

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

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| <b>TITLE (PROVISIONAL)</b> | Diagnosis and mortality in prehospital emergency patients transported to hospital: A population- and registry-based cohort study |
| <b>AUTHORS</b>             | Christensen, Erika; Mulvad, Thomas; Bøgh, Flemming; Bendtsen, Mette; Hansen, Poul; Johnsen, Søren; Christiansen, Christian       |

### VERSION 1 - REVIEW

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| <b>REVIEWER</b>        | Annmarie Lassen<br>Institute of Clinical Research, University of Southern Denmark, Denmark |
| <b>REVIEW RETURNED</b> | 07-Mar-2016  |

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| <b>GENERAL COMMENTS</b> | <p>This is a descriptive study of hospital discharge diagnosis and short term mortality of patients who had an emergency called ambulance transport . The study is based in a Danish region in an eight year period from 2007 to 2014 and it covers a majority of the emergency called ambulance transports.</p> <p>The study deals with an important part of the health care system which until now is only scarcely described. Due to the frequency of prehospital transport , the study has the potential to be of public health interest as well as of interest for a reders of BMJ open. However, in its present form the study is presented in a form most relevant for readers with specific interest in prehospital transport.</p> <p>Major points:</p> <ul style="list-style-type: none"><li>-Although one of the first sentences in as well the abstract as in the introduction states that use of prehospital transport in increasing, and the fact that an analysis of use per 1000 citizens is presented in the analysis section as if an incidence per year should be presented in the study – no analysis for trend by time is provided. This analysis could provide valuable information regarding expectations for use of prehospital transport in the next few years.</li><li>- an analysis of diagnostic groups in relation to time would provide information with relevance for public health planners - maybe in a supplement due to lack of space in the main manuscript.</li><li>-The aim, hypotheses and conclusion of the study are presented with some inconstancies in the abstract, introduction, result section and discussion. Please secure that aim, hypothesis and conclusion are constant - and in line with each other - throughout the study.</li><li>-Diagnosis and mortality might vary widely in relation to age – please present these results for a few major age groups.</li><li>-The statement that mortality is “low” is not well augmented. Low for whom? – and compared to what? I believe it is low compared to intensive care patients but similar – or high – compared to patients in the emergency ward. A 1 day mortality of more than one percent is very high for young patients – but I believe it is much lower for</li></ul> |
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|  | <p>them.</p> <ul style="list-style-type: none"> <li>-A possible problem with the coding practice for patient discharge diagnosis need a sentence or two in the discussion section – including thoughts regarding consequence for the presented results.</li> <li>- The inclusion of patients dead at scene in the expanded analysis does not support a direct relation to clinical practice and should be avoided. It does not give sense to describe prognosis for these patients – as they already are dead – but it does – of course - depend of the level of analysis. If the level of analysis is the 112 call it gives meaning to include the dead patients. If this is the case please be more clear in definition of level of analysis.</li> </ul> <p>Minor points:</p> <ul style="list-style-type: none"> <li>-It is stated that mortality data are based at the Danish Civil Registration system – which covers the whole country -but also stated that patients who lived outside the North Danish County are not followed to death</li> <li>– but “only” during hospitalization. This indicate that the mortality data are found in the local patient administrative system – or another system covering the local county. Please state the correct way of how mortality data were sampled.</li> <li>-Please state if the used discharge diagnoses are from the first (or the last) department the patient had contact to during the total hospitalization related to the analyzed ambulance transport.</li> <li>- Is 112 an internationally used code for ambulance emergency calls? If not please state in figure 1 what a 112 call means.</li> </ul> |
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| <b>REVIEWER</b>        | <p>Daniel Lane<br/>         Alberta Health Services, Emergency Medical Services<br/>         PhD Student, University of Toronto, Institute of Medical Science</p> |
| <b>REVIEW RETURNED</b> | 09-Mar-2016   |

