Saimaa University of Applied Sciences
Health Care and Social Services, Lappeenranta
Degree Programme in Paramedic Nursing

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# Study of Paramedic Staff Safety Comparing Greater Manchester and Finland

Thesis 2017

## Abstract

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Study of Paramedic Staff Safety Comparing Greater Manchester and Finland – observational study, 73 pages, three appendices
Saimaa University of Applied Sciences
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The purpose of this study was to gather information about threats and safety issues from the emergency medical care personnel in Greater Manchester area and compare these results with the same research done in Finland by another research group. This thesis is a part of a bigger safety project, which was commissioned by The Union of Health and Social Care Professionals in Finland (Tehy) and The Union of Finnish Prehospital Medical Care (SEHL).

A mixture of quantitative and qualitative methods were used in this thesis. A structured observation form was composed together with the Finnish research group. Consulting health care professionals was beneficial in this observation form. The collected data was analysed using the SPSS 24.0 software.

The results were divided into six different themes. The results and findings of this study show that the area of safety issues is wide. The most notable factor is that although there were not that many serious incidents, the worker has a critical part in occupational safety concerning many low risk safety factors. This requires cooperation between the workers and employers.

Keywords: occupational safety, emergency care, paramedic

## Table of contents

# 1 Introduction

Working as a paramedic can be demanding psychologically and physically, setting a high pressure on health care workers in prehospital care all over the world. This pressure may cause a higher risk for workers to injure themselves or their colleagues. Van der Ploeg (2003) discovered that a vast majority of paramedics suffer from severe fatigue. Personnel working in an ambulance are in a higher risk of burnout according to the study done in Netherlands. The subject of staff safety and their health has not been studied yet in Finland, and very little across the world.

This study focused on the safety of the paramedic personnel. It was a part of a bigger project ordered by Finnish Paramedic Association (SEHL) and Union of Health Personnel in Finland (TEHY). The main goal of this project was to study the most plausible safety risk factors for paramedic staff. This project presents five different master's and bachelor's theses. All of these theses study paramedic safety by using different methods.

This study was executed in Great Manchester area as a comparison study for the one in Finland. Observation form was constructed with the Finnish colleagues in Lappeenranta during the fall of 2015. The same form was translated in English to be used in Manchester. This way we were able to compare the two studies without any linguistic complications.

The main purpose was to find out risk factors in paramedic staff safety. These include violence towards staff, slips and falls, ergonomic working conditions and general safety precautions to set an example. The second purpose was to compare the Finnish study to the data that was obtained from this study.

The research questions were:

- What kind of hazardous factors may affect the safety of the paramedic staff in Manchester and in Finland?
- What are the most usual hazardous factors that paramedics encounter?
- Are there any differences and/or similarities with the Finnish study?

# 2 Emergency medical service (EMS)

There are many different medical emergency services (EMS). In this thesis the medical emergency system of United Kingdom, especially Manchester's medical emergency system, and Finnish medical emergency system will be presented.

EMS has been long embodied into the history and enhanced by military conflicts. Ricardo Martinez (1996), believes that even though Romans and Greeks evacuated wounded soldiers from battlefields using chariots, the first recorded pre-hospital care system has to be credited to Baron Dominique Jean Larrey in 1797. Larrey was a chief physician in Napoleon's army, who implemented a system that was designed to triage and transport the injured from field to aid stations. Later civilian ambulance services were developed in Cincinnati and New York City in 1865 and 1869. EMS kept on developing and the first known air medical transport occurred during the retreat of the Serbian army from Albania in 1915. The EMS development picked up its pace and new ways to treat more critical patients were invented in 1960. During the same era, Belfast successfully showed that mobile coronary care unit ambulances were able to treat cardiac patients on scene. This sparked the modernization towards the EMS known today. (Martinez 1996.)

Modern EMS provides out-of-facility medical care to urgent medical care patients. It works as a part of the whole health care system. EMS delivers treatment as part of, or in combination with, systematic approaches to decrease mortality of the population. (Martinez 1996.)

This research will explain British and Finnish medical emergency systems, specifying in those regions where the observations were collected.

## 2.1 Finnish medical emergency system

The medical emergency system in Finland comprehends emergency care. Its main purpose is to offer rapid clinical examinations outside of hospitals, possible transport to a hospital and offer medical care in emergency situations. Emergency medical service complies with its actions to health care values, the rights of patients, acts and sections. (Metsävainio 2014, 53; Määttä 2015, 14-15.)

The emergency system includes instant medical treatment of a patient who has fallen ill or has injured themselves. It also contains preparedness of emergency care system and guidelines for major hazardous events in multi-official situations and guidance to psychosocial care. (Terveyslaki 30.12.2010/1326.)

The emergency medical services are formed by different authorities. These are first responders, basic and advanced level paramedics and Accident & Emergency (A&E) medical doctors. To activate the emergency medical care, the citizen is required to inform about the need for help and dial the emergency number. The number is 112 in Finland. The public-safety answering point (later as PSAP) needs to see the call for help and alert the emergency medical care. (Määttä 2015, 14-15.)

**Response categories**

Before PSAP alerts the emergency medical care, it defines the code and response category of the mission. There are four categories all in all.

A- level means a high-risk mission where the patient´s basic vital function is in great danger.

B- level mission means that it is likely a high-risk mission but there is an uncertainty of patient´s basic vital function.

C- level mission means that the patient´s basic vital function is considered stable or the problem is minor, but assessment is needed.

D- level mission means that the patient is in a stable condition and the basic vital function is not in danger, but emergency medical staff needs to make an assessment about the care. (Sosiaali- ja terveysministerön asetus ensihoitopalvelusta 340/2011.)

The hospital district regions are divided to cover an area of one square kilometre. These regions again are divided into different classes of risk areas. There are five risk categories which are formed by the average amount of medical emergency calls, major highways and settlements. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011.)

## X- codes

In 2016, Finnish Ministry of Social Affairs and Health published a report that examined nationwide emergency medical services. The report stated that almost 900 000 medical emergency missions were in 2014 out of which there were 66.6% - lower risk or non-threatening missions were 36.9% category C-missions and 29.7% D-missions. (Ilkka, Kurola, Laukkanen-Nevala, Olkinuora, Pappinen, Riihimäki, Silfvast, Virkkunen, Ekstrand 2016:40.)

In Finland many patients are treated and left at home or on scene. When patient is left at home/scene or they are transported by other means than ambulance, they are categorised into X-codes. (VALVIRA 2:2014.) The categorisation is done by health care professionals following national and regional guidelines. Below different X-codes are explained (table 1) and the amount of X-codes between the years 2010 to 2015 (figure 1).

| | | |
|---|---|---|
| **X-0** | **Technical problem** | Car or equipment malfunction, health problems of the staff. |
| **X-1** | **Patient was dead** | Patient was found dead. He had secondary signs of death. He was assessed by health care professional. |
| **X-2** | **Patient was handed over to the police** | Patient was assessed by the health care professional and they determined that patient does not require acute medical help. Patient was aggressive or intoxicated. |
| **X-3** | **Patient was handed over to other help** | Patient was assessed by the health care professional and they determined that patient does not require acute medical help. Patient might require some other help from other authority. These are e.g. homecare nurse, diabetes nurse, social care worker. |
| **X-4** | **Patient was transported by other means** | Patient was assessed by the health care professional and they determined that patient can be transported by other means to health care facility. Other means meaning e.g. own vehicle, relative/civilian transported the patient, taxi or public transportation. |
| **X-5** | **Patient did not need medical treatment** | Patient did not need any medical treatment. Patient did not have any acute onset. Patient and their vitals were assessed by the health care professional. |
| **X-6** | **Patient refused treatment** | Patient refused treatment, even though health care professionals advised otherwise. |
| **X-7** | **Patient was not found** | The patient was not found at the given location. |
| **X-8** | **Patient was treated at scene** | Patient was assessed and treated at the scene by health care professional. Patients medical problem was resolved and patient did not need any transportation to the health care facility. |
| **X-9** | **Stand down** | Delivered usually by medical dispatch or field manager to working brigade. |

Table 1. X-codes explained. (Määttä 2015, 58-63.)

Ilkka et al. show in their report that the number of patients that are categorised with X-codes has been gradually rising. All usage of X-codes between 2010 and

2015, has risen almost 15%. More importantly the X-8 calls, where patient is treated at the scene and did not require to go into any medical facility after the call, has risen almost 5%. This is due to the enhancement and development in homebased services that paramedics provide with the help of consultation of leading doctor (figure 2). (Ilkka et al. 2016.)

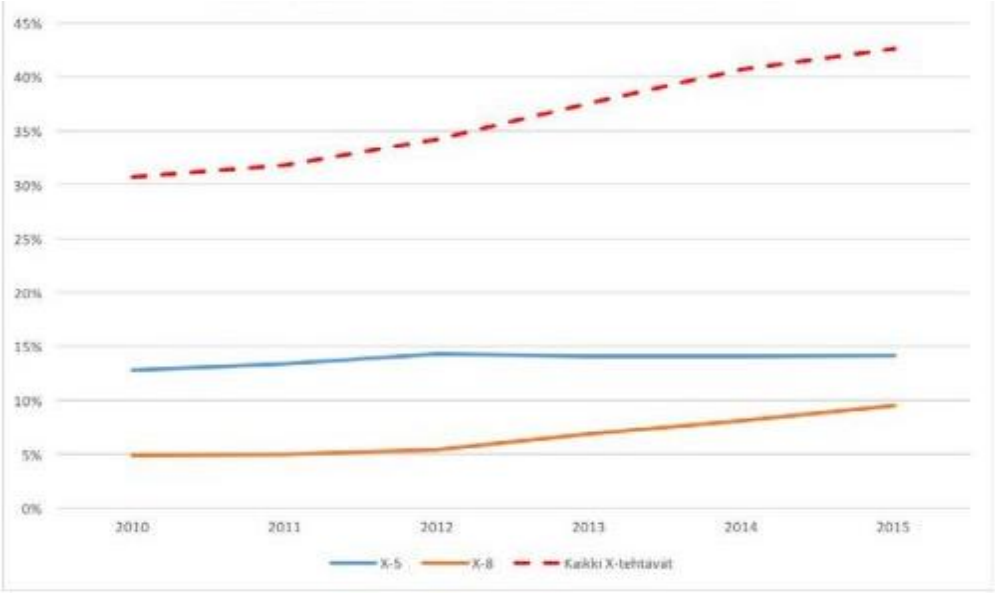


Figure 1. The percentage of X-5, X-8 and overall X-codes from all emergency medical missions during the years of 2010-2015. The red line meaning all X-codes, blue line meaning X-5 and yellow line meaning X-8. HUS and Mid-Finland's medical regions were not included due to the missing code data. (Ilkka et al. 2016:40.)

**Different level of emergency medical care**

Emergency medical services consist of a first response unit, basic level paramedics, advanced level paramedics and in some regions also a medical unit. At least one extra unit is always sent out to high risk missions to assist in procedures. (Castrén, Helveranta, Kinnunen, Korte, Laurila, Paakkonen, Pousi and Väisänen 2012.)

The first response unit is alerted if the patient is a high-risk patient and it is likely that it would be the first unit to reach the target. First response unit is not an ambulance or a paramedic but some other unit of medical services (volunteer fire

brigade for an example.) The first response unit can be anyone or anything that has made an agreement with health care. (Castrén etc. 2012.)

The most familiar units of first response are rescue units. Police and border protection can also practise first response if needed and voluntary maritime rescue operates in archipelago. (Määttä 2015, 14-15.)

Social- and Health Ministry act of emergency medical care state that at least two of the personnel member have completed a first response course if working as a first response unit. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011.)

Being a basic level paramedic means that the personnel have enough education and knowledge to take care of patient´s basic vital functions during transport. Basic level paramedics can start simple life saving procedures if needed and use limited types of medication on patients. (Ensiho1itojärjestelmä, Itä-Uudenmaan pelastuslaitos 2011.)

Basic level brigade (table 2) consist of two members in which at least one is a health care professional by vocational education specialized in emergency medicine. The other can be a health care professional or a fireman. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011, section 8.)

Advanced level paramedics work as a two personnel brigade (table 2). The requirement for an advanced level brigade is that at least one of the staff members is a health care professional that is a bachelor level paramedic or registered nurse with specialisation in emergency medicine. The other member can also be an advanced level paramedic or at least a health care professional by vocational education or a fireman. Advanced level paramedics have a wider knowledge and range of medication to use to treat the patient efficiently than the basic level does. (Castrén et al. 2012.)

