Reviewer's report

Title: Syndromic Surveillance: STL for Modeling, Visualizing, and Monitoring Disease Counts

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Reviewer: Tom Burr

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Syndromic Surveillance: STL Modeling, Visualizing, and Monitoring Disease Counts

1. Is the question posed by the authors well defined?
   Yes.

2. Are the methods appropriate and well described?
   Yes

3. Are the data sound?
   I assume so. A lot of data is described by summary plots, for example in figures 4 and 5.

4. Does the manuscript adhere to the relevant standards for reporting and data deposition?
   Yes.

5. Are the discussion and conclusions well balanced and adequately supported by the data?
   Yes.

6. Are limitations of the work clearly stated?
   Yes, fairly well in the Discussion. However, the C1, C2, and C3 methods and GLM methods are not the only reasonable options to which the STL method might be compared. For example, BioSense uses a GLM-type model with weekly updates of coefficient estimates which somewhat mitigates issues such as non-constant seasonal effects. Perhaps the Discussion could mention other options to which STL might be compared. I like the STL method, but don’t feel so ready to declare it a winner simply because other options for comparison could have been considered. If the authors agree that other options might be competitive, perhaps add some type of “limitations” of the work” to the Discussion section.

7. Do the authors clearly acknowledge any work upon which they are building, both published and unpublished?
   Yes

8. Do the title and abstract accurately convey what has been found?
Yes

9. Is the writing acceptable?
Yes

Opinion regarding publication: Accept pending minor essential revisions. The writing style is excellent and considerable ground is covered in the 12+ text pages. I enjoyed reading it.

Minor essential revisions:
1. Clearly define the C1, C2, and C3 methods – the description on p. 11 is too brief.
2. On pages 7 and 11, the issue re pooling across years—perhaps cite Burr et al. [10], which showed that a hierarchical model that allows for varying seasonal effects across years led to simulated data that was more appropriate for comparing algorithms that the “one-season-fits-all” model used by all other papers that I’m aware of (including [16]).
3. Is the STL acronym ever defined? Also, loess is a good smoother, among many. Is there any compelling reason to prefer loess over, say, lokerns (in R) in this context? I note the “blending” required near the ends of the data with loess. Also, how were the bandwidths chosen? Trial and error and visual inspection of resulting plots? Some “magic” 39 day, 90 day, and 1000 day bandwidths are mentioned.
4. page 3: should “seasonal ARIMA” and “naïve Bayesian classifiers” be defined? Consider audience, but ARIMA is never defined.
5. STL method description: our library doesn’t have J. of Official statistics. Is there another published description? Aim to make the page 5 and 6 description clear enough that readers could implement their own STL-like approach?
6. page 6: “The systematic components $T_t, S_t,$ and $D_t$ are taken to be fixed…” That is not quite what you mean? Obviously each are time dependent, but presumably you mean fixed for a given value of $t$. This is slightly confusing because of course one must estimate $T_t, S_t,$ and $D_t$, so some of the observed variability in $N_t$ arises because you therefore deal with ESTIMATES of $N_t$. Not sure how best to clarify this, but perhaps a sentence to that effect could be added. In practice, we always then have ESTIMATED residuals, and keeping that fact in mind is sometimes useful.
7. page 6: quantiles—$1 - P(y_t, \lambda_t) - I$ think you really mean $P(Y \geq y | \hat{\lambda})$ and note this implies using “$\geq$”, not “$>$” here – so I think you have a small issue in notation.
8. lognormal: write the density and define parameters? I suggest this because there is not a standard notation/parameterization for lognormal, so you should define the parameterization that you’re using.
9. rho is 97th quantile, but then you let rho = 0.01 and I think you mean the 99th
quantile. Check for consistency of meaning of rho. Emphasize: 3% FAR PER DAY! This is a high rate per day isn’t it? Why chosen? And why then use 0.01 in the study of GLM versus STL actual versus nominal FAPs. Consider using terms such as “actual” and “nominal” in this context because that’s pretty standard terminology.

10. page 9. why repeat Eq. (2)?

11. typos:
Page 4: “The square root …” not “Square root …”
Page 4: Fix this: “This is not surprising because the square root of a Poisson….” You don’t really mean what this sentence says – I think you’re trying to say that the sq. root scale stabilizes variance, and you will empirically check whether the resulting ESTIMATED residuals from fitting Eq. (1) are approximately Gaussian. However, the residual mean is nearly 0, which is “small,” so the sentence needs to be clarified.
Page 7: “Because 0 is: fixed “ fix this and what is N in the 0.87 N expression? And use, “The parameter f controls the ..”
Page 10: “Table ? – just above Table 2 – I guess you mean “Table 2”
Page 11 – some repetition here – why say “the two dangers ….” again (first said this on page 3)
Figures: some misleading labels—such as sq. root of counts when plotted values are negative
References: inconsistent format—all caps for article titles or not?

Discretionary Revisions:
1. As mentioned in #6 above, I like STL, but am not convinced that it would “win” compared to other methods not considered, such as frequent updating of fitted GLM-type models, or perhaps other alternatives. I suspect the authors like STL, as do I, but I am not convinced that the reader should come away with “Use STL” just yet. Aren’t there other reasonable alternatives that could also beat C1, C2, C3 a

**Level of interest:** An article of importance in its field

**Quality of written English:** Acceptable

**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**
I declare that I have no competing interests.