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

TITLE (PROVISIONAL)	OVERWEIGHT AND OBESITY IN PREGNANCY: HEALTH SERVICE UTILISATION AND COSTS ON THE NHS
AUTHORS	Morgan, Kelly; Rahman, Muhammad; Macey, Steven; Atkinson, Mark; Hill, Rebecca; Khanom, Ashrafunnesa; Paranjothy, Shantini; Husain, Muhammad; Brophy, Sinead

VERSION 1 - REVIEW

REVIEWER	Wilkinson, John Durham University
REVIEW RETURNED	06-Nov-2013

GENERAL COMMENTS	I think this is a very interesting paper on a subject of great importance to the health services in the UK and beyond. Overall this is a well executed study, but some of the explanations are opaque and need to be improved for a more general readership. Table 2 is the kernel of the study and requires more explanation, as at face value the results shown in the table appear at odds with the description. It may simply be that the authors have tried to encompass too much within this table and have therefore compromised on clarity. More explanation is required about the context of the study, overall size of the population (page 5) of the area from which the study sample is derived etc, in order that others reading the study can assess applicability to their own working environment. The results shown in table 6 seem to have appeared like a rabbit out of a hat, and more explanation is required as to how these data were derived. In the discussion, more emphasis needs to be placed on the weakness of costing systems in the NHS and there is some spurious precision (down to the last pence) throughout the paper. Page 3 - line 31 .. insert ON AVERAGE after cost Page 4 - line 7 missing 'being' after 'women. Reword sentence. Across the nations of the UK, rates of obesity vary from …. Page 5 line 9. In years to come no-one will remember what the economic climate was, so insert 'challenging' between current and economic. Page 5 Line 12 missing 'with' between presenting and a Page 5 line 31 - change 'shall' to 'will' Page 6 line 17 - extra r in routinely Page 6 - line30 - explain the significance of the need for 2 Read codes Page 6 line 34 Read capital R Table 1 Line 55 What is the alcohol parameter described here?

	Make it clear at the top of the table that the figures in brackets are %ages Table 2 Needs to be made clearer as explained above Page 14 line 10. Check figure of 42%. My reading of table 4 looks like a reduction of 21% References Insert page numbers in reference number 2 Reference 17 - vague reference, needs proper sourcing Supplementary table 1. Do all these costs need to be included, is this not published data? Would a reference suffice?

REVIEWER	Bennett, Wendy Johns Hopkins School of Medicine, General Internal Medicine
REVIEW RETURNED	16-Dec-2013

GENERAL COMMENTS	Comments: 1. Intro and Aim - would prefer the Aim to state - identify important predictors of HC utilization, instead of just describe, which is less rigorous and has fewer implications for designing interventions to reduce costs/utilization - would be helpful to include other literature about utilization in pregnancy and after - among women with GDM for e.g., since more has been done in this population, which has high overlap with Obesity - would like to see Hypothesis driven analysis and presentation of the Hypothesis. 2. Methods - BMI - this is MOST important predictor. Was this self-reported. If so, I would be very concerned about validity. Would label as "pre-pregnancy" or early pregnancy BMI - was it recorded by midwife in a standard method? - would like to see all the co-morbidities evaluated. I do not believe that the Charlson index would capture pregnancy-related co-morbidities like preeclampsia, GDM etc. The accurate assessment of co-morbidities is important to this paper because of the link of co-morbid medical and pregnancy complications and the predictor, obesity. - would identify the important co-morbidities, describe and utilize them as co-variates in all predictive models - please exclusions and rationale in the Methods section (fig 1) 3. Results - results - would prefer 3 categories not just normal and ow/obese. Please provide rationale for only 2 BMI categories - would like to know WHY ow/women were higher utilizers of care - is it because of the co-morbid illnesses, other reasons, like decreased ultrasound visualization leading to over monitoring? I think the paper is missing key data to assess reasons for utilization (diagnoses). - why present so many age categories? was there a hypothesis? was there an interaction between age and obesity status? - t3 needs footnote with the co-variates you adjusted for - cost data - would be nice to see it broken down by time period - pregnancy, delivery and post-partum. Maybe the higher cost is due to delivery complications or more c-sections. Would be helpful to see this, and also to see the c-section information adjusted for. - if you adjusted for utilization does cost go down?

VERSION 1 – AUTHOR RESPONSE

Reviewer Name : Professor John Wilkinson
Institution and Country Public Health England
UK

I think this is a very interesting paper on a subject of great importance to the health services in the UK and beyond. Overall this is a well executed study, but some of the explanations are opaque and need to be improved for a more general readership. Table 2 is the kernel of the study and requires more explanation, as at face value the results shown in the table appear at odds with the description. It may simply be that the authors have tried to encompass too much within this table and have therefore compromised on clarity.

