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Knowledge, Attitudes, and Beliefs Toward Third Hand Smoke

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This is to certify that the doctoral dissertation by

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MPH Walden University, 2015

BA University of Yaoundé 1 Cameroon, 2002

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Third hand smoke (THS) is gaining significant interest in the environmental and public health fields as a new but dangerous phenomenon. THS is identified as a form of passive smoke consisting of residual nicotine and chemicals that settle on surfaces. THS is reported to be genotoxic in human cells, yet the public has limited or no knowledge of this new concept. The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in an eastern U.S. state. Social cognitive theory provided the theoretical framework for this study. In-depth, open-ended interviews were conducted with 10 participants, comprised of smokers and nonsmokers, via video conferences that were recorded and interpreted/transcribed using Quirkos. Data were thematically analyzed, resulting in the following main themes: an overall lack of knowledge and beliefs about THS, nonchalant attitudes towards THS, and perceived dangers to human health with no existing practices to protect individuals even though possible modes of prevention are available. Participants stated that the lack of awareness was a foundational issue and that if this issue were addressed through education, their beliefs and attitudes would change. Positive social change could result from the findings of this study if used by policymakers, health practitioners, and community leaders to design THS-specific educational programs to increase the level of THS awareness and its danger to human health. State-funded campaigns to generate resources towards initiatives and new policies that promote smoke bans in homes and public places should be prioritized to promote social change.

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Chapter 1: Introduction to the Study

Third-hand smoke (THS), also known as involuntary smoke, and its effects are a new phenomenon in both the public health and environmental health fields as opposed to the knowledge of active smoking and second-hand smoke (SHS; Acuff et al., 2015). THS consists of residual smoke gases, particles, and dust that remain on surfaces, which under certain conditions can be emitted back into the air (Acuff et al., 2015). THS happens when chemicals in tobacco smoke from indoor, active smokers build up over a period and leave residue on carpets, walls, equipment, doors, and ceilings, which stays long after the smoke clears and smokers move out (Third-Hand Smoke Resource Center [TSRC], 2020). Arguder (2019) reported that THS reacts with various chemicals and forms toxic and poisonous tobacco-specific nitrosamines (TSNA) known to be deadly carcinogens. Further research identified other toxins, like hydrogen cyanide, butane, toluene, formaldehyde, radioactive polonium-210, and polycyclic aromatic hydrocarbons, besides TSNA in THS matter (Arguder, 2019). Subsequent studies revealed that THS has carcinogens that may initiate neurocognitive and respiratory problems (Delgado-Rendon et al., 2017). The National Environmental Health Association (NEHA; 2020) identified children, seniors, and pets as the most affected by THS via skin exposure, dust inhalation, and ingestion. Additionally, research has shown women suffer severely from active smoking, SHS, and THS with increased risk for asthma, cancer, cardiovascular disease, ocular disorders, diabetes mellitus, chronic bronchitis, early aging, and hip fracture (Ianosi & Jimborean, 2019).

Notably, despite public awareness of the numerous health effects of SHS, fewer individuals know about the possible dangers of THS or the prospective combined hazard of SHS and THS exposure (Delgado-Rendon et al., 2017). Other studies acknowledged the lack of research on the damaging effects of THS on human health despite potential additional risks of DNA damage, allergic symptoms, and brain and lung development in children (Arguder, 2019). Acuff et al. (2015) found an association between THS and elevated levels of nicotine in the hands of nonsmokers that live in homes previously occupied by smokers and ultimately end up in involuntary exposure. There is a lack of awareness of THS among the public, indicating that there is a dire need to study THS. According to Acuff et al., the public has a limited understanding of THS, explaining the subject's immature attitudes, beliefs, and knowledge toward THS. Additional studies on THS could ease and enable hazard identification, exposure, and risk assessment to tackle the health impact of THS on vulnerable populations. Studies need to include young children; seniors; women; individuals of lower socioeconomic status (SES); and the difference between THS, mainstream smoke (MS), and SHS (Acuff et al., 2015). The social implications of the current study include bridging gaps in the knowledge and understanding of THS, emphasizing levels of income and education, disease prevention, healthier communities, infant morbidity, and mortality, change in policies, and discrimination. THS should also be studied for biological evidence and political decisions to clear disproportions in understanding, mitigate nonsmokers' exposure to THS, and lower the cumulative dangers involved in the use of tobacco (Acuff et al., 2015).

In Chapter 1, I provide background information on the topic under study and discuss the problem statement, purpose, research questions, nature of the study, definitions, assumptions, scope and delimitations, limitations, and significance.

Background

There is limited literature about THS compared to other related subject areas, likely because it is a relatively new cigarette-associated subject (Chi-Yung, 2016). Nonetheless, available literature related to THS touches on THS, THS versus SHS, lack of awareness, health dangers in children, pregnant women, nonsmokers, beliefs, perceptions and attitudes, gaps, and multiunit housing. According to Cheng et al. (2019), environmental tobacco smoke (ETS) primarily consists of side stream smoke (SSS) from the burning end of a cigarette. It is defined as the residual contamination from cigarette smoke after it is put out. It can be detected in universally used clothing, such as wool, cotton, and polyester, and found to be greater in natural fiber than synthetic polyester fiber (Cheng et al., 2019). When compared to SHS, in terms of sources, Cheng et al. mentioned that an engaging smoker and Smoke expelled from the lit tobacco product make up SHS of exhaled MS. Both SHS and THS have reported associated diseases: SHS has been related to lung and oral cancers, asthma, chronic obstructive pulmonary disease, and coronary heart disease, while THS has been proven to be connected to allergic symptoms, asthma, and brain and lung development alterations in children (Cheng et al., 2019).

It is common public health knowledge that tobacco use is the prominent cause of death in the United States and globally, with cigarette smoking at the forefront of

preventable diseases for both smokers and nonsmokers (Acuff et al., 2015). Regrettably, knowledge of THS is uncommon. Research on THS has been documented to be new and is currently limited to animal studies (Acuff et al., 2015). More so, while the impact of active smoking and SHS is well known, the concept of THS is new to both the public health and environmental health fields, which leaves the public with inadequate information and immature attitudes and beliefs, which are validation of the need for future research (Acuff et al., 2015).

THS has demonstrated a health impact on children, pregnant women, pets, and seniors (Julius B. Richmond Center of Excellence, n.d.). According to Arguder (2019), THS consists of tobacco smoke compounds that can stay on internal surfaces and dust for months and re-released into the air in gaseous form with toxic productive capabilities due to chemical reactions. To emphasize that THS poses a health threat to children, spouses, and employees, Arguder explored THS exposure and found that THS components harm humans and their health, including DNA impairment, asthma, allergic symptoms, inflammation, and brain and lung development among children. Arguder also found an increase in lipid levels, cirrhosis, and nonalcoholic fatty liver disease, which leads to cancer and cardiovascular diseases. The study findings suggested that more acute neurological disorders and behavioral problems in children can arise with prolonged exposure (Arguder, 2019).

According to the TSRC (2020), individuals contact THS when their skin touches a THS-infested area, inhale THS chemicals in the air, or ingest residue from objects when they are put into the mouth. This transmission is a more common practice with children

and infants who spend most of their time close to the ground and in closed environments (Arguder, 2019). Researchers have advocated banning indoor smoking, such as in closed spaces, homes, workplaces, public transport, nursing homes, cars, restaurants, shopping centers, and hospitals, as the most basic THS prevention form (Arguder, 2019). Smokers should be encouraged to quit, and support should be offered to persons who try to stop while smokers stay separated from nonsmokers (Arguder, 2019). Kuo and Rees (2019) suggested that THS prevention can be attained by creating a broad, interdisciplinary research agenda that could advise on innovative policy approaches and provide a more comprehensive scientific base to inform public policy strategies. Additional health communication efforts should be made, and ETS risks should be explained to the public to encourage mitigation schemes.

As a result of THS's relative newness, knowledge gaps have been acknowledged. Kuo and Rees (2019) found a need for more understanding related to THS in Taiwan, such as definition, mode of production, health effects, and remediation strategies. This gap was further emphasized when Arguder (2019) admitted that THS comprises residue from cigarette smoke and particles settled on surfaces and dust; however, its effects on health are still under research and investigation. Delgado-Rendon et al. (2017) described the attitudes, knowledge, characteristics, and behaviors of THS among Hispanics from randomly chosen multiunit housing (MUH) units in Los Angeles to further expose the gap in awareness of THS. The participants acknowledged the harmful effects of SHS by 93%, but only 61% believed that THS is detrimental to children. Their study showed the need for health educators to raise awareness in the community, especially among parents,

to understand the risk and ways to protect their families from SHS and THS (Delgado-Rendon et al., 2017).

Problem Statement

THS, also known as tobacco smoke residue, is the residual nicotine and other chemicals left on a variety of indoor surfaces by tobacco smoke (Dale, 2014). THS increases the strength of nicotine and other smoke ingredients and constituents in indoor environments inhabited by nonsmokers (Bahl et al., 2014). Smoking and SHS have been well-researched (Agaku & Vardavas, 2013; Chen et al., 2013; Kaufmann et al., 2010). However, determining the dangers of THS has become a new research topic related to tobacco use and nicotine dependence. Few studies have specifically researched the perspectives, knowledge, attitudes, or beliefs surrounding THS.

Smoking and THS have known harmful effects on health. Sleiman et al. (2010) determined that the combination of chemicals and carcinogenic chemicals emanating from tobacco smoke is absorbed onto indoor surfaces that oxidize with ambient nitrous acid. This process will produce carcinogenic TSNAs. THS has also been shown to cause damage to the DNA of cells long after smoking has stopped (Hang et al., 2010). THS is thought to be associated with respiratory symptoms and other harmful health effects, including among most children whose airways are still narrow (Centers for Disease Control and Prevention [CDC], 2006). There has been a rise in childhood respiratory symptoms that correlate with THS (Cheraghi & Salvi, 2009). THS is known to affect children who accidentally ingest it, which can be caused by the presence of THS in enclosed spaces, like automobiles and residencies, where habitual smoking occurs (Hang

et al., 2013). Therefore, there is a critical need for THS awareness, especially among caregivers of young children. Seeking to understand the different perceptions of THS in six focus groups of smokers and nonsmokers, Escoffrey et al. (2013) asked 39 participants to respond to questions on whether they knew about THS and its harmful effects. The researchers found that most participants had not heard about THS and did not understand what THS could cause. Despite the mounting evidence of the adverse health effects of THS, there is a gap in how much public health and community awareness exists of THS. Understanding the current community's knowledge base may help design context-specific communications and awareness strategies on THS.

THS is a public health concern that will impact health outcomes now and in the future. Because THS is a new concept, the danger of increasing adverse health effects is worrying. In this study, I gathered the perspectives of community members about their knowledge regarding THS. The findings can lead to positive social change by being used to inform decision-making and promote awareness, understanding, and learning.

Purpose of the Study

The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in Baltimore County, Maryland. Participants in this study were smokers and nonsmokers. This study may help improve the knowledge and awareness of THS smoke dangers and improve individuals' long-term outcomes in the community.

Research Question

What is the knowledge, attitudes, practices, and beliefs of Baltimore County residents toward THS?

Theoretical Framework for the Study

The theoretical base for this study was the social cognitive theory (SCT), which is a social learning theory created by Albert Bandura in the early 1960s that explains how human behavior a collaboration of individual factors, behavior, and environment (Fertman & Allensworth, 2010) is. This project was based on the interactions and observations of smokers, nonsmokers, and reformed smokers about adults, children, infants, and pregnant women. According to the SCT, the behavior of an individual is determined by their personal (i.e., beliefs), environmental (i.e., social influences and physical structures in the environment), and behavioral factors (Fertman & Allensworth, 2010).

Nature of The Study

In this study, I used the qualitative method and an interpretive, descriptive approach that included individual, in-depth interviews. Qualitative research is consistent with a researcher or an inquirer who seeks to understand the level of knowledge, attitudes, practice, and beliefs regarding THS at a community level. The goal of this study was to design context-specific communications and awareness strategies and work with government partners to design effective THS policies and awareness programs. Baltimore County residents were interviewed at length to determine how much they know and if they have been directly or indirectly affected by THS.

Definitions

MS: A form of SHS; tobacco smoke puffed out by smokers that contains nicotine and numerous toxic chemicals that cause cancer (National Cancer Institute [NCI], 2020).

Passive smoking: When the smoke that emanates from a smoker is inhaled or breathed in by another possible nonsmoker; often referred to as SHS. Passive smoking has the potential to cause diseases. According to Anwar et al. (2020), passive smoking exposes adverse effects not only on birth weight and neonatal health but is also a crucial risk factor for respiratory diseases in children.

Reformed smoker: An adult who has smoked a minimum of 100 cigarettes in their lifetime but has stopped smoking for at least 12 months. Cao et al. (2016) researched the survival of reformed smokers, nonsmokers, and continuing smokers after a head and neck cancer diagnosis. They concluded that reformed smokers had a substantially lower risk of being diagnosed than those who continued to smoke and experienced the benefits of quitting within a few years after cessation.

SHS: Also called passive smoke; it occurs when an active smoker emits smoke from a lit cigarette that permeates the environment and is inhaled by nonsmokers in those surroundings (Prabhakar et al., 2019).

SSS: Another type of cigarette smoke, unlike MS, which active smokers exhale. If inhaled by a passive smoker, SSS becomes a danger in the growth and or progression of alcoholic-Hepatis B and Hepatitis C-associated cirrhosis and primary biliary cirrhosis (Kim et al., 2017). SSS can be a form of SHS due to its nicotine and other cancer-causing chemicals in its content (NCI, 2020).

Smoking: An act that involves the inhalation and exhalation of the fumes of burning plant material (Rose et al., 2019). Commonly smoked plant materials are marijuana and hashish; however, the act of smoking is universally linked with tobacco as smoked in a cigarette, cigar, or pipe (Rose et al., 2019).

THS: The residual contamination from tobacco smoke that dawdles in a part of a building, a room, or an area long after smoking has ended. THS stays on the clothes of an individual after they leave a smoky place or environment (American Non-Smokers' Rights Foundation [ANRF], 2019).

Assumptions

As a result of the relative newness of the concept of THS, I assumed that participants would understand little about the subject and would respond based on their imagination and perceptions, not on experience or facts. Another assumption was the study results would be based more on the documents read than firsthand knowledge from the respondents, which could prove that there is a lack of awareness of THS. Data such as this could also demonstrate a need for communication and education on THS to the vulnerable groups and the community. I assumed that the data may validate what researchers have already proven that THS is a public health concern but that few are aware of its harmful effects on health.

Scope and Delimitations

Specific aspects of the research problem included THS, its carcinogenic content, and subsequent effects and the lack of awareness of the health risks of THS, especially among vulnerable populations, like infants, pregnant women, seniors, and pets. I

examined the universal attitudes, beliefs, and knowledge related to THS, and the emphasis on these specific areas emanated from the results of previous research studies. Delgado-Rendon et al. (2017) described traits, attitudes, knowledge, and behaviors associated with SHS and THS in MUH units, maintaining that a small number of individuals know about the possible dangers of THS or the likely combined effect of SHS and THS. Fewer participants in their study believed that THS can harm children. Delgado Rendon et al. recommended that more studies be conducted on the topic and that there was a need to help educators step up and educate parents. Focus on these specific aspects could afford MUH units more extensive policy interventions that protect residents from THS, instructive intervention to inform them of their rights, and empowerment for action.

The population chosen for this study was adult smokers and nonsmokers. Children were excluded because they would not be able to understand the concept and express themselves fully. I chose to use the SCT as the theoretical framework for this study because of the theory's focus on the importance of self-regulation and the idea that a major part of human learning takes place within social contexts (see Schunk, 2012). Human learning and interaction include knowledge acquisition, beliefs, attitudes by engaging with others, and the repercussions of various behaviors (Schunk, 2012). The health belief model would have been suitable for this study because it is a behavior change model that describes how humans decide on their health and the consequences that follow, which might have fit well with MSrs in the study and their contribution towards THS (Boston University School of Public Health, 2022).

. In this study, I focused on humans' beliefs, perceptions, and knowledge towards THS, not the act of smoking. For this reason, the SCT was selected as the theoretical framework. The rational model could also have been suitable for this study because it targets individuals and groups, which aligns with the current study population (i.e., smokers and nonsmokers). This model encourages the dissemination of unbiased information that supports the lack of awareness gap in the current study. The rational model is based on the hypothesis that if a person's knowledge is increased on a given subject, behavior change will occur, which exemplifies the need for parents to be educated on the harmful effects of THS and raise awareness to increase prevention of certain THS-related illnesses in children. This study's results can be easily generalized to all populations because smoking is a universal problem, and THS comes from smoking; therefore, everyone is either a nonsmoker or has the potential to be exposed to a smoker.

Limitations

Limitations that could have affected the data and the overall study included inadequate previous research studies on the subject. Arguder (2019) mentioned that no study exists that shows the negative effects of THS in human health; however, studies have been conducted on mice in conditions that mimic THS exposure to humans. With the lack of previous studies on THS, Acuff et al. (2015) maintained that THS research is new. Only limited animal studies have been completed that investigate the health impacts of an individual THS-precise component (2015).

As a result of inadequate study, insufficient or a lack of data access also presents a limitation. A lack of awareness may have led to an insufficient sample size for statistical

measurement. Personal issues from smokers may have also led to a possible conflict, like denying to share information on family members' smoking status, which could be a cultural issue and lead to information bias. The lack of awareness of THS could have also caused selection bias or the likelihood of participants being retained in the study, which could have significantly hindered the outcomes of the findings. However, the study population was clearly defined and identified from the onset.

Significance

This study could be significant to health care providers because understanding the current community's knowledge base regarding THS could be a guide to designing context-specific communications and awareness strategies on THS. Both policymakers and nonsmokers will find this study significant because it will afford them a knowledge base from which to review policies and laws on cigarette smoke and tobacco control (see Arguder, 2019). After comprehending the community's awareness level, practices, and beliefs towards THS, systems can be created to support 100% smoke-free homes and cars. With this change, nonsmokers would not be exposed to THS, and smokers would be aware of THS, limit their smoking rate, and/or quit or restrict smoking in confined areas, which places the vulnerable at risk (Norton Cotton Cancer Center [NCCC], 2015). The information provided in this study is significant for children who live in households with smokers because they would not be susceptible to environmental pollutants. According to the NCCC (2015), environmental pollutants can react with other compounds in the environment, like the ozone, to create secondary pollutants. After a person smokes, pollutants remain in the gas phase that can be removed through ventilation; however, a

substantial fraction adheres to indoor surfaces and continues over time that range from a few seconds to several weeks or months unknown to persons living in those spaces (Matt et al., 2011). Hang et al. (2015) maintained that THS is responsible for the high levels of DNA destruction found in humans' cells. This understanding of THS is significant to professional practitioners because it would give them additional reasons to transform tobacco control policies, legislate a ban on indoor smoking, and develop new prevention strategies.

