Author's response to reviews

Title: Does the introduction of an intermediate care hospital in a municipality influence health care utilization among elderly patients? A retrospective comparative cohort study

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Author's response to reviews: see over
To the editors

Thank you for the thorough reviews and the opportunity to re-submit the paper. The paper is revised according to the reviewers’ comments and our responses are outlined below.

We have made changes to improve the article according to the reviewers’ helpful comments. Specifically, we have conducted a pooled analysis for the years 2008-2011 to replace the four previous single year presentations in order to make the message clearer. We have also clarified variables, covariates, missing values, rehabilitation, mortality, and also extended the discussion about the services offered by primary health care.

Our changes are highlighted using the “track changes” mode in Word, with the exception of the new figures (Fig 4, 5 and 7) and tables for the pooled analysis (Tab 4 and 5).

Referee 1:

Major compulsory revisions

1. How was the length of stay in the ICH handled: was it a part of the “index hospitalization” LOS, and was it part of the accumulated hospitalization during follow-up?

The ICH is organized by the municipality; not by the hospital. Previously we only included a sentence saying that the ICH stays were added to the primary health care services for the ICHM (in the Methods section under “Samples and data collection”, Sample 3). Now we have specified more clearly that the ICH stays were handled as institutional stays as a part of the primary health care given in the ICHM several places in the manuscript:

- Methods section, last paragraph under Setting: “The proportion of available institutional care beds for inhabitants in the ICHM aged 60+ was 1.5% (including the ICH), while it was 3.4% in the CM (2012).”
- Results section, second paragraph under Use of primary health care services after hospital discharge: “The CM offered in average 12.7 more days in institutional care in the year after hospital discharge than the ICHM (days in ICH included) (p < 0.001).”
- Discussion section, first paragraph under Primary health care utilization: “The utilization of short-term institutional stays after hospitalization was similar in the municipalities (including ICH stays in the ICHM), …”

2. It is unclear what exactly is included in the outcome measure “hour-based use of primary care services”. If the care in the ICH was considered part of this outcome measure, it skews the whole issue: a cost-shift of care days from the
hospital to ICH should not be reported as a desired result. Also, it is unclear how the authors handled the study subjects who had no “hour-based use of primary care services”. This is especially relevant, as one of the determinants (functional status) was only available for patients who did.

Care in the ICH was counted as days, not hour-based. We have added information to specify what is included in “hour-based primary health care services” to the Methods section, last paragraph under Study variables: “The variable hour-based primary health care services includes home care nursing, practical assistance at home, day center visits, and other types of support to persons living at home.”

The subgroup “primary health care group” consists of patients who had received primary health care services (including the ICH) during one year after discharge from the medical or surgical department in the local general hospital. The Regional Committee for Medical Research Ethics required that data on the use of primary health care was not linked to the use of hospital services on an individual level. Accordingly, the data of the cohort (patients admitted to the local general hospital) and the subgroup are reported separately. We have added this information to the Methods section, the last paragraph under Samples and data collection.

Functional status is measured routinely for persons who request or are in need of any primary health care services (hour-based and/or institutional primary health care) in all the municipalities in Norway. There are no such routine measures for hospitalized patients. Therefore, the functional status is not a variable in the cohort (patients admitted to the local general hospital). For some of the patients in the subgroup (those receiving primary health care after hospitalization) ADL scores were not measured and thus, the functional status was missing. These missing values were replaced. See response #4.

3. How were deaths among the study cohorts (during the follow-up year) handled? how did they reflect on the outcome measurements?

We did not get the permission to link deaths to each single patient in the cohort and subgroup (see response #2 about the Regional Committee for Medical Research Ethics). As we do not have information on death on an individual level, we were not able to censor for death in the analysis, i.e. death did not reflect on other outcome measurements.

To remedy this to some extent, we have collected deaths each year for all men and women aged 60 years and older from the two municipalities (2005-2012) from publically available data and presented these as standardized mortality rates. Due to the changes to simplify the presentation of the results (see response to comment #6), we have deleted the previous Table 1 (where the mortality rates were presented) and replaced this with a new figure (Figure 7). See last paragraph in the Results section.

4. What basis was there for the imputations of missing ADL scores? It is reasonable to suspect that a missing ADL score might be correlated with the health state of a person, and the proportion of patients with such a missing score
is not negligible, and possibly different between the study groups.

We have revised the Methods, Analysis section to clarify the missing ADL scores. The first paragraph now reads:

“Due to lack of registration in the municipalities, the ADL scores were missing for 36 patients in the subgroup who had received primary health care services (1.3% the ICHM and 1.5% in CM). The missing values were replaced by the weighted mean functional status of the subgroup receiving primary health care each year (ICHM: 2.2 in 2008, 2010 and 2011 and 2.3 in 2009. CM: 2.0 in 2008 and 2.3 in 2009-2011).”

