Author’s response to reviews

Title: Evaluation of Health Resources Utilization Efficiency in Community Health Centers of Jiangsu Province, China

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Author’s response to reviews:

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Title of Paper: EVALUATION OF HEALTH RESOURCES UTILIZATION EFFICIENCY IN COMMUNITY HEALTH CENTERS OF JIANGSU PROVINCE, CHINA

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Date Sent:
November, 5, 2017

Dear Editor

We are pleased to resubmit for publication the revised version of HRHE-D-17-00105 “Evaluation of Health Resources Utilization Efficiency in Community Health Centers of Jiangsu Province, China” We appreciate the time, efforts and constructive criticisms by the chief editor,
associate editors and reviewers in the manuscript. We have addressed all issues indicated in the review report, and believed that the revised version can meet the journal publication requirements. We will be glad to do further revision if our current effort falls short of the standards of work expected by the journal.

Response to Comments from Reviewer 1

We greatly appreciate the reviewer’s efforts to carefully review the paper and the valuable suggestions offered. We have thoroughly edited the manuscript. We employed the services of a native speaker to help us in this regard. The track changes left in the paper provides testimony of the extensive language editing that has been done.

Comment 1:

Reviewer #1: Page 3, line 9: The expression "pro-poor" should be changed. There are better definitions of policies dedicated to solving inequalities issues or lack of access of disadvantage populations.

Response to Comment

Thank you very much for your comments. As you have suggested we have edited the sentence as follows:

The global effort to eradicate extreme inequity in socioeconomic and health wellbeing of all mankind especially those living on the fringes of society is evident in the numerous social intervention policies that have been rolled out by the United Nations and other international organizations[1]

Comment 2:

Page 3, line 15: The authors should provide additional initiatives or suppress the expression "among others". This expression doesn't help to understand additional actions dedicated to improving quality and access to care.
Response to Comment

We deeply appreciate your comment. Based on your suggestion, we have suppressed some of the inappropriate expressions. The final sentence is as follows:

“These initiatives include the United Nations Millennium Development Goals and the 2011 Rio Summit on the Social Determinants of Health”.

Comment 3:

Page 3, line 15: The text inside parenthesis ("intended to remove the causes of differences in the quality of health and health care across different populations") can be removed. The concept of health inequity is sufficiently discussed in the literature.

Response to Comment

We are grateful for your feedback in this part; We have realigned the sentence as follows:

“In China, eradication of health inequity remains an adventure in transition [2].

Comment 4:

Page 3, line 19: on the other side the explanation about the Healthy China 2020 should be part of the text and not included as a secondary explanation in parenthesis. This phrase must be restructured.

Response to Comment

The theme of the “Healthy China 2020” which is a program launched by the government to provide universal healthcare access and treatment for all in China and reduce health inequities by the year 2020 exemplifies this notion.
Response to Comment

This success was attained because the government’s renewed commitment for better healthcare reform enjoyed strong public support across the China [2]. In this connection, both the central government provided heavy subsidies to support industries involved in producing healthcare products while greater support for enrolment into new social health insurance programs were initiated [2]. The idea to decentralize decision making in healthcare to local governments contributed significantly to pragmatic implementation strategy for health equality.

Comment 6:

Page 3 line 48: This part of the text must be rephrased. There are repeated words: suggest that suggests. "China National Health Equality Survey suggests that suggests that despite overall …..."

However, subsequent audit of post reform performance of China’s healthcare system as shown in the China National Health Equality Survey (2015) suggests that despite overall improvements in the population’s health status, some economic and health policy reforms are inadvertently perpetuating health inequality [5].

Comment 7:

Page 5 line 56: The imbalance pointed out has one or two causes?

A key theme in series of recent studies on China’s healthcare sector [2, 10] attribute persistent imbalance to several factors including the distributive injustice or mismatch between the allocation of health care resources and health services demand in most Chinese communities
Comment 8:

Page 6 line 5: the expression "barefoot doctors" must be changed to explain in scientific terms the lack of medical training to its professionals.