Response: Thank you for your very positive comments. To improve transparency we have added a new table (Table 1) inserted an extra table (table 1) which outlines where each variable is derived from and type of data collected. We have removed table 2 as based on both reviewers comments we felt the information was portrayed more effectively by table 3 which also took into account confounders.

More explanation is required about the context of the study, overall size of the population (page 5) of the area from which the study sample is derived etc, in order that others reading the study can assess applicability to their own working environment.

Response: The following information has been added to the methods section ‘Providing health services for a population of 500,000 individuals, ABMU NHS Board is the largest health board in Wales comprising of 18 hospitals and 77 GP's.’

The results shown in table 6 seem to have appeared like a rabbit out of a hat, and more explanation is required as to how these data were derived.

Response: We have now added the following line to explain how the results for table 6 were derived ‘Table 6 shows the mean total cost for each BMI category calculated using 1) inpatient costs 2) outpatient costs 3) cost of GP visits and 4) cost of medications prescribed by the GP’.

In the discussion, more emphasis needs to be placed on the weakness of costing systems in the NHS and there is some spurious precision (down to the last pence) throughout the paper.

Response: The following has been added to the discussion; ‘It is important to note that there is no standard costing system used throughout the UK NHS and as such the unit costs applied as part of this study merely reflect an average of the resource costs borne in Wales over a certain period. This creates great difficulty when trying to deduce actual resource utilisation at an individual hospital episode level, and means that the unit costs used here may differ from those reported elsewhere in the UK NHS. Nonetheless, the unit costs from the WCR accounts used throughout this study are validated annually during the completion of the Welsh Benchmarking Summary (WBS), providing a robust costing methodology’. We have also amended all the figures (rounding up to the nearest pound).

Page 3 - line 31 .. insert ON AVERAGE after cost Page 4 - line 7 missing 'being' after 'women. Reword sentence. Across the nations of the UK, rates of obesity vary from ….

Response: ‘On average’ has been inserted within the sentence whilst we have rephrased the following sentence as ‘Varying considerably across nations, rates of maternal obesity range from 1 in 15 women living in Wales to lower proportions of 1 in 29 women in London’.

Page 5 line 9. In years to come no-one will remember what the economic climate was, so insert 'challenging' between current and economic.

Response: ‘challenging’ has been inserted.

Page 5 Line 12 missing 'with' between presenting and a Page 5 line 31 - change 'shall' to 'will'

Response: The suggested words have now been inserted.

Page 6 line 17 - extra r in routinely

Response: This has now been removed.

Page 6 - line30 - explain the significance of the need for 2 Read codes Page 6

Response: This method was adopted as a result of ongoing work in which we are investigating the best way to identify an actual GP visit from the numerous read codes available (e.g. administration process vs. phone call to the doctor vs. an actual visit). This is a separate piece of work which shall be put forward for publication in the near future. We have found that the presence of two read codes best correlated with appointment records therefore we utilised this logic in our current paper.

Line 34 Read capital R

Response: This has been edited accordingly.

Table 1 Line 55 What is the alcohol parameter described here?

Response: To provide further clarity we have added the following footnote ‘†Alcohol consumption= had consumed alcohol during pregnancy (self-reported)’

Make it clear at the top of the table that the figures in brackets are %ages Table 2 Needs to be made clearer as explained above

Response: As suggested we have moved the following text to follow the table name (as opposed to a footnote) ‘(presented as number (%))’ and table 2 has been removed (based on feedback from both reviewers) as upon reflection Table 3 provides the same information but in greater detail with added confounders.

Page 14 line 10. Check figure of 42%. My reading of table 4 looks like a reduction of 21%

Response: Thank you for highlighting this error, the text has now been corrected to indeed state ‘21%’.

References Insert page numbers in reference number 2 Reference 17 - vague reference, needs proper sourcing Supplementary table 1.

Response: Both references have been amended accordingly.

Do all these costs need to be included, is this not published data? Would a reference suffice?

Response: To cut down on information we have removed the tables as suggested and included a reference for the tables instead.

Reviewer Name: Wendy Bennett

Comments:
1. Intro and Aim
- would prefer the Aim to state - identify important predictors of HC utilization, instead of just describe, which is less rigorous and has fewer implications for designing interventions to reduce costs/utilization

Response: Thank you we do agree that understanding if obesity predicts more inpatient stays or more GP visits would be interesting but we don't feel it would change interventions to reduce obesity. We wanted to examine how much extra is spent per pregnancy in order to inform how much could be spent on interventions and still be cost saving. We feel predictors of HC utilization is a very different question and not one which we have set out to answer. We were specifically looking at the cost of an overweight/obese pregnancy.

