Author’s response to reviews

Title: A searchable database of medical education objectives - creating a comparable gold standard

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I am writing to address the reviewers comments on our manuscript entitled, “A searchable database of medical education objectives: creating a comparable gold standard” for publication in BMC Medical Education. I greatly appreciate the reviewer’s comments and feel the paper has been significantly improved by addressing them. I will paste the reviewer’s comments below and address how each comment has been addressed line item by line item

Reviewer reports:

(Reviewer 1): The paper clearly describes the innovative web -based browser for searching objectives across medical disciplines and societies. The topic is relevant, up -to -date and quite challenging. Let me have the following comments/questions, which I hope could improve the paper:

1. Background section represents introduction to the paper domain. I miss just a brief state -of -the -art or references of related publications (paper and conference contributions) in last few years. Are there any similar results, which have been already published? .

a. Addressed with addition of : “Medical schools develop curricular mapping on their own, with their efficacy largely being judged based on post -graduation national exam board scores. In the United States there are currently two board tests USMLE (United States Medical Licensing Examination) and COMLEX (Comprehensive Osteopathic Medical Licensing Examination) required for allopathic and osteopathic medical students
respectively, though there is significant crossover test taking as well. Both board review books (e.g. First Aid, Kaplan) and American national societies bin the knowledge needed for these board tests by discipline. The frequency with which the societies update their suggested objective coverage varies widely, ranging from roughly every 6 to 20 years. The private companies update their review materials much more frequently, likely because the revisions are less exhaustive and there is a profit motive to do so. Other parts of the world have had similar efforts, the best example the authors are aware of concerning interschool objective mapping being the National Competence Based Catalogues of Learning Objectives for Undergraduate Medical Education (NKLM) and Dental Education (NKLZ) by the Association of Medical Faculties in Germany (MFT) which relied heavily on work done earlier by Switzerland, Canada, and the Netherlands[1]. The NKLM was not used in any way to make the current database, however it is worth comparing both the size and utility of the datasets. The NKLM had 1956 learning objectives in German compared to 13,121 objectives that are viewable in 103 languages in the current data set. The first couple years of medical education content is almost entirely encompassed by scientific medical facts that should be sharable and of utility globally. The database described in this paper represents the first time objectives suggested for covered by national societies in the United States has been aggregated in one place and one format, and should provide a platform for continued submission of updated objectives for medical schools.”

2. Construction and content section represents the methods. There are only a brief information about the data format and processing of individual objective sets, which were stored in a database. Did authors do any data pre-processing/optimization before the import into system database was done? How the original data look like? Any example of diversity? Were there any inconsistencies and missing values?

a. The following section was added to and modified to address: “When aggregating information, such as this medical objective database has done, it is ideal if none of the content has to be modified by third parties. However, since the objective database was designed to list objectives as at least one full sentence some decisions had to be made by the authors to make the objectives understandable. Examples of how this was done include converting tabular pharmacology objectives or explicitly restating content that was cross-referenced in societal objectives. The most troublesome objectives to incorporate were the pharmacology objectives from the American Society for Pharmacology and Experimental Therapeutics (ASPET)[18]. While there were many ASPET objectives that were clear in sentence form, there were often pharmacological substances whose names were only listed in nested tabular form. Therefore, many of
these ASPET objectives had the pharmacological agents listed with the authors of this paper choosing to add the following constant phrase to end the objective: “describe the mechanism(s) of action, use(s), adverse effect(s), contraindication(s), and any relevant pharmacodynamic(s).” For example, because groups of drugs below were in two columns of a table labeled either “Nonselective Alpha Adrenergic Agonists” or “Selective Alpha2 Adrenergic Agonists”, the following two ASPET objectives were made from one table with different subheadings:

- “For the drugs DOPAMINE, EPINEPHRINE, NOREPINEPHRINE, phenylephrine, and pseudoephedrine as they pertain to synaptic and neuroeffector junctional sites - describe the mechanism(s) of action, use(s), adverse effect(s), contraindication(s), and any relevant pharmacodynamic(s).”

- “For the drugs BRIMONIDINE, CLONIDINE, and METHYLDOPA as they pertain to synaptic and neuroeffector junctional sites - describe the mechanism(s) of action, use(s), adverse effect(s), contraindication(s), and any relevant pharmacodynamic(s).”

In all cases authors chose to not modify the suggested objectives if possible, with the rare exception being fixing clear spelling errors. Student researchers compiled the database in a google doc flat file format before import into the database. There was not data preprocessing/optimization before import into the database. Capitalization and punctuation was left unchanged, though search functionality is not case sensitive.”

3. What type of database did authors use and why (MySQL, PostgreSQL, ...)?

Sentence added “A virtual machine on this server running Ubuntu 14.01 Linux houses the MySQL backend database, Apache server, as well as the PHP front end webpages.”

