Does the use of ambulance helicopter shorten the transport time for trauma patients in Arvika Hospitals catchment area in comparison with land-based ambulance transport?

Version 4

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Abstract

Introduction:
The ambulance helicopter has been an established part of the trauma care in Värmland since 2014. European studies comparing the ambulance helicopters with land-based ambulance often show reduced mortality among patients handled by helicopter. A factor often considered as a risk reducer is shortened transport time. As a step to evaluate trauma care in Swedish rural areas, a study of pre-hospital transport times is required.

Aim:
The aim of this pilot study was to compare the transport times of the ambulance helicopter with the ground ambulance for trauma patients in the Arvika Hospital catchment area.

Methods:
Retrospective data from the ambulance register in Värmland and the ambulance helicopter register in Värmland from September to December in 2017 were compared. The transport time of trauma patients from alarm to the start of medical care in hospital was compared between ground- and airborne ambulances.

Results:
9 ground ambulance transports were compared with 4 airborne. All helicopter transports in the study were faster than land-based ambulance services with comparable transport distances. No helicopter transport for shorter transports than 134 km was included in the study.

Conclusion:
In our study, it is shown that for a total transport distance of more than 134 km the transport with helicopter of trauma patients from Arvika Hospital's catchment area to the nearest healthcare facility is faster than by regular ambulance.

This study includes only a few transports, and to ensure statistical significance, a larger sample and a more accurate analysis of the complex trauma care are required.
Introduction

Arvika Hospital is a relatively small hospital, with most of its catchment area classified as rural. There is an emergency department with surgical, orthopedic and medical skills, and a small intensive care unit. Nevertheless the hospital lacks resources for advanced trauma care.

In the age group 15 to 39 years, accidents and poisoning were the most common causes of death in Sweden in 2017 [1]. Being in a sparsely populated area is a risk factor for trauma, while at the same time the mortality rate among trauma patients is higher in those patients initially treated in a smaller local hospital [2]. Maintaining a high quality trauma care in the smaller hospital has been shown to increase the survival of trauma patients significantly [3]. In Canada, the introduction of The Trauma Care Continuum (TCC) reduced the mortality rate of trauma patients from 52% to 8.6% [4]. A recent Swedish study investigating red trauma alarms in the Swedish urban environment revealed a 3-month mortality in these patients of 10.3% [5].

Scandinavian trauma care faces challenges of long distances between trauma centers and relatively long pre-hospital transport times [6]. Medical decision-making in a rural area means an increased complexity as it also includes deciding transport to a more advanced healthcare institution or not. In addition, worse roads, increased prevalence of high risk activities and that local healthcare professionals usually do not have the same experience in treating trauma patients increase the risk of morbidity and mortality [4].

International trauma care

In a major Canadian study mortality and morbidity were compared between trauma patients directly transported to advanced trauma centers with patients transported to a less specialized local hospital. The study showed significant differences in mortality (odds ratio 1.96) and morbidity as well as shorter care time for patients directly transported to the advanced trauma centers [7]. A similar study showed that trauma patients with an Injury Severity Score of >15 survive more often if transported directly to a larger trauma center compared to those in care at the less-equipped local hospitals [8].

Pre-hospital care

A North American study investigating how the distance from the injury site to the nearest trauma centers affects mortality shows that mortality risk increases by 8% per 8 km distance from the trauma center [9]. However, helicopter transports in North America are not manned by physicians, but most European ambulance helicopters are [10]. This complicates a direct comparison with Scandinavian countries [11]. Especially in Norway, several major studies in pre-hospital ambulance helicopter transport have been made. One such Norwegian study it was shown that the time for transport is not a factor of traumatic mortality, but population density in the area of trauma is a more decisive factor [12].

The differences between the Scandinavian countries’ prevalence rate for pre-hospital care including anaesthesiologist vary. In Denmark, the rate for pre-hospital ambulance manned with anaesthesiologist was 74.9 per 10000 person years. In Sweden it was only 5 [13].

One study that examined the years 2006 to 2012 shows that in trauma from sparsely populated areas, helicopter transport is strongly associated with increased survival [14]. Studies suggest that the difference in mortality is more dependent on the increased medical skills than the
transport time[15]. In a larger study comparing ambulance helicopters with ground ambulance, it was shown that the mortality at transport times over 6 minutes was significantly lower in helicopter transport than land-based transport [16].

