Cancellations of Helicopter Emergency Medical Services dispatches in the Netherlands


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ABSTRACT

Background
The trauma centre-region of the North-West Netherlands (TRNW) has consensus criteria for HEMS scene dispatch. The HEMS can be dispatched by the EMS-dispatch centre or by the on-scene EMS crew and is transported by helicopter or ground transport. Although much attention has been paid to improve the dispatch criteria, the HEMS are often cancelled after being dispatched. The aim of this study was to assess the cancellation rate and the noncompliant dispatches of our HEMS, and to identify factors associated with this form of primary overtriage.

Methods
By retrospective analysis of all HEMS dispatches in the period from 1 July 2006 till 31 December 2006 using chart review, we conducted a consecutive case review of 605 dispatches. Four hundred and sixty seven of these were included for our study, collecting data related to prehospital triage, patient’s condition on-scene and hospital course.

Results
Average age was 35.9 years, the majority of the patients was male (65.3%). Four hundred and thirty patients were victim of trauma, sustaining injuries in most cases from blunt trauma (89.3%). After being dispatched, the HEMS were cancelled 203 times (43.5%).

Statistically significant differences between assists and cancellations were found for overall mortality, mean RTS, GCS and ISS, mean hospitalization, length and amount of ICU admissions (p<0.001). All dispatches were evaluated by using the HEMS-dispatch criteria and mission appropriateness criteria. Almost 26% of all dispatches were neither appropriate, nor met the dispatch criteria. Fourteen missions were appropriate, but did not meet the dispatch criteria. The remaining 318 dispatches had met the dispatch criteria, of which 135 (30.3%) were also appropriate. The calculated additional costs of the cancelled dispatches summed up to a total of € 34,448, amounting to 2.2% of the total HEMS costs during the study period.

Conclusion
In our trauma system, the HEMS dispatches are involved with high rates of overtriage. After being dispatched, the HEMS are cancelled in almost 50% of all cases. We found an undertriage rate of 4%, which we think is acceptable. All cancellations were justified. The additional costs of the cancelled missions were within an acceptable range. According to this study, it seems to be possible to reduce the overtriage rate of the HEMS dispatches, without increasing the undertriage rate to non acceptable levels.
INTRODUCTION

Trauma triage systems seek to identify and provide rapid treatment for the most severely injured trauma patients while at the same time identifying less-injured patients in need of only basic care. These systems have been shown to substantially reduce injury-related morbidity and mortality. An ideal system would equally match the severity of injury and resources required for optimal care with the appropriate trauma facility and personnel. However, in practice it is shown that a “perfect” triage system is not possible, resulting in ruling out overtriage and undertriage. As stated in the American College of Surgeons Committee on Trauma guidelines, “… in general, priority has been given to decrease of undertriage, because undertriage may result in preventable mortality or morbidity from delays in definitive care”.4

Undertriage may lead to delayed diagnostics and inefficient resuscitative measures. Overtriage means increased workload at the receiving trauma centre and the inefficient use of healthcare resources. Overtriage may also cause longer out-of-hospital transport times and loss of emergency medical service coverage in the primary area, although it is necessary to some extent in order to reduce preventable deaths. Even though decrease of undertriage should result in fewer missed injuries or delays in receiving definitive care, the inevitable result has been an increase in overtriage of patients with less-severe or negligible injuries.

In 1995 helicopter emergency medical services (HEMS) were introduced in the Netherlands. The first HEMS was based on the VU university medical centre in Amsterdam, a level I trauma centre of the Trauma centre Region North West Netherlands (TRNWN). Aim of this concept was the delivery of a trauma team to the scene of the accident as quickly as possible, in addition to the Emergency Medical Services (EMS) crew. The HEMS team consists of a specially trained physician (a trauma surgeon or an anesthesiologist) and an Emergency Department (ED) / EMS nurse. They add advanced airway management, rapid sequence induction, placement of chest tubes, administration of specific medication and limited surgical interventions to the on-scene therapeutic spectrum. During daylight hours almost 80% of the Dutch population can be reached within 15 minutes by the (totally four).
HEMS in the Netherlands (Figure 1). After sunset and until midnight, the HEMS are transported by a specially equipped vehicle. In table 1 is shown the difference of the dispatch, assist and cancellation rate between the four HEMS in the Netherlands.

