

## PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form ([see an example](#)) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below. Some articles will have been accepted based in part or entirely on reviews undertaken for other BMJ Group journals. These will be reproduced where possible.

### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Adaptive capacity of the Adjusted Clinical Groups Case-Mix System to the cost of primary health care in Catalonia (Spain): A Observational Study
<b>AUTHORS</b>	Antoni Sicras-Mainar, Soledad Velasco-Velasco, Ruth Navarro-Artieda, Alexandra Prados-Torres, Buenaventura Bolibar-Ribas and Concepción Violan-Fors

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Hsien-Yen Chang Research Associate Johns Hopkins Bloomberg School of Public Health  This reviewer is currently hired as a research associate at John Hopkins University with part of the funding coming from the ACG team.
<b>REVIEW RETURNED</b>	16/03/2012

<b>THE STUDY</b>	<p>1. The authors described that the stepwise method was used to select the final sets of variables to be included in the model. However, the original set of variables to choose from should be stated, either in the text or in the appendix.</p> <p>2. The authors included medical utilization variables when presenting the results of multiple regression in table 3. When it comes to risk adjustment, medical utilization is rarely included because it would award people who use more services regardless of being necessary and present an opportunity for healthcare providers to manipulate the system. It would be interesting to see how the model works without including healthcare utilization.</p> <p>3. To present the results of model building, split-half analysis is usually adopted to reduce the problem of over-fitting. The authors should perform that when reporting the model performance such as R2.</p> <p>4. In the result section of the abstract, the authors mentioned that the explanatory power of the ACG system was 36.9% for cost. However, such result was never mentioned anywhere else; this reviewer couldn't find it either in the text or table.</p> <p>5. There are different outputs to be used from the ACG system in risk adjustment. The simple sum of the ADGs and RUB are probably among the simplest methods and may not demonstrate the ability of the ACG system fully; others to consider include 32 binary indicators of ADGs, etc.</p> <p>6. The R2 of more than 90% is very high and rarely observed in</p>
------------------	---

	explaining costs.
<b>REPORTING &amp; ETHICS</b>	Not quite sure if IRB approval has been obtained.
<b>GENERAL COMMENTS</b>	This manuscript explored an interesting topic and showed that it might not be suitable for claims-based risk adjustment systems developed in one country to be directly applied in another country; some adjustment may be necessary. The authors gave the readers an example on how to identify and solve the problems. It is important given most of the popular claims-based risk adjustment models were developed using US data.

<b>REVIEWER</b>	Javier Rejas Health Economics and Outcomes Research Area Manager Pfizer, S.L.U., Spain  I declare not to have any conflict of interests related with the review of this manuscript.
<b>REVIEW RETURNED</b>	16/03/2012

<b>THE STUDY</b>	The conclusions in abstract should match what the authors conclude in the conclusion section of manuscript. While the conclusion in body of manuscript is quite conservative and balanced, the conclusion in abstract seems less conservative and not adjusted to the evidences observed in the work. Authors should rewrite the conclusion of abstract in agreement with the conclusion in the manuscript.
<b>REPORTING &amp; ETHICS</b>	Authors should specify that according with the Spanish legislation, given the retrospective design of the study and the fact that it did not involve investigation of a particular drug, the study did not need specific approval from an IRB or patient consent except the dissociation of data that is fully explained in the manuscript.

## VERSION 1 – AUTHOR RESPONSE

Reviewer: Hsien-Yen Chang

Research Associate

Johns Hopkins Bloomberg School of Public Health

This reviewer is currently hired as a research associate at John Hopkins University with part of the funding coming from the ACG team.

1. The authors described that the stepwise method was used to select the final sets of variables to be included in the model. However, the original set of variables to choose from should be stated, either in the text or in the appendix.

Response

In the statistical analysis section we have included the phrase:

"(independent variables: age, sex, episodes, number ADG, RUB and pharmacy cost)"

2. The authors included medical utilization variables when presenting the results of multiple regression in table 3. When it comes to risk adjustment, medical utilization is rarely included because it would award people who use more services regardless of being necessary and present an opportunity for healthcare providers to manipulate the system. It would be interesting to see how the model works without including healthcare utilization.

Response

In the results section we have included the phrase:

"In the multivariate analysis by including only the clinical variables age, sex and number of ADG, the R<sup>2</sup> was 56.5%".

3. To present the results of model building, split-half analysis is usually adopted to reduce the problem of over-fitting. The authors should perform that when reporting the model performance such as R2.

Response

In the statistical analysis section we have included the phrase:

"The coefficient of determination (R2) obtained from the ratio intra-group variability/ total variability (ANOVA)".

4. In the result section of the abstract, the authors mentioned that the explanatory power of the ACG system was 36.9% for cost. However, such result was never mentioned anywhere else; this reviewer couldn't find it either in the text or table.

Response

See results section (blue).

5. There are different outputs to be used from the ACG system in risk adjustment. The simple sum of the ADGs and RUB are probably among the simplest methods and may not demonstrate the ability of the ACG system fully; others to consider include 32 binary indicators of ADGs, etc.

Response

We appreciate the comments of the reviewer. In the study we performed the simple sum of the ADGs and RUB. Thanks!. See methods section.

6. The R2 of more than 90% is very high and rarely observed in explaining costs.

Response

Indeed, in the multivariate model (including the cost of medication) was 90%. In contrast the explanatory power of the classification (R2) depending on the cost of care (dependent variable) was 36.9%. See results section.

Not quite sure if IRB approval has been obtained.