Studies from the United Kingdom ambulance helicopters have shown that time gain with the higher speed of the helicopter is reduced during shorter transport due to increased pre-departure time and landing [17]. It has been shown that helicopter transport increases the survival rate of trauma patients with an average odds ratio of 1.16. This means that for every 65th transported patient, an additional patient survives compared to ground transport [18].

In a US study investigating helicopter transport from sparsely populated areas, the survival of trauma patients transported to a trauma center compared to ground transport shows that no such relationship exists. The study is based on American conditions where the medical skills of the ambulance helicopters are comparable to those in the ambulances [19].

“Scoop and run” vs “stay and play”
European countries tend to lean towards "stay and play" with heavier medical measures in the pre-hospital environment, while in particular the United States has a tendency to engage in "scoop and run" where a fast transportation of the injured person to a permanent healthcare institution is given priority [20].

Rapid transport to the proper healthcare institution, regardless of pre-hospital care strategy, is a crucial factor for survival in trauma patients [21]. The most time-reducing factor for reducing the time to transit was preparatory care measures, ie medical measures performed on site before the helicopter arrived at the area [22].

Arvika Hospital, like most hospitals handling trauma cases, whether they are larger regional hospitals or smaller local hospitals, uses defined trauma teams, written guidelines for trauma care, and established written guidelines for activating their trauma team [23].

The fact that trauma care in sparsely populated areas is a complex activity full of challenges is evident when the subject is examined as above. As a first part of an evaluation of the Swedish trauma care in rural areas, this study chose to evaluate possible time gains for medical transport by helicopter.
Aim

The aim of our study was to determine possible time gains when using helicopters for pre-hospital transport of trauma patients to healthcare institutions in comparison with land-based transport in the Arvika hospital catchment area.

Hypothesis: When trauma patients in the Arvika catchment area are transported more than 80 km to reach a hospital, there is a time gain using ambulance helicopter.

Secondary question: How fast can a trauma patient receive advanced medical treatment by a physician, when transported with a helicopter compared to a ground ambulance?
**Material and methods**

The study was designed as a retrospective register pilot study with additional review of medical records. All patient ambulance transports in the county of Värmland are registered in a separate register. From September 2017, the ambulance helicopter also has a similar register for patient transport.

**Study sample**

All trauma patients who received pre-hospital care via ground ambulance or helicopter ambulance during the 4-month period September 2017 until December 2017 were extracted from the ambulance register and the ambulance helicopter register of Värmland. All trauma patients retrieved within the Arvika Hospital catchment area (S940) and who received a continuous transport to a healthcare institution with the highest priority was then included in the study.

The medical records of the included patients were then reviewed for the current care period to ensure that the pre-hospital transport was uninterrupted and comparable. A flowchart of the including and excluding process is shown in Figure 1.

**Data collection**

Data collected included personal identity number, localization, alarm time, triage colour, arrival time and transport route.

Given that inclusion and exclusion criteria were designed to make the transport time comparable we chose not to perform a statistical analysis of the patient base.

GPS coordinates in WGS84 format were plotted on map based on automated radio quotes. The distance between points for alarm reception, vehicle location, patient location and receiving hospitals were compared to the fastest roadway as the reference value. In order to compare transport times between helicopters and ground ambulances, helicopter transport was also given a value of fastest capable roadway.
**Statistical analyses**
The software used for statistical analyses were Microsoft Excel version 16.0.9 with associated Analysis ToolPack. Linear regression was used to estimate the speed per kilometer transported. To determine an intercept of the graphs for land- and airborne ambulance speed, simple linear equation was used.

**Ethics**
The study was designed as a retrospective register study within the framework of quality improvement. All registry entries have been unidentified as far as possible before data analysis. Data is retrieved from a geographically defined area where the number of trauma patients is quite limited. This may allow some of the cases and patients in certain exceptional cases to be identifiable for those involved in the study. In the study report, the lowest possible data at the sample level has been reported to make it difficult to identify the individual case.
Results

All helicopter transports had CSK as a destination, but the destination for land-based transport varied between Arvika Hospital and CSK. The geographical pick-up site is shown in Figure 2 below.

