Reviewer's report

Title: Knowledge, Attitude and Practice of Antibiotics: A Questionnaire Study among 2500 Chinese Students

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Reviewer: Oliver James Dyar

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This is an interesting study of both medical and non-medical students in China. Few studies of this scale have been conducted on the knowledge and attitudes of medical students, and the study design has allowed comparisons of the different year groups of students. Although there are many important revisions to be made prior to publication, the results presented provide key insight into medical education in China, where it is increasingly important that students learn appropriate antibiotic stewardship principles.

Major Compulsory Revisions

1. Abstract conclusion: I think it is not possible to infer that these results 'reflect an inherent weakness in the system of medical curriculum on proper use of antibiotics' when earlier it has been shown that knowledge of antibiotics is higher in medical students.

2. Background: Whilst interesting to read, this should be considerably more focussed: it is only on paragraph three that medical students are introduced. Furthermore, there is no introduction to the pathway medical students take at these universities in their studies; this is important in order to interpret a number of the findings. Do the students have lectures in the first two years and then clinical work in the final three years? When do students typically receive education on antibiotics? When do students start to get practice at prescribing antibiotics? Most of these points can be addressed in the discussion section, but some form of introduction is required here.

3. Materials and methods, background of respondents: the first paragraph needs to be considerably clearer as to how the questionnaire was conducted. 'Face to face interviews' are mentioned but in the results section it is stated that 2470 questionnaires were returned. Were interviews used, and if so, who conducted them? Or was this a paper-based or online questionnaire sent to students to conduct alone? If a mixture of methods were used, this needs to be very clear, and a breakdown of response rates by questionnaire type should be included in the results.

4. Materials and methods, background of respondents: further detail should be included on the selection and randomisation process. There are more medical student respondents than non-medical student respondents, yet only one medical university was included in the study, how did this occur? Were 2500
students randomly selected from all students at all the universities? Or was there some form of proportionate sampling used? Also, were all the medical students from the medical university and all the non-medical students from the other two universities, or was there a mixture of both non-medical and medical students selected from each university?

5. Materials and methods, design and implementation of questionnaire: why were two marks allocated for correct answers? This should be explained. Also, it would be very useful for the supplementary material questionnaire to indicate in each instance which responses were considered ‘right’ or ‘wrong’. Similarly, for responses to part iii) of the survey it states that five choices were provided with different points for different responses; there should be more transparency as to what was considered a correct response, since the results for these answers are a) higher for NS than MS (which as is mentioned is unexpected) and b) a chart is presented rather than a table meaning it is not possible to infer what has been considered a ‘correct response’ here.

6. Materials and methods, statistical analysis: it does not appear that any adjustment has been made here for the large number of statistical tests that has been conducted; as there are at least twenty comparisons throughout the paper, at least one of these results would be expected due to chance if the significance level is set at <0.05.

7. Results, behaviour: It is stated that ‘MS would advocate use of antibiotic almost without exception’ for symptoms of respiratory tract infection, yet this does not appear to agree with table 4, where for each of the subcategories mentioned only 10.9-37.9% would ‘always’ or ‘often’ use antibiotics in these cases.

8. Results, different grades: it is stated that attitude of MS is ‘greatly enhanced’ yet in figure 1b their ‘score’ appears to be 8 for first years and final years, briefly going to 9 for 2nd/3rd/4th years. If the chart is correct, this is quite an overstatement.

9. Discussion, paragraph 2: this is quite hard to follow at points. The studies cited should be directly compared to the results from the present study; currently there is not a comparison made to the studies in the first sentence (in Sweden and the UK). I feel the comparisons with the study in Holland is inappropriate and must be removed: firstly, MS in China are being compared with public in Holland; secondly, a very selective set of results have been compared as being ‘much higher’ which is an overstatement given that there is only a ~10% difference; thirdly, 60% of the respondents in the survey from Holland advocated using antibiotics in acute bronchitis, substantially more than the 29.5% of MS and 13.5% of NS in the present study. More generally, if comparisons are to be made, there should be an attempt at interpreting why such differences exist between countries. I do not understand the two sentences starting ‘On treatment of common cold, 19.15% of MS resolved to…’; this needs re-writing.

10. Discussion, paragraph 2: it is stated that ‘the most remarkable finding was that many MS attributed antibiotics abuses to prevailing view in the society that antibiotics can speed up recover of various illnesses’; firstly, I do not think this is the most remarkable finding of the study; secondly, there was only a 10%
difference between MS and NS for this question; thirdly, the results of this question in the survey (question 28) may be quite hard to interpret as any important real difference, since respondents could include between one and four answers. It may be more sensible to present the responses to this question in a chart format in the results section to allow easier comparison of the results, which are currently only very briefly mentioned in the text of the results section.