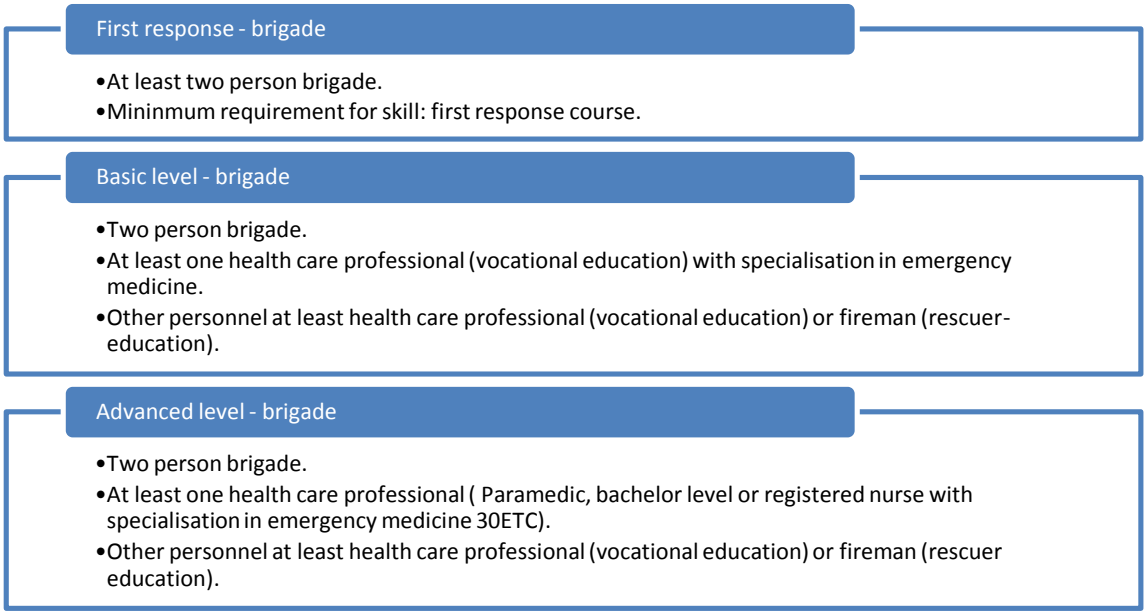


Table 2. Differences between emergency medical brigades. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011, section 8.)

Primary care setting in emergency care states every hospital district to have an around- the- clock working field management. Field managers work under the auspices of an A&E emergency medical doctor and the doctor who answers to the whole emergency medical services. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011.) Field managers are superiors to other emergency care units in situations that have multiple patients and during a multi authoritative missions. They are advanced level paramedics by profession, which allows them to be an additional support to other paramedic units. Field managers can help the Emergency Response Centre (later preferred ERC) in high peak missions by re-directing missions to other units or prioritising missions. (Castrén et al. 2012.)

**Organization of the emergency medical care**

Health care act states that the municipalities have the responsibility of organizing emergency medical care in hospital regions. The emergency medical services are provided by joint municipal authorities in hospital districts in Finland. The emergency medical services are planned and implemented in cooperation with units providing emergency medical care as to form a regionally coherent system.

Joint municipal authorities for hospital districts may provide emergency services in their areas, in the parts of those areas or through in-house personnel, in cooperation with the regions rescue services or joint municipal authorities for other hospital districts, or by outsourcing the services to other service providers. (Terveydenhuoltolaki 1326/2010, section 39.)

The hospital districts that have special responsibility areas, have to collaborate to organize specialized medical care. Districts that manage the University hospitals (figure 2) need to arrange special level nursing in their remit due to special healthcare act 9. (Terveydenhuoltolaki 30.12.2010/1326.)

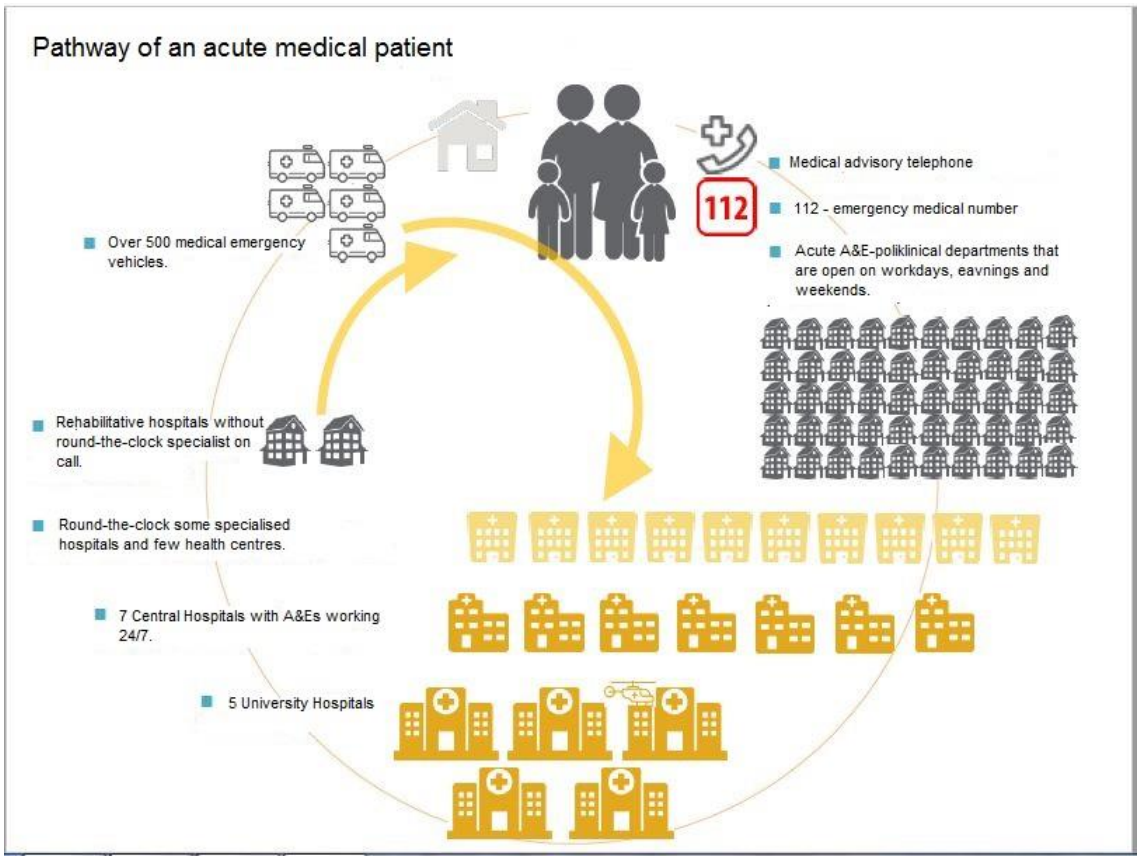


Figure 2. Pathway of an acute medical patient. (ESH regional draft, published in Finnish entrepreneurs summary report regarding emergency medical services 2016. (Translated)

The standard of service in medical care is set in the federation of municipalities of hospital districts. Its purpose is to define the content of emergency medical care to be efficient, on demand and properly measured. The standard of service

takes notice of different views of different authorities. This is based on risk analysis of the population of the area and its age demographic but also rural living, travelling and public commute. The analysis acknowledges risks of accidents, casualties and local factors such as natural factors and illnesses. (Sosiaali- ja terveysministeriön asetus ensihoitopalvelusta 340/2011.)

Hospital and health care regions are supervised and assessed by Regional State Administrative Agencies (AVI) and National Supervisory Authority for Welfare and Health (Valvira). These supervisory agencies are governed by Finnish Ministry of Social Affairs and Health (STM). Valvira and AVI are also responsible for testing and managing health care professionals work permits. The supervisory chain is shown below in table 3. (Regional State Administrative Agencies – Healthcare 2017; National Supervisory Authority for Welfare and Health, Web – Valvira 2017; Finnish Ministry of Social Affairs and Health – Health Services 2017.)


Table 3. Finnish supervisory chain in emergency medical services. (AVI – Healthcare 2017; VALVIRA Web – Valvira 2017; STM – Health Services 2017.)

**Multi agency cooperation**

The task of an Emergency Response Centre is to produce ERC services. One of its main functions is to provide support to fire and rescue services, police and social officials. This happens by redirecting an emergency notification or a mission to right officials. (Laki hätäkeskustoiminnasta 692/2010.)

According to Finlex, Rescue act (379/2010) the state and municipal authorities, public utilities and institutions are obliged to take part in the planning of rescue operations under the guidance of the rescue service. They are required to work in a way that rescue operations can effectively be carried out during accidents and hazardous situations. Rescue operations are always lead by rescue authorities on accident sites. If other units take part in these situations, such as the police and health care authorities, rescue officials have command over these units. If a major accident occurs, a special command centre can be set up to act as a base centre for the lead of the rescue services and any experts required. (Pelastuslaki 379/2010.)

Finlex, Border Guard Act (578/2005) also states that border guards take part in other rescue missions and in the search of a missing person in open country, or in need of immediate help. This by making equipment available to use, enough personnel and expert services, if this is considered necessary in view of the scale or special nature of the accident or emergency. The border guard may also perform urgent ambulance services if the authority or ambulance service provider responsible for the service is unable to do them without endangering the rescue missions. (Rajavartiolaki 578/2005.) The same Act oblige the Army to operate likewise in the same kind of situations.

*"The Police are responsible for searching a missing person in land areas and inland waterways cordoning dangerous areas and performing other duties concerning the maintenance of order and safety at accident sites"* (Pelastuslaki 379/2010). The police need to offer help to other officials, if these are prevented to implement their duties.

Welfare and health authorities and the agencies in the relevant administrative sector are responsible for organising emergency medical care, services concerning psychosocial support as well as the services and accommodation of those in distress as results of accidents (Pelastuslaki 379/2011).

Emergency medical services cooperate with other officials through public authority network identified as VIRVE. It is used by all officials as a key communication network in Finland. It is based on Terrestrial Trunked Radio, TETRA, and it operates as a professional mobile radio and a two-way transceiver. TETRA was specifically designed for the use of government agencies, emergency services like police officials, fire departments and ambulance services. The officials have different channels of the network to use, but it is easy to switch between them. This enables fluent cooperation between different authorities. (Laki viranomaisverkon käytöstä 13.1.2015/10.)

## 2.2 UK Emergency medical service

The emergency dispatch system with 999-number was taken to use in 1937. This was due to quicken the response of emergency personnel after a fire in London. This was the start of the UK emergency dispatch. (Garry Holland 2010.) There were more than 8.5 million calls to 999 between the years 2013 and 2014. Out of these calls, 6.3 million were redirected as missions to correct emergency authorities. The missions were classed as response category A in 45 % of the calls (Red 1 and Red 2). (Ambulance Services, England 2013-14.)

The medical emergency dispatch response categories are following;

**A** [Red 1 (Purple), Red 2], **B** [Green 1, Green 2] and **C** [Green 3, Green 4]. (Turner 2008) These are also explained in figure 3.

| | | | | | |
|---|---|---|---|---|---|
| **Red 1** (Respiratory / cardiac arrest) | **Red 2** | **Green 1** | **Green 2** | **Green 3** | **Green 4** |
| Response in 8 minutes | Response in 8 minutes | Response in 20 minutes | Response in 30 minutes | Telephone assessment within 20 minutes | Telephone assessment within 60 minutes |
| Two resources should be despatched to these incidents where possible. Patient suffered cardiac arrest or stopped breathing. | All other life-threatening emergencies. | Blue lights and sirens | Blue lights and sirens | Response within one hour (no blue lights required) | Telephone assessment within 60 minutes |

Figure 3. UK response categories explained. (North East Ambulance Service, NHS Trust, 2011.)

In the year 2014, 111-non-emergency number was officially launched (Pope, Turnbull, Jones, Prichard, Rowsell and Halford 2017). Patients can call this number in non-emergency medical situations and if they need advice regarding their health and health care. National Health Service (NHS) 111 is available for 24 hours a day. Trained and qualified dispatchers answer all the calls. An NHS 111 - dispatcher works together with health care professionals to assess and give correct advice to the patient. When the patient calls 111, the dispatcher will go through a question-based pathway to determine what kind of help the patient requires. If the patient falls off the pathway, the dispatcher will consult the medical health care personnel. This is usually either a nurse or a paramedic working the NHS 111-centre. The health care professional will call back to the patient. They will make a more thorough assessment of the problem with the patient. (NHS 111 – service, NHS Urgent and emergency care services in England 2015.)

In urgent cases, the NHS 111- dispatcher can connect the health care professional straight to the call or redirect the call to ambulance services. This will exclude the 999- dispatch centre. 111- call centre will receive most of the 999- call centre C-category calls. These C- category calls make the 25 % of incoming 999- emergency dispatch calls. NHS 111 also tries to relieve the pressure from A&E by advising the patient with their health care problems and redirecting them to right facilities. (Cambridge and Petersborough Clinical Comissions Group, NHS.) This pathway is described in figure 4.