4. What is data model of designed database?

Addressed in follow section: “Data was input into a MySQL database with a webpage set up for retrieval (http://data.medObjectives.marian.edu). A script to create the database with all data can be found in the supplemental data (SupplementalDigitalContent2–medSchlObj-sqlCreate.txt). While the excel allows a flat file format to import new objectives, that data is split into multiple tables for querying in the database. The 3 currently used tables(columns) are:
1. objectives (see Table-2).

2. disciplines (discipline, displayName, inDB)

3. societies (name, abbrev, approvalLevel)

a. Most fields require minimal space being stored as varchar <256 with the exceptions in the objectives table being objective = varchar(2048), objectives notes = text, objective answer = text. These 3 fields allow longer objectives, and much longer notes and answers to the objectives.”

5. What hardware (server specification), software (framework, data processing and modelling tools) and programming languages were used during the development and implementation?

b. The following content was added to address: “The database was developed and deployed on a HP ProLiant DL370 G6 blade server with 8 CPUs (Intel® Xeon® X5550 @ 2.67 GHz). A virtual machine on this server running Ubuntu 14.01 Linux houses the MySQL backend database, Apache server, as well as the PHP front end webpages.”

6. How the authors generate a list of medical discipline? It is predefined or standardized list?

c. The following section was modified to cover: “Suggested medical school objectives were aggregated from disparate national societies in the United States of America (Table-1)[1–20]. The disciplines attempted to cover were determined from the two types of medical schools in the United States, both Allopathic[21] and Osteopathic[22]. In most cases this was for a single discipline with the intent to teach this material in the first two years of medical schools in the United States.”

7. Utility and discussion section represents the results and discussion. From my opinion, the utility (results) should deserve more space to mention main characteristics and features of developed browser. I propose to split this particular section into two separate parts and describe
in detail achieved results. May be some typical use case introducing the browser usage in practice could be mention here.

d. A significant use case section was added as follows: “There are various use cases for such a medical objective database which can mostly be categorized by a single lecturer’s use versus a medical school using across their curriculum. An individual lecturer could use the database to discover gaps in their content as well as extraneous information they may be including. At the most simple level the database has already proven a useful tool for clinicians that lecture at Marian University but are not full time faculty. Since external clinicians often come in to give 1-4 lectures, but are not career educators, they are often not versed in how to make a “good” objective, and could use the database to quickly paste objectives related to their lectures. Having these pre-vetted objectives has also seemed to keep external lecturers “on message” and guide external clinicians in the design of their PowerPoints and lectures, because once the objective is listed in their second slide they need to make sure they cover that content in the remaining slides. Up to 100 objectives from a single search result can be copy and pasted into excel or a PowerPoint with two clicks (along with associated discipline, year, society, subheadings, and note). A faculty member could quickly find objectives they likely should cover content for based on keyword searches but had not initially had in their PowerPoints, which often occurs when they are teaching about a disease state which has manifestations in a different discipline they did not understand well. A lecturer’s keyword search could also fail to retrieve many, or any, objectives which could hint that the content being delivered contains minutia that is likely beyond what the a new medical students needs to hear, or likely will be able to recall. … The medical objective database would likely yield greater results if adopted by an entire medical school. A medical school could decide they want to cover all the objectives in the database, or a subset thereof. Either way the database would then provide a checklist to go through and link which objectives are presented to students in each lecture. A first pass at this would expose “gaps” in the curriculum, i.e. objectives that should be covered but had not been assigned to a lecture. Redundancies would also be found, where multiple lecturers were repeating the same content. Redundancy is sometimes desired in medical school to hammer home certain content but, in the authors view, is more often an unintended consequence of each lecturer wanting to make their lecture self-contained enough to ensure a student can comprehend the content they are delivering.

8. Did the authors consider to use any standardized classification for individual objective (e.g. Bloom's taxonomy)? If no, please, explain why. In general, the authors did a great work. I have found this open access database very promising, but unfortunately the paper brings only
superficial description (4 pages of text excluding figures and tables). I think the paper need to be extended because of paper topic seems to be very interesting.

e. Addressed in the following modified section: “An initial schema for the objective database allowed for unlimited keywords in a separate tall MySQL table, however it was decided limiting the keywords to 15 was acceptable to allow the ability to combine the tables in a flat format and allow future contributions via an excel file. Other non-existing classifications were considered such as: Blooms Taxonomy, clinical verse basic science knowledge, usual year of edification, and quality metric of objective; however it was decided such fields would be better determined by the community in a future iteration of the database which could allow for user defined field creation. The most common form of metadata across societies was a top level subheading, which multiple objectives were grouped under. The notes section was also extensively used, often containing paragraph text from a heading above multiple objectives which applied to all objectives in a set.”

