PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Potentially avoidable hospitalisations of German nursing home patients? A cross-sectional study on utilisation patterns and potential consequences for health care
AUTHORS	Leutgeb, Rüdiger; Berger, Sarah; Szecsenyi, Joachim; Laux, Gunter

VERSION 1 – REVIEW

REVIEWER	Matthew Lohman University of South Carolina, Arnold School of Public Health, South Carolina, USA
REVIEW RETURNED	20-Jul-2018

GENERAL COMMENTS	The purpose of this study was to compare the rates and relative odds of hospitalisations and potentially avoidable hospitalisations between those living in and not living in a nursing home in Baden-Wuerttemberg, Germany. Overall, the authors do a good job of describing the issues facing aging health services in Germany, including geriatric health care worker shortages, a growing older population and demand for nursing home services due to increased life-expectancy, and adequate training of geriatric healthcare workforce. My primary concern relates to the definition and operationalization of key variables (see specific comments below). Because of this lack of clarity, it is difficult to evaluate the importance of the results or the potential influence of alternative mechanisms. However, the results seem to be as one would expect – that persons in nursing homes have greater odds of hospitalization. The conclusions reached about care practices and continuity of care within nursing homes do not seem to be well supported by the evidence in the current study. 1. Page 5, line 83: the authors state that "…a large number of hospitalisations for NH-residents are potentially hasty." It is unclear what the term 'hasty' means in this context. For instance, does it mean that hospitalisations of NH residents were premature and unnecessary, or does it mean that the rate of hospitalisation is greater, faster in NH residents? 2. It is unclear how potentially avoidable hospitalisations are being defined or distinguished from hospitalizations or from unplanned hospitalisations. On page 6, line 99, the authors seem to suggest that PAH are related to ICD-10 diagnoses and ACSCs but the relationship is not made explicit. Are PAH defined as any hospitalisation occurring among someone with an ACSC or because of an ACSC? It is very important that this definition be clarified, as PAH are the primary outcome of interest.

3. Did the authors account for multiple hospitalisations of an individual or does hospitalisation mean that an individual was hospitalised at least once but potentially more than once? This is not explained.

4. Similarly, it is unclear how the authors define nursing home residency? How did they ascertain a person's residence? Who determines whether a residence is a nursing home versus an assisted living facility, a retirement community, or other setting?

5. On page 6, lines 104-110, the authors state that "Data were derived from a comprehensive evaluation programme in German primary care…" However, it is apparent that the data are derived from statutory health insurance claims data on 3.872 million people and that those enrolled in HZV made up 31.19-38.88% of the population. Hence, what do the authors mean by saying that data were 'derived from' HZV? What information comes from HZV and is it only available for those who are enrolled in HZV?

6. Related to the prior comment regarding the definition of PAH, if PAH are defined by the presence of ACSC diagnosis and, as reported on page 10/line 194, nursing home residents had a greater rate of ACSC (79.0%), then, by definition, nursing home residents who were hospitalized would also have a greater rate of PAH by chance alone, even if nursing home residence were in no way related to whether a person had a PAH. This confusion underscores the need for explicitly stating the definition of primary study outcomes and determinants.

7. In general, the study results seem as one would expect. First, it is not surprising that nursing home residents, who are on average 25 years older than non-residents and who have a greater level of comorbidity, level of care, and lower rate of HZV enrollment have greater odds of hospitalisation and PAH. In other words, given the assumed definition of PAH (hospitalisation among an individual with ACSC diagnosis), it would be expected that PAH would be more common among nursing home residents. Second, the results of the multivariable models are not particularly convincing. While the authors control for age, gender, comorbidity, level of care and intervention status, there is distinct possibility of residual confounding due to severity of disease not captured by morbidity and level of care variables. Moreover, there are several social and economic factors not measured that may play a role in hospitalisation and nursing home utilization such as personal finances, presence of an informal caregivers or spouses, etc. Given the modest increase in odds of PAH (22%) among nursing home residents, I would be concerned about these alternative explanations of association. Was it possible to adjust for other factors with the available data? Were any sensitivity analyses undertaken to gauge the potential role of alternative explanations of findings?

