Author’s response to reviews

Title: Educating on professional habits: Attitudes of medical students towards diverse strategies for promoting influenza vaccination

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Author’s response to reviews: see over
Dear Sir/Madam,

We thank you for considering our article. The reviewers’ comments have undoubtedly improved the work. We also would like to include Dr. Alberto L. García Basteiro as an author, because he has helped not only in data collection but in the review process, adding some suggestions and some important comments. Please find enclosed below the changes that have been made in response to the comments.

We look forward to your response

Yours sincerely,

Guillermo Mena

Reviewer #1

Major limitations:

1. This is a cluster trial in that the interventions are assigned to the class (group) level. However, the authors do not provide a power calculation based upon the cluster design nor is the effect of clustering considered in the analysis. The group assignment was not randomized. The clusters do not appear balanced (78 in the web, 15% with ward experience (noted by authors)).

We consider the distribution by blocks sufficient to make the allocation of the interventions. As no posterior analysis was made to determine the factors associated with each group, but with each individual, and their belonging to the groups was already considered according to the variables, we did not consider including a variable of belonging to the allotted groups in the logistic regression model, as we consider they are represented by another variable of interest (no previous clinical rotations-first and second-block - and clinical rotations -third block.)
Those from the Web group had to move to the computer lab and not everyone accepted. This group was therefore the most affected in this regard, as the number of students was fewer. However, the chi square test showed that the principal variable that presented problems due to the reduction in the number of students in the Web group was "sex", with a lower proportion of females. Fortunately, the bivariate analysis showed no significant relationship between the intent to receive the vaccine and sex. Therefore, we consider this smaller number of subjects as a limitation, but we have also explained that the imbalance in the variable "sex" does not seem to affect the multivariate model and the conclusions of the study.

Limitations:

...We did not design a cluster trial, with the corresponding calculation of sample size. The analytic design, without randomization, produced an imbalance in the number of students included in each group. The difference was greater in the Web group, which was smaller because some students did not agree to attend the computer room for the intervention. The result was a higher proportion of female students in this group. Nevertheless, given that the variable “sex” was not significantly associated with the intention to get vaccinated in the analysis, we do not consider this imbalance as a limiting factor in the regression model...

2. The interventions are not described with sufficient detail. Was the tri-fold brochure just distributed? How was the video presented? The authors should describe how the interventions were actually administered in greater detail in the Methods. Was there any measurement of whether the students were actually exposed to the intervention (read the brochure, went to the web etc)?

In the methods section, we now explain in more detail how the interventions were administered.
Interventions:

1. Tri-fold brochure: Containing educational messages and information on risk groups. The brochure was delivered in the classroom and students were asked to read the contents for 10 minutes.

2. Video: Presenting the information contained in the brochure and a short film featuring hospital HCW. The video, which lasted about 10 minutes, was shown to students in the classroom.

3. Web: Surfing the Web of the 2010/11 influenza campaign, and making use of both the technical information and the games and videos posted on the Web. Students were asked to attend the computer room, where they were provided with a computer and the address of the Web page, which they were asked to navigate for 10 minutes.

4. Reference group: No strategy was applied in this group, who solely completed the questionnaire.

A researcher was present in the classroom during all the interventions to ensure that students paid attention to the intervention and that the questionnaire was completed. The researcher also ensured that students only looked at the designated web page during the 10 minutes allotted.

3. The survey instrument was administered only once after the intervention. The authors attempt to use regression methods to determine whether a strategy was associated with the outcome of “intent to get vaccinated.” Association should not be considered causative without a pre-post measure immediately before and after the exposure.
In this quasi-experimental study, instead of using a pre-post design, we made a comparison with a control group. Therefore, we measured the differences with respect to this group in which no intervention was applied. As explained in the limitations, this design prevents the establishment of a causal relationship, as the reviewer suggests, but we could make an associative relationship. The ideal thing would be to carry out a controlled clinical trial after this exploratory study.

