

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Reinventing the community hospital: A retrospective population-based cohort study of a natural experiment using register data
AUTHORS	Swanson, Jayson; Hagen, Terje

VERSION 1 - REVIEW

REVIEWER	John Gladman University of Nottingham UK
REVIEW RETURNED	03-Aug-2016

GENERAL COMMENTS	<p>My first comment is that I am not a statistician and, although the descriptions make sense to me I would not be qualified to give a statistical opinion. However, I found the report understandable and believable. I agree that the findings here are unique and valuable.</p> <p>Most of my comments are minor such as :</p> <p>Abstract I would just adjust the final sentence to "this form of intermediate care" rather than "intermediate care" because intermediate care comprises a range of services both home and bed based, and for admission avoidance and expediting discharge, and this study refers solely to bed based admission avoidance.</p> <p>Discussion: Principal not principle, and complementary not complimentary.</p> <p>However, I have one issue that might be raised in the Discussion. This is that the study was unable to record the number of admissions to MEUs, and so described the changes observed in (other) hospitals. So a question must be what effect an increased supply of beds did to the total number of admissions (hospital and MEU): was there a simple displacement from one setting to another? One might have expected an increased supply of beds to have led to an increased use of beds overall. This leads to a related conjecture, which is what the overall effect of MEUs is upon the total costs of health care. I do not think the study can answer this, but its conclusion makes reference to the Norwegian government's aim to "ultimately more cost effective~" healthcare, and there is just a hint that this study implies that this is the case. I would argue that the study seems to show that the development of MEUs reduces the number of (other) admissions , and that the next steps are to establish whether doing so is equally or more effective, and whether it is value for money. The reason to have this level of critical review is that although community hospitals in the NHS are currently in favour, it was not long ago that they were seen as facilities that</p>
-------------------------	--

	increased the amount of bed based care in a population, and were considered as expensive, inefficient and poor use of estates. To my knowledge, it is still not clear if community hospitals really are good value for money and it would be wise to remember this equipoise, even although political fashions change. This issue can probably be dealt with by a minor change to the final section. This is not to weaken the study's findings: hospitals are full and under increasing demand, so having an alternative that has this effect is welcome at a policy level given that currently the worldview is not to meet demand for acute hospitals by investing in and expanding them.
--	--

REVIEWER	Bronagh Walsh University of Southampton, UK
REVIEW RETURNED	17-Aug-2016

GENERAL COMMENTS	<p>This paper is a useful addition to the literature on intermediate care, particularly in relation to step-up care. The paper could be clearer in describing the rationale for the analyses, the outcomes of interest and the presentation of tables. The limitations and discussion could provide further exploration of the implications, especially of statistical versus clinical/organizational significance.</p> <p>Specific comments are as follows:</p> <ol style="list-style-type: none"> 1. p2: In the abstract, it would be useful to clarify if hospital admissions are all secondary care, acute medical or unplanned admissions 2. p3, line 17-18: Expand on the nature of the bias that may have occurred 3. p4, line 37-42: You note the health problems that were expected in typical MEU patients. It would be useful if the actual health problems were presented in the descriptive statistics so that the reader can determine if the units were operating as expected. 4. p5, line 32-41: Either here or in the descriptive statistics, it would be useful to provide summary data on the total number of admission episodes or patients included in the analysis. Without this information the percentages presented later are difficult to interpret. 5. P6, line 19: Please expand on what the 'estimated effects' related to – is this unplanned admission, medical acute admission, any admission? Identification of dependent and independent variables needs to be clearer. 6. p6, line 29-47: This paragraph about definition of the MEU access variable should clarify that the MEU access variable was the main predictor variable of interest 7. p8, line 8-15: This paragraph might be better discussed in the limitations/discussion section 8. p8, line 19-20: Please expand on how the models were weighted by population – was this via standardizing to rates per 1000 population? 9. p8, 46-50: Please expand on the rationale for this here – it does not become evident until later in the paper 10. p9, Descriptive statistics: Total number of admissions and total population during the study period should be included 11. p9, Figure 1: Should MAU read MEU? 12. p9, line 39: please be consistent in terms used – covariates, dependent or independent variables, demand variables are all used, but it is not always clear what the dependent variables are 13. p9, line 44-46: Please explain the rationale for log-transformation of the variables and consider if tables need to contain log
-------------------------	---

