**Reviewer’s report**

**Title:** Outcomes of Aortic Aneurysm Surgery in England: A nationwide cohort study using Hospital Admissions Data from 2002 to 2015

**Version:** 0 **Date:** 29 Sep 2018

**Reviewer:** Christian Behrendt

**Reviewer's report:**

Thank you very much for inviting me as reviewer for the manuscript entitled "Methodology to Identify Aortic Aneurysm Activity in England from Hospital Admissions Data".

The authors have submitted a study utilizing administrative data from the UK aortic aneurysms services to measure outcomes under real-world conditions.

Inpatient data (hospital-episode statistics) from 2002 to 2015 have been used involving some 100,000 patients.

The database, methods and research topic is timely and interesting. The utilization of claims (health insurance claims and hospital episode statistics) for quality improvement and research is increasing. Harmonization of data analyses and interpretation of results is needed to increase the comparability of these type of studies.

The manuscript is well written. However, the methods and the main message should be clarified and simplified. Even though I read a lot of "data" papers, there are parts of this manuscript not easy to understand.

Furthermore, since one of the main aspects in this study is that decisions were based on the opinion of a consensus group, the set up and process of consensus finding should be clarified. To date, all working groups active in this research field have developed modified algorithms and ways to analyse claims data as it is basically described in this study.

What is different or new in this study is that the authors aim to describe a formal structured way of data usage to be followed by other groups using the same database.

Please find some comments and suggestions that might improve the readability of the manuscript.

**OVERALL/GENERAL REMARK:**

It is challenging for this reviewer to see in-document and PDF line numbers.

The authors might want to review a recently published editorial in the Eur J Vasc Endovasc Surgery considering the utilization of claims for research:

The title reads like the authors aimed to explain rationale and methods but actually this article (also) contains original research (retrospective cohort study of HES).

The title, abstract, and manuscript should be revised to follow the STROBE consensus statement. The statement should be cited or mentioned accordingly.

There are many tables with even more (interesting) information in it. However, it is not easy to understand what the authors want to present (at a first glance). If this message needs 7+1 tables and additional figures, the authors might want to re-evaluate and maybe shorten to what is really important. There are some tables that can be removed to the supplemental.

ABSTRACT:

I had some problems understanding the "stepwise approach". I understand that a clinical consensus group was consulted to discuss methodological details. The relational structure of claims-based data into hospitalisations, procedures, patients, etc. is challenging to fully understand for non-expert readers. Maybe this should be shortened or removed from the abstract and clarified in greater detail in the manuscript instead. Otherwise, the readers will be left with the question if this study contains more patient- or hospitalisation-related results? I assume by stating a linking and examining readmissions, there is patient-related data available over a longer period?

In the methods, the authors state they acquired inpatient data about AA admissions but actually they report only those cases including (invasive) AA repair?

The conclusions are partially include results not given in the abstract before (e.g., homogeneous clinical groups and outcomes).

BACKGROUND:

This section should be shortened. There are several aspects that could be removed to the methods section.

The authors might want to cite or refer to the first VASCUNET report (www.vascunet.org) on AAA repair among European and Australasian countries. This was an important driver for UK quality improvement programmes.
Line 28 Page 4: For the sake of consistency, the authors should either use "in-patient" or "inpatient".

Line 27-52 Page 4: This paragraph should be shortened and explained in greater detail in the methods section. A flow chart might help the readers to understand the UK practice and relational structure of data the authors used for this study.

Line 46-48 Page 4: The characteristics of primary versus secondary diagnoses (and their differences) should be explained in the methods section!

METHODS:
General remark: This reviewer is slightly confused if this manuscript is describing the crude methodology or a retrospective analysis or claims or both. Obviously, there are aspects making the use of the STROBE consensus statement for reporting necessary.

In its current version, the methods section is insufficiently describing the specific consensus process, the composition of experts, and the target population (ICD-10, AA repairs, AA treatments, specific procedures in OPCS etc.). Was there a former version of ICD used? Any changes during the period?!

There was/is obviously an intersection to the European Union General Data Protection Regulation. When was the personal data processed? Was there any consent of the data subjects regarding this study? This aspect should be clarified in the methods or in the paragraph considering ethics approval.

The process of code developing, cleaning data, validating data, and exploring data within the HES database is obviously important and should be clarified in greater detail!

I would strongly suggest to revise and re-structurize using outlines in the methods.
For instance, explain the patient pathway in a simple manner for non-UK readers and refer to special challenges to examine the long-term course of patients in this database.
Then you could explain the utilized codings (and changes over time) for identifying "all vascular patients", "AA conservative treatment", and "AA repair". It is challenging to just refer to an appendix without at least explaining the basic identifiers the authors used.

How did the authors identified complex repair? They should explain the stratification between infrarenal repair with long neck (no renal clamping or special endograft used) versus short neck (renal clamping or e.g., scalloped endografts etc.). Both can be infrarenal...

Why did the authors used single comorbidities (groups) instead of established classifications such as described by Elixhauser? The comparability of claims-based research would increase by using same coding-groups.

