PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	The impact of COVID-19 on emergency department attendance in an Australia hospital: a parallel convergent mixed methods study
AUTHORS	Jessup, Rebecca; Bramston, C; Beauchamp, A; Gust, A; Cvetanovska, N; Cao, Y; Haywood, C; Conilione, P; Tacey, Mark; Copnell, Beverley; Mehdi, H; Alnasralah, Dialla; Kirk, M; Zucchi, Emilliano; Campbell, D; Trezona, A; Haregu, T; Oldenburg, Brian; Stockman, K; Semciw, Adam Ivan

VERSION 1 – REVIEW

REVIEWER	Ermengol Coma Institut Catala De La Salut, Atenció Primària
REVIEW RETURNED	18-Mar-2021

GENERAL COMMENTS	This is an interesting manuscript with a clear objective and methods according to the research question. In addition, results are of interest. I have more questions than concerns but overall I think that the authors performed a good research. My questions to understand some aspects of the authors' work: 1) Why did the authors limit the study for frequent attenders only? I realize that frequent attenders are a group of special concern. However, it would be of interest to know the overall reduction on ED presentations and then perform a subanalysis of frequent attenders. That way it would be possible to compare reductions of both types of patients and to know if frequent attenders had greater or lesser reduction than the general population. 2) I think that in the "Participants'" section of the Abstract, the authors should mention the number of patients included for the time series analysis and not only the 200 patients interviewed. 3) Which is the data source of the study? I didn't find insights about the database that the authors used to obtain the data. 4) In the Methods section the authors mention that they have included "frequent attenders in 2019". That leads the reader to think that the authors include people who presented frequently during 2019. However, as the authors stated in the results, the 4% didn't attend since 1st January 2019. I suspect that the authors have included people who were identified as "frequent attenders" before 2019 using the algorithm? If that is the case, a person identified as a frequent attender in January 2019 is still considered a frequent attender in January 2020? 5) Although the interrupted time-series is clear and the percentage of reduction are great and temporally plausible, did the authors have the possibility to see which is the pattern of these frequent attenders across other years? For example in 2018? The first point of 2019 seems to be an outlier but it is under the trajectory of ED presentations.

6) In Table 1, it seems that the reduction is higher in less urgent visits (between 62% and 67% in categories 3 to 5 and 45%-48% in 2 to 1 categories). That suggests that less urgent health issues suffer more reduction. Could these differences be related to fear of consultation? Or are they more related to the use of telehealth for the less urgent health issues? Maybe you can use this information to support your discussion.

7) One of the references cited in the manuscript affirms that "Implementing telehealth proactively rather than reactively is more likely to generate greater benefits in the long-term, and help with the everyday (and emergency) challenges in healthcare". With that in mind, although the use of telehealth could have some benefits, if this use is related to a more difficult access to the health system could lead to inequalities. How the use of telehealth can reduce disparities in access as the authors stated in the discussion? In some countries the use of telehealth is different across socioeconomic status and a situation that forces people to use more telehealth could increase these preexisting inequalities (for example with patients not fluent in English or speaking other languages). I think that the authors should at least mention the possible collateral damage of this use of telehealth.

8) In the article the authors discuss different reasons that could explain the reductions on ED presentations such as the patients' fear, access to telehealth and reductions of stressors. However, there is no mention of the COVID-19 measures itself. What were the implications of the State of Emergency? In several countries some lockdowns were put in place and there are several articles that discuss the collateral damage of these measures (underdiagnosis, health visits' reductions, etc.). Is it possible that this explain a part of the reductions observed by the authors?

9) Related to the previous question, Renal colic was the second category with greater difference between 2019 and 2020 (in percentage). Could this finding be a sign of the underdiagnosis mentioned before?

10) I think that the conclusions don't rely 100% on the findings of the study. Conclusions should focus on the reduced emergency department use and the fear identified through the interviews (highlighting the fact that probably is only one of the reasons) instead of discussing other reasons that are mentioned before but they are not a conclusion of the work, such as the possible reduction in physiological stress or viral infections.

