Author’s response to reviews

Title: Readmission rates in non-profit vs. proprietary hospitals before and after the Hospital Readmission Reduction Program Implementation

Authors:

Lauren Birmingham (lbirmingham@kent.edu)
Willie Oglesby (Billy.Oglesby@jefferson.edu)

Version: 1 Date: 12 Aug 2017

Author’s response to reviews:

Dear Dr. Logan,

Thank you for considering our manuscript, “Readmission rates in non-profit vs. proprietary hospitals before and after the Hospital Readmission Reduction Program Implementation” and for requesting further revisions. We have read the thoughtful feedback from the reviewers and have responded to their comments in detail below. Also, I have provided a copy of the manuscript with tracked changes, as requested. All line references in the comments below refer to the final version of the manuscript (not the final showing markup view in Microsoft Word).

Thank you.

**All line references refer to the FINAL view of the manuscript in Word (not the Final Markup view with red edits).

I have added "**" before the author responses.

Reviewer 1:

Reviewer reports:

This manuscript presents an interesting comparison of readmission rates pre-post the Affordable Care Act (ACA) between not-for-profit and for-profit hospitals. The manuscript is well written and findings support similar research. Using a difference-in-difference study design the authors
found that for-profit hospitals have an overall lower readmissions rate, yet the rates declined in both groups pre-post ACA.

My major concern is that it is unclear if the two groups were appropriately matched (which the authors note as a limitation). This could mean that factors other than the intervention may explain the results. Without matching, the analysis may not be sensitive enough to detect an effect. The authors acknowledge that the two groups are different related to case mix and control for these differences. However, it is not clear if there are any unobserved factors that may bias results. These differences may violate a primary assumption of the D&D approach (the trend of the intervention and control groups should be equivalent absent the intervention). However, the authors do disclose this as a major limitation.

**Thank you for this feedback. Utilizing a matched design where like hospitals would be another way to answer this research question. I have added performing a similar study with matching as an area for future research at line 281. Additionally, we also mention propensity score matching in the original paper, and this appears at line 324.**

**The parallel assumption of D&D was not made clear in the original manuscript, and I have updated this beginning at line 283. You are correct though, omitted variables could still impact this, and those are still a limitation which we outline beginning at line 274.**

The discussion on the differences between the two hospital types and the perceived impact on readmission rates is brief in both the hypothesis section and discussion section. Space permitting, these factors could be further discussed. For example, does the literature suggest for-profit hospitals have additional resources for quality improvement projects or case management? Given the potential changes to ACA and the findings of this study, are there any policy recommendations going forward that should be included in the discussion.

**In the introduction section I have added some additional differences (with respect to quality) on not-for-profit and proprietary hospitals beginning at line 106. I could not find scholarly, peer-reviewed literature specifically addressing the question of whether or not proprietary hospitals have more funds for QI projects/ case management—but I included broader literature on quality outcomes, which I believe addresses the underlying concern.**

**I have added some more literature to the discussion section as well (line 262) and additional thoughts on differences in quality by non-profit and proprietary hospitals.**

With respect to further research and policy recommendations moving forward, I have added some additional text to the conclusions section which begins at line 315.
Reviewer 2:

Overall

It is unknown whether the HRRP reduced 30-day readmissions equally between for-profit and not for-profit hospitals. The objective of this study was to determine if implementation of the HRRP was associated with different rates of 30-day readmission reductions between for-profit and not for-profit hospitals. Hospital ownership data were provided by the Centers for Medicare and Medicaid services and readmission data was obtained via linkage through the Dartmouth Atlas of Healthcare. This was a quasi-experimental study. Results suggest that while non-profit hospitals have lower rates of 30-day readmissions, the HRPP did not differentially reduce readmissions between hospital types. This national study provides information regarding the impact of HRRP on readmission rates by hospital profit status that may inform policy decisions. While the regression methods presented are appropriate, additional detail on the statistical methods is needed. There are questions regarding the unadjusted analyses. In addition, there are several errors in the text that suggest inadequate proof-reading and possible carelessness.

**Thank you for this review. Please see the responses below. I have made significant updates to the methods and results section, as a result of going back to the raw data and re-running parts of the analysis, as suggested. Additionally, I have made several updates throughout the manuscript to improve the overall language and tone of the manuscript to address the points made in the last sentence of the above paragraph. Thank you again for your detailed review of our manuscript.**

Abstract

In the background, the authors use the word 're-work' when hospital readmission is more appropriate.

**I have changed the language at line 30 to reflect this suggestion.**

Last sentence - authors intended to write not-for-profit and proprietary.

**Yes, thank you for this correction. I have updated the language at line 33.**

In the methods, the authors mention testing not-for-profit status as a potential effect modifier. This is not mentioned in the methods section.

