

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Health research priorities for wildland firefighters: a modified Delphi study with stakeholder interviews
AUTHORS	Pelletier, Chelsea; Ross, Christopher; Bailey, Katherine; Fyfe, Trina M.; Cornish, Katie; Koopmans, Erica

VERSION 1 – REVIEW

REVIEWER	Maloney, Sean Clinical Research and Occupational Medicine
REVIEW RETURNED	16-May-2021

GENERAL COMMENTS	<p>Thank you for the opportunity to review this manuscript.</p> <p>Strengths and Limitations (line 80) - should distinguish between strengths and limitations in following bullets</p> <p>Methods (lines 135-139) - it is unclear exactly how the protocol changed. Recommend elaborating on difference between original protocol and semi-structured individual interviews.</p> <p>Discussion - consider highlighting the fact that long term health outcomes in wildland firefighters are poorly understood and note the ongoing NIOSH study attempting to elucidate this (https://www.cdc.gov/niosh/topics/firefighting/wffhealthstudy.html)</p> <p>Figure 1 - consider reproducing / printing in color - small legend and grayscale make interpretation difficult</p>
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REVIEWER	Vincent, Grace Central Queensland University - Adelaide Campus, Appleton Institute
REVIEW RETURNED	08-Jun-2021

GENERAL COMMENTS	<p>The aim of this project was to identify the occupational health research priorities for wildland firefighters and related personnel using a modified Delphi approach. These types of papers are very important for the field, as they can often be used as standalone pieces to pitch for important research projects to industry and government. Overall, this is a well written manuscript. However, it does read like there has been little research into these areas which is not the case. Please acknowledge the existing research that has been conducted on firefighters health and safety in Canada and internationally. A few other minor comments below.</p> <p>Strengths & Limitations</p> <ul style="list-style-type: none"> • How applicable are the outcomes of this study to broader firefighter groups (nationally or internationally)? • Collecting data in fire season would have been extremely difficult, so I don't really see this as a limitation, rather just a constraint of the occupation. The authors should be commended
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on conducting this work and obtaining such a diverse sample of volunteers.

Introduction

- Page 5, Line 112 – may flow better as a separate sentence rather than stringing onto the previous
- This section in general is under referenced and doesn't acknowledge a lot of the great research that has been done in the wildfire health and safety realm. Some authors that you may consider including here and most definitely in the discussion, Ferguson/ Aisbett (Australia); Cuddy/Ruby/Gaskill (USA); Jeklin/McGillis (Canada); Reinhardt, Abreu, Heil, Reisen, Wolkow.

Methods

- Please outline how this study aligns with a modified Delphi. What are the differences between a modified Delphi and regular Delphi?
- How were 'occupational health policy makers' and 'researchers would had recently published in the field' identified?
- Page 7, Line 161: This sentence is confusing, and I had to read several times, perhaps could be reworded? I think trying to say that participants were asked to provide a list of up to 10 research priorities of concerns for wildland firefighters and a list of 10 research priorities for related personnel (i.e., 2 separate lists?)
- Page 7, Line 170: timeframe between surveys?
- Page 8, Line 186: please be more specific about the type of additional feedback required from participants, it is not immediately clear from this sentence.
- Page 8, Line 192: this sentence should be reworded as its unclear whether two researchers were present for all interviews or they did half of the interviews individually.

Results

- Line 224: include individual % consensus for each topic listed.

Discussion

- The main feedback here is that the literature and existing research has been under referenced. Reading this discussion makes it seem like there is hardly any research into these areas, when this isn't the case. Please provide a more balanced view.
- Line 313: 'national and international representation in surveys'...were firefighters outside of this service sought for participation as well? This is a strong claim which may need further explanation
- No mention of the second most important research outcome 'fatigue and sleep' in the discussion, while all other outcomes were mentioned?