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| <b>GENERAL COMMENTS</b> | <p>This is an interesting study in an area of healthcare that certainly needs some more population level data. I think that the results may be useful to administrators within the EMS system when making decisions about resource allocation, level of training, and initiatives to improve the quality of their EMS system if some issues of internal validity and generalizability can be addressed by the authors. Overall, I feel that the message the authors were trying to convey was not well communicated in the text as there were a number of sentence structure and grammatical errors. I found it challenging to understand at times.</p> <p>Study Objective: The hypothesis describes characterizing a specific group of patients (non-critical, non-specific) but the objective of the study focusses on the diagnostic pattern of all patients. It is unclear to me what the focus is.</p> <p>Study design: If the objective is to look at a specific group of patients as described above, a more focussed strategy in the analysis would be warranted.</p> <p>I am concerned about the validity of using only the first ICD-10 code to characterize patients. Is this the emergency department diagnosis or inpatient diagnosis? is this the primary reason for the person calling an ambulance, or the underlying disease? e.g. ambulances are often dispatched based on an exacerbation of a patients symptoms of a disease, so was it the symptom or underlying disease being identified? Did the authors validate the ICD-10 code against a gold standard for diagnosis of these patients (such as independent chart review)? I think that the validity of this</p> |
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|  | <p>classification is a significant concern in terms of the validity of the results that needs to be addressed.</p> <p>Analysis: was there any analysis for potential bias considered? Conceivably patients not being transported were either not requiring hospitalization, or already deceased. Furthermore the group that was not identified by their patient number may have been more critically ill, preventing the EMS providers from identifying them. This may introduce further bias.</p> <p>References: Unclear on the relevance of some references to the point trying to be made. e.g. pg 5 line 36, the authors discuss a previous study from 1996-97 but cite the ICD-10 guidelines.</p> <p>Results: I think some of the confusion I had around the study objectives translates to challenges in interpreting the results. It's unclear if the average ambulances dispatched included all patients or just the subset being transported. If the latter then this would introduce a significant selection bias.</p> <p>A more focussed look at some of the patients within the ICD-10 main chapter classifications would be more helpful.</p> <p>Study limitations: Concerns about the validity of using a single ICD-10 code to classify these patients, as described about in study design.</p> <p>Standard of English: some editing is required. I found many paragraphs were incomplete or did not answer the questions that they raised.</p> <p>I am unclear about what this study will add to the body of literature. Some more focussed findings and the relevance of these findings may add value.</p> |
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## VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

This is a descriptive study of hospital discharge diagnosis and short-term mortality of patients who had an emergency called ambulance transport. The study is based in a Danish region in an eight year period from 2007 to 2014 and it covers a majority of the emergency called ambulance transports. The study deals with an important part of the health care system which until now is only scarcely described. Due to the frequency of prehospital transport, the study has the potential to be of public health interest as well as of interest for a readers of BMJ open. However, in its present form the study is presented in a form most relevant for readers with specific interest in prehospital transport.

We agree, and have inserted comments regarding the implications of our study in the discussion section, page 15:

"The description of the diagnostic pattern in 1-1-2 emergency call with subsequent hospital contact and their prognosis may have interest for public health care as the prehospital system is an important part of the health care system. Our results may help both health care planners, emergency physicians, and prehospital caregivers."

Major points:

- Although one of the first sentences in as well the abstract as in the introduction states that use of prehospital transport is increasing, and the fact that an analysis of use per 1000 citizens is presented in the analysis section as if an incidence per year should be presented in the study – no analysis for trend by time is provided. This analysis could provide valuable information regarding expectations for use of prehospital transport in the next few years.
- an analysis of diagnostic groups in relation to time would provide information with relevance for public health planners - maybe in a supplement due to lack of space in the main manuscript.

We agree with the reviewer that analyses regarding trends over time of ambulance use and of diagnostic groups in relation to time is of interest. However, this was not the purpose of this study. We plan to do further studies, including studies of trends, within this area.

As our main aim was to describe diagnoses and mortality, not the use of ambulances, we have removed the information regarding ambulance use per 1000 citizens.

We added two references showing that increasing utilization of emergency ambulances is problem in several countries: a review and a study on demographic impact on increased demands for ambulances from Bavaria in Germany (reference 1 and 3).

-The aim, hypotheses and conclusion of the study are presented with some inconsistencies in the abstract, introduction, result section and discussion. Please secure that aim, hypothesis and conclusion are constant - and in line with each other - throughout the study.

We agree. Our main aim was to describe hospital diagnoses and mortality for patients brought to a hospital by ambulance after an emergency call. We have revised accordingly throughout the manuscript.

Furthermore, we have revised the title of our paper to emphasize our focus on patients transported to hospitals.