Summary

I conducted the qualitative study on THS, and the identified population was smokers and nonsmokers in the United States. THS is a relatively new concept with underlying effects on individuals' health and well-being. There is a global lack of awareness on this subject and a need for education focusing on transmission and prevention modes, especially among at-risk populations. The findings of this study may improve the community's knowledge, attitudes, practice, and beliefs regarding THS to improve their health outcomes. In Chapter 2, I will present the literature review and provide more detailed information about the theoretical framework.

Chapter 2: Literature Review

Smoking is an act that involves the inhalation and exhalation of the fumes of burning plant material (Rose et al., 2019). Commonly smoked plant materials are marijuana and hashish; however, the act of smoking is universally linked with tobacco as smoked in a cigarette, cigar, or pipe (Rose et al., 2019). Smoking is among the leading causes of preventable death globally with negative health effects due to smoke inhalation, which comes with challenges to different physiologic processes, like respiration (Nivethitha & Jain, 2018). The National Institutes of Health (NIH; 2020) reported that smoking damages nearly every organ of the body. One in 5 deaths in the United States are caused by smoking, which is accompanied by health problems, like cancers (i.e., lung and oral), lung diseases, blood clots, vision problems, and damage and thickening of blood vessels (NIH, 2020). In recent studies, tobacco smoking was identified as a global problem, serious public health concern, and key cause of morbidity and mortality (Nivethitha & Jain, 2018). Araújo and Costa (2019) noted that processed tobacco and a synthetic filter are two basic components in cigarettes with over 5,000 compounds found in their composition. Among these compounds, a minimum of 150 have been documented as highly toxic due to their carcinogenic and mutagenic potential (Araujo & Costa, 2019). The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in Baltimore County, Maryland.

Search Strategy

To research THS as a public health concern among Baltimore County residents for this literature review, I used the following keyword search terms and combinations: *THS, primary and second hand smoke exposure, reformed smoker, residual nicotin*e, *contaminated surfaces, tobacco residue, mainstream and sidestream smoke, formation of carcinogens, prenatal risk, toddlers, mental illness, hazards, socioeconomic conditions, vulnerable populations, transmission, prevention, behaviors , attitudes, knowledge*, and *social cognitive theory of well-being*. The Walden University Library provided access to the Academic Search Complete, Dissertations and Theses, ProQuest Central, PubMed, World Health Organization databases. I searched for online journals, books, and government resources focused on the knowledge, beliefs, and practices surrounding THS. The search of the previously listed terms was narrowed down to only yield peer-reviewed, scholarly journals with publication dates between 2015–2021.

Theoretical Framework

The theoretical base for this study was the SCT, which is a social learning theory created by Albert Bandura in the early 1960s and explains human behavior as a collaboration of individual factors, behavior, and the environment (Fertman & Allensworth, 2010). According to LaMorte (2019), Bandura initiated the SCT began as the social learning theory in the 1960s and later evolved into the SCT in 1986. In this theory, Bandura posited that, for learning to take place, there must be an interaction between an individual, their environment, and a behavior (LaMorte, 2019). Behaviors of concern could be tobacco cessation, weight gain or loss, or drug addiction. According to

Hou (2014), the SCT blends the essential elements of the social learning theory and the principles of learning by observation and vicarious learning. Among the three main factors identified as effective in behavior change, a sense of self efficacy can help the person endure obstacles more, but a lack of self-efficacy will lead to a lack of ambition and poor resilience (Hou, 2014). In a recent study on the use of tobacco amongst 271 adult Muslims in the United States, Attarabeen et al. (2019) used the SCT and found that interventions that were family centered and affirmed self-efficacy and individual repercussions to stop tobacco use had a higher probability of success in reducing the rate of tobacco use. A unique feature of SCT is the importance it places on social influence alongside intrinsic and extrinsic social reinforcement (LaMorte, 2019).

There is no tobacco persistent pollution on surfaces and in the air that becomes THS without an initiation of the act of smoking by a smoker. A significant prevention method against the harmful effects of THS is the development of policies and procedures for smoke-free spaces like airports and MUHs by policy makers. The SCT aligned with the current study because of the outcome expectancies tied to it. A smoker who lives in an environment with an effective ban on smoking may be forced to stop smoking completely or in tight spaces as a result of the repercussions that may follow. This one action allows nonsmokers to enjoy clean air and a clean environment with no fear of contact with contaminated surfaces. According to the ANRF (2021), as of 2021, a minimum of 634 U.S. airports are 100% free of indoor smoke, which includes airline clubs, passenger terminals, and noncommunity work areas. Community health education

focused on raising awareness on how THS affects children can empower more parents to consider quitting smoking to keep their children safe.

A significant reason that I chose the SCT as the theoretical framework is because this study stemmed from its applicability to change the behaviors of individuals and its emphasis on the individual and the environment (see LaMorte, 2019). This is in alignment with tobacco use, a major determinant of THS. According to Attarabeen et al. (2019), the use of tobacco is fully related to multiple behavioral disorders like substance abuse. In a recent study of substance use among Nepalese youths, Bhandari et al. (2021) determined that the ease of availability of substances, like alcohol, tobacco, and marijuana, in the near environments, such as neighborhoods and local markets, encouraged the youths to try it for the first time. This outcome ties in with the SCT concept of reciprocal determinism, whereby behavior outcomes are based on the individual's behavior and the environment in which the behavior is carried out (Glanz et al., 2015).

Furthermore, the SCT aligned with the current study in that while in SCT it is put forth that behavior can be changed by both internal (i.e., self-efficacy) and external factors (i.e., environment and behavior of others), the knowledge and beliefs towards THS equally posit that THS results from the contamination of tobacco that persists in the air and surfaces (i.e., environment) after an individual has stopped smoking (i.e., behavior; TSRC, 2021). Health promotion to raise awareness of THS and its effects on health, especially on children who are the most vulnerable, can be achieved by reinforcing the knowledge of THS's devastating health effects on adults (i.e., smokers)

while enforcing policies and procedures that penalize persons who practice and model smoking in smoke-free zones. According to the SCT, behavior is an interaction between cognitive and environmental influences known as "triadic reciprocality" (Attarabeen et al., 2019). As a result, the SCT was appropriate to use as the theoretical framework in this study to address the main research question with an answer that is inclusive of both cognitive and environmental factors.

Health Risks of Tobacco Use/Smoking

The CDC (2018a) defined *health* as a multidimensional construct that encompasses the physical, mental, and social spheres. As proven by research, the use of tobacco has emerged among the leading contributing risk factors to poor health in recent years (Adams, 2019). In the United States alone, an estimated 34 million adults smoke with devastating repercussions on their health (Adams, 2019). Individuals who smoke tobacco products, cigarettes, and cigars included, are susceptible to 9 of every 10 occurrences of lung cancer; however, smoking can bring about cancer anywhere in the human body, including the bladder, blood, colon and rectum, esophagus, kidney, renal pelvis, liver, lungs, bronchi and trachea, mouth and throat, pancreas, stomach, and larynx (CDC, 2019b). Butler et al. (2019) identified lung cancer as the second most diagnosed cancer with the highest death toll in the United States and recognized tobacco smoke exposure and radon inducement as a major contributing factor. Butler et al. suggested that educational interventions and reduced radon exposure can help limit the occurrence of lung cancer.

Besides cancer, cardiovascular diseases (CVDs) are also among the leading causes of morbidity and mortality in men and women in the United States and worldwide (Gawlik et al., 2018). Like in the case of cancer, smoking has been identified and recognized as a risk factor for CVDs and many other protracted diseases (Gawlik et al., 2018). Implementing simple behavior modifications, like aspirin therapy and smoking cessation, can prevent CVDs (Gawlik et al., 2018). In a study designed to evaluate sex-precise incidence of CVDs amid an Iranian population with diverse smoking habits, Amiri et al. (2019) determined that male smokers who were smoking at the time of the study had an increased risk of incidence of CVDs. This evidence further confirms tobacco use/smoking as a health risk.

Additionally, COPD is among the health risks of tobacco use. Martinez (2016) reported that in the United States, more individuals die from COPD than any other condition except for cancer and CVDs. Martinez added that the most popular cause of COPD is smoking and in poor countries, exposure to biomass smoke. No known curative therapy exists for COPD except palliative treatments, like smoking cessation (Martinez, 2016). Factors to be noted in relation to COPD and smoking as risk factors are age, smoking rates, and introduction time to cigarettes. Hamed et al. (2019) found that though tobacco smoking is the principal danger of COPD, the number of cigarettes smoked per day and the age at which the individual is introduced to smoking affects the incidence of the disease. Furthermore, the third and fourth decades of a person's life are when lung function attains its maximum level and begins to deteriorate (Hamed et al., 2019).

Another significant health risk of tobacco use arises during pregnancy. Pregnancy can be one of the joyous times in a woman's life; however, smoking while pregnant can result in health risks, like stillbirth and premature deliveries, sudden infant death syndrome, growth retardation, and other long-term consequences that can affect the health and development of a child (Hansen et al., 2018). Smoking during pregnancy is a preceding but preventable cause of poor pregnancy endings, yet about 14% of pregnant women smoke on a regular basis (Taghavi et al., 2018). In a study to explore the different perceptions associated with smoking risks during pregnancy by Alaska Native women, Bronars et al. (2018) reported that a greater part of both pregnant nonsmokers and pregnant smokers believed that the health of the baby could be negatively impacted by smoking. The adult children of women who smoke while pregnant have a higher probability of developing dependence to nicotine than those adult children of women who did not smoke while pregnant (Bronars et al., 2018). This increases the danger of tobacco use during pregnancy and demonstrates a need for early smoking cessation and prevention of relapse postpartum to improve the health outcomes of women who are pregnant (Bronars et al., 2018). Additional complications that may arise from tobacco use during pregnancy include placenta previa, attention deficit disorder, increased risk for respiratory infections, and spontaneous abortion (Bronars et al., 2018).

Another health risk of smoking is the emergence of mental illness. Jelaidan et al. (2018) defined mental illness as a health condition that involves a change in thinking, emotion, behavior, or a combination of all three. On the other hand, mental health is believed to signify a psychological state whereby a person functions at an agreeable level

of emotional and behavioral adjustment (Malik et al., 2015). The health effects of smoking are not limited to the physical level alone because smoking also impacts the mental level. In a study to evaluate and compare the mental health status of smokers and nonsmokers, Malik et al. (2015) reported that smokers had poorer mental health than nonsmokers, an indication that programs are needed to address the mental health complications of smokers. The prevalence of smoking among individuals with poorer mental health is higher and they suffer from higher levels of nicotine dependency, which then exposes them to smoke related harm.

According to the CDC (2018a), smoking is more common among adults with mental health disorders like anxiety and depression than the general population. Statistically, nearly 3 out of every 10 cigarettes smoked by adults are smoked by mental health victims, which could explain the higher rate of depression and anxiety among smokers than nonsmokers (CDC, 2018a). The male sex, older age, tertiary level of education, alcohol use, bipolar, personality, schizophrenia, and schizoaffective disorders, and unipolar depression have been associated with tobacco dependence (Molla et al., 2017). Based on these findings, tobacco use has a major impact on the mental health of individuals. In the following paragraphs, I delve into the health risks of tobacco through the environment in the light of SHS and THS.

Tobacco use also affects an individual's eyes. The CDC (2018b) maintained that, as much as smoking affects the rest of the body, the eyes also suffer, with smoking causing life-threatening eye conditions that can result in vision loss and blindness. According to Goutham et al. (2017), low vision and blindness are significant health

problems that challenge millions of individuals worldwide. Two distinguished threats of tobacco use to the eyesight are age-related macular degeneration and cataracts (CDC, 2018b). Glaucoma and diabetic retinopathy are also listed (Goutham et al., 2017). Age-related macular degeneration affects the central vision necessary to see objects visibly and for common duties, like reading, face recognition, and driving, while bringing about blurry vision that deteriorates over time (CDC, 2018b). Additionally, Goutham et al. listed tobacco use among other risk factors for cataract development besides abuse of alcohol and unhealthy eating habits. In a study on the association between visual impairment and tobacco use, Fernandes et al. (2019) found that the harmful contents of cigarette smoke to health are associated with a reduction of cortical thickness that involves the medial and lateral frontal cortex and a decrease in activity of the occipital cortex. Their results showed that persons who smoked heavily did worse on eyesight degeneration than persons who did not smoke as much (Fernandes et al., 2019). Cessation from tobacco use has thus been documented as the best way to protect from the damage to eyesight that is associated to smoking (CDC, 2018b).

Tobacco or cigarette smoke have an effect on employees' productivity and overall performance at the workplace (Najafi et al., 2016). Najafi et al. (2016) reported that the use of tobacco was extensively higher among the employees with hypertension (HTN), diabetes, and heart disease and recommended preventive public health policies be made mandatory, mainly for youths and male employees, to further their knowledge concerning the disadvantages of cigarette smoke and the use of tobacco. Overall, tobacco use, and

cigarette smoke negatively impact the health of individuals both directly and indirectly through the environment.

Smoking Terms Explained: MS, SSS, SHS, and THS

It is important to distinguish between the terms associated with tobacco use, including MS, SSS, SHS, and THS. MS, a form of SHS, is tobacco smoke breathed or puffed out by smokers that contains nicotine and numerous toxic chemicals that cause cancer (NCI, 2020). Cigarette MS is a dynamic aerosol with over 5,000 chemical constituents, particulate phase, and gas phase, which can be passed into the bloodstream by means of pulmonary circulation and can develop into a strong and latent systemic action (Zhang et al., 2019). When an individual inhales MS, their risk of developing cancer surges as does the risk of other health problems, like heart and lung diseases (NCI, 2020).

While MS is the smoke drawn in by the smoker and exhaled into the environment, SSS is the smoke that is emitted from the end of a burning cigarette, cigar, or pipe (Eldridge, 2020). Unlike MS, whose exposure ends when an individual puts out their cigarette, SSS continues and affects both smokers and nonsmokers for as long as the individuals are in that environment (Elkridge, 2020). The amount of SSS an individual is exposed to is altered by humidity, air temperature, ventilation of smoking space, and number of smokers present (Elkridge, 2020). Some harmful contents of SSS include benzene (i.e., a carcinogen), hydrogen cyanide, formaldehyde, nicotine, and carbon monoxide (Elkridge, 2020). Yang and Ibuki (2018) confirmed that SSS emitted from the burning tip of a cigarette is more harmful and mutagenic than MS exhaled by an

individual that smokes. There is a difference produced by the unfinished burning of tobacco, which leads to a higher concentration of the biochemical carbon monoxide, 2-naphthylamine, 4-aminobiphenyl, and N-nitrosodimethylamine than in the MS that a smoker lets out (Elkridge, 2020). All in all, in comparison to MS, SSS has been found to be 4 times more lethal in total particulate matter, 3 times more harmful per gram, and 6 times more tumorigenic (Elkridge, 2020). SSS is more dangerous than MS because of the higher concentration of chemicals due to its burn at a lower temperature and its production of smaller particles, which makes it easier to penetrate our bodily tissues (Elkridge, 2020).

SHS occurs when active smokers emit smoke that permeates the environment and is inhaled by nonsmokers in those surroundings (Prabhakar et al., 2019). SHS is responsible for over 41,000 deaths annually in the United States and causes or aggravates damaging health effects, like lung cancer, asthma, heart disease, and respiratory infections in adults and children (American Lung Association, 2020). Ndlovu et al. (2020) stated that lack of time, tobacco use by health professionals, insufficient knowledge on tobacco control strategies, and anxiety to push away clients as major roadblocks to reducing SHS, especially in underdeveloped world. There is evidently no safe level of exposure for SHS, thus there is a demand on the role of health professionals, environmental specialists, town planners, and law enforcement officers to prevent SHS exposure (Ndlovu et al., 2020).

Slightly converse to SHS is THS, which is a relatively newer concept than SHS. Residual contamination from tobacco smoke that remains in a part of a building, a room,

or an area long after smoking has ended, and stays on clothes after a person leaves a smoky place is called THS (ANRF, 2019). Exposure of THS takes place when toxins are formed when substances in THS interact with environmental chemicals like nitrous oxide that creates nitrosamines and the reaction of volatile organic compounds with ozone air to produce formaldehyde (Elkridge, 2020). Exposure to THS is mainly through inhalation, ingestion, and dermal absorption. There are multiple similarities in the prevention modes of both THS and SHS such as government institution of comprehensive legislation and voluntary policies that protects residents from smoke (Unger et al., 2019).

SHS Exposure

A major form of ETS exposure is SHS. According to the CDC (2018a), SHS happens when smoke from a burning end of a cigarette, cigar, and pipe conjoins with the smoke exhaled by smokers (CDC, 2018a). This form of smoke is dangerous to both adults and children as it contains over 7,000 chemicals, hundreds that are deadly, and 70 that cause cancer (CDC, 2018a). SHS, also called passive smoke, occurs when active smokers emit smoke, which permeates the environment and inflicts its inhalation by nonsmokers in those surroundings (Prabhakar et al., 2019). Sadly, this can come with disability and death. Kuang et al. (2018) upheld the statistic that a minimum of 250 toxic chemicals are contained in SHS, 50 of which have been recognized as carcinogenic. Secondhand smoke exposure (SHSE) is linked to a growing risk of cancers, respiratory and cardiovascular events, and illnesses, alongside other protracted conditions (Haig et al., 2019). Exposure to SHS ensues in homes, workplaces, public places, cars, and other vehicles (CDC, 2018b). Additional statistics include an affirmation by the CDC that

34,000 premature deaths from heart attacks occur in the United States each year, which are caused by SHS. More so, individuals who do not smoke but are exposed to SHS at home, work, cars, and restaurants increase their risk of suffering a heart attack by 25%–30%, stroke by 20%–30%, and annual deaths from stroke are over 8,000 (CDC, 2018b). Prabhakar et al. (2019) established that SHS falls into two classifications: (a) MS, which is the smoke exhaled by the principal smoker and (b) SSS, which is the smoke that is discharged from the end of a cigar or hookah and considered more dangerous than MS. This is because the toxic substances in SSS continue to linger for a longer period after the cigarette has been extinguished (Prabhakar et al., 2019).