Appendices

- Table 1. Why was demographic data not collected/reported for interviews?
- Table 1. The survey options should match the options presented here – please revise, should be Gender: Male, Female, Gender non-conforming, Prefer not to Answer not Man/Woman.
- Add a Title to Figure 1. The font is also very small and difficult to read
- There should be acknowledgement in the methods section regarding the \$50 Amazon gift cards.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Thank you for the opportunity to review this manuscript.

1. Strengths and Limitations (line 80) - should distinguish between strengths and limitations in following bullets. **Revised**
2. Methods (lines 135-139) - it is unclear exactly how the protocol changed. Recommend elaborating on difference between original protocol and semi-structured individual interviews.

The protocol originally indicated we would hold meetings with stakeholders to discuss research priorities. Given that travel and in person gatherings were restricted due to COVID-19, we instead decided to conduct virtual individual semi-structured interviews to obtain broad perspectives and respect public health guidelines and the wildland fire season. The manuscript has been revised (page 6, lines 135-141):

To align with public health guidelines on physical distancing during the COVID-19 pandemic, we did not conduct meetings with stakeholders to discuss research priorities as indicated in our original protocol. Instead, we conducted virtual semi-structured individual interviews with a sample of survey respondents to contextualize identified research priorities, enable broad representation given COVID-19 public health guidelines on travel, and within the realities of the wildland fire season.

3. Discussion - consider highlighting the fact that long term health outcomes in wildland firefighters are poorly understood and note the ongoing NIOSH study attempting to elucidate this (<https://www.cdc.gov/niosh/topics/firefighting/wffhealthstudy.html>)
We have added comments to indicate the limited amount of knowledge and prior research on the long-term health impacts of wildland fire exposure in several places throughout the manuscript. A fulsome review of the literature on the health impacts of occupational exposure to wildland fire is out of scope for this paper, but we have provided references to our own recent scoping review on this topic (Koopmans et al., 2021) as well as other systematic review reviews (e.g., Groot et al., 2019).
4. Figure 1 - consider reproducing / printing in color - small legend and grayscale make interpretation difficult. **Figure 1 has been revised as suggested.**

Reviewer: 2

The aim of this project was to identify the occupational health research priorities for wildland firefighters and related personnel using a modified Delphi approach. These types of papers are very important for the field, as they can often be used as standalone pieces to pitch for important research projects to industry and government. Overall, this is a well written manuscript. However, it does read like there has been little research into these areas which is not the case. Please acknowledge the existing research that has been conducted on firefighters health and safety in Canada and internationally. A few other minor comments below.

Strengths & Limitations

1. How applicable are the outcomes of this study to broader firefighter groups (nationally or internationally)?

2. Collecting data in fire season would have been extremely difficult, so I don't really see this as a limitation, rather just a constraint of the occupation. The authors should be commended on conducting this work and obtaining such a diverse sample of volunteers.

We have revised the strengths & limitations bullet points.

Introduction

3. Page 5, Line 112 – may flow better as a separate sentence rather than stringing onto the previous
Done
4. This section in general is under referenced and doesn't acknowledge a lot of the great research that has been done in the wildfire health and safety realm. Some authors that you may consider including here and most definitely in the discussion, Ferguson/ Aisbett (Australia); Cuddy/Ruby/Gaskill (USA); Jeklin/McGillis (Canada); Reinhardt, Abreu, Heil, Reisen, Wolkow. **We agree there are many examples of great research in the area of wildland firefighter health and the field is accelerating. We have added some references to this work throughout the Introduction and Discussion sections, but are limited by the word count of the journal. Reviewing the literature is a little outside the scope of this particular paper, but we have also included a reference to our recently published scoping review, which provides a comprehensive review of current literature.**

Methods

5. Please outline how this study aligns with a modified Delphi. What are the differences between a modified Delphi and regular Delphi?
Done (page 7, lines 151-157).

For this study, we have followed a modified Delphi method involving a two-stage online survey (SurveyMonkey, California, USA) with follow-up semi-structured interviews. We modified a traditional Delphi approach by combining qualitative and quantitative data and by not having an expert panel meeting to achieve consensus following the multiple round survey, instead opting to use this approach to obtain a ranked list of research priorities by inviting stakeholder (e.g., people with lived experience as experts).