REVIEWER	Verity Todd
	St John New Zealand, Clinical audit and research
REVIEW RETURNED	05-May-2021

| GENERAL COMMENTS | I have reviewed the work of Rebecca Jessup et al, who investigated the impact of COVID-19 on Emergency Department Presentations with the Northern Melbourne Metropolitan Area, Victoria, Australia. The authors have performed a two-part, mixed methods study, investigating changes in emergency department presentations alongside the reasoning behind these changes in a group of 200 participants. Interviews were conducted over the telephone, with the aid of an interpreter if required. The researchers identified a significant drop in ED presentations after the implementation of COVID-19 lockdown conditions. Four key themes were identified from participants regarding this drop.

Overall, the manuscript is very well written – it's clear and easy to |
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follow. The study investigates important concerns regarding the impact of COVID-19 on healthcare-seeking behaviours. However, it is very concise and I am not sure whether it sufficiently discusses the research findings and implications, thus could be expanded further.

I have a few specific queries from the manuscript:

1. I have concerns that the introduction is too brief. How does this population differ or represent the rest of Australia (demographics)?

2. Page 5 line 55/Table 4. The telephone interviews were conducted and asked an open question about the understanding of managing health conditions under lockdown. There were 25 participants who did not answer this question. As these were conducted over the phone, how was a nil response given? Was there something in common between this group of individuals that could have biased the results in some way e.g. a particular ethnicity?

3. Table 1: Title might benefit from including the name of the triage system, and consider using the descriptive term first in column 1 vs the level number.

4. Page 7, line 29. Calculation of the response rate (64%) – I am not sure where this is calculated from, could you please clarify? I thought the response rate should be 73.5% (272 requests accepted by 200 participants).

5. Table 3: Is the rest of the term missing after "attend medical…"? The formatting within the table is also off, it would be easier to read if the numbers lined up correctly with the terms (work, shopping, exercise etc). There is a significant difference in non-English speaking participants for attendance at medical appointments – this could merit further discussion, as it appears worrying that there was a significantly lower understanding of the allowance for this under COVID-19 lockdown conditions. However, I am confused by the finding in the row below, that a lower proportion of non-English speakers have delayed an appointment - this seems counterintuitive. Do you have any thoughts on this?

6. The conclusion doesn't tie in the findings of the study very clearly, and there is no mention of the qualitative aspects of the research here.

7. Figure 1. I do not have the expertise to comment on the statistical analysis that was performed to produce this figure. However, it is clear that there was a large reduction in ED presentations. There are two blue dashed lines on the figure, but only one is mentioned within the legend.

8. Supplementary material D: there is a skew towards non-English speakers in the interview cohort. Is this intentional, and if so, why? This could be further discussed in the introduction/discussion.

VERSION 1 – AUTHOR RESPONSE

Response to reviewers

Please note :all references to page and line numbers refer to the ***marked up version*** of the manuscript.

Reviewer 1 comment 1) Why did the authors limit the study for frequent attenders only? I realize that

frequent attenders are a group of special concern. However, it would be of interest to know the overall reduction on ED presentations and then perform a subanalysis of frequent attenders. That way it would be possible to compare reductions of both types of patients and to know if frequent attenders had greater or lesser reduction than the general population.

Author response: Based on this comment, we have now added an analysis of the whole ED cohort (without frequent presenters). Data was retrieved from the Northern Health Data warehouse, and the analysis was performed in the same way as the Healthlinks analysis. The non-frequent presenters demonstrated a significant drop in presentations from baseline (15% reduction, p=0.007), and a significant change in slope, with a further 0.6% reduction in presentations per week compared to baseline (p=0.041). These figures demonstrate a descriptively greater relative impact of COVID on frequent presenters (36% decrease in baseline levels with a further 1% decline per week (compared to baseline).

Actions:
- Fig 1 has been modified to include the outcome of the non-Healthlinks cohort.
- Methods have been modified to describe the inclusion of the non-Healthlinks cohort (page 11 lines 236 – 240)
- Results and discussion have been modified to describe the non-Healthlinks cohort.

Reviewer 1 comment 2) I think that in the "Participants"' section of the Abstract, the authors should mention the number of patients included for the time series analysis and not only the 200 patients interviewed.