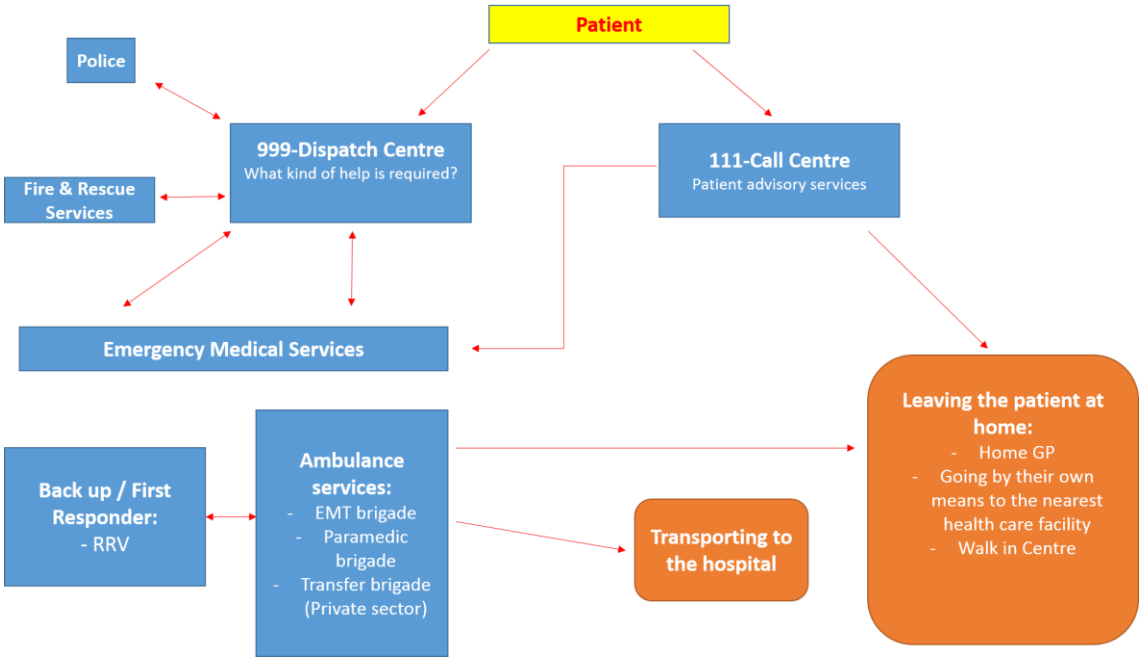


Figure 4. Patient pathway in UK emergency medical care.

In United Kingdom, there are ten regional based ambulance trusts that provide emergency medical care. In United Kingdom, there are private practice ambulance services and ambulance services under NHS trusts. (NHS, Ambulance Services 2017.) This study was done under specific NHS trust in North West Ambulance- district in central ambulance station of Manchester.

There are many different levels of emergency health care personnel. These levels are emergency medical technician EMT 1, EMT 2, paramedic, senior paramedic, advanced paramedic and consultant paramedic. (Figure 5.)

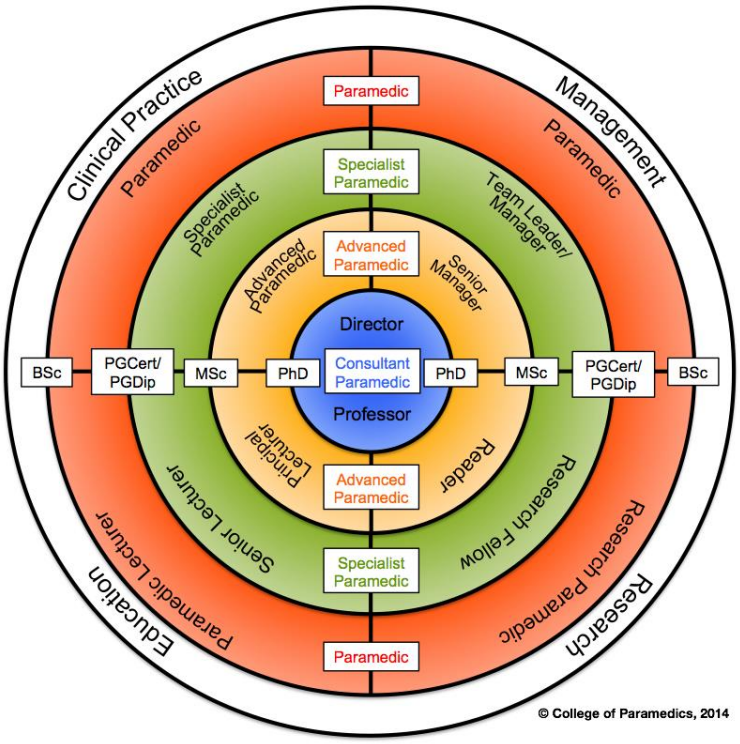


Figure 5. Different levels of education in UK. (Paramedic Career Framework 2017, College of Paramedics.)

An **EMT 1** (Emergency Medical Technician) are lower level qualified emergency medical personnel. EMT 1 – course and training is 13 months. Out of these 13 months, EMT-students will spend 18 weeks in the classroom. An EMT can treat common trauma and clinical patients non-invasively. EMT role is to assist in the prehospital clinical care and transportation together with their partner. They also will be able to provide basic life support (BLS), basic respiration and airway management and minimal drug therapies. (FAST-Services, EMT Course 2017; NWAS-careers, EMT 1 2017.) The Emergency Medical Technician is equivalent to Finnish basic level paramedic.

A **Paramedic** is a university educated and a diploma level emergency medical care professional (figure 6). The paramedic level worker is an autonomous practitioner who can treat and assess patients using invasive skills. The paramedic has the right to work as a clinical lead, until higher educated medical personnel arrives on scene. Usual staff in a brigade is one paramedic and one EMT1 / EMT2. Some paramedics, with more field experience, also work in Rapid Response Vehicles (RRV) which can be a motorcycle, car or a bicycle. (NHS, Ambulance Services 2017; NWAS-careers, Paramedic 2017; College of Paramedics, Career Framework 2016.)

Between the years 2016 and 2017, there was a new reform of the educational plan. This reform stated that in order to become a paramedic, the applicant must get a BSc (Hons) – degree that consists of three years of university education.

A **Specialist paramedic (SP)** has at least a BSc degree or studying towards this degree – level paramedic (figure 6). An SP work most of the time as a solo responder on a RRV. A SP can use advanced clinical skills and have access to additional drugs. These vehicles come first on scene or as a backup for ambulance brigades. They are often sent to a more complex calls of a category A and B – missions (Red 1, Red 2 and Green 1). Senior paramedics evaluate the urgency of the patient and give necessary emergency medical treatment. An SP will also take a clinical lead on missions with ambulance brigades and will assist in advanced medical cases. (NWAS-careers, Senior Paramedic 2017; College of Paramedics, Career Framework 2016.)

An **Advanced paramedic (AP)** has at least a MSc degree or studying towards to it (figure 6). An APs are experienced autonomous paramedics who have deepened their study and skill set therefore be able to fulfil more advanced clinical and managerial duties. They are responsible for the administrative tasks, provide a level of leadership and are responsible for mentoring as a clinical supervisor. They also provide specialist consults and referral to paramedics on calls via mobile phone. They can also respond to the call with his own vehicle and take clinical lead in multi-casualty / multi-authority calls or in difficult medical cases. (College of Paramedics, Career Framework 2016.)

A **Consultant paramedic (CP)** is a paramedic who has completed his doctorate (PhD) in paramedic science (figure 6). CPs are responsible for regional development, research and administrative tasks. They work as an executive level, developing new care pathways, while working together with central health policy makers. They also play role in teaching and education of paramedics and their skills. If wanted, they also can attend extremely difficult medical cases with their own vehicle or partake in a clinical operational shifts. CPs can provide on call advice, clinical leadership and guidance to ambulance brigades on the field via mobile phone or arriving on scene. (College of Paramedics, Career Framework 2016.)

| Paramedic Title | Academic Level | Assessment Standard | Period of Study to Achieve Competency | Experience/ Competency required to be eligible to apply for the next level of the Post-Registration Career Framework |
|---|---|---|---|---|
| Paramedic | • BSc (Hons)<br>• HE– Level 6<br>• SCQF – 10 | • HCPC Standards of Education & Training.<br>• HCPC Standards of Proficiency.<br>• QAA Benchmark Statement – Paramedic Science.<br>• College of Paramedics Paramedic Curriculum Guidance. | 3 Years | Post registration/ graduation Paramedics should obtain sufficient evidence to demonstrate a portfolio of post registration expertise and competence. |
| Specialist Paramedic | • HE – PGCert<br>• HE – PGDip<br>• SCQF – 11 | • CPD Portfolio of Evidence.<br>• College of Paramedics Paramedic Post-Registration Career Framework. | 1 Year – PGCert<br>2 Years – PGDip | Specialist Paramedics should obtain sufficient evidence through education and expertise to demonstrate a portfolio of post registration expertise and competence. |
| Advanced Paramedic | • MSc<br>• HE – Level 7<br>• SCQF – 11 | • Advanced Practice<br>• Examinations/OSCEs.<br>• CPD Portfolio of Evidence.<br>• College of Paramedics Paramedic Post-Registration Career Framework. | 3 to 5 Years | Advanced Paramedics should obtain sufficient evidence through education and expertise to demonstrate a portfolio of post registration expertise and competence. |
| Consultant Paramedic | • PhD<br>• Clinical/ Professional – Doctorate<br>• HE – Level 8<br>• SCQF – 12 | • College of Paramedics<br>• Paramedic Post-Registration Career Framework.<br>• Department of Health. | 6 Years | |

Figure 6. Different levels of paramedic education. (Paramedic Career Framework 2017, College of Paramedics.)

# 3 Work safety and the protective measures

Work safety, in sense, is organising working conditions and the environment as safe as one can. Preventing hazardous situations has a great deal in the staff´s wellbeing. The employer is obligated to take care of the staff, and is assumed to be a professional in their field and to know all the adverse factors in it. The safety and coping of the staff is crucial considering work safety. The key to influence work safety and its culture, is by educating the personnel. This should prevent injuries. The physical and mental capacity of the staff is also crucial to work safety. There is set a law about work safety. Its purpose is to improve the working conditions and surroundings to ensure the personnel´s working conditions, to prevent incidents, occupational disease and physical and mental illnesses. (Työturvallisuuslaki 23.8.2002/738.)

The law of work safety has a lot of individual acts about the threats and danger considering working life. The work safety is a co-operation between the employer and the employee. The employee is obliged to precautionary, instructions, not to cause any harm to other workers and to inform if one notices any shortage in work safety or its device. In short, the work safety has a long-lasting outcome. (Työturvallisuuslaki 23.8.2002/738.)

**Work safety culture**

In general work safety culture is always determined by the workplace, and within the values that are seen important to guarantee a safe setting to work. The culture of work safety is guided by law and professionally. (Työturvallisuuslaki 23.8.2002/738; Sosiaali- ja Terveysministeriö, 2016.) Work safety culture is formed by actions in work community and organization. Two of the key statements are to deal and acknowledge the work safety factors. (Reiman and Oedewald 2004.)

The work safety culture is not only limited to laws and acts, but it is very vast altogether. It is motivating if everyone, despite their job description, do their part to keep increasing work safety. This way the culture of safety is much stronger. It takes perseverance to build, maintain and change the work safety culture. Developing a safety culture, its main points are the atmosphere in a working place,

the meaning of co-operation, management, dedicated employees and safety education. (Tikander 2013, 21-29.)

Safety culture is a flexible and dynamic state, which makes it even more difficult to comprehend without any meters to measure it. It is something that one can influence on the outside or inside. (Reiman et al. 2008; Pietikäinen, Reiman and Oedewald 2008.) Safety, team work, attitude of the management, job satisfaction, or environment and stress identification are some of the parameters taken into the safety culture of paramedicine (Patterson, Huang, Fairbanks and Wang 2010, 3).

# 4 Work safety factors in paramedicine

“Almost all emergencies start the same way. A call, a map and a response time that can mean life or death.”, narrates Gilmour in his video documentary called Paramedico (2013). Usually mission starts with an emergency call (999- call in Great Britain, 112- call in Finland). This results in an emergency mission, meeting the patient, treating him/her and possibly transporting the patient to hospital if needed. (Ilkka et al. 2016.) This thesis does not only observe this chain of events but also other factors that may affect the safety of paramedics.

In this thesis, different safety factors are managed through an emergency care process. We will use the help of Masters Degree´s thesis written by Jauhanen, Pätilä and Van Riel (2016) where the emergency care process is split to factors dependent on the employee, employer, patient and environment.

Safety factors are divided into themes and were used to construct an observation form. To set an example of these:

- Communication between co-workers
- The behavior of relatives and bystanders
- Road safety
- Resources offered by the employer

### On route

An actual paramedic mission starts when an emergency care unit is alarmed for duty. The emergency care unit receives prerequisite about the mission from the Emergency Response Centre (later ERC). The prerequisite consists of disease, symptom and disability categories, the urgency, knowledge of the location and possible phone number of the caller. It also informs if the property is a place to be extra cautious about. This way the emergency medical team can ask the police to help them on the mission. If the mission is a violent one, the ERC will automatically send police there. The police will be the one to take control of this sort of mission and medical team cooperates with them. (Castrén et al. 2012.)