More than 75% of the medical officers working in village clinics are high school graduates with six months of training at a county or community hospitals. These are popularly called ‘barefoot doctors’ because they have received very little medical training for their operations (Wang, 2003). Additionally, only 18.7% of township health workers are educated at medical university compared to 41% in cities (Ministry of Health, 2004).

Comment 9:

Page 6: line 23: how the bed utilization give a good panorama of the health community centers? The health community centers perform admissions? In case of not, these statistics of bed utilization are not well aligned to the matter of the article.

In terms of public health or epidemiological contribution, this study adopts belongs to the stream of outcomes researches. Outcomes research is a branch of public health research, which studies the end results (outcomes) of the structure and processes of the health care system on the health and well-being of patients and populations. Thus the intent of this research is to identify shortfalls in practice and to develop strategies to improve care. Further, the results of outcomes research are used to inform the decisions of legislative bodies that make decisions related to healthcare, as well as of financial bodies (governments, insurers, employers) who seek to minimize cost and waste while ensuring the provision of an acceptable level of care.

Comment 10:

The study didn’t define which is its classification in epidemiological terms: observational or experimental? Descriptive or analytic? In case of being analytic cross-sectional, case control, cohort, ecological? There is insufficient information to presume the study classification considering that it involves a performance analysis through efficiency. The authors should address this point.
Response to Reviewer Comments

Thank you very much for this observation. We have accordingly reworked on the missing section of the paper as follows:

“In terms of public health or epidemiological contribution, this study adopts belongs to the stream of outcomes researches. Outcomes research is a branch of public health research, which studies the end results (outcomes) of the structure and processes of the health care system on the health and well-being of patients and populations. Thus the intent of this research is to identify shortfalls in practice and to develop strategies to improve care. Further, the results of outcomes research are used to inform the decisions of legislative bodies that make decisions related to healthcare, as well as of financial bodies (governments, insurers, employers) who seek to minimize cost and waste while ensuring the provision of an acceptable level of care”.

Comments 11

The variables of the equations should be contextualized to what was considered in the paper as input and outputs. The detailed explanation about DEA was contextualized to describe what the authors performed considering the Chinese data only after of the equation presentation. This presentation can be unified and not duplicated, as in its current form. How were the weights controlled? The orientation of the model to maximize outputs is not easily perceived by someone not familiar with DEA models. The authors should describe the technique considering the need to precisely describe what use was done considering the article data.

Response to Reviewer Comment

We appreciate the suggestion of this very important issue that was omitted in our work. This has been a very invaluable suggestion. Please find the improved work as follows:
Data Collection

There are many CHCs in Jiangsu Province but this study sampled data from 75 CHCs equally distributed in the three zones under review. Two reasons informed the selection of these specific 75 CHCs for the study. Firstly, they are designated as priority CHCs since 2013. For this reason extended support in the form of technology, labour, capital, research and other valuable resources have been invested into them by the Provincial government to ensure high quality and more efficient services. Secondly, the 75 CHCs were chosen because they fall within the research jurisdiction of the Institute of Medical Insurance and Hospital Management (IMIHM) of the Jiangsu University where this study was conducted. Research on other CHCs is conducted by other research centers in the province as part of measures to streamline data collection and research activities among designated organizations by the authorities. Twenty five (25) of the CHCs are in the most economically developed southern zone of Jiangsu Province (Nanjing, Zhenjiang, Suzhou, Wuxi, and Changzhou prefectures). Twenty five (25) of them are also located in Yangzhou, Taizhou, Nantong with relative economic development. These prefectures are located in the middle zone of the Jiangsu Province. Finally, the remaining 25 CHCs were sampled from Xuzhou, Lianyungang, Suqian, Huaian, Yancheng in the Northern zone of the Jiangsu province and are less economically active areas. The same number of CHCs was selected to provide a fair basis to make comparison of results. The Census and Statistics Department which keeps validated and administrative data for the Jiangsu province provided the data [12].