-Diagnosis and mortality might vary widely in relation to age – please present these results for a few major age groups.

A stratified analyses for the age groups of 0-10 years, 11-30 years, 31-60 years, and 61 years and older is now included. We added this in the Methods section on page 8 and in a revised table 1 on page 9.

We have reported the major results concerning diagnoses on page 10:

“Injuries was the most frequent diagnosis among all age groups, except for children aged 0-10 years. Circulatory diseases was the second most frequent among the elderly of age 61 years and above. However, the non-specific R and Z diagnosis chapters constituted a significant fraction among all age groups, and among children (0-10 years) the R diagnoses (chapter 18) was the most frequent.”

We attach as an appendix tables on mortality in the abovementioned age-groups and described the main results concerning overall mortality on day one among these age groups on page 12:

“Mortality varied widely between age groups. The highest overall 1-day mortality was among the elderly, 3.3 % corresponding to 2123 deaths, with 1-day mortality due to circulatory diseases as the highest, 8.6 % (CI 8.1-9.1). In contrast, overall mortality on day one was 0.1 % corresponding to seven deaths in the entire period among children age 0-10; and 0.2 %, with 100 deaths in age group 11-30 years. Among adults aged 31-60 years 1-day mortality was 0.9 % with 431 deaths. Circulatory diseases accounted 177 deaths, corresponding to 4.8 % (CI 4.1-5.5).

-The statement that mortality is “low” is not well augmented. Low for whom? – and compared to what? I believe it is low compared to intensive care patients but similar – or high – compared to patients in the emergency ward. A 1 day mortality of more than one percent is very high for young patients – but I believe it is much lower for them.

We agree with the reviewer regarding this statement. Our study is one of the few reporting overall mortality, so it is not possible for us to make reasonable comparisons. Thus, we reformulated the discussion on page 12:

“The overall mortality varied considerably according to the diagnosis.”

-A possible problem with the coding practice for patient discharge diagnosis need a sentence or two in the discussion section – including thoughts regarding consequence for the presented results.

This may concern the possible discrepancy between the initial symptoms presented out-of-hospital, the initial tentative diagnoses, and the final hospital diagnosis:

We have discussed this on page 14:

“Prehospital studies rarely report final hospital diagnoses according to ICD-10, which is required to get a total picture of the patient group and to compare to other patients admitted to hospital. More often, the prehospital patient population is described according to the initial presented symptoms. This has also been done in a recent Danish study of 1-1-2-calls covering 75% of the Danish population showing the most frequent main symptoms...”

Moreover, we described the use ICD-10 diagnoses in detail in the methods section page 7:

“We retrieved the primary diagnosis, which was the main reason for the hospital contact.[8, 9] In cases where a patient was examined and a diagnosis was not yet confirmed, a tentative diagnosis (observation for) an ICD-10 “Z-codes” (‘factors influencing health status and contact with health services’) may be used. In these cases we searched for the first specific diagnosis applied during the hospital stay, including transferrals to other departments or other hospitals during the stay.”

We have additionally added the following in the discussion section page 13:

“In order to achieve the most complete picture of the final hospital diagnoses, we searched for more specific diagnoses during hospital contact, in cases where the initial diagnosis was ICD 10 main Z chapter, ‘Factors influencing health status and contact with health services’, which includes tentative (observation for) diagnosis for patients examined but without a diagnosis yet confirmed.”

- The inclusion of patients dead at scene in the expanded analysis does not support a direct relation to clinical practice and should be avoided. It does not give sense to describe prognosis for these patients – as they already are dead – but it does – of course - depend of the level of analysis. If the level of analysis is the 112 call it gives meaning to include the dead patients. If this is the case please be more clear in definition of level of analysis.

This study only concerns patients transported to hospitals, hence we removed the supplemental analyses of patients not brought to hospitals, including those dead on scene.

We explained that the unit of analyses is dispatched ambulances arriving at hospital. We have expanded the explanation (Methods section page 7):

“Data were anonymized for analysis. We used a dispatched ambulance that brought a patient to the hospital after the 1-1-2 call as the unit in all our analyses. As it makes no sense to talk about diagnoses for neither 1-1-2 calls nor for ambulances, we named this study population ‘1-1-2 patients’, as each ambulance represents one patient.”