It is not always possible to confirm the subject to be safe in advance. The person might be someone who has not been treated before and this way there is no knowledge if the patient is aggressive or violent. The prerequisite can be very limited or lack entirely. (Aalto, Castrén and Rantala 2008.)

Paramedics could be exposed to many kind of infections and transmitting diseases. For example, if the information about a transmitting disease does not reach the ERC, the lack of information means that the paramedic team does not use the required equipment for protection. (Murtonen and Toivonen 2006.)

### At scene

Proactive activity starts with the placement of the car. While working the paramedic should always make sure that they are safe. When going to a patient´s home the door should always be left open and an escape route noted. (Castrén et al. 2012.)

Threat and risk situations may be formed from poor anticipation. The patient or an outsider may cause a threat, animals and inadequate ergonomics can also produce harm. To improve safety, co-workers should tell if they see something that might become a threat situation. It is not only the patient´s health at risk but also the health of the care personnel. That is why communication between partners is crucially important (Euroopan kommissio 2013.)

Patterson et al. state (2013) that *"Many fail to develop positive teamwork behaviours such as trust, back- up behaviour, and closed-loop communication because of an inability to maintain the dyad due to absences, sick leave and turnover. The average EMS worker accumulates more than 19 different partners annually, with some having more than 50 different partners in one year."* (Patterson et al. 2013.)

The purpose of communication is to share information. Non-verbal communication is also essential. Communication is a great part of Crew Resource Management = CRM. It maintains the knowledge of the situation, validity of work and its rationality. This helps to decrease human factors but also improves leadership (Euroopan kommissio 2013.)

Ergonomics is a crucial part in moving the patient from the floor to a stretcher and into an ambulance. The paramedic unit can ask the fire department to assist in a difficult transfer of the patient. This might happen when the patient is very obese, the working environment is difficult or it is hard to reach or if the patient is a multitrauma patient. Specially in winter the dark, snow and ice form a risk to slips and falls. (Murtonen and Toivonen 2006.)

Violence is a rare but genuine risk in paramedic work. Boyle, Koritsas, Coles and Stanley studied violence in Australia in 2007. Employees who responded to the study, 87.5 % told that they had encountered violence in work. The most common form of violence was verbal but 38 % said that the violence they have experienced was physical. Other forms of violence were sexual harassment and assault. (Boyle et al. 2007.)

Rasimus states that more than 50 % of Accident & Emergency nurses say that mental fatigue is a risk factor at work. The workers cannot control their behaviour sufficiently when tired. The same study says that the staff provoked patients with their own behaviour. (Rasimus 2002.)

The increase of problematic situations has also something to do with the public´s alcohol and drug behaviour but also the increase of mental health patients. It is almost impossible for paramedics to avoid dangerous situations or the influence of violence. These situations are normally associated with the person who needs help from the emergency care unit. (Murtonen and Toivonen 2006.)

### Transportation with/without patient

Patient delivery means that the patient will be transferred to a follow-up care into a hospital. Transfer will cause some movement and discomfort to the patient. During this the paramedics are close to the patient and in this way they are more vulnerable if the patient behaves aggressively. Transferring the patient always requires paramedics to be on alert. Vigilance, professionalism and experience contribute to reduce any hazardous situations. (Sosiaali- ja Terveysministeriö 2016.)

Road safety plays a huge part when driving and transferring the patient because paramedics mainly travel among other traffic. When driving fast with the alarms on, paramedics are allowed to break the Act of road traffic considering speed. Other times they need to follow normal traffic rules. (Tieliikennelaki 3.4.1981/267.) A good driver knows that great speed and unnecessary risk taking do not shorten the duration of the trip (Castrén et al. 2012).

Usage of safety belts will improve the safety of paramedics while driving. It is not always possible to use seat belt while treating the patient in the back of an ambulance. This is still paramedic´s own choice not to use safety gear. (Murtonen and Toivonen 2006.) People travelling without safety belts are in a great risk of dying or getting badly injured during a crash (Becker, Zaloshnja, Levick, Guohua and Miller 2003).

Seat belts have prevented over 280.000 casualties and 7.2 million injuries over the last 35 years in the United States of America. Seat belts have also saved 1.2 trillion in U.S dollars in economic costs. The same period showed that lack of seat belts caused 367.000 unnecessary deaths and major preventable medical costs. (U.S Department of Transportation 2010.)

### At hospital

During the patient handover to the hospital, patients are often moved from the stretcher to a hospital bed. Proper working ergonomics and using tools lessen physical strain. It is important to take notice in working ergonomics because paramedics are exposed to physical strain during the transfer of the patient. This will

have an effect on the ability to work in long haul. (Sosiaali- ja Terveysministeriö 2016.)

Reichard and Jackson 2010) say that different kind of injuries like strains and sprains were the major injuries among EMS, firefighters and police officials (Reichard et al. 2010). Lifting and moving the patient are prominent causes for paramedics to get hurt (Patterson, Anderson, Zionts and Paris 2013). Studies also show that paramedics have a 2.5 times higher risk to work related injuries than other professions (Maguire, Hunting, Smith and Levick 2002).

**Anticipation**

All safety factors in primary care are not directly related to the things that paramedics do in emergency care. These include, for example, security equipment inspections, both personal and work equipment such as car inspections. One important safety factor is suitable and appropriate clothing. The employer is obliged to provide the worker with work clothing and adequate protective equipment to enable him to carry out his work safely. (Työturvallisuuslaki 23.8.2002/738.)

Paramedic´s clothing includes a shirt and a jacket, trousers, safety boots and winter clothing. Other protective equipment includes a safety vest, helmet and infection protection. A carbon monoxide meter is an important tool because carbon monoxide is odourless and tasteless, and this way very hard to detect without proper equipment. Carbon monoxide will stick to haemoglobin of the blood cells and supersede oxygen molecules. Exposure of carbon monoxide is common in houses that have wood burning stoves/ovens. (Salomaa 2016.) In emergency care the employee is exposed to mental and physical stress, which is more burdened than physical stress alone. The Emergency Centre will alert emergency care units in a certain order and do not necessarily distribute tasks evenly between the units. This helps to prevent work stress and to promote endurance at work. (Työterveyslaki 2016.)

It is also important to notice that the paramedics should not let themselves get too tired or overloaded by work. Lack of sleep or stress may affect the ability to work in a disadvantageous way. (Euroopan komissio 2013.)

A study made in Iran 2012 describes that some paramedics suffer from posttraumatic stress disorder. Many paramedics respond to traumatic cases that may affect their psyche. Stress, fatigue and working under pressure will increase the hazardous risk factors and may cause a safety breach in working shift. (Iranmanesh 2012.)

# 4 Aims and the research questions

Our purpose was to find out main hazardous factors via observing what may disable or weaken prehospital workforce. These mixed methods study helped us determine concrete problematic factors in the field.

We compared our results to the one done in Finland with the Finnish study team, and determined similarities and differences between these two theses. This way we were able to choose the best of both studies.

More specifically, the research questions were:

- What kind of hazardous factors may affect safety of the paramedic staff in Manchester and in Finland?
- What are the most common hazardous factors that paramedics encounter?
- Are there any differences or similarities with the Finnish study?

One of the purposes of this study was to find out key factors that reduce the safety of the emergency staff. Due to the problems that we discovered in the field, we may suggest solutions that will eliminate some of these risks. The study did not observe patient safety.

# 5 Methodology

Research data is gathered and analysed by using both qualitative and quantitative methods. The data was collected in Manchester Central station in North West Ambulance Services (NWAS). The comparative data was collected by another research group in Finland. Three different regions were observed in the Finnish research. These regions were Southern Karelia (EKSOTE), Southern Savonia

(ESSOTE) and Tampere region (Pirkanmaa). People in both research groups were a part of the planning process of the study. While gathering their data and evaluating results, the research groups tried to remain punctual, objective and truthful to the process.

In quantitative observational research, the most suitable way would be systematic observation. This usually is done by using structured planning and standardization of the observational form. (Vilkka 2014b.)

Triangulation methods were applied to our research. This means that multiple researchers were a part of the data collection process (Saaranen-Kauppinen 2006). In this research it meant that five researchers were part of the observing team. One researcher collected the observational data (103) in Manchester and other four were collecting data all around Finland. With triangulation method we obtained much higher amount of data. The amount would have been impossible to obtain with only one observer in the given time.

The process of the research is explained in figure 6. First, was the collection of theoretical background and the designing of the observational form (appendix 1). The second step was the collection of the data. Data was analysed using IBM SPSS 23 – program. The results were discussed and published.

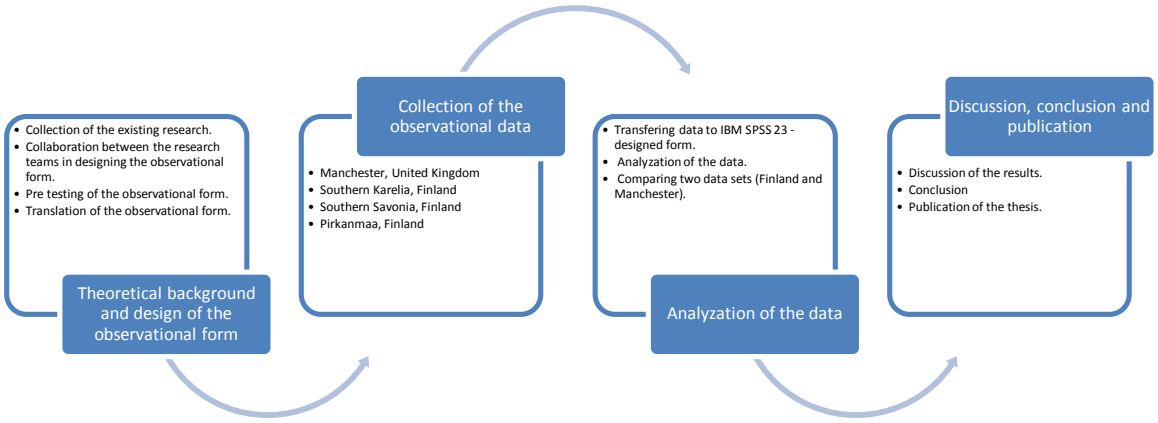


Figure 7. The research process.

## 5.1 Design of the observation form

Planning of the observation form and the timetable was done with care and with the help of research on the topic of staff safety. Paramedics from the NWAS and EKSOTE were interviewed regarding their views on safety factors. The audio of the interview was recorded with the permission of the interviewees. The observation form had to be designed by the research teams due to the nature of the research. Teams did not encounter any existing research that had been done using similar methods. Teams received outside help, regarding the design of the form from two master degree students. These students had a longer field experience of prehospital care and acute care. This way they could evaluate the logic of the observational questions.

Vilkka (2014a) quotes Grönfors (2001) in her publication that with observation of human behaviour and actions there should be beforehand planning of different situations. These situations should be written down in notes and explained how

these situations are handled. When designing the observation form two research teams had five different meetings with supervisors and co-partners, regarding the planning of the form. The observational form was also sent via email for evaluation and any comments to the Southern Karelian manager of the emergency care. There were also many meetings between two research teams. Based on these meetings the observational form was developed to observe vast areas of staff safety. Meetings also helped to eliminate any room for differences in the interpretation of the form.

The observational form was also pretested in Southern Karelia Social and Health region ambulances. The testing was done in four separate ambulances during two days. After pretesting the observational form was modified twice, making the layout and the statements of the form easier to understand.

The observational form was designed using Microsoft Excel. During observational shifts, forms were printed out on A4- paper. The paper version of the form was filled on each observed call. Observers used a pencil to fill out these forms. The observation form consists of 55 statements that are answered with *yes/no* or marked *X*. Each statement has a box for "*more/other information*" for the observer to write if needed. Statements were also divided into six main categories, sub categories and two appendices. These categories helped observers to follow the form while observing the call. They also made the analysis of the data received from observation shifts easier. Appendix 1 was filled once a shift per one brigade. Appendix 1 was observing the state of the equipment and what happened at the station. Appendix 2 was filled if the call consisted of multiple authorities. Table 4 shows how the statements are categorised.

| Category | Amount of statements |
|---|---|
| **On route** | 12 |
| **At the destination** | 19 |
| **Transport with the patient** | 7 |
| **Drop off** | 6 |
| **Journey back without the patient** | 3 |
| **Anticipation (Appendix 1)** | 5 |
| **Multi-authority mission (Appendix 2)** | 5 |

Table 4. Observation form (main categories).

Statements vary in different themes. Themes were determined using theoretical evidence, staff / co-partners and Master-degree students' interviews and pre-test observations (table 5).