With the designation of 10 Level-I trauma centers in the Netherlands in 1999, the prehospital and inhospital triage systems have become more important in providing a high quality trauma care. In 2008 an extra Level-I trauma centre was assigned, counting up to a total of 11 trauma centers in the whole country. Prehospital triage systems have been developed and are constantly being renewed and adapted in order to stimulate an optimal distribution of trauma patients to the appropriate medical facilities, while in-hospital triage systems have focused on the appropriate and prioritized use of these facilities.

The HEMS handle a low activation threshold and are dispatched by the EMS dispatch centre at the same time as the EMS crew (primary call). Alternatively, the EMS crew can request a HEMS team at the scene of the accident for severely injured patients who are for example entrapped (secondary call). The criteria for the primary and secondary calls are listed in Figure 2. It is possible for the EMS crew, after arriving at the scene, to cancel the HEMS dispatch in case they appear not to be necessary.

The HEMS of the trauma centre North West Netherlands, stationed at the VU University Medical Centre in Amsterdam, covers a territory of almost four million inhabitants with five EMS dispatch centers. Yearly, the HEMS have been dispatched approximately 1200 times. In the second half of 2006, the amount of cancellations nearly reached 50%.

The purpose of this study was to evaluate the cancellations of our HEMS dispatches and to define the possible causes of this form of overtriage.

PATIENTS AND METHODS
All HEMS dispatches in the TRNWN between July 2006 and December 2006 were included in this study. Dispatches from other regions were excluded because of handling other dispatch criteria, as well as patients with missing data.

Research data were extracted from the HEMS database, the regional trauma registry of the VU University Medical Centre including the region hospitals, as well as the original EMS forms.

Table 1. HEMS dispatches in the Netherlands in 2006*

<table>
<thead>
<tr>
<th>HEMS</th>
<th>Dispatches</th>
<th>Assists</th>
<th>Cancellations</th>
<th>Trauma</th>
<th>Non-Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifeliner 1</td>
<td>1197 H=819 V=378</td>
<td>606 H=379 V=227</td>
<td>591 (49.4%) H=440 V=151</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>Amsterdam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifeliner 2</td>
<td>1367 H=945 V=422</td>
<td>904 H=585 V=319</td>
<td>463 (33.9%) H=360 V=103</td>
<td>67.7%</td>
<td>32.3%</td>
</tr>
<tr>
<td>Rotterdam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifeliner 3</td>
<td>1100 H=949 V=151</td>
<td>546 H=498 V=48</td>
<td>554 (50%) H=451 V=103</td>
<td>93%</td>
<td>7%</td>
</tr>
<tr>
<td>Nijmegen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifeliner 4</td>
<td>1193 H=837 V=356</td>
<td>888 H=626 V=262</td>
<td>305 (33.7%) H=211 V=94</td>
<td>75.8%</td>
<td>24.2%</td>
</tr>
<tr>
<td>Groningen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H= Mission by helicopter
V= Mission by vehicle

*source: Annual reports Dutch HEMS Trauma centers 2006
Dispatches were divided in assists and cancellations. For each dispatch we collected prehospital information related to reason for dispatch, vital signs (Respiratory Rate (RR), Heart Rate (HR) and Blood Pressure (BP)) and scores (Glasgow Coma Scale (GCS) and Revised Trauma Score (RTS)) of the victim at the scene, and inhospital information related to the condition of the patient at the Emergency Department (ED) vital signs and scores (GCS and RTS), early surgery, admission at the ICU, length of stay in the hospital, mortality and the Injury Severity Score (ISS).

