

“I’m on a First Name Basis with Everybody at the EPA”: Measuring Community Impact of Air Pollution from a Hemp Processing Plant

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Abstract

Air pollution is comprised of a complex mixture of various gases and particulate matter that can be damaging to human health after both short-term and long-term exposure (Bergstra et al., 2018; Sass et al., 2017). This research examined the biopsychosocial impact of exposure to air pollution in a rural community sample using a mixed methods approach. Residents from this rural community engaged a university affiliated environmental health science center to understand and assist with potential health risks associated with a local hemp processing plant. Researchers from the center conducted a mixed methods study that involved in-depth interviews and administration of standardized scales on physical and mental health with seven community residents. Results indicate that there were a range of mild to moderate physical health symptoms and higher than average levels of anxiety/distress. Themes from the interviews included physical health concerns, support from government officials, community support/alienation, impact on relationships, emotional distress, forced relocation and loss, and confounding effect of COVID-19. Implications for community practice to support the biopsychosocial needs of those experiencing environmental exposure or risk are discussed.

Keywords: Air Pollution, Psychosocial Impact, Isolation, Stress, Covid

Introduction

Air pollution is comprised of a complex mixture of various gases and particulate matter that can be damaging to human health after both short-term and long-term exposure (Bergstra et al., 2018; Sass et al., 2017). Air pollution is a significant contributor to the global burden of disease and negatively effects respiratory health (Pope et al., 2008) and cardiovascular functioning (Parker et al., 2018; Pope et al., 2015). Exposure to air pollution contributes to coronary syndromes, heart failure, stroke, and arrhythmia. (Alessandrini et al., 2013); lung cancer (Hamra et al., 2014), chronic asthma (Mannucci et al., 2015), and chronic obstructive pulmonary disease (COPD) (Pope et al., 2015), pneumonia (Anderson et

al., 2012), and diabetes (Bowe et al., 2018); Parkinson’s disease (Kirrane et al., 2015). Additionally, research studies link air pollution to mortality (Pope et al., 2018; Lepeule et al., 2012) which remains constant across subgroups of sex (Di et al., 2017), age (Hart et al., 2015), race-ethnicity (Parker et al., 2018), socioeconomic status (Jarrett et al., 2017), education levels (Thurston et al., 2016), and geographic regions (Pope et al., 2018).

In addition to negative health outcomes, evidence suggests that air pollution has a negative effect on subjective well-being and mental health (Mehta et al., 2015; Power et al., 2015). Air pollution exposure can result in psychological distress (Sass et al., 2017), symptoms of depression and anxiety (Pun et al.,

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2016; Power et al., 2015), and suicide risk (Bakian et al., 2015). Levels of stress increases by exposure to airborne particular matter which directly damages health through environmentally induced inflammation and oxidative stress (Block and Calderón-Garcidueñas 2009) and indirectly through perception of risk, chronic stress. (Thomson et al., 2013).

Several researchers have found that regardless of actual exposure to environmental pollutants and the hazards they pose, the perception of negative health effects can contribute to induced health-related symptoms (Crichton et al., 2014). Perceived exposure to environmental pollution has been associated with poorer mental health and disturbances in sleep (Yamashita et al, 2021).

Research demonstrates that the perception of air pollution, which includes environmental odor pollution, can similarly negatively affect humans in both a physical and psychosocial manner. Several studies indicate that odor exposure is associated with behavioral interference and health risk perception (Wing et al., 2008) Irregular exposure to odor causes stress and anxiety and alters daily routines (Horton et al., 2009). Furthermore, Blanes-Vidal and colleagues (2014) found that exposure to odor in residential environments has a deleterious effect on social health and quality of life and that certain groups including women, non-smokers, younger residents, new residents, those with children, those working from their homes and those residents whose employment was not related to the source of odor were particularly vulnerable to psychosocial interference from environmental odor exposure.