8. Discussion: The authors seem to imply that the results indicate a failing in the quality or continuity of care for nursing home residents; however, given the issues described above, the evidence may not support these conclusions. The analyses do not account for variability of care within or between different nursing homes, nor do they measure any characteristics of the care provided in such nursing homes. An alternative explanation of the findings is that nursing home residents are innately more

	vulnerable to hospitalisation due to factors not captured or controlled for adequately in analysis. The conclusions would be more convincing if some aspects of the nursing homes themselves or the care continuum could be measured. 9. While the authors conclusions with regard to the need for preventive care, training of geriatric health care specialists, care coordination, etc are all legitimate concerns and well-described, the recommendations seem like unsupported extrapolations of study findings which concern only the odds of hospitalisation among nursing home residents and not the quality or adequacy of care. For instance, it is unclear how the evidence provided in this study support the conclusion that staff shortages and high workloads are related to greater risk of PAH among nursing home residents or that greater hospitalisation rates are related to treatment of minor ailments? Were staffing levels measured? Was severity of the ailments leading to hospitalisations evaluated?

REVIEWER	Jennifer Carnahan Indiana University, USA
REVIEW RETURNED	09-Aug-2018

GENERAL COMMENTS	As a US NH researcher, it is striking how similar our struggles are despite being in different health care systems. Very interesting study but I do think it needs a little work. Below are some specific comments: -p. 5 line 83, would try to find a word other than "hasty"--really what you mean here is "inappropriate" or "avoidable." -p. 7 lines 122-125-I think you cut some text here and I am not following what you are saying. -p. 7 line 125-find another word besides "effectivity" -p. 7 line 131-is race or ethnicity not something they collect? If they do then I think this should be included. -p. 10 line 183-WOW! -p. 10 line 185-186-maybe I missed it but how are you determining if a hospitalization is planned?--on pg 7 line 131, you need to clarify that your claims data specified whether or not an admission was planned. -Pg 10 Table 3--please provide more explanation of the table and direction of the numbers -p.13 lines 243-248-I think you want to reword this section. My understanding is that you are saying that there are two issues: 1) qualifications of nursing home staff to enable them to make independent decisions and 2) regulations limiting how many independent decisions they can make anyway. Is that right? It is a little confusing but sounds like a frustrating issue. -p. 15, line 284, Is your paper about UH or PAH or both? You start off as if it is about PAH but UH sort of slowly seeps in over the course of the manuscript. I think you need to tighten this language up across the paper.

VERSION 1 – AUTHOR RESPONSE

Reviewer(s)' Comments to Author:

Reviewer: 1

Reviewer Name: Matthew Lohman

Institution and Country: University of South Carolina, Arnold School of Public Health, South Carolina, USA

Please state any competing interests or state ‘None declared’: None declared

Please leave your comments for the authors below
The purpose of this study was to compare the rates and relative odds of hospitalizations and potentially avoidable hospitalizations between those living in and not living in a nursing home in Baden-Wuerttemberg, Germany. Overall, the authors do a good job of describing the issues facing aging health services in Germany, including geriatric health care worker shortages, a growing older population and demand for nursing home services due to increased life-expectancy, and adequate training of geriatric healthcare workforce. My primary concern relates to the definition and operationalization of key variables (see specific comments below). Because of this lack of clarity, it is difficult to evaluate the importance of the results or the potential influence of alternative mechanisms. However, the results seem to be as one would expect – that persons in nursing homes have greater odds of hospitalization. The conclusions reached about care practices and continuity of care within nursing homes do not seem to be well supported by the evidence in the current study.

