

Exploring EHTP calls in South Limburg

Master's thesis research report

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Abstract

The Emergency Medical Services system in use in the Netherlands is a variation on the Anglo-American system. An important distinguishing aspect of the Dutch EMS system is the prehospital triage and referral qualifications of first echelon ALS ambulance crews. Because of this characteristic, a significant percentage of the calls responded to by the Dutch ambulance services do not result in patient transportation to a hospital facility. These calls in which case patients are treated on the spot or referred by other means are called EHTP calls. EHTP calls are perceived to be a burden on the functioning of the regional ambulance provider in the region of South Limburg. It is for this reason we aim to analyze the factors linked to the occurrence of EHTP calls in the region of South Limburg.

An explorative case study was set up in order to provide an answer to the central research question “How can the RAV South Limburg react on the occurrence of EHTP calls?”. In a first research phase, a series of semi structured interviews was performed. These interviews aimed at determining the factors perceived by South Limburg EMS professionals to be of influence on the occurrence of EHTP calls. In a second phase the data of the regional and national databases were analyzed, based on the results acquired in research phase one.

The limited data available on the trend in time of EHTP call occurrence seem to suggest that the increase in EHTP calls is less explicit on the level of the RAV South Limburg compared to the national level. Different place and time linked factors prove to be of influence on the occurrence of EHTP calls in the region of South Limburg. Person related factors like the influence of the HAP or individual EMS professionals also prove to be of significant influence.

Further research on the subject is necessary, especially on the influence of individual EMS professionals. This would be facilitated by an extension of the current data registration system. The deployment of the rapid responder motorcycles could be fine tuned, based on the time and place linked factors found to be of influence. A dialogue should be started with the HAP services addressing the adaptation and alignment of the EMS referral procedure and criteria.

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1 Introduction

Health care services in Europe have gone through a major evolution over the last decades. The provision of health care got more complicated as technology and science evolved. The same evolution can be observed for prehospital emergency medical services (EMS). As medical science developed, EMS evolved from an underestimated and maltreated element in the care process to a professionalized discipline making emergency health care on hand outside the hospital walls.

With a continuous increase in both treatment possibilities and demand for care, rationalization of the health care process gains year after year in importance. In order to keep health care services within reach for everyone, cost containment and conscientious use of means becomes of utmost importance. At the same time there is an increased focus on quality improvement through, for instance, the implementation of evidence based guidelines. This is no different for the EMS sector. In the Netherlands, the process of rationalizing EMS has already gone through different stages. The initially strongly fragmented sector underwent different waves of merges. In the current situation 25 regional EMS organizations remain (Kommer et al., 2008).

Recently one of these regional EMS providers, also called RAV's (Dutch: Regionale Ambulance Voorziening), experienced a shift in the demand for care. The RAV South Limburg has indications of an increase in the number first aid on the spot calls or Eerste Hulp Ter Plaats (EHTP) calls. In these calls, the initial patient contact between the ambulance crew and the patient is not followed by transportation to the hospital. In many of these cases, the appropriateness of the ambulance services as a caregiver is open to discussion. EHTP calls (Dutch: Eerste Hulp Ter Plaats) are also considered to have a negative influence on the preparedness of the ambulances. Furthermore a different reimbursement scheme by health care insurers is applicable, compared to 'normal' emergency calls. Therefore the RAV aims to acquire further insight in the reasons and mechanisms that form the basis of EHTP calls.

The aim of this research project is to give the RAV ZL more insight in the matter of EHTP calls. The main research question throughout the completion of this research project therefore is stated as follows.

How can the RAV South Limburg react on the occurrence of EHTP calls?

In order to answer this question in its totality, three subquestions are formulated.

- 1 *What is the nature of the care delivered in case of EHTP calls?*
- 2 *Are factors like place and time of influence on the occurrence of EHTP calls?*
- 3 *Who requests EHTP calls?*

The first sub question aims to explore the nature of EHTP calls in order to place the concept in a broader perspective and situate EHTP calls as part of the mission of the RAV as emergency medical services provider in the region of South Limburg. Both the regional and the national perspective are taken in this question. From the first discourses held with members of the RAV ZL's management, factors like the influence of the different regions in the RAV's territory, the different trends in time and the call requesting actors came forward as factors potentially influencing the occurrence of EHTP calls. Therefore the second sub question aims to provide us with more insight on the geographical and time bound factors potentially related with the occurrence of EHTP calls. Through exploration of the patterns in place and time we aim to identify factors useful in making the phenomenon studied more tangible. The third sub question intends to give us insight in the identity of those involved in EMS calls that result in EHTP. The requests for ambulance care initiate both from private actors and professional caregivers. A number of RAV ZL's management staff members indicate a strong perceived influence of professional caregivers on the occurrence of EHTP calls. The third subquestions aims to provide insight in this subject. Through the acquisition of insight in the subjects treated by the three sub questions, we aim to provide an answer on the main research question: "How can the RAV South Limburg react on the occurrence of EHTP calls?". An in-depth answer to the research question in which the insights from the sub questions are included is to provide the RAV ZL's management with a scientific base on which future management decisions addressing the EHTP phenomenon can be founded.

In the first chapter a theoretical framework gives an overview of the literature and theoretical background available on the subject of emergency medical services (EMS) in general and EHTP calls in specific. This first chapter is followed by two chapters subsequently describing the research methodology and the results obtained from the research. The report is concluded with a final chapter in which the results of the research are discussed and conclusions are drawn based on the observations of this research.

2 Theoretical framework

In this chapter the concept EHTP¹ is clarified through an exploration of literature on EMS systems in the industrialized world. Through clarification of the concept EHTP, we aim to give insight in the theoretical foundation of the first sub question ‘What is the nature of the care delivered in case of EHTP calls?’. EHTP is a very specific topic and is closely related to the organizational structure of the Dutch EMS system. This particular position of EHTP calls in the Dutch system is explained through a description of the contrasting approaches in EMS in the industrialized world. After situating EMS systems worldwide in a societal context throughout paragraph 2.1, a delineation is given of the two principal approaches to EMS, being the Anglo-American approach described in paragraph 2.2 and the Franco-German approach described in paragraph 2.3. Illustrations of both systems are given through a description of the systems for prehospital care in the United Kingdom, the United States of America and France. Unlike the systems in France and the United Kingdom, several industrialized countries use varieties on, and blends of these two main approaches. Also, unlike the Netherlands where a countrywide system is in place, many regional differences exist within most national systems. The discussion of these variations, blended systems and regional differences however goes beyond the scope of this research project. The chapter is concluded with an elaboration on the Dutch EMS system and the situation of this system in the European EMS scene throughout paragraph 2.4.

2.1 EMS concept and history

The concept “Emergency Medical Services” (EMS) entails a broad range of elements in the acute medical care for the ill and injured. In order to achieve its primary goal, being a reduction in morbidity and mortality in case of sudden medical emergencies, a chain of essential EMS resources is required. Continuity in bystander care, notification and response, prehospital care, transportation and hospital emergency department care are all important elements in the EMS chain. The concept ‘prehospital care’ on its turn, embraces all the care provided by an EMS system to patients on location and during transportation.

Where most of the elements of EMS have for a long time relied on private initiatives, governments in all industrialized countries have been investing in the development and legal

¹ see ‘*Abbreviations*’ section

regulation of emergency medical systems over the last decades (Sikka & Margolis, 2005). This development was driven both by the expectations of society and the awareness of policy makers that the reduction of morbidity and mortality could have a significant financial benefit for society as a whole (Sikka & Margolis, 2005). Nevertheless the starting point for many EMS systems in industrialized countries was the same, a wide variety of formal EMS systems has emerged from the initially rather basic and often poorly organized informal systems (Sikka & Margolis, 2005). Economical, geographical and political factors influenced the development of regional and national EMS systems. In contrast to the present day situation, research and insights acquired from evidence based medicine were not available or just not taken into account in the early stages of EMS system development (Braun, McCallion & Fazackerley, 1990). Influence of factors like politics and geography resulted in dissimilarities in for example the level of equipment, personnel training, service providers and dispatching.

In EMS, the concept ‘triage’ is used in different settings. At first it can refer to a system of telephone triage in use at the EMS call center to discriminate between urgent and non urgent ambulance calls. Another setting the concept ‘triage’ is used in, is the process of prioritization in case of mass casualty incidents or disaster situations. The concept ‘prehospital triage’ as it is used in this paper however applies to a third meaning of the concept ‘triage’. In this case, ‘triage’ stands for the process in which a referral decision is made by the ambulance crew in non emergency situations based on the patient’s medical needs. The patient is then taken in charge by the ambulance crew or alternatively referred to a general practitioner, to a hospital facility, or to other instances of the health care system.

2.2 The Anglo-American EMS approach

In briefly describing the EMS systems of a number of industrialized countries, the differences between those systems and the consequences of these differences on daily practice are illustrated. A schematic overview of the systems discussed is depicted in table 2.1.

2.2.1 United States of America

The foundation of the EMS system as it functions today in the United States of America were laid in the late sixties and early seventies of the twentieth century. It was in the early sixties of that twentieth century that the National Academy of Sciences pointed out the unsatisfactory care in case of accident (Pozner, Zane, Nelson & Levine, 2004). The responsibility for organizational improvements of the system was laid initially with the

federal government but soon shifted to the state level. This resulted in a variety of different systems across the country. Two systems are distinguished: two tiered and one tiered systems.

In the one tiered systems an ambulance equipped with an Advanced Life Support or ALS trained paramedic is sent out to every emergency call. The provision of ALS entails advanced medical techniques and consists in most cases of protocol based care, delivered by bachelor level trained health professionals, or care, delivered by medical doctors trained in emergency medicine. In the two tiered system a Basic Life Support (BLS) equipped ambulance unit is reinforced with a second vehicle staffed by an ALS trained paramedic in case ALS care is estimated necessary. Several local varieties of the system are in use, but 64% of the EMS systems studied by Braun, McCallion and Fazackerley (1990) were one tiered systems. The training level of emergency call takers and ambulance dispatchers is rather homogeneous, ranging from non-medically educated over BLS trained EMT's to ALS schooled paramedics. Only in the minority of the cases dispatchers differentiated between urgent and non urgent calls (Braun, McCallion & Fazackerley, 1990).

The USA EMS system is an advanced one or two tiered system in which ALS is provided by paramedics. These paramedics operate under the license of physicians, in an off-line system based on EMS service dependent protocols. Only in a minority of the cases, doctors are involved in the process of prehospital emergency care. There are no nationwide standards for dispatching methods, protocols or training programs available (Lichtveld, 2007). The system is generally well organized in urban areas but is often less developed in rural areas (Pozner et al., 2004).

The possibilities for prehospital triage by the EMS personnel involved are limited. In most two tiered systems, BLS level trained emergency medical technicians or EMT's are not allowed to decide on the necessity of transportation to a hospital facility. Every EMS call therefore is followed by transportation to a hospital unless the patient refuses transportation. The same applies for most one tiered systems. In this matter too state level organizational responsibility leads to regional differences in regulation and organization. The subject is addressed extensively in literature. Meta analysis on the subject of prehospital triage by EMS paramedics concluded out of the diverging results of the studies performed, that there is insufficient evidence to support the feasibility of prehospital triage by paramedics in the USA EMS system (Brown, Hubble, Cone, Millin, Schwartz, Patterson, a.o., 2009).

2.2.2 United Kingdom

The start of the organization and rationalization of the Emergency Medical Services in the United Kingdom took place in the same time frame as it did in the USA (Braun, McCalloin & Fazackerley, 1990). Both the US and the UK systems had a comparable starting point and developed in a similar direction. There are however substantial differences in the field. As a dominantly one-tiered system, most UK EMS ambulances are staffed with ALS trained personnel. In addition to these ambulances, rapid responder units are available in order to attain the 8 minute emergency response threshold. In rural areas sometimes a two tiered system is sustained.

Emergency call taking and dispatching centers are manned by ambulance control room officers with different backgrounds. Ambulance experience is not mandatory in every call center (Black & Davies, 2005). Emergency call prioritization is done countrywide by emergency call dispatchers through the Advanced Medical Priority Dispatch System. A differentiation is made between life threatening category A calls, serious but not life threatening category B calls and non urgent category C calls (Black & Davies 2005).

Doctors have an active role in the out of hospital emergency care process in several regions either through helicopter or ground based physician staffed ALS units. The physicians role depends upon regional agreements and is limited because of ALS level first echelon ambulances. The physician staffed second echelon ambulance system does only cover selected parts of the UK territory (Black & Davies, 2005). The system is largely centrally regulated and evolving rapidly. The training of ALS paramedics has been subject to differentiation and extension over recent years. Current differentiation options for paramedics include additional trainings to specialist roles like emergency care practitioner and critical care paramedic. At the other hand initiatives are taken to bring ALS paramedic training up to university master level with the recent (2009) initiation of the Master of Science in Paramedic Sciences as one of the ALS paramedic training programs. These differentiations on the standard paramedic role brought along increased possibilities and responsibilities for the EMS personnel involved. Prehospital triage has, in a few regions, become an option under certain conditions (Mason, Knowles, Freeman & Snooks, 2008). This still is a new element in the system and based on the UK literature we found on the subject, the discussion to date focuses on the appropriateness of the triage decision taken rather than on the factors that contribute to the occurrence of first aid on the spot calls.

2.3 The Franco-German EMS approach

The Franco-German EMS approach contrasts with the Anglo-American EMS approach in several ways. In the following paragraph the difference between the two approaches is illustrated through an elaboration on the EMS system in use in France today.

2.3.1 France

The evolution of the French EMS towards the modern system in place today started in 1955 with the initiation of a first Mobile Medical Intensive Care unit. This initial doctor staffed ALS ambulance experiment was evaluated positively and subsequent countrywide implementation started in 1965 (Adnet & Lapostolle, 2004).

The French EMS scheme today consists of a two tiered system in which the first unit dispatched is a BLS ambulance which, if estimated necessary, is supported by a second tier of physician manned ambulances or helicopters available over the entire French territory. Because of the limited qualifications and limited training cycle of the first tier personnel (BLS level), the role of physicians is extensive in the French ambulance care system (Adnet & Lapostolle, 2004). This fundamental difference between the Franco-German and the Anglo-American system has extensive economical and historical roots. Nevertheless the level of expertise available in the Franco-German system through the deployment of physicians in ambulance care is high, both advantages and disadvantages of the latter system are discussed in literature. Examples of disadvantages mentioned in literature are the presumed longer on-scene times and a lack of experienced physicians. (Dick, 2003). Physicians take a key position not only in the ambulance environment, but also in the call taking and dispatching of EMS means. While calls are primarily taken by specially trained call takers, dispatching physicians have an important advisory function in the daily EMS dispatching (Adnet & Lapostolle, 2004).

Prehospital triage and referral is possible in the French system, but is only permitted for second echelon physician staffed ambulances (Nikkanen, Pouges & Lenworth, 1998). This subject however is, to our knowledge, only briefly discussed in literature. The literature found on the subject mainly describes the phenomenon of prehospital triage but does not address the factors associated with first aid on the spot calls.

