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Research Article

Hand in Hand: Participatory Action Research for Community Empowerment Related to Environmental Health Issues

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Abstract

This article presents findings from a participatory action research (PAR) project that partnered with residents of a rural community experiencing environmental health concerns related to emissions from a local hemp processing facility. Following reports of adverse health effects, oppressive odors, and unresponsiveness from local officials, a group of community members initiated contact with university researchers. Through a series of five community meetings and one public town hall, residents collaborated with environmental health scientists and social work faculty to document and better understand the potential health risks and socio-political barriers related to the plant's operations. Using narrative and thematic analysis, four key themes emerged: [1] physical and psychological health concerns, [2] education and empowerment through knowledge-sharing, [3] perceived barriers to change due to political, economic, and social obstacles, and [4] partnership and compassionate collaboration between residents and researchers. This PAR process empowered residents to co-develop research questions, collect and interpret data, and co-present findings to external stakeholders. Ultimately, the plant ceased operations due to documented environmental violations and sustained community resistance. The study underscores the value of PAR in building trust, supporting environmental health literacy, and fostering actionable outcomes in marginalized communities, especially where institutional support is lacking. It also highlights a critical gap in the literature around odor emissions from hemp processing—distinct from psychoactive cannabis cultivation—and the need for further environmental health research and regulatory attention in this emerging industry.

Keywords: Environmental Health Issues, Air pollution, Participatory Action Research.

Participatory action research (PAR) aims to collaborate with communities to address inequities across a variety of health and social outcomes [1](through each step of the research process, including research focus and questions, methodology design, research collection, and dissemination [2]. PAR aims to empower communities in co-designing a research strategy involving contemporary environmental injustice and or historical injustice and trauma [3], which has included topics as varied as air quality [4], teen dating violence [5], and vaccination (Schmidt-Sane et al., 2022). Moreover, participatory action research is designed to report findings back to participants to improve their environmental health and or health literacy [6].

PAR can be useful in collaborating with historically marginalized and underserved communities, including ethnic and racial minorities, financially neglected communities, and

communities that are stigmatized by their medical diagnostic, mental health, or social status. For communities that are wary of outsiders, having community insiders take part in each phase of research can encourage study participation and increase the robustness of scholarly research (White et al., 2012). Additionally, PAR is a method of decolonizing research and giving back to communities that have historically been subjects rather than participants. It has been seen as a direct response to positivist theory, which valorizes knowing and learning through objective empirical data, rather than the lived experiences of marginalized individuals and communities (Hardbarger, 2019), and aims to re-center the lived experiences of marginalized individuals and communities in research.

According to the framework set forth by [2], PAR consists of nine criteria, which are outlined in Table 1, along with the ways in which this study meets the criteria.

	Criteria (Israel et al., 2003)	**Hand-in-Hand**
1.	Community as a unit of identity	Small rural community (population ~2,000) in a Midwestern state
2.	Study builds on existing strengths and resources within the community	Researchers were invited to facilitate data collection and collect qualitative data during community meetings.
3.	Facilitates collaborative, equitable partnerships in all phases of research	An interview guide was developed based on feedback from community meetings. During the dissemination period, community members co-presented with researchers.
4.	Promotes co-learning and capacity building	Psychoeducation took place during each community meeting.
5.	Integrates and achieves a balance between research and action	Participants provided researchers with information and connection for reporting environmental contamination; researchers assisted participants with data collection and recording.
6.	Involves public health concerns with a broad definition of ecological determinants of health	Residents' concerns included cardiovascular and respiratory health, environmental, and agricultural issues.
7.	Changes to study are made based on collaborative feedback from community members	With participants' permission, researchers collaborated with the EPA and local health authorities.
8.	Findings and knowledge are disseminated to and with all partners	Findings were shared with the community via a presentation. Subsequently, the community organization co-presented with researchers twice.
9.	A long-term commitment beyond one research cycle or funding period	Continued interaction and follow-up with the community organization after data collection and dissemination.

