Author's response to reviews

Title: Is theatre utilization a valid performance indicator for NHS operating theatres?

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Version: 2 Date: 15 August 2007

Author's response to reviews: see over
14th August 2007

Dear Ann,

Thank you for your email from the 4th August. I hope that this email offers sufficient explanation where requested by the reviewers. I have attempted to incorporate most of the suggestions offered by the reviewers as I do feel that they strengthen the article.

I have revised the main document and re-submitted it along with addition of the previously missing sections (‘conflicts of interest’ and ‘authors contributions’). As mentioned in the ‘conflicts of interests’ section I did receive financial support from an NHS organization during my research period. I am unclear whether this organization could benefit from this research but have included it nonetheless. There is no ‘Acknowledgements’ section as no other parties required acknowledgement. Otherwise I have attempted to retain the suggested order and closely follow the editorial requests.

One other query relates to my own affiliation as I have since moved on from St Mark’s (although I do still hold an honorary research contract with St Mark’s). I am unclear on publishing conventions regarding this issue.

Should you have any further queries please do not hesitate to contact me directly either by email or phone (details are on manuscript).

Thank you, sincerely
Omar Faiz

Please find below a detailed response to all four reviewers’ comments.

Reviewer 1 – Robert Gibberd
I have responded to the points in numerical order.
1. I fully agree with the first requests that we include an explanation of the use of Tables 2 and 3. As such we have now included an example of how to use these tables in the results section. ‘The latter tables can be used to predict list utilization rates by extrapolation from the regression equation \( y = a + b(x) \) where \( y \) = the predicted utilization rate, \( a \) =the model constant (or intercept) and \( b \) =the regression (Beta) coefficient of covariate (x). For example, a hypothetical scenario can be taken of a day surgery list where 300 list-score units are operated upon by surgeon 12 and all other session variables correspond to reference categories i.e. the list does not overrun and starts promptly and is carried out by anaesthetist 1. The predicted utilization rate for this scenario equates to the model constant (38.1%) + (300 units x Beta coefficient for list size 0.093)% + (3.8% i.e. the beta coefficient for surgeon 12) + nil else (as all other covariates were the reference categories). Therefore the predicted utilization rate for this list scenario = 69.8%.’ The reason underlying the discrepancy between the model constant (38.1%) and the reported average of about 70% is that the model constant has not been corrected for list size. Therefore the completion of e.g. a 300 unit size operating
list (nb. list-score is a linear variable) would predict for a utilization rate of 38.1% +
(0.093 x 300) – assuming all other reference categories were selected also. This takes the
average up to the reported average.

2. I have also tried to incorporate the second point that reviewer 1 makes into the
discussion i.e. that significant differences do exist between outlying surgeons. As such I
have included ‘Specifically, personnel displayed significant independent differences in
the determination of list utilization in both the DS and MT settings where coefficients
ranged from -3-12% and 0-8% amongst surgeons in these differing contexts respectively.

3. I have simplified the tables where appropriate down to 1 and 2-decimal points where
appropriate (as opposed to 3 previously). I have retained 3 decimal points for R-sq values
as small differences between these are important and statistically significant.

4. I have now used multiple regression instead of multifactorial linear regression as
suggested.

5. Agreed – this paragraph has been transferred to the methods section.

Reviewer 2 – Andrew Kingsnorth
The only suggested minor change offered by Professor Kingsnorth was to update
Reference 7. I do acknowledge that the reference is now 5 years old however I do feel
that its inclusion is warranted as it represents the very first audit commission report into
operating theatres. This is the work that commenced the debate into operating theatre
efficiency in the United Kingdom. I would therefore opt to retain this reference unless it
was strongly felt that it should be removed. I have also included a subsequent audit
commission study published the following year in 2003 (reference 6) also.

Reviewer 3 – Mark J Koelemay
I agree with the reviewer that the relationship between inpatient bed resources and main
theatre utilization cannot be substantiated from the data offered in this study. Most
surgical personnel would acknowledge the obvious link between a full bed state and an
inability to admit elective patients but this cannot be directly proven. Unfortunately bed
capacity data for general surgery was not collected routinely during the majority of the
study period. It was however collected for the last few months (for managerial purposes).
The latter was insufficient to draw meaningful conclusions between these two variables.
Future studies will address this issue. As such I have sought to soften the emphasis placed
on this argument by the inclusion of ‘Importantly, this cannot be directly substantiated in
the current study as bed capacity data was not a collected variable. If however a
relationship between bed capacity and main theatre utilization is accepted – then, in the
context of declining numbers of ward beds in NHS hospitals \(17\), utilization of MT units
may decline also.’ into the discussion.The above reviewer has requested that we offer
potential alternatives to utilization measures. Personally, I advocate the use of appropriate
measures to the level of decision-making undertaken. For strategic or political decision-
making we would advocate the use of workload and efficiency measures (such as Human
Resource Group tariffs per similarly matched theatre per time period). These could be used to compare theatre efficiency between Trusts. For managerial / operational decision-making the latter could also be used to identify poor performing theatres. Simultaneous collection of other managerial parameters (in and out of theatres, such as bed capacity data and patient cancellation data) might additionally permit amelioration of failing theatre complexes subject to cause. To this end I have included ‘Despite this, using measures of surgical workload to measure: intended admissions, patient cancellations and eventual operative list volume might represent more useful managerial data than theatre utilization rates’ into the discussion. Furthermore, I have now chosen to incorporate the following paragraph into the end of the discussion. ‘In the future, quantitative measures of surgical service workload, such as Human Resource Group (HRG) tariffs, are likely to predominate over theatre utilization. Definition of an actual service ‘output’ in NHS Trusts has facilitated political, strategic as well as operational decision-making. A possible extension of this to the operating theatre environment may be to use ‘HRG output per theatre per time-period’ as an efficiency measure. Irrespective however of the validity of a specific tool that quantifies theatre effectiveness; improving elective theatre efficiency demands a broad perspective over the entire surgical pathway.’