2.4 EMS in the Netherlands

As is the case for most European EMS systems, the Dutch EMS system has a history reaching back several decades. During the first decennia of the twentieth century medical care relied mainly on private initiatives and religious organizations. When after the end of the second world war medical treatment possibilities took a leap forward, the numerous local ambulance organizations took distinct initiatives to take these techniques outside the hospital walls. Due to the lack of uniformity in both training and material standards, many practical problems rose in case of mass casualty incidents. It was in 1971 that the first law regulating the ambulance services appeared (Lichtveld, 2007). In the early 1980's this law lead to more uniformity in operation procedures over the different counties and provinces of the Dutch territory. This ongoing evolution was made explicit for example through the publication of a first set of treatment protocols in 1992. These protocols were implemented countrywide and have been updated every 2 to 3 years up until today. Where the quality of ambulance care until the late 1980's depended for a substantial part upon the individual caregivers or ambulance organizations, initiatives taken during the 1990's gave a start to a structure in which countrywide standards guarded uniformity and quality of care. This evolution had its effect on the call centers equally where in 2004 the first version of the national call center protocol was implemented. In the path of these changes, the Dutch EMS landscape evolved over the last 60 years to a modern system in which evidence based medicine and considerate standardization became central elements.

The present EMS system is based on national standards for training, certification, and protocols for daily practice. Every acute care ambulance in the Dutch EMS system is staffed and equipped to provide ALS level care. In contrast to the Anglo-American system where the training of ambulance paramedics is detached from other medical professions, the ALS providers staffing ambulances are registered emergency or intensive care nurses, trained in protocol based ambulance care. Within the limits of the national ambulance protocol, ambulance nurses have the qualification to take the patient into charge or to refer him to a general practitioner or emergency department by own means (Lichtveld, 2008). The second member of the ambulance team is a BLS level trained emergency medical technician.

Apart from the first echelon of nurse-staffed ambulances, there is a second echelon of physician staffed Mobile Medical Teams (MMT) covering the entire Dutch territory. Because of the ALS level training and fitting of first echelon EMS ambulances and because of the

limited number of MMT's available, their role in daily practice is limited mainly to major traumata and mass casualty incidents. In the latter case the MMT teams are supported by the different branches of the Dutch disaster medical aid and support organization (in Dutch: Geneeskundige Hulp bij Ongevallen en Rampen - GHOR).

In the current Dutch EMS system, the coordinating element is the ambulance call centre. These regional call centers, staffed by specially trained and registered nurses, handle demands for both urgent and non urgent patient transfers (Lichtveld, 2008). Within the limits of the national telephone triage protocol called the LSMA or "Landelijke Standaard Meldkamer Ambulancezorg", ambulance dispatchers are left the choice to send out a nurse-paramedic staffed ambulance, a rapid responder unit or an MMT, or alternatively to refer the caller to a general practitioner. The rapid responder unit is a variation on the normal ambulance, consisting of a vehicle manned by an experienced ambulance nurse, possessing of the same means as a normal ambulance except for the capability to transport a patient. The rapid responders deployment possibilities are two-folded. They can be deployed in addition to traditional ambulances and therefore decrease response times. They might for example be send out to regions in which the response times risk to be too long because of the unavailability of traditional ambulances. Another task of rapid responder units is responding to calls of which the telephone dispatcher estimates that there is a good chance that transportation of the patient to a hospital is not necessary. In the regions that deploy rapid responder units, they thus can be sent out to what the dispatcher estimates to be EHTP calls.

Ambulances can be sent out for different tasks requiring different degrees of urgency. Therefore dispatchers categorize the incoming calls in limb or life threatening A1 calls, urgent but not life threatening A2 calls, and planned transportation B calls. Only in case of A1 calls or in case of A2 calls under special conditions the use of priority signals by ambulances is allowed. Every call center depends on a regional ambulance service organization (in Dutch: Regionale Ambulance Voorziening / RAV). These RAV's are responsible for the organization of the entire ambulance care process in a certain region. They have the autonomy to decide on certain organizational aspects of the EMS care in the region like for example regional adaptations to the national protocols or the deployment of rapid responder units.

2.4.1 The Dutch EMS system in a broader perspective

Where many of the EMS systems throughout the industrialized world are directly or indirectly derived from the Anglo-American or the Franco-German system, the Dutch EMS system takes a somehow particular place in the EMS landscape. Nevertheless the Dutch EMS system is related to the Anglo-American system and can be classified as a variety of it, there are several substantial differences that give it a particular place in the EMS landscape. It is these differences that lead to the occurrence of EHTP calls in the Dutch. The main difference of influence in the matter of EHTP is the fact that nurses employed in the system are qualified to undertake telephone and prehospital triage in day to day EMS operations. In case of telephone triage, an EMS dispatching nurse estimates if and how ambulance care is the appropriate answer for the caller's demand. Alternative referral options include a general practitioner or a hospital's emergency department by other means than ambulance care. In case of prehospital triage, Dutch first echelon ambulance nurses are given the responsibility to decide if transportation to the hospital is required. If transportation by the ambulance services is considered not appropriate or suitable, care can be given on the spot before referring the patient to a hospital facility or general practitioner. This is in contrast to for example most of the American EMS systems in which every credible emergency call results in an ambulance being sent out and every ambulance response results in transportation to the hospital unless the patient explicitly refuses care or has deceased (Brown, Hubble, Cone, Millin, Schwartz, Patterson, a.o., 2009). One element explaining this difference is the different training trajectory followed by Dutch and American EMS workers. The nurses employed on Dutch ALS ambulances are trained and experienced in intensive care, emergency care or anesthesiology. In the mainstream Anglo-American systems however, ALS trained ambulance staff gets a separate training trajectory and in hospital work experience is not the standard. Swedish ALS ambulances are, as they are in the Netherlands, staffed with a driver or EMT (Emergency Medical Technician) and an ambulance nurse with an ALS training and specialization in emergency care (Lavis, McCarthy, Jenkins, 1995). In this system however the same choice as in the mainstream Anglo-American systems, not to permit prehospital triage was made, which again contrasts to the current Dutch situation. The delegation of triage to ambulance and dispatching nurses made possible in the Dutch EMS system thus contrasts to other EMS provision systems in the industrialized world. Because of this triage process, a significant percentage of the ambulance calls does result in EHTP calls.

	<i>Anglo-American EMS approach</i>		<i>Franco German EMS approach</i>	<i>EMS in the Netherlands</i>
	<i>United States of America</i>	<i>United Kingdom</i>	<i>France</i>	<i>Netherlands</i>
Ambulance care				
<i>Tiers in the system</i>	one tiered system / <i>two tiered system</i>	predominantly one tiered	two tiered system	predominantly one tiered
<i>First tier staffing</i>	ALS paramedic / <i>BLS EMT</i>	ALS paramedic	BLS EMT	ALS ambulance nurse
<i>Second tier staffing</i>	mostly not available (medical doctor) / <i>ALS paramedic</i> (medical doctor)	critical care paramedic or medical doctor	medical doctor	medical doctor
<i>Role of second tier in daily EMS operations</i>	limited (if available) / <i>extensive</i>	limited	extensive	limited
<i>Prehospital triage</i>	not permitted / <i>not permitted</i>	mostly not permitted or by second tier	by second tier	by first tier
Dispatching centre				
<i>Staffing</i>	differing between regions	differing between regions	dispatchers & medical doctors	dispatching nurses (ALS trained)
<i>Telephone triage</i>	not permitted	call prioritization	call prioritization	call prioritization & caller referral

Table 2.1: Schematic Overview of the Emergency Medical Systems Discussed in Paragraphs 2.2, 2.3 and 2.4

2.4.2 EHTP: defining the concept

Calls, in which care on the spot is delivered but transportation to the hospital by ambulance is considered not necessary are called First Aid On The Spot Calls (in Dutch: Eerste Hulp Ter Plaats) or EHTP calls. These EHTP calls are one of the manifestations of a number of organizational differences between the different EMS systems in general and the Dutch system in particular. These organizational differences make a comparison of data on EHTP calls with other countries in Europe or worldwide unlikely to provide reliable results.

First aid on the spot calls or Eerste Hulp Ter Plaats (EHTP) calls are described in different ways by the different actors in the EMS scene. In order to provide clarity in the definition maintained throughout this work the different definitions from literature are elucidated in the following paragraph. As for the Dutch National Ambulance Institute AZN, the term EHG (Dutch: Eerste Hulp Geen Vervoer) is used in its latest publications instead of the previously employed term EHTP. Throughout this paper the term EHTP (Dutch: Eerste Hulp Ter Plaats) is retained. Both the terms EHTP and EHG cover the same concept, described by the AZN (2009) in its publication ‘Uniform Begrippenkader Ambulancezorg’ (AZN, 2009) in the following way: *calls given out with the intention to help a patient but in which, after consideration on the spot by the ambulance crew, transportation by ambulance is not considered appropriate.*

Furthermore the AZN distinguishes EHTP calls in the following subcategories of calls: calls performed by the rapid responder, treatment on the spot, no treatment considered necessary, treatment refused by patient, transportation refused by patient, assistance of another ambulance at an accident, assistance of another ambulance for a reanimation, assistance of another ambulance to lift the patient, calls in which the patient deceased during treatment and as a last subcategory the calls in which the patient has deceased before arrival. The RAV ZL as another EMS actor, differentiates between EHTP and other calls in a slightly differing way. One data source of the RAV is the information the ambulance crew plots when completing the administration that is kept of every call. One indicator plotted is the ‘type of transportation’. Calls resorting to six different classes of ‘transportation type’ are considered to make up the classification ‘EHTP’: calls in which case the patient has deceased and the final destination is the morgue, calls in which care was provided but transportation not considered necessary by the ambulance crew, calls for an incident without casualties, calls in which assistance for a reanimation was provided to another ambulance crew, calls in which

the patient refuses transportation and at last calls in which any kind of assistance was provided to another ambulance crew. Throughout this paper the definition as stated by the AZN is retained. As to the different categories of EHTP calls, the RAV ZL's differentiation is used.

As becomes clear from this chapter, the Dutch EMS landscape differs in several ways from other national EMS systems. Amongst others, EHTP calls are one expression of these differences. Because EHTP calls appear to be specific to the Dutch EMS system, to our knowledge no international scientific literature is available on the subject. As for the Dutch research into the subject there are, to our knowledge, no publications specifically addressing EHTP calls. This brings limitations to the theoretical underpinning of the subject treated in subquestions two and three addressing place, time and person related influences on EHTP calls.

In this chapter the different approaches to EMS in the industrialized world are depicted in order to provide insight in the theoretical underpinnings of EHTP as it occurs in the Dutch EMS system. Doing so, this chapter forms a theoretical foundation for the first sub question that aims to give insight into the nature of care delivered in case of EHTP calls. In the following chapters this information will be used to acquire a more profound insight in the subject of EHTP calls in order to ultimately answer the question how the RAV ZL should react on the occurrence of EHTP calls.

3 Methods

In order to answer the research question, the subject of EHTP² calls in the region of South Limburg was studied. In paragraph 3.1, this chapter elaborates on the research design used. The operationalization of the research question through two research phases is described in paragraph 3.2. The chapter concludes with a discussion on the validity, reliability and limits of the research in paragraph 3.3.

3.1 Research design

The factors deciding over the right strategy for a research setting are the *type of research question*, the *amount of control the investigator has over the actual behavioral events* and the *focus on contemporary or historical phenomena* (Yin, 2003). Based on these factors, in social sciences one can opt for different research strategies as there are experiments, surveys, archival analysis, histories and case studies. In the case of the EHTP research question, we focused on the occurrence of EHTP calls in the EMS region of South Limburg. There was no control over the events occurring in the daily EMS organization. Together with the fact that we focused on a contemporary phenomenon in a real life context these two elements indicated that a case study was the optimal research methodology for our subject (Yin, 2003). EHTP calls in specific have not been documented extensively in scientific literature. This fact, combined with the geographical limits (EMS region of South Limburg) of the subject studied, stipulated that the optimal strategy for the first phase of our research was an explorative case study (Yin, 2003). In this first research phase, described in detail in paragraph 3.2.1, the central element is a series of semi structured interviews, conducted in order to generate hypothesis. The hypothesis generated in phase one form the basis for the subsequent hypothesis testing research phase. For this hypothesis testing throughout the second research phase (paragraph 3.2.2), retrospective data analysis will be applied onto the data available from different national and regional ambulance services databases. Throughout the two research phases different data sources were used. Table 3.1 gives an overview of the different data sources used in research phase 1 and 2.

² see 'Abbreviations' section

3.2 Operationalization

As stated in the introduction, the main endeavor of this research project was to discover how the RAV South Limburg can react on the occurrence of EHTP calls in its region. In answering this question, the RAV South Limburg aims to optimize its services both in terms of quality and financial sustainability. This aim was summarized in the research question. In order to answer the research question, the problem was looked at from different angles. These different angles were specified in three subquestions as discussed in the introduction. The subquestions and research question were operationalized in two research phases. The first phase was an preparatory phase consisting of semi structured interviews. It was followed by the second phase in which the three subquestions were studied in detail based on the results of the first research phase.

3.2.1 *Research phase 1: Semi structured interviews*

The aim of research phase 1 is to generate a set of hypothesis about the factors looked at in the subquestions. The obtained hypothesis formed the basis for the data analysis in the second research phase.

The first research phase was based on the conduct of a series of interviews performed among EMS personnel at the RAV ZL. The RAV ZL is the regional ambulance service provider in the region of South Limburg in the Netherlands. The RAV ZL operates from three ambulance stations in Heerlen, Maastricht and Geleen and employs 78 ambulance nurses and 17 EMS dispatching nurses (January 2010). The participants focused on in the interviews were the professionals that are confronted with the EHTP phenomenon on a daily basis, being the ambulance nurses and EMS dispatching nurses of the RAV South Limburg. A random selection was made out of the pool of nurses. Because of practical matters the selection of participants for the interview was made based on the working schedule. A minimum of five year experience as an ambulance nurse was set as an additional selection criterion in order to guarantee a selection of professionals with a solid understanding of the concepts looked into. After four to five years the main EMS and additional training program are concluded and recertification for a subsequent cycle of four to five years is initiated. Since an exact definition of an ‘experienced EMS nurse’ is lacking, this first recertification point was chosen as defining for nurses to be considered ‘experienced’ in their EMS function. Per ambulance station 2 ambulance nurses were interviewed for a total of 6 interviews among ALS

ambulance nurses. The interviews were taken on November 17th, November 18th and November 19th 2009. A similar selection process was given shape in case of the EMS dispatching nurses. In this case also a minimum of five years experience was taken as an inclusion criterion. 5 dispatch center nurses were interviewed on the 4th of November 2009 on location in the EMS dispatching center in Maastricht. In total 11 EMS nurses were interviewed. There was no non-response.

For every of the three ambulance stations an appointment was made on a random weekday for which the working schedule had already been set in advance. The nurses to be interviewed were informed about the moment of the interview and about the subject of the interview. The questionnaires were presented on the moment of the interview by handing out a copy of the interview guide. In this guide, found in appendix 3 a and 3 b, the purpose and confidentiality of the interview were explained briefly.