Table 1: Participatory Action Research criteria and Rural Hemp Manufacturing

Current Study

The participatory action research design informed this partnership with a local group of community activists who initially reported to authorities oppressive odors and adverse health effects following the opening of a local hemp processing plant. Smell origins included from onsite storage of hemp as well as the high volume drying prior to extraction. There was an increase in hemp farming and processing in the state where the study was conducted directly resulting from state/national legislation making it legal with appropriate permitting—thus explosive growth in former tobacco growing counties. These activities reached out to a university-affiliated environmental health center following failed attempts to effect change directly. The concerns were both odor and potential air pollution from the hemp processing plant. There were also concerns because of the resistance of town leadership to the reporting of problems and a systematic effort to silence or minimize reporting.

Air pollution is a significant contributor to the global burden of disease and negatively affects respiratory health [7] and cardiovascular functioning [8].

Research on odor emissions from commercial cannabis cultivation (non hemp, psychoactive varieties) indicates that such facilities release significant amounts of biogenic volatile organic compounds (BVOCs) — chiefly terpenes like β myrcene, d limonene, α pinene and β caryophyllene — which contribute to strong "skunky," "herbal" and "pungent" odours detectable both indoors and potentially in the surrounding community [9,10]. These emissions, while relatively modest

in terms of ozone or $PM_{2.5}$ formation (e.g., 2.13–11.12 lbs VOC/ton of harvested cannabis in one Colorado study) still pose a nuisance risk and are subject to regulation [11].

In contrast, there is a notable gap in the literature regarding odor nuisances and air quality impacts associated with hemp processing plants (e.g., drying, de carboxylation and extraction of low THC hemp). While some enforcement cases and basic exposure studies exist [12] and one occupational study documented dust and endotoxin exposures in a hemp processing plant [13], rigorous peer reviewed investigations into hemp processing specific odor emissions, their chemical profiles, dispersion, community impacts and mitigation strategies are virtually absent. Thus, although cannabis cultivation odor emission is increasingly characterized, the odor pollution implications of hemp processing remain under studied.

Given the potential risks and expressed need of the community activists for information and support, a participatory action research approach was employed with this community. This PAR approach, lessons learned, and community response are described below.

Method

Research Design

The participatory action research design informed this work with community members with expressed concern related to the hemp processing plant. Five community meetings were held with seven local activists, university environmental health scientists, and social workers to work together to achieve social justice. A comprehensive community town meeting with local residents and scientists was also held to facilitate information sharing and collaboration. Meetings consisted of information sharing/education on air pollution, and other relevant topics to the hemp processing plant exposure, as well as general questions/answers and problem solving related to community-identified issues. The goals of the sessions were education, empowerment/advocacy, and support.

Sample

The original community members who reached out to the university-affiliated environmental health center attended the meetings. Using snowball sampling, these initial contacts invited other acquaintances and neighbors to meetings. For the community-wide meeting, recruitment was done through word of mouth with key informants and printed recruitment materials. The demographic characteristics of the sample were as follows: 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.

Procedure

A total of five community meetings were held over twelve months. The meetings were held via a secure web-based platform, but community members participated by phone due to technology limitations. All meetings were recorded and transcribed for data collection purposes. Meetings consisted of information exchange and a question-and-answer period for problem-solving and support.

Analysis

This qualitative study utilized narrative analysis, searching for common themes across meetings with local activists and residents. Using an applied thematic approach (Guest, MacQueen, & Namey, 2012), informed by the constant comparative method of qualitative analysis (Boeije, 2002), qualitative data were analyzed using content analysis where each segment of meaningful text was coded. Codes were grouped 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. Themes in the data were discussed and finalized in consensus-building discussions with the full study team, including topic and method experts, and through feedback from the medical providers.

Results

Themes identified from the analysis of community meeting data include 1) health concerns; 2) education and empowerment; 3) perceived barriers to change; 4) partnership and compassionate collaboration.