Hemp

In recent years, Hemp (*Cannabis sativa*) has reemerged in the United States as a sustainable crop and product alternative after the passage of 2014 Farm Bill, which allowed for research and pilot programs involving hemp and hemp-based products (Kolodinsky & Lacasse, 2019). After the federal legalization of hemp in 2018 and the subsequent explosion of interest in the production and commercialization, hemp acreage increased 350% from 2018 to 2019 (Mark et al., 2020). Hemp is the source of compound cannabidiol (CBD), a nonintoxicating compound found in cannabis, and one of the 113 cannabinoids identified in hemp plants, which can be used as an oral supplement and topical substance used for a variety of health-related issues (Fathordoobady et al, 2019). In 2018, the CBD market in the United States was \$600 million, a number which is projected to increase to \$20 billion by 2022 (Kolodinsky & Lacasse, 2019). The environmental

effects of hemp processing, and the physical and psychosocial effects on humans exposed to hemp processing, are relatively unstudied. Er and colleagues (2016) found that workers in a hemp processing plant had higher rates of bronchitis and emphysema development compared to workers in similar factories.

Current Study

The effects of exposure to perceived environmental pollutant exposure caused by hemp manufacturing, and in particular, manufacturing that produces CBD-derivative products, is unstudied. In this study, standardized scales on general health and psychosocial well-being were administered to participants exposed to a hemp processing facility in a small rural community in the southeastern United States. A series of open-ended questions were also asked to assess participants' potential exposure, stress, and support related to their experiences with the hemp manufacturing facility. The purpose of this research is to add to the field's understanding of both objective and subjective experiences of physical and psychological symptoms associated with environmental exposure from hemp manufacturing in a community-based setting.

Methodology

This study utilized a case study design to evaluate the experiences of members of a specific community affected by potential exposure from the hemp manufacturing plant. This case study design employed mixed methods, with the collection of both quantitative data from standardized scales and qualitative data from open-ended questions via in-person interviews.

Sample

The sample for this study consisted of seven individuals from the community affected by a nearby hemp processing plant. The demographics of the sample were: age-86% 65 and older, 14% under 30; gender- 28.6% male, 71.4% female; race- 85.7% white, 14.3% Black/African American; marital status- 71.4% married, 14.3% divorced/separated, 14.3% single/never married; employment status- 57.1% retired, 14.3% unemployed, and 28.6% employed.

Variables and Measurement

Quantitative data on physical and mental health were collected using standardized scales and measures developed for this study. Demographic variables and data on medical conditions were collected via a checklist constructed by this research team. In addition, the *Short-Form Health Survey [SF12]* (Ware

et.al., 1996) was administered, which consists of 12 questions assessing general health, mobility, and activities of daily living as well as general mental health rating items on 5–6-point Likert scales with strong construct validity (0.93).

The *Psychological General Well Being Index* [PGWBI] (Dupuy, 1977) is a 22-item survey using 6-point Likert scale to measure symptoms of depression, anxiety, and general stress. In all studies, the internal consistency of the American PGWBI was high, with strong reliability ranging between 0.90 and 0.94.

Symptoms of *Post-Traumatic Stress Disorder* were assessed with questions taken from the DSM–5 Self-Rated Level 1 Cross-Cutting Symptom Measure (American Psychiatric Association, 2013). The symptoms of PTSD occur in four types: intrusive memories, avoidance, negative changes in thinking and mood, and changes in physical and emotional reactions (Mayo Clinic, 2021). The first of these is intrusive memories. Intrusive symptoms may include emotional distress or physical reactions with reminders of a traumatic event, unwanted and distressing memories of an event, or upsetting dreams and nightmares about a traumatic event.

Stress was assessed using two questions taken from Cohen’s Global Measure of Perceived Stress (Cohen et al., 1983). These questions were assessed using a 5-point Likert scale. The *Coping Scale* (Hamby et al., 2015) is a 13-item questionnaire that assesses cognitive, emotional, and behavioral methods of dealing with problems Internal consistencies are 0.88 and 0.91.