The interviews were semi structured of nature. They consisted of a formalized set of 9 questions (appendix 3a and 3b). During the interview there was a possibility of asking additional questions. The questionnaires used for the interviews with the ambulance nurses and for the interviews with the dispatching nurses were identical. The interviews were performed in the native language of the participants (Dutch) and the interviews were recorded on digital audio track. After verifying the inclusion criteria in question 'a', the questionnaire continued with question 'b' which was aimed at estimating the understanding of the concept EHTP. This orientating question was included to examine the need for clarification of the concept discussed throughout the remainder of the interview. Apart from a definition, an illustration of the concept was demanded through the summation of a number of examples of EHTP calls (question 'c'). The aim of this question was to identify reasons why EHTP calls occur. Question 'd' focused on the different reasons for the occurrence of EHTP calls as identified by the participants. The next 4 questions ('e', 'f', 'g' and 'h') focused on the perceived influence of time, place and person related factors on the occurrence of EHTP calls. Questions 'g' and 'h' were included in the questionnaire in order to acquire insight in the role of the individuals involved in the EHTP call process, starting with the initial call until its final handling as an EHTP call. The questionnaire was concluded with an open question giving the interviewed nurses the chance to bring on other elements they perceived as explanatory for the EHTP phenomenon.

Processing the interviews included transcribing the interview audio recordings and subsequent stepwise analysis of the 11 interviews taken. A three step analysis was performed as depicted in appendix 4b. In the first step, the individual transcribed interviews were broken down into paragraphs and sorted per subject they addressed (time linked, place linked, person linked and other factors). In the second step of the analysis, the paragraphs from the first synthesis were summarized into short phrases per subject interviewed. In the last step, the second synthesis was summarized and a plotting was made of the number of times a specific factor was mentioned during the interviews.

3.2.2 Research phase 2: Retrospective data analysis

The second research phase consisted of a retrospective assessment of call data available from the RAV ZL's database and from the AZN publications. Publications of the AZN were also used to define the concept EHTP. A third data source used was the database of the human resource department of the RAV ZL of which selected data were requested through direct communication with the department. As a basis for the data analysis, hypothesis that were formulated on the basis of the phase one interview synthesis, were used. An overview of the data sources used in research phase two is provided in table 3.1.

<i>Data Input / Source:</i>	<i>Data Outcome:</i>	<i>Outcome used for:</i>
Research Phase 1		
Interview sessions with RAV ZL EMS workers (Appendices 3a & 3b)	Interview Transcriptions (Appendix 4a)	Research Phase 2
Research Phase 2		
Interviews Research Phase 1 (Appendix 4a)	Interview Synthesis (Appendix 4b)	Formulation of Hypothesis ; Subquestions 2 & 3
AZN publications (National data)	National Call Data (Appendix 3c) & Definitions	Data Analysis & Document Study; Subquestions 1, 2 & 3
Ambu Opencare Database (Regional data)	Regional Call Data (Appendix 3c)	Data Analysis; Subquestions 1, 2 & 3
RAV South Limburg Human Resource Database	Regional Human Resource Data	Data Analysis; Sub Question 3

Table 3.1 : Data Sources Used in Research Phases 1 and 2

The RAV ZL's database, called Ambu Opencare, groups all the call data routinely gathered from both the EMS call center and the ambulance staff. The data collected per call by the RAV ZL covers subjects like call geography (intervention location, ...), intervention times, caller profile, ambulance staffing, care provided, and more. The national ambulance institute AZN gathers data from the 25 EMS regions in the Netherlands. These data are published on a yearly basis in reports providing insight in the accumulated national data and to a limited extend in the regional data of the different EMS regions. Combining data from both databases was favorable because a number of limitations of each database were compensated by the other database. As such, the detailed data available on regional level from the RAV ZL's Ambu Opencare database were supplemented with national data from the AZN publications. Calls taken into account in the data analysis are both the urgent A1 and A2 calls and the non urgent B calls unless mentioned differently in the results section. Information about for example the geographical position of the caller and the time of the call were readily available from the RAV ZL Ambu Opencare database which goes back to January 2007. Appendix 3c depicts the different data sources used for the acquisition of call data.

The time period taken into account in the retrospective data exploration covers the years 2007, 2008 and 2009. The amount of detail on the data available from the years prior to January 2007 was limited and therefore not taken into account. The call data available in the RAV ZL database was registered by the ambulance nurses and dispatching nurses during or right after every call. In the final data of the years 2007, 2008 and 2009 there was a considerable amount of incomplete data files. For some relations looked into this was expected to be of influence. Therefore in some analysis a filter was applied. This standard filter used by the RAV in its analysis was called 'filter one'. Because of practical matters, throughout this paper the filter is referred to as 'filter one' as it was referred to in the administration of the RAV. The filter itself excludes several batches of data. The first group of calls excluded by the application of filter one are the calls in which the date, the call number, the urgency of the call and the nature of transport were not filled in. Calls of which the nature of the transport did not fall under the standard categories or was described by multiple categories were also excluded through filter one, as was the case for calls of which the geographical starting point was situated outside of the RAV's territory. A last batch of calls excluded by the filter were the calls of which the time plots were not complete or had been plotted in a non chronological order. Filter one was applied in case the incomplete data

were expected to be of influence on the relations looked into. This was presumed to be the case for the time trends studied. The application of the filter is mentioned at the beginning of the results description. The filter was not applied to all the relations studied because of the decreased comparability of the regional data with the national data after filtering.

As a base for the data exploration, the hypothesis that came forward during the analysis of the interviews were used. It is the testing of these hypothesis that formed the principal part of the retrospective data analysis. The hypothesis are depicted in tables 3.2a and 3.2b and are further elaborated on per research sub-question they relate to.

1 What is the nature of the care delivered in case of EHTP calls?

In order to provide an answer on the *first sub question* (What is the nature of the care delivered in case of EHTP calls?) information from different sources was used as illustrated in table 3.1. At first a document study was done of the different publications of the Dutch national ambulance federation AZN (Dutch: Stichting Ambulancezorg Nederland). The uniform conceptual framework of the AZN defines and describes the concepts related to the ambulance organizations in the Netherlands. Furthermore, the yearly AZN reports give a global overview of the occurrence of general and EHTP calls on national and regional level. The second call data source used was the database of the RAV South Limburg that provided us with more detailed call data on the region of South Limburg.

The first sub question was answered by looking at the subject from three angles. *At first* the share of the different call categories making up the totality of EHTP calls were described on regional level in absolute and relative numbers. *Secondly*, the data on the regional occurrence of general and EHTP calls were compared to the accumulated national figures. *At last*, the share of EHTP calls per urgency class was described. The relative numbers of EHTP calls (% EHTP calls) were compared, as were the absolute number of EHTP and general calls.

2 Are factors like place and time of influence on the occurrence of EHTP calls?

As illustrated in table 3.1, the call data needed to answer the *second sub question* (Are factors like place and time of influence on the occurrence of EHTP calls?) were extracted from the RAV ZL's Ambu Opencare database and from the AZN publications. Central in the data analysis were the hypothesis that resulted from the interviews in research phase one. The hypothesis relating to sub question two are depicted in table 3.2a.

Sub question 2: Are factors like place and time of influence on the occurrence of EHTP calls?			
	Outcome variable	Predictor Variable	Statistical analysis
<i>Time related hypotheses</i>	1 There is a seasonal difference in the occurrence of EHTP calls		
	Single, Continuous	Single, Bi-categorical	Independent Samples T-test
	2 There is an increase in EHTP calls at night and on weekend evenings		
	Single, Continuous	Single, Bi-categorical	Independent Samples T-test
<i>Place related hypotheses</i>	3 In the Eastern mining region more EHTP calls occur then in the Western mining region		
	Single, Continuous	Single, Bi-categorical	Independent Samples T-test
	4 In cities more EHTP calls occur than in rural areas		
	Single, Continuous	Single, Multi-categorical	One Way Independent ANOVA

Table 3.2a: Hypothesis Related to the Second Sub Question; Outcome Variable, Predictor Variable and Resulting Statistical Analysis Technique Used for the Analysis of the Hypothesis

The data needed to examine the hypothesis were extracted from the database using the Dundas® data visualization tool in use by the RAV ZL. After data extraction, statistical analysis was performed when needed. In case regression analysis was carried out, SPSS® data analysis software version 15.0 was used. The concerning hypothesis, together with the types of outcome and predictor variables used are, together with the resulting statistical techniques, described in table 3.2a. The data acquired were visualized in figures in order to allow pattern description.

3 Who requests EHTP calls?

The *third sub question* aimed to provide insight into the origins of EHTP calls through exploring who requests ambulance calls in general and EHTP calls in specific. The data sources used for the third sub question are depicted in table 3.1. Building on the hypothesis that were formed based on the results found in phase one, the influence of several medical chain and non-medical chain actors was studied. Apart from studying the influence of the individual actors requesting ambulance calls, attention was given to the influence of the ambulance caregivers involved. The hypotheses studied are, together with the concerning variables and resulting methods for statistical analysis are depicted in table 3.2b.

Sub question 3: Who requests EHTP calls?				
	Outcome variable	Predictor Variable	Statistical analysis	
<i>Person related hypotheses</i>	5	<i>Calls requested by the HAP around HAP change of guard times are more likely to result in EHTP</i>		
		Single, Continuous	Single, Bi-categorical	Independent Samples T-test
	6	<i>More HAP initiated EHTP calls occur in regions far from the HAP than in regions close to the HAP</i>		
		Single, Continuous	Single, Continuous	Regression Analysis
	7	<i>Police initiated calls are more likely to result in EHTP than calls initiated by the general public</i>		
				None
	8	<i>Experienced EMS call center nurses give out less EHTP calls than their less experienced colleagues</i>		
		Single, Continuous	Single, Continuous	Regression Analysis
	9	<i>Calls responded to by more experienced EMS ambulance nurses are more likely to result in EHTP than those responded to by less experienced ambulance nurses</i>		
	Single, Continuous	Single, Continuous	Regression Analysis	

Table 3.2b: Hypothesis Related to the Third Sub Question; Outcome Variable, Predictor Variable and Resulting Statistical Analysis Technique Used for the Analysis of the Hypothesis

3.3 Reliability, validity, and limitations of the research

A number of remarks are to be made concerning the *reliability* of the research. At first, we aim to discuss the correctness of the data in the RAV ZL's Ambu Opencare database. The registration of data used to assemble this database was performed by the individual ambulance nurses and EMS call center nurses inflicted in the RAV ZL's EMS care process. There are no specific control mechanisms in place with the RAV ZL to verify the correctness of the data registered. Verification of data registration accuracy was also not included in this research assignment. We therefore must build on the assumption of data reliability. This assumption is supported by the fact that those inflicted in the data registration process are professional EMS nurses whom are supposed to be familiar with the registration system in use.

A second element we aim to discuss in the light of the reliability of the research design concerns the different data sources used. As stated in paragraph 3.2.2 and illustrated in table 3.1, the call data used for the second research phase was acquired from two different data sources, being the yearly AZN publications and the RAV ZL's Ambu Opencare database. Due to different inclusion and data filtering methods used in both databases, the AZN (2009) data on the EMS region of South Limburg differed to a certain extent from the data retrieved from the RAV ZL's Ambu Opencare database. Since retrieval of unfiltered data from the AZN was not possible, this divergence was accepted. Patterns and relations looked into were studied however using only one of the data sources at a time because of the limited comparability of both the databases. Doing so we consider the impact of the database discrepancy on the reliability of the study to be minimal.

Concerning the *validity* of the research we would like to stress that, in line with the research question, the capability of ambulance nurse to appropriately decide on the medical necessity of transportation to a hospital was not studied. Neither was the capability of the EMS call center nurse to appropriately apply telephone triage. This research aims not to provide insight in the appropriateness of the triage decision taken.

Furthermore there are a number of *limitations* to the study. At first there is the limited generalizability of the study results because of the geographical limits to the dataset studied. The dataset analyzed in phase two of the research exists of data accumulated in the RAV region of South Limburg. Conclusions of this research thus are based on these data should therefore not be extrapolated outside this RAV region.

Another limitation to the research we would like to address is the time frame studied. We consider the three year time frame studied as too narrow to conclude on the patterns observed in the occurrence of EHTP calls over time in the region of South Limburg as compared to the national level. We therefore do consider these patterns as an indication but do not base conclusions on them.

In this chapter we discussed the methodology used to come to an answer on the research question. The information from this chapter was used to conduct the different phases of the research project of which the following chapter reports on the results.

4 Results

In chapter four the results acquired from the research on EHTP calls in South Limburg are presented. At first the results of the first research phase entailing semi structured interviews are presented in paragraph 4.1. Subsequently the results of the retrospective data analysis performed in the second phase of are presented in paragraph 4.2. The results of both research phases are presented per sub question addressed.

4.1 Research phase 1: Semi structured interviews

Throughout a series of semi structured interviews taken from 11 members of the ambulance and EMS³ call center personnel in service with the RAV ZL, a first insight in the subject dealt with in the research question was acquired. Because of the descriptive nature of the first sub question and the expectation that the answers to the first sub questions would come forward from the data available from the regional and national databases without the need for prior exploration during the interview phase, the attention given to the first sub question throughout the interview phase was limited. The focus during these interviews thus laid on subquestions two and three. The interviews taken are transcribed in Dutch in appendix 4a. Subsequently a three step analysis of the transcribed interviews was made as described in paragraph 3.2.1 and presented in appendix 4b.

At the start of the interview the *inclusion criterion* was tested through question ‘a’ (Do you have 5 years or more of experience in your current position of ambulance nurse/call center nurse?). One ambulance nurse (AMBU VPK 4) did not fulfill the condition. His interview was concluded but not taken into account in the second and third analysis of the results.

4.1.1 What is the nature of the care delivered in case of EHTP calls?

After testing the inclusion criterion, the interviews pursued with the examination the *participants understanding of the concept EHTP*. This subject was addressed through question b’; “Can you briefly describe what the concept EHTP entails?”, question ‘c’; “Can you give some examples?” and question ‘d’; “What reasons for the occurrence of EHTP calls can you describe?”. All participants but one (AMBU VPK 6) showed a clear understanding of the concept and defined EHTP calls as those calls in which patient contact was established but

³ see ‘Abbreviations’ section

no transportation to a hospital facility was carried out. In case of the sixth ambulance nurse interviewed, the concept was clarified before continuation of the interview, where after understanding was verified through the summation of EHTP call examples by the ambulance nurse in question. The examples and classes of EHTP calls mentioned in answer of questions ‘b’, ‘c’ and ‘d’ are summarized in table 4.1.

	<i>EMS ambulance nurse</i>					<i>EMS call center nurse</i>				
	1	2	3	5	6	1	2	3	4	5
Hypoglycemia / diabetes	x	x							x	x
Small traumatic injuries		x	x		x	x		x	x	
Convulsions (fever/ epilepsy)	x					x				
Vague cardiac complaints	x				x					
Unclear calls	x						x	x	x	x
Emotional problems	x									
Low energetic traffic accidents		x	x						x	
HAP related		x		x		x			x	
GP related						x	x			x
No ambulance or GP available			x							
Alcohol related calls					x					
Requested by police						x				
Hyper-ventilation							x			
Elderly people							x			
Weekend							x			
Summertime							x			
Patient deceased									x	

Table 4.1 Different Classes of EHTP Calls Distinguished by the EMS Nurses Interviewed

Categories of EHTP calls mentioned more than one time by the ambulance nurses were diabetes related problems (hypoglycemia), small traumatic injuries, vague cardiac complaints, low energetic traffic accidents and general practitioners after hours service or HAP (Dutch: HuisArtsen Post) related calls. The categories ‘hypoglycaemie/diabetes’, ‘small traumatic injuries’ and ‘HAP related calls’ were also mentioned more than once by the EMS call takers interviewed. Other categories mentioned by this last group were unclear calls, mentioned by 4 out of 5 participants interviewed, and GP related calls.