Minor Essential Revisions
1. Abstract background section: the use of ‘is always focussed…’ is too strong; there are other instances in the text where absolute terms are used inappropriately. It would be better to use a word such as ‘typically’ or ‘normally’ or ‘usually’.
2. Materials and methods, background of respondents: this section also needs to include a statement about whether participation was voluntary (assume so) and whether any incentives were provided.
3. Materials and methods, design and implementation of questionnaire: was the questionnaire in Chinese or English?
4. Materials and methods, design and implementation of questionnaire/results concerning students’ knowledge of antibiotics: table 2 shows six questions, whereas the methods state that eleven questions were used here. Were all eleven questions used to generate the overall comparisons between MS and NS (the first sentence in this results section) or just the six in the table? Just needs a brief clarification, along the lines of ‘when comparing the results of all eleven questions concerning…’.
5. Response rate: this is currently stated as 84.5%, which is the proportion of returned questionnaires that were ‘considered valid for analysis’. The true response rate should be stated as 83.5%, which is the proportion of valid questionnaires divided by the total number of questionnaires sent out (i.e. 2088/2500). The response rate is really quite high for such a survey; it may be worth mentioning this as a particular strength of the study in the discussion.
6. Discussion, paragraph 1: it is stated that ‘NS are better behaved in use of antibiotics’. This phrasing really only applies to some of the questions posed in the survey, i.e. where NS would individually have responsibility for decisions (when to stop antibiotics, what do you follow when you use antibiotics); the questions concerning personal use of antibiotics with bronchitis/cough with fever etc. may not be directly related to the students’ behaviour, but rather the behaviour of their doctors. It is important to clarify this.
7. Discussion, paragraph 2, concerning the questions posed on education and establishing a course on ‘rational use of antibiotics’: the English translation may need to be amended for these questions in the table and questionnaire, perhaps substituting the word ‘education’ for ‘information’. Similarly, the ‘need to establish a course…’ is presumably specifically within medical schools, so consider prefacing the question with ‘within medical schools there is a need to…’ or similar.
8. Discussion, final paragraph: this should be more specific as to the limitations of the study (geographic region, possibly how the survey was administered [could/would students look up correct answers online]), and its strengths (large size, randomized, comparisons between year groups and MS vs. NS), and subsequently an interpretation as to where the results might be more generalizable to – is it likely that similar results would be found in other regions of China? Do these findings therefore suggest a need for antibiotic stewardship education programmes throughout Chinese medical school curricula? The final two sentences are also a little confusing at the moment, it is unclear what ‘loophole’ in a medical school curriculum actually means.

9. Conclusions: it is stated that a correlation analysis showed students’ antibiotic knowledge was related to attitude and awareness; I cannot recall reading this in the results section at all.

10. Conclusions: ‘this was somewhat puzzling’ needs clarification and interpretation, in the discussion section rather than the conclusions section.

11. Discussion and conclusions: these should be greatly shortened overall, in particular the conclusions section. The conclusions should summarise the results rather than provide further references for the importance of public education etc. The final sentence goes considerably beyond the results of the present study, and whilst it may be correct, it is perhaps inappropriate to state this as a conclusion to the results found in this study.

12. References: some references are incorrectly formatted, for instance missing a year of publication.

13. Table 2: Is the data on the question ‘have you heard of antibiotics resistance’ incorrectly presented for final year students (10.8 [final] vs. 89.7 [first])? I suspect this is probably meant to be 100 - 10.8 = 89.2.

14. Table 4: question 30 in the questionnaire is asked as ‘Have doctors prescribed you antibiotics when you catch a cold’, whereas it is included in the table as ‘Asked doctors to prescribe antibiotics when you catch a common cold’; these are completely different questions, the former is not a behaviour/practice of the students but rather of the doctor, whereas the latter is a behaviour/practice of the students. Also it appears that the question ‘are antibiotics obtainable without prescription...’ is considered to be ‘wrong’ in terms of behaviour when answered ‘yes’; however this may have been interpreted as a general rather than individual question (i.e. not whether the individual gets antibiotics, but rather whether they are accessible in general). If the question were instead ‘should antibiotics...’ this would be different.

15. Figure 1: The description of the table should include a mention of whether a high score is ‘good’ or ‘bad’. Also if errors marked are true error margins for each year group, then in the results section for ‘comparisons of different grades’ the comparisons should be presented as trends, as it looks highly unlikely that there are any statistical differences.

Discretionary revisions
1. Materials and methods, design and implementation of questionnaire: it is stated that the questionnaire is subdivided into four categories; it may be helpful in the supplementary material to indicate these four categories as different sub-sections.

2. Results: for non-significant p values, there is no need to include four decimal places, two is sufficient since the significance level is set as <0.05. Similarly, as the number of participants in each group is ~100, two decimal places is overly precise for the percentages. Including one or even no decimal places is sufficient.

3. Table 2: it is an interesting result that 69% [final] vs. 49% [first year] MS think that antibiotics can cure viral infections; since this is a leading cause of antibiotic over-use this result is probably worthy of mention in the text of the results/discussion.

4. Table 4: A number of the questions from the questionnaire are not included in this table, such as antibiotics for pneumonia, allowed to stop antibiotics when complaints lessen; for transparency in terms of interpretation, these results should probably be included.

4. Ethical considerations: It may be worth including a note on any permissions/other considerations necessary for extracting data using students’ numbers at the university – who was permissions sought from, are these ALL students or just students who have their numbers publicly available?

**Level of interest:** An article of importance in its field

**Quality of written English:** Needs some language corrections before being published

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**
I declare that I have no competing interests