Online Supplement

Original Research
Understanding COPD Patients' Perspectives on Utilizing Strategies to Limit Their Exposure to Wildfire Smoke

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Supplementary Material S1. Consolidated Criteria for Reporting Qualitative Studies (COREQ) 32-item checklist

No. Item	Guide questions	Description
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/ facilitator	Which author/s conducted the interview or focus group?	Interviews were conducted by 1 trained physician interviewer (J.Y.)
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	The interviewer had a medical degree and in progress of an MPH degree (J.Y.)
3. Occupation	What was their occupation at the time of the study?	The interviewer was a medical doctoral resident and MPH student (J.Y.)
4. Gender	Was the researcher male or female?	Interviewer was male (J.Y.)
5. Experience and training	What experience or training did the researcher have?	J.Y. had prior experience working with patients as a resident and prior research related experience from his time in medical school and during clinical rotations. J.Y. worked closely with Project PI (L.C.M), qualitative research expert and mentor (A.A.), and the rest of the research team (C.M.L., S.A., K.A.D.) for training in conducting qualitative interviews. Additionally, J.Y. conducted three mock interviews with members of the research team prior to the first patient interview in order to receive feedback and familiarize himself the interview guide. The team members in mock interviews were not familiar with the interview guide prior.

No. Item	Guide questions	Description
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	No interviewers had pre-existing relationships with participants.
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Participants had no prior knowledge regarding the interviewer. Upon recruitment, interviewer identified himself as a resident physician and a member of the research team (J.Y.).
8. Interviewer characteristics	What characteristics were reported about the interviewer/ facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	The interviewer (J.Y.) is a medical resident currently in progress of a MPH with research interest in social determinants of health, including socioeconomic status, racial/ethnic, and sex-based disparities in health outcomes, as well as environmental health/medicine and occupational exposures. As an internist, he is trained in the art of asking open-ended questions and active listening. He has undergone training to limit bias in interaction with patients.
Domain 2: Study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	We performed traditional thematic analysis through the iterative process of analyzing patterns in qualitative data, utilizing both inductive and deductive approaches (Miles and Huberman, Qualitative Data Analysis, 1994).

No. Item	Guide questions	Description
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	We generated a list of eligible patients with COPD who were aged >/=65 years. We did not require that patients live near a previous wildfire event or have direct experience/exposure with wildfire smoke. Patients were randomly sorted into three mailing groups based on a weighted distribution of their zip code in order to ensure geographic diversity. Strata were used to force characteristics of the final sample. People who expressed interest in participating based on the initial mailing outreach were scheduled for interviews. Thematic saturation was reached before additional recruitment contact could be made to participants who had not initially expressed interest, i.e. no cold calling was required.
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Eligible patients were identified via medical record databases with approval from primary care physicians. An initial mailing including a letter from the project PI, a study information sheet, and copies of the HIPPA Authorization and Participant Bill of Rights, was sent to patients' homes. Many eligible patients contacted study staff via email, phone, and mail. Verbal consent was obtained at the beginning of the scheduled qualitative interview time for all participants, which took place virtually at a time convenient for the participant.
12. Sample size	How many participants were in the study?	We sought to recruit ~30 participants to achieve thematic saturation with respect to patient experiences with wildfire smoke and with representation across multiple zip codes covered by Kaiser Permanente Northern California.

No. Item	Guide questions	Description
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Of the 2,112 patients who received the initial mailing, 62 contacted us via phone, email or mail to decline participation. 2 patients scheduled but no showed for an interview, but were not consented because consent would have been collected at the beginning of the interview. No enrolled participants ended their interview early or dropped out of the study.
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Interviews were conducted over Microsoft Teams via computer or phone call.
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Non-participants (family/friends) could have been present in the background for the interview at the discretion of the participant but this was not monitored. No recording had the voices of non-participants. Sound quality was not degraded by background noise.
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Refer to Table 1 for participant demographics and to the Results section for important data which emerged.
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	An interview guide was developed by the PI and study staff (L.C.M., C.M.L., K.A.D.) with consultation and review by the qualitative research expert (A.A.), to ensure completeness, appropriateness of the wording of the questions and ability to gather the intended information. The full guide is provided in the Supplement as well. Pilot testing on patients was not performed.
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	Participation ended once the initial interview was complete with no additional follow-up.