4.1.2 Are factors like place and time of influence on the occurrence of EHTP calls?

The next elements addressed in the interviews were the *place and time related factors* as mentioned in sub question two (Are factors like place and time of influence on the occurrence of EHTP calls?). The interview questions addressing these subjects were questions ‘e’; “Do you think that the time factor plays an important role in the occurrence of EHTP calls?” and question ‘f’; “Do you think that the place factor is important in the occurrence of EHTP calls?”. The synthesis of the place and time linked elements mentioned in response to questions ‘e’ and ‘f’ can be found in appendix 4b. The table in step 3 of the synthesis mentions the number of different staff members that referred to the concerning factors with a distinction made between EMS ambulance nurses (AMBU) and EMS dispatching nurses (MKA). A summary of this table is to be found in tables 4.2a and 4.2b. In these tables the time and place linked factors mentioned by the EMS personnel interviewed as being influential on the occurrence of EHTP calls are depicted.

The **time related factors** referred to by both the ambulance nurses and EMS call center nurses were the seasonal influences of both winter and summer time and the increased number of EHTP call on weekend evenings.

The **place related factors** mentioned during the interviews with the ambulance nurses were the socio-geographical influences (Eastern mining region versus Western mining region), the degree of urbanization and the proximity of schools. Place related factors mentioned by the EMS call center nurses were the socio-geographical influences and the urbanization rate.

EMS call center nurses	
<i>Time related factors (n° of times mentioned)</i>	<i>Place related factors (n° of times mentioned)</i>
Seasonal influence (2): summertime: concentration of people, working in/outside home, festivities	Urban versus rural (3): more EHTP in cities: lower threshold; alcohol, lower threshold to call 112 in cities
Weekends & evenings (5): parties, after working hours, unclear calls at night	Eastern versus Western mining region (2): more in Kerkrade than in Sittard/Maastricht because of social differences between regions Kerkrade more EHTP calls than in Sittard

Table 4.2a: Time and Place Related Factors Mentioned by the EMS Call Center Nurses

EMS ambulance nurses

<i>Time related factors (n° of times mentioned)</i>	<i>Place related factors (n° of times mentioned)</i>
Seasonal influence (3): wintertime: slipperiness summertime: high temperatures, tourism, sport events, parties/events	Eastern versus Western mining region (1): more in Brunsum & Heerlen than in Western mining area
Weekends & evenings (2): Saturday evenings in the city: parties	Urban versus rural (1): more EHTP in urbanized regions
	Schools (1): young girls; emotional problems

Table 4.2b: Time and Place Related Factors Mentioned by the EMS Ambulance Nurses

4.1.3 Who requests EHTP calls?

A last set of elements looked into throughout the first research phase were the *person linked factors*, together with the *factors that are not place, time or person linked*. These factors were addressed in the questionnaire through questions ‘g’; “Do you think there is a person related factor in the occurrence of EHTP calls?”, ‘h’; “As ambulance/call center nurse: do you think you can describe an evolution in the amount of EHTP calls you were involved in over the last number of years?” and ‘i’; “Can you enumerate other factors of influence on the occurrence of EHTP calls?”. A summary of the answers depicted in appendix 4b is given in tables 4.3a & b.

EMS call center nurses

<i>Person related (n° of times mentioned)</i>	<i>Other factors (n° of times mentioned)</i>
EMS call center nurse (4): becomes more careful with more experience, some ask better questions to acquire insight in the need	Societal factors (4): lower threshold to call 112 since 5 to 10 years/since existence of cellular phone, language problems
Police (1): more EHTP in police induced calls	Availability of GP (2): often unavailable, unavailable at work
HAP (5): change of shift HAP	Availability of ambulances (1): influence availability Rapid Responder Motor
	Protocols/Medical insights (1): become more specific, more training, lower threshold for claim filing

Table 4.3a: Person Related and Other Factors Mentioned by the EMS Call Center Nurses

EMS ambulance nurses	
<i>Person related (n° of times mentioned)</i>	<i>Other factors (n° of times mentioned)</i>
EMS call center nurse (5): differences between individual nurses, more time pressure before sending out an ambulance than before, influence of the experience of the individual nurse	Societal factors (3): more demanding public, lower threshold to call 112, older people: more reanimations, lower threshold for claim filing, social/intellectual differences, increase in alcohol use
Ambulance nurse (3): professional experience	Availability of ambulances (1): influence availability Rapid Responder Motor
After hours general practitioners service / HAP (5): more EHTP since start HAP, individual differences between doctors and assistants, change of shift HAP, unavailability GP night & weekend, more EHTP at the border of the HAP district around change of shift HAP, more in HAP Heerlen than in other regions	Protocols/Medical insights (1): change, become more specific, more training
Home care nurse (1): assisting tasks live IV perfusions	

Table 4.3b: Person Related and Other Factors Mentioned by the EMS Ambulance Nurses

From the analysis of the answers to questions ‘g’ and ‘h’ that provided insight in the person linked factors, two groups of actors could be identified. The first group thought to have an influence on the occurrence of EHTP calls were the *actors requesting the calls*. Actors mentioned by the ambulance nurses that resort to this group are the HAP and the home care nurses. The EMS call center nurses on their turn mentioned the HAP and the police as prime EHTP requesting actors. The second group mentioned to be influential on the occurrence of EHTP calls were the *EMS actors involved*. All interviewed ambulance nurses mentioned the EMS call center nurses to be of influence. 3 out of 5 ambulance nurses mentioned the ambulance nurse to be of influence. EMS call center nurses on their turn saw their own position as a determining factor in the occurrence of EHTP calls (4 out of 5), while the influence of EMS ambulance nurses was not mentioned. Factors thought to be of influence on the behavior of EMS call center nurses and EMS ambulance nurses were their amount of experience, individual proficiency and the increasing time pressure in call handling. In relation to the amount of experience 4 out of 5 EMS call center nurses mentioned to have become more careful in not sending out an ambulance after acquiring more experience over the years.

The non place, time or person linked factors that resulted from the interviews are depicted in table 3 of appendix 4b and summarized in tables 4.3a and 4.3b under the category ‘other factors’. This category includes societal factors, changing medical insights and protocols, and the availability of ambulances and hap services.

4.2 Research phase 2: Retrospective data analysis

In the second research phase a data analysis is performed as described in paragraph 3.2.2. Central in the discussion of this second research phase are the three subquestions as put forward in the introduction.

4.2.1 What is the nature of the care delivered in case of EHTP calls?

To answer the first sub question ‘What is the nature of the care delivered in case of EHTP calls?’, first the data on the occurrence of distinct EHTP subcategories is looked into. Subsequently a comparison is made of the relative and absolute occurrence of EHTP calls on national and on regional level. At last a differentiation is made in the EHTP calls based on the urgency class attributed by the EMS call center nurses.

Occurrence of EHTP subcategories on regional level

On *regional level*, 14.4% of the 135,341 calls performed by the RAV ZL over the three years observation period resulted in EHTP calls. As is mentioned in table 4.4, a fraction of 82.3% of the EHTP calls are calls in which the patient is evaluated and treated on the spot but for whom transportation by ambulance was not considered necessary. This fraction represents 11.9% of all ambulance calls for the RAV ZL.

Call category:	<i>n</i> • of calls	% of total <i>n</i> • of EHTP calls	% of total <i>n</i> • of calls
No necessity for transportation	16,038	82.3%	11.9%
In assistance of other ambulance	1,787	9.2%	1.3%
Patient deceased	1,338	6.9%	1.0%
Uninjured	167	0.9%	0.1%
Refusal of care	163	0.8%	0.1%
Total	19493	100%	14,4%

Table 4.4: EHTP Calls performed by the RAV ZL in the Period 2007-2009, Depicted per EHTP Subcategory (Data Acquired from Ambu Opencare Database)

Another 9.2% of the EHTP calls performed by the RAV ZL concerned the assistance of an ambulance crew first on scene. The remainder 8.6% of EHTP calls result from cases in which the patient appears to be uninjured, refuses care or has deceased on arrival or during treatment.

Comparison of national and regional occurrence of EHTP calls

On *national level* the number of calls responded to by the Dutch RAV's varies between regions. When looking into the accumulated figures of the 25 RAV's as presented in table 4.5, a rise in the number of general calls of 2.5% for the period 2007-2008 and of 3.7% for the period 2008-2009 is observed (AZN, 2010; AZN, 2009; AZN, 2008). The numbers of EHTP calls on national level rose in this same time period with respectively 8.9% and 7.4%. This results in EHTP percentages of 15.8% for 2007, 17.0% for 2008 and 17.6% for 2009.

	2007	Difference 2007-2008		2008	Difference 2008-2009		2009
National		Absolute n°	Percentage		Absolute n°	Percentage	
General calls	977,660	+15,106	+2.5%	1,003,050	+13,574	+3.7%	1,041,966
EHTP calls	154,891	+25,390	+8.9%	169,997	+38,916	+7.4%	183,571
EHTP %	15.8%	+1.1%		17.0%	+0.7%		17.6%
RAV ZL		Absolute n°	Percentage		Absolute n°	Percentage	
General calls	42,783	+565	+3.9%	44,520	+294	+7.3%	48,038
EHTP calls	6,023	+1,737	+8.6%	6,588	+3,518	+4.3%	6,882
EHTP %	14.1%	+0.7%		14.8%	-0.5%		14.3%

Table 4.5: General and EHTP Calls Per Year on Regional and National Level
(Data Acquired from AZN)

As for the *regional level* presented in table 4.5, the number of general calls performed by the RAV South Limburg rose with 3.9% for 2008 and 7.3% for 2009 when compared to the number of general calls of the preceding year. For the number of EHTP calls these figures amount respectively 8.6% and 4.3%. When setting out the percentage EHTP calls on regional level, a percentage of 14.1% was observed for 2007, 14.8% for 2008 and 14.3% for 2009. In figure 4.1 an overview of these EHTP percentages on both national and regional level is provided of the data acquired from the AZN publications (2009).

When comparing the relative numbers of EHTP calls, it is observed that the EHTP percentage on national level is higher than on the level of the RAV of South Limburg. Another observation made is that the rising trend in EHTP percentages on national level is not reflected in the South Limburg regional numbers.

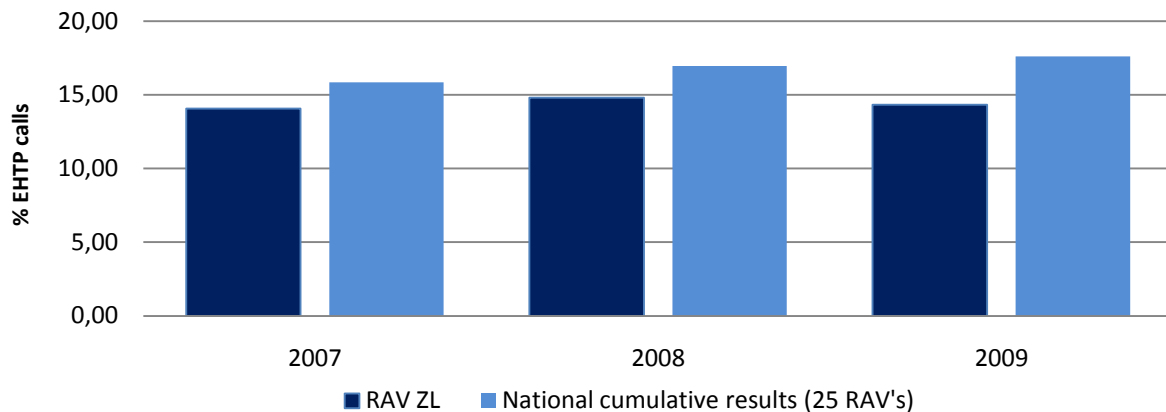


Figure 4.1: Percentage EHTP Calls on Regional and National Level (Data From AZN)

Differentiation in EHTP calls based on urgency class

When considering the RAV ZL's Ambu Opencare data on the percentage EHTP calls per urgency class as presented in table 4.6 it is observed that 70.5% of the calls resulting in EHTP were originally sent out with A1 urgency. Another 25.8% of EHTP calls resulted from A2 urgency calls while the remaining 3.7% of EHTP calls resulted from not urgent B calls.

Call urgency:	<i>n° of general calls / year</i>		<i>n° of EHTP calls / year</i>		<i>% of general calls resulting in EHTP</i>
	<i>Absolute n°</i>	<i>% of total gen. calls</i>	<i>Absolute n°</i>	<i>% of total EHTP calls</i>	
A1	15,973	35.4%	4,580	70.5%	28.7%
A2	10,600	23.5%	1,676	25.8%	15.8%
B	18,539	41.1%	240	3.7%	1.3%
Total	45,113	100%	6,497	100%	14.4%

Table 4.6: Number of General and EHTP Calls Responded to by the RAV ZL Depicted per Urgency Class (Mean Data per Year for the Period 2007-2009, Data Acquired From the RAV ZL Ambu Opencare Database)

4.2.2 Are factors like place and time of influence on the occurrence of EHTP calls?

Different time and place related factors were identified from the interviews in phase 1 of the research. Two time related factors were retained: the seasons (summertime versus wintertime) and weekday versus weekend day. Based on the elements retained in phase 1, hypotheses were formed as depicted in table 3.2a. The first two time related hypotheses are discussed in the following paragraph. The factor change of shift of the HAP is discussed as person related factor under paragraph 4.2.3.

HYPOTHESIS 1: There is a seasonal difference in the occurrence of EHTP calls

The first time related factor mentioned in the interviews that was studied in more detail, was the influence of the seasons on the occurrence of EHTP calls. Data filtering was applied using the RAV's 'filter one'. The occurrence of calls during the winter months (January, February, December) of every year was compared to the data on the summer months of that same year (June, July, August). The results are depicted in figure 4.2.