	<p>transformed data in addition to the original data – the tables are rather dense and this may not aid clarity</p> <p>14. p9, Table 1: Please provide more detail in the title of the table so that it is clear what data are being presented (for all tables)</p> <p>15. p11, line 7-14: The sentence about death rates needs to be rephrased to clarify what, if any, causal relationship is likely</p> <p>16. p11, Table 3: Expand the title to indicate how hospital admissions are being expressed in this table.</p> <p>17. p12, line 7-14: Do these results for type of MEU apply to the whole population or just the population aged 80+?</p> <p>18. p12, Table 4: Again, please clarify what data are being presented in the table – are these rates/1000? This will help the reader to place these findings in context</p> <p>19. p13, line 21: Should be 'principal' not 'principle'</p> <p>20. p13, line 25: Rather than presenting the reduction in admissions as a percentage it might be more useful to present reduction in rate/1000, especially in the absence of data on the total numbers or population size – this applies to all the discussion and presentation of admission data</p> <p>21. p13, line 28-37: These sentences are not clear</p> <p>22. p13, line 46-48: It is difficult to determine given the presentation of the data (ie lack of clarity on total sample size and what is presented in the models), but is it possible that variability is a reflection of relatively wide Cis and low event rates so that results are not stable?</p> <p>23. p14, line 10: You note substitution effects within the host organization, with no increase in capacity. This makes your statement that the expansion of care capacity reduces burden on hospital admissions questionable – your findings suggest that, for host organisations, the burden is simply moved elsewhere. With no net benefit for the host organization, is this a viable model? Further discussion of this would have been useful.</p> <p>24. p14, line 46-50: You correctly note that this analysis has demonstrated statistically significant findings, but it would also be useful to provide some discussion of the likely clinical or economic significance. This will be dependent on population size, admission rates within the population, relative costs of the different care models and the extent of service substitution.</p> <p>25. p15, line 49-54: This analysis does not demonstrate likely gains in cost effectiveness because the assumption that intermediate care is cheaper is untested. Please clarify this in the text. Our experience with post-acute intermediate care indicates that service substitution and higher than expected costs result in no net savings (Walsh et al. BMJ 2005).</p>
--	---

REVIEWER	Barbara Languard Orban, Ph.D. University of South Florida United States
REVIEW RETURNED	20-Aug-2016

GENERAL COMMENTS	<p>While the effectiveness of MEUs in reducing hospital admissions is important, suggestions to improve the manuscript are provided below.</p> <p>The manuscript's title should be more specific to the study conducted, for example: The Association of Municipal Emergency Bed Units (MEUs) with Reducing Hospital Admissions.</p>
-------------------------	--

	<p>The Abstract overstates the conclusion by stating a “significant reduction for the population as a whole.” Since the confidence interval includes 0, this seems an overstated conclusion. The beginning of the Discussion section provides a better summary of the conclusions, which could be included in the Abstract. Also, the Abstract should conclude that further study is indicated since the study design did not integrate the number of MEU patients.</p> <p>In the Strengths and Limitations section, a limitation should be noted that “the number and composition of patients in MEUs are currently unknown,” which is reported in the Analysis section on page 7. Thus, the study considers the presence of an MEU in the absence of MEU patient volume relative to reducing hospital admissions.</p> <p>The Methods section begins by stating psychiatric hospitals were excluded. Were other types of specialty hospitals excluded?</p> <p>The death rate is included as a measure of demand for services; however, a rationale is missing for why death rate is an indicator of demand for services. Also, is this the population death rate or the hospital mortality rate?</p> <p>It is not clear that any time trend in hospital admissions is accounted for. In the Analysis, the Month is reported as included, but it appears there is no interaction variable between month and before/after MEU implementation. It would be useful to integrate the time trend of acute hospital admissions prior to MEU implementation.</p> <p>In two places, Figure 1 refers to MAU instead of MEU.</p>
--	--