1. **Health concerns:** “We thought we were going to die.”

Residents expressed distress anxiety about their physical symptoms, including unusual tastes and smells, headaches, and cardiovascular complaints, all of which they linked to the air quality and byproducts of the plant.

“We were all shocked. We didn’t know what was going on; we were getting sick, and they just allowed it to happen…I went to the emergency room a few times about it…it tasted [like] alcohol…it just feels like you swallowed a gallon of paint in your mouth and you can’t get rid of it, so it puts off your food, and you felt sick.”

“We were getting side effects, the headaches. But in the last few weeks, I've been experiencing terrible symptoms. When it rains, it washes [the contaminants] away, thank goodness. You know when it's not raining, it smells like you're eating alcohol, you smell paint…it's always a horrible taste in your mouth and everything, but I don't know if your equipment will register that.”

Other community members reported experiencing burning sensations in their nasal cavities and coughing problems resulting from the emissions in the air. One local resident asked about this symptom’s etiology. Some locals shared the

information that they were learning about the effects of pollution directly related to the plant's emissions, consistent with Criteria Four of Israel et al.'s 2001 criteria.

A fear of death was a prominent theme that emerged from the meetings, as well as fears of what the health effects might be in the future. Given residents' fears and concerns about their physical health, a chemist asked residents to journal their experiences with symptoms, including air quality data collection.

2. **Education and empowerment:** "I can't understand why someone would allow this company to come in and do these things to the community."

Participants frequently sought out information from the researchers at community meetings regarding the process the plant was using, all possible byproducts of processing, and potential effects of exposure to the byproducts. During community meetings, participants discussed a petition that they had circulated in the community and discussed how best to distribute fliers with information about how to report concerns of environmental contamination.

A significant contributor to education and empowerment was a perceived lack of information or assistance associated with community members' health concerns. One community member reported going to the emergency room for a significant health issue and the doctors at the emergency room not knowing what test to run or how to help. The participant reported, "The only thing [the doctor] could tell me was 'Move.'"

3. **Perceived barriers to change:** "There isn't anybody in town willing to take responsibility and say, I'm going to help you, neighbors. Nobody cares, nobody wants to know, the health department, the district manager, doesn't even want to know."

A significant theme from community meetings and interviews was the demoralization that community members felt around the issue. A motivator for creating the community action coalition was a perceived lack of responsiveness from the company and government officials. One participant stated,

"…they need to get their ducks in a row and get their act together. You know, we were told that they had all the permits and everything…and right now, they don't have any of the permits. They would be in the penitentiary right now, if they put smoke out in [state] like they do here, and [they don't even] act like that rule should apply here."

The demoralization and frustration with elected officials is consistent with marginalized and stigmatized rural communities. One participant reported contacting a government representative. "When we contacted [U.S. senator] several weeks ago…he's not brave enough to ask because he don't know what to say…"

Participants also expressed frustration with the strong economic ties the company had with the community. Many participants felt that their concerns would not be taken seriously due to the company's strong economic ties to the community and the volume of jobs the company provided to the community. This was best summarized by one participant, who stated, "I don't care how many scientists, professors, or whatever...because they [hemp plant] make more money operating and indoctrinating people."

Other participants reported experiencing pressure from individuals and organizations that were not directly affiliated with the hemp manufacturing plant, but stood the potential to economically benefit from a continued positive relationship. A participant who was employed by the local hospital system reported, "They told me not to talk about pollution or air quality or the [plant name] again at the workplace." One participant mentioned posturing by he and security guards—with implicit threat of having armed guards at site. Hence, community fears included intimidation through job threatening as well as verbal and physical intimidation.

The demoralization that participants reported feeling did not interfere with their continued interests in learning more about environmental contaminants or in continuing the research partnership. In one meeting, several participants thanked the researchers for attending to their concerns when they did not feel like anyone else did.

4. **Partnership and compassionate collaboration:** "Any information we can collect and get to the health department or whoever would be beneficial. It's my feeling that the health department has not wanted that private helpers in any way. So maybe they would listen to someone else. If you have documentation to show them…maybe they would pay more attention."