Limitations:

...Lastly, due to the design of this quasi-experimental study and the lack of randomization, we can not make causal inferences. Therefore, the best option would be to conduct a controlled trial after this first approach to the issue.

4. The outcome measure “intent to get vaccinated” may not be the same as actually getting vaccinated.

The reviewer is correct. This is not the same thing and is a limitation of the study. However, as shown by previous reports, intention to vaccinate is an acceptable proxy for cases where there is no record, such as the present study. Self-report, for instance, is also widespread and is also a similar proxy measure.

Studies that examine the "intent to get vaccinated" or "self-report" as a proxy in HCW:


Limitations:

...Another limitation was the lack of records with information on whether, during the study season, the student was vaccinated or not after the intervention. While the intention to vaccinate is not the same as actually being vaccinated, this outcome is widely reported as a proxy in the absence of recorded vaccination.17,18,19

5. Analytic plan. The authors have used a stepwise logistic regression model. Many epidemiologists would discourage such an approach for model building. The authors do not provide a description of the model performance (goodness of fit- R squared, Hosmer and Lameshow, c statistic) as recommended for the reporting of logistic models. Were any of the variables such as having previous vaccination tested for multicollinearity with predictors such as “recommend vaccination” since model building assumes independent predictors?

We understand that the stepwise logistic regression model is as valid today as any other method of logistic regression. In methods and results we now explain how the model was constructed and the tests to analyse goodness of fit of the model.

Methods:

Predictive variables with some association with vaccination (p < 0.05) were tested in multivariate models using forward and backward stepwise multivariable logistic regression and the likelihood ratio method. The probability of a type I error in the final models was established as 0.05 (two-tailed). Goodness of fit for the logistic-regression models was examined using the Hosmer-Lemeshow goodness-of-fit test.

Results:
...The Nagelkerke R Square was 0.364; the Cox and Snell R Square, 0.250; and the Hosmer-Lemeshow goodness-of-fit statistic presented a chi-square of 0.820 (degree of freedom = 7, p = 0.800), suggesting that the model was a good fit for the data.

6. Limitations- the authors state that the major limitation is that the Web contained fewer students. One cannot draw valid conclusions about the effectiveness of any of the strategies in modifying influenza vaccination in the target population. A before-after design, demonstrating that the student was exposed to the intervention and including as an outcome measure the proportion actually receiving the vaccine would be required to indicate that any intervention strategy modified behavior.

In this quasi-experimental study, instead of using a pre-post design, we made a comparison with a control group. Therefore, we measured the differences with respect to this group in which no intervention was applied. As explained in the limitations, this design prevents the establishment of a causal relationship, as the reviewer suggests, but we could make an associative relationship. The ideal thing would be to carry out a controlled clinical trial after this exploratory study.

Limitations:

...Lastly, due to the design of this quasi-experimental study and the lack of randomization, we can not make causal inferences. Therefore, the best option would be to conduct a controlled trial after this first approach to the issue.

We now explain (point 4 above), the limitations of the outcome variable “intent to get vaccinated”.

7. *Previously vaccinated students would best be excluded from a study that tests the effects of an educational intervention on planned or completed influenza vaccination.*

We believe that we have expressed this badly. The variable "Previously vaccinated students" refers to having received the influenza vaccination in any of the three previous seasons, not the study season (2010/11). We have now changed the name of the variable to: *Vaccinated in previous seasons.*

8. *The conclusion that “offline strategies may not be as effective” or that any specific strategy is more effective should be framed within the limitations of this study.*

The reviewer is correct. Due to the limitations in the study design, no such conclusion can be drawn. This conclusion has been deleted. We now state:

...*The introduction of online interactive promotional campaigns, such as creating a thematic Web for the promotion of vaccination among HCW, could achieve better results in students in terms of intention to get vaccinated than other more-conventional strategies, such as the preparation of brochures or video presentations.*

**Other limitations:**

9. *Non-response bias. The authors could describe the nonparticipants characteristics if known, group assignment etc.*

The reviewer is correct. Another potential limitation is the lack of information about the characteristics of students who did not participate in the study. This limits the generalizability of the findings, but will be useful when designing future studies.
We include it as a limitation:

...The third limitation was the lack of information on the characteristics of students who did not participate in the study. This limits the generalizability of the findings.

