprisingly, that did not influence their perceptions of having an increased fire risk associated with smoking and oxygen use.

Summary

The study collected data to demonstrate what participants know about the risks associated with smoking and oxygen. Participants could not articulate how oxygen ignites, what happens when it does ignite, and how they know what they know about fire risks from smoking and oxygen use. Very few individuals remember any specific safety rules pertaining to oxygen.

Participants enthusiastically shared why they started smoking and the specific circumstances that caused them to smoke their first cigarette. It is hard to comprehend how in one case alone, a participant of this study smoked over 75 years and can still recall the circumstances of their first cigarette. There is a powerful hold tobacco has on a smoker. It was almost hypnotizing hearing the stories from the participants. On one hand, participants describe how smoking helps their stress and anxiety. On the other hand, they are afflicted with serious health conditions from smoking for so long.

Finally, participants in most cases believe their home fire risks in general are slightly higher than risks associated with smoking and oxygen use. Participants rated their everyday home fire risk a combined average as 2.5 on a scale of 1-10, while rating their perception of a home fire caused by smoking and oxygen only at a combined average of 1.6 on a scale of 1-10.

Participants did not list health concerns or see an increased risk in adding oxygen to their everyday smoking behaviors. Participants did not mention the fiscal cost to themselves or their

self-reported social-economic status. The results require further analysis in Chapter 5 to draw research conclusions from the data collected.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This research study developed four central themes for consideration during the qualitative data collection process. The participants answered interview questions with ease and showed no concerns for their level of comfort during the interview process. All 13 participants appeared to enjoy participating in this research. The format was conversational in nature.

Very early into the research, it was obvious the discussions of the participants' overall health conditions rarely surfaced. It is difficult to tell if this was an intentional avoidance behavior. However, the visual manifestations showed individuals with weakened and compromised health. Participants felt more comfortable sitting during the interview and it seemed they were not overly active in their daily lives.

Summary of the Results

The research improved and expanded the previous knowledge of the fire service by studying the human elements associated with HOT fires. Previous research by Sheckter & Coffey (2024) shows the fiscal impact of HOT fires in the U.S. Yet, this research uniquely sheds light on individual perceptions directly from those individuals likely to experience a HOT fire.

If participants here are a reflection of a larger population of smokers who use oxygen, perhaps they too hold incorrect beliefs about how oxygen properties contribute to fire ignition. Placing oxygen in close proximity to the heat and fuel of a lit cigarette amounts to having an extreme risk of fire ignition. How can smokers' prescribed home oxygen have such confidence a fire will not happen to them? These risk denial behaviors make this population vulnerable to having a HOT fire.

Smoking cessation research from Tanash et al., (2017) & Ahmadi et al. (2024) aligns with this research study. Email communication from Lewarski (2025), referred to in chapter one

also supports the notion people try to stop smoking more than once during their time as a smoker. This participant group expressed multiple attempts at cessation. Unlike the previous existing research, this participant group found those with the longest period of cessation success quit cold turkey without guidance from their physician. The connection between smoking cessation success and HOT fires needs further research. Could the tobacco industry's efforts to "end combustion tobacco products" help the fire service significantly reduce HOT fires? If the tobacco industry is sincere in eliminating combustion products, the U.S. could see a dramatic 30% reduction of home fires annually.

Several common central themes developed directly from this research study. The participants did not fully understand the risks associated with oxygen when it ignites. There is a major disconnect in the education provided to participants about oxygen use in the home. This affects their ability to retain knowledge on the increased risks of having a significant and uncontrolled fire event.

Next, participants disassociate the connection between oxygen and smoking as it relates to their individual risks. Participants believe their smoking practices are safe. Overall, participants believe they have more risk of a home fire in general than from smoking while using oxygen. This way of thinking defies sound logic and shows a concerted effort of risk denial.

Consistently, the participants of this study shared accounts on some form of fire prevention steps they engage in to justify their continued unsafe behaviors. Further research on whether these steps are even effective would benefit the body of knowledge on preventing HOT fires.

More significantly, people who smoke while on oxygen are hard to find in any other location but their home. There are some outliers in this study, but for the most part, the

participants were homebound with limited social connections in the public. Access to this population will remain a challenge for the fire service. Employing government messaging and social media content is not effective to stir a call to action with the research population.

Conclusions Based Upon Your Results

The first major theme pertains to the general lack of awareness of what happens when oxygen is involved in a fire. Participants did not understand the speed at which fire grows; therefore, they discount the severity of a potential fire caused by cigarettes and oxygen. To be fair, this researcher also did not know exactly what would happen until several fire tests took place in controlled settings.