As shown in Table 1, it is seen that the fastest road transport is 45 min and the slowest 129 min. For the airborne transport, the fastest time is 70 minutes and the slowest 130 minutes. The difference in length of transport distance is greater in road transport than in airborne transport. The shortest road transport is 6 km and the longest 146 km with median length 50km. For the airborne transport, the shortest distance is 73 km and the longest 85 km with median length 74 km.

Table 1. The number of transports with respective vehicles, geographic localisation of patient to pick up and transport times.

<table>
<thead>
<tr>
<th>Pick up site</th>
<th>Distance out, km</th>
<th>Distance in, km</th>
<th>Total distance, km</th>
<th>Total time, min</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ground ambulance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlottenberg, Eda</td>
<td>38</td>
<td>108</td>
<td>146</td>
<td>114.00</td>
</tr>
<tr>
<td>Åmofors, Eda</td>
<td>16</td>
<td>95</td>
<td>111</td>
<td>129.00</td>
</tr>
<tr>
<td>Centrally, Arvika</td>
<td>1</td>
<td>73</td>
<td>74</td>
<td>85.00</td>
</tr>
<tr>
<td>Charlottenberg, Eda</td>
<td>1</td>
<td>108</td>
<td>109</td>
<td>114.00</td>
</tr>
<tr>
<td>Norra Ämterud, Eda</td>
<td>6</td>
<td>41</td>
<td>47</td>
<td>47.00</td>
</tr>
<tr>
<td>Väg 61, Arvika</td>
<td>42</td>
<td>6</td>
<td>48</td>
<td>58.00</td>
</tr>
<tr>
<td>Ålgå, Arvika</td>
<td>18</td>
<td>19</td>
<td>37</td>
<td>70.00</td>
</tr>
<tr>
<td>By, Eda</td>
<td>25</td>
<td>25</td>
<td>50</td>
<td>61.00</td>
</tr>
<tr>
<td>Bosebyn, Arvika</td>
<td>11</td>
<td>10</td>
<td>21</td>
<td>45.00</td>
</tr>
<tr>
<td><strong>Helicopter ambulance</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sulvik, Arvika</td>
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<td>85</td>
<td>159</td>
<td>113.00</td>
</tr>
<tr>
<td>Centrally, Arvika</td>
<td>61</td>
<td>73</td>
<td>134</td>
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<tr>
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<td>73</td>
<td>134</td>
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<tr>
<td>Svanskog, Årjäng</td>
<td>81</td>
<td>75</td>
<td>156</td>
<td>94.00</td>
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</table>
For the land transport there is a relatively certain value for transport time per transported km with a linear increase. For the airborne transport, where the transport length is less diverse, transport times are more uniform. Figure 3 below shows the transport times for each transported kilometer.

**Figure 3. Total transport distance for terrestrial ambulance and airborne ambulance. Squares indicate ground transport, circles indicate helicopter transport. Trend line in the form of regression analysis. Solid line describes the land-based ambulance and the dotted line describes the helicopter ambulance.**

*Figure 2. Map plot for transport. Ambulance in red, helicopter in blue.*
Table 2. Helicopter and ambulance transport regression analysis

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>Standard error</th>
<th>t-quotient</th>
<th>p-value</th>
<th>Lower 95%</th>
<th>Higher 95%</th>
</tr>
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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
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<td>194.53</td>
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<td>0.74</td>
<td>-764.25</td>
<td>909.77</td>
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<tr>
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<td>0.15</td>
<td>0.89</td>
<td>-5.53</td>
<td>5.92</td>
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<table>
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<th>p-value</th>
<th>Lower 95%</th>
<th>Higher 95%</th>
</tr>
</thead>
<tbody>
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<td>Ambulance</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>5.87</td>
<td>&lt;0.01</td>
<td>0.41</td>
<td>0.97</td>
</tr>
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</table>

When looking at the time from alarm until trauma first comes into contact with a doctor, it is shown that all patients transported by helicopter had contact within 40 minutes. None of the patients who were transported with a landbound ambulance were taken care of by a doctor within 40 minutes. Comparison between distance for patient transport to time to medical care is shown in figure 4.