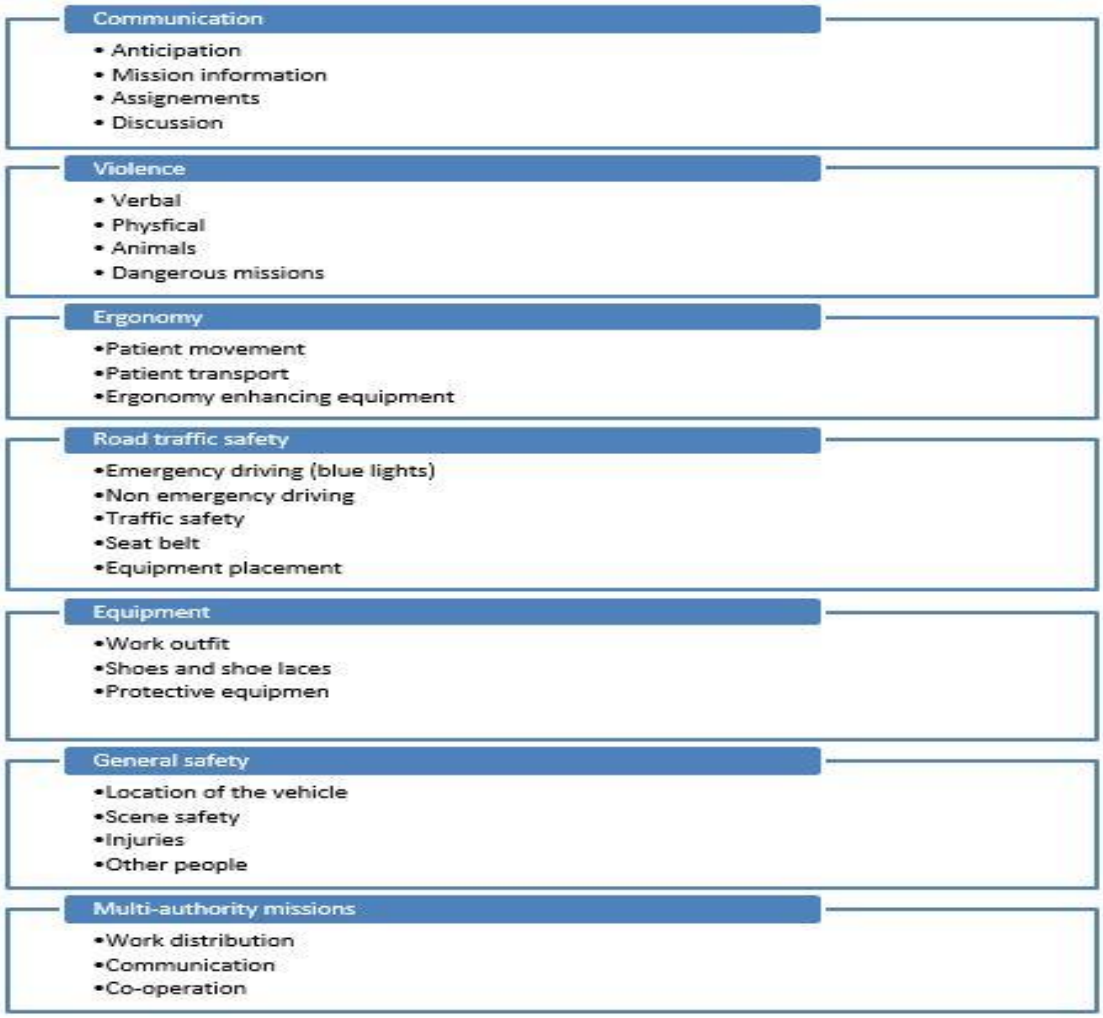


Table 5. Observation form (themes).

Some of the statements may appear twice in different sections. These are for example "Did the paramedic experience violence on the scene?" Or "Did the paramedic experience violence on route to the hospital?". These reappearing statements made it possible to observe similar aspects at different time and environment.

## 5.2 Collecting data

The collection of the data was conducted in two countries, Finland and England. In Finland the data was collected in three different health care regions. Data was only collected at one station and city in England; Manchester Central Ambulance station. Although at this station calls were also received all around the Greater

Manchester. These regions were determined by the possibility of completing long time observations by the observers, due to status of living, working and studying in these regions. Regions like Southern Karelia and Manchester were naturally chosen due to the location of partner universities; Saimaa University of Applied Sciences and Edge Hill University. Due to this opportunity, from these two regions, it was possible to collect bigger amount of data.

The research group had to apply for research permits from each health care region in Finland. During this application process, emergency medical managers from chosen regions, regional research committee and regional field managers had a chance to see the observational form and become familiar with the research proposal. In these regions the working paramedics were only able to view the *Observer's statement about the research* - letter (appendix 2). This letter was sent out or shown to the brigades where observers were collecting their data.

In Manchester, the research group sent out the research proposal to Edge Hill University and North-West Ambulance Services for evaluation and permit to conduct research in Central Manchester Ambulance Station. The chiefs of the Central Station had an opportunity to become familiar with the research proposal and the statement. These files were also send out to the workers of Central Ambulance Station, due to needed explanation of the purpose of this research.

Data was collected using observers who were 2nd year paramedic students of Saimaa University of Applied Sciences. These students were the same who created the observational form and analysed the results of this study. One observing shift lasted 12 hours. The observers did night and day shifts in Manchester and Southern Karelia (table 6). Due to the regional regulations the observers could only take part during the day shifts in Southern Savonia and Tampere region.

This research tried to achieve a minimum of fifty (50) observations per assigned research area. Even though the research team planned to send two observers to collect the data in Manchester, financial and permit complications made this impossible. Only one student was sent out to collect the data in Manchester. The student collected his observational data whilst completing an exchange and placement period in Edge Hill University. When the student was collecting data,

he was wearing a red uniform, signalling the paramedics that he is doing his observation shift and not the placement shift. NWAS was able to help the research team by arranging more observational shifts for the observer due to the complications with the second observer. The observer in Manchester was able to acquire 103 – observed calls in 15 shifts. One observational shift was done in Rapid Response Vehicle (RRV), rest of the shifts were on Paramedic and EMT – brigades.

The second researcher was able to help out the Finnish research team by observing 50 calls from Southern Karelia, making the total amount to 100 calls in that area. Due to the time scheduling regulations, observations in Tampere region had to be collected in one week. In Tampere region there were three observers from both research teams collecting a total of 49 calls. In Finland, there were 68 observational shifts. The total number of calls studied in this research was 302, of which 199 were in Finland (table 6). During the observations we did not observe or record any actions of individual paramedics thus making it anonymous regarding staff call signs or names.

| Region | Amount of calls | Observers | Time of the year (2016) |
|---|---|---|---|
| **Southern Karelia, FIN** | 100 | Sasu Oksman, Teija Auvinen | June - August |
| **Southern Savonia, FIN** | 50 | Annika Siiskonen | June - August |
| **Tampere region, FIN** | 49 | Dimitri Lisitsyn, Petri Oramaa, Annika Siiskonen | October (week 42) |
| **Greater Manchester, UK** | 103 | Dimitri Lisitsyn | February – April |

Table 6. Collected data by regions.

### 5.3 Data analysis and storage

This research combined qualitative and quantitative methods of data analysis. Observation is a multi-dimensional method that works as an independent method of data analysis. It also could be used integrated with other analysis methods. (Kylmä and Juvakka 2007.) Data was analysed using mathematical statistics and their correlation between different statements of the structured observation form.

In this research, all filled observation forms were inserted into the analytic software base. The base was designed using the observational form. All answers were assigned a specific number. In this study answer "yes" was assigned as number 1, and "no" as number 2. This way all the results were used to determine which categories were more probable to cause a safety hazard. All answers were also compared between two studied countries, which gave us a clear view of possible safety feature differences in these countries. All data results were displayed in this research using frequencies, percentages and illustrated charts.

The data collected was analysed using the IBM SPSS Statistics 23-software; the same program was used by the Finnish research group. All of the forms were considered strictly confidential and only two students taking part in this study analysed them form by form.

All of the comparison notes, versions and data will be stored using standard quality rules with the third party. All data will be stored according to regulations given by Saimaa University of Applied Sciences.

## 6 Results

Observations were gathered during emergency calls (blue lights) and non – emergency calls (non-blue lights). Risk categories were marked using Finnish risk evaluation criteria. English calls fitted for these categories following; **A** (Red 1 & Red 2), **B** (Green 1 & Green 2), **C** (Green 3), **D** (Green 4).

| | A | B | C | D | All |
|---|---|---|---|---|---|
| **Suomi** | 14 (7.0%) | 70 (35.2%) | 65 (32.7%) | 50 (25.1%) | 199 |
| **Manchester** | 61 (59.2%) | 41 (39.8%) | 0 (0.0%) | 1 (1.0%) | 103 |

Table 7. Amount of observed calls using the risk categories A-D.

In table 7, we can determine that most of the Manchester emergency calls were categorised as class A or B. Comparing to Finland, which had more than a half of the calls (57.3%) categorised as class C or D. In table 8, we observed how many calls were categorised using English risk categories.

| Red 1 | Red 2 | Green 1 | Green 2 | Green 3 | Green 4 |
|---|---|---|---|---|---|
| 6 | 55 | 9 | 32 | 0 | 1 |

Table 8. Amount of observed calls using English response categories.

Comparing call signs between countries was impossible due to different call sign systems. The most popular call came from NHS 111 – call sign, there were 14 calls with different explanations in Manchester. To set an example of these common calls were abdominal pain, chest pain and nausea. Other popular call signs were breathing problems (7 calls) and unconsciousness or fainting (5 calls).

In table 9, we observed the number of calls during different working hours. We divided time into three different segments;

1) 8 am until 4 pm

2) 4 pm until 12 am

3) 12 am until 8 am

Both countries were busiest during the daytime (segment 1). In Manchester there were significantly more calls during night time (segment 3) compared to Finland. This is basically because the research was done during the day and not during night time in Finland. There was a constant stream of calls in Manchester Central station, the largest number of calls responded during 12-hour observational shift was 13 for one brigade.

| | 08.00-15.59 | 16.00-23.59 | 24.00-07.59 | Altogether |
|---|---|---|---|---|
| **Suomi** | 104 (53.3%) | 83 (41.7%) | 12 (6.0%) | 199 (100%) |
| **Manchester** | 43 (41.7%) | 34 (33.0%) | 26 (25.2%) | 103 (100%) |

Table 9. Calls observed between different hours.

We also observed how many patients were left at home and/or transported to the hospital. Due to the differences in emergency medical systems, the observer team had to assign specific X-codes (reasons to leave patients at home) to English data so it could fit the Finnish data. This way it was possible to compare the data. We noticed that the number of patients that were left at home, were relatively similar between these two countries (table 10). In Finland, there were 35.7 % X-code patients (71 calls) and in Manchester 35.0 % (36 calls). In Finland, most frequent X-codes were X-5 (45.1 %) and X-8 (25.4 %). In Manchester, the most common X-codes, except stand down (X-9), were X-6 (25.0 %), X-4 (16.7 %) and X-3 (13.9 %).

| X-codes | Explanation | Finland | Manchester |
|---|---|---|---|
| **X-0** | **Technical problem** | 0 (0.0%) | 0 (0.0%) |
| **X-1** | **Patient was dead** | 1 (1.4 %) | 0 (0.0 %) |
| **X-2** | **Patient was handed over to the police** | 2 (2.8 %) | 2 (5.6 %) |
| **X-3** | **Patient was handed over to other help** | 0 (0.0 %) | 5 (13.9 %) |
| **X-4** | **Patient was transported by other means** | 11 (15.5 %) | 6 (16.7 %) |
| **X-5** | **Patient did not need medical treatment** | 32 (45.1 %) | 2 (5.6 %) |
| **X-6** | **Patient refused treatment** | 1 (1.4 %) | 9 (25.0 %) |
| **X-7** | **Patient was not found** | 2 (2.8 %) | 2 (5.6 %) |
| **X-8** | **Patient was treated at scene** | 18 (25.4 %) | 1 (2.8 %) |
| **X-9** | **Stand down** | 4 (5.6 %) | 9 (25.0 %) |
| **Altogether** | | 71 (100 %) | 36 (100 %) |

Table 10. Reasons for the patients that did not need transportation to the hospital. Number of the patients left at home.