The above information was compared between assists and cancellations.

All dispatches were evaluated by using our regional HEMS dispatch criteria and the following mission appropriateness criteria, which are used as HEMS appropriateness criteria in the literature.

- ISS ≥ 16 (if trauma).
- Death within 24 hours, unless no effort was made to resuscitate victim on scene.
- Urgent surgical procedure immediately after ED admission.
- Admission to (Pediatric) Intensive Care Unit (ICU).

The additional costs for the cancelled HEMS-dispatches were calculated based on the actual cost as found in the balance of payments of 2006.

Statistical analysis was performed using the SPSS software package (SPSS 14.0 for Windows; SPSS, Chicago, IL, USA). Statistically significant was defined as p<0.05.

**Figure 2. HEMS dispatch criteria**

<table>
<thead>
<tr>
<th>Primary Dispatch Criteria</th>
<th>Secondary Dispatch Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Energy Trauma (Blunt)</td>
<td>Threatened Airway</td>
</tr>
<tr>
<td>Victim launched from vehicle / motorcycle</td>
<td>Severe facial trauma</td>
</tr>
<tr>
<td>Pedestrian hit by motor vehicle (speed ≥ 30 Km/h)</td>
<td>Corpus Alienum</td>
</tr>
<tr>
<td>Fall from ≥ 5 meter</td>
<td>Edema (Quincke’s or burn wound)</td>
</tr>
<tr>
<td>Accidents involving: truck/subway/train/airplane/ship</td>
<td>Stridor</td>
</tr>
<tr>
<td>Multiple (seriously) injured victims (triage)</td>
<td>Expected difficult intubation</td>
</tr>
<tr>
<td>Prolonged extrication ≥ 15 minutes</td>
<td>Threatened Breathing</td>
</tr>
<tr>
<td>EMS traveling time ≥ 20 minutes</td>
<td>O₂ saturation ≤ 96% with max O₂ administration</td>
</tr>
<tr>
<td>Entrapment</td>
<td>Multiple rib fractures/ flail chest/ lung contusion</td>
</tr>
<tr>
<td>Drowning / accidents involving submersion</td>
<td>Hemothorax, tension pneumothorax</td>
</tr>
<tr>
<td>Severe hypothermia ≤ 32 °C</td>
<td>Breathing Frequency ≥ 30 and ≤ 10 per minute</td>
</tr>
<tr>
<td>Accidents involving: explosives / electricity / chemicals / radiation</td>
<td>Threatened Circulation</td>
</tr>
<tr>
<td>Pediatric resuscitation</td>
<td>HR ≥ 120 per minute, SBP ≥ 90 mmHg, shock</td>
</tr>
<tr>
<td>Traumatic amputation of limbs above ankle or wrist</td>
<td>Threatened consciousness</td>
</tr>
<tr>
<td>Penetrating trauma (stab or gunshot)</td>
<td>Glasgow Coma Scale ≤ 8 or sudden drop of &gt; 2</td>
</tr>
<tr>
<td>Possible trauma to airway, shock or coma</td>
<td>Pupil difference, epileptic state, severe CVA</td>
</tr>
<tr>
<td>Burn victims ≥ 15% BSA or involvement of head/neck</td>
<td>Severely commotional / untreatable victim</td>
</tr>
<tr>
<td>Need for amputation on scene</td>
<td></td>
</tr>
</tbody>
</table>
RESULTS

During the second half of 2006 (July 2006 to December 2006), the HEMS had 605 dispatches. Figure 3 shows a summary of included and excluded cases. Of the 605 dispatches, 77 were excluded because these were requested by an EMS dispatch centre from another trauma-region (different dispatch criteria). Eight were excluded as there was not enough information available to trace these back to an EMS dispatch centre.

