Reviewer's report

Title: Using decision fusion methods to improve outbreak detection in disease surveillance

Version: 0 Date: 29 Aug 2018

Reviewer: Reviewer 2

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PEER REVIEWER COMMENTS: To view the full report from the academic peer reviewer, please see the attached file.

REVIEWER COMMENTS FROM REPORT: The aim of this submission is to describe a study conducted to assess the benefit for a decision support system using Decision Fusion (DF) approach for the warning system through the Outbreak Detection Algorithm (ODA) of surveillance data. The authors attempted to evaluate five various methods using the DF criteria for this assessment. The authors are complemented to address this very important methodological topic in using data generated through various health surveillance systems across different regions and countries.

REQUESTED REVISIONS: Below are my comments and suggestions that the authors may consider for improving the presentation of this submission:

1. Although the main focus of the manuscript was to propose and use DF as an approach for using surveillance data for ODA, the ODA performance should be assessed in terms of the defined criteria of what constitutes an outbreak. As the authors correctly noticed that ODA depends on several dimensions and factors. The submission, however, did not address the complexity and diversity of classification of outbreaks from one surveillance stem in assessing the added value of DF. The manuscript is of limited added value without considering its application in existing disease surveillance systems. The authors may emphasize that such issue is beyond this study but should be addressed in the near future prior to the application the proposed DF.

2. Given the available data from various surveillance systems and the limitation of using synthetic data (simulation data), the authors should justify the using of synthetic data particularly if they think their approach has a direct field application.

3. The authors used the term "epidemic signals" in describing their simulation process. There is a need to describe the meaning and/or the difference between the two terms (epidemic and outbreak) and their application in the proposed approach. As a long time implementor and designers of disease surveillance systems, I have hard time to recognize the difference in the application of these two terms. I assume that the authors in their elaboration of the complexity of an outbreak classification, under the introduction, have used synonymously the two terms. If so, for consistency one term should be used across the entire manuscript.
4. I am not clear in the use of term "surveillance stem" versus a single surveillance system. Are various components activities (detection, reporting, various laboratory measurements etc.) of a single surveillance system fit within one surveillance stem? The authors may use some examples from real-life situations to demonstrate their meaning.

5. How the various apparatuses of a surveillance system (e.g. sampling frame, aim of the system, measurement strategies, coverages, frequency of measurements) are considered in the simulation of the data and the quality of the system? All these components are essential in classification and reliability of an outbreak.

6. Although it is appreciated that the authors have given real-life example of a surveillance data of food borne diseases (Norovirus), the justification of using 20 years’ period is needed. Both measurement devices and ecological modifications of food borne diseases are more sensitive to changes with five years' period. The use of training every five years is good approach; assessment every five years should be considered in the presentation of the findings. The assumption that the measurements and ecology of these diseases are consistent over the 20 years, however, may not be valid. The authors may consider this issue as part of the limitations of the study.

7. It seems that the authors applied a log-linear model where are the variables are binary for what it is labeled as logistic model. Are you considering the logistic model as the generic name for log-linear modeling?.

8. It seems that the authors considered the median value in choosing the 50% for the score of Hill Climbing algorithm based on the Bayesian Information Criterion (BIC)? If so it is worthwhile to indicate so with the reason for this selection.

9. The evaluation process for both accuracy and prediction of the usefulness of DF for DOA should be related to the day of the detection of the outbreaks and NOT to consider every day of the outbreak period, let say 15 days, to be equal. It seems that some of the proposed assessment's outcomes are treated the entire period of the outbreak to be equal. The aim of early detection of an outbreak is to recognize the outbreak as early as possible. Thus, early detection should be the aim in assessing the value from the surveillance data for DOA by assessing how the first day of recognition of the outbreak. The signal-to-noise difference (SND) should be the primary outcome for the assessment. Although the other presented assessment's outcome of the proposed approach for DOA are of value, the primary outcome is lost in equally assessing all. In other words, the SND within the period of outbreak in which the system recognizes the outbreak should be the outcome in terms of assessing the overall Se, Sp, or the Predictive Value of Positive (PVP). The authors may consider either dispute this point or clarify the approach.

10. Although the predictivity of the DF can be measured using PVP, it is well recognized that the PVP is associated with the proportion of the outbreaks in the dataset during the evaluation period. It is more appropriate if the estimations of PVP to be shown in relation to various predicted level of outbreaks. The use of ROC is of value but its aim to determine a threshold and NOT to consider the level of outbreaks.
11. Most of the section of "Evaluation of decision fusion" can be summarized into few paragraphs to stay within the aim of the submission. There is no need to elaborate on the various single used methods for DOA since it was not the main purpose of this manuscript. Otherwise the submission requires further elaborations on the evaluation each of these single methods.

12. I wonder if the authors can insert 2-3 sentences to elaborate on the difference between the use of subject matter expert in evaluation of surveillance data for an outbreak to their term of "voting method". I wish we can standardize the terms among the users, providers, and theoretical researchers of surveillance system.

In conclusion, I believe that this submission will significantly contribute to expanding the readers on the theoretical methods of analyzing surveillance data. My above comments and suggestions are meant to share my impressions as a planner and users of disease surveillance systems. The authors may consider these above points in total or partial with the option to write a commentary that can be presented jointly to the manuscript.

ADDITIONAL REQUESTS/SUGGESTIONS: See comments above

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.

No

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

No

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

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Please indicate the quality of language in the manuscript:

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