No. Item	Guide questions	Description
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Interviews were audio recorded, transcribed and reviewed for interview quality. The transcripts were deidentified.
20. Field notes	Were field notes made during and/or after the interview or focus group?	The PI (L.C.M) took field notes as she listened to the recordings after they occurred.
21. Duration	What was the duration of the interviews or focus group?	The recorded interviews (excluding consent process to maximize privacy) ranged from 21-45 minutes (median time 31 minutes).
22. Data saturation	Was data saturation discussed?	Thematic saturation was achieved after 31 completed interviews.
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Participation in the study ended once the interview was complete. Transcripts or themes were not sent to patients.
Domain 3: Analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Two of the team members (C.M.L., J.Y.) conducted initial coding on several interviews to check for consistency. PI L.C.M. was involved in the coding process as referee and to finalize the code book. A.A. provided expert consultation to ensure the results would be meaningful. Final coding for all interviews was completed by one team member (J.Y.).
25. Description of the coding tree	Did authors provide a description of the coding tree?	Including the PI and consulting qualitative research expert, four study team members (L.C.M., A.A., C.M.L., J.Y.) developed and revised the codebook prior to and during initial coding. The codebook was developed based on three primary domains: the patient's understanding and relationship with smoke, facilitators/barriers for protecting health from smoke, and awareness and understanding of prescribed burns.

No. Item	Guide questions	Description
26. Derivation of themes	Were themes identified in advance or derived from the data?	We performed traditional thematic analysis through the iterative process of analyzing patterns in qualitative data (Miles and Huberman, Qualitative Data Analysis, 1994). We took both inductive and deductive approaches. Initially, an inductive approach was utilized where themes emerging from participants' responses were collected into a codebook.
27. Software	What software, if applicable, was used to manage the data?	Dedoose software, version 10.0.25 was used for analysis.
28. Participant checking	Did participants provide feedback on the findings?	Participant did not provide feedback on the findings.
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Illustrative quotations were presented in the Results. Quotations were not attributed to specific participants.
30. Data and findings consistent	Was there consistency between the data presented and the findings?	There was consistency between the interview data and the findings presented.
31. Clarity of major themes	Were major themes clearly presented in the findings?	Three major themes from our analysis are reported in the Results section.
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	We discussed diverse cases, including experiences from those with firefighting experience and those renting (not owning) their homes.

Supplementary Material S2. Participant Interview Guide/Script

Moderator's Introduction:

Thanks so much for taking the time to talk with me today. My name is NAME and I am a JOB TITLE at the Division of Research for Kaiser Permanente Northern California. As we discussed during the recruitment call, we're interested in understanding how people with COPD experience smoke from wildfires. As you know, in the past few years, we've had many large wildfires that last for weeks or, even months, and affect nearly everyone's breathing. You were invited to partake in this interview because you have chronic obstructive pulmonary disease (COPD). People with COPD can have difficulty breathing when there is smoke in the air, so we want to hear from you about your experiences. We're going to be using the information you and others share with me to come up with ways to support people with COPD both before and during future wildfire events.

I want to go over a few things. We understand that for anyone who's had a loss of property or loved ones in a wildfire, this may be upsetting to talk about so we are sensitive to this. If there are questions that you don't want to answer, you don't have to answer. The information you share will not be part of your medical record, and everything you say will be kept confidential among my colleagues on the research team. There are no right or wrong answers, and we encourage you to speak freely in whatever way is comfortable for you. Your name won't be used in any publication or other materials that come out of our discussion. What you say will make a difference in our being able to support people with COPD through future wildfire seasons.

IF SCHEDULED ON A DIFFERENT DATE THAN THE VERBAL CONSENT, CONFIRM CONSENT: In an interview like this, the most important thing is your experience and opinions. Because this is a research project, I do need you to confirm that we have your consent to do this interview?

PAUSE

Great, I'm very interested in exactly what you say, so I'm going to record the interview so I can review the interview later. I want to make certain that you're ok with this?