From each mission, we included the most severely injured patient (in case there was more than one victim). Of the 520 missions in our trauma-region, 501 were matched to an original EMS form. Of these, 41 patients died on scene, 37 were treated on scene without admission to an ED. In 13 cases it concerned a fake call. Four hundred and ten patients were transported to 22 different emergency departments, of which 389 patient charts were retrieved and reviewed. Totally 467 dispatches were included for this study.

Table 2 lists the characteristics of the included dispatches and patients. The majority of the included missions were primary dispatches (91.1%) and most of these were made by helicopter. In the remaining dispatches the HEMS was transported by vehicle.

Average age was 35.9 years, the majority of the patients was male (65.3%). Four hundred and thirty patients were victims of trauma, sustaining injuries in most cases from blunt trauma.
Thirteen patients were victims of penetrating trauma and 44 patients sustained other type of trauma. The remaining 37 dispatches were of non-traumatic origin (17 cardiac, 17 neurological and 3 other).

All missions were categorized according to reason for dispatch / mechanism of injury (MOI) (Table 3). After being dispatched (n=467), the HEMS were cancelled 203 times (43.5%) (Table 2). The missions were divided in assists and cancellations. The characteristics of these missions were compared, the results of which are shown in Table 4.

Not all EMS forms were completely filled in, which resulted for 77 patients in a missing on-scene RTS (19.8%) and for 71 patients in a missing on-scene GCS (18.3%).

The ISS was calculated for 360 patients (77.1%). For the remaining trauma patients there was not enough information available about their injuries.

Statistically significant differences between assists and cancellations were found for overall mortality, mean RTS, GCS and ISS, mean hospitalization (if necessary), length and amount of ICU admissions (p<0.001). Overall mortality includes those who died after EMS and/or HEMS.
arrived on scene. Sixteen patients were dead on arrival. Age and sex did not significantly differ (Table 4).

All dispatches were evaluated by using the HEMS-dispatch criteria and mission appropriateness criteria (ISS ≥16, death within 24 hours, urgent surgical procedure immediately after ED admission, admission to (Pediatric) Intensive Care Unit). Out of the 467 dispatches, 21 could not be evaluated as the available data were not enough for this purpose. We found that almost 26% of all dispatches were neither appropriate, nor met the dispatch criteria (group 1 in Figure 4.). Fourteen missions were appropriate, but did not meet the dispatch criteria (group 2 in Figure 4.). The remaining 318 dispatches had met the dispatch criteria (group 3 and 4 in Figure 4.), of which 135 (30.3%) were also appropriate (group 4 in Figure 4.).

Patient's injuries were compared for the assist and cancellation groups using the AIS anatomical regions from 360 trauma patients whose injuries were completely AIS coded (Figure 5). The majority of injuries in the assist group are to head and chest. This in contrast with the cancellation group, which shows a relative increase of injuries in the upper- and lower extremities.

Four groups were created based on the ISS anatomical body regions and type of dispatch:
- Group 1 contains the HEMS assisted patients with injuries to head and/or chest
- Group 2 the HEMS cancelled patients with injuries to head and/or chest
- Group 3 the HEMS assisted patients with injuries to the remaining parts of the body and
- Group 4 the HEMS cancelled patients with injuries to the remaining parts of the body.

ISS means were compared for these groups with one-way ANOVA. A significant difference of p<0.001 was found between the means of all groups, except for group 2 and 3. The mean ISS for group 1 was significantly higher than those for the other groups, and was the only one to have a mean ISS above 16. Group 4 had the lowest mean ISS (Table 5).