The *Social Provisions Scale* [SPS-10] (Cutrona & Russell, 1987) is a 12-item scale with one positively worded and one negatively worded statement assessing each social provision. Respondents are asked to indicate the extent to which each statement described their current social relationships. Each item is scored on a 4-point Likert scale from 0 to 3. The internal consistency of the instrument was 0.96.

Qualitative data were collected via open-ended questions that included the following: 1) Tell me about your experiences with hemp processing plant. 2) How has this changed overtime? 3) What have you noticed in terms of impact on your physical health? 4) What have you noticed in terms of your stress and emotional well-being? 5) How has your experience with the plant impacted important relationships? 6) How has your experience with the plant impacted other areas of your life? 7) How do you think this has impacted the larger community? 8) What support have you received? What other support do you wish

you had?

Data Collection and Analysis

Data were collected via in person interviews in the homes of participants. Interviews were recorded and transcribed; scores and written notes on quantitative scales were recorded on paper. The study was approved by the Institutional Review Board of the authors’ university and the informed consent was completed prior to data collection. Quantitative data were summarized for scale total and sub-scale scores and compared to norms established in the literature. Inferential analyses were not conducted due to the small sample size of this community case study. Using an applied thematic approach (Guest et al., 2012), informed by the constant comparative method of qualitative analysis (Boeije, 2002), qualitative data was analyzed with the line-by-line coding approach for content analysis where each segment of text was coded. Codes were grouped together to identify themes with unique cases and illustrative quotes for each theme. Data were coded by a single analyst but confirmed through peer debriefing and member checking.

Quantitative Results

Medical Conditions

See Table 1 for a summary of medical conditions and health behavior data. There were a wide range of medical conditions reported, including 57.1% report daily physical symptoms such as headache, coughing, breathing issues, congestion, and stomach symptoms. Given the underlying conditions identified in this inventory, the link between environmental exposure and daily symptoms is unknown but the experience of such remains relevant to the questions posed by this study.

Table 1: Frequency of Medical Conditions

Medical Condition	Frequency
Diabetes	14.3%
Asthma	14.3%
High Blood Pressure	85.7%
High Cholesterol	42.9%
Cancer	28.6%
Heart Attack	14.3%
Stroke	14.3%
COPD	14.3%
Seasonal Allergies	71.4%
Glaucoma	14.3%
Depression	71.4%
Gout	14.3%
COVID-19	28.6%
Changes in Hearing/Vision	71.4% /28.6%

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Health Behaviors

Health behaviors were assessed via items constructed by this team for the current study. Of those interviewed, no interviewees reported smoking cigarettes or vaping. 14.3% indicated that they used CBD oil. There were 66.7% of interviewees who reported exercising seven days a week, 14.3% reporting they exercised three times a week, and 14.3% reporting they exercise two times a week. The most reported types of exercise were walking, yardwork, housework, outdoor activities, and swimming.

General Health Ratings

General health ratings were measured using the Short-Form Health Survey (SF12) (Ware et al., 1996). Only 14.3% of respondents rated their health as excellent, while 42.9% rated as good and 28.6% as fair. There were 57.1% of respondents who reported being limited or somewhat limited in climbing stairs and other kinds of work (within and outside the home). Pain interfered with ability to do this work for 28.6% of participants. Similarly, 57.1% indicated that they accomplished less in the past four weeks as a result of their physical health while 71.4% indicated they were limited as a result of emotional problems. There were also 42.9% who said that these problems interfered with their social well-being. When asked how often they felt peaceful, 42.9% said never, and 42.9% also said they felt downhearted or blue all or most of the time.

Mental Health and Well-Being

PCWBI

Psychological well-being was assessed using the Psychological General Well Being Index (PGWBI) (Dupuy, 1977), a 22-item survey using a 6-point Likert scale to measure symptoms of depression, anxiety, and general stress. Participants' PGWBI scores were higher than average of individuals above the age of 60, with participants scoring an average of 81.57, compared to the established average of 73. Mean scores by domain were as follows: anxiety M=17.86, depression M=12.57, positive well-being M=15.14, self-control, 9.43, general health, 10.14, vitality, 15.57. As these scores indicate, anxiety, vitality, and positive well-being were the areas of greatest need.

