Author’s response to reviews

Title: A physician-scientist preceptorship in clinical and translational research enhances training and mentorship

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Response to Reviewer Comments

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“A physician-scientist preceptorship in clinical and translational research enhances training and mentorship”

We thank the reviewers for carefully considering our work. Their suggestions were helpful, and we feel that the resulting changes significantly improved the manuscript. In response to their comments, we have revised the manuscript with many major concerns addressed including:

1. We clarified and expanded a number of points about how the preceptorship and the survey were developed (Reviewer 1). This included the addition of a new table (Table 3, included below) to show the number of participants and survey respondents separated by academic year of preceptorship participation.

2. We removed Figure 1 and simply cited the results in the text (Reviewer 2).

3. We incorporated additional free-text quotes from our survey respondents (Reviewer 3).
In the updated version of the text, revisions and additions are highlighted using the “Track Changes” function in Microsoft Word. Below, we have also incorporated these revisions and additions as quoted text.

Sandy Cook (Reviewer 1):

The purpose of this paper is to evaluate a formal program designed to mentor md/phd students in clinical/transnational research. The gap in this area is identified due to the disjointed structure of the md/phd program. The value of good mentorship is implied - but it is not clear if it is lack of mentoring or if the real problem is a structural problem of the residencies that limit the ability to concomitantly pursue scientific activities. That link is not clear as to how mentorship will mitigate the structural difficulties once in residency. Further, the introduction can be enhanced if there is some mention why mentorship can be valuable from a theoretical or conceptual framework. What is it about mentorship that will be beneficial. Further, there is no discussion as to why you chose to develop the program in the way you did - why a preceptorship, why a longitudinal, why the content you chose - what evidence is those objectives are the ones needed to help students achieve?

Response: We thank the reviewer for asking these questions about the design of the preceptorship, which led to significant improvements in the manuscript.

Value of Mentorship:

Medical residency and fellowship programs, which are focused on patient care, do limit the time available for conducting research. Furthermore, the challenge of balancing clinical work and research time persists for faculty and attending physicians. To explain how the preceptorship can help overcome these barriers, we added the following to our introduction:

“While there are inherent structural barriers to conducting research while working as a clinician, one of the primary goals of the preceptorship described here is to prepare trainees to understand this challenge and then to overcome it. One of the central means by which this can occur is by pairing trainees with senior mentors that have in practice devised strategies to balance research and clinical work. Mentor-mentee relationships established by the preceptorship can help guide junior trainees, and eventually junior faculty, through these structural challenges by relaying the experiences of senior faculty. Indeed, strong mentorship has been shown to help guide physician-scientist trainees through the above challenges [references in main text]”…

Longitudinal Preceptorship [added to Methods section]:

“This preceptorship can be characterized as longitudinal because research and clinical activities are integrated over the six weeks of the preceptorship, and these six weeks are preceded and followed by months of mentor-trainee interactions while developing the research project proposal and, in many cases, writing a meeting abstract or peer-reviewed manuscript. The
longitudinal preceptorship format for this clerkship was selected because one of our primary aims was to enable trainees to build strong relationships with a mentor, and longitudinal preceptorships have been shown to enhance such relationships [references in main text].”

Selection of course components [added to Methods section]:

“These course components were selected after discussing barriers to conducting translational research and common gaps in knowledge of how to conduct clinical research with our MD/PhD program directors, MD/PhD program graduates, leaders within the medical school education policy committee, and leaders within our Institute for Clinical and Translational Research. The importance of strong mentorship was emphasized and supported unanimously by these parties.”

What is your hypothesis - what did you expect this program to achieve? (that would guide your assessment).

Response: We thank the reviewer for this question and added the following stated hypothesis to our Methods section:

“We hypothesized that the preceptorship would increase self-perceived competency in conducting clinical or translational research.”

By providing an early foundation in conducting translational research and related activities, such as working with clinical research regulators (e.g., IRBs), we aimed to enable our trainees to more readily conduct translational research during medical residency and beyond.

Methods - beyond setting - what are the actual numbers of students total and by academic year who took the program and actual number of preceptors total and by year. You suggest that no all MD/PhD students took this program - so How did those who did differ from those who did not?