The additional costs of all cancelled dispatches summed up to a total of € 34,448. These costs consist of material costs and pilot costs for the helicopter and were calculated based on € 40 per flight minute. For the HEMS-vehicle, which was a gift by the Dutch ministry of Internal Affairs, we assumed that the additional costs were negligible (the fuel costs were very low compared to the helicopter’s, the personnel is in salaried employment). (Table 6).
HEMS CANCELLATION ANALYSIS

Figure 4. Evaluation of the dispatches by using HEMS dispatch criteria and mission appropriateness criteria

<table>
<thead>
<tr>
<th>Group</th>
<th>Mission was appropriate</th>
<th>Mission met dispatch criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 5. Patient’s injuries per AIS anatomical region

Assists: total 491 injuries (100%); Cancellations: total 338 injuries (100%)

Table 5. ISS means of the 4 groups based on the ISS anatomical body regions and type of dispatch
It is difficult to define whether a HEMS mission is medically appropriate or not. The reason for this is that there has never been designed a prospective randomized study to assess the usefulness of physician staffed prehospital trauma teams. Though, several retrospective studies indicated that the HEMS in the Netherlands offers an increased chance of survival for severely injured patients and could lead to reduced morbidity. In studies conducted among prehospital traumatic deaths, airway management has been shown the key in preventable deaths in patients with severe head injury. This study shows that the HEMS does indeed reach those patients that benefit the most from its offered care.

Although the EMS dispatch centers operate according to the present HEMS dispatch criteria, a considerable high percentage of overtriage is shown in our study. The main question that needs to be differentiated is: is the overtriage a result of misinterpretation of the dispatch criteria, or are the criteria not accurate enough and do these need to be revised?

Prehospital triage systems are based on anatomical and physiological parameters and the mechanism of injury (MOI). The optimal combination of these parameters seems to form the most effective triage system. Several studies stated that the MOI criteria alone are not good predictors for major trauma or the need for prehospital and inhospital trauma teams. Individual MOI criteria have no clinical or operational significance in prehospital trauma triage of patients who have an absence of physiological distress and no significant pattern of injury.

In our study, the on scene patient’s RTS was significantly lower in the HEMS assisted group than for the cancellation group. Previous studies have shown that a lowered RTS can recognize severe trauma victims, with a sensitivity ranging between 60 and 80%. A similar study conducted in the Netherlands found lower results, ranging between 40 and 60%. This difference is possibly seen because of the lower prevalence of trauma in our country due to traffic conditions, for example a high traffic load on the (high) way’s due to demographic characteristics resulting in a relatively low average vehicle speed compared to the surrounding countries like Germany and Belgium.

**DISCUSSION**

Table 5. ISS means of the 4 groups based on the ISS anatomical body regions and type of dispatch

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean ISS (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assist and injuries to head and / or chest</td>
<td>20.69 (15.71)</td>
</tr>
<tr>
<td>2. Cancellation and injuries to head and / or chest</td>
<td>10.08 (12.71)</td>
</tr>
<tr>
<td>3. Assist and injuries to the remaining parts of the body</td>
<td>8.65 (11.88)</td>
</tr>
<tr>
<td>4. Cancellation and injuries to the remaining parts of the body</td>
<td>2.22 (3.29)</td>
</tr>
</tbody>
</table>

Table 6. Costs of HEMS dispatches*

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total HEMS costs during study period</td>
<td>€ 1,537,747</td>
</tr>
<tr>
<td>Mean cancelled dispatch flight duration</td>
<td>5.98 minutes</td>
</tr>
<tr>
<td>Total cancelled HEMS dispatch costs*</td>
<td>€ 34,448</td>
</tr>
<tr>
<td>Mean cancelled HEMS dispatch costs*</td>
<td>€ 239.20</td>
</tr>
</tbody>
</table>

* based on the actual cost as found in the balance of payments of 2006
The mean prehospital GCS was also found to be lower in the HEMS assisted group. Prehospital lowered GCS has been shown to be a good predictor for inhospital trauma team activation, being indicative of possible serious trauma. Limitation of triage to anatomic and physiologic criteria does not seem to be the solution, because this results in dangerous levels of undertriage. We can say that some degree of MOI and provider judgement needs to be incorporated. Several retrospective studies have introduced new prehospital triage models to identify major trauma patients in the prehospital setting. However, these models still need to be validated in prospective studies.