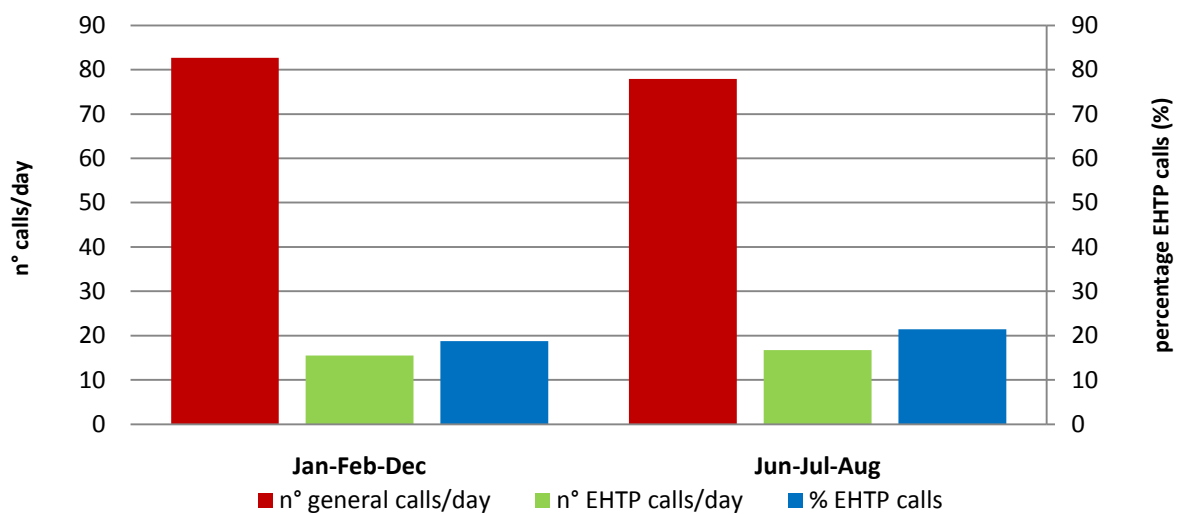


Figure 4.2: Number of General and EHTP Calls per Day During Winter and Summer Months; EHTP Percentage During Winter and Summer Months (Mean Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

When analyzing the obtained results statistically, following findings were made. When performing an independent samples t-test, the average amount of general calls during winter months ($M = 82.93$, $SD = 4.95$) is found not to be significantly higher than during summer months ($M = 77.30$, $SD = 4.10$), $t(4) = 1.52$, $p > .05$. The same conclusion was drawn from the independent t-test analysis of the difference between the average amount of EHTP calls during winter months ($M = 15.43$, $SD = 1.30$) and summer months ($M = 16.03$, $SD = 1.42$),

$t(4) = -0.54 ; p > .05$. For the percentage EHTP calls however a significant decrease in the call percentage is found for the winter months ($M = 18.57, SD = 0.48$) over the summer months ($M = 20.71, SD = 0.85$), $t(4) = -3.82; p < .05$.

HYPOTHESIS 2: There is an increase in EHTP calls at night and on weekend evenings

A second time related element that came forward during the interviews with the EMS nurses of the RAV ZL was the presumed relative rise in EHTP calls at night and on weekend evenings (Saturday and Sunday night). Data filtering using RAV's 'filter one' was applied while studying the data on this subject. First, the data on the number of general and EHTP calls per day from the period 2007-2009 were accumulated and compared for weekdays and weekend days. The average number of general calls per day throughout the week and throughout weekdays was considered statistically. When performing an independent samples t-test, it is observed that the mean number of general calls on week days ($M = 87.73, SD = 0.30$) lays significantly higher than on weekend days ($M = 69.42, SD = 0.23$), $t(5) = 76.69 ; p < .05$. For the average number of EHTP calls per day, there is a statistically significant decrease on week days ($M = 15.54, SD = 0.08$) over weekend days ($M = 16.38, SD = 0.12$), $t(5) = -11.20, p < .05$.

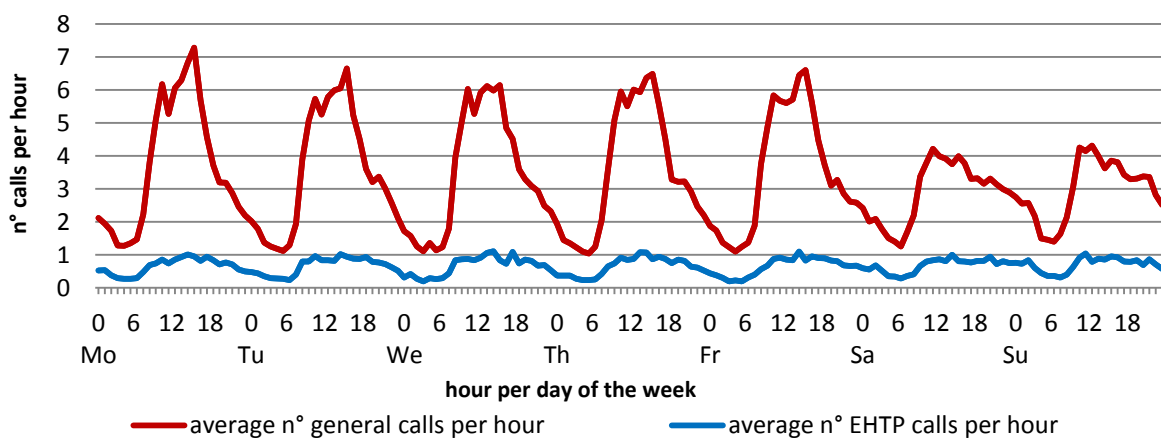


Figure 4.3: Week-time Pattern of General and EHTP Calls per One Hour Time Interval (Mean Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

In figure 4.3 a week time pattern of general and EHTP calls per hour is provided. Recurring patterns are observable with a differentiation between weekdays and weekend days. On *weekdays* the mean number of general calls per hour varies between a maximum of 6.63 calls per hour at 3 p.m. and a minimum of 1.18 calls per hour at 5 a.m. For the EHTP calls throughout weekdays there is a variation between 1.06 calls at 2 p.m. and 0.25 calls per hour

at 5 a.m. On *Saturdays and Sundays* the number of general calls varies between 4.18 calls per hour at 11 a.m. and 1.32 calls at 6 a.m. For the EHTP calls throughout the weekend these values vary between 0.49 calls at 11 a.m. to 0.32 calls per hour at 6 a.m.

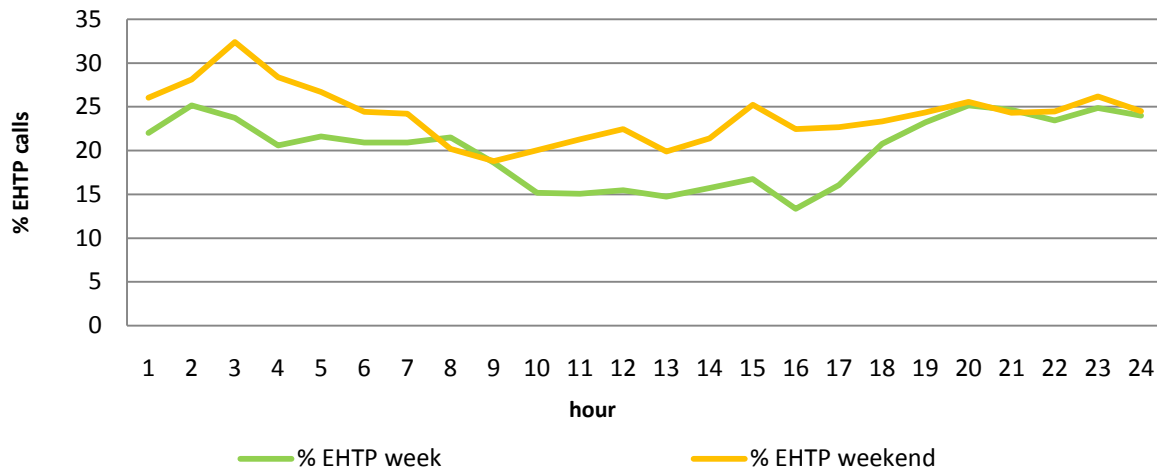


Figure 4.4: Weekday Versus Weekend Day Time Pattern of EHTP/General Call Ratio (Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

In figure 4.4 the mean EHTP/general call ratio per hour is presented for both weekdays and weekend days. The lowest relative occurrence of EHTP calls during weekdays is observed at 3 p.m. (13.3%). Also during weekdays, this gradually increases to a maximal EHTP/general call ratio of 25.2% at 1 a.m. During weekends the EHTP/general call ratio varies between 17.8% at 8 a.m. and 32.4% at 2 a.m. From the independent samples t-test performed, it appears that the mean EHTP call percentage during the week ($M = 19.58$, $SD = 0.07$) is significantly lower compared to the mean EHTP call percentage during weekend days ($M = 23.94$; $SD = 0.09$), $t(5) = -67.47$, $p < 0.05$.

A second set of factors that came forward from the interviews performed amongst the RAV ZL’s EMS personnel were geographical or place related factors. Two place related factors were retained: the eastern versus the western mining area or socio-geographical factor and the degree of urbanization. Based on these factors retained in phase 1, hypotheses were formed as depicted in table 3.2a. The third and fourth hypotheses are place related and are discussed in the following paragraph.

HYPOTHESIS 3: In the Eastern mining region more EHTP calls occur then in the Western mining region

The first of the place related factors studied is the alleged link between socio-geographical factors and the occurrence of EHTP calls. Filter one was not applied for the analysis of these data since it does not concern time trend data. In figure 4.5 the number of calls per 1000 inhabitants per year in the Eastern mining region against the number of calls per 1000 inhabitants per year in the Western mining region is presented.

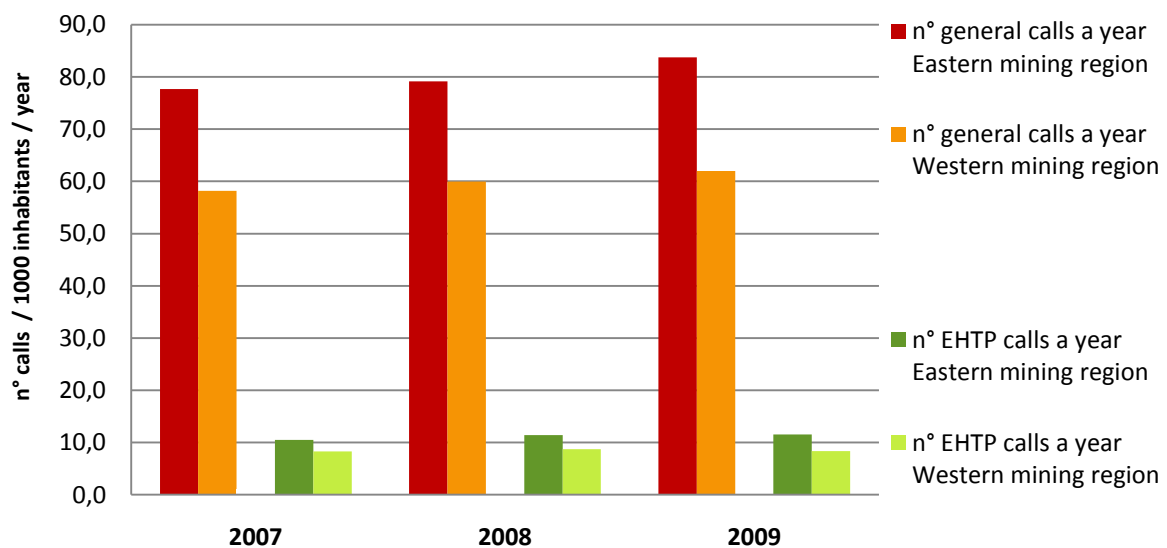


Figure 4.5: Number of General and EHTP Calls per 1000 Inhabitants per Year (Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

When applying statistical analysis, the independent samples t-test reveals that over the three year period studied, the number of general calls per 1000 inhabitants per year is significantly higher in the Eastern mining region ($M = 80.20$, $SD = 3.12$) compared to the Western mining region ($M = 60.07$, $SD = 1.90$), $t(4) = 9.54$, $p < .05$. An also statistically significant difference is observable for the number of EHTP calls per 1000 inhabitants per year in the Eastern mining region ($M = 11.13$, $SD = 0.55$) compared to the Western mining region ($M = 8.43$, $SD = 0.23$), $t(4) = 7.83$, $p < .05$. When considering the EHTP/general call ratio, a mean value of 13.9% ($SD = 0.46$) is observed for the Eastern mining region that does not differ significantly of the mean value of 14.1% ($SD = 0.53$) for the Western mining region, $t(4) = -0.50$, $p > .05$.

HYPOTHESIS 4: In cities more EHTP calls occur than in rural areas

The second place related factor studied was the occurrence of EHTP calls in relation to the urbanization rate. The urbanization rate was calculated, based on the area address density. For this, the area address density or OAD (Dutch: omgevingsadresdichtheid), being the number of registered addresses per square kilometer, was taken into account (CBS, 2009). Through categorization of the communities per degree of OAD, five categories could be identified as depicted in table 4.7. For the analysis of these data, filter one was not applied. Four digit postcode areas with less than 3 EHTP calls a year or less than 100 inhabitants in total were not taken into account because of the bias these cases induce in the data file.

<i>OAD category</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
OAD range: (n° addresses / km ²)	2,500 or more	1,500 to 2,499	1,000 to 1,499	500 to 999	499 or less
n° general calls / 1000 inh. per year	68.19	57.54	52.09	59.03	41.88
<i>SD</i>	29.77	20.28	13.00	66.73	21.52
n° EHTP calls / 1000 inh. per year	12.93	10.01	9.82	10.33	7.42
<i>SD</i>	6.41	4.89	2.57	12.51	4.72
% EHTP calls	18.67	17.22	19.02	17.41	17.63
<i>SD</i>	1.64	3.47	3.14	3.23	3.52

Table 4.7: Number of General and Number EHTP Calls per 1000 Inhabitants per Year in Function of the Area Address Density category; EHTP percentage in Function of the Area Address Density category (Mean Data for the Period 2007-2009, Acquired From the Ambu Opencare Database)

As can be observed from table 4.7, the four more densely populated categories on the urbanization scale used, have an EHTP/general call ratio varying between 19.02% and 17.22%. The fifth category which represents sparsely populated rural territory, has an EHTP/general call ratio of 17.63%. Statistical analysis using an analysis of variance (ANOVA) procedure revealed no significant effect of the OAD category on the amount of general calls per 1000 inhabitants, $F(4, 106) = 1.46, p > .05$. The same conclusion was drawn for the effect of the OAD category on the number EHTP calls per 1000 inhabitants, $F(4, 106) = 1.30, p > .05$, and on the % EHTP calls, $F(4, 106) = 1.10, p > .05$ (see table 4.7 for means).

4.2.3 Who requests EHTP calls?

The interviews with EMS personnel of the RAV ZL during research phase one, resulted in the identification of two groups of actors thought to be involved in the occurrence of EHTP calls. At one hand there were the actors requesting EHTP calls like the HAP, home care nurses and the police. At the other hand there was the EMS personnel itself as influencing actor, influenced by their amount of experience, individual proficiency and the increasing time pressure in call handling. Based on these different actors retained from phase 1, hypotheses were formed as depicted in table 3.2b. Hypotheses 5 to 9 are person related and are discussed in the following paragraph.

The call center of the RAV ZL registers general figures on the identity of the person referring the patient to the ambulance services. The amount of calls requested by the principal classes of callers for the 17,544 EHTP calls received over the three year observation period are depicted in table 4.8. These actors are the individuals calling the emergency number 112, the general practitioners after hours post or HAP, the individual general practitioners or GP's, the police force of South Limburg, hospitals and various other actors like for example the fire department or actors registered as 'other'. 'Filter one' was not applied on the data acquired from the RAV ZL's Ambu Opencare database.

<i>EHTP requesting actors:</i>	<i>n° of general calls</i>	<i>n° of EHTP calls</i>	<i>% EHTP calls</i>	<i>% of the total n° of general calls</i>	<i>% of the total n° of EHTP calls</i>
Private 112 call	36,948	12,734	34.5%	29.8%	72.6%
HAP requests	7,222	1,514	21.0%	5.8%	8.6%
GP requests	35,166	941	2.7%	28.4%	5.4%
Police	2,884	1,180	40.9%	2.3%	6.7%
Hospitals	31,025	162	0.5%	25.1%	0.9%
Various actors	10,590	1,013	9.6%	8.6%	5.8%

Table 4.8: Actors Requesting EHTP Calls (Cumulative Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

General practitioner on guard service (HAP) as call requesting actor

A first actor described in the interviews performed during phase one as being influential on the occurrence of EHTP calls was the HAP. The HAP ensures the availability of a general practitioner during out-of-office hours. The concept of one geographically central located station with several general practitioners on guard foresees the possibility to visit the patient at home or to consult a GP at the HAP station. First contact by patients is made through a designated HAP phone number. The call is answered by a HAP call-taker with a protocol-based decision making qualification. The HAP call-taker has the possibility to refer patients to the GP on guard in the HAP, to send a HAP GP to the patients address, to give the patient the advice to contact the dedicated GP during office hours or to refer them to the emergency medical services.