Participants hold an incorrect understanding of how fires could start with cigarettes and oxygen. This lack of awareness likely stems from the fact nothing has happened to the participants yet. In general, participants did not believe a fire could start by placing a lit cigarette near the oxygen nasal cannula. Most assumed a lit match, candle or direct flame was required to cause a fire involving oxygen.

Because the participants have not had a fire incident with oxygen while smoking, they are likely to continue engaging in risky behaviors that involve smoking while using oxygen. As stated earlier, the risk of fire ignition nearest the nasal cannula places the smoker at an increased likelihood of having a severe or life-threatening inhalation burn injury. Therefore, the act of smoking while using oxygen is dangerous as a continued behavior.

Along that same vein, it was rare for participants to recall the oxygen safety education they received at the time of home oxygen delivery. Durable medical equipment supply companies are required to provide oxygen safety education, warning placards, and even have the patient sign acknowledgement of such education. Still, it was atypical to find a participant who

remembered receiving those instructions. It begs the question, are the current methods of providing safety education effective for elderly COPD patients?

Recent discussions with DME providers suggest family members should play a larger role in providing home oxygen education for their loved ones. As families seek ways to keep elderly parents in their own homes, the DME has no choice but to leave the safety literature with the only occupant in the home at the time of oxygen delivery. Getting families to take direct responsibility for their parent's care and safety is not easy.

The second theme revolves around the smoking culture. Participants hold tightly to their smoking behavior and rationalize seemingly unsafe behaviors. The powerful role nicotine addiction plays in the psychological control of participants contributed to their risk denial behaviors. Participants defended continued smoking by blaming stress, anxiety, and loss of will power as justifications to smoke. Even those who quit smoking acknowledge triggers, even minor ones, can cause individuals to pick right back where they left off.

It was surprising to hear participants express a sense of enjoyment in smoking. The allure of the smoking culture and the initially described *need to fit in* was a very prevalent theme in the data collection process.

What the participants did not address was the connection between smoking and oxygen use. They answered questions about oxygen and fires, albeit incorrectly. However, it seemed like a complete subconscious dissection of the two components used together. The research instrument clearly tied smoking and oxygen use together, yet smokers mostly talked about their smoking behaviors and fire prevention practices. The physical properties of oxygen significantly and rapidly change the incipient stage of a fire. That concept was lost on all participants. The participants did not grasp the severity of an oxygen-fed fire.

Perhaps the most significant theme involved the participants' lack of perception involving their own fire risk. It seems illogical that participants believe their general risks of a home fire were higher than risks attributed to smoking and oxygen use. The participants seemed to justify their own belief, *it will never happen to me,* because of the prevention actions they take from those listed in Chapter 4. Overcoming this risk perception gap is an insurmountable adaptive problem to address.

Do all of the participants *actually* take steps to shut off their oxygen before smoking? If that is true, why are HOT fires so prevalent in the U.S.? Perhaps this sample group engaged in optimism bias and said they shut off the oxygen to appease the researcher. Given the frequency of HOT fires nationally, this researcher finds it difficult to believe 100% of the participants of this study engage in *safe* smoking practices. In fact, it would seem contrary to existing research data presented in Chapter 2. Truthfulness and engagement in optimism bias remain key concerns with this population.

There is a strange dichotomy at play in the research. Smoking with oxygen use is perhaps the most dangerous thing an individual could do to increase the likelihood of a home fire. Yet, the participants rated the risk extremely low. The majority of participants seem to disassociate the connection between smoking with oxygen use and the risks involved. Both Rickard (2014) and Kaushal & Rhodes (2015), suggest people who engage in risk denial behaviors are one negative experience from gaining a completely new perspective.

A final concerning theme is the contrast between the frequencies of HOT fires compared to the difficulty in locating people who smoke while using home oxygen. Social isolation, mobility limitations, poverty, and compromised health conditions make these individuals an "invisible" population for fire department outreach. Government messaging and social media are

not effective in stirring a call to action for this participant group. Creative partnerships designed to engage HOT participants at their homes are essential.

Addressing any community risk requires reaching and engaging the individuals who are directly affected. The inability to locate HOT users until they surface by calling 911 makes addressing these risks more difficult for the fire service. The participants felt comfortable participating with this study while in their own homes and in the public casino (a place of enjoyment). It is difficult to say if they would be as forthright and open if this research occurred in a healthcare setting with their physician. Somehow reaching participants in a place of comfort is highly recommended if replicating this research.