Response

If it was obtained. See section of Ethics Approval

This manuscript explored an interesting topic and showed that it might not be suitable for claims-based risk adjustment systems developed in one country to be directly applied in another country; some adjustment may be necessary. The authors gave the readers an example on how to identify and solve the problems. It is important given most of the popular claims-based risk adjustment models were developed using US data.

Response

Thank you very much for your comments.

Reviewer: Javier Rejas

Health Economics and Outcomes Research Area Manager Pfizer, S.L.U., Spain

I declare not to have any conflict of interests related with the review of this manuscript

The conclusions in abstract should match what the authors conclude in the conclusion section of manuscript. While the conclusion in body of manuscript is quite conservative and balanced, the conclusion in abstract seems less conservative and not adjusted to the evidences observed in the work. Authors should rewrite the conclusion of abstract in agreement with the conclusion in the manuscript.

Response

We have replaced the conclusion of the summary in accordance with the conclusion of the manuscript.

Authors should specify that according with the Spanish legislation, given the retrospective design of the study and the fact that it did not involve investigation of a particular drug, the study did not need specific approval from an IRB or patient consent except the dissociation of data that is dully explained in the manuscript.

Response

In the methods section we have included the phrase:

"According to Spanish law, being a retrospective design and because it is not investigated the effectiveness of any medicine, the study does not need specific approval from an IRB or the patient's consent, but instead required the dissociation of the data".

## VERSION 2 – REVIEW

<b>REVIEWER</b>	<p>Hsien-Yen Chang, PhD Research Associate Johns Hopkins Bloomberg School of Public Health Baltimore, MD, USA</p> <p>The Johns Hopkins University receives royalties for non-academic use of software based on the ACG methodology. Dr. Chang receives a portion of his salary support from this revenue.</p>
<b>REVIEW RETURNED</b>	25/04/2012

<b>GENERAL COMMENTS</b>	<ol style="list-style-type: none"> <li>1. The authors described that the stepwise method was used to select the final sets of variables to be included in the model. However, the original set of variables to choose from should be stated, either in the text or in the appendix.</li> <li>2. The authors included pharmacy cost as a predictor in the regression model. Pharmacy cost is part of the outcome as well as an independent variable. The authors should consider reporting the results without using pharmacy cost as a predictor.</li> <li>3. To present the results of model building, split-half analysis is usually adopted to reduce the problem of over-fitting. The authors should use this technique when reporting the model performance such as R2.</li> <li>4. It seemed two different R2 of the same were reported: in the abstract the explanatory power of the ACG system was 56.9% without outliers; in the results section (the last sentence in the second paragraph on page 7) 56.5% was reported.</li> <li>5. The authors might also want to discuss the possible causes of the very high R2 of the model; some explanations included: the inclusion of pharmacy cost, the exclusion of people who didn't require care, etc.</li> </ol>
-------------------------	---

## VERSION 2 – AUTHOR RESPONSE

Reviewer(s)' Comments to Author:

Reviewer: Hsien-Yen Chang, PhD  
Research Associate  
Johns Hopkins Bloomberg School of Public Health  
Baltimore, MD, USA

The Johns Hopkins University receives royalties for non-academic use of software based on the ACG methodology. Dr. Chang receives a portion of his salary support from this revenue.

Response authors:

The reviewer is right. We are sorry not to have understood previous comments.

We have reviewed the study, and we believe that Table 3 provides a lot of confusion, not clarity to the study. Table 3 has been removed. Paragraph of results in Table 3 was deleted.

We do not provide results of linear regression model. The explanatory power of ACG classification was made based on the coefficient of determination. See section on statistical analysis. The tables were renumbered.

1. The authors described that the stepwise method was used to select the final sets of variables to be included in the model. However, the original set of variables to choose from should be stated, either in the text or in the appendix.

Response

Was removed from the study, see the sections on statistical analysis and results.

2. The authors included pharmacy cost as a predictor in the regression model. Pharmacy cost is part of the outcome as well as an independent variable. The authors should consider reporting the results without using pharmacy cost as a predictor.

Response

We have excluded the pharmaceutical cost model. The reviewer is right.

3. To present the results of model building, split-half analysis is usually adopted to reduce the problem of over-fitting. The authors should use this technique when reporting the model performance such as R2.

Response

Table 3 was deleted. Not show the results of over-fitting. The reviewer is right.

4. It seemed two different R2 of the same were reported: in the abstract the explanatory power of the ACG system was 56.9% without outliers; in the results section (the last sentence in the second paragraph on page 7) 56.5% was reported.

Response

It has been modified in the abstract (56.5%). Thank you.

5. The authors might also want to discuss the possible causes of the very high R2 of the model; some explanations included: the inclusion of pharmacy cost, the exclusion of people who didn't require care, etc.

Response

Table 3 was removed. In this respect, it shows the R2 values of 90%. The reviewer is right.

Only describes the results concerning the explanatory power of ACG classification.

In conclusion, we believe that the results of multiple linear regression model provide no relevance to the study. The explanatory power of the classification is calculated from the coefficient of determination. The manuscript was adapted.

<b>REVIEWER</b>	<p>Hsien-Yen Chang, PhD Research Associate Johns Hopkins Bloomberg School of Public Health Baltimore, MD, USA</p> <p>The Johns Hopkins University receives royalties for non-academic use of software based on the ACG methodology. Dr. Chang receives</p>
-----------------	--

	a portion of his salary support from this revenue.
<b>REVIEW RETURNED</b>	11/05/2012

<b>GENERAL COMMENTS</b>	<p>1. Table 4: I don't see R2 reported in the table. This footnote can be removed.</p> <p>2. Figure 2: It seems that the total % of outliers should be 100%.</p>
-------------------------	--