The burden of health risks attributed to SHS is more on children than adults because children take more breaths than adults (Prabhakar et al., 2019). Immediate effects of SHS are seen on the cardiovascular system and can bring about coronary disease and stroke (Prabhakar et al., 2019). It is important to note that, SHS contains four times more destructive compounds than mainstream and brings about 41,000 deaths among adults who do not smoke, 400 deaths in children annually, and production loss of approximately $5.6 billion a year (Akpinar, 2019).

In reference to SHS and its effects on prenatal development, SHS exposure may trigger preterm birth, a risk factor for future asthmatic experiences, decreased gross motor function, and hospitalizations (Akpinar, 2019). It has been determined that prenatal and postnatal exposure to tobacco smoke is linked with health impairments like cognitive dysfunction, learning disability and behavior, and communication and attention-deficit disorders (Akpinar, 2019). A government-regulated decree for a smoke-free environment

that includes private cars, open areas of public places, and homes may be effective in reducing SHS (Akpinar, 2019).

In relation to the environment, SHS comes with debilitating effects as well. In a study to investigate the relationship between exposure to SHS and adult mortality, Diver et al. (2018) evaluated the associations of early years and adult SHS exposure with mortality from all causes that ranged from ischemic heart disease to COPD among 70,900 men and women nonsmokers and found that childhood and adulthood SHS exposure increased the risk of death from COPD. Adult SHS is profoundly associated with higher mortality from vascular disease, which is consistent with previous studies (Diver et al., 2018). In another study that analyzed the relationship between SHS exposure and heavy metal intensities in children, Li et al. (2018) demonstrated that children who were exposed to SHS had a higher level of cadmium accumulation and lead in their bodies. In light of this, it is safe to conclude that SHS exposure should be reduced not only during childhood but throughout life (Diver et al., 2018).

The most dangerous side effect of SHS on children is sudden infant death syndrome (SIDS), which is the unexpected, unexplained, sudden death of an infant while in their first year of life (CDC, 2018b). Unfortunately, SIDS is now considered the leading cause of death in otherwise healthy infants, and it happens in the first year of life in developed nations (Ton et al., 2017). Some of the ways through which SHS enhances the danger of SIDS are pregnant women who smoke while pregnant, exposure of infants to SHS after birth, and the effect of chemicals in SHS on the brain such that it interferes with its regulation of breathing (CDC, 2018b). Lastly, infants lost to SIDS are found to

have had a higher concentration of nicotine trapped in their lungs and higher levels of cotinine, a biological marker for SHS exposure, than infants who die from different causes (Ton et al., 2017). Studies show that 85% of SIDS infants are exposed to tobacco smoke in utero (Ton et al., 2017). Further, Ton et al. mentioned (2017) that most pregnant women who want to quit smoking go for nicotine replacement therapies. However, data from Ton et al.'s has shown that in utero, introduction to nicotine damages the development of the conduction system and the demonstration of key sodium channels that take part in cardiac automaticity, which asserts that nicotine replacement therapies during pregnancy increase the risk for SIDS.

In addition to SIDS, a sad consequence to SHS exposure, children are also exposed to health effects like ear infections, more recurrent and severe asthma attacks, respiratory symptoms such as coughing, sneezing and shortness of breath, respiratory infections like pneumonia and bronchitis, and of course an increased risk for SIDS (CDC, 2018b). It is well established that children are vulnerable to SHSE and are more inclined to suffer damage to their health since they are at the pinnacle of their growth, fast development, proliferation, cell division, and organ growth, and are more open to interference from exogenous compounds (Li et al., 2018). Children between the ages of three to nine years old have increased rates of nicotine metabolites in their system than adults and median levels in children are assessed to be more than twice that of adults who do not smoke (Li et al., 2018). Daly et al. (2017) determined the efficacy of two short multistrategic child health nurse delivered interventions to reduce the dominance of infants subjected to SHS, reduce incidence among infant parents and caregivers and

enhance the dominance of household bans. They found that the interventions administered as an element of regular clinical consultations were ineffective in decreasing the prevalence of infant exposure to SHS, which warrants a need for additional research (Daly et al., 2017).

To take this subject further is the effect of SHS on blood and blood vessels. According to the National Heart Lung and Blood Institute (NHLBI, 2019), high blood pressure sometimes called HTN is a conventional disease in which blood flows at a higher-than-normal pressure through blood vessels or arteries. Blood pressure occurs when there is a force of blood pushing against the walls of the arteries as blood is pumped by the heart (NHLBI, 2019). When this happens consistently without medical or lifestyle intervention, it might lead to stroke or heart disease (CDC, 2018b). When it comes to risk factors, certain lifestyles, and exposure to SHS has been documented. In a recent cohort study to access the role lifestyle behavior plays on the risk of hypertension, Díaz-Gutiérrez et al. (2019) found that both lifestyle and factors in the environment contribute to the risk of HTN, which are smoking, obesity, high consumption of alcohol, and unhealthy dietary habits. In the same study, a comparison was made between former, current, and never smokers and a slightly higher risk of HTN was found among current smokers as opposed to never smokers (Díaz-Gutiérrez et al., 2019). Further, when the impact of the number of packs smoked in years of smoking cigarettes on HTN was assessed, it was found that those who have smoked in less than 40 packs per year presented major increase in the danger of HTN in progress in comparison with nonsmokers (Díaz-Gutiérrez et al., 2019). In addition, Park et al. (2018) established that

SHS exposure is greatly linked with high blood pressure in women who have never smoked.

Regarding cardiovascular health, MS is not the only risk factor; SHSE features an engrained risk factor (He et al., 2019). According to Lv et al. (2015), CVD remains the principal cause of death worldwide, with smoking as a significant modifiable risk factor. In the same investigation, SHS was linked with a 25% to 30% increase in coronary heart disease as well. The final analysis showed that nonsmokers who were exposed to SHS, compared to those who were unexposed, had a considerably higher risk of 18% for all-cause mortality, 23% for CVD, 23% for congestive heart failure, and 29% for stroke-striking a solid conclusion that SHSE might have an association with the increased risk for CVD (Lv et al., 2015).

Despite the health effects of SHSE, several researchers have come up with different modes of intervention that could reduce the disease burden and mortality rate that results from SHSE. The CDC (2018b) maintained that individuals can protect themselves from SHS by cessation, prohibiting smokers around or inside their living environment (home), car whether windows are down, ensuring that children's daycare centers and schools are tobacco-free, only going to restaurants and places that forbid smoking, educate children on SHS and how to stay away from smoke, and above all, become a role model for children by not smoking. Tong et al. (2015) conducted a systematic review of clinical interventions to bring down SHSE among pregnant women who do not smoke, in which 16 databases for publications between 1990 and 2013 with no language barriers were searched. Tong et al. concluded that clinical interventions

furnished in settings that provide prenatal reduced SHSE. The types of clinical interventions advocated for in this study were psychosocial and pharmaceutical interventions to be provided in an antenatal health care setting and by any provider (Tong et al., 2015). Smoking has harmful effects that cause health challenges like lung cancer, leukemia, ischemic heart disease and bronchitis; however, SHSE has come up recently as a significant public health concern after its recognition as the third leading source of preventable disease around the world after active smoking and alcohol use (Li et al., 2018).

THS

Residual contamination from tobacco smoke that remains in a part of a building, a room, or an area long after smoking has ended and stays on clothes after an individual leaves a smoky place is called THS (ANRF, 2019). This smoke may come off simply as an offensive smell; however, it indicates the presence of tobacco toxins (ANRF, 2019). Intriguingly, THS contains the residue of tobacco from products like cigarettes, cigars, and other products of tobacco left behind after smoking and accumulates on surfaces and furnishings (ANRF, 2019). The ANRF further noted that particulates like nicotine that are highly toxic, and sticky can cling to ceilings and walls; meanwhile, gases can be inside dust in parts of a building (room), carpets, upholstery, draperies, and fabric, which can be re-emitted into the air and reintegrate to form compounds that are harmful and can stay in high levels long after the end of smoking.

The CDC (2017) identified THS as residual nicotine along with other chemicals abandoned in an enclosed surface by tobacco smoke. According to Arguder (2019), THS

is a significant source of exposure to TSNA, as shown by studies that evaluate its presence in house dust samples. Like previous observations, further research to estimate THS's human exposure on animals determined that THS is made up of tobacco smoke compounds that can last months on internal surfaces and dust remitted into the air as gaseous (Arguder, 2019). Reports from the International Cancer Research Center stated that by the year 2020, 10 million deaths from cigarettes would be recorded yearly, 70% of which will occur in developing nations (Arguder, 2019).

Evidence of Human Exposure to THS

THS is a relatively new concept in the public health field and the environment (Arguder, 2019). However, its exposure and identification are vivid wherever there is a possibility of human interaction, including hair, skin, clothing of smokers, walls, benches, furniture, dust, air, and surfaces (Arguder, 2019). In addition to the three recognized pathways of THS exposure (dermal absorption, ingestion, and inhalation), Kuo and Rees (2019) posited that nicotine from THS typically reacts with ozone, nitrous acid, and formaldehyde to produce carcinogens like Nicotine-derived nitrosamine ketone (NNK) and N'-nitrosonornicotine, which are re-released as vapor or engrossed on dust. Consequently, it reverts to aerosol form, which can be inhaled. Understandably, infants and children have been identified as the higher-risk population for THS due to their precarious nature of hand-to-mouth and skin exposure from interaction with contaminated surfaces and toys, blankets, floors, and pacifiers (Kuo & Rees, 2019). In a study to examine the connection between THS exposure (THSE) during pregnancy and postpartum depression (PPD) among Chinese women, it was suggested that women who

were pregnant and exposed to THS had an approximately double increased risk of developing PPD compared to those who were not exposed (Wang et al., 2018). Another study to recapitulate the health consequences of both secondhand and thirdhand marijuana smoke found that possible effects of THS are reported with damage to the DNA from exposure to nongaseous elements that oxidize with environmental nitrous acid (Holitzki et al., 2017). Additional investigation into the harmful effects of both SHSE and THSE, though limited, showed an impairment of endothelial function in animals (Holitzki et al., 2017).

More research evidence of THS to human exposure is seen in the lack of public awareness of its reality and its negative consequences. Roberts et al. (2017) acknowledged the existence of evidence of health risks posed by SHSE and the increasing evidence of THSE but regrettably expressed that there would have been more significance if there was public awareness to help reduce childhood exposure. Roberts et al. understood the knowledge gap particularly in highly pronounced groups like current smokers, previous smokers, and individuals who do not have children in the home. In addition, the need for awareness across all cohorts analyzed in their study concerning the hazards posed to children by exposure to THS is mainly prominent (Roberts et al., 2017).

History and Background Knowledge of THS

It is documented knowledge that United States has grown tobacco contained in cigarettes for many years (around 1 Before Common Era, which were chewed and smoked by native populations as a form of social and religious ritual (Ungvarsky, 2019). During that time, populations believed that these plants contained medicinal properties

hence its coming to United States and other parts of the world with European explorers to start the practice of drying and smoking tobacco leaves in pipes. In the 17th century, notice was made of an association between lung sicknesses and exposure to large amounts of smoke (Ungvarsky, 2019). The first cigarettes were known to roll out in the 19th century and later gained popularity in the United States during the Civil War of 1861–1865 predominantly among soldiers (Ungvarsky, 2019). Despite the many concerns raised about the dangers of cigarettes, an entire century went by (1960s) before the official issuance of warnings about the health risks involved. According to expert knowledge disseminated at the time, modern cigarettes contained about 600 ingredients that release as many as 7,000 more chemicals when burned, which intensifies the health dangers of smoking (Ungvarsky, 2019). On the one hand, chemicals contained added ingredients to improve the taste and increase addictiveness to the product while causing cancer on the other hand (Ungvarsky, 2019).

Along with the history and inception of tobacco and its consumption in the United States is the background knowledge of THS. The concept of THS or the chemical residue deserted in an area after cigarette is smoked is a rather new notion (Ungvarsky, 2019). Earlier in 2015, research recorded that THS remained the least studied route of exposure of health effects to humans as opposed to mice who showed detriments in growth and immunity (Ferrante et al., 2015). Fascinatingly, THS first originated in the first part of the 21st century and was initially documented in print in 2006 (Ungvarsky, 2019). A Harvard professor, Jonathan Winickoff, and others first popularized it in a journal article in 2009 meanwhile the idea had hit its initial stages almost ten years earlier. Further along in

1991, findings showed contamination with nicotine in the dust found in homes where smoking had occurred (Ungvarsky, 2019). Sequentially, Ungvarsky, 2019 maintained that by 2002, researchers found that additional chemicals from a burning cigarette could possibly linger on surfaces in an environment for days and more so years, which when combined with others in the air materialized into multiple hazardous chemical substances. As mentioned, notable findings of THS at this time include chemicals in buildups on buildings, vehicles, and hard and soft surfaces. In addition, studies indicated that these chemical particles form a difficult to remove film traceable even after surfaces have been washed, cleaned, and wiped down (Ungvarsky, 2019). Other studies suggested that the use of fans to recirculate air does not noticeably lower the presence of THS; however, rug replacement and repainted walls could eliminate all traces of the smoke-related chemicals (Ungvarsky, 2019). In addition, a study published in *Science Advances* put out evidence that cigarette smoke found outside can be pulled into the ventilation system of a building and deposited on surfaces in smoke-free areas (Ungvarsky, 2019). With the inception of THS, some experts have considered its association with asthma, pneumonia, and ear infections with the recognition of the need for more extensive studies on the subject.

With the history and background knowledge described, THS, though relatively new, has the potential to affect the health of many especially vulnerable populations like children and minorities. Ungvarsky (2019) concluded that with all the studies conducted on THS and its outlined danger to human health, many THS chemicals could be traced to other sources besides cigarettes.

Hazards/Dangers of THS

THS is tobacco pollution that stays both in the air and surfaces after a smoker stops smoking (TSRC, 2020). THS is the gas and particle from SHS that stays stuck and becomes embedded in objects and materials like walls, carpets, blankets, furniture, and toys (TSRC, 2020). Human contamination occurs when humans encounter contaminated surfaces, eat contaminated objects or dust, inhale air, and resuspend THS smoke elements (TSRC, 2020). The ensuing hazards are evident in non-smokers, children, human health, the environment, and the underprivileged.

Non-smokers are characteristically individuals who do not smoke. According to Sheu et al. (2020), a significant public health concern that is poorly understood is the contamination of indoor nonsmoking environments. The TSRC (2020) explained that a nonsmoker gets affected by THS when an outdoor smoker comes indoors after smoking. Unconsciously, the smoker brings in toxic tobacco residue (THS) on their clothes, skin, hair, and even exhaled breath, which is an indication that a combination of tobacco smoke pollutants has been brought into the home (TSRC, 2020). At this point, the effect in the house is like that outside because the particles can be transferred, get stuck, and embedded in materials and things in the home, which leaves nonsmokers exposed to toxic THS without a cigarette smoked inside (TSRC, 2020). More so, THS is associated with high levels of nicotine on the hands of persons who do not smoke but live in homes formerly occupied by smokers and has led to unintentional chronic exposure (Acuff et al., 2015). Dermal absorption of nicotine-related substances is mentioned as a possible

occurrence when nonsmokers reside in a home environment that has been previously occupied by smokers (Acuff et al., 2015).

Complimentary to nonsmokers is the hazards of THS on children. The American Public Health Association identified children as part of the vulnerable population (Joszt, 2018). Children are considered to have poor organ development and low immunity, spend more time outdoors, breathe more air, respond differently to medicines and interventions, and drink more water per body weight than adults (Joszt, 2018). According to the World Health Organization (WHO; 2020), environmental risks highly impact the health and development of a child from conception through childhood, adolescence, and adulthood, notably air pollution. Acuff et al. (2015) explained that THS is present in dust and happens through dust ingestion. Children are markedly vulnerable to dust ingestion because they crawl and intermingle closely with the environment.

Additionally, studies maintain the possibility of an adverse impact on the immune system and structural and functional development of the lungs of children exposed to any form of cigarette smoke (Acuff et al., 2015). Reported respiratory risks of exposed children could also possibly alter the trajectory of biological development with an increased risk of incident asthma in infants, toddlers, and school-age children, which makes it crucial to not only ensure that infants and children are not inhaling air contaminated with tobacco smoke but also protect them from daily physical contact to THS residues (Acuff et al., 2015). The WHO (2020) recorded 1.7 million deaths of children under the age of 5 years old and 26% of child deaths from environmental risks like indoor and outdoor contamination. It is estimated that 40% of children worldwide are

exposed to environmental tobacco exposure (SHS or THS) with a short-term association with allergic reactions and a long-term association with acute myocardial infarction, lung cancer, and COPD (Torres et al., 2020). Clinically, ETS precedes behavioral conditions, toxic hazards on the brain, attention deficits, and hyperactive conduct during childhood (Torres et al., 2020).

Northrup et al. (2019) carried out a study to explore routes of contamination in a neonatal intensive care unit (NICU) by characterizing nicotine levels discovered on the fingers of NICU medical staff and measuring finger-nicotine correlates. Results determined that nearly 4 in 5 staff in the NICU had a measurable amount of finger nicotine, which could be transferred to NICU incubators and furniture, which exposes infants to airborne constituents via skin, ingestion, and inhalation (Northrup et al., 2019). Participants in this study were reportedly nonsmokers, some of whom stayed in hotels with complete smoking bans. Sadly, visitors and employees who are MS may believe that they are safe when they extinguish cigarettes outside and instantly enter the hospital; however, unbeknownst to them, they continue to push out particulate matter for equal to 90 seconds (Northrup et al., 2019). Additionally, their breath and clothing harbor greater concentrations of neurotoxic substances that damage lung cilia for premature and low-birth infants who are already at risk for respiratory impairment as a result of the immaturity of their respiratory functioning, low metabolic capacity, and compromised immune systems (Northrup et al., 2019). With the knowledge that everyday cleaning methods have proven abortive in the removal of nicotine that gets absorbed to indoor surfaces like pillows, mattresses, and sheetrock walls, an awareness of the smoking

environment that includes homes of persons who report smoking outside is crucial to minimize exposure opportunities as modes of THS elimination is sought after (Northrup et al., 2019).