As depicted in table 4.8, during the observation period on average 21.0% of the calls made by the HAP resulted in EHTP calls. For the general practitioners this was 2.7%. The region of South Limburg is divided in the three HAP regions Sittard-Geleen, Heerlen and Maastricht. Table 4.9 gives an overview of the mean number of EHTP calls and general calls per 1000 inhabitants together with the EHTP percentages of the different HAP services. Figure 4.6 visualizes the number of general and EHTP calls demanded by each HAP service together with their respective percentages of calls resulting in EHTP calls.

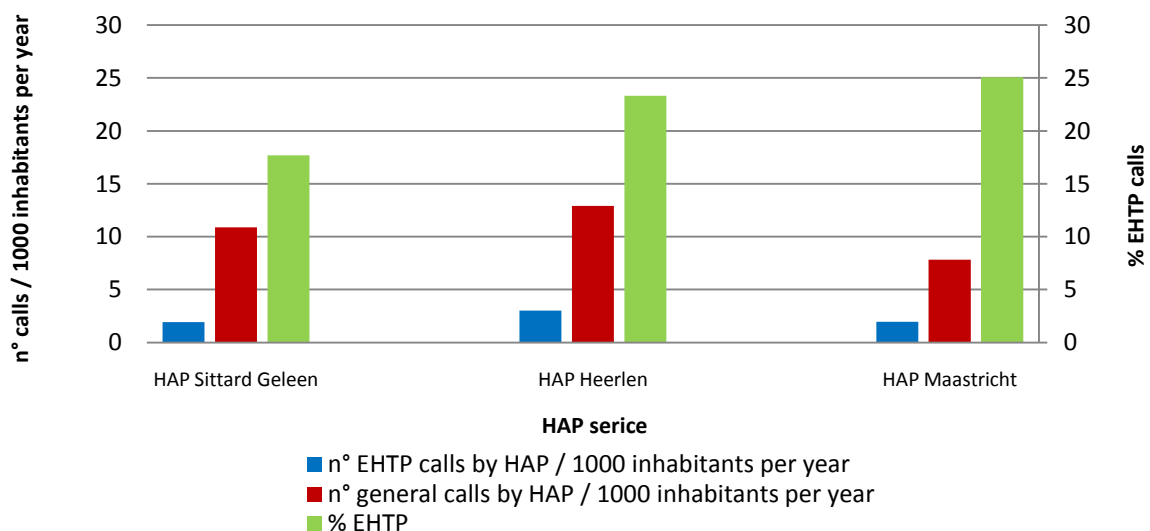


Figure 4.6: Number of General and EHTP Calls/1000 Inhabitants per Year per Individual HAP Service; Percentage of the Calls Resulting in EHTP per Individual HAP Service (Mean Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

<i>Hap Service</i>	<i>general calls / 1000 inhabitants per year</i>	<i>EHTP calls / 1000 inhabitants per year</i>	<i>% EHTP calls</i>
Sittard-Geleen	10.89	1.93	17.7%
Heerlen	12.89	3.01	23.3%
Maastricht	7.82	1.96	25.1%

Table 4.9: Number of Calls per HAP/1000 Inhabitants per Year and Percentage EHTP Calls per HAP (Mean Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

HYPOTHESIS 5: Calls requested by the HAP around HAP change of guard times are more likely to result in EHTP

A first influential factor related to the HAP described in research phase one, was the presumed rise in EHTP calls right before or during the handing over of the guard between the HAP and the general practitioner (GP) during weekdays and the handing over of guard between doctors on guard at the HAP during weekend days. On weekdays the HAP ensures the availability of a GP in the evening hours and at night. On weekend days the HAP is open on a 24 hour basis. The general practitioners in the HAP work in a three shift system. Table 4.10 depicts the change of guard hours and the respective number of calls and the general EHTP percentage on these moments. Also indicated is the amount of calls, requested by the HAP on these changing hours that results in EHTP.

<i>Change of guard hour</i>	<i>n° of general calls per hour from HAP</i>	<i>n° of EHTP calls per hour from HAP</i>	<i>general % EHTP calls</i>	<i>% of calls requested by HAP resulting in EHTP</i>
Week				
5 p.m.	222	47	15.7%	21.2%
6 p.m.	290	68	17.5%	23.4%
7 a.m.	263	42	16.3%	16.0%
8 a.m.	47	5	12.2%	10.6%
Weekend				
8 a.m.	141	25	15.3%	17.1%
9 a.m.	220	35	16.0%	15.9%
3 p.m.	176	37	18.9%	21.0%
4 p.m.	179	34	18.2%	19.0%
11 p.m.	120	26	20.4%	21.7%
12 p.m.	103	25	19.9%	24.3%

Table 4.10: Cumulative Data over the Period 2007-2009 on the Number of Calls per Hour and EHTP Percentages During HAP Change of Guard Hours (Data Acquired from Ambu Opencare Database)

In Figure 4.7 the time pattern in ambulance requests by the HAP on weekdays is depicted. In figure 4.8 this same time pattern is depicted for weekend days.

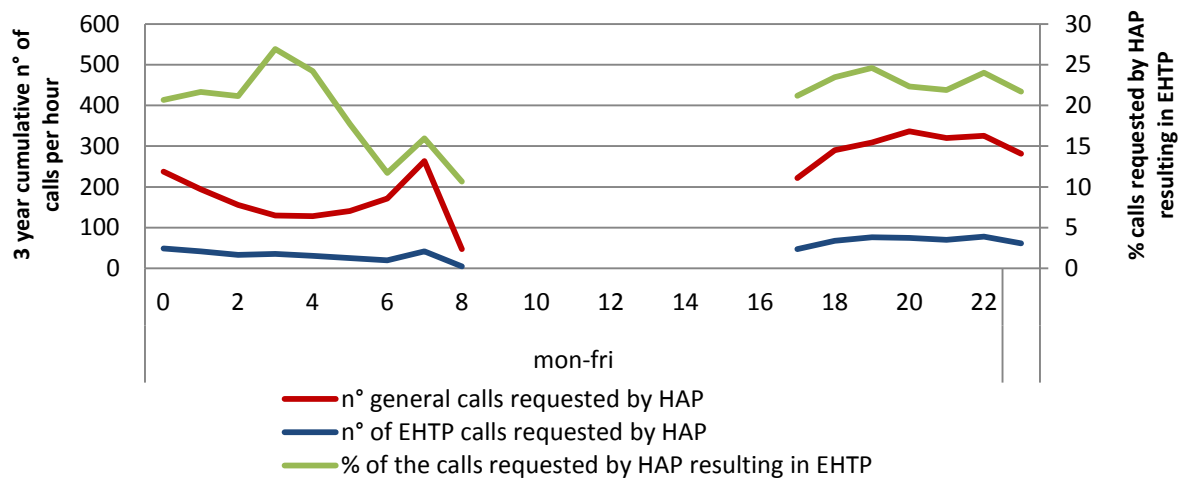


Figure 4.7: Calls Requested by HAP on Weekdays
(Cumulative Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

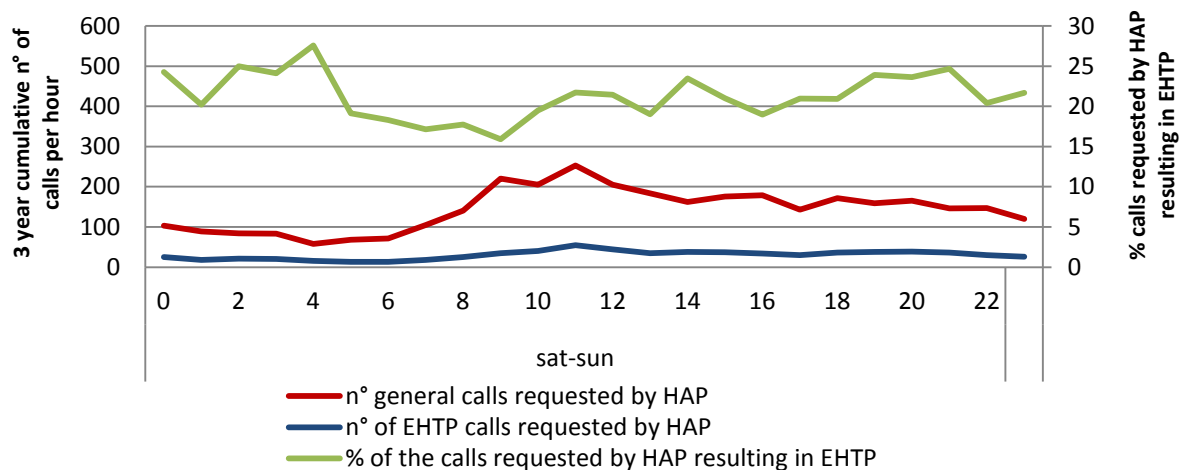


Figure 4.8: Calls Requested by HAP on Weekend Days
(Cumulative Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

The number of calls from the HAP that resulted in EHTP calls on change of guard hours and on the HAP working hours between the change of guard was studied statistically. When performing an independent samples t-test analysis on the number of general calls from the HAP on change of guard hours ($M = 176.10$, $SD = 75.25$), no statistically significant difference can be demonstrated compared to the number of general calls received on hours between the changes of guard ($M = 174.23$, $SD = 79.81$), $t(38) = 0.07$, $p > .05$. The same conclusion was drawn from the comparison of the number of EHTP calls from the HAP on

change of guard hours ($M = 34.40$, $SD = 16.55$) to the number of EHTP calls received on hours between change of guard ($M = 37.83$, $SD = 18.85$), $t(38) = -0.51$, $p > .05$. For the EHTP percentage it was observed that there is a statistical significantly lower percentage of EHTP calls requested by the HAP on the hours that the guard changes on the HAP ($M = 19.08$, $SD = 4.13$) than on the hours between change of guard ($M = 21.66$, $SD = 3.18$), $t(38) = -2.06$, $p < .05$.

HYPOTHESIS 6: More HAP initiated EHTP calls occur in regions far from the HAP than in regions close to the HAP

A second factor presumed to be of influence on the amount of calls requested by the HAP resulting in EHTP was the distance between the intervention address and the HAP guarding post. In this analysis postcode areas in which less than 10 ambulance calls by the HAP occurred during the observation period were excluded. In figure 4.9, the percentage EHTP calls was set out against the distance towards the HAP centre. Other relations depicted in figure 4.9 are the amount of general calls and the amount of EHTP calls in relation to the distance to the HAP.

	<i>B</i>	<i>SE B</i>	β
Constant	10.62	0.94	
n° general	0.16	0.11	0.14*

Note: $R^2 = .02$, $*p > 0.05$

Table 4.11a: Results of the Regression Analysis of the Relation Between the Number of General Calls (Dependent) and the Distance to the HAP (Independent)

	<i>B</i>	<i>SE B</i>	β
Constant	1.85	0.25	
n° general	0.08	0.03	0.25*

Note: $R^2 = .06$, $*p < .05$

Table 4.11b: Results of the Regression Analysis of the Relation Between the Number of EHTP Calls (Dependent) and the Distance to the HAP (Independent)

	<i>B</i>	<i>SE B</i>	β
Constant	17.7	1.54	
n° general	0.40	0.18	0.21*

Note: $R^2 = .04$, $*p < .05$

Table 4.11c: Results of the Regression Analysis of the Relation Between the Percentage EHTP Calls (Dependent) and the Distance to the HAP (Independent)

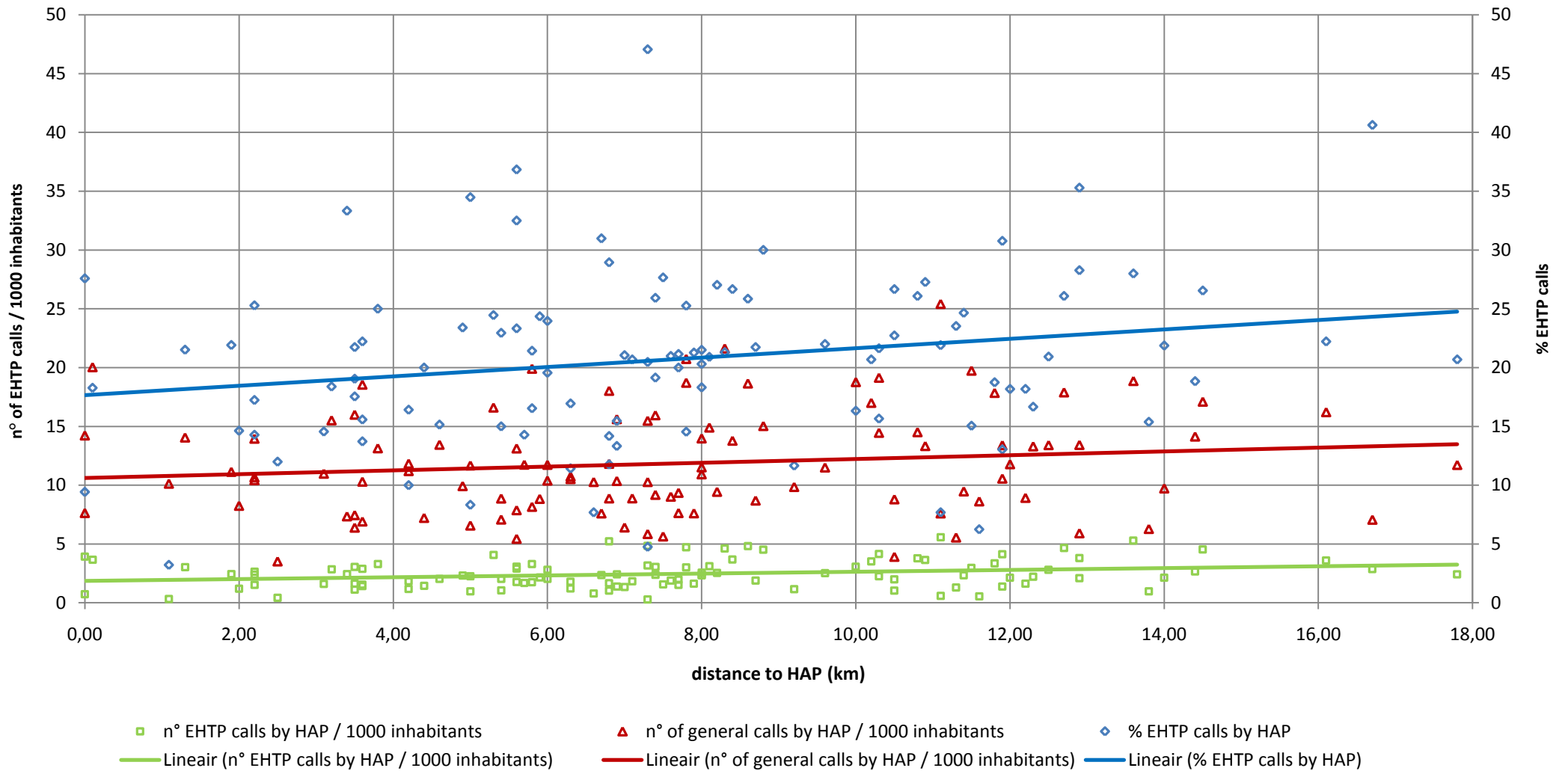


Figure 4.9: Percentage EHTP Calls by HAP in Function of Distance to HAP (km); General and EHTP Calls by HAP/1000 Inhabitants in Function of Distance to HAP (km); (Cumulative Data for the Period 2007-2009, Acquired from the Ambu Opencare Database)

The results of the statistical analysis of the relations depicted in figure 4.9 are described in tables 4.11 a, b and c. From the regression analysis performed, it can be concluded that the distance to the HAP does not significantly predict the the number of general calls from the HAP. Concerning the number of EHTP calls in function to the distance to the HAP there is a significant positive correlation that can account for 6% of the variation. The percentage EHTP calls is also positively correlated with the distance to the HAP. The distance to the HAP can account for 4% in the variation in EHTP percentages.