Limitations

There are some limitations with this research study. The researcher's role as a fire chief runs the risk of engaging in reflexivity or guiding the direction of the research. Despite all steps to remain unbiased in the research process, having a fire service background may heighten attention to safety issues discussed in the interviews giving them more weight compared to other less risky behaviors. The design of the instrument tool helped reduce this researcher bias.

Another more obvious limitation is the small mostly regional sample of research participants. The deaths of two participants prior to completing their interviews proved challenging in the middle of the study. The decision to find alternate participants or continue with fewer participants, while using their circumstances to shed light on the participant's health and risky smoking behaviors, limited additional data collection. However, it shows the continuous health and safety risks of this population.

The interview process allowed participants to self-disclose their individual smoking behaviors. Smoking has an overall negative societal standing so the research methods could

inadvertently allow an opportunity for participants to engage in social desirability bias. Because participants knew the research aims to address smoking and oxygen fires, it is likely they avoided disclosures of more risky smoking behaviors.

Finally, the initial recruitment methods were not effective in producing the sample population desired to complete the research. Finding those participants shifted at the midpoint of the research from a wide net social media approach to a snowball sampling practice to locate qualifying participants.

It is important to note, this sample population does not represent all smokers on oxygen and is only a sample from two states that are not within the COPD prevalence top 12 list for the Centers for Disease Control and Prevention. It is possible those states with higher incidence of COPD and increased poverty could yield different or more conclusive results.

Implications and Recommendations to the Field

Recommendation #1: Redesign the oxygen safety education HOT patients receive to make it more effective and repeated.

The saying "an ounce of prevention is worth a pound of cure*,"* especially holds true in addressing home oxygen fires. Current one-time oxygen safety education is not effective. Physicians, fire department public educators, and durable medical equipment providers must work together to create an effective program so participants have better retention of their home oxygen fire risks. That education needs repeated intervals more than a one-time initial home visit. The current safety education is not effective because patients did not remember who provided the education about home oxygen hazards.

Recommendation #2: Prioritize development of engineered safety solutions that minimize reliance on human behavior for oxygen fire safety.

The participants of this study believe they currently engage in safe smoking practices while using oxygen. As a result, they underestimate their actual risks. The continued disconnect over participant's perception of fire risk and their actual risks is concerning. Engineered solutions designed to mitigate the human fire risks from smoking while using oxygen are integral to reducing home oxygen therapy fires.

Since the risk of a fire is the highest concern, products that prevent fires or stop the flow of oxygen could reduce the severity and frequency of HOT fire events. Currently, thermal fuse technology is an example of such a product. A thermal fuse is a bi-directional valve that stops the flow of oxygen when a fire occurs. However, new innovative products made from materials that do not support combustion would benefit smokers in this high-risk category.

Recommendation #3: Develop government policy mandates requiring the use of engineered protections to protect smokers on oxygen from the risks they fail to acknowledge.

The participants of this study did not believe they were at risk of a fire event from smoking on oxygen despite the frequency of HOT fires. The Department of Veteran Affairs has mandated engineered solutions (i.e.: thermal fuses) since 2018 for all Veterans who use home oxygen. Their model of adoption shows that mandatory safety practices are possible.

Much like setting mandatory drunk driving alcohol limits or mandated seatbelt laws, private insurance industries, agencies responsible for funding healthcare and elected officials must proactively adopt policies and mandates to reduce costly fire losses from home oxygen fires caused by smoking.

Recommendation #4: Consider implementing a multi-discipline approach to engage individuals who smoke while using oxygen.

The fire service's traditional community risk reduction outreach programs will not be effective unless those affected are located. Collaborating with those who know where HOT patients live will offer the best chances for success. Home health care agencies, physicians, and durable medical providers working in concert with the local fire department offer the best chances for implementing meaningful risk reduction education and safety protection.

Social media messaging and government warnings do not resonate with this population of smokers on oxygen. If home oxygen therapy is in use in a residential setting, more emphasis on fire prevention safety and smoking cessation must be more of a priority. The participants in this study who live in multi-family apartment buildings affect more than their own safety when they smoke while using oxygen. Deaths from smoking and oxygen use are preventable.