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
 Reviewer Name: John Gladman
 Institution and Country: University of Nottingham, UK
 Competing Interests: None declared

My first comment is that I am not a statistician and, although the descriptions make sense to me I would not be qualified to give a statistical opinion. However, I found the report understandable and believable. I agree that the findings here are unique and valuable. Most of my comments are minor such as:

Abstract

I would just adjust the final sentence to "this form of intermediate care" rather than "intermediate care" because intermediate care comprises a range of services both home and bed based, and for admission avoidance and expediting discharge, and this study refers solely to bed based admission avoidance.

Response: The suggestion was noted and the change applied

Discussion:

Principal not principle, and complementary not complimentary.

Response: These spelling errors were corrected

However, I have one issue that might be raised in the Discussion. This is that the study was unable to record the number of admissions to MEUs, and so described the changes observed in (other) hospitals. So a question must be what effect an increased supply of beds did to the total number of admissions (hospital and MEU): was there a simple displacement from one setting to another? One might have expected an increased supply of beds to have led to an increased use of beds overall. This leads to a related conjecture, which is what the overall effect of MEUs is upon the total costs of health care. I do not think the study can answer this, but its conclusion makes reference to the Norwegian government's aim to "ultimately more cost effective~" healthcare, and there is just a hint that this study implies that this is the case. I would argue that the study seems to show that the development of MEUs reduces the number of (other) admissions, and that the next steps are to establish whether doing so is equally or more effective, and whether it is value for money. The reason to have this level of critical review is that although community hospitals in the NHS are currently in favour, it was not long ago that they were seen as facilities that increased the amount of bed based care in a population, and were considered as expensive, inefficient and poor use of estates. To my knowledge, it is still not clear if community hospitals really are good value for money and it would be wise to remember this equipoise, even although political fashions change. This issue can probably be dealt with by a minor change to the final section. This is not to weaken the study's findings: hospitals are full and under increasing demand, so having an alternative that has this effect is welcome at a policy level given that currently the worldview is not to meet demand for acute hospitals by investing in and expanding them.

Response: We agree to this comment. Both a closer look into the total number of bed days and the cost effectiveness of being treated at MEUs and hospitals, respectively, are needed. We have now underlined these questions in the conclusion.

Reviewer: 2

Reviewer Name: Bronagh Walsh

Institution and Country: University of Southampton, UK

Competing Interests: None declared

This paper is a useful addition to the literature on intermediate care, particularly in relation to step-up care. The paper could be clearer in describing the rationale for the analyses, the outcomes of interest and the presentation of tables. The limitations and discussion could provide further exploration of the implications, especially of statistical versus clinical/organizational significance.

Response: We hope we have made changes that can satisfy the reviewer. In the limitation section of the discussion we have now discussed more in details the problems of self-selection and generalizability. For comments to the other elements in the statement, see further comments below.

Specific comments are as follows:

1. p2: In the abstract, it would be useful to clarify if hospital admissions are all secondary care, acute medical or unplanned admissions

Response: Changes were made to make the type of admissions analysed more explicit.

2. p3, line 17-18: Expand on the nature of the bias that may have occurred

Response: We agree that the limitations should be presented in detail. We have now added detail to the main body of the paper

3. p4, line 37-42: You note the health problems that were expected in typical MEU patients. It would be useful if the actual health problems were presented in the descriptive statistics so that the reader can determine if the units were operating as expected.

Response: We agree that this would have been useful. However, currently no national statistics for the MEU population exists. Statistics based on specific MEUs indicate that the patient population is in line with what was expected. We will however not conclude on the bases of these figures. No changes are therefore done.

