Reviewer's report

Title: Quality of Care and 30 day Mortality among Patients with Hip Fractures: A Nationwide Cohort Study

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Reviewer: Reijo Sund

Reviewer's report:

The authors examine associations between the quality of care and mortality among hip fracture patients. They use comprehensive nationwide data and conclude that higher quality of care was associated with lowered mortality. In principle, this seems to be a novel study on an important issue. However, I have some comments that should be considered carefully before the manuscript can be accepted for publication.

Major Compulsory Revisions

1. The introduction to the principles of quality assessment in the manuscript is very brief even though your approach deserves some explanation. It seems that you are validating your externally determined process-type quality indicators against mortality instead of assessing the quality itself. If I understood correctly, you assume that quality is something that takes place on individual-level. However, it is not likely that the quality of care would vary significantly within one provider (or team). In this sense, the fruitful quality interpretation can be achieved on provider level but not on individual level. Putting it simply: on individual level there may be reasonable clinical contraindications that override any external quality criteria. On the the provider-level, relative comparisons (of the proportion of treated patients fulfilling certain quality criterion) between the providers can be used to identify “good” and “bad” providers. Please see [Sund R, Liski A. Quality effects of operative delay on mortality in hip fracture treatment. Qual Saf Health Care 2005;14:371-77] for an example on the issue.

What I would like to see in the manuscript is justification of your approach and discussion about the point I made above.

I would also like to see an additional table that reports for each (possible anonymous) provider (hospital or some another meaningful unit) 1) the proportions of patients for whom the quality criteria were met (please include also the proportion of patients with operative delay of more than two nights), 2) the proportion of missing values for each criteria, 3) mortality, and 4) length of stay of initial hospitalization.

2. The use of 30 day mortality as an outcome may not be an adequate choice to be used with hip fractures and proxy indicators for quality. First, almost half of the perioperative deaths seem to be unavoidable (even if quality of care is excellent) [Foss NB, Kehlet H. Mortality analysis in hip fracture patients: implications for
design of future outcome trials. Br J Anaesth 2005;94:24–9.]. Second, the
treatment episode for hip fracture easily takes a long time (about four months at
the population level [Heikkinen T, Jalovaara P. Four or twelve months' follow-up
2005;94(1):59-66.] and it is not very promising for the patient if the quality effects
disappear even before discharge to home.

As you can most probably easily obtain 120 day, 180 day or one year mortality
from the register data, you should repeat the analyses for one of these longer
follow-ups.

3. There seem to be a strong potential for selection bias in the main results. You
have a paragraph of this potential problem in your discussion, but you do not
consider the time factor: Your outcome is 30 day mortality after hip fracture, but
some your quality of care measures are measured several days after the time of
fracture (or admission), which is a methodological flaw (in some cases discharge
may be even after 30 days). The exclusion of patients died during the initial
hospitalization may help, but it could be even better idea to start the actual
mortality follow-up at discharge (then you could also adjust for the length of stay
in hospital).

4. Have you adjusted for long-term care or ADL before fracture? Functional
capacity or known institutionalization status may lead to serious selection bias
towards more healthy patients (that cannot be seen in ASA-scores or Charlson
index). Please do the adjustment or discuss the issue.

5. Operative delay (more than two nights / 48h) is commonly used quality
indicator. Although the association between operative delay and mortality is
negligible (after adequate adjustments including variation of the shape of the
effect between providers), it certainly reflects quality on the provider level
(exceptionally high proportions of delayed patients is an indication that the
provider is not able to select patients who should be operated fast and who
should wait) [Sund R, Liski A. Quality effects of operative delay on mortality in hip
fracture treatment. Qual Saf Health Care 2005;14:371-77]. Please test the use of
operative delay as an quality criterion.

Minor Essential Revisions

6. Have you excluded all patients with multiple hip fractures or only the
subsequent fractures after the first (included) hip fracture?

7. The evaluation of ADL before the fracture was done after the actual fracture,
right?

8. In the first paragraph of discussion you talk about evidence-based quality of
care criteria, but in first paragraph of page 13 you characterize them as proxy
measures for processes believed to influence... Please be consistent.

**Level of interest:** An article of importance in its field
Quality of written English: Needs some language corrections before being published

Statistical review: Yes, and I have assessed the statistics in my report.

Declaration of competing interests:

I declare that I have no competing interests.