PAUSE

Do you have any questions before we start?

PAUSE

Okay, let's get started then. These interviews usually take about 45 minutes, sometimes less, sometimes more, depending on how much you want to tell me. If you

need to take a break to focus on your breathing at any time, just let me know. I'm going to turn on the recorder. To protect your privacy, please do not mention names or identifying information while we record.

Interview:

Relationship with and understanding of smoke

Q. People have a range of experiences with smoke over the course of their lives, such as growing up with wood-burning heaters in the house, roasting marshmallows over a campfire, living through large wildfires. Can you tell me about how smoke may have affected you in these different types of situations, from the time you were young until recently?

- Have you ever needed to evacuate your home due to wildfires or had a house burn down?

Q. In the past five years or so, about how often have you been smelling smoke where you live?

- How aware of wildfire smoke are you on a week to week basis?

Q. What is your understanding of how smoke affects your health?

- Can you walk me through how smoke gets into the body and affects your organs?
- To what extent do you think your body is affected by smoke one time versus long term?

Q. Often people have symptoms, like cough or shortness of breath, when they breathe in smoke. Can you describe what symptoms, if any, you've noticed when there is smoke in the air from a wildfire?

- Can you tell me about times when you developed symptoms that you thought were related to smoke but you couldn't actually smell it?
- Do you ever need to use rescue inhalers because of wildfire smoke?
- If you use supplemental oxygen, do you need to turn up the number of liters of supplemental oxygen to help your breathing?
- During wildfires, have you ever needed to go to see the doctor to help you with your breathing?

Protecting your health from smoke

Q. People get information about wildfires in various ways, such as news on the TV, the internet, radio in the car, friends and neighbors. How do you tend to hear that there is a wildfire near you that could bring smoke to your neighborhood?

- Can you tell me about any alert systems you're aware of or subscribe to?
- Can you tell me about how familiar you are (if at all) with low cost sensors, like PurpleAir?

Q. If you wanted to know current and/or future air quality, what resources would you use?

- How often would you check?
- What would be the most useful time interval to know when poor air quality will occur?

Q. Can you tell me about anything your doctor might have told you to do when there is smoke in the air from wildfires?

- What is the most helpful thing someone has said to do to prevent breathing in smoke from wildfire?

Q. When people are living close to wildfires, there are things they can do to protect their breathing. Can you tell me about anything you might have done during recent fires to protect your health during wildfire events?

Q: Here are some potential ways people avoid smoke exposure:

  - wearing masks outdoors
  - putting your vehicle on air recirculation setting
  - staying indoors as much as possible
  - using portable air cleaner devices
  - ensure the tight sealing of windows and doors in your home
  - ensure the filter on the house heating/cooling unit is clean

Can you tell me about why you don't or wouldn't do any of these? Examples might be the cost, they don't seem worth the hassle, I would need help with that or I didn't know those things could help.

- Is there anything that would make you use any of these more?

Q. Let's say you were planning to go for a walk outside, to get the mail or take out the trash, but there is smoke in the air from a nearby wildfire. What would make you decide NOT to go outside for the walk. For example, some people might decide not to go out based on how dark (grey, orange) the sky is, how strong the smell of smoke is, how strong the warning messages are from government agencies (EPA, CDC). Do any of these resonate with you?

Q. We're in the process of designing a program to help people in the community be able to stay healthy during periods of poor air quality due to wildfire smoke. What are your thoughts on how Kaiser Permanente could help you when the air is filled with wildfire smoke?

- Here are examples of what we could do to help. Do any resonate with you?
    - Send you an informational pamphlet at the beginning of wildfire season (spring) that contains a checklist to prepare for wildfire season, such as a reminder to change the air filter in your heating/air conditioning system
    - Send you real-time electronic messages warning of poor air quality in the next 1-2 days
    - Deliver equipment directly to your home during periods of poor air quality (masks, air cleaner)
    - Deliver prescriptions directly to your home in the mail during periods of poor air quality
- If you said that real-time electronic messages would be helpful, how would you want to be contacted so the messages are the most helpful to you, such as secure message, text, telephone call with voicemail?
- Who do you trust most to get information about how you might be affected by smoke in the air?

