

A high proportion of prehospital emergency patients are not transported by ambulance: a retrospective cohort study in Northern Finland

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All authors designed the study, analyzed and interpreted the data, drafted and critically revised the manuscript. MH collected and extracted the data. All authors have read and approved the final version of the manuscript.

All authors declare that they have no financial or any other conflicts of interests.

Acknowledgements: The EMS personnel who collected the data while taking care of the patients are highly acknowledged. The statistical help of Mr. Pasi Ohtonen, MSc, during the design and analysis of the study is appreciated. This study was funded by an EVO grant from Oulu University.

Short title: [Non-transportation in EMS](#)

Word count: 2460

Abstract

Background: The number of missions in the emergency medical services (EMS) has increased considerably in the recent years. People are requesting ambulance [for](#) even minor illnesses and non-medical problems, which is placing financial and resource burdens on [the EMS](#). [The aim of this study was](#) to determine the rate of non-transportation missions in Northern Finland and the reasons for these missions.

Methods: All ambulance missions in two hospital districts in Northern Finland during the six-month period of January 1 through June 30, 2014, were retrospectively evaluated from the EMS charts to identify missions [in which](#) the patients were not transported by the EMS. The non-transportation rates and reasons were calculated and expressed as percentages.

Results: In 41.7% of the 13 354 missions the patient was not transported [from the scene](#) by an ambulance. After [a](#) medical assessment and care [was](#) provided by the EMS, 48.2% of [these](#) non-transport patients were evaluated as not needing further treatment in the emergency department and were directed to contact the municipal health care center during office hours. There was no need for any medical care [in 39.9% of non-transportation missions](#).

Conclusion: This study showed a high rate of EMS missions [resulting in non-transportation](#) in two hospital districts in Northern Finland. [In the majority of these missions there was no need for emergency admission to an emergency department or for any medical care at all](#). These findings indicate [that an improvement in](#) the dispatch process and primary care resources [might be of benefit](#).

Key words: Emergency Medical Services, Ambulance Diversion, Emergency Medical Service Communication Systems

Introduction

The number of missions in the emergency medical services (EMS) has increased considerably in recent years.^{1,2} People increasingly contact emergency medical communication centers (EMCCs) and request an ambulance [for](#) even minor illnesses or injuries, as shown by a recent review.³ Adequate risk assessment and emergency dispatching play key roles in EMS utilization, EMS resource management and costs.⁴ Triage at dispatch has to be sufficiently sensitive to identify true life-threatening situations, but over-triaging and merely sending ambulances [on-request may lead to an](#) inappropriate use of available EMS resources.

In recent decades the rate and nature of non-transportation EMS missions have changed. Several EMS providers in the UK did not previously allow EMS crews to leave patients non-transported, unless the patient refused transportation.⁵ Such a policy may lead to overcrowding of the emergency departments; for example, in the US 70% of transported patients are discharged home from the emergency departments.⁶ Because the health care system is imposing a widened range of tasks and interventions to be performed by the EMS, the scope of EMS practice has changed, and guidelines for non-transportation situations have been implemented.^{5,7} In Finland, guidelines enable EMS providers to make liberal non-transportation decisions based on the patient's actual needs, which may lead to a high proportion of missions in which transportation by ambulance is not indicated.

In Finland municipal health care centers are responsible for urgent outpatient medical care during office hours (Mon-Fri 8:00 AM - 4:00 PM), whereas care outside office hours is centralized to the regional hospitals. The hospital network is currently undergoing a reform, which creates larger but fewer units for the provision of emergency care overall. For many patients, this means longer distances to the closest outpatient clinic or hospital. In Northern Finland [this will result in](#) distances longer than 100 km [for some patients](#), which may affect the use of EMS services.

The main objective of this study was to determine the rate and causes of non-transportation missions in two Finnish emergency medical systems. Secondly, we wanted to explore whether there is a relationship between the availability of and the distance to health care services and the use of EMS.

Methods

This retrospective registry study was carried out in two similar hospital districts and EMS-systems (Kainuu and Länsi-Pohja) in Northern Finland (Figure 1).