**I have largely removed the portions of this paper that referred to the evaluation of the emergency department as an effect measure modifier. I decided to do this because there is very
limited data in our dataset (only 68 hospitals without EDs, and only 45 in both 2010 and 2012 that we can use in the analysis). The conclusion we originally drew- that having an ED did not modify the effect of the HRRP policy- is very much in-line with what others have published, making it a less unique/ interesting finding. Furthermore, the primary purpose of the paper was to assess whether or not the HRRP program had a differential impact on non-profit and proprietary hospitals from 2010-2012, and the ED analysis is a significant deviation from this research question. I think removing this part of the analysis keeps the scope of the paper more focused, and does not take away from its contribution to the literature, since this finding has already been published (with the use of a more robust dataset specifically addressing emergency departments).

Conclusion - data never 'support' the null. We fail to reject the null.

**I agree. I have updated the language in the abstract and methods section to reflect this.

Methods

The figure is a flow diagram or chart. A consort diagram is specific to clinical trials.

**I agree. I have updated the name of the diagram to “Hospital Flow Diagram”

Overall, the statistical methods section should contain more detail. There is no explanation of how the models were constructed, even though 3 adjusted models are presented in Table 2. Furthermore, the authors identify 3 research questions but only use a regression model to analyze the last question. Why wasn't regression use to control for case mix, ect when examining baseline differences, or even when examining change over time within hospital type? The bivariate analysis shows that case mix did change over time. The authors didn't mention

**Thank you for this feedback. This comment (and others) led to a significant re-evaluation of our data and methods. I have made significant changes to the methods section starting at line 165. I have detailed which statistical methods were used for each research question to help alleviate confusion.

I updated the results to use regression to examine the impact of non-profit status on 2010 (baseline) and 2012 (post-implementation) readmission rates. I agree that presenting adjusted information is more meaningful here. This data appears in the new Table 2.
Results

The statement that the regression analysis confirmed the null hypothesis is incorrect for the reason mentioned earlier, but also doesn’t belong in the results section. This is a discussion item. **I have corrected the wording to reflect this comment. There are no references to “confirming the null” in this paper now.

Table 2 contains a lot of information that is essentially not discussed in the results. For example, what is model 3? Never mentioned.

**I created Table 4 to replace the old Table 2. As a result of the comments made by reviewer 2, I revisited my raw data to re-evaluate the models presented in the paper and the story they told. In doing so, I found the way I performed the DiD regression analysis was incorrect. I had a long data format (where there were 2 observations for each hospital— one for 2010 and one for 2012) and a binary variable indicating the year 2012, which does not result in correct parameter estimates—especially in the unadjusted regression analyses. I have corrected this and followed instructions from a SAS whitepaper on Difference-in-Differences modeling that utilizes PROC MIXED to account for repeated observations (http://www.lexjansen.com/wuss/2016/49_Final_Paper_PDF.pdf). Correcting this substantial error resulted in large changes in the adjusted regression results, and much smaller changes in the adjusted regression results. Table 3 now presents the results of the unadjusted linear regression results and Table 4 presents the results of the multiple linear regression with the DiD term. Unfortunately the authors did not catch this error in data analysis prior to submission, but we have corrected it so that the current results are correct and accurately reflect the data. We apologize for this mistake.

**To address this specific comment- I have described the model creation process in greater detail in the paragraph preceding Table 4 (starts at line 221).

Under 'Assessment of Emergency….', the total number of hospitals w/out emergency departments is given as 45. This conflicts with information given in Table 1 (n=68) AND with information given later in the discussion. However, the same number is mentioned in Table 3. This discrepancy needs to be resolved and the analyses may need to be re-run.

Thank you for pointing this out. There were 45 hospitals with emergency **departments that had readmission rates reported in both 2010 and 2012. There were 68 hospitals that did not have an
emergency department that had a readmission rate reported in either 2010 or 2012. There were 23 hospitals without emergency departments that were missing (or did not report) a readmission rate in 2010 or 2012.

As previously described, I have removed the references to the emergency department analysis as it does not fit with the scope of this paper, and there is very limited data on which to draw conclusions.

Discussion of effect modification assessment should have been in the methods. Also, the analysis of effect modification by emergency room was conducted without adjusting for case mix. This reviewer doesn't understand why the authors only adjusted for case mix in their primary model and used unadjusted analyses everywhere else. An explanation is warranted.

**I agree. As previously mentioned, we have removed this part of the paper, and there are no longer references to the emergency department as an effect modifier.

Discussion

Line 218 - Zuckerman et al reported that HRRP targeted readmission rates for... the words readmission rates for are missing.

**I have updated this starting at line 248.

Line 221 - this is an awkward sentence that could be reworded.

**I have reworded this sentence (at line 250).

Line 235 - extra word 'to' needs to be removed.

**I have deleted the extraneous “to”.