Recommendations for Future Research

During the process of gathering data for this capstone, additional avenues of research emerged. First, a comparison of HOT deaths to the IAFC HOT Toolkit dashboard, and COPD prevalence from top 12 states would be helpful to determine if HOT fires could be predictable by state. Such pattern recognition would help to focus resources needed to address HOT fires. If HOT incidents are predictable, they are preventable.

Replication of this study on a large scale would determine if this sample population are outliers relating to their described prevention actions. Comparing this study to larger studies would benefit the body of knowledge on this topic of risk perception. The failure of these sample participants to recognize their actual fire risk while continuing to smoke using oxygen is a central theme that needs explored on a wider scale.

Finally, if government safety messaging, social media pieces or factors contributing to the demise of their own health were not effective motivators to cessation, future research focused

on what influences HOT smokers would benefit practitioners who engage in community risk reduction.

Conclusion

This research has determined that incidents of home oxygen fires occur more often from smoking cigarettes. A research gap exists between smoking and smoking while using home oxygen therapy. The central paradox shows that awareness does not equate to behavior change. Addiction overrides rational decision making to stop smoking while using home oxygen. People justify dangerous behaviors to maintain their level of comfort.

The research tool was effective in highlighting the level of control tobacco has over participants. The female participants of this study reflect the effectiveness of the tobacco industry to target females who are now the grown baby-boomers with significant COPD ailments. The fact two participants died prior to their scheduled interviews underscores the fragility and risk of this population. One of those deaths in a house fire was from smoking and oxygen use, case in point as to the urgent need for more research on home oxygen fires.

The findings underscore individuals involved in this study hold an incorrect understanding of what happens when oxygen ignites or how quickly fires develop. The research participants predominantly believe their smoking behaviors while using oxygen present less risk than general fire risks anyone faces in their homes.

At the completion of this capstone, this researcher learned that participant #3 had also recently died from COPD related medical complications. In just 4 months of research, three people in the intended participation group of 15 had died. One from a home fire caused by smoking and oxygen use, and two from COPD medical conditions. This disassociation of risk, in such a vulnerable health compromised population, speaks to the need for developing engineered

safety solutions to reduce their fire risk. A risk that remains unrecognized by this population group.

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Appendix A

NUCARA MEDICAL

MEDICAL HOME SAFETY ASSESSMENT

Pt. Name: _____

Address: _____ Date: _____

City, State, Zip: _____ Pt. Phone: _____

Pt. E-mail: _____ Alternate Phone: _____

Emergency Contact: _____ Emergency Phone: _____

Relationship to Pt.: Emergency E-mail:

FIRE SAFETY **OK or N/A**

- ☐ Hazards of Smoking
- ☐ Fire Extinguisher
- ☐ Emergency Numbers
- ☐ Well Ventilated Areas
- ☐ Comments:
- ☐ Smoke Detectors
- ☐ Flammable Materials
- ☐ Range (Gas, Electric

ELECTRICAL SAFETY **OK or N/A**

- ☐ Extension Cords
- ☐ Frayed Electrical Cords
- ☐ Overloaded Circuits
- ☐ Comments: _____
- ☐ Ground Outlets
- ☐ Proper Use of Space Heaters (Near 02 Cone.)

ENVIRONMENTAL SAFETY **OK or N/A**

- ☐ Stair Climbing
- ☐ Floor Surfaces, waxed floors, etc.
- ☐ Cluttered
- ☐ Bathroom Unsafe
- ☐ Comments: _____
- ☐ Loose Handrail/ No Handrails
- ☐ Narrow
- ☐ Carpets / Throw Rugs
- ☐ No Electricity

AMBULATORY/ FALL RISK **OK or N/A**

- ☐ Fear of Falling
- ☐ Balance Coordination
- ☐ Comments: _____
- ☐ History of Falls
- ☐ Gait Disturbances

DEMONSTRATE OPERATING PROCEDURES, EQUIPMENT FEATURES **OK or N/A**

SAFETY AND INFECTION CONTROL **OK or N/A**

- ☐ Proper handling of Sterile Supplies
- ☐ Mechanical Safety
- ☐ Comments:
- ☐ Proper Storage of Nutritional Formulas
- ☐ Proper Disposal of Bodily Fluids

SECURITY ASSESSMENT **OK or N/A**

- ☐ Pets
- ☐ Security Guard/ Gated Community
- ☐ Comments:_____
- ☐ Building Intercom/Buzzer