Stress

Stress was assessed using two questions taken from Cohen's Global Measure of Perceived Stress (Cohen et al., 1983). The mean item score was 2.64 out of 5, and the mean total score for the stress scale was 5.29 (SD = 1.89) out of 10, with a range of between 2 and 8.

Post-Traumatic Stress Disorder (PTSD)

The mean overall score for PTSD scale was 9.86 (SD=4.02), with a range of between 3 and 15. The individual question apprising intrusive symptoms had a mean score of 3.14 (SD=1.46), with a range between 1 and 5. The individual questions apprising arousal symptoms had a mean score of 3.14 (SD=1.86), with a range between 1 and 5. Finally, the individual question on avoidance symptoms had a mean value of 3.57 (SD=1.62), with a range between 1 and 6.

Coping Scale

Coping was assessed using the Coping Scale (Hamby et al., 2015), which contains two subscales: appraisal coping and behavioral coping. The mean of the appraisal coping scale was 21.57 (SD=2.70), with a range between 19 and 27. The mean of the behavioral coping subscale was 15.86 (SD=3.76), with a range of between 12 and 22. The total for the Coping Scale had a mean of 37.43 (SD=6.02), with a range between 32 and 49.

Social Support Scale

Finally, social support was assessed using the Social Provisions Scale (SPS-10) (Cutrona & Russell, 1987). The social support scale had a mean of 33.57 (SD=5.91), with a range of between 24 and 39. Comparatively, the average standardized mean is 36.04 (Orpana et al., 2019), indicating that subjects in this study report lower perceptions of social support.

Qualitative Results

Physical Health

Participants reported that the smell and smoke emanating from the nearby hemp processing plant was affecting their physical health. Participants most frequently reported that they experienced headaches, sore throats, burning eyes, dizziness, burning of the throat, nose, and chest, blurry vision, and coughing. Moreover, those interviewed reported secondary physical health effects, such as weight gain, from not being able to engage in exercise on their property. Several of the interviewees reported that they had been seen by doctors, with two of those interviewed reporting that they had been seen in the emergency room.

The interviewees mentioned that they had difficulty breathing due to exposure to odor and smoke. Participants reported that this difficulty breathing caused them significant distress. One participant reported severe chest pain and headaches, "burning, burning heat ... chest tightness and like I said, the coating on my throat, that sort of thing, the headaches, if I go outside... burning inside of my

nose.” One participant shared: “at the time, I was extremely stressed out about it. When they stopped [processing hemp], you could breathe.” Participants universally reported that this inability to breathe when they were experiencing odor from the hemp processing plant caused considerable emotional distress, in addition to the physical symptoms they were experiencing.

Support from Government Officials

Participants overwhelmingly agreed that they did not receive adequate support from city, county, state, and national-level government officials. One participant reported that the community had “no support from our county... the city. We’ve reached out written letters to [state senator], [local government official], [mayor], [US senator]... nobody has answered any of our letters. We have had no support.” Several participants attributed this lack of support to money in the form of bribes or other kickbacks: “I mean, it feels like, you know, the city just doesn’t want to know...I was like, they [the hemp processing company] put some money in people’s pockets.” Further, several interviewees placed blame on government officials for allowing the hemp plant to begin operation initially. Participants also noted that city and county officials blamed them for situation, with one reporting, “I don’t want to call his name – our mayor, judge, and county... I felt like I couldn’t really trust them. They just look like they were trying to make us look like the bad guys.” Other participants also reported that they were disparaged for speaking out against the hemp processing plant. One participant reported that they noted that this criticism occurred in the town’s on-line forums, as well as in person, with community participants expressing that those speaking out against the hemp processing plant should just “shut up” and allow the plant to operate.

Participants shared dismay in the attempts to bring the hemp processing plant into compliance with state and federal regulations came only after the plant began to operate. One participant reported “he [state commissioner of agriculture] said, ‘this has to be regulated, and it’s not gonna be easy to get it regulated.’ And instead of putting everybody through this – it’s never been regulated.”

