Author's response to reviews

Title: A study to investigate the effectiveness of SimMan as an adjunct in teaching preclinical skills to medical students

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Author's response to reviews: see over
To,

The Editorial board

BMC Medical education

I have attached point by point response to the reviewers’ comments and made appropriate changes in the manuscript (page numbers and line numbers are attached for reference).

Reviewer 1:

This is an interesting study that adds to the literature. The major finding is that SimMan provides the ability for medical students in the early part of the programme to learn about abnormal clinical examination findings. As the authors state this is an “adjunct to peer examination” and is not a replacement for learning clinical examination skills on peers.

The crossover design is a real strength of the study.

My main concern is that the methods do not provide adequate detail. Table 2 and 3 require attention as outlined below. In my view, addressing the following issues could strengthen the paper.

**Major Compulsory Revisions**

**Methods**

What was the total number of students (n) who were invited to participate? Did all participate, if not why not?

As it was not a compulsory session, seventy nine students of the total 104 invited year 1 students voluntarily participated in the study.

Page 3 Last paragraph:

“One hundred and four first year medical students at Durham University were invited to participate in the study. Seventy nine students volunteered and were included in the study.”

Please provide knowledge questions and confidence questions and tutors scoring sheet.

Questionnaire with knowledge and confidence questions provided.

Tutors scoring sheet provided

What knowledge improved? This may need to be reflected in the discussion.

This aspect has been addressed in the 1st paragraph of discussion, Page 10 and 11.

Describe how performance was assessed? Was this part of a summative assessment?

Page 4, Last paragraph, 13-15 lines

“The tutors scored students’ performance formatively using a scoring scheme (with the maximum score of twenty) similar to the one used to assess them during the formal summative clinical examinations.”

No, this was not part of a summative assessment instead it was used as formative assessment to provide feedback to students.
How was thematic analysis undertaken? Who undertook the analysis?
Page 5, 1st paragraph, 6-10 lines
“From the free text comments, codes were identified which were subsequently grouped
into categories. Themes were then identified which were relevant to the questions. Two
authors (MSw and MS) independently coded the data and any differences were then
discussed to reach an agreement.”

Results
Paragraph 1 Please explain this sentence: “The knowledge test scores increased
significantly between the two groups for the post-test.” My reading of the data is
that there was a significant difference from baseline in both groups, but no
difference between the two groups at post-test. This is articulated in the next
sentence “This suggests that their knowledge had improved equally after both
groups had performed examination on SimMan (independent t-test, t = 0.109, P = 0.913)”
Yes, there was a significant difference from baseline in both groups after SimMan, but
no difference between the two groups at post-test. I have added ‘did not differ
significantly’ in the text (Page 5, last paragraph, 7th line).

Table 1
Table 1 could be included in the text.
Table 1 is included in the text, Page 4.

Table 2
Table 2 contains a “*” but with no reference to what the “*” refers to -
presumably a p value.
The difference between midtest and post-test group A is reported as significant
in the text (paragraph 2 results) but is not reflected in the table.
Added in Page 15 (Table 2 is changed to Table 3)
Note: * denotes p< 0.05 between Group A and B for the midtest
† denotes p<0.05 between Group A midtest and Group A post-test

Table 3
Table 3 should reflect the difference between the peer and SimMan performance
as described in the text.
Page 15, Table 4(previously Table 3) is changed and reflects the difference between
peer and SimMan

Table 4
Table 4 label is too vague.
Page 15, Table 5 (previously Table 4) - Label changed to ‘Evaluation results of students’
feedback questionnaire’

Discussion
This may need to be altered to reflect the additional information requested
above.
Reviewer 2:

Reviewer's report
Title: A study to investigate the effectiveness of SimMan as an adjunct in teaching preclinical skills to medical students
Version: 2
Date: 4 April 2014
Reviewer: David Cumin

Reviewer's report:
This work attempts to add to the literature on the utility of simulation in undergraduate simulation. The study is well designed and there are a range of measures used which is important for thorough evaluation. The work shows that the use of a simulator with the capabilities of providing heart and lung sounds was useful in increasing student knowledge of and confidence in differentiating between normal and abnormal cardiorespiratory signs. However, tutor-scored performance improved with examination of peers, rather than the manikin. Together with student feedback about the different methods, the authors conclude that simulation is a useful adjunct to more traditional pedagogic methods.

Major compulsory Revisions
The major criticism of this study is that it is an almost identical study with almost identical results was published by the same group in BMC Medical Education in 2013 (doi:10.1186/1472-6920-13-20). Other than a different, and larger, cohort of students, the addition of tutor-assessment and student free-text feedback are the only contributions. While the previous study was framed as a pilot, the results were convincing and this paper adds little to them. The authors reference their previous study in the introduction to argue that students evaluate the use of a manikin in developing preclinical skills as positive. There is no other reference to the original work.