THS and Socioeconomic Conditions/Status

SES represents the social standing or class of a person or a group and is characterized by education, occupation, and income (American Psychological Association [APA], 2018). A low SES thus looks at unemployed adults with lower educational attainment levels or living close to or below the United States federal poverty level (CDC, 2019a). In 2016, the poverty rate was at 12.7%, high school graduates only accounted for 28.9%, high school completion was at Grade 11, and no diploma was given to 4.2% (CDC, 2019a). In the United States, higher rates of cigarette smoking have been reported amongst the low SES group than the general population (CDC, 2019a).

In a study to measure global financial expenditure of diseases caused by direct exposure to smoking, Goodchild et al. (2018) found that the amount of health care costs caused by smoking reached a purchasing power parity (PPP) of $467 billion in 2012 in addition to productivity loss, it totaled a PPP of $1852 billion with nearly 40% of its occurrence in developing countries. Smoking imposes a heavy economic burden all over the world especially in Europe and North America where tobacco epidemic is furthermost advanced (Goodchild et al., 2018).

Regarding THS and its relation to SES, Jacob et al. (2017) posited that the hazards of THS are less satisfactorily documented than those of SHS, which calls for further research. Nonetheless, researchers maintain that the lifestyles of children, along

with parental smoke and SES, are grossly linked with low academic performance, predominantly among Japanese children (Yamada et al., 2019). This analysis stems from their research study investigating the connections between children's academic performance with overall lifestyle, parental smoke, and SES in Japan (Yamada et al., 2019). SHS affects more than THS hazards are depicted because results showed a significant association between parental smoke and low academic performance (AP) through carbon monoxide, which depletes oxygen supply to the brain, and nicotine, which affects both the endurance and development of essential nervous system components are responsible for low mental performance a crucial public health ramification (Yamada et al., 2019). These findings are justifiable by the fact that children in this study (junior grades) spend more time with parents, particularly mothers than children in senior grades (Yamada et al., 2019).

In line with SES, Yamada et al. (2019) demonstrated an inverse association between low AP and SES even after adjusting for lifestyles, parental smoke, sex, and grade. It emerged that the connection between soft AP and SES, as it relates to parental smoke, is more significant in senior grades than in younger grades. According to Wan (2019), public health authorities have accumulated data on the lethal nature of smoking and some research on the health effects of THS, but the data remains scarce and limited to studies that involved mice. Researchers are sure of the fact that chemicals from tobacco smoke (THS) linger on surfaces, clothes, and skin and worry that the increase in socioeconomic disparity in smoking causes low-income families to be more prone to live in homes and neighborhoods where decades of smoking have led to THS accumulation

(Wan, 2019). All in all, it is seen that low SES leads to an increased rate of persons affected by THS due to living conditions, poor sanitation, and low literacy levels.

THS and SES/Vulnerable Populations

SES suggests the social standing or class of a person, or a group assessed as a blend of education, income, and occupation which when examined, reveals discriminations in accessibility to resources alongside matters associated to privilege, power, and control (APA, 2018). There are two types of SES: (a) low and (b) high. There has been growing evidence to support the connection between lower SES and negative psychological health outcomes, cigarette dependence, illicit drug use and episodic heavy drinking by adolescents while more optimistic psychological outcomes like cheerfulness, self-esteem have been associated to higher levels of SES (APA, 2018). Purposely, MUH and associated with impoverished outcomes are primarily positioned in deprived neighborhoods and are typically used by low-income occupants with designated income limits for eligibility (Northridge, 2010). Delgado-Rendon et al. (2017) illustrated that SHS and THS exposure is predominant in MUH, and people of color and low-income occupants are unevenly exposed unlike other populations. In a study to describe the physiognomies, attitudes, knowledge, and associated behaviors to SHS, THS and marijuana smoke exposure among Hispanic residents in MUH in Eastern Metro Los Angeles, Delgado-Rendon et al. discussed that, approximately 25.8% of United States residents with low SES and who are Hispanic live in MUH with 32% of that population residing in California. These residents are exposed to THS, which contains carcinogens

that may bring about respiratory and neurocognitive complications (Delgado-Rendon et al., 2017).

Acuff et al. (2015) identified that exclusively low-income residents experience a higher prevalence of involuntary tobacco exposure and are less expected to benefit from complete home smoking bans as compared to their wealthier equivalents. Notably, fewer individuals are aware of the possible health risks of THS as demonstrated in a national survey that indicated 93% awareness of SHS and its danger to children and only 61% of respondents believed that THS is dangerous to children, a discrepancy that calls for health education especially among parents (Delgado-Rendon et al., 2017). Overall, SES leads to an increased risk of exposure to the dangers of THS.

Other populations that are vulnerable to the impact of THS are infants and young children, pregnant women, and nonsmoking adults. According to Sheu et al. (2020), nonsmokers suffer the health risks of THS; however, children and infants are the most affected because children represent mostly the vulnerable populations. The National Environmental Health Association (NEHA, 2020) estimated that by 2020, tobacco-related deaths would lead to 10 million deaths annually. NEHA identified children, seniors, and pets as the most affected by this underappreciated health hazard (THS) via skin exposure, dust inhalation, and ingestion. Globally, 40% of children are exposed to the toxic effects of tobacco smoke in their environment and while adults who smoke have a choice of where to smoke, children who live, play and study in these areas where smoking takes place are involuntarily exposed to the effects of tobacco smoke exposure, SHS and THS (Myers et al., 2020). Environmental tobacco smoke exposure is believed to

be a significant public health issue in pediatric health (Ratajczak et al., 2018). Regardless of the awareness of the public on the dangers ETS among children, about half of children's world population continue to be constantly exposed to passive smoking (Ratajczak et al., 2018). Infant and children's susceptibility to the harmful effects of THS emanates from the very nature of children. As compared to adults, children have a higher rate of breaths per minute, their hepatic metabolism is underdeveloped, and more air is inhaled per body weight, which has led to SIDS, low birth weight, repeated respiratory tract inflammations, and asthma (Ratajczak et al., 2018).

The environment works in correlation with the nature of children to make children a target for the harmful effects of THS. Drehmer et al. (2017) clarified how THS can be used to guard children's health and enhance the distribution of tobacco control interventions for parents in the child health care setting. The researchers explained that young children spend more time on the floor, easily put their hands and objects into their mouths often, and breathe faster than adults, which increases exposure to inhalation and because of how thin the skin of children is, dermal absorption is made more efficient (Drehmer et al., 2017). To evaluate the degree of person exposure to both SHS and THS, biomarkers NNK (nicotine derived nitrosamine ketone) and nicotine are used and toddlers who live with smokers have demonstrated a higher level of NNK /nicotine level, which implies these toddlers are subjected to a greater ratio of THS compared to SHS than adults (Drehmer et al., 2017). In addition, the dust that settles on living rooms and bedroom surfaces of infants in homes that belong to smokers contain nicotine, higher amounts of urine cotine (a biomarker for exposure to nicotine) as compared to homes

where parents smoke outside (Drehmer et al., 2017). Emergency room reports stated that children of smokers with illness probably associated with smoking had nicotine on their hands as proof that a positive correlation exists between the amount of nicotine found on the hands of children and the amount of cotinine detected in their saliva. An additional finding was that children are more exposed than adults to higher ratios of THS thus their vulnerability (Drehmer et al., 2017).

Pregnant women have been classified as vulnerable to the harmful effects of THS, which is reported to be genotoxic in human cells (Acuff et al., 2015). Clearly, THS is unappreciated among varied public health concerns despite its increasing risks. Investigators relentlessly propose more systematic research, biological evidence, and political decisions to close the gaps in comprehension, ease nonsmoker's exposure to THS, and bring down its collective impact on morbidity and mortality (Acuff et al., 2015). Smoking while pregnant poses substantial risks to both the health of the mother and the child (Gould et al., 2020). Tobacco smoke and exposure to nicotine throughout prenatal and postnatal life can damage the development of the lungs, change how the immune system responds to viral infections, and intensify the frequency of childhood wheezing (Gibbs et al., 2016). Equally associated with tobacco exposure during pregnancy is an increased risk of obstetric complications and dangerous after-effects for exposed children in-utero (Gould et al., 2020).

According to Wang et al. (2018), THS is a hidden source of tobacco smoke which has allowed its harm and exposure to be overlooked by many studies, as such, an investigation of the prevalence of pregnant women to THS exposure and its relation to

PPD in nonsmokers was warranted. In Wang et al.'s study, it was proposed that pregnant women are habitually in contact with surfaces and dust since they spend more time indoors. Two modes of transmission of THS are inhalation and dermally due to increased respiration, disabled in action, abdominal size, changes of both metabolic capacity and immunologic systems; pregnant women are more sensitive than others to pollutants which can potentially lead to infection (Wang et al., 2018). Despite the publication of comprehensive tobacco control measures, researchers maintain that a significant percentage of pregnant women were exposed to tobacco smoke in places known to be smoke-free (Wang et al., 2018). This makes it difficult to protect pregnant women from the debilitation dangers of THS. These outcomes make available concrete proof to encourage house and workplace policies that ban smoking not only in shared areas but in private homes as well. Future research on the association of infants' mental disorders and THSE at home and other sources should be supported (Wang et al., 2018).

Background, Behavior, and Attitudes Towards THS

Over the years, tobacco use has presented itself as the principal cause of death in the United States and the world at large, with cigarette smoke at the forefront of health risks for smokers and nonsmokers alike (Acuff et al., 2015). Even though the negative weight on the health of active smokers and SHS are well documented, the concept of THS is a relatively new phenomenon both in the environmental and public health fields (Acuff et al., 2015). Díez-Izquierdo (2018) explained that the term THS, also known as residual tobacco smoke or aged tobacco smoke, was first mentioned in 2006 in a commercial press with no definition until 2011 as pollutants of residual smoke that stayed

on surfaces and dust after tobacco has been smoked. Acuff et al. (2015) maintained that THS was only a notion coined in 2009, obscured until an article on the subject was published by the New York Times. This has left the investigation on THS restricted to studies on animals that study the health bearings connected with an individual THS-exact component (Acuff et al., 2015). There is a limited public understanding of THS, which has resulted in immature attitudes and beliefs around THS exposure. There is a need for further research to ease identification of hazard, exposure, and risk assessment that addresses the effects of THS on vulnerable populations and distinguishes THS versus active smoking and SHS (Acuff et al., 2015).

Considering attitudes and behaviors towards THS, Díez-Izquierdo (2018), in an online cross-sectional study of 1,406 parents with children between the ages of three months and 36 months, gathered information on knowledge and beliefs of the health impacts on THS on their children's health. Díez-Izquierdo concluded that 3 out of 10 parents were oblivious about THS, and 8 out of 10 parents with adequate information believed that THS is dangerous for their children. As reported by Acuff et al. (2015), a focus group study was launched in 2013 to examine knowledge and attitudes toward THS among low-income groups including awareness, perceived harm, and inspiration to make a smoke free home was assessed. Results showed that most of the contributors were unfamiliar with THS but after its definition, some immediately acknowledged their experience with the toxic effects of residual tobacco amidst dust and the smell of tobacco that lingers in clothes and around their houses (Acuff et al., 2015). Study participants who smoked an average of 11 cigarettes daily showcased a possibility to concur that the

residue of tobacco and dust on surfaces can be toxic to adults and children and that air breathed today in an environment where someone smoked yesterday posed a danger to infants and children as opposed to nonsmokers after THS was defined and explained (Acuff et al., 2015). The study concluded with all participants, together with non-smokers who live with smokers, pointing to the fact that knowledge of THS will inspire them to maintain a smoke-free home (Acuff et al., 2015).

Darlow et al. (2017) acknowledged the limited number of studies that have addressed beliefs in association with THS among adults from the usual population; however, not much is known about the beliefs of health care professionals about THS and related communication practices. Additionally, since health care professionals are a highly respectable population within the community, an assessment and an understanding of their knowledge and beliefs about THS would be valuable (Darlow et al., 2017). In addition, an endorsement of the harmful effects of THS by health care professionals is hypothesized to be connected to negative attitudes about smoking, support for bans on public smoking, and government action on the road to a smoking ban (Darlow et al., 2017). In their research, a third of the sample had an idea of THS prior to sample completion and over two thirds believed that THS has not received adequate attention (Darlow et al., 2017). An overall belief of the harmful effects of THS was undeniable by the respondents; however, feelings were mixed in the area of discussion of THS with others, nonetheless, the researchers identified that factors such as being a female and the belief that the quality of parenting is associated with THS' toxic effects contributed to the likelihood of discussion with others (Darlow et al., 2017). Researchers deduced that

provider education on THS could create motivation in patients and smokers, who receive information from their health care providers that could lead to the possibility of smoking cessation or reduction of smoke exposure (Darlow et al., 2017). In line with health care providers and THS, Ratajczak et al. (2018) evaluated and compared the efficacy of pediatricians and family doctors in screening and antismoking therapy and established that those interventions during routine visits at the pediatrician's office were discouraging. The investigators further critique that 95% of parents in the United States believe that a significant part of the medical history at a child's pediatrician visit should be the discussion of cigarette smoking and family members due to the existing correlation between a parent smoking and persistent respiratory infections and asthma, but it is rather undervalued by both pediatricians and general practitioners (Ratajczak et al., 2018). Researchers recalled that 77% of pediatricians in Poland failed to inquire about smoking by family members at routine visits as opposed to only 27% in the United States, which justifies an overall low effectiveness of pediatricians when it comes to screening and anti-smoking therapies (Ratajczak et al., 2018). Other findings include men's likelihood to not believe that THS is harmful compared to women; more men smoke cigarettes than women and have hardly any plans to quit smoking, and men reported lesser supposed risk to lung cancer and less interest in policies to ban smoking (Darlow et al., 2017). Therefore, men should be a priority target to receive targeted smoke free education (Darlow et al., 2017).

Parental perceptions or attitudes towards THS is equally significant. Myers et al. (2020) exposed the failure of research to find an operative way to protect children as the

reports of parents on exposure are often erroneous and blamed on deficiencies in perceptions of what comprises exposure. In addition, a significant number of parents are oblivious of the toxic effects of smoking on their children, which has led to a proposition that parents should receive all-inclusive information on the negative effects of passive smoking on the health of their children (Ratajczak et al., 2018).

Transmission, Prevention Modes, and the Need for THS Education

Current studies have shown that THSe is toxic while other studies have offered solid support that benefits advocacy for environments to be free of THS contamination for families and children (Drehmer et al., 2017). As new as the concept of THS is, and as much as THS is portrayed a threat to public health, understanding its modes of transmission is crucial to the development of prevention and possible remediation approaches (Drehmer et al., 2017). According to Csipor et al. (2017), THS is the invisible residue left behind after active or passive smoking accumulates on every object in a smoking area. These areas include: (a) furniture, (b) paving, (c) carpets, (d) floors, (e) skin, (f) hair, (g) food, (h) walls, (i) drapes, (j) inside of cars, and (k) homes and could last months after the end of smoking (Csipor et al., 2017). These toxic particles can be transmitted into the body through the skin when exposed, inhaled as dust, or by ingestion (Csipor et al., 2017). It has been documented that some of the toxic components of THS reside in the fibers or threads of clothes for up to 19 months (Díez-Izquierdo et al., 2018).

Acuff et al. (2015) identified THS as a valid concern because smoke can travel through air ducts, cracks in the walls, and floors in addition to plumbing and electrical routes that are able to contaminate other units and humans. THS is especially harmful in

young children who habitually touch everything with their hands and mouth and individuals oblivious of the danger (Csipor et al., 2017). It was estimated that out of a study of 260 medical students, 9.6% were aware of the toxicity of SHS, and only 4.2% knew about THS (Csipor et al., 2017). Notably, while smokers' endeavor to protect family members against SHS by stepping outside, their exhaled breaths, skin, hair and clothing can transmit smoke residue into the home thus their families are exposed to THS with higher levels of nicotine than SHS (Wang et al., 2018).

THS is contaminated air that persists after SHS has been emitted in the air and contains toxins that are harmful to humans, animals, and the environment (Jacob et al., 2017). Prevention strategies must be devised to curb the many health hazards of smoke like cancer, PPD, asthma, and SIDs for children. Different companies in the United States have attempted curative services for home and commercial structures affected by tobacco smoke, fires, and flood (Jacob et al., 2017). Interestingly, studies assess that prevention and treatment of THS contaminants is possible via a combination of complete carpet removal and or use of liquid detergents meanwhile, ammonia-based cleaners are in the same way recommended for the removal of tobacco odors (Jacob et al., 2017). Also, ozone concentrations have been used as an alternative to remove strong tobacco odors (Jacob et al., 2017). In addition, other investigators have determined that for prevention, parents who believed in the toxicity of THS and used cessation assistance were more likely to put in place a strictly enforced smoke free home and car policies more frequently than parents who did not believe endorsing education as a preventive tool (Díez-Izquierdo et al., 2018). Researchers asserted that brief THS education intervention

to caregivers in the emergency room with children under 36 months bring about changes in smoking manners (Díez-Izquierdo et al., 2018). Parents and caregivers that receive education on THS are more likely to take precautions that will in return reduce the incidence of harmful effects from THS. There is a need for THS centered education and social instructional policies dedicated to parents and caregivers (Díez-Izquierdo et al., 2018). This is key because study results showed a correlation between the belief that THS harms children and the voluntary adoption of smoke free rules at home by parents (Díez-Izquierdo et al., 2018). Raising awareness through education and instructional materials on THS is thus a major form of prevention.