Minor points:

-It is stated that mortality data are based at the Danish Civil Registration system – which covers the whole country -but also stated that patients who lived outside the North Danish County are not followed to death

– but “only” during hospitalization. This indicates that the mortality data are found in the local patient administrative system – or another system covering the local county. Please state the correct way of how mortality data were sampled.

Our data on vital status is from the regional administrative data, which in turn receives data on vital status from the Danish Civil Registration system for persons living in the region. In cases where we did not have updated information on the vital status of the patient, (i.e. patients with addresses outside the North Denmark Region) the cases were censored on the day they left the hospital.

This is explained in the Methods section on page 6 and 7.

- Please state if the used discharge diagnoses are from the first (or the last) department the patient had contact to during the total hospitalization related to the analyzed ambulance transport.

We explain in the Methods section, page 7:

"We retrieved the primary diagnosis, which was the main reason for the hospital contact.[8, 9] In cases where a patient was examined and a diagnosis was not yet confirmed, a tentative diagnosis (observation for) an ICD-10 "Z-codes" ('factors influencing health status and contact with health services') may be used. In these cases we searched for the first specific diagnosis applied during the hospital stay, including transferrals to other departments or other hospitals during the stay."

- Is 112 an internationally used code for ambulance emergency calls? If not please state in figure 1 what a 112 call means.

We have now clearly stated that 1-1-2 is the national common emergency number in Denmark – Methods section, page 6 and in figures.

Reviewer: 2

This is an interesting study in an area of healthcare that certainly needs some more population level data. I think that the results may be useful to administrators within the EMS system when making decisions about resource allocation, level of training, and initiatives to improve the quality of their EMS system if some issues of internal validity and generalizability can be addressed by the authors. Overall, I feel that the message the authors were trying to convey was not well communicated in the text as there were a number of sentence structure and grammatical errors. I found it challenging to understand at times.

We tried our best to improve the language and the grammar, and the initial manuscript was sent for academic editing by a native English-speaking professional at a Canadian proofreading firm. Please, let us know, whether it needs more linguistic improvement.

Study Objective: The hypothesis describes characterizing a specific group of patients (non-critical, non-specific) but the objective of the study focusses on the diagnostic pattern of all patients. It is unclear to me what the focus is.

Study design: If the objective is to look at a specific group of patients as described above, a more focussed strategy in the analysis would be warranted.

We agree, and have revised the manuscript to our main aim, which was to describe hospital diagnoses and mortality for the entire group of patients brought to a hospital by ambulance after an emergency call. We revised it accordingly in the introduction section page 5:

"The aim of this study was to examine the diagnostic pattern and mortality in patients brought to the hospital in an ambulance dispatched after an emergency call."

We have subsequently revised it throughout the manuscript, and revised the title of our paper to emphasize that we focus on patients transported to hospital.

I am concerned about the validity of using only the first ICD-10 code to characterize patients. Is this the emergency department diagnosis or inpatient diagnosis? is this the primary reason for the person calling an ambulance, or the underlying disease? e.g. ambulances are often dispatched based on an exacerbation of a patients symptoms of a disease, so was it the symptom or underlying disease being identified?

This is an important issue. We used the primary diagnosis, which is the main reason for hospital contact. In our administrative registries based on the ICD-10 secondary diagnoses are optional diagnoses supplementing the primary diagnosis by, e.g., describing the underlying chronic disease that is related to the current patient contact. We did not include these. Also there are referral diagnosis which is the diagnosis given by referring unit as the reason for referral - used when a primary care doctor admits the patients, but not used in EMS as it does not include dispatch codes or

criteria. Another recent Danish study described the latter (reference 20).

In this study, we used the first in-hospital diagnosis, as our purpose was to describe the diagnostic pattern, not the initial presenting symptoms. The initial presenting studies among patients in Denmark calling 1-1-2 was recently published (reference 20).

We explained it into more detail in the Methods section page 7:

“We retrieved the primary diagnosis, which was the main reason for the hospital contact.[8, 9] In cases where a patient was examined and a diagnosis was not yet confirmed, a tentative diagnosis (observation for) an ICD-10 “Z-codes” (‘factors influencing health status and contact with health services’) may be used. In these cases we searched for the first specific diagnosis applied during the hospital stay, including transferrals to other departments or other hospitals during the stay”

We also discuss it on page 14:

“Prehospital studies rarely report final hospital diagnoses according to ICD-10, which is required to get a total picture of the patient group and to compare to other patients admitted to hospital. More often, the prehospital patient population is described according to the initial presented symptoms. This has also been done in a recent Danish study of 1-1-2-calls covering 75% of the Danish population showing the most frequent main symptoms....”