4. p5, line 32-41: Either here or in the descriptive statistics, it would be useful to provide summary data on the total number of admission episodes or patients included in the analysis. Without this information the percentages presented later are difficult to interpret.

Response: We have provided information of the total number of admissions for the entire population and for the subgroups in the first paragraph of the methods section, sub-heading 'data and study population'

5. P6, line 19: Please expand on what the 'estimated effects' related to – is this unplanned admission, medical acute admission, any admission? Identification of dependent and independent variables needs to be clearer.

Response: We have carefully read the text and adjusted the text a few places where ambiguities existed.

6. p6, line 29-47: This paragraph about definition of the MEU access variable should clarify that the MEU access variable was the main predictor variable of interest

Response: This clarification has been made

7. p8, line 8-15: This paragraph might be better discussed in the limitations/discussion section

Response: We have expanded the limitation section as stated above

8. p8, line 19-20: Please expand on how the models were weighted by population – was this via standardizing to rates per 1000 population?

Response: We first normalize the variables, for example admissions, by number of inhabitants per municipalities. This gives us standardized admission rates at the municipal level. A problem when we run regressions on Norwegian municipal data is that there are many small municipalities. In an unweighted regression the effect from the smaller municipalities will dominate the effects of the bigger municipalities and consequently lead to results not representative to the population (but representative to the municipalities). Weighting each observation by the size of the population (population weights) will make the results representative for the population. We have now presented this more carefully in the text

9. p8, 46-50: Please expand on the rationale for this here – it does not become evident until later in the paper

Response: We have expanded the description at this point.

10. p9, Descriptive statistics: Total number of admissions and total population during the study period

should be included

Response: We have included these figures at the beginning of the methods section

11. p9, Figure 1: Should MAU read MEU?

Response: This has been indirectly corrected now that the term MAU is being used.

12. p9, line 39: please be consistent in terms used – covariates, dependent or independent variables, demand variables are all used, but it is not always clear what the dependent variables are

Response: The terms covariates were changed to independent variables

13. p9, line 44-46: Please explain the rationale for log-transformation of the variables and consider if tables need to contain log transformed data in addition to the original data – the tables are rather dense and this may not aid clarity

Response: Log-transformation gives us the effects in percentage directly. Another argument is that log-transformation imposes a more flexible form of the variable. Please note that descriptive statistics are already included in table 1 and 2.

14. p9, Table 1: Please provide more detail in the title of the table so that it is clear what data are being presented (for all tables)

Response: We have expanded the titles for each of the tables

15. p11, line 7-14: The sentence about death rates needs to be rephrased to clarify what, if any, causal relationship is likely

Response: The information here has been updated with information taken from Table 3

16. p11, Table 3: Expand the title to indicate how hospital admissions are being expressed in this table.

Response: This table title, along with the other table titles, has been expanded to be more explanatory

17. p12, line 7-14: Do these results for type of MEU apply to the whole population or just the population aged 80+?

Response: This has been expanded upon, clarified and adjusted to reflect the new information in the new Table 4

18. p12, Table 4: Again, please clarify what data are being presented in the table – are these rates/1000? This will help the reader to place these findings in context

Response: We have clarified that this is estimates from the regression models

19. p13, line 21: Should be 'principal' not 'principle'

Response: This has been noted and fixed

20. p13, line 25: Rather than presenting the reduction in admissions as a percentage it might be more useful to present reduction in rate/1000, especially in the absence of data on the total numbers or population size – this applies to all the discussion and presentation of admission data

Response: Since we now have included the figures on number of patients, we have kept the results in percentages.

21. p13, line 28-37: These sentences are not clear

Response: We have clarified the main results

22. p13, line 46-48: It is difficult to determine given the presentation of the data (ie lack of clarity on total sample size and what is presented in the models), but is it possible that variability is a reflection of relatively wide Cis and low event rates so that results are not stable?

Response: We have discussed these effects more carefully in the discussion section.