### 6.1 On route

We observed twelve (12) different statements in the first part of the observation form. The main statements were regarding the anticipation of the call. First statement was regarding the information of the call given by the dispatch. Paramedics in both countries were quite happy with given information. In Finland only 13 (6.5 %) calls were without sufficient amount of information, this usually was regarding the location of the call, the amount of people/patients, the aggressiveness of the patient and the need of the police. In Manchester 14.6 % of the paramedics thought that the given information was not sufficient enough. Only once dispatch was contacted on route for more information. This was observed by listening to the paramedics' discussion about the call on route. (Table 11)

Given the information of the call, paramedics have a chance to call for a backup. In Finland only an eight (4 %) calls required back up which was called by the brigade. These calls mainly required back up from the fire department (four calls), the police (three calls), field manager or extra brigade (1 call). From those eight calls, back up was received five times and declined only once. Two of the observations sheets had blank in these statements. In Manchester, 14 (13.6 %) calls required back up (table 11). Out of these five were provided by the Police, three by the Paediatric ICU and one from the fire department. Five of the calls were provided by another brigade due to the lack of possibility to transport the patient by RRV (table 11). From those 14 calls, ten eventually received their asked back up.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Information given about the mission was sufficient?** | 186 (93.5%) | 88 (85.4%) |
| **Back up was requested using the given information?** | 8 (4.0%) | 14 (13.6%) |
| **Back up did arrive to the scene?** | 5 (62.5%) | 10 (71.4%) |

Table 11. First statements of the observation form.

The anticipation about the call were discussed in 91 cases (88 %) in Manchester. Comparing this to anticipation in Finland, only 43 % of the observed calls were discussed (table 12). The anticipation was observed only by listening to the discussions between co-workers regarding the given call and its plausible risks. This means that if the paramedics discussed the given call during the drive to the scene the observer marked this as anticipation of the call. The work roles were usually predetermined at the start of the shift. This is why both countries had answered 100 % yes on the observation form.

| Anticipation (discussion about the given call on route) | | | |
|---|---|---|---|
| | Yes | No | Altogether |
| **Finland** | 86 (43.2%) | 113 (56.8%) | 199 (100%) |
| **Manchester** | 91 (88.3%) | 12 (11.7%) | 103 (100%) |

Table 12. Anticipation - statement. Comparison between two countries.

Equipment was secured loosely (93 calls, 90.3 %) during transportation in Manchester. All of the two personnel brigades did not have any designated place to secure their equipment bag. The bag was loose on the floor or on the table. Only observed calls (10 calls, 9.7 %) with RRV had their equipment secured during the ride. The equipment was not secured on route to the destination in 46 calls (23.1 %) in Finland. Designated place to secure their oxygen bag were not available in 23 of the cases.

On route to the call, seatbelts were more often used in Finland than in Manchester. Paramedics wore seatbelts during the ride to the location in 83 calls (80.6 %) in Manchester. Paramedics wore seatbelts in 198 calls (99.5 %) in Finland. The results were observed and determined on yes / no basis. Even if only one of the paramedics did not have his/her seatbelt on, the answer was no (table 13).

| Paramedics wore seatbelts (On route to the location) | | | |
|---|---|---|---|
| | Yes | No | Altogether |
| **Finland** | 83 (80.6%) | 20 (19.4%) | 199 (100%) |
| **Manchester** | 198 (99.5%) | 1 (0.5%) | 103 (100%) |

Table 13. Seatbelts wore on route.

We also observed that the paramedics wore proper safety clothing like uniform and boots. In both countries, 100 % of the staff wore fitting work uniforms and safety boots. We observed the right use of safety boots. This was done by observing whether the shoe laces were tied / zippered up or not (Table 14). In Manchester every working paramedic had shoe laces tied during the call, and there were no zippered versions of the working boots. In Finland, shoe laces were left untied or the shoe was not zipped up in 71 calls (35.7 %).

| Working shoes tied / zipped up | | | |
|---|---|---|---|
| | Yes | No | Altogether |
| **Finland** | 86 (43.2%) | 113 (56.8%) | 199 (100%) |
| **Manchester** | 91 (88.3%) | 12 (11.7%) | 103 (100%) |

Table 14. Correct usage of working boots.

In the statement regarding the usage of extra protective equipment on route to the destination, was the equipment observed differently compared to the Finnish study. In England we observed what equipment was used during the ride to the location. This equipment was mainly radio (103 calls, 100 %), gloves (6 calls, 0.5 %) and reflective jacket (1 call, 0.1 %). In the Finnish study, this statement observed what protective equipment was in use in the ambulance. This statement was misunderstood by the observer in different teams. Radios worked well in both countries (Manchester: 99 %, Finland 99.5 %). Only once in both countries there were problems with the service, which caused interruptions in radio traffic.

One of the biggest differences in hazardous factors between the two countries was driving to the destination. In Manchester paramedics responded to most of the calls (102 calls, 99.0 %) on blue lights (table 15). Only one call observed was not responded on blue lights. In comparison, Finnish paramedics responded on blue lights quite rarely (84 calls,42.2 %). Dangerous or close call situations happened more than expected in Manchester. Eleven calls (10.7 %) had dangerous / close call situations while driving to the destination, all of these calls were while driving with the blue lights on. In Finland, there were six (3.0 %) calls that had dangerous / close call situations (table 15). Only one dangerous situation happened while ambulance was not with the blue lights on. In both countries, all of the situations were considered as close calls. They often resulted an evading manoeuvre done by the paramedic driving the ambulance. Most of the dangerous situations were caused by the actions of the pedestrian (Manchester: 10 calls, Finland: 4 calls). These were usually sudden stops of the pedestrian in front of

the ambulance or driver pulling over the same lane in front of the ambulance. Both countries had one call that was poor judgement of the paramedic. Both of these situations were regarding high speed crossing the street causing the pedestrian to stop for not to be hit by the ambulance from the side.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Driving with blue lights on to the destination.** | 84 (42.2%) | 102 (99.0%) |
| **There was a dangerous situation during the drive to the destination.** | 6 (3.0%) | 11 (10.7%) |

Table 15. Hazardous driving in both countries.

## 6.2 At the destination

There were 19 statements regarding the hazardous factors and factors regarding safety at the destination in the observation form. Some of the table diagrams and number of total calls differ depending on the statement. This is due to the fact that some of the calls were cancelled and the observer did not need to fill this segment of the form. Some of the forms were not filled out and had blank spots.

When arriving to the destination, we observed the correctness of the information received from the dispatch. We compared the information received from dispatch and the information observed on scene, observing the number of patients/people at the scene, the risk of aggression and the reality of the situation assessed by the dispatch. From the observed calls, 179 calls (89.9 %) had the correct information about the call responded in Finland. Compared to Manchester´s calls, 79 of these calls (76.7 %) had the correct information when arrived to the scene (table 16). Most of the misinformation were either simulations (two calls), patient

was absent from the scene (one call), the symptoms were not as severe as presented in the information (two calls).

We also observed the positioning of the car at the scene. The position of the car was taken into account in 143 cases (71.9 %) in Finland. The placement of the ambulance was taken into account in 91 calls (88.3 %) in Manchester. The main reasons for the specific placement of the car was the closeness to the patient and the quickness/easiness of the departure (table 16).

Animals were rarely moved to another room. Animals were present at the scene in 31 calls in Finland. Out of these calls only ten (32.3 %) had the animal moved to another room. There were only 12 calls that had an animal present at the scene in Manchester. Out of these 12 calls, six (50.0 %) times the animal was moved to another room. Some of the animals ran away or hid from the paramedics or were considered harmless to humans (table 16).

In the statement regarding the statement usage of protective equipment before entering the scene, we observed how the paramedics used the equipment provided. We did not observe if the scene needed any usage of the protective equipment, but if it had been beneficial to the paramedic, the observer wrote it down in the observation form. Manchester had 77 (79.4 %) calls where paramedics wore more of the provided protective gear at scene or before entering the scene. Out of these calls, 76 wore gloves and one a reflective jacket. The paramedics used some kind of protective equipment at scene in 183 (93.4 %) calls in Finland (table 16).

One of the statements contained a question regarding securing the exit strategy. This was observed for example by watching if the paramedics had left the front door unlocked/open. In Finland, in 88 cases (46.6%) paramedics secured their exit strategy. In Manchester, there were 23 cases (36.5%) of the possible calls where paramedics secured their exit strategy. The most usual way this was done was by leaving the front door unlocked (Finland: 48 cases, Manchester: 22 cases), some of the calls were in the hospital (Finland: 10 cases) or at the presence of the security personnel (Manchester: 1 case).

Entering the scene paramedics often use "plus one – rule." This means that there could be anyone hiding at the scene. We observed if the paramedics asked or looked around the scene for possible intruders or other existing civilians. In Manchester, in 75 calls (79.8 %), paramedics investigated the scene. In Finland, paramedics investigated the scene in 131 calls (69.3 %). We also observed if the paramedic removed or asked the patient to move away from any possible harming equipment or equipment that could be considered as a weapon. These could be sharp items like kitchen knives or blunt items like hammers. In the observations we did not observe every item as a possible weapon, although almost any item can be determined as one. Most common reason why this statement had “no”-answer was due to the lack of weapon like items at scene or visible to the paramedics. If there were items considered as weapons, most of them were noted by moving them away, handed over to the police or by the placement of the medical bags. These results can be observed in the table 16.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **First given information are corresponding** | 179 (89.9%) | 79 (76.7%) |
| **Placing the car was noted** | 143 (71.9%) | 91 (88.3%) |
| **Exit was secured** | 88 (46.6%) | 23 (36.5%) |
| **Animals were removed to a different room/space** | 10 (32.3%) | 6 (50.0%) |
| **Before entering, staff used extra equipment for protection** | 77 (79.4%) | 183 (93.4%) |
| **Other civilians were noted at the scene** | 131 (69.3%) | 75 (79.8%) |
| **Weapons/objects considered as a weapon were noted** | 45 (22.6%) | 9 (13.8%) |

Table 16. Results regarding the observations at scene.

Patients had to be moved 219 times during the observation of these two studies. In Manchester, patients were moved 81 times. From those moves, 77 times (95.1 %) were done ergonomically correct. Most of the times patient helped by moving themselves (55 times). All in all, four times a patient was not moved in an ergonomically correct way. This was often due to either the difficult location of the move or the agitated patient that was difficult to move. Patients were moved 138 times in Finland. Out of these moves, 115 times (83.3 %) were done ergonomically correct. Patient was not moved in the ergonomically correct way in 23 times. Most commonly paramedics lifted the patient incorrectly due to a difficult patient/location. (Table 17)

In Manchester, ergonomical assistive equipment was more often used than in Finland. Equipment was used 33 times (82.5 %) while moving the patient at scene. Most common helping equipment in Manchester was a hydraulic lift (27 times), wheelchair (16 times) and a stretcher (10 times). In Finland, ergonomical helping equipment was used 91 times (65.9 %) while moving the patient at scene. Most commonly used equipment in Finland, was a stretcher (54 times) and a lifting chair (33 times). Asking for help to move the patients was seldom requested in neither country. Help was only asked eight times (20.5 %) in Manchester. Reasons for the asked help were commonly heavy patients or mental health patients. Help was received six times by an outsider passing the scene. Help was asked six times (5.5 %) in Finland. The most common reasons were the difficult placement of the patient and the help to carry the medical equipment. Help was received four times by a pedestrian. (Table 17)

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Moving the patient was done ergonomically correct** | 115 (83.3%) | 77 (95.1%) |
| **Utilities that enhance ergonomics were used during moving the patient** | 91 (65.9%) | 33 (82.5%) |
| **Help was asked to move the patient** | 6 (5.5%) | 8 (20.5%) |

Table 17. Ergonomics at scene.

We also observed the amount of violence experienced by the paramedics at scene. We divided violence into two categories, verbal and physical. Verbal violence meets its criteria when the patient or relative starts cursing towards paramedics or have a threatening / agitated tone. Physical violence meets its criteria when paramedics experience any kind of physical violence, this can be pushing, punching or kicking. In Manchester, there were zero calls where paramedics experienced any physical violence. In Finland, there was one call were paramedics experienced violence. This was caused by a patient. Verbal violence was experienced more frequently than physical in both countries. There were four calls in Manchester, where paramedics experienced verbal abuse. Three of these calls were caused by the patient and one by the relative. There were also four calls in Finland, where paramedics did experience verbal abuse. Two were caused by the patient, one by the relative and one by a civilian. These results can be observed more closely in table 18.

| Paramedics experienced violence (At scene) | | | |
|---|---|---|---|
| | Physical (Yes) | Verbal (Yes) | Altogether |
| **Finland** | 1 (0.5%) | 4 (2.0%) | 199 (100%) |
| **Manchester** | 0 (0.0%) | 4 (3.9%) | 103 (100%) |

Table 18. Violence experienced by paramedics at scene.

During the observation period in both countries, paramedics did not have to press any emergency buttons during their call. Neither of the countries had any accidents that led to the paramedic being physically injured. There were still close call situations in both countries. Four calls had a close call situation at scene in Manchester. Three of these were handling a sharp object like a needle, and once a picture frame fell and hit the paramedic´s head. There was one accident while moving the patient in Finland. In this scenario, a paramedic hit his head inside a car during the transfer of the patient. These results can be observed more closely in table 19.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Staff member had an accident or a close call – situation while handling the equipment.** | 0 (0.0%) | 4 (4.3%) |
| **Staff member had an accident or a close call – situation during the moving of the patient.** | 1 (0.5%) | 0 (0.0%) |

Table 19. Accidents and close call - situations at scene.