1. Page 5, line 83: the authors state that “…a large number of hospitalizations for NH-residents are potentially hasty.” It is unclear what the term ‘hasty’ means in this context. For instance, does it mean that hospitalizations of NH residents were premature and unnecessary, or does it mean that the rate of hospitalization is greater, faster in NH residents?
--> We have changed the term “potentially hasty” into “potentially avoidable”. Our results point in the direction that the rate of hospitalizations is greater and could potentially be avoidable frequently considering the list of ACSCs.

2. It is unclear how potentially avoidable hospitalizations are being defined or distinguished from hospitalizations or from unplanned hospitalizations. On page 6, line 99, the authors seem to suggest that PAH are related to ICD-10 diagnoses and ACSCs but the relationship is not made explicit. Are PAH defined as any hospitalization occurring among someone with an ACSC or because of an ACSC? It is very important that this definition be clarified, as PAH are the primary outcome of interest.
--> We could identify one main diagnosis for every hospitalization within our dataset. We compared these diagnoses with a consented ACSC list and defined PAHs as hospitalizations with clearly matched ACSCs. PAHs are therefore defined as hospitalizations because of ACSCs.

3. Did the authors account for multiple hospitalizations of an individual or does hospitalization mean that an individual was hospitalised at least once but potentially more than once? This is not explained.
--> We assessed every hospitalization for every patient in the observation year. So an individual could be hospitalized once but also more than once.

4. Similarly, it is unclear how the authors define nursing home residency? How did they ascertain a person’s residence? Who determines whether a residence is a nursing home versus an assisted living facility, a retirement community, or other setting?
--> We could not identify nursing homes, particularly. However, we could identify, if the insurant lived in a nursing home unambiguously due to a binary variable made available by the health insurance company “AOK”.

5. On page 6, lines 104-110, the authors state that “Data were derived from a comprehensive evaluation programme in German primary care…” However, it is apparent that the data are derived

from statutory health insurance claims data on 3.872 million people and that those enrolled in HZV made up 31.19-38.88% of the population. Hence, what do the authors mean by saying that data were 'derived from' HZV? What information comes from HZV and is it only available for those who are enrolled in HZV?
--> We had the complete data set of all health insured persons. Moreover, there was a binary variable indicating if a health insured person was enrolled in HZV. The word "derived" refers to the evaluation study of the HZV for which we initially obtained the data.

6. Related to the prior comment regarding the definition of PAH, if PAH are defined by the presence of ACSC diagnosis and, as reported on page 10/line 194, nursing home residents had a greater rate of ACSC (79.0%), then, by definition, nursing home residents who were hospitalized would also have a greater rate of PAH by chance alone, even if nursing home residence were in no way related to whether a person had a PAH. This confusion underscores the need for explicitly stating the definition of primary study outcomes and determinants.
--> You are right. However, if we would expect nearly the same ACSCs in nursing homes than in the patient group living not in a nursing home, namely 15%, you would expect 23,982 x 0.1502= 3,602 ACSCs in nursing homes, but we found 6,449. This is an increase of 79%.

7. In general, the study results seem as one would expect. First, it is not surprising that nursing home residents, who are on average 25 years older than non-residents and who have a greater level of comorbidity, level of care, and lower rate of HZV enrollment have greater odds of hospitalization and PAH. In other words, given the assumed definition of PAH (hospitalization among an individual with ACSC diagnosis), it would be expected that PAH would be more common among nursing home residents. Second, the results of the multivariable models are not particularly convincing. While the authors control for age, gender, comorbidity, level of care and intervention status, there is distinct possibility of residual confounding due to severity of disease not captured by morbidity and level of care variables. Moreover, there are several social and economic factors not measured that may play a role in hospitalization and nursing home utilization such as personal finances, presence of an informal caregivers or spouses, etc. Given the modest increase in odds of PAH (22%) among nursing home residents, I would be concerned about these alternative explanations of association. Was it possible to adjust for other factors with the available data? Were any sensitivity analyses undertaken to gauge the potential role of alternative explanations of findings?
--> It is an important remark by you. It would have been very interesting, if we could have all those variables in our data set which you listed. E. g. the presence of spouses or caregivers would perhaps influence the decision of a physician, if a patient should be hospitalized or not. In Germany, health insurance companies urge physicians not to hospitalize patients because of a social indication. Therefore we have a nursing care insurance to finance other solutions for people living alone e. g. to contact social services or to consider, if a patient should migrate to a nursing home. But we cannot estimate case-by-case decisions of physicians.
And you are right: Our data set does not allow to assess the severity of diseases. A pneumonia may be handled outpatient but may be a life-threatening disease.
In future we will include such potential influences in prospective studies and we will focus our research to assess, if ACSCs can be handled outpatient or not with particular regard to the Out-of-Hours setting.