6. How were 'occupational health policy makers' and 'researchers would had recently published in the field' identified?
Researchers who had recently published in the field were identified through the contact information available on recent papers in related areas of study on wildland firefighter health. Occupational health policy makers included people known to the research team or connected through our partners at the BC Wildfire Service (including workplace regulations).
We have clarified this in the manuscript (page 7, line 166-169).

We have further added a statement to the limitation section acknowledging that our convenience approach to recruiting these stakeholder participants may have limited the breadth of our sample (page 17, lines 391-394): Occupational health policy makers and researchers were identified by convenience sampling through our partnership with BCWS and by

extracting contact information from recently published papers in the field, which may have limited the breadth of stakeholder participant perspectives.

7. Page 7, Line 161: This sentence is confusing, and I had to read several times, perhaps could be reworded? I think trying to say that participants were asked to provide a list of up to 10 research priorities of concerns for wildland firefighters and a list of 10 research priorities for related personnel (i.e., 2 separate lists?)
This statement has been revised for clarity (page 7, line 169-171):
Participants were asked to list up to 10 research priorities of concern for wildland firefighters and up to 10 research priorities for related personnel in two separate lists (see supplementary file 1).
8. Page 7, Line 170: timeframe between surveys?
Survey 1 was sent in March 2020 and survey 2 in June 2020, we have added these dates to the manuscript.
9. Page 8, Line 186: please be more specific about the type of additional feedback required from participants, it is not immediately clear from this sentence. **Done – we have removed reference to ‘additional feedback’**
10. Page 8, Line 192: this sentence should be reworded as its unclear whether two researchers were present for all interviews or they did half of the interviews individually. **This has been clarified (page 9, lines 201-202): One researcher took detailed field notes and the other facilitated the interview using a semi-structured interview schedule.**

Results

11. Line 224: include individual % consensus for each topic listed. **Done**

Discussion

12. The main feedback here is that the literature and existing research has been under referenced. Reading this discussion makes it seem like there is hardly any research into these areas, when this isn't the case. Please provide a more balanced view. **We have added additional references to the Introduction and Discussion sections to describe some of the related work in this area. We are somewhat limited by the word count restrictions and would instead point readers to our recent scoping review summarizing the health risks from occupational exposure to wildland fire.**
13. Line 313: 'national and international representation in surveys'...were firefighters outside of this service sought for participation as well? This is a strong claim which may need further explanation **We have removed this statement from the discussion.**

We have also added a statement to the limitations (page 17, lines 391-394) that we did not conduct a systematic or comprehensive collection of researchers or other stakeholders and a broader international project may be necessary to contextualize findings to different jurisdictions.

14. No mention of the second most important research outcome 'fatigue and sleep' in the discussion, while all other outcomes were mentioned?

This is a fair point and we have added the following to the discussion, along with appropriate references to current work on the area of fatigue/sleep of wildland firefighters

(page 15-16, lines 351-359): Participants indicated a need to understand the cumulative mental and physical health toll of both busy and quiet fire seasons, and recovery in the off-season. Of particular concern was the need to understand the risk of chronic fatigue resulting from an increasing length of fire seasons and reduced opportunity to recover. The nature of the occupation typically necessitates sleeping at a fire camp, where wildfire fighters do not typically achieve appropriate quality of quantity of sleep [24-26]. While research has documented poor sleep conditions and reduced cognitive functions in-field [24-26], research questions remain about the optimal work to rest schedule for wildland fire fighting, strategies for recovery in the off-season, and how to balance sleep hygiene with the realities of wildfire operations and crew management.