Overtriage results in little impact to the patient, but it can result in significant strain on hospital and system wide resources and personnel. According to the American College of Surgeons – Committee on Trauma, an undertriage rate of 5-10% is considered unavoidable and is associated with an overtriage rate of 30-50%. In this study, the HEMS were cancelled in almost 50% of all dispatches. According to the above mentioned, our cancellation rate is acceptable, but only if the undertriage rate is minimized. Figure 4 shows that the HEMS were cancelled 19 times (4.3%) while the mission was assessed to be appropriate (severely injured patient) (cancellations of group 2 and 4). These cases form the undertriaged group. According to the above mentioned, we think that this combination of over- and undertriage is acceptable in our trauma system. Of the 19 undertriaged patients 11 were directly admitted to the ICU and two were directly brought to the operating room. Four of them died within 24 hours. Of these, two young patients died in the ED due to cardiac failure. One died at the scene of the accident and one in the ICU, both due to traumatic brain injury. In the last two cases, the HEMS was cancelled because in one the patient was pronounced dead at the scene due to severe traumatic brain injury, in the other the patient needed emergency transportation to a hospital due to neurological symptoms. In the first two cases, the HEMS were cancelled before even the EMS crew arrived at the scene. The reason for cancellation was that it concerned in both cases a cardiac resuscitation instead of a traumatic, which is not a primary dispatch criterion in our trauma region and in the Netherlands until today. Even thought the above mentioned is true, we think that cardiac resuscitations, especially in young patients can be difficult, and the presence of a specialized physician can be helpful.

An earlier study, conducted in the Netherlands, showed that the HEMS can be considered cost-effective. The calculated additional costs of the cancelled dispatches summed up to a total of €34,448. Considering these costs amount to 2.2% of the total HEMS costs during the study period (€1,537,747), we think these costs are acceptable.

In our study, it was not possible to identify the group of patients who met dispatch criteria and were severely injured, but for who the HEMS were not deployed at all (primary undertriage). The results of a study in another Dutch trauma region showed that emergency dispatchers only deployed the HEMS in 14% of all calls meeting the formal dispatch criteria. This means that strict adherence to dispatch protocols can lead to an increase in the number of dispatches by a factor of seven.

Therefore we suggest a study in our trauma region where all trauma emergency EMS dispatches are included and the primary undertriaged patients are analyzed.

In 128 cases (group 1 and 2 in Figure 4) we saw that the mission did not meet the dispatch criteria. This may be a result of incomplete and unclear information given by a lay caller to the dispatch centre. Although in the literature we see cases where incomplete or unclear calls
resulted in undertriage, we suppose that this can also cause overtriage. Although, it is known that
the use of criteria based dispatch systems increase the efficiency of EMS. According to earlier
studies in the US, the use of these systems significantly decreased inappropriate Advanced Life
Support (ALS) dispatching, as defined by decreased rate of ALS cancellations. When dispatch
protocols are used by personnel without ALS training, a significant rise of inappropriate scene
responses and ALS cancellations is seen.

It was not possible to clearly define the reason of the cancelled, but appropriate missions in
this retrospective study. We suppose that time plays a crucial role. During daylight hours, the
HEMS are transported by helicopter, which is a fast way to reach the patient. After sunset and
until midnight, the HEMS are transported by a specially equipped vehicle. This may delay the
arrival of the HEMS on scene, especially when the distance is long. In situations with unstable
patients (threatened vital signs), the EMS personnel will have to choose between waiting on
scene for the HEMS, or transporting the patient as fast as possible to the nearest trauma centre
and cancelling the HEMS. The latter is a justifiable option in our opinion. After approval by the
Ministry of Health, one of the Dutch HEMS (Lifeliner 3, Nijmegen) started a night pilot in 2006.
This HEMS is 24-hours a day available and covers after sunset and especially after midnight
almost the whole country. According to the results of this pilot, soon all four Dutch HEMS will
be available day and night.