Knowledge Gaps and Priorities for Further Research

A discussion on THS will be incomplete without the knowledge gaps addressed and the priority areas for further research defined. Considering that THS is documented as a relatively new concern with limited information (Díez-Izquierdo et al., 2018), a few gaps exist specifically in the areas of awareness (education) and impact on health with population groups like parents and caregivers, health care providers, nonsmokers, researchers, and policy makers (Kuo & Rees, 2019). Unlike SHS, there are gaps in the level of awareness of the existence of THS and its overall impact on health. Regardless of the wide-ranging information on tobacco, long-lived tobacco smoke components (THS) have only recently gained recognition as a consequential risk to health (Samet et al., 2015). This lateness in awareness has involuntarily exposed nonsmokers, adults, and children alike to THS in areas where smoking had previously taken place like hotel rooms, rental cars, and properties (Samet et al., 2015). A lack of awareness was seen in a

Mahabee-Gittens et al.'s (2019) study to examine how varied home smoking behaviors add to THS, combined THS and SHS exposure, and if THS levels are connected to respiratory infirmities in children who do not smoke. Their discovery established that little is known about the effects of THS on combined THS and SHS exposure levels and is therefore another priority area for further research (Mahabee-Gittens et al., 2019). Wang et al. (2018) acknowledged that THS and its effects have been overlooked in many research studies with zero findings on the association between THS and PPD.

Wang et al. proceeded to investigate the prevalence of pregnant women to THS contact and the links with postpartum depression in persons that have never smoked. Accordingly, more than 70% of women were found exposed to THS while pregnant and over 17% tested positive for PPD, an indication that THS is a risk factor for PPD amid women from China, which gives emphasis to the necessity to raise awareness on the impact of PPD in puerperal Chinese women exposed to THS (Wang et al., 2018). Moreover, children and infants have previously been identified as vulnerable to the risk of THSe. A need to educate and raise awareness to change attitudes and beliefs towards THS amongst parents and caregivers by mostly health care authorities is heightened when Mahabee-Gittens et al. (2019) concluded that knowledge on THS is crucial for remediation strategies to be developed.

In the area of further research, priorities have been identified in manifold THS subject areas. To begin with, Mahabee-Gittens et al. (2019) explained that the pervasiveness of THS in dust and surfaces open-up exposure dermally and via ingestion, pathways usually disregarded for SHS, and which calls for THS to be separately

addressed as sources of pollution and exposure. These results have led to a gap for future research, which is to conduct a test on the effect of the implementation of acquired THS reduction approaches on outdoor tobacco smoke levels and the health of children (Mahabee-Gittens et al., 2019).

Samet et al. (2015) described THS and took up the challenge involved in reducing THSE among nonsmokers and children (vulnerable populations) related that the extension of indoor smoking bans to hotels and casinos and appropriate cleanup efforts made in places where smoking has been done remain the most effective way to stop THSE. However, the lack of public awareness of the dangers of THSE is an area where future investigations need to focus on (Samet et al., 2015). Schemes must be invented to educate the individuals involved through campaigns and distribution of informational brochures (Samet et al., 2015). An additional priority area for further research identified is to study preventive interventions to protect pregnant women from THS-related PPD (Wang et al., 2018). According to Gould et al. (2020), further findings need to focus on smoking cessation medications and e-cigarettes to reduce and curb THS exposure to smoking and barriers that facilitate smoking while pregnant.

In a study to explain how the concept of THS can be vital in child health protection and equally enhance interventions to control tobacco for parents in the child health care settings such as counseling, Drehmer et al. (2017) identified a need for clinicians to communicate cessation as being imperative to parents and caregivers. Investigators also concluded that with recent scientific studies, not enough is known on THSE; therefore, further research is a priority on the subject, and hopefully, tobacco

control policies will be spurred to protect individuals and stimulate delivery improvement (Drehmer et al., 2017). Clearly, THS is not exactly smoke, but chemicals that stick to surfaces that can be discharged back into the air, undergo chemical transformations, and/or mass (Jacob et al., 2017).

Summary

Researchers have sought to explain processes like the distribution and chemical changes that take place as SHS is transformed into THS, studies on environmental contamination, human exposure, and toxicology with the use of animal models and in vitro systems, probable approaches to prevent exposure, remediation of THS contamination, and priorities for further research. This has led to the discovery of a need for future research on the chemistry of THS and the degree of environmental contamination to determine the exact substances that are possible risks for health. In Chapter 3, the research rationale, data collection, and data analysis plans will be presented.

Chapter 3: Research Method

The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in Baltimore County, Maryland. Participants in this study were smokers and nonsmokers. This study may help improve the knowledge, awareness, and level of exposure of THS dangers and may improve individuals' long-term health outcomes in the community. In this chapter, I present the research design and rationale, the role of the researcher, the methodology, and issues of trustworthiness.

Research Design and Rationale

In this study, I used the qualitative method with an interpretive, descriptive approach that included individual, in-depth interviews. This approach was chosen over other research designs, like ethnography and grounded theory, because it allowed me to focus on one problem (i.e., THS); recruit participants regardless of their culture; and ask questions based on their experiences, knowledge, and perceptions of THS unlike ethnography, which requires a specific setting and participants of a certain culture who must be primarily observed and listened to in order to infer conclusions (see Keen, 2019). Qualitative research was also consistent with a researcher or an inquirer who seeks to understand the level of knowledge, attitudes, practice, and beliefs regarding THS at a community level. The focus of the qualitative research method is to gain insight and understanding of the perceptions of an individual on an event or circumstance (Creswell & Creswell, 2018). The qualitative approach is used to explore and understand the meaning an individual or a group ascribe to a social or human problem (Creswell &

Creswell, 2018). THS that emanates from smoking affects both society and the health of humans; therefore, use of the qualitative research method was the most appropriate for this study. The research question that guided this study was: What is the knowledge, attitudes, practices, and beliefs of Baltimore County residents towards THS?

Role of the Researcher

Qualitative research is interpretative in nature and allows the inquirer to be typically involved in a continuous and intensive experience with participants (Nanduri, 2018). In this study, I played the role of an observer-participant. The subject of THS is relatively new; however, studies have affirmed that individuals in the community unknowingly suffer from its effects (Akbay et al., 2023). Investigation into the health impairments from exposure to thirdhand marijuana smoke is limited, but there is preliminary evidence from an animal model that endothelial function is impaired (Holitzki et al., 2017). A study to examine the association between THS during pregnancy and PPD among Chinese women acknowledged THS as a hidden source of tobacco smoke with its effects overlooked (Wang et al., 2018). This limitation of inadequate studies also limits the amount of knowledge participants may have on the subject and may affect their attitudes and beliefs. As a result, I played both the role of the observer and participant to offer periodic support and provide information on some hidden facts where necessary.

Potential biases that may have shaped my interpretations as the researcher may have included past experiences, connections with the participants, the participants' willingness to participate, consistency, language bias, power imbalance, conflict of

interest, and the research site. I directed significant attention towards ethical issues before the study; at the beginning of the study; throughout data collection and analysis; and while reporting, sharing, and storing the data (see Creswell & Creswell, 2018). Anticipated ethical issues for this study included selection of a site that had no vested interest in the results; unidentified cultural, gender, and religious differences; privacy protection; participant exploitation; plagiarism; and bias in result/information disclosure. To limit or combat these biases, this study was reviewed and approved by the Walden University Institutional Review Board (IRB) to identify any needed protections against human rights. I ensured that the selected site had no vested interest. I also made certain that participants were clear on their role and that I showed respect for their cultural, religious, and gender values and their boundaries. I was fair to all participants and avoided deception and power imbalances. Participants were involved in the recruiting process to avoid exploitation while I remained sensitive to any information that may be harmful to the participants and gave credit to all information sources.

Methodology

Participant Selection Logic

A sample size of eight to 10 participants is typical in a qualitative research study. Saturation is usually easily attained with this number of participants (Creswell, 2018). According to Creswell and Creswell (2018), a researcher brings data collection to an end when the themes are saturated or when new data no longer inspire new insights. Both saturation and sample size are integral considerations in qualitative data collection, and these concepts relate in their interdependence. The sample size of a study commonly

impacts research saturation. Hennink et al. (2019) maintained that saturation is usually used to control the sample size of a qualitative study, and it remains a significant guiding principle to measure data adequacy for a purposive sample. The sample in the current study included both immigrants and nonimmigrant adults selected based on the following criteria: smoking status (i.e., smokers and nonsmokers), gender (i.e., male and female), age (i.e., between 20–60 years old), SES (i.e., low income and middle class), family status (i.e., parents, pregnant women, and nursing mothers), and knowledge of THS (i.e., participants may or may not have had any experience or knowledge of THS).

The inclusion criteria for this study was justified by previous studies on THS. THS, also known as passive smoke, is a topic of enormous concern for public health due to its well-known adverse effects on human health (Arguder, 2019). Approximately 22% of cancer-related deaths globally are linked with passive smoking, while active smoking is inadvertently linked to many health problems, such as cancer, stroke, coronary heart disease, respiratory diseases, diabetes mellitus, rheumatoid arthritis, and impaired immune system (Arguder, 2019). Active smokers were also included in this study. Exposure to cigarette smoke has also been proven to cause serious consequences for nonsmokers, especially children (Arguder et al., 2019). Infants and children have been shown to be at higher risk for THS exposure due to hand to mouth and dermal exposure from contact with surfaces that are contaminated (Kuo & Rees, 2019). While children remain the most vulnerable population to the harmful effects of THS, adult smokers and nonsmokers were an appropriate population for this study.

Participants, Recruitment, and Data Collection

The population for this study consisted of 10 purposefully selected Baltimore County residents. I selected Baltimore County residents because of the high adult smoking rate in the county. According to data from the Robert Wood Johnson Foundation (2015), Baltimore City had an adult smoking rate of 23.90% compared to Montgomery County, with 7.90%, and Howard County, with 8.49%. Baltimore is inhabited by up to four different ethnic groups: Blacks or African Americans; Whites, both Hispanic and non-Hispanic; and Asians, with varied cultures, practices, and belief systems that may benefit from the results of this study. Notably, THS consists of respiratory and neurocognitive-causing carcinogens, yet few individuals know these dangers (Delgado-Rendon et al., 2017). In a recently conducted national survey, 93% of participants knew that SHS was harmful to children, but only 61% believed THS is dangerous to children (Delgado-Rendon et al., 2017).

Participants for this study were recruited through two online platforms: Facebook and Instagram. I made an online post on these platforms requesting participants to indicate their interest in the study by stating it in the comments section or through a private message with a "YES" reply. My recruitment post included a summary of the nature and purpose of the study and the participant inclusion criteria for the study, including the age range, smoking status, and place of residence sought. Using a private message, I requested an email address from interested individuals and sent them an invitation for the interview. The email invitation included the semistructured interview

guide (see Appendix A). An interview guide provides questions about the subject to be examined during the interview (Patton, 2015).

Before conducting the interviews, I provided the participants with the informed consent form, which detailed the purpose of the study and their role as a participant and my role as the researcher (see Appendix B), via email and asked them to indicate their consent by replying to the email with the words, "I consent." I conducted the interviews through the Zoom video conferencing platform to collect data for this study. During the interviews, I asked each participant prepared questions and gave each of them a few minutes to respond. The interviews lasted approximately 30 minutes each. I audio-recorded the interviews and transcribed the collected information into Notes. After the interview, participants received a $10 Amazon e-gift card by email. After the interviews, I informed participants that their validation of the interview was needed. This was done via a follow-up email within 2 weeks of the interview. Participants were sent an additional $5 Amazon e-gift card after receiving a response to the follow-up email.

Prior to any interviews being conducted, all 10 participants had received the informed consent form and a semi structured interview guide. Once an email acknowledgement providing their informed consent was received, I scheduled an interview date and time with the participant. A Zoom link was then created and sent to each participant.

According to Patton (2015), varied tools and formats are provided for coding by software programs; nonetheless, the principles and the process of analysis are similar if done manually or with the help of a computer program. For this study, I used NVivo 12.0

software to analyze the data. Unlike human beings, qualitative software programs help with data storage, coding, retrieval, comparing, and linking (Patton, 2015).

Data Analysis Plan

Data analysis is intended to understand both text and data, as in transcripts, and image data, as in photographs, by splitting up data and bringing it back together (Creswell, 2015). The data was further reduced into themes via a process where the data are coded and condensed. The data analysis approach consistent with an interpretive, descriptive study starts with data preparation whereby data are collected in the desired format (i.e., audio recordings) and are precisely transcribed and read entirely (Elliot & Timulak, 2005). This is followed by dividing the data into different meaning units from which an organized data structure is found and then generated into categories. Creating categories is an interpretive process done by the researcher who carefully ensures that the labels chosen are closely aligned with the participants' language and considers their previous understanding of the problem (Elliot & Timulak, 2005).

Issues of Trustworthiness

Credibility in qualitative research looks at the data's confidence or internal validity influenced by the method, researcher, and philosophical belief in the value of qualitative inquiry (Patton, 2015). To ensure the credibility of this study and data accuracy, I conducted participant validation by making the study results available to the participants and holding follow-up interviews with them via email within 2 weeks of the initial interview. To further strengthen this study, I located a public health official at the TSRC via Instagram to interview to gain a different, expert perspective. The TSRC is a

nonprofit organization geared towards helping individuals reach 100% smoke-free surroundings via research, outreach, and education (THSRC, 2023). To ensure internal validity, I employed the strategies of saturation and reflexivity, which allowed me to provide enough data to support the need to develop a strong and valid awareness of THS.

To establish external validity (i.e., transferability), I thoroughly described THS and all other forms of passive smoking that were relevant to this study. Caution was also taken to select participants who could best answer the research questions. Confirmability establishes the validity of a study (Patton, 2015). In a qualitative study, the researcher has continuous and rigorous experience with the participants (Patton, 2015). This experience brings personal issues, such as culture and history, into play and, consequently, bias; however, with reflexivity, I can help the reader understand my connections with the study. I practiced reflexivity in this study through notetaking during the interview process and reflecting on my experiences to find a relationship and identify with the subject.

Ethical Procedures

This study was approved by the Walden University IRB (Approval No. 09-26-22-0251657) before any participants were recruited. To ensure confidentiality and further maintain ethical standards, I had participants complete an informed consent form (see Appendix B). The data collected will be kept confidential and secure on a password-protected computer for 5 years, with access limited to only me as the researcher.

Summary

The purpose of this qualitative study was to describe the participants' levels of knowledge and different attitudes regarding THS. A participant sample of 10 adults, both

smokers and nonsmokers, were interviewed for this study. This study may help improve the awareness of THS, its health effects, and modes of prevention, which may lead to improving individuals' long-term health outcomes in the community and guide policymaking around tobacco use and prevention. In Chapter 4, I will discuss the thematic analysis of the collected data and present the study findings.

Chapter 4: Results

The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in Baltimore County, Maryland. Participants in this study were smokers and nonsmokers. This study may help improve the knowledge and awareness of THS dangers and individuals' long-term health outcomes in the community. The research question that guided this study was: What is the knowledge, attitudes, practices, and beliefs of Baltimore County residents towards THS? In this chapter, I discuss the demographics, data collection and analysis, evidence of trustworthiness, results, and a summary.

Participant Demographics and Characteristics

Baltimore city has a population of 622,452 with 52.9% of the population female, an average household income of $38,555, and a density of stores that sell tobacco connected with negative behaviors detrimental to health, like smoking and the inability to quit (Galiatsatos et al., 2020). All 10 participants fell into the age range of between 20 and 60 years old. The youngest participant was 25 and the oldest was 52. The gender identities of the participants were six males and four females. Two of the participants were current smokers and eight were nonsmokers. All 10 participants were residents of Baltimore and had lived in the city between 4 and 15 years. One participant was in the process of relocating out of Baltimore to Texas. Two of them lived in the heart of Baltimore city while eight lived in Baltimore County. All four females were married with children, one male was married and expecting his first child, one was single, and three

were married with children. All 10 participants had a basic high school diploma and could understand and communicate clearly in English.

Data Collection

As a participant observer, I focused my attention on the experiences of the participants to gain a broad understanding of their knowledge of THS. Data were collected through one-on-one, semi structured interviews and the participants' body movements. Each interview was conducted over Zoom. I recruited participants online using Facebook and Instagram. According to recent data, Facebook (2021) had an average of 2.85 billion monthly active users and Instagram had an average of 1.22 billion monthly active users in the first quarter of 2021. Prior to recruiting the 10 qualified participants, I took a virtual tour of both Facebook and Instagram and searched terms like Baltimore, smokers, and nonsmokers. The search resulted in over 100 pages and groups on Facebook and about 20 accounts on Instagram and included businesses, news networks, health and government organizations, schools, police organizations, and tobacco agencies like Tobacco 21 Maryland and prisons. I joined and followed most of these groups and pages so I would have a wide, diverse population to recruit from and a fair chance of recruiting enough qualified volunteers to reach data saturation.

Next, I published an invitation post on both platforms in which I clearly described the purpose and nature of the study, inclusion criteria, study location, mode of interview, expected duration of the interview, and the action needed. Within 20 days, I received 40 responses on Facebook, amongst which were 10 random responses, eight unfollows, 22 positive responses, and zero responses from Instagram. Out of the 22 positive responses,

12 met the inclusion criteria and 10 were selected. I ensured that these 10 selected participants met the following eligibility criteria for the study: (a) being a smoker or nonsmoker, (b) living in Baltimore, and (c) between the ages of 20 and 60 years old. Selected volunteers received a private direct message request for their email address. I then sent them individual emails for privacy with the informed consent form and an interview guide. Volunteers were clearly told that they were free to withdraw from the study at any time. Notably, as a platform for knowledge consumption and distribution, social media has become progressively important as individuals shift from traditional media, like television or newspapers, to online and mobile media as their principal media source (Jung et al., 2022).

On the day of each interview, I made sure that all my electronics were working properly, and the internet connection was good. I was prepared 10 minutes before each session and ensured that the room/setting had no distractions, like wall pictures, if participants chose to turn on their video. It is critical to choose a place for an interview that is noiseless and distraction free (Patton, 2002). Participants were given the choice of how to attend the Zoom interview (i.e., with both audio and video or audio only). Each participant was told that the interview was recorded and were reminded of their right to withdraw from the study at any time. Four of the 10 participants chose to leave their video on throughout the duration of the interview. Two participants started off with their video on but later switched their video off and stayed with the audio only. Four participants chose audio only from the onset. Each interview took between 20 and 45 minutes and participants answered all questions. During the one-on-one, in-depth

interviews, I made personal notes alongside the documented data for verification in case of any misinterpretation to make sure that I was getting an accurate interpretation of the participants' intentions. I audio recorded the interviews through Zoom. Each participant received a copy of the transcript of their interview for review purposes and to establish accuracy.