Did the authors validate the ICD-10 code against a gold standard for diagnosis of these patients (such as independent chart review)? I think that the validity of this classification is a significant concern in terms of the validity of the results that needs to be addressed.

The Danish administrative registries are frequently used in epidemiological research, and has been shown valid based on chart reviews for several diagnoses. We added a review on this subject as a reference (reference 9) and added this in the discussion section, page 11.

Analysis: was there any analysis for potential bias considered? Conceivably patients not being transported were either not requiring hospitalization, or already deceased

This study only concerns patients transported to a hospital, thus patients not being transported represents no bias in this context. Accordingly, we removed the supplemental analyses of patients not brought to a hospital, including those dead on scene.

Accordingly, our findings cannot be generalized to prehospital emergency patients not transported to hospital. We added this as a limitation on page 13

Furthermore, the group that was not identified by their patient number may have been more critically ill, preventing the EMS providers from identifying them. This may introduce further bias.

We agree, however this is a common problem to all studies concerning prehospital emergency patients. We discuss this limitation on page 13:

In our study, the patient’s civil registration number was missing for 17.8 % of the dispatched ambulances. This constitutes the major weakness of our study, as well as for many other studies on prehospital emergency medicine, because the identity of the patient is often unknown in this phase. Our study included patients brought to hospital with ambulances, thus our findings cannot be generalized to prehospital emergency patients not transported to hospital.

References: Unclear on the relevance of some references to the point trying to be made. e.g. pg 5 line 36, the authors discuss a previous study from 1996-97 but cite the ICD-10 guidelines.

We agree with the comment, and have removed the reference to ICD-10 from here to the Method section.

Results:I think some of the confusion i had around the study objectives translates to challenges in

interpreting the results. Its unclear if the average ambulances dispatched included all patients or just the subset being transported. If the later then this would introduce a significant selection bias.

The aim of this study was to examine the diagnostic pattern and mortality in patients brought to a hospital by an ambulance dispatched after an emergency call. Thus, our study does not include all dispatched ambulances and we only draw our conclusion on patients brought to a hospital. This may therefore not be seen as selection bias, as we did not intend to study all dispatched ambulances. However, our findings cannot be generalized to prehospital emergency patients not transported to hospital.

A more focussed look at some of the patients within the ICD-10 main chapter classifications would be more helpful.

We agree, but found it to exceed the aim of our study, which was to describe the diagnostic pattern of the entire group of patients brought to a hospital by ambulance after an emergency call. However, as the diagnostic pattern may vary considerably between age groups, we supplemented table 1 on page 9-10 with the main ICD-10 chapters for the age groups of 0-10 years, 11-30 years, 31-60 years, and 61 years and older. We reported the major results concerning diagnoses on page 10 and reported mortality among these age groups on page 12. We attach as an appendix tables on mortality in the abovementioned age groups

Study limitations: Concerns about the validity of using a single ICD-10 code to classify these patients, as described about in study design.

We used the ICD-10 diagnosis, the primary diagnosis, which is the main reason for hospital contact. Please, see our response above.

Standard of English: some editing is required. I found many paragraphs were incomplete or did not answer the questions that they raised.

We hope this revised version is better, and if there still are problems, please let us know.

I am unclear about what this study will add to the body of literature. Some more focussed findings and the relevance of these findings may add value.

We agree with your initial comments that this could be useful to administrators within the EMS system when making decisions about resource allocation, level of training, and initiatives to improve the quality of their EMS system. As emergency patients constitute a considerable number in the health care system, we think this study adds new information, which could be of interest to health care planners, as well prehospital caregivers. We added this to the discussion section page 15: "The description of the diagnostic pattern in 1-1-2 emergency call with subsequent hospital stay and their prognosis may have interest for public health care as the prehospital system is an important part of the health care system. Our results may help both health care planners, emergency physicians, and prehospital caregivers."