### 6.3 Transportation with / without patient

Patients were transported to the hospital all together 194 times. Relatively both countries had to transport most patients to the hospital. In Manchester, the patient was transported to the hospital 67 times (65.0 %) and in Finland, the patient was transferred to the hospital 127 times (63.8 %).

We took notice on if the patient´s relative travelled with the patient during the transport. This was a big difference between the two studied countries. During the 36 transfers there was one relative present in Manchester. Only in two of these, the relative travelled with their own car. In the rest of the cases the relative travelled in the back of the ambulance. A relative travelled with the patient in an ambulance in eight of these transfers in Finland. Out of these calls, five times the patient travelled with the driver and three times with their own vehicle. This can be observed in table 20. During the drive we observed how the equipment was secured. The equipment in the back of the ambulance was not secured on any observed call during the transportation of the patient in Manchester. This was due to the OBS bag that did not have any designated storing place. The bag was just rolling around on the floor. The equipment was secured in 90 calls (table 20) in Finland.

In Manchester, drivers more often asked for a permit to start moving the car than in Finland. Permit was asked 64 times (95.5 %). The driver asked for permit to move the car 80 times (63.0%) during the observation done in Finland. We also observed how paramedics used seat belts when transporting the patient. Only 15 times (22.4 %) both paramedics used seatbelts in Manchester. The majority of the paramedics sitting in the back did not wear any seatbelts when transporting the patient (46 times). Comparing this to Finland, both paramedics wore seatbelts in 96 observations (75.6 %). Only nine of the paramedics in all did not wear seat-belt in the back of the ambulance. This can be observed in table 20.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Family member was travelling with the patient.** | 8 (6.2 %) | 36 (53.7 %) |
| **Equipment was secured during the drive.** | 90 (70.9 %) | 0 (100 %) |
| **Staff wore a seat belt during drive.** | 96 (75.6 %) | 15 (22.4 %) |
| **Driver asked a permission to move.** | 80 (63.0 %) | 64 (95.5 %) |

Table 20. Driving with patient to the hospital.

During the transportation of the patient to the hospital in both countries, there were no cases where paramedics experienced any physical violence. There was only one case where paramedics experienced verbal violence during the transport (table 21) in both countries. The violence was inflicted by the patient. There were a few close calls or small accidents while transportation (table 21). In four (6.0 %) of these cases the paramedic had a close in Manchester. In three of these cases the paramedic had a misstep or shake so that it caused the paramedic to almost fall and one case where the paramedic hit their head. There was only one call (0.8 %) where the paramedic, sitting in the back of an ambulance, had a close call situation in Finland. This was caused by a shake that caused the paramedic to almost fall down. There was no dangerous situation caused by traffic or driving in either country while the ambulance was transporting the patient (table 21).

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Paramedic experienced physical violence during the transportation.** | 0 (0.0 %) | 0 (0.0 %) |
| **Paramedic experienced verbal violence during the transportation.** | 1 (0.8 %) | 1 (1.5 %) |
| **Staff member had an accident or a close call – situation during the transportation.** | 1 (0.8 %) | 4 (6.0 %) |
| **There was a dangerous situation during the drive to the hospital.** | 0 (0.0 %) | 0 (0.0 %) |

Table 21. Dangerous situations during the transportation of the patient.

We also observed the safety driving without the patient. This was when paramedics had a call cancelled, left the patient at home or when they were driving back from the hospital to the station. There were more documented (186) cases in Finland than in Manchester (29). This was due to the fact that in Manchester paramedics received more calls in a more intensive rate. They did not have to drive back to the station as frequently as in Finland.

In Manchester, securing the equipment was a problematic to observe. In this scenario too, the OBS bag was on the floor without any designated place. This caused observer to mark every observed call as “no” in this statement. In Finland, there were 46 cases (24.7 %) where equipment was not secured during the drive without the patient (table 22). Mostly this was caused by not securing the defibrillator or the oxygen bag properly. Some of the calls had similar problem as in

Manchester. This was due to the differences in ambulance brigades depending on the region observed. We continued observing the usage of seatbelts during the return drive. In Manchester, seatbelts were worn 18 times (62.0 %) during the return ride to the station. In Finland there were only 3 cases where seat belts were not worn, overall in 183 cases (98.4 %) seatbelts were worn (table 22). There were also a few dangerous situations during the drive without the patient. In both countries there were two cases that were written as dangerous situations. In Manchester, both of these cases were caused by traffic or the paramedic driving. In Finland, one case was caused by the traffic, where a civilian car almost crashed into the ambulance. The second case was caused by a broken ampule that was left on the seat. The paramedic almost sat on it. These can be observed in table 22.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Equipment secured during the drive.** | 46 (24.7 %) | 0 (0.0 %) |
| **Staff wore seat belts.** | 183 (98.4 %) | 18 (62.0 %) |
| **There was a dangerous situation during the drive back to the station.** | 2 (1.1 %) | 2 (6.9 %) |

Table 22. Drive without the patient.

### 6.4 Drop off

One of the biggest questions during the handover of the patient to the hospital was ergonomics. In all of the 67 calls, (100%) the patient was moved to the hospital bed or a chair ergonomically correct in Manchester. Out of these calls, the patient helped the paramedics 26 times by moving themselves to the bed. One-time help was received from hospital staff. Patient was moved ergonomically correct (table 23) in 119 calls (93.7 %) in Finland. Out of these calls, the patient

moved themselves 17 times and twice there were helping hands from the hospital staff. There were eight calls (6.3 %), where the patient was moved ergonomically incorrect. These were caused by moving the patient with a rounded back (four times), moving the patient alone (one time) and moving the patient from a poor position (one time) to a better one.

Due to the misunderstanding between observation groups, the question regarding the usage of ergonomical assistive equipment during the patient´s drop off, the statement was observed differently. In Finland, this statement was observed as what kind of ergonomical equipment could be found in the ambulance. In Manchester this was observed as in what kind of equipment was used in the handover of the patient. Due to this misunderstanding, we will only observe the data collected from Manchester. In Manchester there were 47 calls (70.1 %) where ergonomical helping equipment was used in the movement of the patient during the handover (table 23). Most frequently the equipment used was hydraulic lift (34 times), stretcher (31 times), wheelchair (11), lifting cloth (16 times) and sliding board (4 times).

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Moving the patient was done ergonomically correct during the handover of the patient.** | 119 (93.7 %) | 67 (100.0 %) |
| **Utilities that enhance ergonomics were used moving the patient.** | N/A | 47 (70.1 %) |

Table 23. Ergonomics during the handover of the patient.

During the handover, we also observed the violence experienced by paramedics and staff personnel. In Manchester, there were significantly more cases of violence, both verbal and physical, during the handover than in Finland. There were three cases (4.5 %) where paramedics had to experience violence during the handover in Manchester (table 24). One was a physical incident inflicted by the other patient aka civilian, who was suffering from mental health issues. This was while the observed paramedics were handing over their own patient, a civilian punched the observed paramedic in the chest. This resulted in a situation where paramedics had to restrain the violent civilian onto the ground and wait until the security arrived. Three other cases contained verbal violence towards paramedics and hospital staff. Verbal violence was caused once by the patient and twice by the relative.

| Paramedics experienced violence (At handover) | | | |
|---|---|---|---|
| | Physical (Yes) | Verbal (Yes) | Altogether |
| **Finland** | 0 (0.0%) | 0 (0.0%) | 127 (100%) |
| **Manchester** | 1 (1.5%) | 3 (4.5%) | 67 (100%) |

Table 24. Violence experienced by the paramedics during handover.

We also observed if there were any close call – situations or if there were accidents during the handover of the patient. In Manchester, there were three cases where there was a close call – situation, most of these were caused by the same violent patients and one was almost a slip while moving the patient. In Finland, there were one close call – situation. This was during the movement of the patient, when a paramedic almost fell when moving the patient out of the ambulance.

## 6.5 Anticipation

This is regarding the first appendix in the observation form. In this part we observed how the cars and equipment was working, how the paramedics prepared for the shift and what kind of safety equipment there was in use. In Manchester, there was also a new hired “make ready” -company that restacked, cleaned and fixed the ambulances before the start of the shift. The paramedics do this procedure by themselves in Finland.

Paramedics checked the ambulance at the start of 13 shifts (86.7 %) in Manchester and in Finland in 51 shifts (75.0 %). We also observed if there was any equipment malfunction and if so, was it reported. There were three equipment malfunctions in Manchester. Out of these one was reported to the management. One was replaced and one was left unreported. In Finland, eight equipment malfunctions were discovered. From these, two were left unreported, one was replaced and one did not need any fixing. This can be seen in table 25.

| Car and equipment check was performed during the start of the shift | | |
|---|---|---|
| | Answers (Yes) | Altogether |
| **Finland** | 51 (75.0%) | 68 (100%) |
| **Manchester** | 13 (86.7%) | 15 (100%) |

Table 25. Car and equipment checks at the start of a shift.

CO-monitors (64 observations) were attached to OBS bags as a precaution in Finland. The monitor will beep if the scene has any carbon monoxide. In England they did not have any CO-monitors in ambulances (0 observations). We also observed if the calls were redirected during the shift. The dispatch redirected the ambulance six times in Manchester. Twice it was during the shift and four times it was more than once during the same shift. In Finland, field manager redirected the ambulance during three shifts. Every time it was not more than once a shift.

## 6.6 Multi-agency co-operation

We observed how the multi-agency or multi-authority co-operation was handled by the paramedic team and other colleagues like the fire department, police and social workers. Overall in Finland, there were 11 calls that had multi-authority personnel working on the call. In Manchester, there were only six multi-authority calls. In neither country during multi-authority call was there a check list used. In Manchester, the work distribution was clear on all six calls. In Finland, work distribution was clear on all but one (table 26).

Changing the radio frequency to communicate with the possible other authority personnel was impossible in Manchester. In Finland there were five calls, where paramedics changed their radio frequency as ordered. There were only five due to the fact that all multi-authority calls do not require changing the radio frequency. Paramedics received clear instructions from the authority at the scene. In Manchester, on all six calls, paramedics received good instructions from the leading authority. From these six calls, instructions were received four times from the police, one time from the fire department and one time from the HART-team. In Finland, on nine calls, paramedics received clear instructions from the authority in charge (table 26). From these nine calls, instructions were received three times from the police, five times from the fire department and once the paramedics were the leading authority. Once the paramedics did not receive clear instructions and once the observation form was blank on this statement. Patients in Finland did not require multi-authority presence during the transportation of the patient or transportation with other vehicle than an ambulance. In Manchester twice the police had to transport the patient to the nearest hospital instead of the ambulance (table 26). This was due to aggressiveness or suicidal intentions of the patient.

| Statement | Finland (Yes - answers) | Manchester (Yes – answers) |
|---|---|---|
| **Work distribution was clear.** | 10 (90.9 %) | 6 (100.0 %) |
| **Paramedics got clear instructions from the other authority.** | 9 (90.0 %) | 6 (100.0 %) |
| **Other authority was a part of transporting the patient.** | 0 (0.0 %) | 2 (33.3 %) |

Table 26. Multi-authority operation.

# 7 Conclusion

Overall, this study has just scratched the surface regarding the staff safety in emergency medical care. Emergency care and work environment are generally the same in all parts of the world. According to Manchester´s data, it can be seen that incidents were more common in traffic than patient-related situations. Manchester has 2.7 million residents. The people and larger ambulances bring transport challenges to both paramedics and other road users. However, the biggest differences are in small things such as the usage of seat belts, ergonomics or patient-related situations. Paramedics usually discuss with each other during the drive on call. Often they try to anticipate what kind of situations they are going to encounter. This anticipation was seen in the study. The paramedics talked more often with each other about the sent call and even mentioning the plausible risks in Manchester. The paramedics in Manchester discussed about the given call 45.1 % more often than their colleagues in Finland.

However, violence mentioned in the media and major car pileups are relatively rare. This is also reflected in this study. We noticed that the threat of violence is still real, Manchester had a higher percentage in verbal (3.9 % at scene) and

physical (4.5 % during the drop off) violence is compared to Finland. During the observation period in Manchester, the North West Ambulance Service received 102 official notifications of physical violence against the paramedics and 106 reports of verbal violence (figure 7). However, only a few of these situations got documented in the observations. Many paramedics do not even make a formal notification of what happens in the field.

February / March / April 2016

| | February | March | April | Total |
|---|---|---|---|---|
| Physical Assault | 27 | 38 | 37 | 102 |
| Threating behaviour | 27 | 25 | 30 | 82 |
| Verbal Abuse | 43 | 30 | 33 | 106 |
| Total | 97 | 93 | 100 | |

Figure 8. Formal documented notifications of violence inflicted on paramedics in NWAS from February to April 2016.