Appendices

15. Table 1. Why was demographic data not collected/reported for interviews? **Demographic data (beyond role) was not collected/reported during the interviews because the relatively small sample pool and the need to protect participant confidentiality given the sensitive nature of the project in relation to the participants' workplace. For example, there are limited number of women working in BCWS and several participants expressed the risk of being able to identify them based on reporting fire zone and role. Thus, we decided that reporting the primary role and geographic location were the most relevant characteristics to ensure diversity among our sample.**

16. Table 1. The survey options should match the options presented here – please revise, should be Gender: Male, Female, Gender non-conforming, Prefer not to Answer not Man/Woman. **Revised.**

17. Add a Title to Figure 1. The font is also very small and difficult to read **The figure caption has been provided in the main document file (before references) per journal style. Figure 1 has been revised for readability by increasing font size and using colour.**

18. There should be acknowledgement in the methods section regarding the \$50 Amazon gift cards. **Done**

VERSION 2 – REVIEW

REVIEWER	Maloney, Sean Clinical Research and Occupational Medicine
REVIEW RETURNED	20-Nov-2021
GENERAL COMMENTS	Thank you for considering and making recommended changes.
REVIEWER	Vincent, Grace Central Queensland University - Adelaide Campus, Appleton Institute
REVIEW RETURNED	11-Nov-2021
GENERAL COMMENTS	The authors have done a good job at responding to the majority of the comments. However, I still have a few remaining concerns.

	<p>1. My major concern is still around pitching a research agenda while not acknowledging the majority of the existing research in the field. While effort has been made to add a handful of references, the assertion that 'word count' and 'this is not a review of the literature' is an appropriate justification for completing dismissing the work of other researchers in the field, is quite honestly, offensive. If word count is truly a limiting factor (with numbered references...) then I would encourage you to request some leeway with the editor to allow for the appropriate references to be cited. The request was to not acknowledge every paper in the field, but to at least acknowledge the seminal articles/reviews in a transparent way.</p> <p>2. The new text added on pg.15/16 Ln 351-359 had a type 'appropriate quality of quantity of sleep'. I think the middle word should be 'and'.</p> <p>3. The justification around why demographic data wasn't reported or recorded is reasonable, but this justification should be added to manuscript.</p>
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VERSION 2 – AUTHOR RESPONSE

Comments to the Author:

The authors have done a good job at responding to the majority of the comments. However, I still have a few remaining concerns. Thank you for your comments. We have addressed your concerns and added to our manuscript to include a description of previous work in the field.

1. My major concern is still around pitching a research agenda while not acknowledging the majority of the existing research in the field. While effort has been made to add a handful of references, the assertion that 'word count' and 'this is not a review of the literature' is an appropriate justification for completing dismissing the work of other researchers in the field, is quite honestly, offensive. If word count is truly a limiting factor (with numbered references...) then I would encourage you to request some leeway with the editor to allow for the appropriate references to be cited. The request was to not acknowledge every paper in the field, but to at least acknowledge the seminal articles/reviews in a transparent way. We have added a paragraph to the introduction to describe the current knowledge on the health impacts of wildland firefighting (page 5/6, lines 115-138) and referenced some current work in the discussion (page 16/17, lines 379-382).

2. The new text added on pg.15/16 Ln 351-359 had a type 'appropriate quality of quantity of sleep'. I think the middle word should be 'and'. This has been corrected.

3. The justification around why demographic data wasn't reported or recorded is reasonable, but this justification should be added to manuscript.

We have added the following to the manuscript (page 8, lines 182-187): Interview participants were asked to identify their job role, but we did not collect further demographic information (e.g., age, gender) to protect participant confidentiality. Given the relatively small sample pool, limited number of women working for the BCWS, and sensitive nature of the project in relation to the participants'

workplace, the identify of some participants may be easy to deduce based on their fire zone and role and was thus not collected or reported.

VERSION 3 – REVIEW

REVIEWER	Vincent, Grace Central Queensland University - Adelaide Campus, Appleton Institute
REVIEW RETURNED	05-Jan-2022
GENERAL COMMENTS	Thank you for adequately referencing this manuscript.