Author's response to reviews

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

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Author's response to reviews: see over
REFEREE 1

**Reviewer's report:**
I have no comments; this is an excellent manuscript and the authors have successfully responded to reviewers concerns

**Response:**
We thank the reviewer for the helpful comments and kind words regarding our manuscript.

REFEREE 2

**Reviewer's report:**
The authors have comprehensively responded to all my previous comments. Sensitivity analyses provide important evidence showing that the found associations are not random and not due to the most obvious confounding factors.

The only thing I'm a bit worried about is the presentation of only the "best" results in the abstract. For example, most likely the actual assessment of ADL before discharge is done at discharge. In that case it is easy to argue that if a patient dies during hospitalization there is "no need" for ADL assessment, which leads to overpresentation of patients who died during the 30 days in the "not met" category. For the nutritional risk assessment there should not be as strong potential bias as it is done within 2 days after admission. Based on the sensitivity analyses, this reasoning seems to be valid as the exclusion of patients who died during hospitalization changes OR from 0.28 to 0.42, but OR for nutritional risk assessment hardly changes at all (0.98 vs. 1.01). In this sense, the latter results (where patients who died during hospitalization were excluded) seem to be closer to truth (at least in the discharge-ADL case) and should be reported as main results in the abstract instead of the biased ones.

**Response:**
We agree with the reviewer that specifically for the ‘ADL before discharge’ indicator, excluding patients who died before discharge is a crucial sensitivity analysis, which is also done specifically for this indicator in the Danish National Indicator Project (DNIP) annual report. In the revised abstract, page 2, we have now reported the ‘ADL before discharge’ estimate excluding deaths during hospitalization, as suggested. For the other indicators, we would argue that they are either meant to be recorded for all patients early during admission (early assessment of the patient’s nutritional risk, assessment of ADL before the fracture), or hold the possibility to exclude patients as non-eligible (systematic pain assessment, prevention of future osteoporotic fractures).

Another small but interesting addition would be to include the estimated number of "avoidable" deaths, i.e. to report how many lives would have been saved if the
quality of treatment had been "optimal".

Response:
We agree that the concept of excess number of deaths is principally interesting. However, we observed substantial confounding associated with ‘optimal treatment’ (i.e. fulfilment of all quality of care criteria) in our regression model. This model provided adjusted relative mortality estimates. Because of confounding, reporting the crude excess number of deaths associated with sub-optimal treatment appears less compelling. We consider calculation of confounder-adjusted excess number of deaths, for example based on standardized mortality rates or other statistical techniques, is outside the scope of our paper.

Finally, a bit deeper speculation/discussion of possible causal mechanisms between the examined factors and short-term mortality could strengthen the manuscript.

Response:
We agree and have added more comments and references on this issue in the Discussion section, page 13.

We already stressed that assessment of ADL before the fracture and again before discharge cannot per se reduce mortality; however, assessment may promote adequate mobilization and rehabilitation, eventually leading to an improved prognosis. Similarly, it is known that poor nutritional status is associated with increased length of stay (van Hoang H et al, J Nutr Health Aging 1998) and mortality (Bastow MD et al, BMJ 1983) following hip fracture. Supplementary food intake may decrease mortality (Bastow MD et al, BMJ 1983), and assessment of the patient’s nutritional risk forms the basis for nutritional therapy. There is similarly good evidence that undertreated postoperative pain contributes to increased length of stay and enhanced recovery after hip fracture (Feldt KS et al, Orthop Nurs 2009; Morrison RS et al, Pain 2003; Arinzon Z et al, Disabil Rehabil 2007). Again, systematic pain assessment forms the basis for improved pain control (Arinzon Z et al, Disabil Rehabil 2007). Finally, there is increased risk of early subsequent hip fracture after a first hip fracture (Klotzbuecher CM et al, J Bone Miner Res 2000). Anti-osteoporotic treatment such as calcium and vitamin D supplementation may decrease future hip fracture risk (Jackson RD et al, NEJM 2006) and be associated with other beneficial effects in these patients such as reduced infection risk (Zasloff M, Nat Med 2006).