![Graph](image-url)

*Figure 4. Time to physician. Squares indicate ground transport, circles indicate helicopter transport. Trend line in the form of regression analysis. Solid line describes the land-based ambulance and the dotted line describes the helicopter ambulance. For the ambulance helicopter, the minimum time for vehicle start-up was set as the intersection of Y.*
Table 3. Time to physician via helicopter and ambulance transport, regression analysis.

<table>
<thead>
<tr>
<th>Helicopter</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>t-quotient</th>
<th>p-value</th>
<th>Lower 95%</th>
<th>Higher 95%</th>
</tr>
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<tr>
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<td>0.99</td>
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<table>
<thead>
<tr>
<th>Ambulance</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>t-quotient</th>
<th>p-value</th>
<th>Lower 95%</th>
<th>Higher 95%</th>
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<tbody>
<tr>
<td>Constant</td>
<td>30.90</td>
<td>9.62</td>
<td>3.21</td>
<td>0.015</td>
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<tr>
<td>X-variable</td>
<td>0.69</td>
<td>0.18</td>
<td>5.87</td>
<td>&lt;0.01</td>
<td>0.41</td>
<td>0.97</td>
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</table>
Discussion

This study reviews the pre-hospital trauma transports in the Arvika Hospitals catchment area. The geographic point of departure of the ambulance helicopter is located just outside the area. The land-based ambulance is based on the immediate vicinity of the hospital, which could shorten transport times somewhat in favour of the ground ambulances. Having a centrally placed helicopter and several local ambulance stations is however part of the pre-hospital reality.

Although Swedish ambulance has a highly educated staff compared to many other countries, the medical skills of helicopter ambulance staff is often higher because they are usually staffed with physicians. As soon as the helicopter arrives at the trauma scene, the patient can be given more qualified medical care. During ground ambulance transport, this is delayed until the patient reaches the nearest healthcare facility.

The treatment of trauma patients in the pre-hospital environment is logistically complex. In many cases the ground ambulance co-operates with the helicopter or with an emergency car. This study has not analysed the different parts of the care, but in order to draw some deeper conclusions about the effectiveness of the entire treatment, undoubtedly a more profound analysis is required.

Triage

The majority of deaths due to trauma occur within 4 hours from the injury and triage of the injured patient becomes a decisive factor in the outcome [21]. Triage based on mechanism of injury (MOI) accounts for most of the triage although triage that is based on the patient’s physiological parameters, providing a more accurate assessment [24]. There is currently no national unity in determining the priority of trauma. Physiological parameters, status findings and injury mechanism were used and the assessment criteria were highly heterogeneous between different hospitals in between [23]. In complex situations where correct triage is of extraordinary importance, it may be a priority to quickly get a doctor on site, and according to our study, this would be achieved faster with helicopter than with ambulance.

As mentioned earlier rapid transport to the proper healthcare institution is a crucial factor for survival in trauma [21]. In a large Norwegian study it was shown that the average time on site for the emergency care was 10 minutes before transport commenced. For penetrating torso damage, the median time was 5 minutes and for a cardiac arrest 20 minutes. Intubation extended the time to transport by 10 minutes [22]. In a major study on intubation trials in pre-hospital environments performed by anaesthesiologist, it was shown that they succeed in over 99% of cases and in the majority of cases was seen to be a direct life-saving measure [25]. Therefore, injury assessment of the patient in question can be a direct determinant of the mode of transport to be chosen.

A Danish study of physician-staffed emergency vehicles shows that doctors in the pre-hospital environment increase the level of treatment modalities and survival when treating trauma patients [26]. A regionalization of trauma centers has also been shown to reduce mortality and lead to shortened pre-hospital time where an integrated healthcare system in the region is a key component for an effective trauma care [27].
In a comparative evaluation of the two strategies “scoop and run” versus “stay and play”, patients with traumatic brain injury appear to receive most of the benefits of the increased care at the injury site with prehospital airway protection. However, in penetrating torso damage, survival increased with a predominantly reduced time to trauma centers for control of surgical bleeding [20]. Thus, the injury mechanism could be a factor when selecting transport means. It should be considered that the helicopter is given an increased priority in the case of severe traumatic head injury, as our study showed that the patient reaches physicians faster in all of the study cases.