Selection of Input and Output Variables for DEA Analysis

The study used an input and output form of DEA however, the efficiency of a DMU or CHC is not dependent on the absolute value of the input variable but the outcome of the model. The guidelines for variable selection in a DEA analysis by [13] was used to select 14 initial human resources, materials, financial and service variables. This requires the selected variables to reflect input and output situation of community, representativeness sample, elimination of multicolinearity among variables, consistent sample size-evaluation units ratio etc). The fourteen input variable initially selected for regression were number of centers, number of beds, number of health workers, number of general standardized training practitioners, financial investment, the cost per visit, proportion of CHC within an area of 3,000m2 and proportion of residents under grid management in communities CHC. The initial output variables selected included the number of discharged patients, cure rate, bed occupancy rate, average inpatient days, the daily number of outpatient and emergency visits of doctor, the daily number of inpatient stays of doctor. The variable selection was done after searching related materials and consulting with health administrators, CHC managers and experts. Three methods were adopted to validate and assess trend and standardization of initial 14 variables using SPSS Version 19 before the final selection. Firstly a cluster analysis was performed to help address the overlap between the
capability of variables to explain the same portion of the outcomes and this helped to shortlist the essential and representative variables as recommended by [13], after which a correlation matrix was extracted to identify and eliminate multicolinearity among the variables. Thirdly due to the susceptibility of DEA technique susceptible to a bad selection of variables (possibility of selecting input that may not adequately explain variations in selected output), we formulated and conducted regression analysis to choose the inputs with high capability to explain a substantial amount of the variance of the outputs selected. A coefficient of determination value of 60% was used as benchmark to select the final list of input and output variables. The regression model was complemented with the coefficient method to select final list of input and output variables based on degree of dispersion from the shortlisted ones. Consistent with traditional production functions, labor and capital were treated as input variables in the production of health services in a Community Health Center. Labour was represented by (1) the number of doctors, (2) the number of nurses, (3) the number of pharmacists, and (4) the number of the other staff (medical staff and administrative workers). The number of beds was used as proxy for the CHCs capital stock (see [7, 13, 14]). On the other hand, the number of outpatient and inpatient cases was treated as outputs variables and were chosen for the 13 cities over an eight year period for the final analysis [14-16].

Another important issues that was addressed was the case of controlling of weights of input and output variables. Charnes, Cooper and Rhodes (nnnnnnnn) recognised the difficulty in seeking a common set of weights to determine relative efficiency. They recognised the legitimacy of the proposal that units might value inputs and outputs differently and therefore adopt different weights, and proposed that each unit should be allowed to adopt a set of weights which shows it in the most favourable light in comparison to the other units. To overcome this challenge, we employed a cross-efficiency approached proposed by Sexton et al. in 1986 and popularized by Doyle and Green's (1994) where each DMU peer-appraises all other DMU's with its own factor weights.

Reviewer Comments 12

I suggest the use of the strobe protocol to better organize the methods section. There is important information missing.

Response to Comment
We are grateful for the observation. We have accordingly reviewed the manuscript guidelines and the STROBE guidelines. We have redrafted our manuscript in terms of content and structure to conform to these benchmarks. Moreover we have used the required referencing format to as recommended by your guidelines. We will be very happy to make further corrections as you deem fit if our current effort is not satisfactory.

Reviewer Comment 13

How the selection of the CHC was performed. Which procedures were used to avoid selections bias? The CHC choose was only intentional?

Response to Comment

Thank you very much for alerting us on this important information. We have accordingly addressed this concerned in our revised article

“There are many CHCs in Jiangsu Province but this study sampled data from 75 CHCs equally distributed in the three zones under review. Two reasons informed the selection of these specific 75 CHCs for the study. Firstly, they are designated as priority CHCs since 2013. For this reason extended support in the form of technology, labour, capital, research and other valuable resources have been invested into them by the Provincial government to ensure high quality and more efficient services. Secondly, the 75 CHCs were chosen because they fall within the research jurisdiction of the Institute of Medical Insurance and Hospital Management (IMIHM) of the Jiangsu University where this study was conducted. Research on other CHCs is conducted by other research centers in the province as part of measures to streamline data collection and research activities among designated organizations by the authorities. Twenty five (25) of the CHCs are in the most economically developed southern zone of Jiangsu Province (Nanjing, Zhenjiang, Suzhou, Wuxi, and Changzhou prefectures). Twenty five (25) of them are also located in Yangzhou, Taizhou, Nantong with relative economic development. These prefectures are located in the middle zone of the Jiangsu Province. Finally, the remaining 25 CHCs were sampled from Xuzhou, Lianyungang, Suqian, Huaian, Yancheng in the Northern zone of the Jiangsu province and are less economically active areas. The same number of CHCs was selected to provide a fair basis to make comparison of results. The Census and Statistics Department which keeps validated and administrative data for the Jiangsu province provided the data [12].
Reviewer Comment 14