For patients discharged from the general hospital to the ICH-stays, and without need for primary health care services, the ADL scores were missing. We agree that persons in the subgroup with only ICH stays (with no other primary health care services during one year follow-up) might have a different health state than those receiving primary health care services. Therefore, we conducted a particular calculation for these patients. This is described below and also added to the Methods, Analysis section, in the second paragraph:

“The ADL variables were not measured for 10.6% (157 patients) from the ICHM because these patients received only intermediate care and no other primary health care services. The missing values for this group were replaced by the average of the ADL scores for 36 individuals who were part of another study that investigated a population that was included in and partially overlapped with the subgroup in this study. The 36 individuals were also discharged from the local general hospital to intermediate care and did not receive other primary health care services during one year follow-up. Their ADLs were measured at discharge from the ICH and 3 and 6 months after index hospital discharge. The average functional status for the three points of time was calculated to 1.36. Replacing the missing values (in the subgroup of patients with only ICH) with 1.36 resulted in a decrease of the weighted mean functional status of 0.1 (i.e. increased functionality) for the ICHM-patients in the subgroup in 2009 - 2011 (Table 3). As a sensitivity analysis, functional status scores of 1 and 2 were also tested. These values caused only small changes (data not shown); meaning that the overall difference in use of primary health care services remained the same.”

5. It is unclear what exactly the procedure for the ANCOVA analyses was, how the authors decided on the covariates to be used, and what the effects of the covariates in the final models were.

In the Methods section under Study variables (in the first paragraph) we have added more about the reason for the chosen covariates:

“Patient characteristics are predictors of use of health care services. Therefore, age and gender were included as adjustment variables, as were diagnosis-related group (DRG) weight during the index stay (in the cohort) and functional status (in the subgroup). Additionally, the analyses were adjusted for year in consideration of time effect. The DRG weight indicates the amount of hospital resources required to treat the patients within a DRG category, and was used as a proxy for the complexity of disease. Functional status represents each person’s care needs and was calculated as a weighted mean value of 17 activities of daily living (ADL) variables that were measured during the follow-up year. The ADL variables were routinely
recorded by the primary health care staff using a five-point scale [36]; this is elaborated in Table 1.

The effects of the covariates in the final model were included in the Methods section under Analysis (in the last paragraph):

“Only minor differences between crude and adjusted estimates for all outcome variables regarding the use of general hospital were observed. For primary health care use, the adjustments increased the estimated outcomes in the ICHM while the opposite occurred in the CM.”

To inform the readers of the effects of the covariates in the final models, we have presented both the crude and adjusted values in the tables (Table 4 and 5).

6. It is unclear why, in all the tables and figures, the data are reported separately for each year, but the year is not included in the ANCOVA analyses. Also, the presentation of the results separately for each year confuses the reader. Either there is a time effect (such as the decrease in average LOS), in which case time should be a (possibly categorical) covariate, or there is none, in which case no adjustment for time is needed. And in both cases, a pooled analysis would keep the message clearer.

We agree with the reviewer, that the presentation of the results separately for each follow-up year gives an unnecessary level of detail. We have therefore revised Table 4 and 5, changed the presentation of the results and only reported on the pooled analysis for the cohort and the subgroup. We included year as a categorical covariate in the ANCOVA (see also the Methods, the last paragraph in under Analysis).

To give the reader an overview of the yearly changes, we have added two new figures (Figure 4 and 5) to show the distribution of the main outcomes from the index years 2008 to 2011. The Results section is also rewritten in accordance with the pooled analysis (i.e. under the subtitles: Readmissions to the local general hospital, Use of the local general hospital, Use of primary health care services after hospital discharge).

7. The article is lengthy and includes large amounts of irrelevant data, especially the demographics in Table 1. This information is not used in the analyses, and does not add to the questions asked. Suggest deletion.

Table 1 is deleted.

Discretionary Revisions

8. The issue of unwanted effects of the ICH is only discussed in relation to mortality, readmissions and primary care use. As the actual survival of the study subjects was not analyzed, mortality is a substitute, but not a very good one. The
rationale for choosing only these unwanted effects for discussion should be specified.

The discussion are now focused on readmission, LOS and primary health care use as these were the focus of the aim of the study. In the revised article we have added more to the discussion of primary health care utilization.

See also response to comment #3.

9. The differences between the ICHM and CM in the functional status and long-term care is reported but not discussed. There is no discussion on whether the differences observed in the study (e.g. in the amount of primary care) is related to the population-level differences reported in Figure 4. I suggest a clarification of this issue in the discussion.

