Author's response to reviews

Title: Evaluation of Standardized Doctor's Order Sets as an Educational Tool for Undegraduate Medical Students

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Author's response to reviews: see over
Editor's Comments:

1) “First, the presentation of data is confusing. Table 1 labels the two groups by condition and hospital. The text refers to Hospitals A and B, but the table lists hospitals TWH and SMH. Labeling should be consistent.”

The changes have been made to keep the labelling consistent when referring to Hospitals A and B in the manuscript. As suggested by the reviewers, flow charts were used to present the breakdown of study subjects within the study. (Pages 20, 21 and 22, Figures 1, 2 and 3)

2) “Measures of agreement should be provided for rating of the open-ended responses on the measures. One of the reviewers had suggested that the scoring rubric be provided as an additional file.”

We agree with the editor that the open-ended responses on the measures can render the rating to be quite subjective without a prior marking scheme of the questionnaire. A marking scheme of the questionnaire was used and is attached as an appendix (Page 31, Appendix 2) to the manuscript.

3) “Effect size associated with the differences between groups should be provided in the results. Standardized mean differences can be added to provide a measure of the difference between the groups in standard deviation units.”

Standardized deviations of the differences between groups were added to provide effect size in the Results section (Page 10, Paragraph 3).

Reviewer # 1

Major Compulsory Revisions

Comment 1:

“Methods: The authors stated that the use of order sets was hospital-based. Specifically, that the COPD order set was implemented only at Hospital B while the CIWA-Ar order set was implemented only at hospital A. Why then were 5 students using CIWA-Ar order sets at TWH (Hospital B) and 43 students used CIWA-Ar order sets at SMH (Hospital
A)? Who were these 5 students who were able to use the order sets? The discrepancy between the described methods and the results make study difficult to interpret”

We agree with the reviewer that this appears to be confusing and have clarified this as a footnote in Figure 2 which replaced Table 1 (Page 21). These students based at Hospital B admitted to have done an elective rotation on CTU at Hospital A where they were exposed to CIWA order sets. That is the reason why we decided to ask this question to assess for the contamination. We have described the limitation in our Discussion section (Page 14, Paragraph 3).

Comment 2:

“Outcome: the a priori marking scheme of the questionnaire should be presented as an additional file since the open-ended nature of many of the questions clearly can render the marking to be quite subjective. In particular, how to score writing admission orders that specify dose and frequency would be particularly subject to interpretation. I find it difficult to see how scoring could be standardized. Thus, presentation of the marking scheme would be critical in persuading the audience that the marking scheme is standardized.”

We agree with the reviewer that the open-ended nature of many of the questions can render the marking to be quite subjective without a prior marking scheme of the questionnaire. A marking scheme of the questionnaire was used and is attached as an appendix (Appendix 2) to the paper (Page 31).

Comment 3:

“Choice in outcome: if only the use of AW order entry could be analyzed, why is the primary outcome a composite score of both AW and COPD? Please defend the choice in outcome. With secondary outcome: please clarify if the score consists of admission order writing portion of the examination of both AW and COPD or is it only for AW?”

The primary outcome was not a composite score of both AW and COPD. Rather, the primary outcome was based only on the total score of AW and not the total score of the COPD questionnaires. We excluded analysis of the primary outcome for the COPD due to the lack of students who used the order set for COPD. Also, the secondary outcome was the score on the admission order writing portion of the AW questionnaires. We have revised the manuscript to clarify this issue (Page 8, Paragraph 2).

Comment 4:

“Analysis: multivariate analysis uses base hospital as a control variable. Again, please clarify this. If the base hospital is what dictates the exposure to the order writing set, why is this included in the multivariate analysis?”
We anticipated that there could be cross contamination since some senior students experienced their elective rotation in other hospitals which is dependent on their base hospital. We felt it was important to measure this factor by incorporating whether Hospital A was their base hospital or not.

Comment 5:

“Limitations: additional major limitations need to be expanded upon. For example- a) the fact that exposure to clinical cases is by self-report. Very likely, students who saw and admitted cases of AW or COPE but do not remember so going to be systematically different from students who admitted cases and remembered doing so”

We agree with the reviewer that students who remember seeing cases may be systematically different from students who do not remember admitting patients. We acknowledged this limitation in our Discussion section. (Pages 14 and 15, Paragraph 4 on page 14).

b) “power- this study estimated needing 120 participants, but final analysis compared 48 students who used standardized order set vs 20 who did not”

We estimated needing 120 participants; however, only 68 students wrote admission orders for cases of AW for which the final analysis was based. This reduced the power of our study and we failed to reject the null hypothesis. We identified this limitation in our Discussion section and have further highlighted this issue (Page 15, Paragraph 2).

c) “confounders- the role for confounders cannot be understated in this observational study.” And “generalizability”

We agree that since it is not a randomized controlled trial, there could have been many possible confounders in the study which was identified in the Discussion section (Page 15, Paragraph 1). We also acknowledged that other larger studies from different hospital systems will be required to assess generalizability (Page 15, Paragraph 2).