South Limburg Police force as call requesting actor

A second actor that came forward from the interviews of phase 1 was the police. In relation to this actor, hypothesis seven was formulated.

HYPOTHESIS 7: Police initiated calls are more likely to result in EHTP than calls initiated by the general public

For the analysis of these data filter one was not applied. As can be observed in table 4.8, 2.3% of the total number of calls is requested by the police. 40.9% of these requests results in EHTP. This represents 6.7% of the total number of EHTP calls in the region of South Limburg.

EMS nurses as call handling actors

In order to provide insight into the question ‘Who requests EHTP calls?’ not only the role of the call requesting actors involved was considered, but the influence of the EMS nurses was taken into consideration as well.

HYPOTHESIS 8: Experienced EMS call center nurses give out less EHTP calls than their less experienced colleagues

The RAV call center nurses have different options when receiving a call. They can advice people to contact the general practitioner or HAP, to go to the hospital by own means or they can send an ambulance or rapid responder vehicle to assess the situation on the spot. Despite the fact that these decisions are supported by protocols and decision trees, there is a factor of individual consideration in the referring decision taken by the call takers. The amount of data available on this subject was limited. The RAV ZL’s data on the years 2007 and 2008 were considered incomplete. Therefore this analysis was limited to the data of the year 2009. When

looking at the data, a mean EHTP percentage of 12.8% EHTP calls was found after exclusion of the call-takers from whom data were not available.

One of the prime factors considered to be of influence on the number of EHTP calls is the number of years of experience in the function of EMS call taker. Therefore the amount of years in service in the current function on the 1st of January 2010 was taken as a measure for the professional experience. Figure 4.10 graphically presents the relation between the percentage of EHTP calls per EMS call taker and the number of years in service with the RAV ZL. Both the relations corresponding with the percentage EHTP including and excluding the rapid responder calls are depicted. Further calculations are done excluding the rapid responder calls. In this group the highest EHTP percentage observed was 14.9% where the lowest value was 8.7% in a distribution with a standard deviation of 1.80.

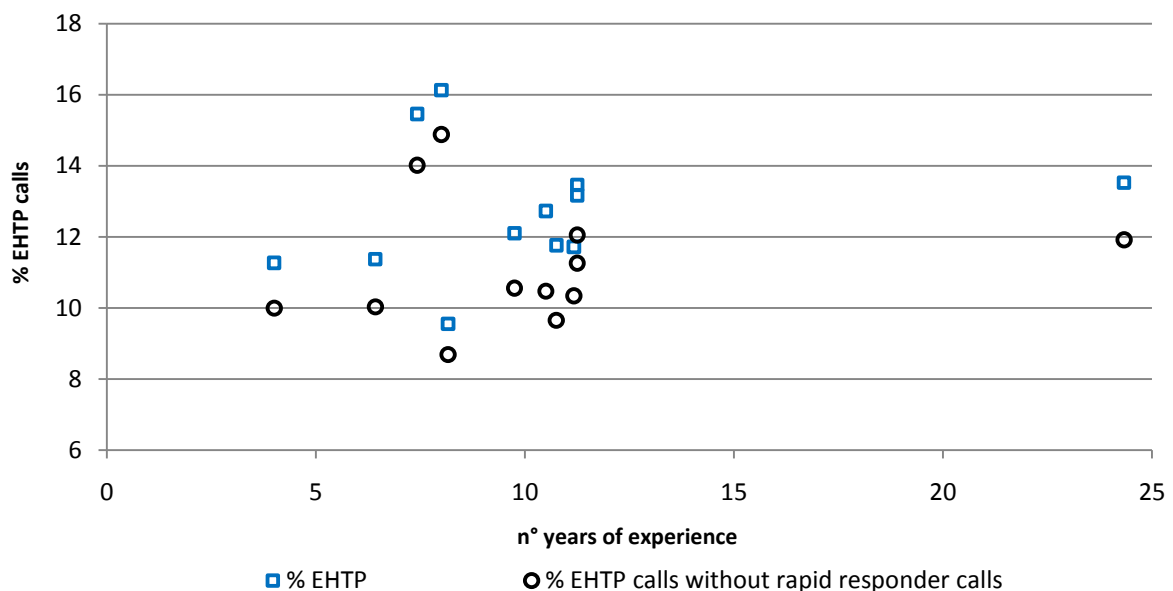


Figure 4.10: Percentage EHTP Calls per MKA Call Taker in 2009 in Relation to Number of Years in Service as Measure for the Experience per Call Taker, Corrected for Rapid Responder Calls (Data Acquired from the Ambu Opencare Database)

In table 4.12 the results of the regression analysis performed are presented. From this analysis it can be concluded that no statistically significant linear relation is observed between the amount of experience of the MKA call takers and the percentage of the calls handled resulting in EHTP.

	<i>B</i>	<i>SE B</i>	<i>β</i>
Constant	10.76	1.29	
n° general	0.04	0.11	0.11*

Note: $R^2 = .01$, $*p > .05$

Table 4.12: Results of the Regression Analysis of the Relation Between the Percentage EHTP calls per EMS Call Taker (Dependent) and the Experience (in Years) of the Call Takers (Independent)

HYPOTHESIS 9: Calls responded to by more experienced EMS ambulance nurses are more likely to result in EHTP than those responded to by less experienced ambulance nurses

Except for the influence of the EMS call center nurses on the occurrence of EHTP calls, the individual numbers of EHTP calls per EMS ambulance nurse were considered. Data on nurses whom had taken part in less than 300 calls over the period 2007-2009 and nurses with a part time deployment on the rapid responder motor were excluded from the analysis. The reason for the exclusion of this last group is the specific purpose of this rapid responder motor to respond to calls likely to result in EHTP calls, resulting in a mean EHTP percentage for this group of nurses of 26.2%. The mean EHTP percentage of the ambulance nurses after exclusion of the groups mentioned is 11.9%. The highest observed EHTP percentage for an individual ambulance nurse is 21.0%. The lowest value is 5.8%. The standard deviation of the distribution is 3.1. For this group as well, experience was considered to be a possibly influencing factor on the amount of EHTP calls of the individual EMS ambulance nurses. Its relation to the percentage EHTP calls per ambulance nurse was studied. Figure 4.11 visualizes the relationship between the percentage EHTP calls per EMS ambulance nurse and the number the of years she or he works for the RAV ZL as a measure for professional experience. The results of the regression analysis preformed are depicted in table 4.13.

	<i>B</i>	<i>SE B</i>	<i>β</i>
Constant	13.1	0.88	
n° general	0.02	0.07	0.05*

Note: $R^2 = .02$, $*p > .05$

Table 4.13: Regression Analysis of Relation between the percentage EHTP calls per ambulance nurse (dependent) and the experience (years) (independent)

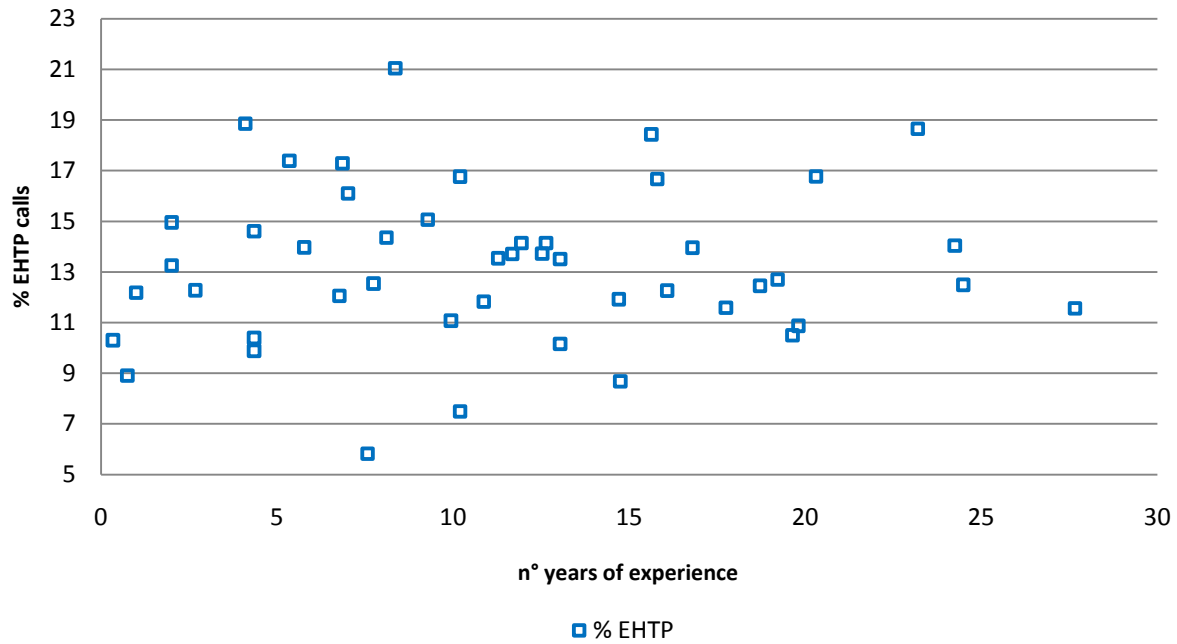


Figure 4.11: Percentage EHTP Calls per EMS Ambulance Nurse in Relation to the Number of Years in Service as Measure for the Experience of the EMS Ambulance Nurse (Data Acquired from the Ambu Opencare Database)

Throughout this chapter the results acquired during the two research phases are presented. The results of the interviews performed in research phase one were presented per sub question. The elements that came forward from this first phase formed the basis for the hypothesis used in the data analysis in research phase two. In paragraph 4.2, the results of this second research phase are described. In this paragraph as well the elements studied were differentiated per subquestions they aimed to provide insight to. In the first sub question the nature of care in case of EHTP calls was explored and the occurrence of EHTP calls was looked into both on national and on regional level. In the second sub question the influence of place and time on the occurrence of EHTP calls was studied based on the first four hypotheses. The third sub question aimed to provide insight in the actors involved in the occurrence of EHTP calls. Under this sub question the last five hypotheses depicted in table 3.2b are looked into. The results of the analysis performed in this chapter are discussed in the following chapter. In paragraphs 5.2 and 5.3 the answers on the hypothesis are discussed.

5 Discussion and Conclusion

The Dutch EMS system has, compared to other EMS systems throughout the industrialized world, a number of peculiarities that makes it a unique system (Alagappan, Dib, Naderi, Sheridan, 2006). The prehospital triage performed by the EMS nurses in the Netherlands leads to the occurrence of EHTP calls. In these EHTP calls, initial patient contact is not followed by transportation to a hospital. Where in other EMS systems the discussion whether prehospital triage by ambulance personnel should be permitted is ongoing (Brown, Cone, Greenberg, Hubble, Millin, Patterson, et al., 2009), prehospital triage by ambulance personnel has been common practice for decades in the Netherlands. Throughout this paper we aimed to provide insight in the occurrence of EHTP calls in the RAV⁴ region of South Limburg. We aimed to do so by providing an answer to the research question “*How can the RAV South Limburg react on the occurrence of EHTP calls?*”. This research question was operationalized in the following three subquestions: “*What is the nature of the care delivered in case of EHTP calls?*”, “*Are factors like place and time of influence on the occurrence of EHTP calls?*” and “*Who requests EHTP calls?*”. These subquestions were addressed in both the first qualitative research phase, discussed in paragraph 5.1 and the second quantitative research phase, discussed in paragraphs 5.2 and 5.3. In the following chapter the results acquired from the different research phases are aggregated per sub question. Based on these analyses, an answer on the research question is formulated in paragraph 5.4. In paragraph 5.5 the chapter concludes with recommendations for further research.

5.1 What is the nature of the care delivered in case of EHTP calls?

Despite some differences in the conceptual descriptions of the term EHTP by the national ambulance institute AZN and the RAV South Limburg, it can be stated that the concept EHTP entails all calls in which arrival of EMS personnel on scene was not followed by transportation by ambulance. As can be concluded from table 4.4 in paragraph 4.2, 17.8% of the EHTP calls that occurred in South Limburg represent issues like patients refusal of care, uninjured patients, assistance to a primarily arrived ambulance, or decease of patients. This class of calls represents non transportation calls of which the occurrence is inherent to most organizational forms of EMS care described in paragraph 2.1. The remainder 82.3% of the

⁴ see ‘*Abbreviations*’ section

EHTP calls carried out by the RAV ZL, concerned patients evaluated or treated on the spot for whom no transportation by ambulance was estimated necessary. These 82.3% of the EHTP calls are calls resulting from prehospital EMS triage, a process uncommon for EMS worldwide and typical to the Dutch ambulance nurses based system (Alagappan, Dib, Naderi, Sheridan, 2006). This class of calls represents 11.9% of the total amount of calls treated by the RAV ZL. In the majority of the EMS systems described in paragraph 2.1, these patients are taken into charge and transported to an emergency department.

As for the occurrence of EMS calls in general and EHTP calls in specific over the period studied, there is a rise on both national and regional level. As depicted in table 4.5, the absolute number of general and EHTP calls in the region South Limburg increased over the period 2007, 2008 and 2009. This is however not reflected in the EHTP percentage which decreases with 0.5% over the period 2008-2009. Unlike the relative decrease on regional level, the absolute increase in general and EHTP calls also depicted in table 4.5 of paragraph 4.2, is translated in a slight increase in the EHTP call percentage of 1.1% and 0.7% for the respective periods 2007-2008 and 2008-2009. It should be emphasized however that the three year period on which the observations are based is too short to conclude on a upward or downward trend in the occurrence of EHTP calls. In order to do so, a longer observation period is to be taken into account. From table 4.6 it can be concluded that the majority of the EHTP calls on regional level (70.5%) results from urgency A1 calls. The non urgent or planned care or B calls represent with 3.7% only a small fraction of the EHTP calls.