8. Discussion: The authors seem to imply that the results indicate a failing in the quality or continuity of care for nursing home residents; however, given the issues described above, the evidence may not support these conclusions. The analyses do not account for variability of care within or between different nursing homes, nor do they measure any characteristics of the care provided in such nursing homes. An alternative explanation of the findings is that nursing home residents are innately more vulnerable to hospitalization due to factors not captured or controlled for adequately in analysis. The

conclusions would be more convincing if some aspects of the nursing homes themselves or the care continuum could be measured.
--> You are very right. We only can assume that factors we discussed have an influence of potentially avoidable hospitalizations. In literature, which we have cited, we find many hints that staff shortage insufficient education of staff and high workloads of physicians lead to potentially avoidable hospitalizations. But with our results we cannot prove such presumptions. The health care politicians in Germany discuss a failing in the quality or continuity of care in nursing homes intensively because of missing professionals in nursing homes and because of a lack of doctors especially in rural areas. Please, look additionally at point 9.

9. While the authors conclusions with regard to the need for preventive care, training of geriatric health care specialists, care coordination, etc are all legitimate concerns and well-described, the recommendations seem like unsupported extrapolations of study findings which concern only the odds of hospitalization among nursing home residents and not the quality or adequacy of care. For instance, it is unclear how the evidence provided in this study support the conclusion that staff shortages and high workloads are related to greater risk of PAH among nursing home residents or that greater hospitalization rates are related to treatment of minor ailments? Where staffing levels measured? Was severity of the ailments leading to hospitalizations evaluated?
--> This a really valid point. Indeed, with our study design we cannot deduce, that staff education, staff shortage and workload are the one and only issues attributing to the observed differences. Therefore we alleviated our conclusions. Our future work will focus on exactly the issues addressed by you (variability of care between different nursing homes, characteristics of care provided, severity of diseases) within the given context, in order to be able to figure out the vital entities influencing the PAHs and UHs more exactly.

Reviewer: 2
Reviewer Name: Jennifer Carnahan

Institution and Country: Indiana University, USA

Please state any competing interests or state ‘None declared’: none declared

Please leave your comments for the authors below
As a US NH researcher, it is striking how similar our struggles are despite being in different health care systems. Very interesting study but I do think it needs a little work. Below are some specific comments:
-p. 5 line 83, would try to find a word other than "hasty"--really what you mean here is "inappropriate" or "avoidable."
--> We changed the term “potentially hasty” into “potentially avoidable”.

-p. 7 lines 122-125-I think you cut some text here and I am not following what you are saying.
--> We changed the wording of the section:
The new outpatient models of care introduced by the NHS in England for patients with long term conditions may be approximately comparable with the models of care in Germany. The five vital areas of long-term conditions (LTCs) described in these social models of care correspond to the items of level of care classification in Germany. The implementation of the models of care in daily routine are currently examined and evaluated in different vanguards spread across England.25-27

-p. 7 line 125-find another word besides "effectivity"
--> We changed the word “effectivity” into the term “implementation in daily routine”

-p. 7 line 131-is race or ethnicity not something they collect? If they do then I think this should be included.
--> This comment was very inspiring. We could identify the nationality of the patients. 21.1% of the patients not living in a nursing home were not German citizens. In nursing homes only 3.21% of the patients were not of German nationality. Taking into account the variable “nationality” the odds ratios of PAHs or UHs differed slightly. The odds ratios were about 1.218 PAH and 1.5139 UH versus 1.222 PAH and 1.505 UH without adjustment for nationality.

