Author's response to reviews

Title: The Effect of Performance-Related Pay of Hospital Doctors on Hospital Behaviour: A Case-Study from Shandong, China

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Author's response to reviews: see over

Explanation of revisions according to comments provided by reviewers

Comments from Dr Tang:

1. There is an inconsisence of statements in page 20 and page 12 "a bonus switch from one with a weaker incentive to one with a stronger incentive ws one of the factors explaining the decrease in the visits/admission ratio, but not the decrease in admissions/operation ratio, suggesting...." and "All 6 hospitals showed in a decrease in the admissions/operation ratio".

This inconsistency was caused by a typo, which has been corrected. Thanks a lot for identify this error.

2. The article mentioned that there were three types of bonus systems developed in China: flat bonus, quantity-related bonus, and revenue-related bonus. However, the six hospitals included in the study only applied the first and the last one of the bonus systems. Is there any literature or study looking at the effects of quantity-related bonus system?

This was very unfortunate – there were only non-bonus, flat bonus, and revenue-related bonus in this selected 6 hospitals. In a wider study which covered 127 hospitals with less in-depth analysis, there were all types of the bonus systems. See: X Liu, A Mills: **The influence of bonus payments to doctors on hospital revenue: results of a quasi-experimental study**. *Applied Health Economics and Health Policy* 2003, **2**:91-98.

3. Since there have been changes in quality of services over the study period and also possibly the case mix, it might be problematic to state ".... because the increase in inputs exceeded increase in outputs, most productivity indicators decreased (Table3) with exception of operation per doctor."

We added some text when we report the results. Also the issue of the quality has been fully discussed in the discussion section.

4. The revenue-related bonus system might have encouraged higher admissions and operation rate. However, we should also understand that the use of more high tech and improved skills and knowledge over the past decade have also led to greater admission and operation rates.

This was well taken. This was added as one possible factor to affect productivity in the discussion.

5. The article oughts to be careful in the use of term "containment of government cost" in its conclusions. I understand that the government cost in the article indicates only the government health grants given to

health facilities. The government has also provided a substantial chunk of fund to support social health insurance scheme, which was not well contained.

This was well taken, and made clear that this was the containment of the government costs for public facilities.

Comments from Meng

1) Relationship between the key indicators. Given the assumption in the study that official prices (P) used for charging patients were followed by the hospitals (this assumption should be cautious), the direct question becomes how relationship between changes in bonus systems and changes in quantities (Q) of health care/drugs can be examined. Q centers the performance indicators (Revenue=Q*P; Cost recovery=Q*P/Cost; Productivity (Unidimensional ratio)=Q/number of staff; and unnecessary care=Unnecessary Q*P/Total Q*P). Obviously, those four indicators would have different intensity in relation to Q. While indicators of revenue and unnecessary health care could have more direct relation with Q, the other two could be more influenced by costs and number of staff. For example, rapid expansion of hospital sector in terms of capital investment and staff recruitment during the study period would mask the effect of increase of Q that was stimulated by bonus arrangements. This consideration could be reflected in justifying selection of the indicators in the method section and in explaining findings in the discussion selection.

The reviewer analyzed the indicators used in this paper very well. Hospital expansion related to hospital investment and increase in the number staff was added as a possible factor to influence quantity, revenue and productivity.

2) The method. What are the variables of input and output used in DEA and how they are weighted were not presented in details. Those are important for readers to judge what would be the exact implications of the DEA scores. In the discussion section, justifications for not to adjust quality and case-mix in measuring productivity were presented. However, it seems this should be extended for making the justifications more convincing. For making organization of method and result sections more logic, it is better to move the methods of correlation and regression analyses from the result section to method section.

For revision, the author added a whole sub-section – Data analysis --- to the text. Inputs and outputs in DEA were elaborated. DEA does not need weights in the analysis, which is one of the characteristics to avoid subjective assignment of weights among variables.

3) In the third paragraph on page 14, negative relationship between productivity and unnecessary care was reported. In the second paragraph on page 15, the result shows a positive relation between those two indicators. How can they be explained?

The second paragraph on page 15 talks about two relationships: (1) the relationship between unnecessary care and hospital revenue; (2) the relationship between unnecessary care and cost recovery. The authors are not talking the relationship between unnecessary care and productivity. May be there is some confusion due to wording, thus we changed the text to make it clearer.

4) In discussion section in the second paragraph on 19, what is the measurement of drug market for imported drug, is it value of drugs or types of drugs? If it is monetary value, the percentage of 30-55% for imported drugs should be checked.

The measure of market size is by monetary value of sales. This was added, and the figures checked.

5) Hypotheses presented in the background section are important for predicting the effect of various bonus arrangements on hospitals? behaviors and explaining the results (for example, the first sub-section in the result section). Those hypotheses could be more developed by considering other factors, besides bonus system. The period from 1978 to 1997 in which the study was conducted, has seen many significant changes in hospital sector in relation to changes in the major indictors the study measured. Both hospital financial policy reform as external changes and implementation of General Responsibility Contract Method within hospitals would be among the determinants for hospital behaviors. This means besides bonus, arrangements and pressures from the hospital and department administrative bodies are also crucial, in influencing efforts made by the individual doctors. In addition, intensity of incentives perceived by individual doctors would closely relate to status of wealth of those individuals. When they were less wealthy, say at early stage in 1980s, they might be more sensitive to increase in incomes even though flat bonus was used. Those dimensions could be strengthened in the background section.

There are whole array of factors that may affect the dependent variables which were addressed in this article. However, focus of this paper was to examine the interrelationships among revenue, productivity, unnecessary care, and bonus system. Also other influence from other possible factors were taken as residual because of lack of data, and they are beyond what we could covered. However, these factors were discussed in the discussion section of this paper.

6) In second paragraph on page 18, is it unidimensional ratio productivity or DEA or both?

This is for both unidimensional ration analysis and DEA. Revision was made according to this comment.