This disappointment in the lack of regulations was confounded by confusion regarding the state of the plant’s permits. One participant shared “even acknowledging the fact that they didn’t have permits, because the first thing out of his mouth was, well, they have all their permits in order, and it feels like things weren’t handled properly, and it would prevent this from happening.” When government officials noted

that the plant was operating with the necessary permits, this conflicted with participants’ belief that the plant was operating without a permit, which served to deepen the mistrust that participants felt towards local and state officials.

Community Effects

Participants were mixed in their reports regarding the effect that the hemp processing plant had on the community. Several interviewees remarked that they worried about the general health of the community. Moreover, while some interviewees noted that the plant caused divisiveness between those experiencing the odor and smoke from the plant and those who wished to maintain the plant’s presence in the town, other interviewees noted that the effort to stop the plant from operating acted as a way to galvanize community members together. One participant shared, “I also think it kind of brought some of the community closer together”

which expresses the dialectical nature of the responses. One participant reported, “We didn’t know [community member names]... but this brought some of us closer together, whereas other people are trying to get rid of people’s jobs and stuff like that.”

Several participants reported that community members supported the plant due to the belief that it brought employment to the region. One participant reported, “one of the reasons why they all were down on me about the hemp plant, because [name] worked over there so whatever I did was going against their employment and it was going to put them out of a job.”

However, these participants stated that the health effects of having the plant in the community was not worth the jobs that it created. Maintained one participant: “that’s not, you know, a few jobs are not worth one person health. I don’t care who you are.”

Furthermore, participants reported that they felt socially isolated and experienced social stigma as a result of speaking out about the plant. Participants indicated that fellow community members denied their lived experienced and distress.

Effect on Relationships

Participants uniformly reported that enduring the pollution from the plant negatively affected at least one relationship in their lives. In one instance, this tension was the result of dissimilar and contradictory coping mechanisms, with one half of a dyad wishing to avoid talking about the situation and the other half of a dyad wishing to verbally process their distress. “She goes in her room, I go in my room, we don’t really talk much anymore... so it’s been very, very difficult.” The participants also noted that the odor the

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plant produced had a negative effect on their ability to entertain in or around their homes, which negatively affected their relationships with friends and family members.

Overwhelmingly, participants expressed repeated concern for the loved ones who were also experiencing the pollution from the hemp processing plant. This concern extended to both the physical and mental health of the study participants' loved ones. One participant shared, "I was more worried about [spouse] than I was about myself. I'm afraid that it would make her sick." Furthermore, several interviewees expressing concern for the welfare of their neighbors and fellow community members.

Emotional Distress

Participants mentioned the emotional distress inflicted by the pollution from the hemp processing plant more than any other effect. Participants reported feeling afraid for their physical and mental health, as well as their loved ones' physical and mental health, and the health of their fellow community members. In particular, interviewees expressed concern themselves or their loved ones developing cancer and dying. Participants also shared that they were afraid of moving and afraid of the financial implications of the plant's effect on their property values.

Furthermore, participants shared, overwhelmingly, that they suffered stress as the result of the pollution. This stress was compounded by the relentless nature of the hemp plant's processing schedule and their inability to permanently escape the pollution. One participant shared: "And we watched it all the time. We just, we just didn't want things happening like that to everybody around her and to us. It's, it's been pretty stressful, yes, and emotional too." Moreover, one participant reported that "you never knew what you're gonna wake up to," and another shared "when you sort of just thrown out of your property, you don't know where to go. So, you're very dislocated. Yeah, and that's part of all stress," expressing that the uncertainty of their living situations and their exposure to pollution was a source of stress.

Participants also shared that financial concerns created, as a result of being exposed to the hemp processing plant, were a significant source of stress. The financial stress expressed had three root causes: first, financial difficulties as a result of paying for gas and lodging to flee from the odor, and secondly, financial concern created by the perceived loss of value to their properties, and third, one participant lost her livelihood as a result of not being able to use their

property. As one participant reported, "we would leave home at night to drive far enough away... and that's gas and money we wouldn't have spent otherwise."

