Reviewer’s report

Title: Exploring the usefulness of Lexis diagrams for quality improvement

Version: 0 Date: 22 Aug 2019

Reviewer: Julie Reed

Reviewer's report:

Thank you for the opportunity to review this interesting manuscript that I think would be of interest to specialists in this field. I think this paper could be suitable for publication but requires major revisions.

I am not an expert in survival probability or lexis diagrams, but am very interested in the practical use of data (and the need to appropriately visualize complex information) to drive action and have conducted extensive qualitative research on the relationship between data use and actions taken.

I think that the issue of data visualization and interpretation is very important to the field of quality improvement. As such I was very interested to read this paper and to learn of a new method.

However, I found at times the text to be hard to follow as it assumed a lot of prior knowledge and failed to appropriately explain key concepts so that they can be easily followed. This was particularly an issue in the introduction, and in general I felt I had to do a lot of work to make sense of the manuscript (not helped by having to scroll up and down to the figures which I appreciate is out of the authors control).

I have put detailed comments below about where I struggled to understand or make sense of the manuscript with suggestions for how this can be improved. I don't believe this is necessary a flaw of the study or interpretation, but more the clarity required to present new complex ideas in a way that make sense to others in the field.

I did have one major concern regarding the study validity. Methodologically the paper would be stronger if others who hadn't been involved in constructing the diagrams were then exposed to the diagrams with either verbal and/or written information to see their reactions and ability to interpret. The diagrams are not straight forward and I wonder how frontline staff would have responded to them. Clearly the group who developed them have spend significant time and investment therefore biased in perceived value. Indeed in one of the quotes an interviewee mentions that they perceive that other staff would value seeing the data (how long patients live for) - this could be tested empirically which would greatly strengthen the paper.

Detailed comments:
Abstract

Methods: suggest for clarity change sentence order -
Lexis diagrams were produced based on data from…
The usefulness of Lexis Diagrams was explored through…
Iterative development of the diagrams…

Results:
First line belongs in methods.
I found the results confusing - not having prior knowledge of what Lexis diagrams do, nor having read the paper. This needs work to make the findings clearer to someone who is not an expert in this approach. e.g. stating the basic principles of what a lexis diagram shows and the extent to which users found this helpful.

Introduction:
I found the text from line 59 - 67 introduced intriguing in concepts, but it was hard to understand the logic connecting the statements and the meaning the author would like the reader to take from them. I think all the points raised are relevant but a little more "hand holding" to explain the meaning of the points in relation to the authors overall argument, perhaps with an example, would help make this section clearer.

e.g. Why does system complexity and non-linearity matter when building knowledge to guide local QI efforts - and how specifically does this relate to the use and presentation of data?

I feel I am trying to imagine/guess the connections and direction of the authors argument.

What does "complexity harnessed in data documentation" mean? Can you explain or provide an example?

Why do control charts not represent complexity? Some experts would argue that they do - so you need to be clearer in your reasons for this statement.

I'm not sure control charts assume that people know the related processes - QI would often advocate for other methods to better understand processes that should be used in conjunction with control charts, of which searching medical records would only be one.

Line 73 - I feel this sections jumps to two new topics - statistical significance and survival data.
I think it would be helpful to introduce this section more clearly - e.g. One area in which improvements could be made in the visual representation of data is patient survival probability… Explain what patient survival probability is and why important (assuming no prior knowledge of the reader), Explain how data normally represented and why the data could be better represented…

It would be helpful if they author could specify information about the other visualisation methods mentioned (given this is the key point of the article) rather than assume the reader knows or requiring the reader to search for the information. e.g. what are the key features of Kaplan-Meier curves in visualising survival probability? What are the strengths and limitations of such methods in visualising data for what purposes (prediction, action etc)? Could an example K-M diagram be included alongside the sample Lexis diagram?

Could a table be presented in which the key features and benefits/limitations of the two diagrams could be compared side by side? and perhaps include control charts as a third visualisation method given its dominance in QI and the authors dismissal of this method.

Figure 1 - it would be helpful for the author to describe a couple of the lines in detail so the reader has a clear sense of how to interpret the lines and what information can be gleaned from the diagrams. This could be done in main text or in as Fig text.

Line 105 - "this versatility enhances understanding" - this needs a lot of unpacking - it is not immediately clear to me why this is. It would be helpful to understand more about the types of trends and patterns that are easy to identify using these diagrams and how this is done.

Line 107 - it would be helpful to explain more clearly how the Lexis diagrams can help with prediction, timeliness and complexity. Not immediately clear.

Line 141 - I am still not clear why timeliness is an issue for traditional analysis, nor how this issue is mitigated using lexis diagrams - can this be explained? I assume relates to the time taken to collect sufficient sample size and then conduct analysis as a one-off event? Whatever the reason this needs to be much clearer.

Line 142 - it is not clear how Lexis diagrams relate to before/after analysis -so the "third" reason is confusing - can this be explained earlier.

Line 162 - I am not familiar with the term "process owner" - can you explain what this means?

Line 223 - its not clear to me why the line representing surviving patients goes down and backwards (right to left) - this implies going backwards in time? I would have thought that the line would go down and forwards (left to right)? Useful to explain this convention.

Line 233 - in this paragraph are you essentially say that you count the number of dots between certain lines? If so is it helpful to quantify the number of dots for the cells you are talking about to help illustrate the point? Would this be standard practice? Or are you just meant to eyeball the graph?
Are these figures statistically significant? If not how are you comparing the results to the statistical survival curve? This also suggests that there is a difference in survival rates from the beginning of the timeline?

These claims need more precision.

Line 257 - "no clear trend seen when all data included" - I'm confused as to whether this means Figure 3b is wrong or just showing something different? Surely if you look at the same data in different ways and get different answers that is problematic? Again do you mean just by eyeballing the data? or counting the dots?

Line 266 - what is meant by the "number of relapses is steady over the years" - how do you know that? Are you counting dots in segments? Then you need to make this clear methodologically?

Line 270 - how many green dots would signify a problem? Seems a vague statement and is not clear how this would link to action.

Line 325 - I think the point about the two methods being complementary should be made much earlier - i.e. in the introduction when explaining the different methods

Line 342 - how was the process owners perception confirmed?

Line 350 - 357 - is this a suggestion for future work? Should this belong in the discussion?

Line 392 - how do you know may deaths are due to leiomyoscaroma? Dot counting?

Discussion

I'm still not clear on how the Lexis diagram aids prediction - could some clear examples be provided of the role it can play here? How could the prediction be tested?

Line 436 - I am not sure it is within the scope of this paper to make recommendations for how data coding issues should be resolved - this has not been the focus of the paper so this section should be only focus on known limitations and suggestions for future work (not unrelated recommendations).

The discussion would benefit from a comparison with other QI data methods - especially given the role of control charts is raised (and dismissed) in the introduction it would be helpful to make clear the benefits/limitations of each approach here.

I also wonder if most of the visualisation interpretations you discuss could not just be found with an excel spread sheet and an interested clinician looking at the data and trends? I assume a value of these charts is that not many clinicians will sit and analyse an excel spreadsheet - and so here you are presenting something that is visually intriguing that allows new ideas and interpretations to come to mind that can then be further explored (by counting the dots?? or more advance methods?). It would be helpful for this to be clearer.
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.

Unable to assess

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.

Not relevant to this manuscript

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 declare that I have no competing interests

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/). 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