A Finnish study comparing the mortality of helicopter-transported trauma patients showed that the prehospital mortality was higher among rural patients compared with urban-localized patients. The prolonged pre-hospital exposure time is considered as an important parameter especially in trauma patients from sparsely populated areas [28]. This study suggests that in longer transports the helicopter is the faster option and should be considered as the primary transportation in trauma cases.

Several studies have been conducted to study interhospital transports of trauma patients. A Norwegian study from 2017 that examined triage, transport and effect on trauma patients in a combined rural and urban environment, similar to the topography in Värmland, showed that of those with severe trauma (ISS > 15), 79% sometime during the time of care was treated at a larger trauma center. 41% of those with severe trauma were initially cared for at the less qualified local hospital and nine percent of all trauma underwent inter-hospital transport [29]. In a major review article from 2011 [30] that examined 36 observational studies, no difference in mortality was found between the trauma patients who were transported directly to a trauma hospital or those who were transferred at a later stage between hospitals.

In US, more than 3 times as many of the seriously injured in vehicle accidents are transported to the local hospital instead of the nearest fully equipped trauma center. In these circumstances, the importance of local hospitals and their skills in dealing with trauma patients is high in terms of reduced mortality [31]. A 2008 study that looked at the one-year survival from the injury shows that no significant difference between the trauma patients directly transported to a trauma center from the site of injury or those transferred from another hospital was found [32]. The most common group of patients who were transported by helicopter between hospitals were men with penetrating trauma, usually after traffic accidents [33]. As with the initial triage, older people are more often under prioritized when it comes to interhospital transport [34].

Even in the same country, the geographical variation in the benefits of helicopter transport can be great and requires a local analysis [35].

Before any further conclusions are drawn from the results of this study, the entire chain of trauma care must be evaluated and the consequences of any interventions compared with both morbidity and mortality.

**Limitations**

One of the limitations in the study is the lack of correlating data in the two registries used. This has complicated the comparison between patient categories and patient characteristics. A larger study for a longer period of time with more detailed patient data is needed to draw final conclusions on the subject.
Data is exclusively from the period September to December 2017. During the given period, the road conditions is generally worse than the average road conditions during the year. This could have had a negative impact on the transport time of the ground ambulance. Weather conditions for the period have not been analysed in the context of this study, whether it is road or air conditions.

Some data are automatically recorded without review, which means there is a risk of incorrect registration.

In the ambulance helicopter, most of the data are recorded afterwards and some data may therefore be well-balanced estimates. It should therefore be taken into account that certain error margins can be found, especially regarding the time periods.

The study chose to include cases where vehicle problems caused disturbances in transport as this is part of reality and de facto becomes a factor to take into account. This significantly increased the time of transport in a noted case regarding the helicopter. Further analysis for how much and what reason is required.

**Future**

In future studies, a follow-up and review of the patients examined in our study would be of interest. Comparing medical interventions, mortality and morbidity in patients as well as correlating this to transport times could provide data for guidelines how the ambulance helicopter and ground ambulance should be used in relation to each other in terms of optimizing care for trauma patients in rural areas.

Pre-hospital medical care and diagnostics, development is rapidly advancing and more studies are needed to evaluate and standardize the entire care process, from injury to final discharge.

Continuously, a comparison and evaluation of patient transport would be of interest where not only the distance, time and type of vehicle is included but also destination (with type of healthcare facility) were included in the evaluation.

The quality of local trauma care is partly threatened by the ever-increasing subspecialization in both staff and healthcare institutions [6] and further studies how this affects trauma care, especially in rural areas should be done.

Furthermore, it would be of interest to study the pre-hospital triage specifically. For example, whether existing triage parameters are valid and to what extent they are followed. Challenges with pre-hospital triage are even greater in rural areas, where the transport routes are long and the distance to trauma centers is greater.

Given that Sweden has guidelines for equal care for the entire population irrespective of geographical location, the interest in studies towards just rural medicine should be of high interest, and also with particular interest in trauma and transport.
**Conclusion**
This pilot study indicates that there is no time gain in using the ambulance helicopter for pre-hospital transportation of trauma patients if the total vehicle distance is less than 80km.

The small number of helicopter transports included in the study resulted in a low statistical significance for the linear regression and hence the result.