23. p14, line 10: You note substitution effects within the host organization, with no increase in capacity. This makes your statement that the expansion of care capacity reduces burden on hospital admissions questionable – your findings suggest that, for host organisations, the burden is simply moved elsewhere. With no net benefit for the host organization, is this a viable model? Further discussion of this would have been useful.

Response: We agree that this is a puzzling result and have elaborated on this finding and adjusted the text in the discussion. We have also removed the sentence referring to the expansion being responsible for a reduction in burden.

24. p14, line 46-50: You correctly note that this analysis has demonstrated statistically significant findings, but it would also be useful to provide some discussion of the likely clinical or economic significance. This will be dependent on population size, admission rates within the population, relative costs of the different care models and the extent of service substitution.

Response: We agree and recommend further analyses. In particular analyses of the patient population at MEU level and of the cost effectiveness of the MEUs would be valuable

25. p15, line 49-54: This analysis does not demonstrate likely gains in cost effectiveness because the assumption that intermediate care is cheaper is untested. Please clarify this in the text. Our experience with post-acute intermediate care indicates that service substitution and higher than expected costs result in no net savings (Walsh et al. BMJ 2005).

Response: We understand the reviewers concerns here and agree, but the cost effective solutions is a reference to the goals of the coordination reform which we are reiterating from before. Here we don't make the assertion that this is a cost effective alternative but rather go on to say that there are important gains in reducing hospital admissions. We then go on to say, in the next paragraph, that further examination of cost effectiveness would add value to determining the overall success of implementing these services.

Reviewer: 3

Reviewer Name: Barbara Languard Orban, Ph.D.

Institution and Country: University of South Florida, United States

Competing Interests: None declared

While the effectiveness of MEUs in reducing hospital admissions is important, suggestions to improve the manuscript are provided below.

The manuscript's title should be more specific to the study conducted, for example: The Association of Municipal Emergency Bed Units (MEUs) with Reducing Hospital Admissions.

Response: After consideration of the reviewers' suggestion, we have decided that the current title is appropriate.

The Abstract overstates the conclusion by stating a "significant reduction for the population as a whole." Since the confidence interval includes 0, this seems an overstated conclusion. The beginning of the Discussion section provides a better summary of the conclusions, which could be included in the Abstract.

Response: The confidence interval goes to 0 due to rounding the values and we didn't include more digits to stay consistent with other values reported. The values should actually be -0.0% not 0.0%. The p-value is also valid. We have corrected the lack of a negative sign.

Also, the Abstract should conclude that further study is indicated since the study design did not integrate the number of MEU patients.

Response: Further study suggestions were added to the conclusion section of the abstract

In the Strengths and Limitations section, a limitation should be noted that "the number and composition of patients in MEUs are currently unknown," which is reported in the Analysis section on page 7. Thus, the study considers the presence of an MEU in the absence of MEU patient volume relative to reducing hospital admissions.

Response: Additional information about the limitation of the unknown MEU patient data was added to the middle of the strengths and weaknesses section.

The Methods section begins by stating psychiatric hospitals were excluded. Were other types of specialty hospitals excluded?

Response: Norwegian hospital data is often divided into somatic and psychiatric. Therefore this distinction references all other hospitals which aren't classified as psychiatric

The death rate is included as a measure of demand for services; however, a rationale is missing for why death rate is an indicator a demand for services. Also, is this the population death rate or the hospital mortality rate?

Response: Information was added to distinguish what type of death data was used. An additional is that this references the general approach from the works cited #10-12; The more people that die (particularly elderly, which is usually the vast majority in developed societies) one would assume there is a decreased need for elderly health services or less burden on the system with less people if there is a negative effect or alternatively if there is a positive correlation then it could reflecting higher use of hospitals at life's end (which is stated in the paper in the discussion).

It is not clear that any time trend in hospital admissions is accounted for. In the Analysis, the Month is reported as included, but it appears there is no interaction variable between month and before/after MEU implementation. It would be useful to integrate the time trend of acute hospital admissions prior to MEU implementation.

Response: We have experimented with time trend and that does not change the results.