Comment 6:

“Throughout the manuscript- the conclusion that there was no significant difference between control and intervention groups should be revised to this study did not detect a significant difference. The inability to detect a difference should not be equated with lack of difference, especially in light of the study’s limitations. Likewise-exposure to clinical cases was associated with improvement in knowledge. It should not be stated that exposure to clinical cases improved knowledge.”

These have been changed throughout the manuscript (Pages 2 and 16, Paragraph 1).

Minor Essential Revisions

Comment 1:
“Background: A more thorough review of the literature will help set the stage. Suggest expanding more in either the introduction or the discussion upon the need to balance. Only 8 references are cited. Perhaps include other key articles such as Massaro TA Acad Med 1993 and Bates DW’s work on CPOE.”

We have added a more extensive review of the literature and have added the reviewer’s references. This was added in both the background and discussion sections. (Page3, Paragraph 1 and page 14, Paragraph 1).

Comment 2:

“Methods: The details on the year 3 six-weeks and year 4 three-week rotation should be clarified. Do students undertake 6 weeks in their 3rd year and then rotate again through for 3 weeks in their 4th year or do students rotate through only once. If the former, then the study needs to account for students who have been exposed to both hospitals. Further, workload of trainees for each hospital should be presented. If at one hospital, for example, trainees admit on average 1 patient per evening, compared with another hospital where trainees admit on average 10 patients per evening, then it would be difficult to attribute any learning outcomes to the type of order systems.”

We agree with the reviewer that those details about their workload and their rotations during third and fourth year clerkship will help interpret the study better. The details are included under Study Subjects (Page 5 Paragraph 1).

Comment 3:

“Methods: The # of admission per hospital per year should be provided in order for comparisons to be made between hospitals in terms of % of admissions per year on COPD and alcohol withdrawals. Presenting only absolute numbers of admissions per year makes it difficult to compare the 2 sites.”

The number of admissions per hospital per year is provided under study subjects to better compare both hospitals (Page 5, Paragraph 1). The number of admissions per hospital is very similar and the percent of admissions per year on COPD and alcohol withdrawals is comparable as well.

Comment 4:

“Outcome measures-page 7- the authors made note of true or false questions in assessing knowledge. I was unable to identify any true/false questions in the attached appendix”

There are two true/false questions under section 3 in COPD questionnaires.

Comment 5:
“A flow chart is needed in order to present the student population. It would appear that for AW-out of 175 students, 109 were in one hospital, while 66 in the other. Of the 109, 74 were exposed to AW patients (35 were not); and of the 74, 50 wrote orders (24 did not), and out of the 50, 43 used standardized order set while 7 did not. In terms of 66 students in the other hospital, 31 were exposed to AW patients (35 were not); and of the 31, 18 wrote orders (13 did not); and of the 18, 5 used standardized order set while 13 did not. Thus the comparisons were 43 in one hospital plus 5 in the other who used order sets compared with 7 in one hospital plus 13 in the other who did not. Thus it will take the readers too long to sort out your comparison groups and where they came from. Also please present the flow chart for the COPD portion as well. This will allow the readers to understand the representativeness of the student population.”

We agree with the reviewer about the complexity and difficulty understanding the data. As per the reviewer’s suggestion, three flow charts were added to the manuscript (Pages 20, 21 and 22, Figures 1, 2 and 3).

Comment 6:

“Page 9- the authors presented total exam score difference of -0.41 (95% CI -2.44 to 1.62) please clarify if this is truly the exam score difference that is presented or is this the multivariate parameter estimates that is being presented. Same with the -0.14 presented for the secondary outcome measure.”

These point estimates were the covariate parameter estimates within the multivariate model and not the exam score differences. This was clarified in the Results section (Page 11, Paragraph 1).

Comment 7:

“Results, score’s correlation with level of training: please present these results.

The total scores were positively correlated with level of training. The total scores for Year 3 and Year 4 were 9.73 and 12.36 respectively (P< 0.0001). The results were added to the Results Section (Page 11 Paragraph 2).

Comment 8:

“Table 1- please refer to hospital as hospital A and hospital B as is done throughout the manuscript. Please present as a flowchart rather than a table (see #5 above)

As discussed in Comment #5, a flow chart (Figure 2) has been provided (Page 21).

Comment 9:

“Table 1 - CI of estimates need to be presented.”
The 95% confidence limits have been added to Table 1.

Comment 10:

“Please revise to improve clarity of the variables (what they are being compared to)- eg- year 3 (compare with year 4); etc”

The baseline variables have been added to Table 1.

Discretionary Revisions

Comment 1:

“Discussion, second paragraph: please clarify if this study is evaluating knowledge acquisition or retention. It seems to me that it is evaluating only knowledge acquisition.”