In Finland, there is a national dispatch authority with six regional EMCCs. The common European emergency number 112 is used for all emergencies requiring urgent assistance, whether from police, rescue, medical care or social services. EMCC personnel receive a national 18-month formalized training without an official status as health care professionals. The same EMCC dispatcher works as a call handler as well as a dispatcher for all authorities throughout the emergency call. All incoming calls for medical emergencies are assessed according to a criteria-based, nationally standardized dispatch protocol. The EMS calls are prioritized in four categories, A, B, C, and D, where A indicates an evident or suspected life-threatening situation, B other high-risk situation, C other urgent situation, and D a non-urgent situation.

The study areas consist mostly of suburban and rural populations. A total of 140 000 inhabitants, representing 2.6% of the Finnish population, live in these areas with a population density of 4.7 inhabitants per square kilometer. There are 6 to 8 municipal health care centers and one regional hospital in both districts. Both districts are covered by a single EMCC (Oulu) which dispatches a total of 35 000 EMS missions in the study areas annually. The districts share similar 3-tier EMS systems, organized by the hospital districts. The EMS providers have written guidelines for documenting the reasons for non-transportation situations. The decisions to not transport the patient are made after examining the patient and excluding disturbance of vital functions, and after consultation with an on-call emergency department physician according to protocol.

The data for this study were collected retrospectively from all EMS charts in the two study districts between January 1 and June 30, 2014. In the Kainuu region, the main author manually transferred the data from the paper EMS charts to the statistical program, whereas in the Länsi-Pohja region the data were electronically transferred from the EMS database (Merlot Medi®, CGI, Canada). All dispatched EMS missions within every priority category were included, whereas secondary (inter-facility) transports and missions of home care assistance were excluded. The EMS missions that were cancelled before patient contact were also excluded. Collected data included priority and dispatch code, demographic data and the non-transportation code. Patients with multiple non-transport missions were also identified. Distances to hospital were calculated using the municipal population

centroid, not the patient's actual home address. General information on health care use in the regions was obtained from the National Institute for Health and Welfare, which produces a range of statistics in the fields of social welfare and health care to support decision making, development and research. As a statistical authority it is responsible for the maintenance and development of statistical and register resources.

The study design was observational and no clinical interventions were performed. Therefore, according to the local policies, approval of the local ethics committee was waived. Permission to carry out the study was obtained from the Hospital Districts (20 Mar 2014; 8 Apr 2014) and the Office of Data Protection Ombudsman (dnro 719/4225/2014).

Statistical analyses

Statistical analyses were performed with SPSS Statistics, version 22 (IBM Corp., Armonk, NY). Data were expressed as mean with standard deviation, unless otherwise stated. Categorical variables were expressed as percentages, and Fisher's exact test was used for statistical comparison. A two-tailed *P* value of less than 0.05 was considered statistically significant. The Spearman's correlation coefficient was used to evaluate the association between distance to the emergency department and rate of non-transportation missions.

Results

A total of 13 354 EMS missions fulfilled the inclusion criteria during the six-month study period (Figure 2). Three-quarters (10 332) of the missions were due to illness or disease, while the remaining missions were related to various traumas. Of the patients, 50.7% were male, and the median age of all patients was 68 years.

The rates and the reasons for non-transportation missions are presented in Table 1. There were 5570 missions (41.7%) that did not lead to transportation by ambulance. In almost half of them (48.2%), the patient was evaluated by the EMS **to not require** acute treatment in the emergency department and was instructed to contact the municipal health care center during office hours. In another 1891 patients (33.9% of the non-transported patients), there was no need for medical care at all, and 509 patients (9.1% **of the non-transported patients**) were considered to need assessment or treatment in the emergency department but were directed to use vehicles other than ambulance (e.g., taxi, a relative's car).

During office hours (Mon-Fri 8:00 AM - 4:00 PM) the non-transportation rate (NTR) was 29.3% (95%CI 27.9%-30.7%) and outside office hours it was 46.9% (95%CI 45.9%-48.0%) ($p<0.001$). Figure 3 shows the NTR in relation to the time of the EMS mission. The NTR outside office hours increased **with longer distances** to the emergency department (Spearman $\rho= 0.656$, $p=0.008$) (Figure 4). The NTR in the Kainuu region was 46.2% (95%CI 45.1%-47.3%) and that in the Länsi-Pohja region was 32.3% (95%CI 30.9%-33.6%) ($p<0.001$).

During the six-month study period, 28.8% of the non-transportation patients had multiple contacts with EMS resulting in non-transportation missions. The **highest** count of non-transportation missions for one patient was 45.