Prescribed burns

Q. Outside of large wildfire events, there can be local, planned fire-related events, like burning brush or piles of dead branches, that can happen in communities. This is called a "prescribed burn." As you might already know, they're intentional fires with the goal of managing the land or burning fuels to prevent large wildfires. Can you tell me anything you might know about planned burns – for example....

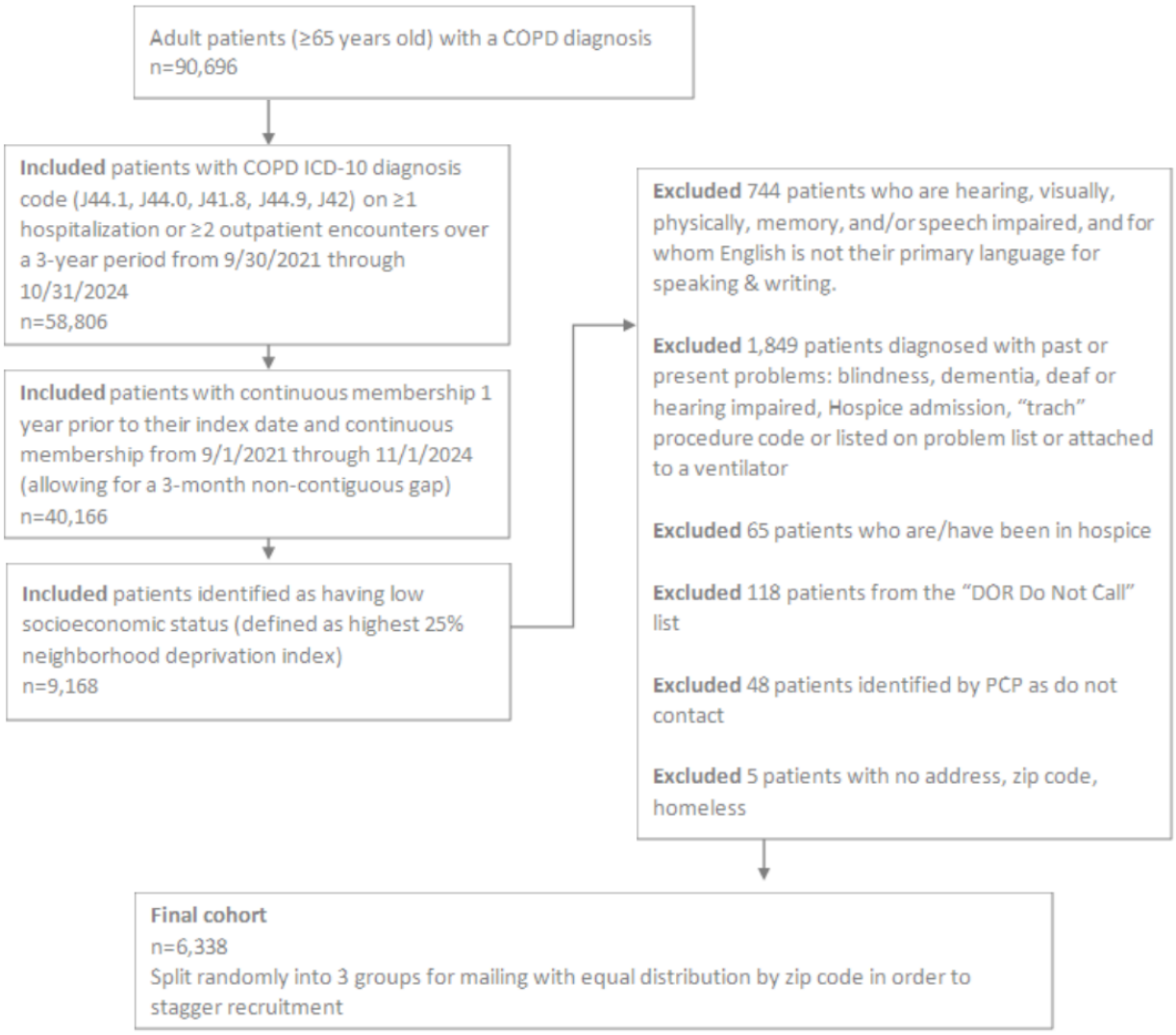
- Have you ever had a planned burn in your neighborhood?
- (if yes) Do you/did you receive notifications about planned burns?

