Author’s response to reviews

Title: Implementation Study of a 5-component Pediatric Early Warning System (PEWS) in an Emergency Department in British Columbia, Canada, to inform provincial scale up

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Response to the reviewer comments, BMC Emergency Medicine

RE: Revisions to "Implementation Study of a 5-component Pediatric Early Warning System (PEWS) in an Emergency Department in British Columbia, Canada, to inform provincial scale up" (EMMD-D-19-00108)

Dear Dr. Hasegawa,

We would like to thank you and the reviewer for the comments and recommendations on our manuscript. Please find a point by point response to the reviewer’s suggested revisions below. The changes as noted below have been incorporated into the manuscript. If any further changes are required, please let us know. Thank you for your time and consideration.

Sincerely,
Theresa McElroy
Response to reviewer comments

Keywords
1. Please separate keywords with a semicolon.
   Done.

Collecting data

2. In collecting data, why did you consider the one year, before and after the intervention? We chose this time frame to account for the full cycle of seasonal variation in Emergency Department presentations. We have added this explanation to the manuscript (lines 150-151).

3. What was the reason for selecting people under 17 years old in this study? In British Columbia, this is the age where patients receiving hospital care are defined as “pediatric”. We have added this clarification to the manuscript (lines 154-155).

4. How sample size was determined? The final sample included the following:
   - All patients who had been transferred to a higher level of care
   - 50% of the admitted CTAS 2 &amp; 3 patients - randomly selected within the stratified age groups indicated in the manuscript. 50% was chosen due to issues of feasibility.
   - All CTAS 1 and 4 patients who were admitted to the hospital (as they were a smaller population).

   CTAS (Canadian Triage Acuity System) is a measure of patient acuity, with 1 being the highest and 5 the lowest (explained in lines 103-104). CTAS 5 patients were excluded from the study for being non-urgent.

   We have updated the manuscript to include this information (lines 157-162).

5. What exactly were online survey questions? There is not much talk about online surveys.

   The overall themes of the questions asked in the surveys are explained in lines 173-176. We have added additional explanation of the types of questions in the online survey: multiple choice, checkbox, Likert scales, and open-ended questions. We explained that Fluid Surveys is an online data collection platform. We have added that the tools were pilot tested by three experienced registered nurses prior to data collection; we have adjusted the manuscript to reflect these explanations (lines 176-180).

6. In semi-structured interviews, very general explanations are provided.
We have added the understanding being sought through interview: “this information was important for understanding how this complex system might function in a busy ED setting, to inform changes required and implementation processes.” (lines 186-187)

7. You stated the trustworthiness of the study very briefly. We used a variety of methods to increase the trustworthiness of our study. These include pilot testing of the online surveys (line 178-180), member checking (lines 209-210), and most importantly triangulation of data collected from different sources. Triangulation of data allowed us to explore the system from multiple angles and offset the limitations or biases of any one method. Triangulation has been captured throughout the results and discussion by juxtaposition of quantitative results from surveys and patient charts and qualitative results from interviews and open-ended questions of the surveys. We have added additional participant quotes to the manuscript to further reflect this (Table 8).

8. What was the method of qualitative analysis? Thematic content analysis as described and referenced (lines 204-205). We have added a sentence about why this approach was chosen rather than an approach with more interpretation (line 210-212).

9. Provide a brief explanation of the reason, with a reference, why qualitative studies are appropriate. We have added this into the introduction to data collection approach: “The qualitative methods allowed us to round out this information by answering questions related to what, why, how the system was working from the perspective of the ED providers” (lines 145-147)

10. In what language were the interviews conducted? English. Added to the manuscript (line 184).

11. How was the verbatim transcription? How was the interview recorded? For example tape recordings, video material, notes, etc. There was no verbatim transcription. As we note in the manuscript: “To confirm accuracy and credibility, the interviewer (YT) took notes capturing the responses and then summarized these for participants at the end of the interview.” (lines 188-189)

12. Please note how the data in the qualitative section is saturated? Saturation occurred in the themes noted across the survey AND interview responses. This statement has now been added to the manuscript in the analysis section (line 212).

13. How was the sampling method for selecting participants?
There was no sampling for the survey— all staff of the ED were invited to participate. We have added the word “ALL” to the statement about who was invited to participate (line 172). For the interviews, we purposefully chose to interview the hospital administrator, registered nurse educator and physician who championed and supported the intervention as they were most involved in the planning and implementation (lines 183-185).

14. Qualitative data collection only refers to interviews and online surveys. Did you also have an observation, field note, memo, and documentation review? Some qualitative data was collected by the medical record reviewers in the form of field notes and text entry into the chart audit tool to help with the analysis and interpretation of medical record data. This has been outlined in the (lines 168-169).