EQUIPMENT ORDERED **OK or N/A**

- ☐ Respiratory /Oxygen ***(Rx)***
- ☐ Suction Machine ***(Rx)***
- ☐ Ambulatory Aids ***(Rx)***
- ☐ CPM ***{Rx)***
- ☐ Hospital Beds
- ☐ Nebulizers ***(Rx)***
- ☐ Phototherapy ***(Rx)***
- ☐ Support Surfaces ***(Rx)***
- ☐ Other:_____
- ☐ Comments:
- ☐ CPAP / BiPAP ***(Rx)***
- ☐ Apnea Monitors ***(Rx)***
- ☐ Commode
- ☐ Enteral Pump ***(Rx)***
- ☐ Manual Wheelchairs
- ☐ Patient Lifts
- ☐ Seat Lifts
- ☐ Tens [redacted]
- ☐ Bath Safety

COMMENTS/ CONCERNS

_____ _____

NUCARA HOME MEDICAL EMPLOYEE SIGNATURE **DATE**

Appendix B

INTERVIEW CONSENT FORM

Identification of Purpose Statement

You are being asked to participate in a research study conducted by Raymond Reynolds. This research purpose is conducted to better understand a critical issue involving smoking habits that may contribute to home oxygen therapy (HOT) fires. HOT fires are of concern for the fire and emergency services agencies of this nation. The research will further knowledge on the issue and support completion of the researcher's participation in the Executive Fire Officer Program of the National Fire Academy.

Research Procedures

Should you decide to participate in this research, you will be asked to sign a consent form. The research will involve an interview to determine your awareness of smoking and oxygen fire risks, psychological factors involving smoking, and understanding your perception of risks while smoking. Your answers will be correlated in the three sections listed above. Your interview may be audio recorded for transcriptions purposes. You may choose not to answer any questions and your participation is completely voluntary.

Time Required

Participation in this interview will take approximately 25 minutes.

Risks

This researcher does not believe there to be any risks associated with this qualitative research interview. The questions are directed at smoking behaviors and are not intended to be a personal indictment of your smoking behaviors as it relates to the presence of oxygen. The National Fire Academy is not responsible for any outcomes or actions as a result of this study.

Benefits

There are no direct personal benefits as a result of participating in this study. However, your participation may provide valuable insight into the issue of human behaviors as it relates to HOT fire incidents nationally. Your participation will provide key insights into a very important issue and may contribute to other community risk reduction steps in the future.

Incentives

There are no financial or other incentives available for participating in this research study.

Confidentiality

At no time during the collection, transcription, or presentation of this research will your personal information be provided beyond gender and years of smoking. Outside readers of this research will not be able to ascertain the identity of the participants. Your information will be provided with a numerical code and referred to that code in all research.

Questions About the Study

At any time if you have questions about the study or research, you can contact:

Ray Reynolds, NFA Student

rreynolds@cityofnevadaiowa.org

Giving of Consent

I understand the intent of my involvement in this research and hereby consent that I have been fully informed of the purpose and intent of this research. I further state I am above the age of 18 and no promises or benefits have been made for my participation.

☐ I give my consent to participate in this interview. _____ (Interviewees initials)

☐ I give consent to be recorded during this interview. _____ (Interviewee initials)

Interviewer Signature		Date/Time:	

Appendix C

HOT INTERVIEW QUESTIONS

Awareness Factors:

- Do you think it is possible to start a fire with a cigarette used in close proximity to oxygen?
- Can you explain how oxygen tubing ignites when exposed to a source of fire ignition?
- Have you received any education (informal or formal) about the type of risks associated with smoking while using oxygen?
- Where did you gain your knowledge of those risks you explained above?

Psychological Factors:

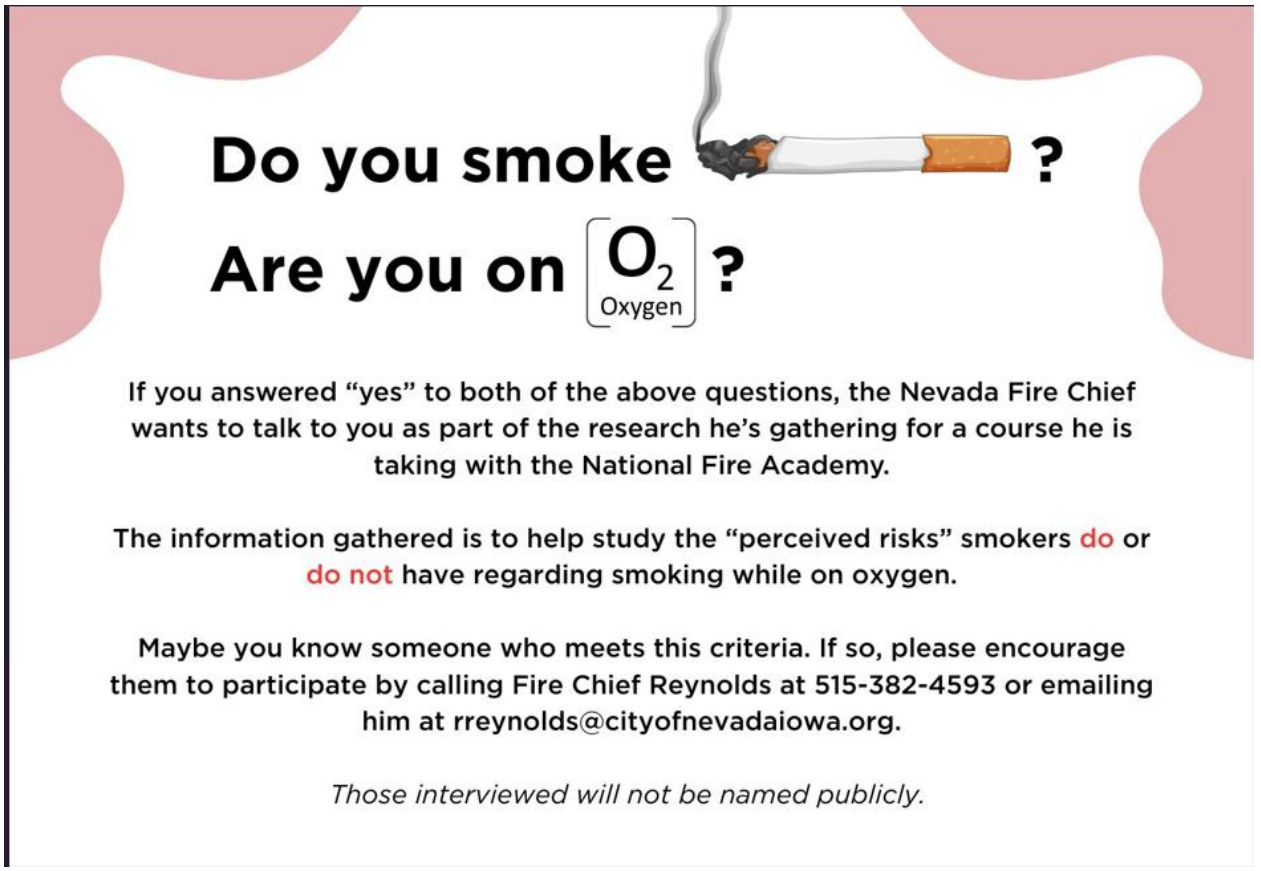
- In your own words, describe why you smoke and for how many years?
- Has there been a period of time when you quit smoking? Why or what reason would you give for returning to smoking?
- Can you stop smoking? Why or why not?
- What challenges would you have in order to stop smoking while using oxygen?
- After starting home oxygen, has your smoking behavior changed? (frequency, # of cigarettes smoked in a day, location you smoke at).

Perception of Risk:

- On a scale from 1-10 (1=very low risk to 10 =very high risk) how likely are you to experience a home fire in general (not attributed to smoking and oxygen)? Why do you have that belief?
- Using the same scale 1-10, how likely are you to experience a fire related to smoking and oxygen? Why do you have that belief?
- Do you consider the consequences of a home fire from smoking and oxygen use including injury to yourself and everyone in the home?
- What factors do you consider for forming your perception of the risk of fire from smoking while using oxygen?