9. From the formal perspective: ¬ Table 1 is not referred in the text.

f. This comment was incorrect, Table-1 was referenced in the following 2 sentences. “Suggested medical school objectives were aggregated from disparate national societies (Table-1).” … “The authors would like to thank all the societies listed in Table-1 for developing lists of objectives they think are relevant for their given disciplines.”.

10. Sometimes the abbreviations of societies are missing (e.g. Association of American Medical Colleges, page 3 row 24).

g. Fixed


h. Fixed
(Reviewer 2): This paper and database addresses an important challenge in medical education—the accessibility and transparency of educational objectives across medical schools and disciplines; this is a highly relevant and insufficiently addressed issue.

However, despite the importance of the topic, the manuscript has in my opinion some major shortcomings:

12. How is your work relevant to medical educators outside the US? I see that it could be interesting for non-US educators and curriculum manager, but, transferability to other countries/curricula is not addressed in your manuscript. What lessons did you learn? What are your experiences so far? This is related to the next point.

a. The following section and functionality was added: “For the first time a searchable database combining suggested medical objectives from societies in the United States across most disciplines has been created and made publically available. The search term must be in English, but there is a dropdown to convert all text to other languages which should make this tool useful outside of English speaking countries. This translation dropdown is available on the front search page, the results page, and the help page. ”

13. What use cases and needs are you addressing? How is the database related to the curriculum maps of medical schools? How are educators using the database? What was the aim—just the searchability across disciplines (use case)?

a. Addressed in section added in Reviewer1-Q#7 above

14. Please be specific about what "national" means and that you focused on objectives and societies in the US.

This section was changed to “Suggested medical school objectives were aggregated from disparate national societies in the United States of America. In most cases this was for a single discipline with the intent to teach this material in the first two years of medical schools in the United States.” … “In addition, some societies, such as the Clerkship Directors in Internal Medicine and Society of General Internal Medicine (CDIMSHIM) [13], have content that is usually covered in years 3 and 4 of medical schools in the United States, during clinical rotations.”
15. Also, the medical school structure is different in other countries, so, it would help to understand from the beginning that you are referring to US medical curricula.

a. The first 3 sentences of Construction and Content are now: “Suggested medical school objectives were aggregated from disparate national societies in the United States of America (Table-1)[1–20]. The disciplines attempted to cover were determined from the two types of medical schools in the United States, both Allopathic[21] and Osteopathic[22]. In most cases this was for a single discipline with the intent to teach this material in the first two years of medical schools in the United States.”

16. Abstract: What are didactic years? Are you referring to the first two clinical years of US medical schools?

a. Addressed in section added in Reviewer2-Q#4 above

17. Background

1) Very short and does not put the work into broader scientific and international context. What has been done so far in this direction (in the US but also in other countries?). How exactly could an overall database be useful and which problems could be solved?

a. Addressed in section added in Reviewer1-Q#1 above

18. 2) Please be more specific that in your curriculum description you are referring to the US.

a. Addressed in section added in Reviewer2-Q#4 above

19. 3) p3, l8ff: I am not sure how your database helps in identifying gaps and overlaps in curricula, since there seems to be no connection or mapping with curriculum maps of the medical schools.
20. Utility and discussion 3) What can educators do with the search results? Export them? Could you describe use cases and what experience you have with these? Have you in any way evaluated the database? For non-US educators this would provide valuable information in case they plan something similar with the societies relevant in their countries.

a. Addressed in section added in Reviewer1-Q#7 and Reviewer1-Q#1 above

21. 4) p5. line 6¬7: This statement might be true for the US, but it is not world-wide. Please be specific here and/or cite similar databases and maybe put your database development in context to such international approaches (e.g. the development of the NKLM in Germany, see https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4580444/)

a. Addressed in section added in Reviewer1-Q#1 above

22. 5)l7¬8: I do not understand the second sentence of this paragraph — is there something missing?

a. This sentence in the conclusion was rewritten, expanded, and references Figure-1 now: “This single database provides transparency to compare between societies and disciplines, showing sometimes an order of magnitude difference in the number of objectives suggested to be covered during medical school for a given discipline (Figure-1). Some of that discrepancy is due to the verbiage of disciplines covering a different level of scope on a topic, but there is also just a difference in coverage between suggested objectives. Nesting objectives under a hierarchical tree-of-knowledge, such as MeSH terms, could provide a metric for the scope of objective and content delivery.“ … In addition a previous section details this further - “However a significant amount of the difference in the suggested number of objectives appeared due to societies differing in the depth with which they felt their content should be taught. Weighing the importance of the different disciplines’ content in order to assign medical students time is often hard to do when trying to compare siloed disciplines. The shared database provides transparency to disciplines’ requests of student’s time. A few disciplines were covered redundantly, by separate societies, and their suggested content also varied widely, at least 3-4 fold (Figure-1).

23. 6) Minor issues: I am not a native speaker, but there seem to be a few typos and grammar issue
a. Checked and fixed from start to end.