Reviewer's report

Title: Clinical Characteristics Associated with the Onset of Delirium among Nursing Home Residents

Version: 1 Date: 28 Nov 2017

Reviewer: Kenneth Boockvar

Reviewer's report:

This manuscript describes an observational study of nursing home residents during 2010-15 in Ontario with the objective to identify predictors of delirium using the MDS. The authors use logistic regression to identify dementia, pain, and antipsychotics as associated with incident delirium. Strengths of the study are the large, regional sample and the research question, which has not been well-studied. An important weakness is a lack of sensitivity of MDS assessments for delirium, because assessors are known to miss signs of delirium and because MDS assessments are completed quarterly so episodes of delirium, even if recognized, may not be captured if they occurred between assessments. Another important weakness is that the date of onset for those that do have delirium is not precisely known, so it is not known whether time-varying factors found to be associated with delirium such as pain and use of antipsychotics preceded or followed delirium onset. The authors acknowledge that this reduces ability to determine whether delirium is a cause or effect of these associated factors.

Specific comments:

1. Abstract (and elsewhere in the paper): The delirium rate calculation is not an "incidence" since time is not standardized in the denominator. It is a frequency (number of residents with delirium per nursing home stay).

2. Introduction: My understanding is that the number of older adults living in nursing homes in the U.S. is decreasing, not increasing, so the authors may want to check the Canadian data and/or modify their statement.

3. Methods: Please clarify what is meant by "census-level." Does this mean individual-level data is used, as opposed to facility-level?

5. Methods: Selection criteria should be more specific. What is the minimum length of stay required to be in the study (e.g., 90 days)? What about individuals who have temporary interruptions in length of stay (such as for acute care)? What about individuals who have more than one long-term nursing home stay separated by time in the community: are each of their stays included?

6. Methods: Selection criteria need to be better justified and defined. "Many of the symptoms we examined relied on self-report" is not entirely accurate because MDS 2.0 does not require patient interview, it is based on staff observation. What is your precedent (from previous experience or literature) for excluding residents who could not recall any of the 4 items in "memory/recall ability?" At what level (modified independence - severely impaired) is a patient excluded for not being able to make decisions regarding tasks of daily life?

7. Methods: Are all analytic variables from the MDS? If so, state this at the beginning and indicate clearly what the MDS definitions of each variable are and their relevant performance characteristics if known from the literature. Consider referencing MDS item numbers (e.g., B.4. for "Cognitive skills for daily decision-making"). For comorbidity status, it is misleading to mention "the medical chart" since readers may take this to mean medical charts were reviewed as part of this study.

8. Methods: Technically, pain is not self-reported on the MDS 2.0 because patient interview is not required to complete the MDS 2.0. Please simplify the pain definition as "pain of any frequency and intensity over the 7 days prior to the assessment" if this is correct. In some parts of the paper the term "acute pain" is used but this is not defined in the methods.

9. Methods: The definition of incident delirium using MDS items and the CAM algorithm should be spelled out fully. State clearly how the delirium score was calculated.

10. Results: How many residents were excluded by each of the exclusion criteria?

11. Results: It is not clear what "presence of dementia, pain, and the use of antipsychotics within 3 months of the assessment" means. Does "the assessment" refer to the assessment that triggered delirium? Does "within 3 months" mean 3 months before the assessment? What about patients who never experienced delirium—which assessment is selected for reference? These choices need to be specified in the statistical analysis section or another part of the methods.
12. Discussion: Again, the delirium calculation is not an "incidence" since time is not standardized in the denominator. It is a frequency (number of residents with delirium per nursing home stay).

13. Discussion: Here the term "acute pain" is used but this is not defined in the methods.

14. Discussion: The points that the authors use to conclude that "Therefore, changes in characteristics that were found to be associated with delirium were most likely present at the time of delirium" are not clear or convincing to this reader. How do the authors know which came first, delirium or predictors?


Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.
No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.
Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.
Yes

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.
I am able to assess the statistics

Quality of written English
Please indicate the quality of language in the manuscript:
Acceptable
**Declaration of competing interests**

Please complete a declaration of competing interests, considering the following questions:

1. Have you in the past five years received reimbursements, fees, funding, or salary from an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

2. Do you hold any stocks or shares in an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

3. Do you hold or are you currently applying for any patents relating to the content of the manuscript?

4. Have you received reimbursements, fees, funding, or salary from an organization that holds or has applied for patents relating to the content of the manuscript?

5. Do you have any other financial competing interests?

6. Do you have any non-financial competing interests in relation to this paper?

If you can answer no to all of the above, write 'I declare that I have no competing interests' below. If your reply is yes to any, please give details below.

I am a researcher in the same topic area.

I agree to the open peer review policy of the journal. I understand that my name will be included on my report to the authors and, if the manuscript is accepted for publication, my named report including any attachments I upload will be posted on the website along with the authors' responses. I agree for my report to be made available under an Open Access Creative Commons CC-BY license ([http://creativecommons.org/licenses/by/4.0/](http://creativecommons.org/licenses/by/4.0/)). I understand that any comments which I do not wish to be included in my named report can be included as confidential comments to the editors, which will not be published.

I agree to the open peer review policy of the journal.