The transcripts from the interviews are currently stored on my password-protected computer where they will remain for 5 years. Prior to recruitment, I expected to have difficulties in getting participants because of the relative newness of the concept of THS, but the topic ignited curiosity and I received more positive feedback than I expected. Half of the participants reported the belief that they had to know about the subject before the interview despite a clear statement in my initial social media post that they did not need previous knowledge of THS. Despite the relative newness of the concept of THS, none of the participants asked to withdraw from the study, and insightful data were communicated as each interviewee responded to the interview questions. In their responses, each participant showed enthusiasm, cluelessness, and surprise but had natural, open perceptions of THS.

At the end of the one-on-one, semi structured interviews, I began transcription. I had trouble transcribing the video files on Microsoft Word, so I used Otter to transcribe the video interviews. Otter is software that allows the importation of existing audio or videos for transcription (Zapier, n.d.). I read over the transcripts while listening to the audio and edited as needed. Next, I read through the data a second time to familiarize

myself with the responses and noted reoccurring ideas and initial reactions. I exported the transcripts into a Word document and saved it on my computer.

A few variations occurred from the original data collection plan. The original plan was to recruit participants from both Facebook and Instagram, but only Facebook was used because I received zero feedback from Instagram. I planned to transcribe data using NVivo, but I ended up using both Microsoft Word and Otter for transcription and Quirkos for themes, categories, and codes. I faced an unexpected circumstance whereby I lost most of the initial data and had to contact participants again, and they were kind enough to show up a second time. All in all, the entire recruitment and data collection process lasted 12 weeks.

Data Analysis

Data analysis commenced after member checking where each participant reviewed their transcripts and agreed with their accuracy. NVivo did not work for me as anticipated earlier, so I switched to Quirkos for data analysis. Quirkos is a qualitative analysis software designed to immerse its users into their qualitative text data and help them while providing simplicity, ease of use, and quick understanding (Walden University, 2023). According to Patton (2002), qualitative analysis transforms data into outcomes; however, there is a challenge in finding the significance amongst massive volumes of data. This supports my decision to use an interpretive, descriptive approach in this qualitative study. An interpretive descriptive approach uniquely holds the understanding that the experiences of humans consist of complex interactions (Thompson Burdine et al., 2021).

I engaged in a thorough reading of all the transcripts to get a sense of the whole data set while simultaneously reflectively thinking about what the data presented, which is also known as content analysis. Content analysis refers to exploring text for recurring words or themes (Patton, 2002). This strategy enabled the initial formation of patterns, categories, and themes. Forming codes and categories is the heart of qualitative data analysis (Patton, 2002). I identified patterns of participants reporting ignorance, indifference, weak health sensitivity to THS, personal values and feelings and formed these patterns into six major themes that I further classified under three main categories: personal, behavior, and environment. These categories are supported by the theoretical lens of the SCT. As developed by Bandura, the SCT is an interpersonal level theory that accentuates the synergy between individuals (i.e., personal factors), their behavior, and their environments (Glanz et al., 2015).

I proceeded to import all 10 files into Quirkos, added the themes into quirks (i.e., bubbles), and continued to code all themes. Researchers can investigate a public health phenomenon with the aim of identifying themes and patterns among individual perspectives while also reporting variations between participants or individuals (Thompson Burdine et al., 2021). Each category had two themes and five to 10 codes per theme. Themes are not concealed in the data waiting to be discovered but surface during the researcher's engagement with the data in the effort to address the research question (Thompson Burdine et al., 2021). Themes, thus, become practical tools that help the investigator generate an account of the data set. In the following subsections, I discuss the initial themes identified. Table 1 shows each category and the derived themes.

Table 1

Categorization of Six Themes

Personal factors	Behavioral factors	Environmental factors
Lack of knowledge	Attitudes	Structure prevention
Perceived dangers	Unstructured prevention	Practices
Personal beliefs		

Note. The seven emerging themes of the study were classified under these three major categories.

Below are a set of themes and corresponding codes from the transcripts of all 10 participants:

Knowledge

I don't know, never, never heard, none, no effect, no understanding, no idea, no knowledge, no thoughts, first time hearing, limited, some little. Duration of smoke: few hours, 2 months, 3 months, long time, a year, forever, not sure, very long. Knowledge of SHS: more dangerous, only know, SHS, SHS.

Attitudes

Nasty, uncomfortable, concerned, struggling, none, irritate, toxic, sick, inhale soke, I don't care, I don't know, dangerous, secondhand smoke, polluted, not good.

Beliefs

Carried by air, distributed by wind, nonsmokers die, nonsmokers get cancer, impossible, I don't care, no difference, bad, it depends on, a lot of smoking in Baltimore, it doesn't exist, education is needed, cancer, cough, sick, adverse effects, health issues, death, some conditions, deficiencies,

Practices

None, doesn't exist, selling drugs, prescription, no program, take shoes off, clean up, shut doors, shut windows, avoidance, nothing, smoke outside, abstain, careful, hard nothing, cleaning, shut doors, ignorant, avoidance, advise others. Suggestive Measures: illegalize, ban, signs, property rights, education, sensitize, radio, social media. State measures: none, no program, not helping, smoking signs.

Evidence of Trustworthiness

Credibility

Researchers have established credibility as one of the fundamental markers for a strong qualitative inquiry (Liao & Hitchcock, 2018). Credibility in every study is built on the type of protocol and the methodology that the investigator has chosen for data collection from their participants. In this study, credibility meant that the entire interview process with the participants excluded my personal life, predispositions, opinions, and biases and placed complete attention and focus on what the participants had to say regarding their experiences around tobacco use and THS. A single interview protocol was used for all 10 of the participants, and I presented myself as a participant observer. This gave me a better understanding of the level of awareness the participants had of THS and allowed me the flexibility to ask questions accordingly. I read every interview question clearly and audibly, and some participants asked me to repeat some of the questions more than once. Participants responded confidently without any pressure to conform to anything. The time spent during the interview was relative for everyone because each

person responded to the questions to the best of their knowledge with no expectations to understand the phenomenon under study (i.e., THS).

After the data was transcribed, exported into a Microsoft Word document, and saved, I conducted member checking by asking each participant to review the document. Member checking helped to determine the exactness of the qualitative data by the participants for accuracy and validity (Creswell, 2013). The transcribed Microsoft Word documents were reviewed by all 10 participants and approved with no comments. I was unable to locate a public health official at the TSRC via Instagram to interview and gain a different or expert perspective on the subject. I adjusted by ensuring that I had more than one smoker who had smoked longer than 10 years alongside nonsmokers to strengthen the quality of the information provided during interviews.

Transferability

Transferability in qualitative research establishes validity. This study and its results make use of rich, thick descriptions to allow understanding of the researcher, participants, and anyone else who comes across it. Creswell (2018) maintained that to ensure that study findings are transferable between the investigator and participants, a thick description is needed. With the diversity of the participant demographics (gender, smoking status, age) alongside the detailed description of terms, themes, and categories, readers will be able to transfer the information in this study to other settings.

On the one hand, the findings from this study can be used as a sample to conduct further research on THS, its level of awareness, health effects on communities and raise awareness. On the other hand, in terms of location, results from other cities, states or

nations might reflect different responses due to their existing laws on smoking, statistics of smokers versus nonsmokers, public health education practices and SES. Regardless, as a qualitative researcher generalizability is possible but may not guarantee the same results under every circumstance until further research is carried out by other qualitative researchers.

Dependability

Dependability in this study aligns with the recruitment, interview, and data analysis process. During the recruitment process I used more than one social media site to recruit, I increased the diversity of volunteers by joining and following different groups and profiles on Facebook and Instagram. Secondly, I utilized member checking. Once the interview data was transcribed into a Microsoft Word document, all participants were given the opportunity to review and agree with the transcribed data, I made sure to keep to the interview protocol for dependability. A qualitative researcher should guarantee dependability centered on good note keeping and focus on data effectiveness to attract others (Miles & Huberman, 2012). In cooperation, dependability and confirmability are recognized through an auditing of the research process (Creswell, 2018).

Confirmability

To ensure confirmability, I intentionally broke free from my personal biases about smoking and THS. I did this by reflecting on my own experiences to make sure that no connection was identified. All 10 participants were given the liberty to provide their responses to all interview questions, free from coercion regardless of the relevance or irrelevance nature of their responses. At the point of saturation, I analyzed the data with

the use of Quirkos software using an inductive approach and concluded with themes, categories, and codes. Saturation and reflexivity were engaged to ensure internal validity and that there was enough data to meet the aims of this study.

Results

Specific to this study, it is important to note that the interview process was divided into two sections. During the first section, participants responded to six sub-questions worded in a manner that they could understand and feel invited to open and talk. These questions were framed to elucidate and illuminate THS, the main subject explored during the interview. This was done in a conversational style focused on environmental, passive, and THS.

For Session 2, I shed light on the subject focus THS and proceeded with the six research questions. I did this to help ease participants into a subject considered new (foreign) in public health to get informed responses and accuracy of analysis. Even though there is mounting evidence of the harms of THS exposure, social scientific research has uncovered that the public is unaware of the effects of exposure to THS (Record et al., 2023). In addition, with the lack of awareness around the science of THS, the target audience (participants) can be assumed as uninvolved and not actively trying to participate and most likely will be clueless about the personal relevance of the topic (Record et al., 2023). This can broadly impact the quality of their responses and the results.

The overall research question for this study was: What is the knowledge, attitudes, and beliefs of Baltimore residents towards THS? The following are excerpts from the interviews with the 10 participants.

1- Tell me your thoughts about breathing air in a room where someone has smoked.

P001, I am very uncomfortable with this because of the potential to smoke second hand which I know is dangerous to one's health.

P002, you know, I. Have never thought about it nor read any research to see how much of an impact that can be, but just from seeing the effects of tobacco on people, in fact, like the boxes say how dangerous it is. I feel like. That will be a problem because it will be like I'm also smoking and so I will inhale the...is it nicotine? I don't know what that is, but yeah, I just feel like it is not safe.

P003, like someone who has never smoked and who has never lived with a smoker or shared a room or a smoker. It's very toxic to me. I find it very difficult to breathe. I don't know if everybody feels it that way. But for me, the air is polluted already, and I can't even be there for a minute.

P004, it's basically inhaling the same air. It's like I'm smoking myself.

P005, So, I think for me, personally, it's very uncomfortable to stay in that kind of environment. Just because I know, at least to an extent, the adverse effects of staying inside a room that's filled with, you know, any type of gas, or smoke. But personally, I haven't really experienced it. So, I really can't say I know the adverse effects, like I said, that make it uncomfortable for someone to be in such environments.

P006, well, if someone smokes in a room, and is now seated inside, I don't think breathing, it's going to be easy because I will be kind of finding it difficult to breathe because the air is not pure, very intoxicating. Make me either cough or something.

P007, Well, because I'm a smoker. And I do smoke regularly. It doesn't bother me. If someone else is smoking around. I don't feel any type of way, I'm sorry.

P008, no, I never smoke inside the house. Okay. I always smoke outside, and my family is sitting in my vehicle, I don't smoke in my vehicle.

P009, it's very uncomfortable staying in a room where somebody has just smoked because you'll be struggling to breathe, maybe struggling to talk, maybe struggling to do other things, and then you are straining. It's very uncomfortable, that's what I will say.

P010, So, if you are breathing air in the same room where someone is smoking. You are obviously. Smoking, breathing that same air, you're already a smoker because that air is already polluted.

2- Do you believe that you can get sick simply by living in a house that has once been owned by a smoker?

P001, I don't believe so. Houses get cleaned after the previous occupants leave. That should be enough, right?

P002, that's a good question, but honestly, I just I don't know. I just don't take it that seriously. I've ignorantly been around people who smoke, and I just never take it seriously.

P003, yes, I've had an experience where I am I have rental properties. I have had tenants have turn down or break the lease or something like that because a former smoker had lived in that house. With the idea that I have asthma, and this exacerbates my symptoms, I cannot live in this room.

P004, to tell the truth, I've never thought about that. There are certain times that it's possible, but it just never crossed my mind, you carry on and try to avoid the smoke as much as you can, or hopefully that with time is going to blow away. You know, but I've never thought about it. I think it is possible. Yes, yes. That's a possibility.

P005, I do not know. That is very honest. Answer

P006, I don't know about that, but I believe if the House has once been owned by smoker, probably before getting in that house it must have been cleaned up. Probably if the house is not cleaned up, you just come and buy the house, probably you might be sick.

P007, yes ma'am, I do believe if the nicotine is on the walls and they have constantly smoked in the household, I do believe people can get sick.

P008, Yes

P009, yes, you can fall sick because of the atmosphere, the smoke is still in that house.

P0010, I'm not sure of that question but no, but if I'm living with the person, yes. But if the person is no longer in that house, no.

3-How will you feel about a smoker hugging or kissing a baby?

P001, I wouldn't recommend that especially if they just smoked.

P002, Truth be told another I don't know, and I really don't care, I don't think beyond how dangerous it is.

P003 sounds uncomfortable, but it all depends on let's say the duration of the hug. If it's been hours since you smoked and hug the baby and let it go, I don't think it's going to have that much effect on the child though.

P004, That's insane. That's wrong. Terrible, I mean…

P005, Personally, I will be upset.

P006, the baby might get sick. The baby's immune system is still growing at that stage. It's not advisable for a smoker to hug a baby.

P007, Well, since I'm a smoker. I wouldn't pick up a baby because I know I have the smell of cigarettes on my clothes, so I typically don't touch the baby unless I go wash off and maybe change my clothes so I wouldn't touch the baby at all.

P008, I don't like that. I've been there done that, like, you know, but I never did that.

P009, I am a mother of a toddler. I will not let somebody that is smoking or somebody that I know is a smoker hug and kiss my child because secondhand smoke is even more dangerous than primary smoking.

P0010, no, that baby is obviously inhaling the smoke. There's a probability that the baby is smoking, partially because the breath of that smoker is already polluted. Uncomfortable yes, very uncomfortable for a smoker to even carry the baby because they are close to each other. Their clothes already carry the smoke.

4-What do you think could happen to a child who puts his hands in the mouth after touching surfaces in a smoker's house?

P001, I don't think anything can happen.

P002, if the person is not smoking while the baby is sitting next to him, I just feel like nothing else matters I. Don't know.

P003, I don't think it will have an effect. The child may pick up something other than cigarettes, you know, and not only stuff that has to do with cigarettes or with smoking.

P004, that child may develop some conditions. some kind of deficiencies at a later age.

P005, it is not hygienic, dangerous to their health.

P006, a person's smoke settles on the person. So, hugging a baby that small, transfers, whatever settlement of the smoke onto the baby that can affect the breathing of the baby.

P007, See, when you are a smoker, you don't think about that.

P008, it's nasty, the surface is not clean.

P009, Eventually, that child will get sick. I am a toddler mom. My child sucks two of his fingers, I endeavor to keep a clean environment. I do not allow people to come in with shoes talk less of an environment where somebody smokes.

P0010, OH, I never thought of that but asking me that question and I'm trying to reason it out so the child can just obviously inhale some of the material.

5-How long do you think smoke particles can remain in a room?

P001, Until the room is cleaned or properly aerated.

P002, that's another thing I don't know. I have no idea. I just feel like maybe you open the windows after the person in like 15 minutes 30 minutes everything is gone, that's what I think.

P003, very long, over two months, more than three months

P004, I don't know, for a long time, I guess I don't know a day or 2 a long time.

P005, I think it remains there until someone cleans it up.

P006, Let's say at least more than a month.

P007, it's going to be some years.

P008, A few hours

P009, I am not sure how long, but I think I can say for a very long time.

P0010, I do not know, it can take days like 3 days.

6-What measures do you take to protect yourself from THS.

P001, I don't like hanging around smokers and generally avoid close association with them. That is the extent of my protective measures.

P002, that's a tough question because I don't really have anybody around close to me that's smokes. I can still be exposed to that without knowing because we go to places, we go to the stores, we enter different people's houses from time to time and you could be exposed to that without knowing, but personally, I don't really have people around me who smoke like close relatives and friends, so I've never thought about figuring out ways to prevent it.

P003, in the community where we are, it's extremely difficult because I live in an apartment complex where everybody around me smokes cigarettes. I was quite uncomfortable, but I moved to an area where we have designated areas for smoking, yet it still did not help. Because when you smoke the wind carries it around the place, so you still smoke it's very difficult. I do the best I can to shut my windows and doors almost all the time because I have a neighbor who smokes. I do the right thing, but the wind carries the smoke to my room. So, the only precaution I take is I make sure that my doors and windows are always shut whether I am home or away.

P004, walk away or tell them to leave.

P005, so currently, just because of my ignorance about this topic of discussion, I haven't been taking any steps to prevent it, or to avoid it

P006, sometimes it's hard to prevent yourself from being exposed to second hand or thirdhand hand smoke because we live in an environment where people are free to do anything publicly. And you walking out there, you might encounter people that are smoking in the public space, the smoke flies all over. So, it's difficult to prevent one from inhaling the smoke from a cigarette.

P007, I don't know, I guess never be around people that smoke, but if it's third hand you wouldn't know you wouldn't know at all.

P008, smoke outside, you know, stay away from the house, you know, don't smoke inside the house or near a person.

P009, do not go close to people that smoke or a smoke-filled environment.

P0010, by not entering any house where a smoker has been in.

7- How much Knowledge do Baltimore residents have about THS?

P001, not much. I think most people just think in terms of the impact on the actual smoker.

P002, None, no, no. I would think none.

P003, they are aware.

P004, I'm not sure but I think very little because myself, I didn't know anything about it much. I never really thought about it in that regard. So, I doubt many people know.

P005, I do not know. I don't have the statistics. I don't know if, you know, awareness has been created for the people in Baltimore. So, I can't say,

P006, I don't think they have much of that knowledge because from my observation, I find so many people smoking and I think if they do understand the aftereffects of it or have a background knowledge about the rate of smoking or the use. So, if I could do a percentage wise of categorizing, I would say probably 80% of the people who have some knowledge about it.

P007, Nothing!

P008, None? I guess not.

P009, umm, I don't think most of them have knowledge about thirdhand smoke.

P0010, None. We know about secondhand smoke and not thirdhand smoke.