15. Did you have a repeated interview? If yes, for what reason? No we did not.

16. In ethical considerations, there is no mention of the confidentiality of the participants and allowing them to leave the interview at any time. We note in the Declarations that this protocol went through ethics approval and informed consent was obtained by all participants. This consent included confidentiality and the right to withdraw (the latter for interview participants only, since the online surveys were anonymous, withdrawal would have not be possible) as per standard ethics practice. We have added this clarification to the manuscript (lines 488-492).

Data analysis

17. Please take separate subheadings in qualitative and quantitative data analysis.

Done.

18. In this sentence “…Responses were reviewed, coded and categorized into commonly occurring themes by two separate researchers to enhance trustworthiness of the data…” further explanation is needed to help readers understand which of researchers did this?

We have added “These researchers (TM and Research Associate JM-N) had experience and training with qualitative analysis in health research.” (lines 207-208)

Results

19. In Table 3, what is the sample size for men?
All patients were identified as either male or female (although we did have an ambiguous category). We have added the male figures into the table to clarify this.

20. How did you reach saturation through semi-structured interviews with three key informants?

We reached saturation across the qualitative data collection methods, not solely through the interviews. This statement has been added as per question 12 (line 212).

21. Please write the frequencies and percentages throughout the manuscript as follow: n=? , ?%.

Done. Thanks.

22. In "Overall, majority of survey respondents were satisfied or very satisfied with PEWS scoring system (71.8% nurses, 81.8% physicians), PEWS flowsheet (56.2% nurses, 81.2% physicians), escalation guide (68.8% nurses, 81.8% physicians), and reference cards (75% nurses, 70% physicians). Satisfaction was relatively lower for situational awareness tools (41.2% nurses, 36.4% physicians) and the communication framework (54.5% nurses, 45.5% physicians)." Please clarify the reason for these results in the discussion.

This was a Likert ranking question, therefore we don’t have the explanation as to why they were less satisfied with these aspects. We are looking into this matter in the provincial scale-up.

23. Why are most quotes related to nurses?

PEWS is primarily a nursing assessment tool and the majority of respondents were nurses, so this representation is proportionate.

24. Please include themes, sub-themes, and examples of code in a separate table?

We think the way Table 8 has been currently formatted provides the themes (first column) and sub-themes (second column) that the reviewer has requested. Due to small volume of the data, the codes were done at a very low level of inference and would not be more helpful to the reader than the quotes provided. We have added additional quotes to Table 8 to provide more clarity on our analysis. .

25. Each sub-theme requires a short story based on the participants' experiences. Next, bring a quote.

We have added additional quotes to Table 8 but feel that the sub-themes as delineated in the table provide the reader with sufficient information regarding the content of the themes. We did not elicit stories from the participants in a way that would lend itself to writing the paper in this format.

26. In Table 8, please check the title.

Good catch. The second part of that table is negative effects- we have corrected this.
27. In this study, were not clearly stated the unwanted effects of the intervention. We have described the negative or perceived negative outcomes of the program as well as its limitations throughout the results and discussion. In Intervention Utility, we describe some participants indicating the need for further tailoring of the forms (lines 324-326). Further in intervention utility we describe false positives as another weakness (lines 342-343). Program limitations such as increased triage time (lines 340-341) and false positives (lines 423-424) are further addressed in the discussion section and another limitation (perceived reduced autonomy) has been described in lines 417-418. The perceived negative outcomes of the program as stated by the staff are also listed in the second part of Table 8.

Discussion

28. Please clarify generalizability (external validity, applicability) of the findings. The results of this study offer further the evidence on the effectiveness of PEWS in an emergency setting and also explore it as a complex healthcare intervention instead of a single component (e.g. PEWS score). However, given the diverse context of hospitals and emergency departments worldwide, we cannot comment on validity and generalizability of this program beyond the site for which it was tailored. We do discuss how this pilot program helped us in developing a provincial scale-up strategy which is currently underway. The provincial scale-up takes place across a large number of sites, and therefore its results would have more external validity, which we aim to discuss in future publications.

29. Please check the lines 338 to 340. "However, we concluded that it is important that the tools and training strategy are tailored to the ED context to enhance implementation fidelity and satisfaction." Errors have been corrected. Thank you!

30. In line 418, please clarify who is "P"? "In all areas of practice, low practice volumes present challenges with maintenance of competency, thus guidance provided by P can assist with identification of serious illness (8)." Meant to be PEWS. A typing error that is now corrected, thank you again.