The HEMS have been designed to enable a trauma team to arrive as quickly as possible at
the scene of injury. The team supplements but does not replace the EMS crew. Although it is
proven that patient transportation by helicopter offers a possible time benefit, only 2-15% of
patients are transported by helicopter after on scene treatment in the Netherlands. Due to
geographic conditions, in the majority of the cases, within 20 – 30 minutes an appropriate level
1 trauma centre can be reached by ground ambulance after extrication of the injured patient at
the accident scene.

In Europe, there is a great variation in organization of trauma care. Many European
countries have designated trauma centers and use mobile medical teams in the prehospital
setting in order to improve trauma care. Although the same idea is realized in different areas,
substantial differences are seen in dispatch and cancellation frequencies. We think that this
difference can be partially explained by the difference in dispatch types. Table 1 shows that
the cancellation rate is lower for the HEMS with a higher non-trauma dispatch rate. In a recent
Dutch study a comparison was made between the dispatch frequencies in different emergency
dispatch regions by relating the dispatch of the HEMS with the number of inhabitants. The
deployment of the HEMS proved to differ significantly between emergency dispatch centers.
Dispatch centers coordinating HEMS conducted significantly more HEMS calls with a lower
cancellation rate.

Analysis of the German HEMS data of the ADAC (General German Automobile Association)
of 33 German HEMS during the same (research) period showed an emergency dispatch rate
of 17,823 of which 14.3% were cancelled. Only 38.2% of all dispatches were of traumatic origin.
This is not comparable with the results of our study, since in our study the dispatches were
predominantly based on trauma indications (95%). This could be caused by the difference
between the Dutch and the German EMS systems. An EMS crew in the Netherlands consists
of two persons: an ambulance driver and an ambulance nurse. The ambulance nurse has
being trained in A(T)LS and is allowed to perform many advanced medical procedures like
endotracheal intubation and administration of analgesic medication. Therefore, the HEMS in the Netherlands are predominantly needed in more difficult trauma related situations than in Germany.

LIMITATIONS
Retrospective, comparative observational studies are inherently less accurate than a properly setup prospective study. We tried to minimize selection bias by performing a consecutive case review. Missing data however remains a clear obstacle in performing adequate research in trauma systems. Also, several major obstacles to the development of quality EMS research exist. Funding is woefully inadequate and integrated information systems are needed to link data on patient care with information on outcome. The properties of emergency medicine and trauma patients itself make it hard to apply the optimal scientific study design in this population. In trauma care, prospective (randomized) research in the prehospital is even more difficult. Although prehospital randomisation in trauma research is complex, it seems to be feasible. Therefore, we suggest a large prospective study were severely injured patients are included with the aim to trace and analyse the causes and reduce the rate of over- and undertriage.

CONCLUSION
In our trauma system, the HEMS dispatches are involved with high rates of overtriage. After being dispatched, the HEMS are cancelled in almost 50% of all cases. Although 4% of all patients were undertriaged, we think that this combination of over- and undertriage is acceptable. All cancellations were retrospectively justified. The additional costs of the cancelled missions were within an acceptable range. In the Netherlands, the HEMS dispatch rate of traumatic origin is relatively high compared to other European countries. There seems to be a relation between the increase of the non-traumatic dispatch rate and the decrease of the cancellation rate. According to the results of this study, a reduction of overtriage seems to be possible, without increasing the undertriage rate to dangerous levels. Further research is needed in order to assess the primary undertriage rate of our system and, if necessary, to refine the dispatch criteria.
REFERENCES


4. Surgeons Committee on Trauma–American College of Surgeons, Resources for Optimal Care of the Injured Patient, American College of Surgeons, Chicago, IL (1998)