-p. 10 line 183-WOW!
--> Thank you!

-p. 10 line 185-186-maybe I missed it but how are you determining if a hospitalization is planned?—
--> We can identify unplanned hospitalizations with the available dataset of the health insurance company because unplanned hospitalizations are marked specifically. Planned hospitalizations are not marked.
On pg 7 line 131, you need to clarify that your claims data specified whether or not an admission was planned.
--> For example, planned hospitalizations are hospitalizations with a clear admission appointment e.g. to a surgery, chemotherapy or medical clarification of ambiguous results. These hospitalizations are not marked by a health insurance company. Only unplanned hospitalizations without an appointment are marked.

-Pg 10 Table 3--please provide more explanation of the table and direction of the numbers
--> We inserted an explanation: This means, the adjusted chance for a PAH was nearly 22% higher looking on patients living in a nursing home and the adjusted chance of UHs was more than 50% higher for patients living in a nursing home compared with patients living at home.

-p.13 lines 243-248-I think you want to reword this section. My understanding is that you are saying that there are two issues: 1) qualifications of nursing home staff to enable them to make independent decisions and 2) regulations limiting how many independent decisions they can make anyway. Is that right? It is a little confusing but sounds like a frustrating issue.
--> You are right, this is what we wanted to say. In Germany, the education catalog for nursing home staff will be adapted in future. For the education of nurses in hospitals a valid step.
Ultimately it is a political decision if the regulations for nursing home staff may be loosened.
Requirements are an outstanding education of nursing home staff and a better staffing ratio.
We changed the wording of the section:
Considering the increasing shortages of GPs, especially in rural areas, as well as increasing shortages of appropriately trained nursing home staff, health policies and health services experts have to look for innovative approaches to ease the health care services crisis emerging in nursing homes. Therefore, additional measures to be pursued are that the education of nursing home staff should be reviewed and improved and nursing staff should be formally empowered to manage minor ailments e.g. like fever and pain in the first instance. Unfortunately, government regulations in Germany currently prohibit in many cases independent clinical decisions of nursing staff in nursing homes. The daily work of nursing staff and medical practitioners is made difficult because of such regulations are no longer in keeping with the tensions and demands in clinical practice in these settings.43,44

-p. 15, line 284, Is your paper about UH or PAH or both? You start off as if it is about PAH but UH sort of slowly seeps in over the course of the manuscript. I think you need to tighten this language up across the paper.
--> We introduced the term “unplanned hospitalization (UH)” already in the abstract-results and tightened the language up across the paper.

VERSION 2 – REVIEW

REVIEWER	Matthew Lohman University of South Carolina, United States
REVIEW RETURNED	18-Oct-2018

GENERAL COMMENTS	The purpose of this study was to compare the rates and relative odds of hospitalisations and potentially avoidable hospitalisations between those living in and not living in a nursing home in Baden-Wuerttemberg, Germany. Overall, the authors do a good job of describing the issues facing aging health services in Germany, including geriatric health care worker shortages, a growing older population and demand for nursing home services due to increased life-expectancy, and adequate training of geriatric healthcare workforce. Upon reviewing the original version of this manuscript, my primary concerns related to the definition and operationalization of key variables. In the revised manuscript and response, the authors have done a satisfactory job in clarifying and using more consistent terminology. The authors have also addressed other concerns related to the discussion and the study limitations. As with any analysis, I understand that the authors are limited by the quality and comprehensiveness of the existing data. The authors have now more directly addressed the speculative nature of discussion recommendations and have provided adequate citation to support their conjectures. I am satisfied that my concerns with the original manuscript have been addressed and I have no additional comments or concerns.

REVIEWER	Jennifer L Carnahan Indiana University, United States of America
REVIEW RETURNED	09-Nov-2018

GENERAL COMMENTS	line 249-remove the comma from "there is little doubt on, a case" etc.