Given the fact that some students may have used order sets early during their rotation or during their third year clerkship, our study was able to assess retention in addition to acquisition. In addition, there are questions regarding the dose of thiamine, multivitamins and benzodiazepam. It is possible that students who used manual order writing may remember the dose of the medication while the students who used the standardized admission orders may not be able to retain the information on the dose of the medication due to the lack of reflection. This was added in Discussion section (Page 12, Paragraph 1)

Comment 2:

“Face Validity raised in the discussion section. This term is general considered arhaic and probably should be avoided.”

The discussion section has been modified (Page 13, Paragraph 1).

Comment 3:

“Second limitation raised by the authors- the authors can test whether or not scores are trending higher as the study progressed which can then allow inferences on whether or not the impact of order sets may be attenuated.”

We agree with the reviewer. We have tested and failed to detect the significant trend on higher scores as the study progressed (Page 13, Paragraph 3).

Comment 4:

“Last line of conclusion- in my version this sentence is incomplete. Not sure if it’s just my version.”
The last line of conclusion has been corrected (Page 16, Paragraph 1).

**Reviewer #2**

**Major Revisions**

**Comment 1:**

“The adoption of standardized order sets seems erratic. Despite being available for over a year prior to the study beginning, the two year study documented only 2 students used the standardized order set at Hospital B (I believe this is defined as “TWH” in Table 1, but this is not clearly designated). By comparison, one student used the standardized order set at Hospital A (again I assume this is “SMH” in Table 1). Not only was adoption woefully inadequate, but how were students using the standardized order set at hospital A if the methods describe that “only Hospital B trainees have access to the COPD order set”. Even more significant cross-contamination was noted with Alcohol Withdrawal order set. Again, “only Hospital A trainees have access to the CIWA-Ar order set” according to the methods. However, Table 1 again demonstrates that 5 (28%) students at Hospital B used standardized orders. Given this situation, the authors cannot claim to have a control group that was not exposed to standardized orders.”

We agree with the reviewer that this is a significant limitation of the study. We could not accrue a large number of students that used the standardized order sets for COPD, and there was cross contamination of the use of the CIWA order set. We attributed the latter due to students being previously exposed to the CIWA order set from past elective rotations at Hospital A. That is a key reason why we decided to ask this question to assess for the contamination. We also excluded the students in the COPD group from the analysis. To adjust for contamination, we included the student’s base hospital within the multivariate model. As these were issues highlighted by Reviewer #1, we have incorporated these issues in the Results (Page 10, Paragraph 3) and Discussion sections (Page 14, Paragraph 3).

**Comment 2:**

“The erratic adoption hampers the evaluation of the primary outcome, total exam scores among students that wrote order. Since only 68 students wrote alcohol withdrawal orders, 20 of whom used standardized orders, the sample size is not sufficient to draw any conclusions. To detect meaningful difference, even the authors admit that they needed 120 participants to achieve an 80% power.”

We agree with reviewer that the study could not adequately recruit enough students in the standardized order sets for both the COPD and CIWA sets, significantly reducing the power of our study. We revised the wording of the study to state that we failed to show a difference between the students who used standardized order sets compared to those who did and that a larger, well-powered study will be required (Page 15, Paragraph 2).
Comment 3:

“The combination of year 3 and year 4 students places serious face validity on the outcomes. Year 3 and Year 4 students should have vast difference in exposure and experience. Combing them into the same groups and testing them on a knowledge based examination introduces significant heterogeneity to the results, particularly since one would assume that some 4th year students were exposed to a standardized order set as a 3rd year students and as a 4th year student, both years or not at all. These are vastly different characteristics that should not be folded into a relatively homogeneous 3rd year group who only differ on exposure.”

We agree with the reviewer that year 3 and 4 students should have differences in exposures and experiences. When we reviewed the distribution of year 3 and 4 students in the control and intervention groups, there were 20% of fourth year students (out of 20) in the control group and 28% of fourth year students (out of 46) in the intervention group for the CIWA order set. The slight increase in proportion of fourth year students in the intervention group could have increased the total score resulting in no difference in total scores between both groups. It is possible that the intervention group could have scored less if there were a less proportion of fourth year students. This limitation was added in Discussion section (Page 15, Paragraph 1).

Minor Revisions

Comment 1:

“The language in the paper needs consistency. It is a difficult manuscript to follow because of multiple different references. For example, the text only refers to Hospital Q and Hospital B, yet Table 1 makes reference to TWH and SMH, which are not defined in the remainder of the paper. Likewise the assessment instrument for the intervention is called a “questionnaire” in some areas but as a “post-test” or a “test” or an “examination” in others. Please decide on a name for your intervention assessment and be consistent throughout the manuscript.”

The changes have been made throughout the manuscripts as suggested.