8. Please clarify P.6 the response to the question “hospital counts on them for vaccination promotion” conclude “no significant difference to this question p=0.008 comparing quite a lot or a lot to the other options- Please comment.

The variables “hospital counts on them for vaccination promotion” and “Would recommend vaccination to other students” were collected in a different manner (using a Likert scale), so their inclusion may cause more confusion than their exclusion. We have now deleted both variables from the study.

9. Table 1-include proportion by group who had prior vaccination.

Again, we have expressed these factors badly. "Respondents" refers to students who responded to the questionnaire. "Previously vaccinated students" refers to receiving influenza vaccination in any of the three previous seasons, not the study season.

None of the students had received influenza vaccination in the study season, since the vaccine had not been distributed for administration by early October 2010.

Specific review comments for BMC Education

There is no sample size based upon an estimated effect of the intervention strategy in a cluster trial. The instrument was only administered post intervention. This is a major concern when one tries to draw conclusions about the effect of an educational intervention on attitudes or behavior (planning on getting the vaccination).
In this quasi-experimental study, instead of using a pre-post design, we made a comparison with a control group. Therefore, we measured the differences with respect to this group in which no intervention was applied. As explained in the limitations, this design prevents the establishment of a causal relationship, as the reviewer suggests, but we could make an associative relationship. The ideal thing would be to carry out a controlled clinical trial after this exploratory study.

Limitations:

...Lastly, due to the design of this quasi-experimental study and the lack of randomization, we can not make causal inferences. Therefore, the best option would be to conduct a controlled trial after this first approach to the issue.

The conclusions are more definitive than would be appropriate for the study given the major limitations. Presenting this as an exploratory or pilot study would seem more appropriate.

The reviewer is correct. We have modified the presentation of the study. Due to the design of this quasi-experimental study, we can not make causal inferences. Therefore, the best option would be to conduct a controlled trial after this exploratory study.

We now state in the limitations:

...Therefore, the best option would be to conduct a controlled trial after this first approach to the issue.

The references are appropriate regarding medical student influenza vaccination. I believe that the authors could place the vaccination of medical students in the
context of the literature on interventions to improve vaccination in health care workers. One would suspect that if the goal is to achieve a very high rate of vaccination, educational interventions are unlikely to be effective as the sole strategy. The authors could briefly discuss the effect of educational interventions (and other strategies) on vaccination acceptance in other health care workers.

The reviewer is correct. However, we do not want to mix our data with other data on HCW. The reason is that these are different groups, and educational strategies to compare medical students, who are in training, and their predisposition to this type of initiatives, may be different to that of HCW. In addition, this group of students will not necessarily be working in the future in hospitals, where most studies on vaccination strategies have been carried out. Finally, it is unclear that educational strategies in HCW are effective, so including more conflicting information may not be appropriate.
The aim of the research is not well defined. The most important is real vaccination, not intention to be vaccinated. Previously, it has been demonstrated that more students declared intention to be vaccinated against influenza than to do it in practice [6]. Medical staff and medical students know that they must to be vaccinated, but frequently they not do it due to laziness or lack of the time [6].

Aim of the study:

The objective of this study was to evaluate the effect of three vaccination promotion strategies on the intention of medical students to get vaccinated and to analyze associated factors.

The reviewer is correct. This is not the same thing and is a limitation of the study. However, as shown by previous reports, intention to vaccinate is an acceptable proxy for cases where there is no record, such as the present study. Self-report, for instance, is also widespread and is also a similar proxy measure.