Response: As stated in the Results section of the text, “During its first five years (2014–2018), 38 MD/PhD students and 36 faculty mentors participated in the preceptorship.”

We also added the following table, and the following two paragraphs, to the manuscript. We thank the reviewer for all of the above feedback, which led to multiple improvements in the manuscript.

Table 3. Preceptorship participants by academic year

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Eligible students</th>
<th>Preceptorship trainees</th>
<th>Trainee survey responses*</th>
<th>Mentors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013–2014</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>
*One survey respondent did not indicate the preceptorship year and thus is not counted in this column.

“At least 80% of eligible students participated in the preceptorship each year (Table 3).” …
“During the first academic year in which the preceptorship was offered (2013–2014), four students had already earned the available academic credits through another clerkship, so they were ineligible to participate in the preceptorship. In subsequent years, all fourth-year medical students in the MD/PhD program were considered eligible students.”

“We did not send surveys to the students that decided against participating in the preceptorship, primarily because we knew from previous informal discussions that some of these students opted out of the preceptorship due to personal or family hardships, and we did not want our survey to induce emotional distress for these individuals. One or two students opted out of the preceptorship in four of the five years evaluated (Table 3). The six students that opted out of the preceptorship subsequently entered a range of residency programs, including radiology, surgery, pediatrics, and family medicine, so no obvious enrichment for specialty choice was observed among these students.”

Measures - what did the surveys look like - how many questions, how were they developed and by whom? why chose those items in that way? More details on who it was set to - you said 38 who completed survey - but how many were existing students, how many alumni and from which year? Same with the 51 students who have not completed preceptorship. (How can those who have not completed preceptorship talk about the program?) Data Analysis - was mann-whitney the only analysis done?

Response: Screen shots of the full surveys are included in the manuscript as Supplemental Figures 1–3. In the revised manuscript, we moved each of these figures to a separate page so that they are more readily apparent.

The following two paragraphs were added to the Methods section of the manuscript. We thank the reviewer for helping us to improve this section of the manuscript.

“The survey questions were developed by the authors, which include the MD/PhD program architects of the preceptorship, MD/PhD program trainees, the preceptorship directors, and a member of the Institute for Clinical and Translational Research with experience in survey design.
The specific questions were designed to assess changes in self-perceived competency in each of the specified preceptorship objectives (Table 1). A combination of questions with Likert-type responses and questions with free text open response options were included to enable both quantitative analysis and open-ended feedback on the preceptorship.

“The survey of preceptorship trainees included 17 questions, two of which were free text response (Supplemental Figure 1). The survey of preceptorship mentors included 11 questions, two of which were free text response (Supplemental Figure 2). The survey of MD/PhD students that had not yet completed the preceptorship, but had selected a doctoral thesis advisor, included three questions (Supplemental Figure 3). All three surveys were kept as brief as possible in order to decrease the time burden, especially for recent MD/PhD program graduates in their first or second years of residency.”

We also updated the description of who the survey was sent to. Please note that this includes a reference to our new Table 3 (above).

“Separate surveys (Supplemental Figures 1–3) were sent to all students and alumni that completed the clerkship (n = 38), all students in the University of Wisconsin MD/PhD program that had not yet completed the clerkship (n = 51) but had already selected a PhD thesis mentor, and all mentors for the clerkship (n = 36) (Table 3).”

We also expanded our discussion of the statistical analysis that we performed:

“In our statistical analyses, we used a non-parametric test, the Mann-Whitney test, because of the ordinal nature of the data derived from the Likert-type survey, and to avoid potentially improper assumptions about the distribution of the data. Mann-Whitney test values were determined by exact permutation (two-tailed) [reference in main text].”

Program itself - How did you come up with these topics- did you, for example interview those who were successful in and found that having a mentor who addressed these issues helped? Did you interview those who struggled to progress with their research to identify what they wished they knew or the barriers they encountered (i.e., lack of mentor)?

Response: We thank the reviewer for requesting these details, which we added to the manuscript Methods section as shown here:

“These course components were selected after discussing barriers to conducting translational research and common gaps in knowledge of how to conduct clinical research with our MD/PhD program directors, MD/PhD program graduates, leaders within the medical school education policy committee, and leaders within our Institute for Clinical and Translational Research. The importance of strong mentorship was emphasized and supported unanimously by these parties.”
Selection of mentors and projects proposals - here you talk about creating a project that helps align students career interest and goals. This seems like creating an individualized learning plan - it would be good to talk in the introduction about the value of those (if there is literature about it) as it seems less to be about a mentoring relationship as much as a program/process to help students create this learning plan and experience the types of activities they might while in residency to try to balance.