The previous published work was conducted by the first author of the present study at Newcastle University as a pilot on 24 graduate entry medical students (graduates/healthcare medical students) in the MBBS Accelerated Programme (4 years). The present study was conducted at Durham University on students in the Medicine Programme (Standard 5 years Programme). The cohort includes school leavers (undergraduates) with only a few graduates. This study was conducted in their first year (Phase 1/preclinical years include 1st and 2nd year) as opposed to the previous study which was at the end of their preclinical/Phase 1 year. Also the study has included larger number of students and taught by a different University staff. We wanted to know how effective SimMan® would be as an adjunct for teaching clinical skills to undergraduate students, (who are mostly school leavers) as early as their first year in contrast to graduate entry students just before they move to clinical phase (Phase2). The focus of the discussion in the previous study was whether SimMan® is an useful adjunct to teach clinical skills to preclinical students whereas
the present study adds further as to why the students felt that it was an useful adjunct.

The differences in results of the two studies has been included in discussion –
a. page 10, Discussion- 1st paragraph, 6-10 lines.
“Our findings are similar to other studies that have reported improvement in preclinical medical students’ knowledge and confidence after simulation [12, 13]. We found significant increase in students’ knowledge after examining the manikin in both groups whereas in the study conducted by Swamy et al [13], there was a similar non-significant trend in the group using peer examination initially.”
b. Page 11, 2nd paragraph, 7-11 lines.
“In the study by Swamy et al [13], it was found that graduate entry students when performed on the manikin scored higher/ the same when compared to peer examination. This could be because they were mature students and the drawbacks felt by the students of using the manikin were not as much of a hindrance as for the school leavers.”

The previous paper is referenced in Introduction, Methods and Discussion.

There are also many details in this study that are missing in the manuscript that make rigorous interpretation of the data impossible:
1) Details around the intervention itself are missing. For example, it would be useful to know:
a. Did each student have an opportunity to examine a peer and the manikin? Yes, each student had an opportunity to examine their peer and the manikin.

Methods section Page 4, last 2 lines:
“Thus all students performed examination both on their peers as well as on the manikin.”

b. How were abnormal findings presented to the peer group, if at all (i.e. how could they have been expected to correctly answer the questions)?

During teaching sessions, students were taught the necessary information which is required to perform chest examination, prior to the study. Thus it is expected that they recall, integrate and apply the relevant knowledge while performing clinical skills and hence correctly answer the questions.

It is assumed that they have learnt the generic skill of examination and are able to apply it on patients when they move onto Phase 2 medicine rotations. But as mentioned in the discussion, 1st paragraph, Page 10, lines 11-19:
“When students’ perform examination on each other, they become familiar with normal examination findings but they are aware that they are examining a healthy person. SimMan®, on the other hand provides students with the variability of having both normal and abnormal clinical signs which is what they are likely to encounter in clinical practice and during examinations help students to actually look for signs rather than just comment that they were either present or absent. The manikin provides them with the opportunity to apply and thus reinforces normal findings; and focus towards picking abnormalities/ any deviation from normal”.
As abnormal findings cannot be presented to the peer group, the performance scoring scheme did not include scores for identification of abnormal signs in both the SimMan and peer examination.

c. What were the tutor-student ratios in each group?
The tutor-student ratio was 1:2.

Page 4, Last paragraph, 1-2 lines
“Within each group they were further subdivided into subgroups of 2 students who were facilitated by a tutor.”

d. Were the peer-exams also held in a “clinical environment”? What effect might that have?
Yes, the peer exams were held in an environment similar to SimMan with the exception of the equipment connected to SimMan.

Page 4, 2nd paragraph, 1-4 lines
“Preclinical medical students at Durham University practice clinical skills on each other in a safe and supportive environment, the clinical skills laboratory. Students performed chest examination on each other and examined SimMan in a similar clinical setting in order to create a more realistic environment.”

2) The authors make no mention of the methods for dividing the students into two groups or report any demographics of the two groups that could contribute to differences in learning. It would also be useful to know why this number of students was chosen for the study.
As it was not a compulsory session, seventy nine students of the total 104 invited year 1 students voluntarily participated in the study.

Methods, Page 3 Last paragraph:
“One hundred and four first year medical students at Durham University were invited to participate in the study. Seventy nine students volunteered and were included in the study.”

Page 4, 3rd paragraph, 1-4 lines:
“The students were randomly divided into two groups (A and B). Within each group they were further subdivided into subgroups of 2 students who were facilitated by a tutor. The subgroups were created based on students’ preference of their peers with whom they were comfortable in performing examination.”

Page 5, last paragraph, 1-4 lines
“When the two groups were compared, it was found that the knowledge test scores (Table 2) did not differ significantly between group A (using peer examination initially) and group B (using SimMan initially) for the pretest, (independent t-test, t = 0.602, P = 0.549). Hence the baseline level of knowledge of both groups was considered to be equal.”
3) It would be useful to understand what the “seven knowledge-based questions” were and how that translates into a “maximum score of twelve” and what, if any, evidence is there for using these questions. 
Scoring sheet is provided

4) The confidence questionnaire would also be useful to include – what were the four questions and how was a score calculated from this? Similarly, there are no details of the numbers used to calculate the significant difference.
Questionnaire is provided

Numbers used to calculate the significant difference are included in the results section Page 6.