Appendix D

SOCIAL MEDIA RESEARCH REQUEST

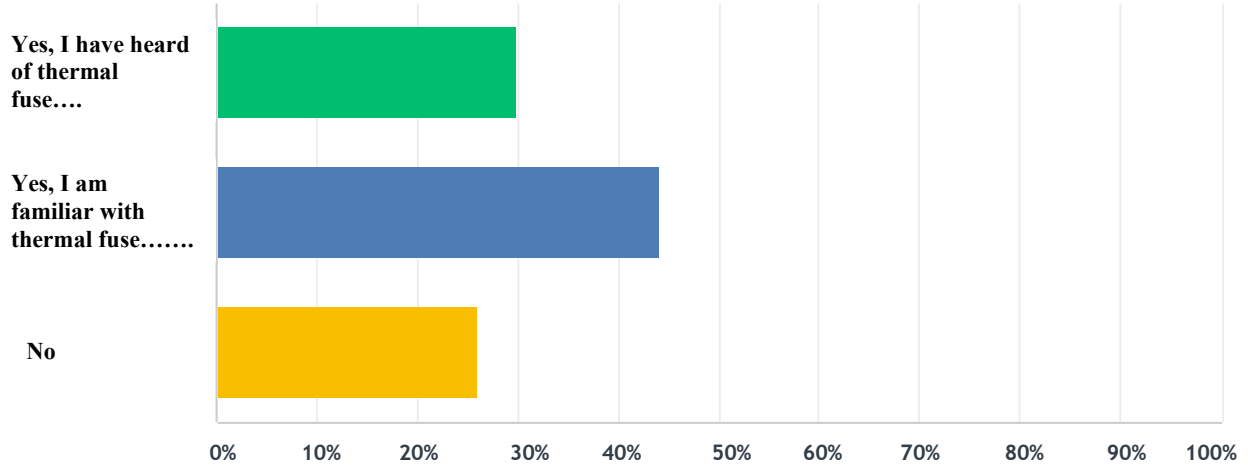


Appendix E

DURABLE MEDICAL EQUIPMENT PROVIDER SURVEY

Q1 Have you heard of thermal fuses?

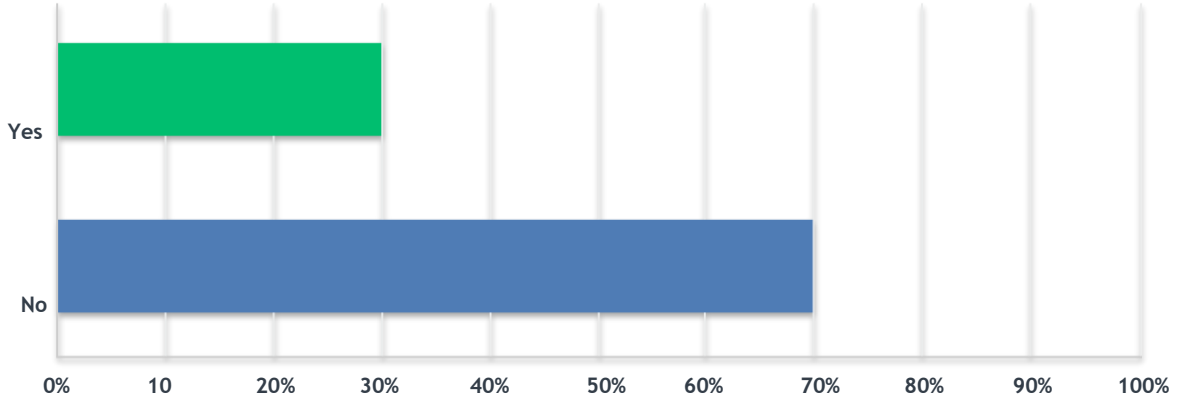
Answered: 104 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes, I have heard of thermal fuses but am not very familiar with them	29.81%	31
Yes, I am familiar with thermal fuses and am aware of how they are used and installed	44.23%	46
No	**25.96%**	**27**
TOTAL		**104**

Q2 Do you install them?

Answered: 104 Skipped: 0



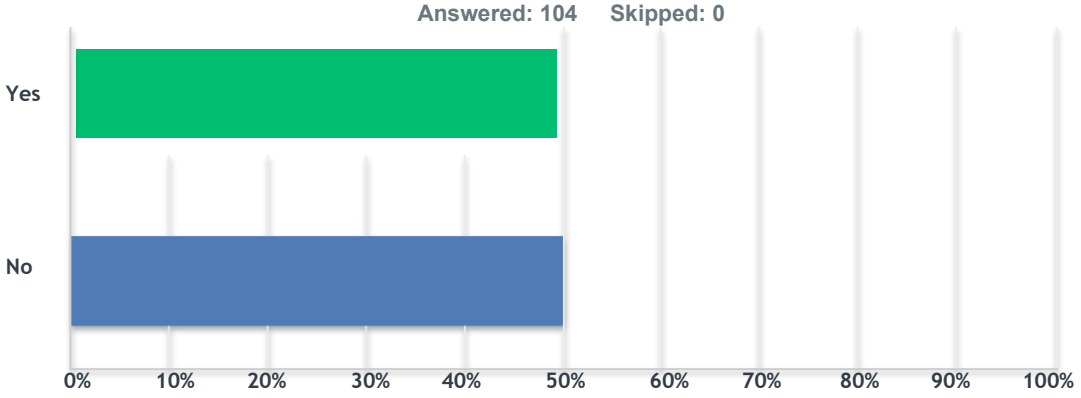
ANSWER CHOICES	RESPONSES	
Yes	30.77%	32
No	**69.13%**	**72**
TOTAL		**104**

Q3 If you already know that thermal fuses reduce home oxygen fires, what is the biggest obstacle preventing you from installing and using them?