Response: We thank the reviewer for this comment. Recently, individualized learning plans have been implemented within the biomedical research field to help students identify useful skills for their future careers and implement strategies for obtaining these skills. We agree that while mentoring plays a significant role, gaining skills that are unique to a specific individual and his or her future career is part of why this course is successful. We have added discussion to the Methods section around this topic, as shown here:

“Many of the skills needed to balance research and clinical work may also be specialty-specific and even unique to a given individual, thus requiring an individualized training plan. The importance of such individualized education was recently emphasized by funding agencies requiring individualized development plans (IDPs) for trainees [references in main text]. The use of IDPs has promoted learning within the medical field and has enhanced the skills necessary for career success [references in main text]. Thus, we incorporated an individualized training program element into the preceptorship described here.”

Results - of those who responded (29 out of 38) - are they representative of whole group? Any differences? - Here you say 39 out of 61 students completed; but on pg 9 you say it was 51 who had not yet completed? Which is it?

Response: We thank the reviewer for catching this typo, which was corrected to “51” in the revised text.

pg 9 line 226 - you state "across all MD/PhD program students surveyed, 87% of respondents..." I think you mean Across all MD/PhD program students who responded, 87% reported....Is that similar to the entire population? (I'm asking these questions to get at an assessment of how generalizable your results would be to your population of MD/PhD students - are they similar/different?

Response: We thank the reviewer for this comment and have updated the manuscript as suggested to clarify its meaning. We revised and expanded the description of these results as shown here:

“Importantly, across 67 previous and current MD/PhD program students that responded to the survey question about their doctoral research classification, 58 (87%) reported conducting primarily basic science research during their PhD training, reinforcing the need for clinical and
translational research training met by this preceptorship. Given the response rate of 67 (75%) out of the 89 MD/PhD program trainees and graduates eligible to answer this question, we can conclude that the majority of MD/PhD trainees in our program conduct basic science research for their doctoral thesis work. The theoretical minimum that conduct basic science research is 65%, which would only be true if all of the survey non-responders conducted clinical research. The true percentage of MD/PhD trainees that conduct basic science doctoral thesis research is more likely to be closer to the observed 87% in our sample of the population.”

Overall, we believe that the students who responded are similar to our entire population of MD/PhD students. For example, we assume that most of the respondents who answered that their PhD work was more clinical (13%) participated in graduate training programs such as Epidemiology or Population Health Sciences based on their thesis projects, while the students who answered they participated in more basic science (87%) largely were in graduate programs such as Biochemistry, Cellular & Molecular Biology, and Neuroscience. With an average cohort of 10 students, we would expect based on our respondents’ answers, that this would correlate to approximately one student per year participating in a program such as Epidemiology, which is what we see in both current and alumni cohorts. We did not collect any identifying data on our survey so it is otherwise difficult for us to compare those who answered our survey to those who did not.

Pg10 line 240 - you imply that the preceptorship "significantly increased competency" - you can't say that as you didn't measure competency. You can say that the students self-reported they felt their competency increased.

Response: We thank the reviewer for this clarification and updated the manuscript to reflect this point:

“Based on student self-assessments, students felt their competency significantly increased in core skills areas including writing a translational research proposal, conducting translational research, analyzing clinical research data, balancing clinical and research activities, and implementing clinical/translational research into practice (Figure 1).”

Because the program was run over several years - did you make any changes from year to year, thus limiting the ability to combine results - maybe the results should be done by cohort - especially if you made changes over time. Maybe time makes a difference in their perspectives as well to be discussed in your sub-group analysis. (I didn't see supplemental figure 4 in the material I had).

Response: We did not make any significant changes to the preceptorship from year to year. Since the inception of the preceptorship, all components have remained the same, including the requirements for the research proposal, conduction of research, research regulatory meetings, research report, and oral presentation. One minor change was made to the syllabus, and that was
adding more explicit instruction around the community-based interviews. Thus, we believe that we can combine the results from all cohorts.