5) There is limited detail on how the free text evaluation feedback was analysed. How many researchers viewed the text, how were themes generated and verified?
a. It seems that many of the quotes in “Improved clinical contextualisation” and other themes should actually be in “Abnormal signs and external equipment useful”.
Page 5, 1st paragraph 6-10 lines
“From the free text comments, codes were identified which were subsequently grouped into categories. Themes were then identified which were relevant to the questions. Two authors (MSw and MS) independently coded the data and any differences were then discussed to reach an agreement.”
We agree that some of the quotes i.e., “It is useful to examine in a more clinical context, with issues occurring around SimMan and to listen to abnormal sounds” could fit in both the themes. We have included the quote in both themes.

The authors discuss limitations of the manikin used in this study as “Also students cannot perform certain steps of examination [with the mankin]”.
Similarly, the authors state that “SimMan, a simulated patient cannot provide learning experience that is derived from real patients in clinical practice [sic]”.
Please could the authors elaborate on these points in the context of the study.
Page 11, 2nd paragraph 2-4 lines
“Also students cannot perform certain steps of examination. For ex., SimMan cannot turn the head when looking for JVP/ bend the wrist for flapping tremors.”

Page 11, 4th paragraph 2-4 lines
“SimMan, a simulated patient cannot replace learning experience that is derived from real patients in clinical practice. But, providing real patients may not be practical in preclinical years with respect to feasibility, accessibility and availability [13].”

Minor Essential Revisions
1) The second sentence in the abstract conclusions, that “…it helps prepare students for future patient contact.”, is not supported by the data as there is no evaluation of future patient contact. Perhaps the authors meant “Students perceived the incorporation of mannikin-based examinations to prepare them for patient contact.”
Changed in abstract conclusion 3-4 lines
2) The reference for “SimMan can be programmed with a range of clinical examination findings [2].” does not seem to support the statement. I would advise the authors to check all references.

Changed in the references Page 13:


3) This paper focuses on a particular simulation device and would be well served by a discussion of other alternatives, for example Harvey® or .

Page 11, 2nd paragraph, last 3 lines:
“Although SimMan® and other simulators like Harvey’s simulator, ventriculoscope have their own advantages and disadvantages, SimMan® provides a more realistic and holistic experience of examining a patient [13].”

4) This work fails to acknowledge a growing body of literature utilising simulation for undergraduate teaching of clinical skills. Some references that might be of interest:

Included in page 3, 2nd paragraph, 5th line and in the references- page 13

5) The statistical methods should be described, at least in brief form, in the methods rather than referring to the results section.

Included in the methods section, Page 5

6) The results section includes discussion points. Sentences such as “This could be because they were performing examination [sic] on SimMan…” should be moved to the discussion.

Moved from results to discussion
Page 11, 2nd paragraph, 6-7 lines
“because they were examining the manikin for the first time. This may explain why students scored higher during peer examination when compared to examining the manikin.

7) The authors conclude with “Integrated learning by using SimMan... can be exciting and motivating...”. However, there are no data to support this statement.

Changed, Conclusion - Page 12, last 2 lines
“Integrated learning by using SimMan® as an adjunct to peer examination can benefit preclinical medical students’ ability to acquire clinical skills.”

Discretionary Revisions
1) It would be appropriate to acknowledge the trademark of “SimMan” in the paper. Similarly, replacing with “manikin” in many instances would make the paper easier to read.

“SimMan” Is replaced in most instances with “manikin”
2) The authors report “All students … had previously performed examinations on their peers”. It is interesting to note that repeated exposure to presumably similar training, does not improve knowledge of skills.

Included in discussion, 1st paragraph, 4-5 lines, Page 10
“it is interesting to note that repeated exposure to peer examination did not improve students' knowledge”.

3) The flow chart provided is useful but is not referenced in the text. It would be advisable to give the figure a label and reference it as per the tables.

Referenced as Table 2, Page 4 and 5

4) It may be interesting to consider if any particular knowledge questions were most improved when the manikin was used compared with the peer examination?
This aspect was not analysed in the current study

5) The evaluation results could be presented elegantly as a table that could make the paper easier to read.

6) There are also some areas of the manuscript where English could be vastly improved. Some examples are listed below:

- “equipments” in the last sentence of paragraph 3 in the methods section
  Changed to “equipment”

- Remove comma after “which” in the sentence starting “The students then answered…” in paragraph 4 in the methods section
  Removed

- The first sentence of the paragraph below the flow chart “Anonymised data was analysed with specific statistical analysis which is described…” needs to be reworded to at least consider the analyses as plural. As above, the statistical approaches should be outlined in the methods and not in the results.
  Reworded and included “ analyses”

- The free text evaluation results are not “Their responses” but rather the themes as identified through thematic analysis and examples.
  Changed, Page 6, 5th paragraph
  “Their responses to open-ended questions were analysed as follows:”

- The formatting of quotes in the free-text evaluation results is inconsistent.
  Have corrected them

Level of interest: An article of limited interest
Quality of written English: Needs some language corrections before being published
Statistical review: Yes, and I have assessed the statistics in my report.
Declaration of competing interests: I declare that I have no competing interests.
Many Thanks,
Meenakshi Swamy