In our study, it is shown that for a total transport distance of more than 134 km the transport with helicopter of trauma patients is faster than by regular ambulance. The result is consistent with previous international studies. When studying the time from alarm to the patient’s first contact with a doctor, the time was shorter for the helicopter in all cases included in the study, which may be important for certain patients, for example those with traumatic brain injury needing oral intubation for airway protection.

**Acknowledgement**
A special thanks to Emil Palm, Marcus Rommedahl, Arvika Hospital, the ambulance helicopter in Värmland and Wolmer Edqvist.
References


Cover Letter

Dear editor!

I hereby send you my latest study in hope it will offer you an interesting reading and if possibly is offered an opportunity for publication in your journal.

The study in question is a pilot study that deals with transportation times for trauma patients in rural areas. Trauma- and pre-hospital care are two topics, and for many reasons interesting subjects, which in combination with each other, in my humble opinion, become even better.

With an increasingly and more advanced pre-hospital care and an expanded helicopter use the possibilities of medical interventions in the pre-hospital healthcare environment and the complexity of the care is increasing.

Trauma care in general and airborne trauma care in particular is a costly resource that is often subject to review from an economic perspective. To make a fair and balanced assessment, a thorough evaluation of the resource in question is required. This pilot study reviews the prehospital transportation of trauma patients from sparsely populated areas to established healthcare facilities and examines any time gained from using helicopters instead of ground ambulances.

The result is not only fascinating for those who are particularly interested in trauma and rural medicine but should also be interesting for all healthcare professionals who may come into contact with pre-hospital transport decisions.

Yours sincerely

Raimo Lindgren, med kand, Örebro University
Etiskt övervägande

Raimo Lindgren

Generellt sett måste det ses som etiskt riktigt att använda och analysera registerdata. Registret är upprättat med användandet av resurser, bland annat i form av arbetstid och pengar men också i investerad tid av bland andra patienter.
Att använda informationen för att få ut resultat och i slutändan förbättra sjukvården får nästan ses som en skyldighet då registret upprättas.
Likaså borde det för all sjukvårdspersonal vara en självklarhet att kontinuerligt ägna sig åt kvalitetsförbättrande och procedurprövande studier. Detta då vården skall vila på en evidensbaserad bas i en ständig föränderlig miljö.

Den här studien utformas som en retrospektiv registerstudie inom ramen av kvalitetsförbättrande arbete. Inga patientinterventioner sker och ingen behandling kommer påverkas i och med studien vilket minimerar risken för negativ patientpåverkan.
I fortsättningen kan studiens resultat ligga till grund för djupare analyser av sjukvården i Värmland och Sverige samt i slutändan förbättringar inom framförallt glesbygdsmedicin och traumasjukvård.
Alla registeruppgifter har aidentifierats i största möjliga mån innan analys av data men då data är inhämtat från ett geografiskt avgränsat område där antalet traumapatienter är täligen begränsat finns risken att några av fallen kan vara möjliga att identifiera för de inblandade i studien. Det skulle kunna innebära en potentiell kränkning av patientens integritet. Risken för detta minimeras genom att det i studierapporten redovisats minsta möjliga data på sample-nivå.
Populärvetenskaplig sammanfattning

En mindre pilotstudie som berör Arvika sjukhus och traumaomhändertagandet i glesbygd har genomförts.


Den här studien har jämfört transporttiderna för ambulansen och ambulanshelikoptern när det gäller olycksfall i Arvikaområdet.

Sammanlagt 15 fall analyserades och transporttiderna från larm till patientens ankomst till sjukhus användes för att få fram den genomsnittliga transporttiden för respektive fordonsslag.

Studieresultatet visar att vid de analyserade akuta transporterna som överskred 134 km så var ambulanshelikoptern snabbare än den markbundna ambulansen. Det innebär i realiteten att vid olyckor som behöver transporteras längre än till sjukhuset i Arvika, till exempel till Centralsjukhuset i Karlstad, så är helikopter oftast snabbare. Studien föreslår även att vid skador där snabb läkarkontakt är prioriterad bör helikoptern övervägas även vid kortare transportsträckor.

Studieresultatet kan komma att ligga till grund för större och mer utförliga undersökningar inom området glesbygdsmedicin och omhändertagandet vid olyckor.