Finally, several participants reported feelings of helplessness. One participant shared that "I think that's been the worst thing, is that having nobody, no recourse of action, no one to report it to. Totally helpless. Helpless would be the word." These feelings of helplessness were compounded by financial limitations that kept participants from seeking out alternative housing, as well as by the lack of response from local, state, and federal officials. Several participants attempted to reach out to government officials regarding the air pollution, however none reported receiving assistance. Moreover, four participants report contacting the environmental protection agency (EPA), with similar results.

Forced Relocation and Loss

Relocation from their homes to escape the odor was also a source of stress for participants. One participant reported, "I can smell it inside my house, outside my house. And that's when they went full force... we just went away. I was scared to stay." The participants reported relocating to locations where they temporarily stayed, as well as to locations where they spent at least one night, such as the homes of relatives or hotels.

Participants report that leaving their home was motivated by a fear response, fearing for the health of themselves and their loved ones. Two participants also reported fearing for the health of their pets, sharing: "So, I had to take my dogs with me to the hotel down in [nearby town], and I'm like, then the whole way down there, I was, like, one of my other dogs could just die. So, it's really it's really sad." Often, fleeing with pets meant difficult choices to leave some pets behind, provoking emotional distress and fear for the beloved pets that remained on the property.

Several residents also shared that they considered selling their properties and moving to a new location. One participant noted that reaching this decision represented a process akin to the process of grieving: "it's kind of like a grief process really, that you won't have your job anymore. Your friends, your neighbors, lifestyles, anything you feel so totally displaced, but you've accepted in your mind that you've lost it all."

Ultimately, the participants interviewed chose not to sell their properties before the point in time that the interview took place. Several of the residents live on properties that have been passed on inter-

generationally, representing a link to their families. Moreover, the individuals interviewed report that staying on their properties was also prompted by financial considerations, as well as concern for the health and safety of those who might purchase the property.

A related topic was job impacts of the exposure. Participants reported that the odor from the processing plant made it difficult for them to do their jobs. The participant shared, "it affected my job, because my chest was always killing me...like getting a bottle of nail polish and bringing it [along with you] all day long while you're trying to work." They reported that while their business was negatively impacted the beginning of the pandemic, her not being able to work due to the odor of the hemp plant resulted in her business failing and her becoming unemployed.

Support and Coping Mechanisms

Participants garnered support from a wide variety of sources. The small group that banded together to bring the plant into compliance represented a major source of support. While two participants found the EPA to be a source of support, other participants felt that the EPA was a barrier. One participant shared that,

She [the EPA] would come out with her little wand and she said, 'oh, there's nothing in the air. Are you sure you're not just imagining it?'

And I'm like, 'Hey, lady, I woke up in the middle of the night in bed, you know, gasping for air.' I said, 'that's not normal,' you know, just like being a nail salon.

And she's telling me it's my imagination. And it all depends on one lady too, some people have allergies, some people have had COVID, maybe they won't smell anything. And then they're sending this one little lady out over and over again. And depending on what she smells on that day, this whole area gets help or doesn't get help.

Another participant shared: "right now, the only thing that I could smell from the plant is probably about a week ago, whenever we called the EPA, I call them and left a message. They never did call me back. I don't know if they're working from the home or where--I didn't call them in a while." The participants who reported feeling as though the EPA failed to support them indicated that this was a source of stress and emotional distress, as well as a source of frustration. However, two participants felt supported by the EPA. One participant reported, "They [the EPA] are the only people who helped us. If they had not been here, we wouldn't have had anything. But I've told lots of people: 'I'm on a first name basis with everybody in

the EPA'. This stands in marked contrast to the feeling of stress, emotional distress, and frustration of the other participants. While this resident reported feeling that they were let down with the EPA, they noted that they felt support from the organization because it was the only source of support they could find.