Studies that examine the "intent to get vaccinated" or "self-report" as a proxy in HCW:


Limitations:

...Another limitation was the lack of records with information on whether, during the study season, the student was vaccinated or not after the intervention. While the
intention to vaccinate is not the same as actually being vaccinated, this outcome is widely reported as a proxy in the absence of recorded vaccination.\textsuperscript{17,18,19}

2. Examined group consisted of 421 students with control group 128 students. However, many subgroup are few (5-12 students). In these groups conclusions are not reliable. The percentage of students vaccinated is no clearly presented, although it was the most important factor associated with intention to be vaccinated.

Limitations:

We did not design a cluster trial, with the corresponding calculation of sample size. The analytic design, without randomization, produced an imbalance in the number of students included in each group. The difference was greater in the Web group, which was smaller because some students did not agree to attend the computer room for the intervention. The result was a higher proportion of female students in this group. Nevertheless, given that the variable "sex" was not significantly associated with the intention to get vaccinated in the analysis, we do not consider this imbalance as a limiting factor in the regression model.

As for the size of the subgroups, the reviewer refers to the variable "Risk factors in the student." Due to the size of the subgroups and because the variable did not show statistical significance in the bivariate analysis, it was not included in the multivariate analysis. Therefore, no conclusions were based on this variable.

We have badly expressed the so-called “vaccinated students”. "Respondents" in Table 1 refers to students who responded to the questionnaire, and has now been replaced by "number of students". "Previously vaccinated students", in Table 2, refers to having received influenza vaccination in any of the three previous seasons, not the study season. This variable is now named "Vaccinated in previous seasons." None of the
students had received influenza vaccination in the study season, since the vaccine had not been distributed for administration by early October 2010.

3. **Discussion is too narrow thus becoming the major weakness of the work, failing to consider many aspects having impact upon intention to be vaccinated.**

The reviewer is correct. We have extended the discussion, expanding both the reasoning of the results and the section of limitations.

4. **Authors analyse impacts of three intervention types (Web, video, brochure) upon declaration to take vaccination while obviously such declarations are made under various other factors, not discussed in the work.**

The reviewer is correct in referring to conclusions that have been made under the influence of other factors not discussed in the work. Unfortunately, we can not measure everything that could have an influence. This is a limitation which will be included in the discussion section:

...Another limitation was that the intention to get vaccinated may be conditioned by variables other than those included in the study and which could act as confounders.

5. **Some students were vaccinated before interventions; hence they did it under influence of other, undetermined interventions or motivations. As earlier vaccination (experience) constituted the strongest factor associated with intention to be vaccinated, it would be interesting to understand these motivating factors.**

We have badly expressed the so-called “vaccinated students”. "Respondents" in Table 1 refers to students who responded to the questionnaire, and has now been replaced by "number of students". "Previously vaccinated students", in Table 2, refers to having
received influenza vaccination in any of the three previous seasons, not the study season. This variable is now named "Vaccinated in previous seasons."

None of the students had received influenza vaccination in the study season, since the vaccine had not been distributed for administration by early October 2010.

6. What was it that developed this intention?

We had no record of students’ vaccination and do not know if they were finally vaccinated. As explained in point 1, self-report and the intention to vaccinate have been used as outcome variables in previous studies in HCW. However, this point will be mentioned in the limitations section:

...Another limitation was the lack of records with information on whether, during the study season, the student was vaccinated or not after the intervention. While the intention to vaccinate is not the same as actually being vaccinated, this outcome is widely reported as a proxy in the absence of recorded vaccination.\textsuperscript{17,18,19}

7. Discussion is separated from earlier education before interventions. This could suggest why that students participating in clinical study classes may be more ready to take up vaccination. This could have been an effect of specific courses in University – not interventions examined.