Line 18 Page 7: What is meant by "vascular specialists" in this study? Where they clinical specialists (e.g., in endovascular or open treatment of AA) or also specialists in coding practice of vascular procedures?
RESULTS:
A) Developing Case Mix Groups
It appears as if the authors just discriminated infrarenal versus complex aortic repair. I would suggest to re-evaluate that. An infrarenal AA repair can be complex (e.g., for short neck). A thoracic aortic aneurysm repair can be non-complex.

A1) Categorisation of Elective and Emergency
There can be an urgent/emergent admission without any corresponding procedure. There can also be an elective admission followed by an emergent procedure in the later course. What do the authors want to categorise? The admission mode or the procedural urgency? These are two different information.

It there also any category for urgent admissions or procedures (or are they merged into emergent)?

A2) Categorisation of ruptured aortic aneurysm
I can not fully understand the conclusion of the consensus group. They decided to interpret all AA-rupture ICD-10 codes as ruptured AA because of the overall higher mortality when compared to the intact codes? It would be quite odd if this was not the case. Furthermore, considering the large numbers, small differences would be statistically significant. The authors should weight the statistical difference against the clinical importance!

The delayed repair for a ruptured AA is quite striking. This raises the question of validity! It is probable that a ruptured code was misused for symptomatic intact AA in a proportion of patients.

A4) Identifying complex AA procedures performed by vascular specialists
Why have procedures performed by C/CT-surgeons been excluded? If there is any specific situation in UK, this should be clarified in the methods section accordingly. Which medical specialties are actually performing AA repair in the UK?

Does HES collect information regarding procedure-performing medical specialty or department requesting the reimbursement or discharging department?

A5) Identifying AA-related deaths without any repair
Are there any patients included dying from heart attack or from other reasons with AA-diagnosis within CIPS?
Have only primary or also secondary diagnoses been included here?

Are there any inpatients treated for AA to prepare a future AA repair? For instance, coronary angiography or valve repair or inpatient-diagnostics etc.? Have these cases been included here? What was actually done during these hospitalisations?

Line 41FF Page 12: The proportion of emergency admission seems to be better comparable to published real-world-data regarding proportion of ruptured AA than the rate of rAA codings.

C1) Emergency AA repair for intact and ruptured AA and AA-related deaths without definitive repair
What is meant by "definitive repair"? Is this also including attempts (where the patient died during the operation) or finalized AA repairs?

Figure 3 is not easy to understand and should be simplified. What is the key message of these trends?

How are AA-related deaths identified in the data set?

C2) Post-operative mortality
The abbreviation CIPS was already explained.

DISCUSSION
This reviewer is missing the discussion of advantages/disadvantages of claims (e.g., HES) when compared with registry data (e.g., NVR).

This study approach bases on linked (patient-related) data while other studies using HES or comparable datasets from other countries are often procedure- or hospitalisation-related. This difference could be added and discussed.

Line 15 Page 15: The group might want to state that they developed standardised methods to identify AA activity and outcomes in England but they do not describe the methodology of consensus sufficiently!
Furthermore, the outcomes are basically limited to mortality, length of hospital stay, and readmissions.

Line 17 Page 15: The stepwise approach and especially the experts (clinicians, data analysts) are not described sufficiently.

Line 22 Page 15: These pitfalls and ambiguities need to be clarified in greater detail.

Line 57 Page 15: The authors should discuss how challenges of EU General Data Privacy Regulation can affect record linkage and how this can be solved.

Line 1 Page 16: This reviewer cannot fully understand how the study results prove this.

Line 35FF Page 16: The authors might want to review and discuss the following editorials regarding limited validity of registry data:

CONCLUSIONS:
The conclusion that "many short and long-term outcomes can be analysed by linking admission... seems not to be based on this study results.
Same appears for the conclusion that HES remains an underused resource for quality assessment of AA services.
Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Unable to assess

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

No

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I recommend additional statistical review

Quality of written English
Please indicate the quality of language in the manuscript:

Acceptable

Declaration of competing interests
Please complete a declaration of competing interests, considering the following questions:

1. Have you in the past five years received reimbursements, fees, funding, or salary from an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

2. Do you hold any stocks or shares in an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

3. Do you hold or are you currently applying for any patents relating to the content of the manuscript?

4. Have you received reimbursements, fees, funding, or salary from an organization that holds or has applied for patents relating to the content of the manuscript?

5. Do you have any other financial competing interests?

6. Do you have any non-financial competing interests in relation to this paper?
If you can answer no to all of the above, write 'I declare that I have no competing interests' below. If your reply is yes to any, please give details below.

I declare that I have no competing interests

I agree to the open peer review policy of the journal. I understand that my name will be included on my report to the authors and, if the manuscript is accepted for publication, my named report including any attachments I upload will be posted on the website along with the authors' responses. I agree for my report to be made available under an Open Access Creative Commons CC-BY license (http://creativecommons.org/licenses/by/4.0/). I understand that any comments which I do not wish to be included in my named report can be included as confidential comments to the editors, which will not be published.

I agree to the open peer review policy of the journal

Do you want to get recognition for reviewing this manuscript?

Add a record of this review to Publons to track and showcase your reviewing expertise across the world’s journals. Signing up is quick, easy and free!

Yes