8- What attitudes do nonsmokers/smokers have towards THS and its effects on health?

P001, I think it is a negligent attitude. There isn't much talk about THS.

P002, Long story short, they will be like it's Not that serious

P003, Yeah, they care about and understand that it may cause some problems, but like I said before, they cannot control it. They move around and they know that well if anything happens, it was meant to happen. Because they cannot control their environment, they can't do anything.

P004, I mean, I guess some people wouldn't even know.

P005, with knowledge I will be more careful. I am now more conscious. In fact, I will speak to people about this. Because I mean, that's how you spread knowledge. Without knowledge, no attitude.

P006, if someone has no knowledge about something, their attitude will be a carefree attitude, because he does not know the aftereffects of it. So why should we care about thirdhand smoking effect? The attitude to me is just, well, let's live the life leave, because they're ignorant about the health effects.

P007, they're going to be more willing and be mindful of what they're doing and where they're doing it if they have been taught. They will care but without knowledge they won't.

P008, I'll be careful and try to quit. You know, but uh, I can't tell other people how they're going to think about it because this is dangerous. If I don't know I will not do anything.

P009, I think they don't care.

P0010, we are not aware so there is no attitude. No care is being taken towards that.

9-What are the beliefs of Baltimore residents towards THS.

P001, I think is nonchalance. Post pandemic, it's not like priority, people are not really concerned. All right.

P002, the truth is they will need more education and awareness to be able to start believing that it is a problem, because even like when we started out, I just felt like it's not a big deal.

P003, I've heard, divided, opinion. When I ask them, you know what is happening. They respond with…people die of cancer who have never smoked. They don't understand thirdhand smoke. No belief.

P004, some people wouldn't believe it. I mean, I guess many people wouldn't believe it.

P005, each person that hears this would have to go and do their research and see what science has said about this.

P006, I don't think many of them do believe it has an after effect because it's smoke.

P007, it depends on how we present the information to them, if we're presenting the information to them on the television through ads on Facebook and IG live and things like that, then yeah, they're going to be susceptible to believe it. What you're saying now if you just put It in the paper most people don't read papers in Baltimore City, so then they won't. They won't have that knowledge.

P008, Remember, many, many people say that this exists, but they don't care.

P009, they don't care, they don't have any belief about it.

P0010, I don't think they even have any beliefs. They are not even aware that it exists. I have lived in a family house where they smoke and do not care.

10- What practices exist among Baltimore residents regarding THS.

P001, Yeah, I mean, number one, I think there should be a mandate on this for all apartment complexes to notify residents if the previous occupants were a smoker, and then to implement some additional cleaning activities that could prevent those risks, especially children.

P002, I've never heard of anything.

P003, I've seen the "No Smoking" signs, but people will light cigarettes under the sign and smoke, and they can read. I don't think there is any.

P004, none.

P005, I don't think so. I have never come across any. So, I will say, None.

P006, I'm not sure about it.

P007, No ma'am, because if nobody knows about it, then nobody is going to do it.

P008, no, the county is not helping at all.

Here are a few examples. Cigarettes are expensive now. People are still buying it. one of them this marijuana, it's not legal, it can be prescribed, and you can smoke it. And people are smoking everywhere, they don't care how bad that smells. The county is not government and is not helping at all. You know, they've been selling drugs, you know, prescribing drugs, and all that is not right. They should be cutting that stuff off, rather they are selling it. It used to be illegal, now it's legal, to sell them by prescriptions.

P009, they sometimes they try to give them incentives to encourage them to stop smoking.

P0010, they don't have anything.

11-What are the perceived dangers of THS to the community?

P001, Number one lower income people might seem more likely to smoke. Again, by virtue of cost of living might be in specific areas. And with that, you're going to be more prone to smoking dangers. I don't think many communities are aware of how dangerous it is. Right? With other challenges they might be facing.

P002, children being diagnosed with Asthma, people just having side effects of things that they never knew about or got actively involved in for instance, you do not buy cigarettes and smoke but now you must deal with the consequences of inhaling absorbing the substances that come from cigarette. So, I think it's a bad situation.

P003, we are in a situation where things are getting worse. A lot of people are aware of the dangers of smoking, but they feel helpless. They cannot help themselves to get out of it. There's some good trial, but according to them it's not working, so they just stay in it. And we educate about cancer and asthma. Nothing is going to change because they continue to smoke unless the government decides to ban cigarette smoking, which is impossible because this has to do with money with the company producing tobacco. They need money. And I know that they cannot do without people smoking. They need the money in so it's going to be very difficult to stop it. And all these illnesses will continue you know. Yeah, to

grow in our community and we'll still struggle to treat them and. That's all we. Can do.

P004, cancer from inhaling all that nicotine.

P005, adverse effects, severe illnesses, ailments, and even as far as death.

P006, Look, looking at the rate of diseases, especially cancer, sometimes you wonder how babies still get cancer? They were just born. They haven't lived a lot, but they got cancer, too. Probably part of it might be thirdhand smoke.

P007, well, we can have kids that get affected, pregnant ladies that have babies that have deformities, because if it sits on the surface and it gets more toxic as time goes by. But people are constantly smoking at the same spot at the same time every day. More people will get sick. More people could die.

P008, It's dangerous. it's not it's not good. Even the air in the atmosphere is getting bad enough.

P009, health issues, sickness, death.

P0010, So, there will be more respiratory illnesses. More sick people, especially children born with respiratory illnesses or cancer, the spread of cancer. So, it's just because of the ignorance and we don't have any information about that.

12-How can THS be prevented in Baltimore?

P001, I think first it must be like a government initiative. Because I believe that that's where it starts, workplaces need to implement some laws that protect employees. You know, we travel with things like Busses, trains, those kinds of

information can be readily viewable. People should be educated and at least there should be broad regulation that protects people.

P002, I believe more awareness is first, enforcing laws that can help with housing authorities making sure that things are ok before moving in. Testing equipment to test out and see if the house is safe? Now I think there's just nothing that enforces anything like that. No Rules and regulations for Apartment complexes and houses. Regular check-ins before renting out will be good.

P003, That's tough. It just needs a lot of discipline and there's a lot of indiscipline, that's what I know.

P004, I think organizing more workshops, more chats like this or more? Educating people basically, stuff on these things? I think more education, more awareness, creating awareness surrounding stuff like this.

P005, I would start with my apartments, leasing agents or leasing companies should designate places outside of the apartment, their homes, parks, or something where people can smoke. You know, avoid smoking in confined places, avoid smoking inside the house. I know personally, in the property rights, they recently they come up with this law or this rule whereby people should stop smoking in the house and give them a distance from the house at which they can smoke.

P006, well, I think social media is the best way of disseminating information or local TV networks or radio stations can help create awareness of the aftereffects of thirdhand smoke.

P007, we must educate the population and then we must come up with some kind of chemical or surface cleaner that we can totally clean the house with.

P008, they should cut down on this prescription or stuff like that, it should be illegal. Stop selling drugs.

P009, continue to give incentives to encourage people to quit smoking, advise people not to go to environment where there are smokers.

P0010, I think a lot of sensitizations should be done concerning thirdhand smoking because I can say. This is like my it's my first-time hearing about. So, I think there should be more sensitization so that we will have less people that are sick.

Interview questions are further discussed with excerpts from the transcripts.

Discussion of Results

Studies show that THS is a relatively new concept that emerges from tobacco use, with limited studies on its impact on human health (Akbayet et al., 2023). As a result, current knowledge about THS is scarce (Díez-Izquierdo et al., 2018). Notwithstanding, according to Record et al. (2023), when an individual is exposed to THS, DNA is directly damaged, oxidative stress is induced, and cell reproductive function is changed, with children at the highest risk for adverse health effects. All 10 participants in this study shared how much they knew or did not know about THS. Interestingly, participants were able to clearly express their feelings when in contact with smoke from a smoker, such as "I am uncomfortable with this," one participant stated. Another said, "It is very toxic to me; I find it difficult to breathe…the air is polluted already, and I can't even be there for

a minute." One said, "It doesn't bother me when a smoker is smoking around me," while another admitted that "I have never thought about it nor read any research to see how much of an impact that could be" but after a brief explanation on THS was shared and were asked how much they knew about THS, participants responded with "None," "not much," "nothing," "I guess not." Based on these responses, there is a negative tolerance for smoke, but little or no knowledge of THS exists. Lack of knowledge is significant here.

In terms of attitudes, in a study to portray the knowledge and convictions on THS in parents of children below 3 years old in Spain, Díez-Izquierdo et al. (2018) explained that parents who held that THS was dangerous sourced cessation assistance more often than parents who did not believe. A state of mind on a phenomenon affects what attitude a person will uphold and what action they may take. All 10 participants in this study shared their different attitudes towards THS. For example, one participant noted, "There isn't much to talk about this," another stated, "It's not that serious," and one said, "Without knowledge, no attitude," and one said, "If I don't know, I will not do anything." A clear pattern of indifference and uncertainty could be seen through most of their responses, and I could hear expressions of certainty in their responses, provided they understood THS. Like the participant who stated, "without knowledge, no attitude."

During this study, when participants were asked about what they thought would be the beliefs of Residents in Baltimore regarding THS, one participant said "Nonchalance" and added that "post-pandemic, it's not a priority, people are not really concerned." Another stated that, "The truth is, they will need more education and

awareness to be able to start believing that it is a problem because when we started, I just felt like it's not a big deal." One subject said, "They don't understand thirdhand smoke; they have no belief." To further emphasize patterns of nonchalance and disregard for THS, a participant stated, "I don't think they even have any beliefs. They are not even aware that it exists. I have lived in a family house where they smoke and do not care." These responses generated two themes: knowledge and awareness and skepticism about THS.

THS-related activities in a location may include measures that address or minimize knowledge of THS and its effects, such as billboards, posters and signs, cleaning and disinfecting, educational workshops, smoking bans and restrictions, education, and awareness campaigns, policy advocacy, and avoidance. Eight out of all 10 participants indicated an absence of activities regarding THS in Baltimore, the following statements: "I've never heard of anything," "None," and "No! the county is not helping," "I don't think so. I have never come across any, so I will say none," and "they don't have anything." Two of all 10 participants mentioned one or two activities. For instance, one participant said, "I have seen the NO smoking signs, but people will light cigarettes under the sign and smoke, and they can read," but concluded in line with the other eight by stating, "I don't think there is any." The other stated that "they sometimes try to give them incentives to encourage them to stop smoking." One out of all 10 participants gave a response that suggested things the city could do in association with THS. This respondent said, "I think there should be a mandate on this for all apartment complexes to notify residents if the previous occupants were smokers and then implement some

additional cleaning activities that could prevent those risks, especially for children." A pattern of nonchalance and disregard could be seen here, along two emerging themes of existing activities regarding THS, prevention, and a recurring theme of knowledge of THS.

Various studies have shown that THS has dangerous effects at the gene level, is risky for babies and can cause damaging changes in lung physiology in rats (Özpinar et al., 2022). Additionally, researchers showed that the smoke in THS, contained carcinogenic substances meanwhile in animal studies, an association was established between ETS exposure and illnesses as prediabetes, asthma, attention deficit hyperactivity disorder, asthma, metabolic syndrome, and low birth weight (Özpinar et al., 2022). Most of the participants in this study believed THS came with dangers to human health. Some specified the type of danger while others were vague. For example, a participant stated, "children being diagnosed with cancer" another mentioned "cancer from inhaling nicotine" and one stated "children being diagnosed with asthma." Other vague responses included "adverse effects, severe illnesses, ailments and even death" by one participant, another stated "health issues, sickness, death" as perceived dangers while others ambiguously stated, "well we can have kids that get affected," "it's dangerous it's not good," "there will be more respiratory illnesses." One participant expressed disgust by saying "a lot of people are aware of the dangers of smoking, but they feel helpless…we educate about cancer and asthma…nothing is going to change…and all these illnesses will continue." Interestingly, the word "cancer" came up six times and "death" three times. This could show their perception of the severity of the impact THS

has on people. It is worth noting that 4 out of all 10 participants immediate thought about babies and children when responding to this question., one said, “sometimes you wonder how babies still get cancer, they were just born,” another stated “well, we can have kids that get affected,” and “…especially children born with respiratory illnesses.” Multiple responses showed that some of the participants were overwhelmed by the understanding of THS and its dangers. This could be perceived in the following responses of three participants “sometimes you wonder how babies still get cancer, they were just born, they haven’t lived a lot, but they got cancer,’ another replied that “even the air in the atmosphere is getting bad enough,” a different respondent asserted “I don’t think many communities are aware of how dangerous it is.” These variations in response to this question is significant to the overall purpose of this study. Many are not aware, the few that are aware of THS and its effects to health have a vague or general understanding. It also shows that ETS is already a burden and people feel like there is no escape as the air itself is polluted as a respondent clearly stated. Adults are burdened by the disease burden on children who may not be able to care for themselves. More awareness is needed to help parents make informed decisions about what kind of environment they should have their children in.

With the emergence of studies on the likely harm of THS exposure and emphasis on its association with harmful health effects, prevention is needed. I was pleasantly surprised at the different strategies that were suggested. All 10 participants gave suggestions on how to approach THS prevention. Their suggestions ranged from administrative and educational to personal. Examples of administrative approaches were

government initiatives like laws around smoking bans, enforcement of laws that could help housing authorities test apartments for smoke before tenants depart, smoking designated areas, illegalize cigarettes, government-initiated incentives to encourage people to quit smoking and produce chemicals that could clean up THS permanently. According to Rendón et al. (2017), THS is invisible, and usual cleaning methods cannot get rid of it. Five subjects gave educational strategies for prevention. One participant suggested that Baltimore city needed more education on THS; another said workshops should be organized to sensitize the population on THS and raise awareness. One participant shared that social media and TELEVISION networks were the best in information dissemination. Two participants believed that individuals could form personal habits such as self-discipline and the invention of a chemical that could permanently eradicate THS and its toxins. These responses showed that preventing THS is not an impossibility. Most importantly, it could be concluded that if the community is informed about THS, there will be no problem getting residents to work towards the prevention of THS.

Themes Developed from Semi structured Interviews

Lack of Awareness/Knowledge

To discover and describe the level of knowledge that individuals in Baltimore have about THS was one of the topics this study sought to address. Based on this, participants were given the opportunity to respond to questions about tobacco smoke without any explanation of what THS meant (Session 1) and after some explanation was made (Session 2). In S1 eight of the 10 participants who identified as nonsmokers

associated tobacco smoke with discomfort, breathing difficulties, intoxication, and adverse effects. While four out of eight nonsmokers interpreted the presence of tobacco smoke in their environment as SHS, one of them shared that it meant nothing to them, while the other stated, “Personally, I haven’t really experienced it.” Words like “uncomfortable” were mentioned five times. It was interesting to me when two participants who identified as smokers expressed nonchalance and extreme conscientiousness. One said, “because I am a smoker and I do smoke regularly; it doesn’t bother me if someone else is smoking around me,” Likewise the other who stated in confidence that “I never smoke inside the house, if my family is sitting in my vehicle, I don’t smoke in my vehicle.” In S2, all 10 participants expressed ignorance about THS when asked how much they knew about it. Worth noting are the responses of the two smokers; one responded, “Nothing,” and the other, “None, I guess not.” These results indicate that people dislike the smell of tobacco smoke. They understand that it is not good; they even know about SHS; however, they are unaware that it is THS, it is more dangerous than SHS, and they need to be aware of it. Per Acuff et al. (2015), while the impact of active smoking and SHS is well-known, the concept of THS is new both in public health and the environmental health field, which leaves the public with inadequate information, immature attitudes and beliefs, a validation of the need for future research. Based on these results, it can be concluded that there is a lack of knowledge about THS and a need to raise awareness.

Attitudes of Smokers and Nonsmokers

An individual's attitude regarding a specific subject influences how they respond to that concept. Looking at the perspectives of all 10 participants, as shown through their responses in S1 and S2, it can be said that without THS knowledge, individuals will ignore THS and its health dangers. This study showed that most individuals do not care about what happens after a person smokes and leaves the environment. The primary concern, if any, is to avoid the smoker. There is no knowledge of residue lingering on the smoker's clothes, curtains, rugs, or the rooftops of cars. Individuals will be happy to move into an empty smoker apartment if it has been cleaned.

Meanwhile, components of THS are known to stay in the fibers of clothes for up to 19 months (Diez-Izquierdo et al., 2018). After some light was shared on THS, I noticed that participants became more aware, careful, sad, surprised, curious, and eager to know more. I could perceive that information about THS, and its effects affected how the two smokers felt. One smoker, looking sad, expressed that if he were informed about this, he would be more mindful of their smoking and more careful of where they smoked, but without any knowledge, their attitude would be "carefree" and "let's live the life and leave." Diez-Izquierdo et al. (2018) in their study to portray the knowledge and attitudes about THS among parents of children 3 years and younger in Spain maintained that the parents were unaware of this but after providing brief information about THS, most of them agreed to its harmful effects to children after exposure. Most importantly, Diez-Izquierdo et al. found that these parents proceeded to use cessation assistance more frequently than parents who lacked information on THS. Attitudes of nonsmokers,

especially smokers, can be affected by knowledge THS which is directly related to change and subsequent decrease of disease burden (Diez-Izquierdo et al., 2018).

Beliefs Toward THS

Like attitudes, participants felt that the population in Baltimore will care less about THS if no attention is paid to providing education on the subject. According to participants, most individuals are more concerned about what they can see in their immediate surroundings, like food and shelter, after the pandemic. “I have lived in a family house where they smoke and do not care,” said a participant. They pointed out that some attention could be given to SHS because it involves a visible individual and smoke that is noticeable; however, smoke that has settled, and they are told that it contains harmful substances is not a priority. Besides their indifference, 6 out of 10 participants said the information was hard to believe. In addition, I felt the lack of concern towards THS in their fixed beliefs about death. Participants thought that one day, everyone would die, so there was no relevance in learning about THS and its effects. I attributed this lack of belief and concern to the lack of knowledge about THS. Individuals will alter their behavior towards something if they believe that it is harmful and can cause death (Glanz et al., 2015). This is also known as also known as preventive health behavior. In this study, participants had an overall weak and indifferent belief about THS. This shows a gap in THS knowledge and a need to raise awareness on the subject. According to Ozpinar et al. (2022), high-level education can potentially eradicate THS.