I do also acknowledge the point that the above reviewer has made regarding the direct extrapolation of a single centre study to the NHS. As such I have included the following paragraph early in the discussion ‘The results of this study pertain to a single centre. Direct extrapolation of the study results to other Trusts, or even other specialties, is not possible. Many problems within NHS hospitals are however shared between centres. Although only data from one centre was used, the results and conclusions of this study are therefore, by proxy, of relevance to other units.’

**Reviewer 4 – Henry Redmond**

The above reviewer proposes a significant shortening of the discussion. I have tried to achieve this without compromise of the actual content. The reviewer requested that I limit the discussion to three pages and I have reduced it to just over three-and-a-half with a short conclusion. I hope that this suffices as I have struggled to incorporate other recommended insertions by reviewers also. Further shortening of the text would, in my opinion, compromise the explanation of research findings. Theatre utilization represents a concept that will not have been considered by many of the readers previously and, as such, some of the detailed explanation of assertions in the discussion is in my opinion relatively necessary.
Reviewer's report
Is theatre utilization a valid performance indicator for NHS operating theatres

Title: ?

Version: 1 Date: 13 June 2007
Reviewer: Robert Gibberd

Reviewer's report:

General
This paper presents an analysis of data from one hospital to determine whether the theatre utilisation measure used is valid. As expected it reveals serious problems, and hence is worth reporting. The paper is well written, and I have only a few suggestions that would be worth incorporating.

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)
1. The multiple regression analyses present the betas, and it is useful to include some text as to how these are to be read. The constant term is the utilisation score for the case where all reference values are used. In Table 2 it is low 38.124, while the reported average is about 70. This may be because the betas for the reference values are not 0, but in any case the Table needs to give the reference value and include it in the table. Eg 0.0* where * is a footnote saying Reference.
2. The beta values are important (more interesting than the discussion on p-values and R-square, and should be discussed. In Table 2, the surgeons changed the index from -13.2 to + 3.8 relative to surgeon 1. Similarly, the late starts reduced the index y -3 and -10.
3. The paper gives values with 2 decimal places: one is plenty, and this would simplify the Tables also.
4. Multifactorial linear regression could be simplified to Multiple regression.
5. The second paragraph in the “Theatre list utilisation rates” section belongs to the Methods section.

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Discretionary Revisions (which the author can choose to ignore)

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article of outstanding merit and interest in its field
Quality of written English: Acceptable
Statistical review: Yes, and I have assessed the statistics in my report.
Declaration of competing interests:
'I declare that I have no competing interests'
Reviewer’s report
Is theatre utilization a valid performance indicator for NHS operating theatres

Title: ?

Version: 1 Date: 18 June 2007
Reviewer: Andrew Kingsnorth
Reviewer’s report:
General

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)
None

Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)
Reference 7 should be updated

Discretionary Revisions (which the author can choose to ignore)

What next?: Accept without revision
Level of interest: An article of outstanding merit and interest in its field
Quality of written English: Acceptable
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
Reviewer's report
Title: Is theatre utilization a valid performance indicator for NHS operating theatres?
Version: 1 Date: 27 June 2007
Reviewer: Mark J Koelemay
Reviewer's report:
General
The authors have performed an original study to analyse the reliability of utilization rates as indicator for theatre performance. Several variables with possible influence on utilization were entered in a multivariate analysis. Size of operating list, overruns and late starts were independent predictors of utilization. The discussion is convincing in that utilization may not be an appropriate indicator for performance.
I have only a few comments as I think that this is a well written and methodologically sound paper.

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)
In the discussion the authors state that bed capacity is probably the most influential factor on utilization. This is speculative and not supported by the data as this variable was not included in the analysis and is brought up as a proxy for operating list size. Did the authors have the opportunity to test this assumption? I realize that it is virtually impossible to retrieve data on bed capacity during a seven years period, but it would be interesting to find further support for this statement.
When utilization is not an appropriate indicator for performance, can the authors offer an alternative?
Can you speculate a little bit more on the generalizability of the findings to other trusts? Did you encounter specific problems for the particular hospital that was used for the current analysis?

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Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

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Discretionary Revisions (which the author can choose to ignore)
Reviewer’s report
Title: Is theatre utilization a valid performance indicator for NHS operating theatres?
Version: 1 Date: 23 July 2007
Reviewer: Henry P Redmond

Reviewer's report:
Reviewer’s Report:
Major Compulsory Revisions:
None.
Minor Essential Revisions:
1. The paper is well written and I believe it achieves its objective very well, the only minor essential revision I have relates to the length of the discussion which runs to 5 pages. I believe this to be excessively long for such a manuscript; it could be shortened to 2 or 3 pages maximum.

Level of interest:
An article of importance in its field.
Quality of written English:
Very good.
Statistical review:
Not necessary.
Declaration of competing interests:
I declare that I have no competing interests.