We apologize that Supplemental Figure 4 was not readily apparent. In the revised text, we separated all of the figures and tables so that they are located on their own individual pages. Supplemental Figure 4 includes a time-based analysis where we separated our cohorts into whether they recently completed the preceptorship (<2 years ago) or whether they completed the preceptorship >2 years ago. On the self-competency assessment, the only difference between cohorts was students who took the preceptorship >2 years ago felt that they were more competent in conducting clinical/translational research before taking the preceptorship compared to students who more recently have completed the course (p=0.008). The underlying reason for this slight difference is unclear based on our data. On all other measures such as balancing clinical and research activities, writing proposals, understanding regulatory components of clinical research, analyzing data, presenting data, and implementing research into clinical practice, there was no significant difference between the cohorts.

Student productivity - is there any evidence that this additional productivity (which MD/PhD students should have ample from their PhD) helped in their career plans. You also mentioned "some" had already published - how many? Isn't that an expectation of a PhD - shouldn't they all have had at least one publication to get their PhD?

Response: We apologize that our wording was unclear in the previous manuscript. It is a requirement of our program that students have at least one-first author publication prior to graduation, and in fact, most students perform well above this standard. On average a student leaving the University of Wisconsin MD/PhD program has 5.5 publications from their graduate work. Our referring to “publishing” in this manuscript was meant to refer only to publications from preceptorship projects, not from a student’s graduate (PhD) work. We have updated the manuscript to clarify this point:

“Based on the survey results, at least 11 peer-reviewed manuscripts based on preceptorship projects, which are distinct from the trainees’ doctoral thesis projects, were produced by the 38 students that participated in the clerkship. Some of these preceptorship-based manuscripts have already been published [references in main text], while others remain under peer-review.”

There is evidence that ongoing research, particularly in graduate medical education, does help MD/PhD students get full-time faculty positions (Andriole and Jeffe, 2016). Additional evidence suggests that increased publication during one’s training predicts publication success during one’s early independent career. Further, the ability to synthesize knowledge and skills from multiple mentors has been associated with successful academic careers. Thus we believe that by encouraging ongoing research during the last years of medical education with this preceptorship, students are not only potentially increasing their publication number but also learning skills that are critical for future success as a physician-scientist. We have added a paragraph in the discussion on this important topic.
“An additional benefit of the preceptorship is that by participating in a new research project distinct from doctoral thesis work, students expand their research network and learn how to apply previously gained skills in a new context. Recent evidence suggests that trainees are more likely to be successful in academic research if they synthesize knowledge from multiple mentors [references in main text]. The scientific productivity of the preceptorship, as demonstrated by peer-reviewed publications, abstracts, and grant submissions, suggests that trainees are gaining meaningful exposure in biomedical research fields distinct from their doctoral research. In many cases, when compared to the trainee’s doctoral research, this preceptorship research project is by design more directly related to the trainee’s future clinical specialty.”

Mitra Amini (Reviewer 2):

Good article. The figure number 1 can be deleted and can be mentioned in the text.

Response: We thank the reviewer for the positive assessment. As suggested, we removed Figure 1 and updated the remaining figure numbers accordingly.

Gerald Wickham (Reviewer 3):

This retrospective dive into your MTSP cohorts is a positive step in better understanding clinical-translational curriculum/learning experiences, and is a valuable contribution to the medical education literature. Only one point of feedback -- if there are open-ended narrative statements from postgraduates in your survey I would encourage you to select a balance of these for inclusion in the publication. Otherwise, thank-you for this important work.

Response: We thank the reviewer for this positive assessment and evaluation of our work. As suggested, we added additional open-ended narrative statements from the preceptorship participants, including post-graduate trainee participants:

“I gained some unique insight into how difficult it is to balance your clinical duties with research, especially in a surgery subspecialty.”

“I learned that there are numerous opportunities to do clinical research in our day to day practice and that the challenge is organizing and implementing these endeavors intelligently despite our busy clinical workload.”

“I found familiarization with the IRB process to be the most valuable part. The research was fun, the clinic was fun, the mentorship was good for networking/career building, but the area that most practically contributed to my understanding of clinical research was appreciating the review process.”