Page 9, line 1: The article (13) reported don’t define a specific conjoint of steps to define which variables should be selected to DEA analysis in the health context. The authors should state clearly how the variables were selected. DEA is a technique susceptible to a bad selection of variables. To define which inputs and outputs should be considered there is necessary identify how the variance of the output might be explained by the inputs selected. In fact, DEA will perform an evaluation of relative efficiency with any kind of inputs and outputs. This is one is a critical point to be addressed while using this technique. Using regression techniques before choosing the inputs and outputs is a methodological procedure to address this issue. The cluster analysis performed might address the overlap between the capability to explain the same portion of the outcomes, but is not the most adequate to exam how the inputs and the outputs are related, in terms of the variance explained. You need to be sure that the inputs selected have the capability to explain a substantial amount of the variance of the outputs selected. Doing this you can be sure that changes in the inputs and the outputs could be performed to improve the efficiency of the health care offer. The consensus of experts is an insufficient approach to solve this question. You need to better support the selection of the variables to be used as a proxy of health care process. Additionally, the process of care offer is supported by elements of structure, process, and outcomes. Donabedian defines this approach to be used as a guideline to think the quality in the process of care offer. The final selection of inputs did not reflect the full range of elements necessary to perform a satisfactory offer of health services. From a management perspective, change the area of the CHC itself, even when considered together with the other inputs and outputs might not be sufficient to improve the quality of care offered and solve inequities issues.

Response to Reviewer Comments

We appreciate the suggestion of this very important issue that was omitted in our work. This has been a very invaluable suggestion.

Selection of Input and Output Variables for DEA Analysis

The study used an input and output form of DEA however, the efficiency of a DMU or CHC is not dependent on the absolute value of the input variable but the outcome of the model. The guidelines for variable selection in a DEA analysis by [13] was used to select 14 initial human resources, materials, financial and service variables. This requires the selected variables to reflect input and output situation of community, representativeness sample, elimination of multicolinearity among variables, consistent sample size-evaluation units ratio etc). The fourteen input variable initially selected for regression were number of centers, number of beds, number
of health workers, number of general standardized training practitioners, financial investment, the cost per visit, proportion of CHC within an area of 3,000m2 and proportion of residents under grid management in communities CHC. The initial output variables selected included the number of discharged patients, cure rate, bed occupancy rate, average inpatient days, the daily number of outpatient and emergency visits of doctor, the daily number of inpatient stays of doctor. The variable selection was done after searching related materials and consulting with health administrators, CHC managers and experts. Three methods were adopted to validate and assess trend and standardization of initial 14 variables using SPSS Version 19 before the final selection. Firstly a cluster analysis was performed to help address the overlap between the capability of variables to explain the same portion of the outcomes and this helped to shortlist the essential and representative variables as recommended by [13], after which a correlation matrix was extracted to identify and eliminate multicolinearity among the variables. Thirdly due to the susceptibility of DEA technique susceptible to a bad selection of variables (possibility of selecting input hat may not adequately explain variations in selected output), we formulated and conducted regression analysis to choose the inputs with high capability to explain a substantial amount of the variance of the outputs selected. A coefficient of determination value of 60% was used as benchmark to select the final list of input and output variables. The regression model was complemented with the coefficient method to select final list of input and output variables based on degree of dispersion from the shortlisted ones. Consistent with traditional production functions, labor and capital were treated as input variables in the production of health services in a Community Health Center. Labour was represented by (1) the number of doctors, (2) the number of nurses, (3) the number of pharmacists, and (4) the number of the other staff (medical staff and administrative workers). The number of beds was used as proxy for the CHCs capital stock (see [7, 13, 14]). On the other hand, the number of outpatient and inpatient cases was treated as outputs variables and were chosen for the 13 cities over an eight year period for the final analysis [14-16].