Answered: 77 Skipped: 27

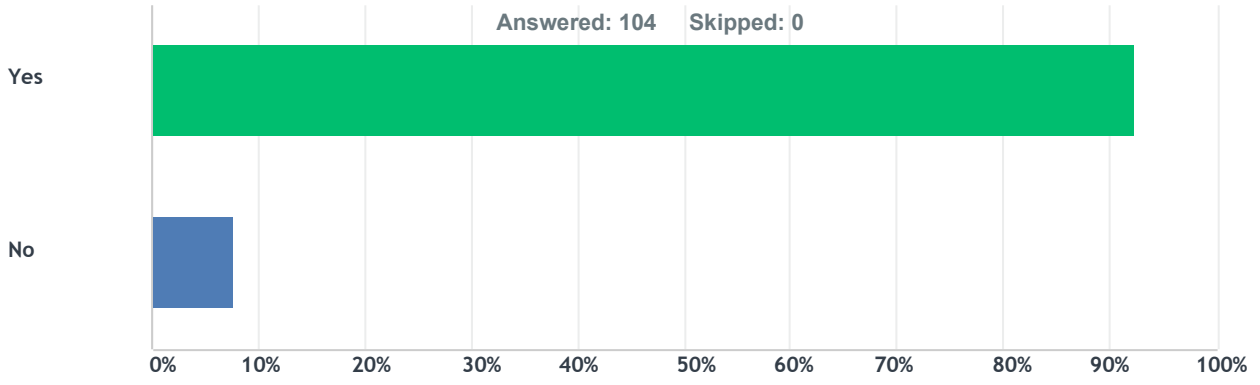
Q4 Have you had a patient who was injured or killed by a home oxygen fire?

Answered: 104 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	49.04%	51
No	**50.96%**	**53**
TOTAL		**104**

Q5 Would you install thermal fuses if they were of no cost to you and provided by another agency?

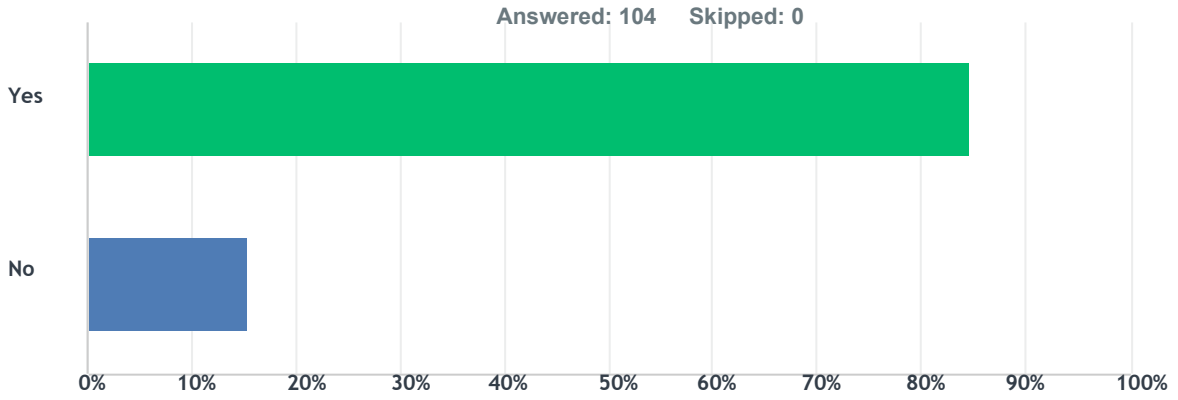


ANSWER CHOICES	RESPONSES	
Yes	92.31%	96
No	**7.69%**	**8**
TOTAL		**104**

Q6 On average, how many hours per year does a home oxygen patient require your services?

Answered: 88 Skipped: 16

Q7 Do you handle any state Medicaid oxygen patients?



ANSWER CHOICES	RESPONSES	
Yes	84.62%	88
No	15.38%	16
TOTAL		**104**