Moreover, participants found support from the university conducting this study. Finally, two residents report hiring an attorney, which they credited as a source of support. However, participants wished that they had support from local, state, and federal government officials, including the local health department. Participants reported a myriad of coping mechanisms as they dealt with the odor from the hemp processing plant. Participants reported that the feeling of sharing in their difficulties with the hemp processing plant helped them cope. They reported, "I feel like I have to go on this thing alone. I couldn't even understand when [I heard] that other people had been calling up [the EPA] because I thought this was my own battle, you know" Hearing from others and knowing that one was not alone in their difficulties regarding the plant allowed others to reach out to fellow community members for support. Participants also report researching the effects of being exposed to hemp processing plants, demonstrating an intellectualization of their distress, as well as closely watching the hemp processing plant and meticulously recording the dates and times of major events at the plant.

Potential Impact of COVID-19 Pandemic

Nearly every participant reported that the negative effects of exposure to the hemp processing plant was confounded in some way by the COVID-19 pandemic. Two participants reported that they wished to socialize outside with their relatives in order to maintain social distancing and follow the mandate to avoid indoor spaces. The participants reported going so far as to contact the owner of the plant and ask that the owner cease hemp processing during their relative's visit to allow them to socialize outside, a request which was ultimately ignored. Moreover, participants reported going to the emergency room with respiratory symptoms due to exposure to odor from the hemp processing, only to be turned away from further evaluation due to the pandemic: "but you know, they asked me what my symptoms were, and I told them and they said, 'well, you don't have a fever, you don't have these other symptoms of COVID. So, it's not COVID. Go home.'"

Finally, two participants in the study contracted COVID-19 during the pandemic. The participants

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lived together and one of the participants lost their sense of smell, a hallmark symptom of contracting COVID-19. Of the dyad, the partner who did not lose their sense of smell and primarily stayed at the home indicated that they experienced greater levels of emotional distress than the other. That participant shared, "I was in the house all the time. So, it was pretty rough." For the other participant in the dyad, he left the property regularly and lost his sense of smell which lead to different lived experiences of the odor from the hemp processing plant.

Discussion

As established by Bergstra and colleagues (2018), exposure to the hemp processing plant in this community-based study had a negative effect on the health of study participants. As a result of exposure to the hemp processing plant's odor 57.1% of the study participants reported experiencing daily physical symptoms such as headache, coughing, breathing issues, congestion, and stomach symptoms. These reported breathing issues echo research done Pope and colleagues (2015) that indicates that air pollution negatively effects respiratory health.

Further, the evidence gathered for this study suggests that exposure to the hemp processing plant had a negative effect on subjective well-being and mental health (Mehta et al., 2015; Power et al., 2015), as well as participants' life satisfaction (Orru et al., 2016). In the qualitative data, participants reported a high level of emotional distress, with feelings of hopelessness, fear, stress, and worry. Interestingly, participant PGWBI scores were higher than average of individuals above the age of 60, with participants scoring an average of 81.57, compared to the established average of 73. Participants' anxiety and depression subscales from the PGWBI also indicates that exposure to air pollution is significantly associated with incident moderate-to-severe depressive symptoms and significantly associated with moderate- to-severe anxiety symptoms (Pun et al., 2016; Power et al., 2015).

As Tajik et al. (2008) found, the odor from the hemp processing plant caused stress and anxiety, altered daily life, and had negative effects on social events. The qualitative data indicated that participants were under a high level of stress. The quantitative data supports this, with participants scoring above average the on the questions pertaining to stress. Participants reported in the qualitative data that their participants' daily lives, such as the way they exercised, their time spent outdoors, and their time spent in their homes, was substantially altered.

Further, as Blanes-Vidal and colleagues (2014) found, exposure to odor in participants environments is associated with psychosocial effects that have a deleterious effect on social health. In qualitative data, participants report being unable to socialize with friends and relatives due to the odor from the hemp processing plant. Participants also reported that the odor from the hemp processing plant had a deleterious effect on their relationships with family members, friends, and community members. Blanes-Vidal and colleagues (2014) reported that participants who spend more time at home are particularly vulnerable to psychosocial interference from environmental odor exposure. The majority of those interviewed were retirees or unemployed, thus making our sample population one that is particularly affected by exposure to the odor from the hemp processing plant.