Discussion

This study showed that four out of ten EMS missions did not lead to ambulance transportation of the patient. In almost half of these cases the patients could stay at home after **the** medical assessment by the EMS crew and contact their municipal health care center later with **an** non-urgent matter, while one-third of the non-transportation patients did not need any medical care at all. The NTR was higher outside office hours and it increased with the distance to the emergency department. These findings necessitate a discussion **as to** the dispatch process and the reasons why people with minor illnesses request an ambulance.

The limitations of this study relate to the fact that the study was retrospective, **and therefore** the registries used were not specifically designed to explore **those** issues **under examination**. **The available data, however**, which were initially documented for administrative and medico-legal purposes, were of good quality **and had** no data missing. Human factors in the EMS system **may** distort the results, **as** the compliance of EMCC dispatchers and EMS providers with the predefined dispatching protocols and non-transportation guidelines could not be documented during the study. The strengths of this study pertain to the large cohort from two different hospital districts.

The finding that more than 80% of the non-transported patients could be left at the scene and instructed to contact their primary health care center during office hours, or did not need any health care at all, highlights the difficulty in assessing **a patient's** condition over the phone. It may be difficult to **obtain** adequate information from the caller, but one must also ask whether the current dispatch protocols, the dispatchers' education and dispatch centers' resources are optimal. The dispatch protocols aim at identifying acute illness or injury, and in most non-transported patients the nature of the problem (chronic disease or a social issue) was less urgent. The protocol **used** may not be **sufficiently** accurate to identify such problems. **In** patients with high-risk symptoms (e.g., chest pain, shortness of breath), **however**, it is reasonable to dispatch EMS to evaluate the patient's condition at the scene, even if **in retrospect** the mission did not require transportation of the patient.

On the other hand, the dispatcher's education plays a significant role. The current national 18-month dispatcher training in Finland may need to be refocused on the changing needs in the evaluation of requests for EMS, as the advisory and assessment tasks in less urgent situations **appears** to become increasingly **in demand**. **As** the current Finnish EMCC dispatchers are not health care professionals and therefore not covered by the legal framework the same way as health care professionals are, they

may experience a fear of prosecution, and this in turn may lower the threshold for dispatching an ambulance. There are differences between the Nordic countries with regard to the organization of emergency medical dispatch systems as well as the use of dispatch protocols.⁸ The level of education of the EMCC personnel varies from a few weeks' training to that of health care professionals—nurses or paramedics—who handle medical emergency calls. A study by Forslund et al showed that when health care professionals provided informational support to the dispatchers who were dealing with non-urgent calls to the dispatch center, the number of missions leading to non-transportation was reduced.⁹

It is unclear why people with minor illnesses or non-medical problems request an ambulance. This inappropriate utilization of ambulance services has been a worldwide problem,¹ and the phenomenon has been known since the 1970s.¹⁰ In our series there was no need for medical care or interventions in one-third of the non-transportation missions. These missions represented 14.2% of all EMS missions. In addition, 3.8% of all patients were directed to use vehicles other than an ambulance. In a Swedish study, ambulance personnel estimated that the usage rate of taxis or other vehicles could be even higher, up to 31% of the missions.¹¹ One reason for the high NTR could be that the primary health care is unable to meet the needs of the patient. During the study, there was a severe shortage of primary care physicians in the study districts (Kainuu 20.8% and Länsi-Pohja 8.3%), and 96% of the population in Kainuu experienced difficulties in getting a doctor's appointment on a weekly basis,¹² Moreover, several ambulance visits to the same patient without the need for transportation may indicate that the patient's problems have not been adequately dealt with in primary health and social care. An association between a lack of primary care resources and the regional unfocused use of EMS may be a sign to decision makers that primary care must be strengthened. The high NTR implies that the EMS compensates for the lack of primary care resources in some regions although this has not originally been the intention in the healthcare system.

Another reason for the high NTR might be the distances involved in these regions. We found a positive correlation between the distance to the emergency department and NTR (Figure 4). Especially outside office hours, when municipal health care centers are closed, people may prefer to call for an EMS unit rather than make their way to a distant emergency department. Similar findings were found in a Norwegian study in which increased distance was associated with lower rates of all contact types to casualty clinics except telephone consultations by a doctor.¹³ This correlation between NTR outside office hours and the distance to the emergency department was an interesting finding which may be difficult to interpret. Could it be that the threshold for transporting a patient a

long distance is higher at night than during daytime? If so, can such a pattern be ascribed to the fact that an EMS unit is away from its response area for a lengthy time and the reluctance to transportation is therefore higher? Or is the threshold for dispatching an ambulance lower at night?