Author response: The participants section of the Abstract has now been changed to include the number of participants in the time-series:
'A total of 4,868 patients were included in the time-series. A sub-group of 200 patients were interviewed, mean age 66 years (range 23-99).' (page 2 line 49)

Reviewer 1 comment 3) Which is the data source of the study? I didn't find insights about the database that the authors used to obtain the data.

Author response: Data was sourced from the Northern Health data warehouse. This information has now been added and modifications made to subsequent information to ensure date range of source data is clear (page 7, lines 149 -150).

Reviewer 1 comment 4) In the Methods section the authors mention that they have included "frequent attenders in 2019". That leads the reader to think that the authors include people who presented frequently during 2019. However, as the authors stated in the results, the 4% didn't attend since 1st January 2019. I suspect that the authors have included people who were identified as "frequent attenders" before 2019 using the algorithm? If that is the case, a person identified as a frequent attender in January 2019 is still considered a frequent attender in January 2020?

Author response: The date range for the data was 1st of January 2019 to 30th of September 2020. The cohort of patients were selected from via the Healthlinks algorithm which is designed to identify high hospital users and those at risk of potentially preventable future admissions. It uses a number of variables to predict the likelihood of patients re-presenting that includes, but is not limited to, ED presentation (as outlined in the supplementary material). This may explain the 4% who did not attend, coupled with the fact that the algorithm is not 100% sensitive so there will be some false positives (people who are predicted to present but who do not). We have made the date range clear and provided greater in text description of the algorithm on page 7 lines 149 through to 156.

Reviewer 1 comment 5) Although the interrupted time-series is clear and the percentage of reduction are great and temporally plausible, did the authors have the possibility to see which is the pattern of these frequent attenders across other years? For example in 2018? The first point of 2019 seems to be an outlier but it is under the trajectory of ED presentations.

Author response: We selected day 1 of the study data as Jan 1, 2019 as a comparison for COVID in terms of monthly activity. The first point of Jan 2019 does appear to be an outlier

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but this can be explained by a seasonal reduction in presentations over the New Year period. As described in methods, pg 8, lines 172 to 175 "Presentations to ED were observed to be lower in the two weeks surrounding 1 January 2019 and 2020. A sensitivity analysis was therefore used to investigate the seasonal effect of these dates on the overall results of the simpler, unadjusted model". As described in the results (page 10, lines 232 to 234), "There was evidence of seasonality however this did not change the outcome of the simpler, unadjusted model (see supplementary material B and C for coefficients)".

Reviewer 1 comment 6) In Table 1, it seems that the reduction is higher in less urgent visits (between 62% and 67% in categories 3 to 5 and 45%-48% in 2 to 1 categories). That suggests that less urgent health issues suffer more reduction. Could these differences be related to fear of consultation? Or are they more related to the use of telehealth for the less urgent health issues? Maybe you can use this information to support your discussion.

Author response: Thank you, this is an important observation and one that we have not discussed in detail in the discussion. We have now added some additional discussion as below:
'This has possibly led to improved access to primary care, thus reducing perceived need to attend ED. This is reflected in the greater reductions seen for lower acuity conditions across triage categories 3 to 5 in this study.' (page 17, lines 324 - 327)

Reviewer 1 comment 7) One of the references cited in the manuscript affirms that "Implementing telehealth proactively rather than reactively is more likely to generate greater benefits in the long-term, and help with the everyday (and emergency) challenges in healthcare". With that in mind, although the use of telehealth could have some benefits, if this use is related to a more difficult access to the health system could lead to inequalities. How the use of telehealth can reduce disparities in access as the authors stated in the discussion? In some countries the use of telehealth is different across socioeconomic status and a situation that forces people to use more telehealth could increase these preexisting inequalities (for example with patients not fluent in English or speaking other languages). I think that the authors should at least mention the possible collateral damage of this use of telehealth.