We tried to control for this aspect using the design for two-year blocks. As explain in the text, each of the four interventions was conducted in three blocks: in the four classes of the first two courses (pre-clinical), in the four classes of the two intermediate courses and in the four classes of the last two courses (clinical). Therefore, there should be no difference in the education received in the bulk of students assigned to each strategy. In contrast, other experiences that students have
had during their studies could influence their decisions. These factors can not be controlled, and we state this in the limitations.

...Another limitation was that the intention to get vaccinated may be conditioned by variables other than those included in the study and which could act as confounders.

8. **Interventions presented in the work are not unique motivation to declare intention to be vaccinated.**

We suggested the hypothesis that there could be a relationship, using a quasi-experimental study, but given the limitations of the study, we can only present it as an exploratory study of a possible association between the strategies used and the intention of receiving the vaccine.

In limitations:

...Another limitation was that the intention to get vaccinated may be conditioned by variables other than those included in the study and which could act as confounders.

9. **Authors should have highlighted conclusions more clearly. Conclusions boil down to a statement that students prefer websites as information source over video and, specifically, brochures. Research results demonstrated negative impacts of the tri-fold brochure since a lower number of persons declared their intention to take vaccination that in the reference group, and less students declared willingness to educate colleagues. Therefore, preparation of brochures and video presentations for students does not make much sense since, as shown by survey results, it would be only a waste of time and resources. This is an important practical conclusion.**

These recommendations have been given more weight in the discussion.
10. *Methods are well-described, however some details are not presented. Did authors verify the extent to which students became familiar with information provided by brochures, video presentations or websites? Have they been able to absorb knowledge provided by these 3 sources?*

No information was collected on the students' knowledge since, due to the study design, we could not determine how familiar the students were with the materials or what knowledge they extracted.

11. *It is unclear why the authors examined if considered hospitals counted on them for vaccination promotion? This element seems to be unnecessary as it hardly provides any practical information and these results are not discussed.*

The variables “hospital counts on them for vaccination promotion” and “Would recommend vaccination to other students” were collected in a different manner (using a Likert scale), so their inclusion may cause more confusion than their exclusion. We have now deleted both variables from the study.

12. *Moreover, authors failed to describe what risk groups represented examined students (5-8% in each group)?*

The reviewer is correct. We did not indicate which categories we were referring to. We now explain the risk groups in the footnotes to the table.

13. *The work is a part of a broader survey; hence, presentation of only one aspect without considering the entire background constitutes its weakness.*

In reality, this is part of a three-part survey. The first part contains the information presented in this paper, the second concerned various questions about the relationship between social networks and influenza vaccination (1) and the third part consisted of opinions of students on medical and surgical specialties (2).
Therefore, given the nature of the rest of the survey, we do not consider this a limitation of the study.


...This study formed a part of the larger INTENVAC study of medical students and their attitudes to different tools promoting influenza vaccination and the role of social networks.20,21

14. The knowledge about vaccination of the medical staff and the intention of the medical student to be vaccinated before and after intervention were not evaluated. It would be a better determinant of effectiveness of examined interventions. An optimum solution would involve determining the share of vaccinated students before and after each intervention.

In this quasi-experimental study, instead of using a pre-post design, we made a comparison with a control group. Therefore, we measured the differences with respect to this group in which no intervention was applied. As explained in the limitations, this design prevents the establishment of a causal relationship, as the reviewer suggests, but we could make an associative relationship. The ideal thing would be to carry out a controlled clinical trial after this exploratory study.
15. Probably is an error in table 1. Number of female 12 in the group with Web is not 60.3%. The presentation of data in tables in not clear.

The reviewer is correct. There was an error in the presentation of the results. We have also worked to present the results in the tables in a clearer way.

16. I recommended better justification of the results. The clarity of the paper needs to be improved.

We understand the reviewer's concerns. We have worked to better justify the results and make the manuscript clearer, eliminating variables that could lead to confusion, and further developing and justifying the limitations and results.