Existing Practices/Activities

The global prevalence of THS necessitates widespread policies and educational action to address it (TSRC, 2023). However, this should be channeled through practical activities in the community. Such activities must be tailored around understanding what THS is and how it is transmitted. According to Ozpinar et al. (2022), THS exists in dust and is transmitted through inhalation, ingestion, and skin absorption. Eight out of 10 participants in this study needed to be more knowledgeable about any activities in the city that could help prevent THS. If there were any activities, susceptible areas like workplaces, public transportation, government buildings, hospitals, schools, restaurants, bars, and private homes (Matt et al., 2023) are places that could benefit.

Furthermore, two subjects thought that if state officials could initiate statewide cleaning activities or incentivize smokers to quit, a conversation around THS could start and lead to actions. As great as these suggestions sound, it may only be effective if proper education is done. The lack of any identifiable practices or activities around THS, as expressed by participants, tells me that policymakers have paid little or no attention to this subject. This could lead to more exposure to its health effects and, ultimately, an increase in disease burden. In a study by Matt et al. (2023) to understand the policy-relevant discrepancies between SHS and THS, it was determined that existing smoke-free policies focused directly on SHS and did not amply address the risks posed by THS. I liken this to the lack of existing activities in the city which indicates that priorities around ETS need to be modified to emphasize THS.

Health Concerns/Perceived Dangers of THS

Significant in the study of THS is the impact it has on the health of individuals, especially young children. THS like SHS has pollutants that are transported through the air, however THS pollutants are remitted from their tanks. Basic actions like donating furniture, selling cars, the return of smokers from break, disposing of old carpets, preowned toys, books, property hand overs, THS pollutants are moved to new locations as well. This includes smoke-free spaces (Matt et al., 2023). These pollutants contain cancer, asthma, respiratory illness, and birth defects causing substances like benzene, lead, and formaldehyde (Matt et al., 2023). Participants in this study understood that tobacco smoke is dangerous to human health and considered THS to be more dangerous. They expressed that, because it is almost nonexistent in terms of lack of knowledge, many more individuals, especially children, could be affected. Consistent with previous studies, participants thought that THS could lead to cancer, nicotine inhalation, deformities, respiratory illnesses, and death. I was impressed by the richness in their awareness of its dangers. I was interested in one respondent who conveyed an emotionally invested position. He stated, "a lot of people are aware of the dangers, but they feel helpless…they have tried to quit but it's not working."

Based on the knowledge expressed by these participants, THS is a health problem, dangerous to humans and more individuals need to be made aware. This will empower them to take both personal actions for prevention and adhere to state regulated measures of prevention. Matt et al. (2023) admitted that recognition of THS as a distinct health risk adds to the close of loopholes and promote tobacco endgame strategies like the need for a

speedy ban on smoking in indoor areas without exemptions, bring new partners to tobacco control efforts and address remediation of THS and who should be responsible for the cost.

Prevention of THS

All 10 participants demonstrated a possibility in preventing the exposure of THS and consequently the health effects. I noted that their responses were two-fold, structured and unstructured possible ways of prevention. Structured prevention modes centered around government intervention, such as smoking bans, policy regulation around smoking, remediation equipment, and mandatory check-ins by designated officials, especially in rented properties. Raising awareness through workshops, social media, and television was emphasized, and habit formation. Without comprehensible knowledge of the role of various household materials in the storage and release of THS, effective remediation approaches cannot be developed (TSRC, 2013). Also, an added robust approach would be to insist that THS is breaking the rules about housing and that it needs to be fixed (Matt et al., 2023).

I perceived that the prevention of THS could not be an individual effort. It should be a joint effort between the city of Baltimore and the residents. Without the support of the city, the efforts by residents will not last either for lack of resources, the will to continue, or lack of information. If the city decides to embark on it without involving the residents, their efforts will be met with a lack of follow-through, which may ruin the goal. Therefore, with adequate knowledge of THS, the individuals will be willing to participate in protecting their health and that of their families thus making prevention a possibility.

Summary

In this chapter, I collected data by conducting semi structured interviews with 10 purposefully selected participants who are both smokers and nonsmokers. I selected these participants using Facebook, an online platform. I followed standard protocol for IRB with respect to all instructions. The interviews were conducted through Zoom, and participants were given the choice of video or audio. Each participant chose the day and time that was convenient for them. I ensured that there was little or no distraction in the room. I took time to do a technology check to avoid internet or device failures. I showed 30 minutes before each session to feel prepared and ready for my participants. Each participant answered all questions asked and I reminded them that they had the right to say no to any question that made them feel uncomfortable. After I collected the data from all 10 participants, I transcribed the data using Microsoft word and later used an electronic software device called Quirkos to manually generate themes and codes for my data. By doing it manually, I was able to eliminate redundancies. These codes helped me generate six themes. These themes aligned with the responses based on their perceptions, beliefs, and practices around THS from the seven research questions. These were: Lack of awareness/knowledge of THS, attitudes of smokers and nonsmokers, beliefs towards THS, existing practices/activities, health concerns /perceived dangers, Prevention of THS. The findings of this study revealed that Baltimore residents have a basic general understanding of tobacco smoke, SHS and its effects but lack knowledge of THS. However, with a brief explanation, they were able to identify gaps and tendencies that could lead to health concerns in the community from exposure to THS. Participant

responses aligned with the research questions. Moreso, a little knowledge of THS triggered thoughts of prevention with specific ways to execute them. This implied that, with education and population appropriate sensitization, of THS, more individuals would become aware, mindful, and willing to take steps to prevent the spread of THS hence a decrease in its impact on human health. It is my assumption that, this does not only justify the problem this study set out to solve (knowledge gap), but it would benefit children who are the most vulnerable to be raised by a THS informed community/parents. In Chapter 5, I provide my interpretation of the findings of this study, its limitations, recommendations for further research and implications for social change.

Chapter 5: Discussion, Conclusion and Recommendations

The purpose of this qualitative, interpretive, descriptive study was to discover and describe the level of knowledge, attitudes, practices, and beliefs regarding THS among individuals in Baltimore County, Maryland. Participants in this study were smokers and nonsmokers. I conducted this study to help improve the gap in knowledge and awareness of THS dangers and individuals' long-term health outcomes in the community. Baltimore County residents were interviewed at length to determine how much they knew and if they had been directly or indirectly affected by THS. The key findings from this study show that the participants had a basic understanding of the danger of tobacco use and a few facts about SHS but lacked knowledge of THS and its health dangers. With a brief explanation of THS, participants understood what THS is; recognized that without any knowledge, they did not care about their attitudes around tobacco smoke or have any practices around THS; and recognized that with some knowledge of THS that they were able to think and share their perceptions of how THS could affect their health and determine how it could be prevented.

Interpretation of the Findings

The data collected from all 10 participants during one-on-one, in-depth interviews confirmed that THS has adverse health effects, yet there is a gap in how much public health and community awareness exists on it. The responses that I gathered from all 10 of the participants established a lack of awareness of THS, nonchalant attitudes towards it from both smokers and nonsmokers, limited or no beliefs about it, no existing practices, perceived health dangers, and over 10 different ways to prevent THS exposure. During

the interviews, participants demonstrated some knowledge of SHS and an understanding of the effects of tobacco smoke but no knowledge of THS. I found that individuals may not know what THS is, but they know that tobacco smoke is dangerous and if they are exposed to a smoker, they become a victim of SHS. Researchers have previously shown that, smoking can cause cancers, CVD, mental illness, and miscarriages during pregnancy (Cheng et al,2019). In a study to explore the different perceptions associated with smoking risk during pregnancy by Alaska Native women, a greater part of both pregnant nonsmokers and pregnant smokers believed that the health of the baby could be negatively impacted by smoking (Bronars et al., 2018). A study that was conducted to understand perceptions of SHS and THS among Hispanic residents of MUH further confirmed that participants understood the definition and health effects of SHS; however, none of them knew the definition of THS but after they received an explanation, they became aware of the effects (Rendon et al., 2017).

The attitudes of participants in the current study towards THS were nonchalant and unconcerned. I found that these attitudes stemmed from a lack of understanding of what THS is. One of the participants who identified as a smoker reported that he does not smoke in his house, car, or around his family as a decent practice not because he felt that the particles will settle and possibly harm his children. After a brief explanation, I saw a humbling facial expression followed by a resolve/statement that “we must educate the population.” Another smoker stated, “It should be illegal.” On the one hand, this showed the effect of lack of awareness (i.e., indifference), and on the other hand, the power of education (i.e., involvement). If more individuals understand what THS is, more

individuals will be careful and may quit smoking completely. Prior research examining knowledge and attitudes toward THS among low-income groups showed that most of the participants were unfamiliar with THS, but after having it defined for them, some immediately acknowledged their experience with the toxic effects of residual tobacco amidst dust and the smell of tobacco that lingers in clothes and around their houses (Acuff et al., 2015).

The lack of beliefs or feelings about THS was another one of the findings of this study. All 10 participants said they had no beliefs about THS because they had no idea anything like THS existed. A lack of feelings about THS leads to a lack of intentionality when renting cars, houses, living with smokers, and paying zero attention to children when they crawl around. As a result, asthma and other respiratory illnesses in children may increase, the number of adults with CVD and birth defects may increase, and smokers will continue with this deadly habit. Darlow et al. (2017) acknowledged the limited number of studies that have addressed beliefs in association with THS among adults from the usual population. The researchers also stated that not much is known about the beliefs of health care professionals about THS and their related communication practices. Meanwhile, an assessment and an understanding of their knowledge and beliefs about THS would be valuable. Parental awareness and beliefs regarding the effect of THS on children's health can influence the parents' behavior directly and determine if children avoid THS or not (Xie et al., 2021).

The deficiency of existing practices and activities to foster awareness of THS in Baltimore was a significant finding in this study. Eight out of 10 participants reported no

knowledge of any THS-related practice that was ongoing or had taken place in the past. THS is the invisible toxic residue left behind after active or passive smoking accumulates on every object in a smoking area, such as carpets, curtains, and clothes, and can be transmitted into the body through the skin when exposed, inhaled as dust, or by ingestion (Csipor et al., 2017). Therefore, existing practices are needed to reinforce the existence of THS and remind residents to be more mindful. This is consistent with the finding that environmental risks, particularly air pollution, are highly impactful on the health and development of a child from conception through childhood, adolescence, and adulthood (WHO, 2020).

The perceived dangers and health concerns associated with THS was also a major finding in this study. From the 10 participants' responses, I understood that they were aware of the dangers of smoking, so with the additional explanation of THS, it was easy for them to perceive the possible dangers to human health. Based on their responses, THS could lead to children getting asthma, cancer from inhaling nicotine, respiratory illnesses, babies born deformed, and other adverse effects. This finding harmonizes with those of previous studies on THS that revealed that THS has carcinogens that may initiate neurocognitive and respiratory problems (Delgado-Rendon et al., 2017). Prior research has also shown that tobacco exposure can be counted as one of the major risk factors for harmful maternal consequences, such as an ectopic pregnancy and spontaneous abortion (Sun et al., 2021).

All 10 participants agreed that THS could be prevented either through government regulations or by personal habits of self-discipline and quitting smoking.

Some of the strategies of prevention that participants offered were creating smoking restrictions at certain places, instituting smoking bans, reducing cigarette smoking, inventing chemicals that could get rid of THS, raising awareness though education, organizing workshops or government-sponsored incentives, and using social media and TELEVISION stations to disseminate information on THS. According to participants, incentives would motivate smokers to quit smoking. In accordance with these findings, Sun et al. (2021) advocated for pregnant women to quit smoking along with their husbands. The researchers noted that if tobacco exposure is unavoidable, individuals should refrain from smoking around pregnant women, and the government should reinforce prenatal education with specific emphasis on the dangers of passive and active smoking. Increased awareness would protect pregnant women from hazards of tobacco and, consequently, THS.

Other past studies confirmed the need for THS-centered education and social instructional policies dedicated to parents and caregivers (Díez-Izquierdo et al., 2018). Díez-Izquierdo et al. (2018) found that brief THS education intervention to caregivers in the emergency room with children under 36 months old brought about changes in smoking manners. Parents and caregivers that receive education on THS are more likely to take precautions that will in return reduce the incidence of harmful effects from THS.

The theoretical base for this study was the SCT, which is a social learning theory created by Bandura in the early 1960s explaining how human behavior is a collaboration of individual factors, behavior, and the environment (Fertman & Allensworth, 2010). I found that the themes that emerged from all 10 participants' responses were founded on

their behavior, which was influenced by their personal (i.e., beliefs), environmental (i.e., social influences and physical structures in the environment), and behavioral factors (see Fertman & Allensworth, 2010). Their behavioral capability depended on how much knowledge they had about THS. Participants reported that they would also engage in practices against THSE if the environment put things in place like smoking bans, restricted smoking spots, and laws to ban smoking. According to the SCT, individuals with a sense of self-efficacy can change their behavior even in the face of obstacles or being under pressure. Some of the participants suggested incentives to encourage individuals to quit smoking as a mode of prevention because incentives may have the power to boost self-efficacy and in turn alter a person's behavior positively.

Limitations of the Study

A significant limitation to this study was the inadequate number of previous research studies on the subject of THS. Arguder (2019) mentioned that no study existed that shows the negative effects of THS in human health; however, studies have been conducted on mice in conditions that mimic THS exposure to humans. With the lack of substantial previous studies on THS, Acuff et al. (2015) maintained that THS research is new, and at this time, only limited animal studies have been completed that investigated the health impacts related to an individual THS-precise component. As a result of the inadequate number of studies on the topic, there was insufficient or a lack of access to data that I could use to compare to the current study findings.

During the participant recruitment phase, I received no response from Instagram, which was one of the platforms I tried to use to recruit participants. As a result, I

eliminated Instagram and only focused on Facebook. Most of the volunteer participants hesitated to join the study because they thought they needed to have previous knowledge of THS to qualify for the study. The lack of awareness on THS may have led to an insufficient sample size for statistical measurement. Personal issues from smokers may have also led to conflict, like not sharing information on family members' smoking status, which could be a cultural issue and lead to information bias. Thankfully, all 10 participants responded freely to all the questions asked.

Recommendations

I conducted this research study with male and female smokers and nonsmokers who reside in Baltimore County. With the knowledge that THS affects children and pregnant women the most, I recommend that in the future, researchers should include pregnant women and parents, especially mothers, in the sample population. Studies have shown that more than 40% of children between the ages of 3- and 11-years old experience tobacco smoke exposure at home, and exposure to smoke is known to be prevalent with children that live beneath the poverty line (Rendon et al., 2017).

The sample size for this study was limited to 10 participants in Baltimore County, which is not a big city/county. The findings in this study may not be generalizable to a larger population or geographical area. Future studies should include a larger sample size. Due to the increase rates of health effects from THSE, I recommend that future studies should recruit more smokers to increase the likelihood of cessation through knowledge and experience. I used the SCT for this study; however, use of more than one theory as a

framework could help to develop, manage, and evaluate interventions, such as theory of planned behavior or communication theory.

Implications for Positive Social Change

This research study was about the knowledge, attitudes, and beliefs of individuals in Baltimore County, Maryland towards THS. The positive social change implications of this study are that the findings could be used to bridge gaps in knowledge, the understanding of THS and emphasize levels of income, education, disease prevention, healthier communities, infant morbidity, and mortality, change in policies, and discrimination within the community. The findings of this study could help health care providers understand the community's current knowledge base to use as guide to design context-specific communications and awareness strategies on THS. Both policymakers and nonsmokers may find this study significant because it will afford them a base to review policies and laws on cigarette smoke and tobacco control (see Arguder, 2019). After comprehending the community's awareness level, practices, and beliefs towards THS, systems can be created by health officials in support of 100% smoke-free homes and cars. With these changes, nonsmokers would not be exposed to THS, and smokers would be aware of THS and may limit their smoking rate, quit, or restrict smoking in confined areas, all risk factors to the vulnerable (see NCCC, 2015).

The findings and overall information in this study may help inform parents of children who live in households with smokers to understand the children's susceptibility to environmental pollutants. According to the NCCC (2015), 20 environmental pollutants from tobacco smoke can react with other compounds in the environment, like the ozone,

to create secondary pollutants. After a person smokes, pollutants remain in the gas phase that can be removed through ventilation; however, a substantial fraction adheres to indoor surfaces and continues to build up over time that ranges from a few seconds to several weeks or months unknown to persons living in those spaces (Matt et al., 2011). Hang et al. (2015) maintained that THS is responsible for the high levels of DNA destruction found in humans' cells. A better understanding of THS is significant for professional practitioners because it would give them additional reasons to transform tobacco control policies, legislate a ban on indoor smoking, and develop new prevention strategies. Positive social change may be achieved through this informed decision making, awareness, understanding, and knowledge.

Conclusion

The intent of this study was to discover and describe the level of knowledge, attitudes and beliefs regarding THS among 10 participants, smokers, and nonsmokers, in Baltimore County, Maryland. Through one-on-one, in-depth interviews with participants, I identified a significant gap in knowledge regarding THS. This finding may encourage policymakers to revise and create policies surrounding THS to protect nonsmokers and vulnerable populations. Health care policy and practice should include awareness talks on THS during patient visits, and public health professionals should be encouraged to raise awareness of THS with greater intensity. Public health educators should consider developing diverse methods of sensitization, such as reaching community members through social media, TELEVISION, and community organizations.

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Appendix: Semistructured Interview Guide

The following issues and questions will be explored during the interview:

SMOKING STATUS

Smoker and non-smokers:

1. Tell me your thoughts about breathing air in a room where someone has smoked.
2. Do you believe that you can get sick simply by living in a house that has once been owned by a smoker?
3. How will you feel about a smoker hugging or kissing a baby?
4. What do you think could happen to a child who puts his hands in the mouth after touching surfaces in a smoker's house?
5. How long do you think smoke particles can remain in a room?
6. What measures do you take to protect yourself from THS?
7. How much knowledge do Baltimore County residents have about THS?
8. What attitudes do non-smokers/smokers have towards THS and its effects on health?
9. What are the beliefs of residents in Baltimore County towards THS?
10. What kinds of activities exist among Baltimore County residents regarding THS?
11. What are the perceived dangers of THS to the community?
12. How can THS be prevented in Baltimore County?