## VERSION 2 – REVIEW

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| <b>REVIEWER</b>        | Annmarie Lassen<br>Department of Emergency Medicine, Odense University Hospital,<br>5000 Odense C, Denmark |
| <b>REVIEW RETURNED</b> | 29-Apr-2016  |

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| <b>GENERAL COMMENTS</b> | The authors have revised the manuscript in accordance to the previous reviews. In the present form it is a clear written paper with no need of further revision. |
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| <b>REVIEWER</b>        | Dan Lane<br>Alberta Health Services, Emergency Medical Services<br>Institute of Medical Science, University of Toronto<br>Canada |
| <b>REVIEW RETURNED</b> | 14-Apr-2016  |

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| <b>GENERAL COMMENTS</b> | <p>This study describes and characterizes the outcomes of an EMS population using ICD-10 coding and hospital outcome data. I see value in this characterization for both government and EMS executive in focussing training and resources towards these populations. Overall, i felt that the manuscript was improved from the last version and have a few minor issues that i feel with further improve the clarity.</p> <p><b>Abstract:</b><br/>The first sentence in the conclusion seems incomplete to me, are you trying to say that you were successful in linking EMS patients to their ICD-10 diagnosis? Right now it reads to me as patients diagnosis = ICD-10 main chapter, which is more of a methodology statement and one that was not verified in this study.</p> <p><b>Introduction:</b><br/>The first paragraph nicely outlines why this is an important issue, but then the second paragraph discusses another study that examined the issue you outlined. What were the limitations of this study, why did you repeat it, or what was missing that needed to be addressed? If the major difference was urban to rural then this should be emphasized.</p> <p><b>Methods:</b><br/>It is still unclear to me what you did in your analysis for the patients with unspecified diagnosis at admission - the results still classify some patients with the "factors influencing healthcare..." but you describe searching for a primary diagnosis for all of these patients. This is a significant group of your patients and so further explanation and exploration (if possible) will make it more clear to the readers of how this limitation make affect the results.<br/>Consider another stratification for rural and urban patients. This is emphasized in your introduction but not explored in the results.</p> <p><b>Results:</b><br/>Consider adding Urban/Rural stratification as above.</p> <p><b>Discussion:</b><br/>Overall i think the discussion would benefit from some reorganization. Perhaps 1) Other studies, 2) What this study adds, 3) limitations, 4) Conclusions. I think this would flow better.</p> <p><b>Principal Findings</b><br/>The biggest question in my mind still is which patients fall into these two unknown categories that make up a substantial amount of your population. Further analysis, or further explanation about why these patients could not be classified is warranted.</p> |
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|  | <p><b>Strengths and Weaknesses</b><br/>         Again you discuss searching for more specific diagnosis in the unknown patients, but don't describe what you did when a more specific diagnosis was identified. Agreed this is a strength of your study if you changed the initial diagnostic code, but right now with such a substantial portion of the patients still unknown I see this as a weakness.</p> <p>Patients missing registration number, again this is a significant portion of patients and likely a more critically ill. Further discussion about how this may bias the results, or reasons for missing numbers is important for readers to understand the potential biases.</p> <p><b>Other Studies</b><br/>         Again i think you should put this section first in your discussion and then discuss what your study adds. Right now it reads as a good summary of the literature but I don't understand what value it is adding to your study, or yours to the overall body of literature.</p> <p>Second paragraph seems to be more of an introductory paragraph to me. Consider switching with the first.</p> <p><b>Interpretation</b><br/>         The first sentence seems incorrect to me, unknown diagnosis is not the final diagnosis.... it is just the final diagnosis for patients being admitted. I think some clarity is needed here.<br/>         I would caution you against stating anything about "patients without need for an ambulance" as this is subjective and based on individual patient perspective not research.<br/>         How did you concluded that the remarkable 30 day mortality may be an indication of chronic illness? None of the classifications specifically address chronic illness.</p> |
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## VERSION 2 – AUTHOR RESPONSE

1)

Abstract:

The first sentence in the conclusion seems incomplete to me, are you trying to say that you were successful in linking EMS patients to their ICD-10 diagnosis? Right now it reads to me as patients diagnosis = ICD-10 main chapter, which is more of a methodology statement and one that was not verified in this study.