- would be helpful to include other literature about utilization in pregnancy and after - among women with GDM for e.g., since more has been done in this population, which has high overlap with Obesity

Response: As suggested, we have added further information to our background section; 'A recent study compared healthcare costs (including those related to neonatal care) between women with and without gestational diabetes mellitus (GDM), of whom all had a BMI greater than or equal to 25 kg/m² 17.Adjusting for age, education and BMI, the authors reported greater inpatient costs (44% higher) amongst those women with GDM. Based on participants' from a Finnish prevention trial, the authors emphasise that they cannot rule out any potential intervention effects on healthcare use'.

- would like to see Hypothesis driven analysis and presentation of the Hypothesis.

Response: The following has been added to the background section : 'Our hypothesis is that overweight/obese women have higher health service utilisation and accompanying costs during pregnancy in comparison to normal weight women. This difference in cost could be used to inform the amount that could be spent on public health initiatives and still be cost saving.'

2. Methods
- BMI - this is MOST important predictor. Was this self-reported. If so, I would be very concerned about validity. Would label as "pre-pregnancy" or early pregnancy BMI - was it recorded by midwife in a standard method?

Response: Pre-pregnancy BMI was obtained from records provided by midwives within antenatal records. We have added table 1 to clarify where each of our study variables have been derived from.

- would like to see all the co-morbidities evaluated. I do not believe that the Charlson index would capture pregnancy-related co-morbidities like preeclampsia, GDM etc. The accurate assessment of co-morbidities is important to this paper because of the link of co-morbid medical and pregnancy complications and the predictor, obesity.

Response:
We feel pregnancy related co-morbidities like pre-eclampsia and GDM are not confounders but are complications on the causal pathway as to why obesity may lead to higher health care usage. We do not feel we should adjust for factors on the causal pathway.

- would identify the important co-morbidities, describe and utilize them as co-variates in all predictive

models

Response: We do not feel we should arbitrarily select conditions as this is likely to increase error caused by unmeasured confounding in conditions we may have missed. We would prefer to stick to an indexed list of co-morbidities which represented chronic conditions, conditions which can potentially lead to obesity and are not necessarily caused by obesity, thus confounders.

- please exclusions and rationale in the Methods section (fig 1)

Response: We have now updated the Methods section to state all of our exclusion criteria (to match that of Figure 1).

- results - would prefer 3 categories not just normal and ow/obese. Please provide rationale for only 2 BMI categories

Response: We decided to combine overweight and obese women into one group due to the low number of obese women (11%) in our study population. To tease out any differing effects and provide further information for our readers we included Tables 5 and 6 to demonstrate usage and cost by each BMI category.

- would like to know WHY ow/women were higher utilizers of care - is it because of the co-morbid illnesses, other reasons, like decreased ultrasound visualization leading to over monitoring? I think the paper is missing key data to assess reasons for utilization (diagnoses).

Response: In agreement we feel this is a beneficial area to explore. We are currently in the process of developing algorithms to efficiently extract this information from the routine data (due to the numerous coding requirements) and hope to publish our findings within the near future. In order to emphasise our intentions to the reader, we have inserted the following text into our conclusions ‘Future work shall investigate the reasons why overweight and obese women accrue higher rates of health service use and accompanying costs, with specific focus on the specialties accessed and timing of usage’.

- why present so many age categories? was there a hypothesis? was there an interaction between age and obesity status?

Response: In light of your comments and those provided by the other reviewer we have decided to remove table 2 as we feel it may appear slightly confusing and unnecessary given that table 3 provides the same information but in greater detail (with adjusted confounders). Table 4 has also been edited to provide further simplicity.

- t3 needs footnote with the co-variates you adjusted for

Response: Footnote has been inserted.

- cost data - would be nice to see it broken down by time period - pregnancy, delivery and post-partum. Maybe the higher cost is due to delivery complications or more c-sections. Would be helpful to see this, and also to see the c-section information adjusted for.

Response: Within our manuscript, we currently provide information regarding the percentage of use for each health service area examined whilst stating no difference in specialties accessed between the groups (please see results section ‘Health Service Utilisation’). To support your comment we have emphasised this further through adding the following text; ‘Consequently, the overweight and obese women accrued higher costs through generic use of healthcare services, not through accessing one particular area of health service’ to our conclusion section.

Regarding c-sections (available on 466 women), 20.5% of normal weight women in comparison to 26.3% of overweight/obese women had a c-section. This equated to an odds ratio of 1.38 (0.83, 2.3). As you can see this difference was not significant therefore we have not placed any importance on this finding within our paper.

- if you adjusted for utilization does cost go down?

Response: As our cost is based on HC utilisation, the cost would go down if we made the adjustment. To make clear how we calculated the total cost we have added the following information; 'Table 6 shows the mean total cost for each BMI category calculated using 1) inpatient costs 2) outpatient costs 3) cost of GP visits and 4) cost of medications prescribed by the GP'.