To elaborate on this, we added more information about a separate analysis we did to investigate this. The information is given in the Discussion section, Primary health care utilization, which now reads:

“The utilization of short-term institutional stays after hospitalization was similar in the municipalities when including ICH stays in the ICHM, whereas the differences between the municipalities in long-term stays and hour-based care were significant. As this might be due to differences in the inhabitants’ functional status (worse functional status indicates need for institutional care), we did a supplementary analysis comparing functional status adjusted for age and gender each year. Functional status was the same except for 2011 where it was worse (i.e. higher value) in the CM (2.27 vs 2.11, p = 0.020). Hence, it seems reasonable to explain the observed differences in use of hour-based and institutional stays in primary health care by different local health politics and not by minor differences in functional status. Using hour-based services to enable elderly people to stay in their own homes as long as possible is in accordance with the current health policy in Norway [2]. Furthermore, the difference in use of institutional care may be dependent on the available institutional care beds which are considerable higher in the CM (1.5% for inhabitants in the ICHM aged 60+ compared to 3.4% in the CM).

The utilization of primary health care services in both municipalities remained fairly constant throughout the study period. Due to this stable pattern of utilization, it is likely that the ICH had a minor impact on the use of primary health care services during the follow-up years.”

Referee 2:

Major Compulsory Revisions:

1) The paper should describe the activities in the studied general hospital, notably the existence of rehabilitation units. For instance, if there is a rehabilitation unit in the general hospital, one could easily imagine that elderly from ICHM are
discharged to the ICH where they can get rehabilitation services from ambulatory physiotherapists, whereas elderly from CM stay in hospital in the rehabilitation unit; therefore, hospital stays for elderly from CM are longer than those for people from ICHM.

The medical and surgical department in the general hospital accounted for 96-98% of all inpatient admissions in the current age-group between 2008 and 2011. In addition to these departments, there is a 15-bed rehabilitation department and a gynecological department at the general hospital.

We added that the general hospital has rehabilitation and gynecological departments in the Methods section, second paragraph under Setting. Under Samples and data collection we added: “During the patients’ follow-up year, all subsequent in-patient admissions to this hospital were also registered (this included the rehabilitation and gynecological departments).”

However, we have not gone into greater detail on the rehabilitation department in the article. To substantiate this, we have here added some more information for the reviewers/editors regarding equal availability and use of the rehabilitation department in the general hospital for both municipalities:

After a stay in the medical or surgical department, patients both from the CM and the ICHM might be transferred to the rehabilitation department in the general hospital. The rehabilitation stays are targeted at patients who are in need of complex specialized hospital rehabilitation offered by a multidisciplinary team of medical specialists in addition to a care team. These stays are not comparable to stays at the ICH which is staffed with a general practitioner during weekdays and a multidisciplinary care team (mainly nurses in addition to physiotherapists and occupational therapists). Furthermore, direct transfers from the surgical department to the rehabilitation department are unusual while direct transfers from the medical department might happen, e.g. for patients with complex conditions after stroke. The stays at the rehabilitation department are also often much longer than at the medical department, and the index hospital stay might be attributed to the rehabilitation department and thus not included in cohort of this study.

**Minor Essential Revisions:**

1) Line 201: the sentence is not totally clear and we don't understand what authors mean by "used to allow for valid comparisons"

The sentence in the Methods section, third paragraph under Analysis is rewritten to: “The analyses were age and gender standardized using the direct method.”

2) Table 1: this level of detail in data is not useful at all and it would ease the lecture of this paper by showing either a figure instead or a less detailed table.

Table 1 is deleted.

**Discretionary Revisions:**

1) The paper should have included data from the University hospital, since the relative rate of admissions in this hospital is quite different between ICHM and
We agree with the reviewer that the data from the University Hospital should have been included in the ANCOVA, but due to lack of permission from The Regional Committee for Medical Research Ethics we did not have access to link the data from the general hospital to the University Hospital on an individual level.

2) The discussion should have questioned more the transferability of the results of this study in other municipalities in Norway.

We have added the following to the Strength and limitations in the Discussion section (in the second paragraph):

“The generalizability of the findings to other municipalities in Norway depends on the local circumstances. However, we believe that the results of this study can be generalized to similar municipalities in Norway and to other similar settings.”

3) A more precise description of available primary care services in each municipality would have helped for understanding why ICH didn't influence their use.

In the Methods section, last paragraph under Setting we have added:

“The proportion of available institutional care beds for inhabitants in the ICHM aged 60+ was 1.5% (including the ICH), while it was 3.4% in the CM (2012).”

We also added more to the Discussion section about Primary health care utilization. See the response to referee 1 #9.