5.2 Are factors like place and time of influence on the occurrence of EHTP calls?

During the interviews performed among the EMS personnel of the RAV South Limburg several place and time related factors were brought forward as influential for the occurrence of EHTP calls. A first *time related factor* mentioned by both EMS call takers and EMS ambulance nurses was the influence of the *seasons*. The nature of these seasonal influences suggested differed between the participants interviewed. Some participants had the impression that during wintertime factors like slipperiness provoked an increase in the amount of EHTP calls, where others pointed out tourism in summertime as a factor contributing to an increase in EHTP calls. The season as influential factor on the occurrence of EHTP calls was addressed in the first hypothesis “*There is a seasonal difference in the occurrence of EHTP calls*”. The data collected on the seasonal differences in calls in the region of South Limburg

as depicted in paragraph 4.2.2 indicated no statistically significant difference in the number of general calls nor in the number of EHTP calls when comparing the summer and winter months. A statistically significant increase during summer months over winter months was however observed in the relative occurrence of EHTP calls or EHTP percentage. Despite the lack of a significant difference in the absolute numbers of general and EHTP calls, it can thus be concluded that the percentage EHTP calls rises during the summer months. Therefore it can be stated that the first hypothesis was confirmed.

The second time related factor brought forward during the interviews and looked into through data analysis was the increase in EHTP calls at *night*, especially *during the weekends*. When looking at the week time pattern for general and EHTP calls depicted in figure 4.3 of paragraph 4.2.2 a clear pattern is apparent. Explicit variations in the number of calls are observable with patterns varying for week and weekend days. In figure 4.4, the weekday versus weekend time pattern in the EHTP call percentage is illustrated. The factors ‘*night-time*’ and ‘*weekend*’ were translated into the second hypothesis “*There is an increase in EHTP calls at night and on weekend evenings*”. As depicted in paragraph 4.2.2, the percentage EHTP calls on weekend days is significantly higher than on weekdays. This difference is explained by a significant decrease in general calls combined with a significant increase in EHTP calls on weekend days. This difference between weekdays and weekend days is most explicit during the afternoon from 11 a.m. to 5 p.m. and in the early morning between 1 a.m. and 7 a.m. For these moments the EHTP percentage lays on average 6% higher for weekend days than for weekdays.

Apart from the time related factors, different perceived ***geographical factors*** came forward from the interviews in research phase 1. A first factor looked into is the influence of *socio-geographical* elements on the occurrence of EHTP calls. Two different regions were identified during the interviews, being the Eastern and the Western mining area. Both regions have a differing economical and industrial background. The perception of the EMS workers interviewed was that there was a considerably higher number of EHTP calls in the Eastern mining region. This perception was translated into hypothesis three: “*In the Eastern mining region more EHTP calls occur then in the Western mining region*”. The data available on this subject was looked into, analyzed statistically and described in paragraph 4.2.2. When considering the absolute numbers of calls per 1000 inhabitants, a significant increase in both

general (+20.1 calls per year) and EHTP calls (+2.7 calls per year) is seen in the Eastern mining region compared to the Western mining region. Despite this difference in the absolute numbers of calls, there is no statistically significant difference in the percentage EHTP calls observed. It can thus be concluded that despite a difference in absolute numbers, a difference in the relative EHTP call percentages for the Eastern and Western mining region was not observed.

A second geographical factor brought forward was the *degree of urbanization*. The perception of the EMS personnel interviewed was that there was a positive correlation between the EHTP percentage and the density of the population in a certain area. This was articulated in hypothesis four: “*In cities more EHTP calls occur than in rural areas*”. An analysis was performed of the number of EHTP calls per 4-digit postcode area in relation to the area address density. The results are depicted in table 4.7 of paragraph 4.2.2. The table shows different levels of general calls and EHTP calls per OAD category. From the statistical analysis performed, it appeared that no significant effect could be observed of the OAD on neither the number of general calls, the number of EHTP calls or the EHTP percentage.

5.3 Who requests EHTP calls?

A third subject studied were the groups of actors influencing the occurrence of EHTP calls. Two groups were identified, being the *actors requesting EHTP calls* and the actors inflicted in the process of a general call resulting in an EHTP call. As can be seen in table 4.8 in paragraph 4.2.3, 72.6% of the calls resulting in EHTP were requested by private actors through the 112 emergency number. The second largest group of calls (8.6%) was requested by the *HAP*. Throughout the interviews in phase 1, the influence of the HAP was mentioned 14 times and can be considered as a factor with a strong perceived influence. Since the is an element in the medical chain that can be influenced HAP - in contrast to private actors - its influence on the occurrence of EHTP calls was studied more in detail. In the region of South Limburg three different HAP services are active, each in its own geographically restricted area. From the results described in table 4.9 and depicted in figure 4.6, it becomes clear that there are significant differences between the different HAP services, observable in both the number of general and EHTP calls. Differences up to 65% for the number of general calls per 1000 inhabitants and 54% for the number of EHTP calls per 1000 inhabitants are denoted. As

can be seen in table 4.9, the percentages of the calls requested by the HAP that result in EHTP calls also differ considerably.

On average, 21% of the calls requested by the HAP resulted in EHTP. This is a fairly high percentage in comparison to the 14% of calls resulting in EHTP in the general population for a class of calls referred to the ambulance services by a medical chain partner. One of the factors perceived to contribute to a high number of HAP calls resulting in EHTP calls, as was mentioned by the EMS personnel interviewed, was the handing over of the guard between HAP and GP or between GP's on guard at the HAP. This factor was expressed in the hypothesis "*Calls requested by the HAP around HAP change of guard times are more likely to result in EHTP*". When considering the time pattern depicted in figures 4.7 and 4.8, it can be observed that seemingly there is no sharp rise in the percentage of general calls resulting in EHTP calls at the change of guard hours. Statistical analysis of the percentage EHTP calls on change of guard hours and between change of guards hours as described in paragraph 4.2.3 does not confirm the hypothesis that there is a relative increase in EHTP calls on the change of guard hours. No statistically significant difference is shown for the absolute number of calls nor for the number of EHTP calls. In contrast to the perception of the participants interviewed in phase one, the EHTP percentage shows a discrete but statistically significant decrease during the change of guard hours compared to the hours between the change of guard.

Another factor appointed during the interviews to be influential in relation to the occurrence of EHTP calls was the distance to the HAP. The hypothesis "*More HAP initiated EHTP calls occur in regions far from the HAP than in regions close to the HAP*" addresses this factor. In figure 4.9 of paragraph 4.2.3, the relations between the number of HAP induced general calls, EHTP calls and EHTP call percentage are set out against the distance to the HAP. The results of the statistical analysis of these relations is depicted in tables 4.11a, b and c. From these analysis it can be concluded that there was no significant correlation between the number of general calls and the distance to the HAP. For both the absolute and relative number of EHTP calls a significant positive correlation was shown as depicted in paragraph 4.2.3.

As can be concluded from table 4.8 in paragraph 4.2.3, a third important EHTP call requesting actor is the South Limburg *police force*. Calls requested by the South Limburg police account for 2.3% of the total number of general calls requested. Of these calls, an

unusual high proportion of 40.9% results in EHTP calls. This means that 6.1% of EHTP calls are requested by the South Limburg police. The according hypothesis “*Police initiated calls are more likely to result in EHTP than calls initiated by the general public*” is confirmed.

Apart from the call requesting actors, the *actors inflicted in the process of a general call resulting in an EHTP call* are studied as well. The first actor studied in this group are the *EMS call center nurses*. There are individual differences resulting in a range of different EHTP percentages for individual call center nurses between 8.7% and 14.9%. In relation to these differences, professional experience resulted as a perceived influencing factor from the interviews in phase one of the research assignment. In the eighth hypotheses stating “*Experienced EMS call center nurses give out less EHTP calls than their less experienced colleagues*”, this factor is articulated. In figure 4.10 the percentage EHTP calls per MKA call taker is set out against the number of years in service with the RAV ZL as a measure for experience. From the statistical analysis of this relationship reported on in table 4.12, it is concluded that no significant relation can be observed between the experience of the ambulance nurse and the EHTP call percentage given out by the MKA call center nurse.

The second group of actors inflicted in the process of general calls resulting in EHTP studied, are the *EMS ambulance nurses*. This group of EMS professionals is the subject of the last hypothesis studied, stating that “*Calls responded to by more experienced EMS ambulance nurses are more likely to result in EHTP than those responded to by less experienced ambulance nurses*”. For this group the variation between individual nurses is more pronounced than in the case of the EMS call taking nurses. EHTP percentages per ambulance nurse ranges from 5.8% to 21.0%. For this group as well experience was mentioned as a perceived influential factor on the amount of EHTP calls per ambulance nurse. Figure 4.11 visualizes the percentage EHTP calls per EMS ambulance nurse in relation to the time in service with the RAV as a measure for professional experience. The regression analysis on this relation of which the results are depicted in table 4.13 does not show a significant relation between the experience of the nurse and the percentage of EHTP calls the ambulance nurse is involved in.

A final set of factors that came forward during the interviews were the *general factors*, including the influence of changing medical insights and protocols and a range of social-demographic factors (decreased threshold to use emergency number, mobile phone use,

increased number of claims, language problems, aging) and the occurrence of unclear calls. Nevertheless, examination of these predominantly societal factors goes beyond the scope of this research project.

5.4 How can the RAV South Limburg react on the occurrence of EHTP calls?

From literature we learn that the occurrence of EHTP calls is specific to the variation on the Anglo-American EMS system that is applied throughout the Netherlands (Alagappan, Dib, Naderi, Sheridan, 2006). A central element in this system is the triage function appointed to the EMS ambulance and call center nurses. EHTP calls that are a direct result of this triage function represent 11.9% of the total amount of calls performed by the RAV ZL. These calls are considered to be a burden on the preparedness of the EMS ambulances. When put in an international perspective however, these 11.9% of calls, not followed by transportation, could - the medical correctitude of the triage decision not taken into account - be considered to represent an increase in EMS preparedness. Another possible benefit of the system in use is a decreased load on the emergency departments because an unspecified percentage of the patients are referred to other health care instances like the general practitioner (Hauswald, 2002). In order to acquire insight in this matter however, further research beyond the scope of this research project would be appropriate. From the insights acquired from this research it thus can be concluded that EHTP calls are a phenomenon specific to the Dutch EMS system. From an international perspective, they might be considered to yield a number of advantages to the health care system in general.

EHTP calls are not a new phenomenon. They have occurred in the Dutch EMS systems for the past decades. For the limited time frame studied, the number of EHTP calls in the region of South Limburg appears to be increasing at a slower pace than on national level. Intended to be, inter alia, an answer to the occurrence of EHTP calls, the RAV South Limburg currently deploys rapid responder motorcycles. The use of rapid responder vehicles as a mean to respond to EHTP calls could be optimized through the incorporation of the geographical and time related factors studied, into their deployment scheme. Furthermore, a dialogue should be started with the different HAP services addressing both the individual differences between the HAP services and the adaptation and alignment of the EMS referral procedure and criteria currently used. This with the aim to confine the number of calls referred by the HAP - being a

medical chain partner - that results in EHTP. The benefit of a similar endeavor addressing the police forces is less definite because of their status of non medical actor.

As for the variation in EHTP calls per EMS nurse, too little information is available on the causes of the phenomenon to conclude on how to address the matter. In order to facilitate future research endeavors on this subject, a more detailed registration of elements like the nature of the care provided and the profile of the patient cared for is essential. These elements could be incorporated in the electronic data registration form currently being introduced in the RAV ZL's service. Furthermore, as mentioned in paragraph 4.2.1, the differences, found in the data acquired on regional level from the Ambu Opencare database and on national level from the AZN publications, are an indication of differing data management strategies applied by both the RAV ZL and the AZN. The provision of clarity and uniformity in this matter might be a precondition for further research on multi RAV or national level.

Overall, individual call handler related elements like the variation in EHTP percentages per ambulance nurse might indicate a certain variability in care that could be addressed with initiatives like training programs or the provision of more detailed guidelines on the subject of prehospital triage. When implementing similar initiatives however, it should be carefully considered if such measures lead to a presumably unfavorable annihilation of the deliberative and decisive freedom of the EMS workers in question, that makes the Dutch EMS system to what it is.

5.5 Recommendations for further research

With this research we aimed to provide the RAV ZL insight in the matter of EHTP calls. We found the scientific literature on the subject to be limited. In order to acquire insight in the full spectrum of factors related to the occurrence of EHTP calls, further research is necessary. Based on our findings we found that the following factors should be focused on in future research endeavors on the subject.

As stated in paragraph 3.3, the three year timeframe is too short to conclude on the trends observed in the absolute and relative number of EHTP calls. Continued monitoring of the data over the years to come should provide more insight in the patterns occurring on national and regional level.

The variation in percentage EHTP calls per EMS nurse is another subject requiring further research. This research would be facilitated by more extensive data registration on RAV level as mentioned in paragraph 5.4.

Further research is needed not only into the factors linked to the occurrence of EHTP calls, but also in the beneficial or adverse effects of prehospital triage on the EMS system as a whole. Acquiring insight in this matter however requires an international comparative study taking into account the experiences from EMS systems in other industrialized countries.

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Abbreviations

A1, A2 & B calls:	Categorization of calls between limb or life threatening (A1) calls, urgent but not life threatening (A2) calls, and planned transportation (B) calls. Only in case of A1 calls or in case of A2 calls under special conditions the use of priority signals by ambulances is allowed
ALS:	<i>Advanced Life Support</i> : a set of advanced life supporting techniques essential in case of medical emergencies, performed by an ALS paramedic and usually delegated to him/her by a medical doctor
OAD:	Dutch: <i>AdresOmgevingsDichtheid</i> : number of addresses registered per square kilometer: used as a measure for the population density
BLS:	<i>Basic Life Support</i> : a set of basic life supporting techniques essential in case of medical emergencies, performed by a paramedic, EMT's or volunteers trained in this specific matter
EHTP:	Dutch: <i>Eerste Hulp Ter Plaats</i> : first aid on the spot calls: in these calls, the initial patient contact between the ambulance crew and the patient is not followed by transportation to the hospital
EHGV:	Dutch: <i>Eerste Hulp Geen Vervoer</i> : synonym for EHTP
EMS:	<i>Emergency Medical Services</i> : all services responsible for transportation and care in case of out of hospital medical emergencies
EMT:	<i>Emergency Medical Technician</i> : professional or voluntary caregiver with, depending on the context, usually a BLS level training
GHOR:	Dutch: <i>Geneeskundige Hulpverlening bij Ongevallen en Rampen</i> : Dutch nationwide institute responsible for the organization of medical care in case of disaster
GP:	<i>General Practitioner</i>
HAP:	<i>HuisArtsenPost</i> : after hours General Practitioner on guard service

- LSMA: Dutch: *Landelijke Standaard Meldkamer Ambulancezorg*: Dutch national EMS telephone triage protocol
- MMT: Dutch: *Mobiel Medisch Team*: helicopter or ground based medically staffed second echelon ambulance team in the Dutch EMS system
- RAV ZL: Dutch: *Regionale Ambulancevoorziening Zuid-Limburg*: one of the 25 Dutch regional EMS organizations, responsible for the region of South Limburg

Appendices

Appendices on CD - Rom:

- Appendix 3 a: Interview guide and questionnaire; *Dutch*
- Appendix 3 b: Interview guide and questionnaire; *English*
- Appendix 3 c: Data sources used for the acquisition of call data
- Appendix 4 a: Interviews; *Dutch*
- Appendix 4 b: Interview syntheses 1,2 and 3; *English*