In two places, Figure 1 refers to MAU instead of MEU.

Response: This has been indirectly corrected now that the term MAU is being used.

VERSION 2 – REVIEW

REVIEWER	Bronagh Walsh University of Southampton, UK
REVIEW RETURNED	24-Oct-2016

GENERAL COMMENTS	Most of the points raised have now been clarified. I still feel that the reason for inclusion of mortality rate as an independent variable is unclear. In the discussion, it becomes evident that this relates to increased hospital use in the final year of life. This could be made clearer in the methods.
-------------------------	--

REVIEWER	Barbara Langland Orban University of South Florida Tampa, Florida United States
REVIEW RETURNED	24-Oct-2016

GENERAL COMMENTS	<p>While the authors addressed most suggestions, the following are pending decisions by the editor.</p> <p>The authors' elected to retain their original manuscript title. The title is vague and does not reference either Municipal Acute Bed Units or reducing hospital admission rates, which is the focus of the analysis.</p> <p>The prior concern was the confidence interval includes 0 in the Abstract. The authors changed this to -0, and explained, as follows: "The confidence interval goes to 0 due to rounding the values and we didn't include more digits to stay consistent with other values reported. The values should actually be -0.0% not 0.0%. The p-value is also valid. We have corrected the lack of a negative sign."</p> <p>This does not address the concern. Further, -0 is not an actual number. To avoid confusion, the p-value would be better to use in the Abstract, especially since the confidence interval for the "80 years of age and above" model ranges from a negative to positive number.</p> <p>On page 5, "800 thousand" should be changed to 800,000.</p> <p>On page 12, the authors wrote "A 1% increase in the death rate increased the number of total admissions by 0.05% (P<0.01)..." The word "increased" should be changed to "was associated with" as the model does not allow for determining cause and effect. This change is also indicated in a later sentence in the same paragraph.</p> <p>The additions on pages 13 and 14 should describe the results using</p>
-------------------------	--

past tense.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 2

Reviewer Name: Bronagh Walsh

Institution and Country: University of Southampton, UK

Competing Interests: None declared

Most of the points raised have now been clarified. I still feel that the reason for inclusion of mortality rate as an independent variable is unclear. In the discussion, it becomes evident that this relates to increased hospital use in the final year of life. This could be made clearer in the methods.

Response: This is now also explained in the methods section.

Reviewer: 3

Reviewer Name: Barbara Languard Orban

Institution and Country: University of South Florida, Tampa, Florida, United States

Competing Interests: None

While the authors addressed most suggestions, the following are pending decisions by the editor. The authors' elected to retain their original manuscript title. The title is vague and does not reference either Municipal Acute Bed Units or reducing hospital admission rates, which is the focus of the analysis.

Response: The title has been changed to include the study design as per requested by the Editor

The prior concern was the confidence interval includes 0 in the Abstract. The authors changed this to -0, and explained, as follows: "The confidence interval goes to 0 due to rounding the values and we didn't include more digits to stay consistent with other values reported. The values should actually be -0.0% not 0.0%. The p-value is also valid. We have corrected the lack of a negative sign."

This does not address the concern. Further, -0 is not an actual number. To avoid confusion, the p-value would be better to use in the Abstract, especially since the confidence interval for the "80 years of age and above" model ranges from a negative to positive number.

Response: Rounding to one decimal place by convention the trailing digit is lost and the number becomes -0.0%, but this indicates that the value is in fact below 0 because it is negative and therefore the model range does not include 0 but is just below it.

On page 5, "800 thousand" should be changed to 800,000.

Response: This has been changed in the text

On page 12, the authors wrote "A 1% increase in the death rate increased the number of total admissions by 0.05% (P<0.01)..." The word "increased" should be changed to "was associated with" as the model does not allow for determining cause and effect. This change is also indicated in a later sentence in the same paragraph.

Response: This has been noted and changed in the manuscript

The additions on pages 13 and 14 should describe the results using past tense.

Response: Sentences noticed with present tense were switched to past tense