- To what extent have you ever developed respiratory symptoms as a result of a planned burn?
- Do you think the idea of a planned burn makes sense to prevent large wildfires even if they have a cost of producing a small amount of smoke?

Conclusion:

Thank you so much for taking the time to talk with me today. I have learned so much from what you've shared with me about your thoughts and experiences. Is there anything we haven't talked about that would give me a better understanding of how wildfires affect your breathing? I really appreciate your perspective.

Supplementary Material S3: Flow Diagram of Eligibility List



Supplementary Material S4. Qualitative Analysis Code Book

1) Relationship with and understanding of smoke
    a) Experience with smoke (including smoking cigarettes/cigars) (open-ended)
    b) Awareness of smoke (time interval) (number of times over last 5 years and weekly frequency)
    c) Evacuation due to wildfires in past? (Yes/No)
        i) Yes
        ii) No
    d) How smoke impacts health (example: enters nose/mouth, impact breathing)
    e) Impact of one-time exposure vs cumulative exposure
        i) One-time exposure
        ii) Long-term, repeated exposures
    f) Direct impacts from smoke (symptoms, use rescue inhaler/more O2, see doctor) (if ppt doesn't endorse symptoms as related to smoke, don't count symptoms)
        i) Eye irritation
        ii) Cough
        iii) Shortness of breath
        iv) Sore throat
        v) Dizziness / Weakness
        vi) Chest pain / tightness
        vii) Sinus issues
        viii)None
    g) Actions due to smoke
        i) Increased necessity for inhaler use
        ii) Increased necessity for oxygen supply
        iii) Increased symptoms to the point of needing a doctor visit
2) Protecting your health from smoke
    a) Sources of information related to smoke
    b) Time interval for knowing air quality forecast
    c) Physician counseling related to smoke (Yes/No)
        i) Yes
        ii) No
    d) Most helpful thing someone has said related to smoke
    e) Mitigation tactic: Staying Indoors
        i) In use / Does this
        ii) Open to adoption (not currently in use/ does not do)
        iii) Not likely to adopt (not currently in use/ does not do)
        iv) Reason to use/not use
    f) Mitigation tactic: Wearing Masks When Outdoors

i) In use / Does this
ii) Open to adoption (not currently in use/ does not do)
iii) Not likely to adopt (not currently in use/ does not do)
iv) Reason to use/not use

g) Mitigation tactic: Using Vehicle Air Recirculation Setting
i) In use / Does this
ii) Open to adoption (not currently in use/ does not do)
iii) Not likely to adopt (not currently in use/ does not do)
iv) Reason to use/not use

h) Mitigation tactic: Checking Home's Ventilation System Filters
i) In use / Does this
ii) Open to adoption (not currently in use/ does not do)
iii) Not likely to adopt (not currently in use/ does not do)
iv) Reason to use/not use

i) Mitigation tactic: Sealing Windows/Doors
i) In use / Does this
ii) Open to adoption (not currently in use/ does not do)
iii) Not likely to adopt (not currently in use/ does not do)
iv) Reason to use/not use

j) Mitigation tactic: Utilizing Portable Air Cleaners
i) In use / Does this
ii) Open to adoption (not currently in use/ does not do)
iii) Not likely to adopt (not currently in use/ does not do)
iv) Reason to use/not use

k) Top reason for not going outside

l) Receptiveness to potential KP interventions
i) Potential Intervention: Informational pamphlet at beginning of wildfire season
ii) Potential Intervention: Kaiser electronic messages (emails)
iii) Potential Intervention: Phone calls/text messages
(1) Preferred method for contact
(2) Trusted source of the message
iv) Potential Intervention: Delivering equipment (Masks, air filters, prescriptions)
v) Potential Intervention: Other

3) Prescribed burns

a) Prescribed Burn Exposure/Experience?
i) Yes
(1) Familiarity with / notifications
(2) Symptoms due to prescribed burn
ii) No

b) Acceptance of prescribed burns