Author response: Thank you for this feedback. We have now added some additional commentary and references to highlight that disparities still exist as outlined below:
'Studies have shown that there has been greater uptake of telehealth from older people during the pandemic than pre-pandemic, perhaps reflecting that this medium provides a safe alternative to face-to-face care for those at higher risk from the virus (2-4). However, these studies also demonstrated that racial disparities that existed in the access and use of telehealth prior to the pandemic were still evident during the pandemic. Policy changes that enhance the use of telehealth for chronic disease management should continue to work toward improving engagement for disadvantaged communities to reduce disparities and improve outcomes.' (Page 17, lines 338 - 346)

Reviewer 1 comment 8) In the article the authors discuss different reasons that could explain the reductions on ED presentations such as the patients' fear, access to telehealth and reductions of stressors. However, there is no mention of the COVID-19 measures itself. What were the implications of the State of Emergency? In several countries some lockdowns were put in place and there are several articles that discuss the collateral damage of these measures (underdiagnosis, health visits' reductions, etc.). Is it possible that this explain a part of the reductions observed by the authors?

Author response: We have modified the initial paragraph of the discussion to reflect the findings that interpretation of the requirements placed by the government related to the state of emergency may have influenced the results (so a lack of understanding, rather than fear and avoidance). (pages 16-17, lines 313 to 329)

Reviewer 1 comment 9) Related to the previous question, Renal colic was the second category with greater difference between 2019 and 2020 (in percentage). Could this finding be a sign of the underdiagnosis mentioned before?

Author response: We have added additional discussion, and rearranged our overall discussion, to include the findings across the top 10 categories (including renal colic). See pages 18, lines 348 to 354.

Reviewer 1 comment 10) I think that the conclusions don't rely 100% on the findings of the study. Conclusions should focus on the reduced emergency department use and the fear identified through the interviews (highlighting the fact that probably is only one of the reasons) instead of discussing other reasons that are mentioned before but they are not a conclusion of the work, such as the possible reduction in physiological stress or viral infections.

Author response: The conclusion has now been rewritten, and now reads:
'The second wave of COVID-19 in Victoria resulted in a significant reduction in ED attendances across the state. This study found that for patients with a history of frequent attendance prior to the COVID-19 pandemic the reduction in presentations fell by 36% and continued to fall by 1% per week, compared to a 15% drop in non-frequent attenders and a weekly reduction of 0.6% per week. More than one third of participants reported actively avoiding the hospital, however the content analysis suggests that these changes in health seeking behaviour appear to be influenced both by fear and better access to remote care as an alternative. COVID-19 has necessitated a rapid pivot towards readily accessible, remotely provided health care outside of the hospital and in this way it has been a driver towards achieving what multiple complex interventions could not. This finding has important implications for the planning and provision of healthcare services beyond the pandemic.' (page 21, lines 419 to 435)

Reviewer: 2

Reviewer 2 comment 1) I have concerns that the introduction is too brief. How does this population differ or represent the rest of Australia (demographics)?

Author response: I have added an additional paragraph into the introduction describing the population as follows: 'Australia is a very multicultural country, with almost 30% of Australians born overseas and over 200 languages spoken (5). Residents of the northern suburbs of Melbourne are more culturally diverse than the Australian average, with more than 40% of residents born overseas (6). The area has lower income, educational attainment, and health literacy than Victorian state averages (6-8). Approximately 10% of Victorias population live in the northern suburbs of Melbourne, however 1/3 of Victoria's COVID-19 cases were located in this area at the height of the pandemic, reflecting the greater vulnerabilities to COVID-19 experienced in this community'. (page 4 lines 89 – 96)

Reviewer 2 comment 2) Page 5 line 55/Table 4. The telephone interviews were conducted and asked an open question about the understanding of managing health conditions under lockdown. There were 25 participants who did not answer this question. As these were conducted over the phone, how was a nil response given? Was there something in common between this group of individuals that could have biased the results in some way e.g. a particular ethnicity?

Author response: This is an interesting observation. In fact, 29 participants were unable to finish the interviews. The interviews were long and some participants were unable to complete them due to fatigue. Additional information about who was able to complete the interviews has been added to the results section as follows: '14.5% of participants (n = 29) were unable to complete all questions in the interviews. Those who did not complete were slightly older (mean age 71, SD 16) and 25 spoke limited English and were interviewed using interpreters. All who did not complete cited their reason for incompletion as fatigue.' (page 12, lines 265-268)

We have also added this as an additional limitation in the discussion as follows: A limitation of the study is that participants who had limited English proficiency were over-represented in the group that did not complete all questions, and this may have impacted on the significance found for some of the outcomes. (page 20, line 403 to 406)

Reviewer 2 comment 3) Table 1: Title might benefit from including the name of the triage system, and consider using the descriptive term first in column 1 vs the level number.