The results of this study indicate a need for further studies—most importantly, studies that look into patient safety issues in an EMS system with such a high NTR. Data as to whether these non-transport decisions are correct or affect patient outcome are lacking. Studies are also needed to evaluate the extent to which involvement of health care professionals in EMCCs reduces the number of missions that do not necessitate an EMS response. The feasibility, safety and cost-effectiveness of forwarding non-urgent requests and missions to telephone health advisors, home care, or paramedicine providers, for example, should be studied. The use of other than EMS professionals for the evaluation of patients on the scene in less urgent situations is becoming increasingly common in Finland, corresponding with reports from several programs on community paramedicine.¹⁴ Although the results cannot be generalized to other health care systems, our study indicates that there is a need for studies evaluating the overall provision of EMS in healthcare systems.

Conclusion

This study showed a high rate of non-transportation missions in two Finnish EMS systems. In half of these non-transportation missions the EMS personnel assessed that there was no need for emergency admission to an emergency department, while in another third there was no need for any medical care at all. These findings indicate that an improvement in the dispatch process and primary care resources might be of benefit, especially during out-of-office hours.

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Figure 2. Flowchart of study selection and distribution of missions by priority categories and non-transportation rates. Priority A, evident or suspected life-threatening situation; priority B, other high-risk situation; priority C, other urgent situation; priority D, non-urgent situation.