Response:

We agree and changed the text (p 4): "Patients' diagnoses from hospital stay after calling 1-1-2 in this population-based study, were distributed across all ICD-10 chapters"

Similarly, we re-phrased the text in the conclusion (p 15-16): "In conclusion, the diagnoses of prehospital emergency patients in this population-based study were distributed across all the ICD-10 chapters."

2)

Introduction:

The first paragraph nicely outlines why this is an important issue, but then the second paragraph discusses another study that examined the issue you outlined. What were the limitations of this study, why did you repeat it, or what was missing that needed to be addressed? If the major difference was urban to rural then this should be emphasized.

Response:

We understand your point. The earlier study was a small (n= approx. 6,000 patients), old (twenty years) study covering only a short period (two three months periods) in 1996 and 1997 from another region in Denmark, but also mixed urban-rural area.

We elaborated on this in the text (p 5): "Twenty years ago a small prehospital population-based study including only approximately 6,000 patients during two short periods of three months, explored the diagnostic pattern among emergency ambulance patients".

Furthermore, we added this to explain the background for this study: "In the North Denmark Region, one of the five Danish health care regions, which covers both urban and rural areas, electronic data on prehospital emergency patients has been available since spring 2006. This gave us the opportunity to conduct a large population-based study on prehospital emergency patients during the last years.

3)

a) Methods:

It is still unclear to me what you did in your analysis for the patients with unspecified diagnosis at admission - the results still classify some patients with the "factors influencing healthcare..." but you describe searching for a primary diagnosis for all of these patients. This is a significant group of your patients and so further explanation and exploration (if possible) will make it more clear to the readers of how this limitation make affect the results.

Response:

We retrieved the main hospital diagnosis at a chapter level in ICD-10. This means that the diagnoses we present were the hospitals' diagnoses of these patients concerning that particular hospital contact after a 1-1-2 call. We changed our terminology throughout the paper to 'hospital diagnosis', instead of 'final diagnosis'; and 'ICD 10 chapters' instead of 'main chapter'. Because chapter XXI (Z) contains several 'observation for...' diagnoses, we studied whether the patients with chapter XXI diagnoses during the same hospital stay had a more specific diagnosis and accordingly classified these patients according to their specific diagnoses. For those patients where we did not find a more specific diagnosis, we registered it as a chapter XXI (Z) diagnosis.

We added (p 7): "These patients were then included in the study according to the first specific ICD-10 diagnosis at chapter level. For patients where we did not find a more specific diagnosis, we kept the Z diagnosis as the hospital diagnosis."

We supplemented the results with information on the number of 'Z-patients' where we identified a more specific diagnosis (p 12): "There were 56,193 patients where the first diagnosis was a non-specific Z-diagnosis, and for 35,247 of those we found and assigned a more specific diagnosis, and these patients are classified according to this."

b) Consider another stratification for rural and urban patients. This is emphasized in your introduction but not explored in the results.

Response:

We agree this would be interesting. It was a mixed urban and rural area, and we consider exploring more into that in future studies, but it was not part of our aim for this study.

4)

Results:

Consider adding Urban/Rural stratification as above.

Response:

Please see our response in 3 b) above

5) Discussion:

Overall i think the discussion would benefit from some reorganization. Perhaps 1) Other studies, 2) What this study adds, 3) limitations, 4) Conclusions. I think this would flow better

Response:

We follow the guidelines for the discussion: "The case for structuring the discussion of scientific papers. 1999 BMJ editorial; 314:1224-5"; As well as the BMJ open guidelines: "We also recommend, but do not insist, that the discussion section is no longer than five paragraphs and follows this overall structure (you do not need to use these as subheadings): a statement of the principal findings; strengths and weaknesses of the study; strengths and weaknesses in relation to other studies, discussing important differences in results; the meaning of the study: possible explanations and implications for clinicians and policymakers; and unanswered questions and future research". We chose to leave this order unchanged, but changed the order in the subsection 'Other studies, please see comment below, response 9.

6)

Principal Findings

The biggest question in my mind still is which patients fall into these two unknown categories that make up a substantial amount of your population. Further analysis, or further explanation about why these patients could not be classified is warranted.