Participants also appear to be experiencing symptoms of PTSD, with participants scored above average in all three categories of symptoms of arousal, avoidance, and intrusion. This is reflected in the coping styles of several participants, which include avoidant behavior, as well as intrusive behavior in the form of experiencing an inability to think or talk about anything but their experience with the hemp processing plant.

In general, study participants reported that they felt a lack of support. This included support from local, state, and federal government officials, local health departments, as well as support from family members, friends, and community members. The data from the social support scale reflects this, with a mean of 33.57, compared to an average standardized mean of 36.04 (Orpana et al., 2019). Similarly, participants reported myriad ways of coping with the odor from the hemp processing plant, including sharing their difficulties with others, intellectualization, and avoidance. Moreover, several participants in our study indicated that they experienced social isolation and social stigma because of their experience with the hemp processing plant. One participant reported being socially ostracized at work due to others' belief that losing the hemp processing plant would result in job loss. Further, another family reported that their family members refused to visit them due to the hemp processing plant. Finally, several participants reported being socially isolated by their community due to their activism in fighting the hemp processing plant.

Participants also reported economic impacts in the qualitative data. For some, this took the form of paying for gas and lodging to escape the odor. Others

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experienced a financial impact due to a loss in the value of their property, or in the form of potentially moving from that property with or without being able to sell it. Finally, as one participant experienced, the odor from the hemp processing plant caused them to lose their livelihood altogether, and they are now unemployed. Interestingly, not every participant was equally impacted by the exposure to odor from the hemp processing plant. Some participants presented with significantly more distress than others, even within the same households. The qualitative data reflects this, particularly in households where other factors such as employment and other health issues impacted mobility.

Although further research is needed, the quantitative and qualitative research in this study suggests that the experience of living near a hemp processing plant and being exposed to the odor it produces is emotionally distressing and stressful. Further, participants in this study felt a general lack of support and struggled with their ability to cope with the situation. The lives of those who had the lived experience of living near a hemp processing plant was severely impacted.

Strengths and Limitations

Literature has established that environmental exposure, particularly air exposure with odor, with or without physical impact, has significant psychosocial consequences. The preliminary data gathered here suggesting that the same risks are true for those exposed to odor from hemp processing plants as well. However, the sample size is small, and the study is specific to one geographical area, limiting its generalizability. Further, almost all the participants in this study were white and above the age of 65, limiting the generalizability of the study to people of color or young and middle-aged people. Further, the COVID-19 pandemic presents a confounding variable in the data collected in this study. Several study participants contracted COVID during the study, making it difficult to differentiate between the effects of COVID and the effects of environmental exposure on respiratory health. Another area of potential confound was in the report of feelings of social isolation—participants felt socially isolated because other members of the community disagreed with their stance on the risks of the plant, but the pandemic also contributed to these feelings of isolation as participants were forced to spend more time at home.

Future Research

Further research into the effects of exposure to hemp processing plants is needed, including studies with

larger representative samples and across geographical areas. Future research should also include direct measures of environmental contamination and medical symptoms versus self-report and perceived health impacts. More research into the psychosocial effects of prolonged exposure to odors is necessary, including longitudinal evaluation of impacts over time, protective factors for coping and resiliency.

Conclusion

Understanding more about the lived experience of individuals who live near hemp processing plants enables social workers to be trained in the effects of exposure to hemp processing plants and allows social workers to better serve such individuals. Moreover, this research better equips community members who are experiencing the ill effects of hemp processing plants with environmental literacy and galvanizes communities that wish to engage in community action against a hemp processing plant. This research also supports community advocacy and can influence strategies for community-based action against hemp processing plants. This research indicates that those who run hemp processing plants would benefit from following federal, state, and local laws when establishing their businesses. Further, it also suggests the need for those who run hemp processing plants to work with local community members and be open to feedback from community members without socially isolating or vilifying them.

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