Author response: These changes have all been made to Table 1.

Reviewer 2 comment 4) Page 7, line 29. Calculation of the response rate (64%) – I am not sure where this is calculated from, could you please clarify? I thought the response rate should be 73.5% (272 requests accepted by 200 participants).

Author response: Thank you for identifying this error, this has now been amended to a 73.5% response rate.

Reviewer 2 comment 5) Table 3: Is the rest of the term missing after "attend medical…"? The formatting within the table is also off, it would be easier to read if the numbers lined up correctly with the terms (work, shopping, exercise etc). There is a significant difference in non-English speaking participants for attendance at medical appointments – this could merit further discussion, as it appears worrying that there was a significantly lower understanding of the allowance for this under COVID-19 lockdown conditions. However, I am confused by the finding in the row below, that a lower proportion of non-English speakers have delayed an appointment - this seems counterintuitive. Do you have any thoughts on this?

Author response: This table has now been reformatted and a legend added to improve readability. The discussion has been modified to reflect the finding that non-English speaking participants were more likely to not postpone appointments, but less likely to understand that they were able to attend medical appointments (pages 16 -17, lines 320-329)

Reviewer 2 comment 6) The conclusion doesn't tie in the findings of the study very clearly, and there is no mention of the qualitative aspects of the research here.

Author response: The conclusion has been rewritten, and now reads:
'The second wave of COVID-19 in Victoria resulted in a significant reduction in ED attendances across the state. This study found that for patients with a history of frequent attendance prior to the COVID-19 pandemic the reduction in presentations fell by 36% and continued to fall by 1% per week, compared to a 15% drop in non-frequent attenders and a weekly reduction of 0.6% per week. More than one third of participants reported actively avoiding the hospital, however the content analysis suggests that these changes in health seeking behaviour appear to be influenced both by fear and better access to remote care as an alternative. COVID-19 has necessitated a rapid pivot towards readily accessible, remotely provided health care outside of the hospital and in this way it has been a driver towards achieving what multiple complex interventions could not. This finding has important implications for the planning and provision of healthcare services beyond the pandemic.' (page 21, lines 419 to 435)

Reviewer 2 comment 7) Figure 1. I do not have the expertise to comment on the statistical analysis that was performed to produce this figure. However, it is clear that there was a large reduction in ED presentations. There are two blue dashed lines on the figure, but only one is mentioned within the legend.

Author response: Thank you. We have amended the dashed lines and Figure legends to make it clearer. One of the dashed lines has been converted to a dotted line, and clarified in the figure legend.
Action: Figure legend now reads "The vertical dashed line is at the 16th of March coinciding with commencement of the Victorian State of Emergency. The x axis values represent year and week within that year. E.g. 2019-40 represents the 40th week in 2019. The horizontal dashed blue line represents the expected trajectory of ED presentations if COVID-19 pandemic had not occurred. The horizontal dotted blue line describes the change in level of weekly ED presentations at the point of impact (16th March 2020)."

Reviewer 2 comment 8) Supplementary material D: there is a skew towards non-English speakers in the interview cohort. Is this intentional, and if so, why? This could be further discussed in the introduction/discussion.

Author response: In the introduction we have now added further detail about the multicultural nature of the Northern Health community (which is more diverse than national averages) (page 4 lines 89 to 96) and had previously identified that speaking a language other than English is likely to increase vulnerabilities around accessing and understanding information related to COVID.

In the methods section, we then identify that we wanted to gain insights across a range of culturally and linguistically diverse groups and that we employed stratified sampling to include limited English proficiency patients from the top 10 spoken languages in the region. We believe this to be a major strength of the study as these populations are often not included in this type of research (page 8 lines 188 to 193).

VERSION 2 – REVIEW

REVIEWER	Verity Todd St John New Zealand, Clinical audit and research
REVIEW RETURNED	30-Aug-2021

GENERAL COMMENTS	I am satisfied that the authors have addressed the comments and concerns in my initial review. The revisions made to the manuscript in response to both reviewers have resulted in a good paper of relevance to an international audience.