Consistent with the Participatory Action Research framework used in this study, a significant theme of the community groups and interviews was partnership and compassionate collaboration. Community participants were inquisitive and engaged with the study's researchers from the beginning of the study. In some cases, participants came to the meetings having collected their own air quality data and sought out collaboration with the researchers to expand both the researchers' and participants' knowledge. The collaborative nature of the research relationship contributed to building trust between researchers and community members. One participant stated, "I like the idea that you will come and take any kind of samples and go to the health department or whoever you can go to and show them that work. [It shows] that you are legitimate and that you are trying to help us."

Consistent with PAR Criteria Five, researchers made a concerted effort to maintain transparency in collaborating with community members, even when it involved telling participants when they did not have answers to the questions participants asked. Further, any outreach to other universities, researchers, elected officials, or health departments was done after receiving the explicit consent of community participants. In one community meeting, a member of the research

team asserted, “We will do nothing without your express permission. You guys have been active from the get-go in wanting something to happen, and we want you to be respected in this process and get what you need out of it.”

Discussion

Themes identified included 1) health concerns; 2) education and empowerment; 3) perceived barriers to change; and 4) partnership and compassionate collaboration. Themes related to health concerns are consistent with the literature on exposure to air pollution [14]. Participants identified a number of physical health concerns such as burning in nasal cavities, coughing, and strong odor impacts. They also described mental health issues such as anxiety (fear of death, worry about their animals/loved ones), depression/demoralization (perceived loss, not feeling heard), and social isolation (lack of support from community).

The perceived barriers to change represent unique challenges of this community related to environmental health exposure, but are similar to what other communities may experiences with employment and revenue for the community are at risk. Participants reported lack of support of elected officials, as well as both individual residents and organizations in the community. The partnership of the research group was identified as a protective factor in this stressful situation, helping them feel heard, supported, and validated in their concerns.

Themes related to education and empowerment and partnership and compassionate collaboration are in alignment with the goals and practices of PAR (Chamberlain et al, 2019). Participants described the educational pieces of this PAR work as particularly helpful, as there was previously limited understanding of the impact of the pollution even from medical professionals from whom they sought help.

Two successful indicators of the PAR nature of this work were 1) co-presentation of results with community members at conferences and 2) the use of data from community meetings to develop subsequent research study-mixed methods study on biopsychosocial impact of hemp exposure—they defined need, questions, and helped interpret results of that as well.

Strengths of this PAR study include the prolonged engagement (multiple community meetings were held over a year and a half), member checking (results of research/collaboration were reviewed and co-presented with community members), triangulation of themes (in depth analysis identified a variety of perspectives on the work) and triangulation of methods by addition of surveys/interviews as follow up (Logsdon et al, under review). Limitations of the research include the lack of broader community engagement. Future research could include intentional tracking of use of educational information and change in community dynamics/risk.

There are a number of implications of this research. First, the use of the PAR approach was an effective tool to meet the expressed needs of the community, as they received both the information and support sought from University partners. Per the goals of PAR, the community members also helped shape, implement, and interpret subsequent research related to the biopsychosocial impact of the exposure. This PAR study shows the important opportunity for partnership with communities and the critical empowerment role that university partners can play when community members are viewed as collaborators. Second, the experiences of community members related to health and mental health impacts of exposure related to the hemp processing plant raise important concerns for future environmental health research. Perceived impact and associated distress are an emerging area of study [15] that provide opportunities for scholarship, advocacy and practice for a wide range of disciplines. Lastly, there is an opportunity to study further the impact of PAR in communities affected by environmental risks. Lastly, in the case of this community, the hemp processing plant did shut down permanently due to findings of smell violations, poor drying process control resulting in two fires in ventilation stack, and the community resistance to restarting production. This outcome highlights the opportunity to utilize and study PAR approaches to not only understand but effect change in community partnerships.

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