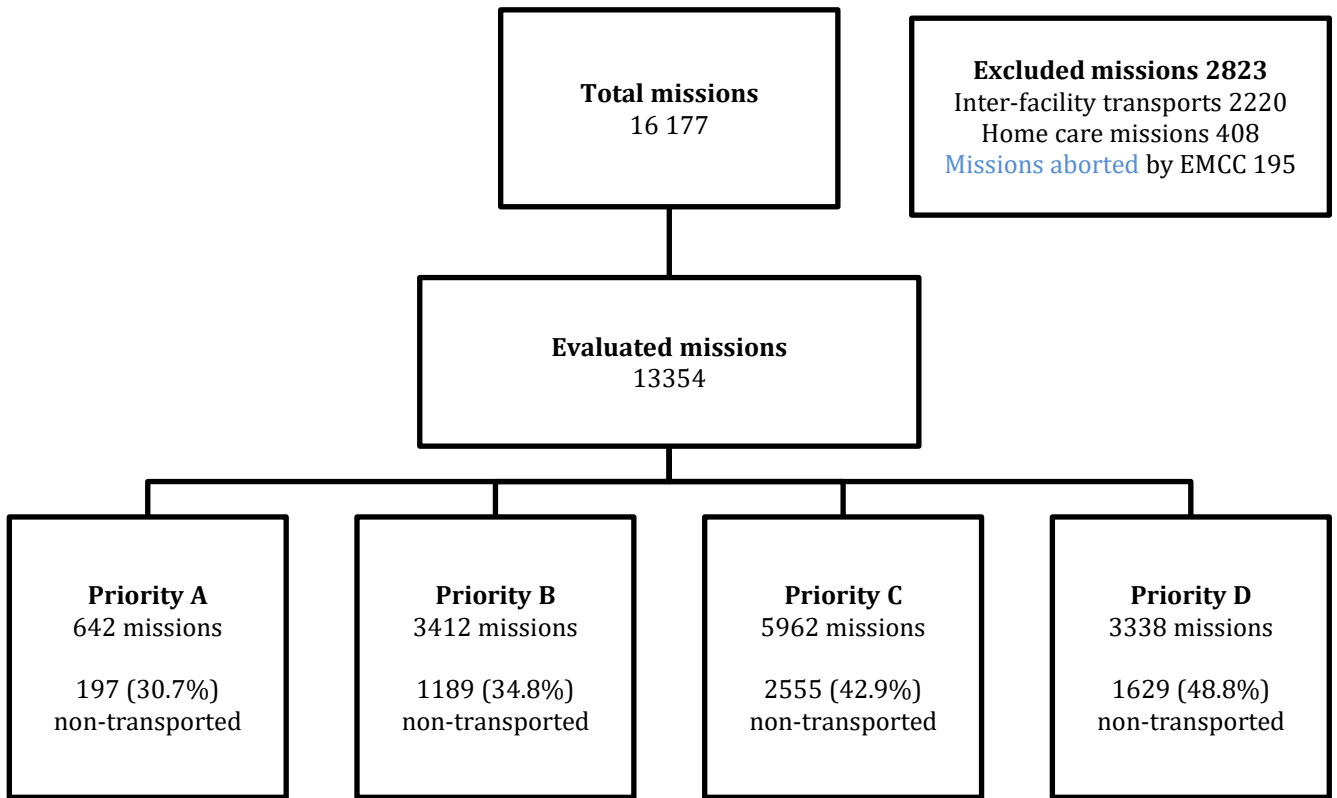


Figure 3. Non-transportation rate (bars) and number of missions (line) in relation to the time of the EMS mission.

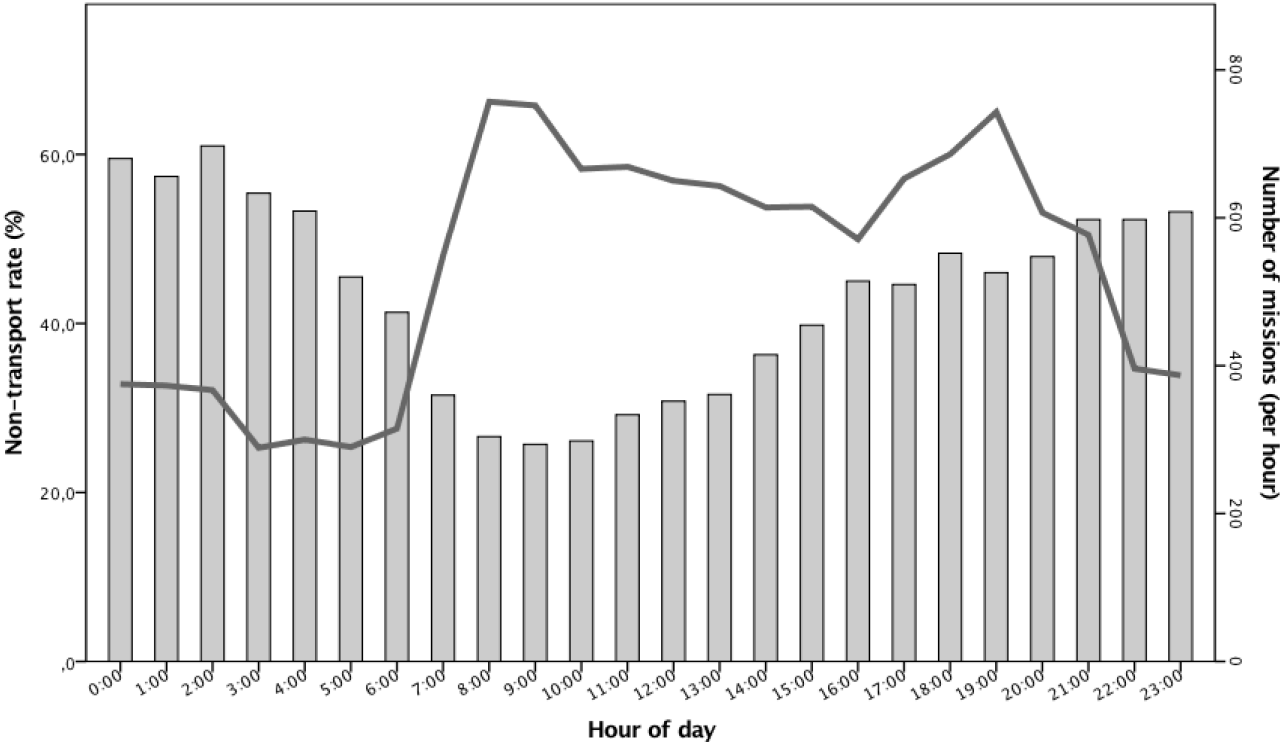


Figure 4. Non-transportation rate in relation to the distance between the municipal population centroid and the emergency department during office hours and outside office hours. Spearman's correlation coefficient $\rho=0.220$, $\rho=0.656$ ($p=0.431$, $p=0.008$).