Another important issues that was addressed was the case of controlling of weights of input and output variables. Charnes, Cooper and Rhodes (nnnnnnnn) recognised the difficulty in seeking a common set of weights to determine relative efficiency. They recognised the legitimacy of the proposal that units might value inputs and outputs differently and therefore adopt different weights, and proposed that each unit should be allowed to adopt a set of weights which shows it in the most favourable light in comparison to the other units. To overcome this challenge, we employed a cross-efficiency approached proposed by Sexton et al. in 1986 and popularized by Doyle and Green's (1994) where each DMU peer-appraises all other DMU's with its own factor weights.
Reviewer Comment 15

Results Section: It should be provided a descriptive table with raw data related to inputs and outputs.

Response to the Reviewer Comments

We are very grateful for this observation. We have added descriptive table with raw data related to inputs and outputs as additional table.

Reviewer Comment 16

Discussion: The authors did an extensive discussion in the introduction section about the need to address inequities. The study is organized much in terms of the use of the econometric techniques itself, than approaching the important matter of equity and how to improve efficiency in care. How your contributions can help to solve the iniquity problems in Jiangsu Province? How can a policy maker use your findings to change the way health policy is designed, funded and evaluated? The list of items defined as recommendations for policy makers at page 17 is not fully supported by your findings. They are generic and not related to the findings from your data.

Response to the Reviewer Comments

We are very grateful for this observation. We have revised and augmented the discussion section with appropriate information suggested by the reviewer. Please refer to the sections below:

The observations made about efficiency of healthcare facilities in Jiangsu province and its implication on health equity in China as explained in this study are not peculiar to the Province. Indeed Yin [20] argues that the situation is widespread among Chinese province. Zhang et al [21] even contends that several countries (Sweden, UK, etc) face similar challenges of technical and scale inefficiency, resource redundancy and under resourced healthcare facilities etc. The major difference in the case of China and other countries is the variation in positioning value
orientation of health resource allocation, role of market forces and the governmental functional orientation to resource allocation [21].

There are many different options available to the Provincial government to explore within the configuration of the Healthy China 2020 Agenda without distorting or overstretching its limits to stimulate greater equity to healthcare through efficient allocation of resources especially to less endowed areas in Northern parts of the country. There is an urgent need for Jiangsu Province to adopt a new model for health resource allocation and service utilization that eliminates redundancy in places where resources are not needed. This can further deepen the Deepened Medical Reform that appears to yield some significant results. Prior research studies have proposed the shifting of healthcare professionals (clinical and non-clinical) from areas with excess availability of human resources to underserved areas such as the northern parts of Jiangsu Province.

Several techniques to ensure this transfer have been proposed but the use of incentives has been widespread. In China in particular, many different incentive proposals and models have been implemented to attract healthcare professionals to work in less developed areas, yet the gap still persist. This is an indication that a single approach is not enough. Jiangsu Province can while ensuring rapid transfer of healthcare resources to backward areas by readjusting its healthcare supply chain to ensure quick or easy flow of healthcare resources across cities. The rapid expansion of transportation system in China can be a strong partner in this respect without forcing professionals to stay in areas they least prefer. In other words, there is the need to promote integrated regional health planning that facilitates inter-facility cooperation between medical centers to actively share medical resources.

Another approach is to cultivate talents. This requires an initiative to build the capacities of rural health human resources through the institutionalization of training activities in developed regions. For example Guangxi province has initiated a policy to provide support for medical and healthcare trainees in exchange for a bonded period of work in designated areas of the Province. This has the potential to guarantee the availability of a recognizable number of healthcare professionals and quality healthcare over a period of time to reduce inequity in access to quality healthcare.

Comments of Reviewer #2:

Good article. It is of importance in its field.
Response to Comments

Thank you very much for your comment, we appreciate your commendation.