Response:

We agree with you, but as mentioned above in our response 3a) there were 56,193 patients where the first diagnosis was a non-specific Z-diagnosis. For 35,247 of those we found and assigned a more specific diagnosis. Our main result was that a large proportion of patients calling 1-1-2 for an ambulance later leaves the hospital with a non-specific diagnosis; either ICD10 chapter XVIII (R) or chapter XXI (Z), and we find this result very interesting. Certainly, we plan to do more studies to go more into possible explanations behind this, and this will be a research focus for us in the future.

7)

Strengths and Weaknesses

Again you discuss searching for more specific diagnosis in the unknown patients, but don't describe what you did when a more specific diagnosis was identified. Agreed this is a strength of your study if you changed the initial diagnostic code, but right now with such a substantial portion of the patients still unknown I see this as a weakness.

Response:

The aim of our study was to elucidate the hospital's diagnoses of these patients – and it turned out that actually a large proportion of hospital's diagnoses for these patients were among non-specific diagnoses either ICD10 chapter XVIII (R) or chapter XXI (Z). Because chapter XXI (Z) contains several 'observation for...' diagnoses, we studied whether the chapter XXI diagnoses during the same hospital stay was followed by a more specific diagnosis. For those patients where we did not find a more specific diagnosis, we kept the chapter XXI (Z) diagnosis. In this way, we managed to change the Z-diagnosis to a more specific diagnosis in 35,247 of 56,193 patients, and we added this in the results. Please also see our response to comment no. 3.

8)

Patients missing registration number, again this is a significant portion of patients and likely a more critically ill. Further discussion about how this may bias the results, or reasons for missing numbers is important for readers to understand the potential biases.

Response:

We agree, this is the major weakness of our study. However, we cannot tell whether they were more

or less severely ill. We added in the discussion (p 15): “This can be a bias in the study as these patients may be either more or less critical ill than those with a civil registration number.”

9)

#### Other Studies

Again i think you should put this section first in your discussion and then discuss what your study adds. Right now it reads as a good summary of the literature but I don't understand what value it is adding to your study, or yours to the overall body of literature.

Second paragraph seems to be more of an introductory paragraph to me. Consider switching with the first.

Response:

Please see our answer to comment no. 5. We agree with you concerning the paragraph ‘Other studies’ where we compare our results to other studies on similar topics, so we exchanged the order of the first paragraph and the second comparing our results to international studies.

10)

#### Interpretation

The first sentence seems incorrect to me, unknown diagnosis is not the final diagnosis.... it is just the final diagnosis for patients being admitted. I think some clarity is needed here.

Response:

We agree and deleted ‘final’ and changed it (p 15): “Our study reveals that non-specific diagnoses constitute a significant part of the hospital diagnoses in prehospital emergency patients brought to hospital with ambulances.”

11)

I would caution you against stating anything about "patients without need for an ambulance" as this is subjective and based on individual patient perspective not research.

Response:

We agree that the need seen from the patient's perspective might differ from the need assessed by the call-taker and we did not study that.

In our EMS, health care professionals take the 1-1-2 calls and assess the severity and the need for sending an ambulance according to a criteria-based dispatch protocol. We added this to the ‘Study setting’ (p 6): “....(1) the Emergency Medical Coordination Centre that receives the 1-1-2 calls, where health care professionals assess the severity and need for an ambulance,..”

We also revised it in the Interpretation (p 18): “We cannot tell, if this is due to a necessary over-triage at the Emergency Medical Coordination Centre of patients with potential serious conditions, subsequently not confirmed at the hospital; or whether the criteria for sending an ambulance are too broad resulting in over-triage of ambulances to low level of urgencies. Some of these patients might be helped better by another kind of support, and future studies are needed to explore this. Moreover, the patients’ perspective would be of interest to study.”

12)

How did you concluded that the remarkable 30 day mortality may be an indication of chronic illness? None of the classifications specifically address chronic illness.

Response:

We agree that this is a hypothetical statement mostly based on the age distribution. We revised it (p 18):

“Among the three age peaks noted, the elderly constituted the majority of 1-1-2 patients, and patients older than 60 years constituted 43 % of all 1-1-2 patients. Vesper et al, also found that aging was one

of the demographic changes with impact on emergency medical services.[3] The total number of deaths among the patients with non-specific diagnoses on day 30 is remarkable and raises further questions for research. Based on the age profile one may hypothesize the underlying cause partly being acute exacerbation of chronic diseases.”