Comparison of factors affecting the safety of personnel among the various countries broadens the outlook on issues related to emergency care. This gives new perspectives for developing emergency medical care in Finland. A good example would be the advancement of ergonomics in UK emergency medical care. Back pain and number of injuries dropped significantly when the hydraulic tailgate came to be a standard equipment in ambulances. Even though in our observation no paramedic suffered from any injuries, close call – situations were still present (6 % in transportation of the patients). Lower back pains are the most common musculoskeletal disorders which appear in 60 to 80 % of the people in some point in their lives. Out of these, 10 to 20 % develop into chronic illness and/ or continue to have chronic symptoms. (O´Sullivan 2005, Twomey and Taylor 2002.) The biggest risk factor noticed in Finland was lifting the patient in a carry chair into an ambulance through the side door. This was also seen in the Finnish study which had 16.7 % incorrect ergonomical lifts compered to Manchester's 4.9 %. European commission (2013) guide book states that personal attitude has an important role regarding lowering the risks for musculoskeletal disorders. This was

also seen in the usage of ergonomic helping equipment, Manchester had much higher usage rate of 82.5 %. This was 16.6% higher than in Finnish observations.

Even though there were not one specific hazardous factor that should be fixed right away, this study still fulfilled its main purpose and confirmed already existing ideas regarding the hazardous factors in prehospital medical care. One of the biggest differences and hazardous factors between the two studied countries was driving to the scene. In Manchester, most of the calls (99.0 %) were responded on blue lights. In Finland only 42.2 % of the calls were responded on blue lights. In both countries most of the dangerous situations happened during the blue light calls. Manchester had a 10.7 % risk rate to get into a dangerous situation while driving to the scene. The biggest reasons were still the civilian reactions (ten calls out of 11 in Manchester) in traffic when the emergency vehicle approached them. The same results were seen in Finnish study.

With a higher risk of road traffic collision with an ambulance, the use of seatbelts cannot be addressed enough. The observation showed that even with the higher risk of dangerous situations, Manchester paramedics used less frequently seatbelts when driving to the location. They used seatbelts in fact 18.9 % less frequently than the observed Finnish colleagues. We also noticed that in both countries, paramedics used less seatbelts when transporting the patient to the hospital. The paramedics staying in the back of the ambulance used seatbelts in Manchester only 15 times (22.4 %) and in Finland 96 times (75.6 %). Although there were no hazardous situations during the transportation of the patient, this was still a significant drop comparing to the usage of seatbelts in front of the ambulance.

# 8 Discussion

The aim of the thesis was to include as much reliable and truthful information as possible, by agreeing in advance about the observer´s role during the mission. The observer did not participate in the emergency care at any point, but only served as an observer with the staff. This was also clarified for all employees.

Only in a situation in which the observer´s action was necessary to save a person´s life or to prevent injury, was the observer able to suspend the actual observation and participate in the mission as a basic level paramedic.

At the request of Manchester Central and Development Managers, the research plan was sent to the paramedics via email. They did not see the actual observation form in order to avoid influencing the way the paramedics work. The paramedics were also told that the study itself was totally anonymous. The paramedics were not individually observed and this way they cannot be identified from the study or the final report.

### 8.1 Limitations

Ernest Stringer (1999) lists flowingly observable circumstances regarding action research: places, people, activities, events and time. Making observations is always dependent on the observer. We cannot see everything that is going around us, so we have to pick our observations. The observation screening will determine what kind of data will be analysed. (Kylmä and Juvakka 2007.)

This form only gave subjective statement of the observer. This study did not tell the theme of observation to the staff. Otherwise, this may have affected the behaviour of the working staff and the results too. There were situations that differed from natural work experience because the study was a qualitative study with an observer on board of the brigade. This left room for a human error.

The form also restricted the possibility to evaluate everything. That is why a specific designed box for explaining was added. All the statements that was used in the observation form were already defined and discussed with the Finnish research group.

There was only two observers and limited amount of time. The purpose was to conduct the study in as many different types of brigades as possible.

The data was originally going to be collected and analysed by two Saimaa University of Applied Sciences students. Due to the difficulties with the timetable and

legal issues in England, there was just one student collecting the data in Manchester. The other student participated in the collection of the data in Finnish research.

## 8.2 Quality and ethics

The quality control of this study followed the standard ethics when observing individual staff members. The patients or treatments were not part of the observations and thus the study did not require patient ethical approval. In other words, the study only focused on the working medical staff and their safety. Patients were informed about the study with a cover letter, and they were entitled to refuse.

Even though the observer is a paramedic student, he or she did not participate in any treatment of the patient. If the observer interfered with the mission in any way, he or she did not include that mission into the data for analysis. The observer did not give any specifics about the study, but did mention that the staff will be observed for the study. The study also did include a written paper that stated the meaning of the observer. This cleared some misunderstandings in patient treatment situations.

We also discussed with two North West Ambulance Service senior paramedics that helped us to define the themes and some questions for the observation form. Their opinions and knowledge of the regional problems helped with the observation in Manchester region.

The quality control was achieved by storing every significant document concerning this study. After the observations, the collected data was processed and discussed the possible outcome of the Finnish observations. Collecting all statements properly made it possible to not to come up with early conclusions.

The observation forms are confidential and the authors of this study were the only to process the forms during the analysis of the results. Original forms will not be released to anyone. Hospital districts and Manchester partners will be provided with the material, if they want it. The data was processed in a way that no individual paramedics or units cannot be identified.

## 8.3 Conflict of interests

Even though this study was ordered by TEHY and SEHL, this research did not receive any funding from these organisations or any outside funding. The research was done during the free time of the students and they did not receive any payment or salary during the completion of this study.

There were no predetermined results that the study team tried to accomplish. There were no close personal relations between the observers, observed staff members or the patients. All of the results are in the original form and were not manipulated in any way. These facts stated, this study does not have any conflict of interests.

## 8.4 Future research

This study managed to confirm what kind of hazardous factors the emergency medical responders can face in their field of work. This study still had it limits due to the timing and funding. It was only observed during one season of the year; Manchester (winter) and Finland (summer/autumn). Although the multi seasonal observation would have given a more precise look on the problems caused by the different seasons of the year.

The used observation form could be further developed to be more efficient and easier to understand regarding possible future research, using the results and comments revealed in these two studies. This way there would be less misunderstandings between possible observers

Using a non-systematic observation in the future, could reveal new hazardous factors that were not even considered in this systematic observations. Observers using a non-systematic approach would need to know how the emergency medical system works. Emergency medical situations can develop rapidly into a possible disaster. Due to this, observers have to go through possible training regarding the observations and those quick pace situations.

One of the possible future research topics could be the usage of the developed systematic form in other studies completed in different countries. This way this

thesis could be the one to compare how some of the hazardous factors are combated in different cultures, systems and countries. A paper review containing these studies could help the emergency medical field in better understanding of staff safety.

**Figures**



**Tables**

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# Appendices

## Appendix number 1 – Observation form in English

### Observation form vol.5 Paramedic staff safety

| | |
|---|---|
| **Mission received (time)** | |
| **Mission code:** | |

Fill before the shift: Appendix 1

**Moving to destination**

| | Yes | No | Other/More |
|---|---|---|---|
| **Destination information** | | | |
| 1. Multi-authority cooperation (Appendix 2.) | | | |
| 2. Information given about the mission was sufficient | | | |
| **Proactive action** | | | |
| 3. Using the given information they requested help (tick if they got help, how long did it take to help arrive?) | | | |
| yes / no; why / more: | | | |
| 4. Anticipation (discussion ) | | | |
| 5. Dividing the assignments (before/during the drive) | | | |
| 6. Equipment secured during the drive | | | |
| 7. Staff wears seat belts during the drive | | | |
| **The gear** | | | |
| 8. Staff wears working boots | | | |
| Shoelaces tied / Shoelaces open / Creeper (winter) | | | |
| 9. Staff uses correct working uniform (weather and size) | | | |
| 10. Staff used extra equipment for protecB24:I26tion (if yes, tick what) | | | |
| Gloves / safety goggles / flashlight / reflecting jacket / Other: | | | |
| cut protection jacket / cut protection gloves / mouth guard / radio | | | |
| **Dangerous situation** | | | |
| 11. There was a dangerous situation during the drive to the destination. (Emergency drive/non-emergency drive) | | | |
| **Other** | | | |
| 12. Usage of the radio caused problems. (Explain what kind of problems) | | | |

**Destination**

| | yes | no | Other/More |
|---|---|---|---|
| **Destination info** | | | |
| 13. Destination (tick what) | | | |
| home / Public indoors / outside / institution / other | | | |
| 14. First given information are corresponding | | | |

| | | | |
|---|---|---|---|
| 15. Animals were removed to a different room/different space (If not; why) | | | |

**Preparedness**

| | | | | | |
|---|---|---|---|---|---|
| 16. Placing the car was noted | | | | | |
| 17. Before entering staff used extra equipment for protection (if yes, tick what) | | | | | |
| Gloves | safety goggles | flashlight | reflecting jacket | Other: | |
| cut protection jacket | cut protection gloves | mouth guard | radio | | |
| 18. Exit was secured (If yes, add how into the other section) | | | | | |
| 19. Weapons/objects considered as a weapon were noted (How) | | | | | |
| 20. Other civilians were noted at the scene | | | | | |
| 21. Moving the patient was done ergonomically correct (If not, why and in what context?) | | | | | |
| 22. Utilities that enhance ergonomics were used moving the patient (tick the box;what) | | | | | |
| lifting cloth | electrical stretcher | lifter | slide board | other: | |
| scoop stretcher | stretcher(normal) | lifting chair | spine board | | |
| 23. Help was asked to move the patient into the car (tick why / if not, explain why) | | | | | |
| heavy patient | trauma patient | difficult place | lots of equipment | other: | |

**Dangerous situations**

| | | | | | |
|---|---|---|---|---|---|
| 24. Paramedic experienced violence (tick the box for what kind/add how into other section) | | | | | |
| Physical | Verbal | | | other: | |
| 25. Who caused the violence (tick the box) | | | | | |
| Patient | Family | Bystander | Animal | other: | |
| 26. Staff used emergency button to alert about their danger (Add why into More-box) | | | | | |
| 27. Staff was injured at the destination (How) | | | | | |
| 28. Staff member had an accident or a close call - situation while handeling the equipment. (If yes, tick what equipment) | | | | | |
| Ampoule | Needle | Defibrillator | Scissors | other: | |
| 29. Staff member had an accident or a close call - situation during the moving of the patient. (If yes, how and in what kind of situation) | | | | | |

Other

| | | | |
|---|---|---|---|
| 30. Patient was transported to hospital/other | | | |

If there is no transportation: fill the X-code and time and move to "Journey back"

| |
|---|
| **X-code:** |
| **Mission ended (time):** |

## Transport

| | yes | no | other/more |
|---|---|---|---|

Preparedness

| | | | | | |
|---|---|---|---|---|---|
| 31. Family member was travelling with the patient.<br>(If yes, where) | | | | | |
| At the back | Front seat | Own car | other: | | |
| 32. Equipment secured during the drive | | | | | |
| 33. Staff wears a seat belt | | | | | |
| 34. Driver asked a permission to move | | | | | |

Vaaratilanteet

| | | | | | |
|---|---|---|---|---|---|
| 35. Paramedic experienced violence during transportation<br>(tick the box for what kind/add how into other section) | | | | | |
| Physical | Verbal | | other: | | |
| Patient | Family member | | | | |
| 36. Staff member had an accident or a close call - situation during the transportation.<br>(If yes, how and in what kind of situation) | | | | | |
| 37. There was a dangerous situation during the drive from the destination. (Emergency drive/non-emergency drive) | | | | | |

## Journey back without the patient

| | yes | no | other/more |
|---|---|---|---|

Ennakoiva toiminta

| | | | |
|---|---|---|---|
| 38. Equipment secured during the drive | | | |
| 39. Staff wears seat belts | | | |

Dangerous situations

| | | | |
|---|---|---|---|
| 40. There was a dangerous situation during the drive from the destination. | | | |

## Drop off

yes no other/more

Preparedness

| | | | | | |
|---|---|---|---|---|---|
| 41. Utilities that enhance ergonomics were used moving the patient (tick the box;what) | | | | | |
| lifting cloth | electrical stretcher | lifter | slide board | other: | |
| scoop stretcher | stretcher(normal) | lifting chair | spine board | | |
| 42. Moving the patient was done ergonomically correct (If not, why and in what context?) | | | | | |

Dangerous situations:

| | | | | | |
|---|---|---|---|---|---|
| 43. During the drop off dangerous situation took place (If yes, what kind of and when? | | | | | |
| 44. Utilities that enhance ergonomics were used moving the patient (tick the box;what) | | | | | |
| 45. Paramedic experienced violence during transportation (tick the box for what kind/add how into other section) | | | | | |
| Physical | Verbal | | | other: | |
| Patient | Family member | | | | |

| |
|---|
| **Code:** |
| **Mission ended (time)** |

## More:

## Appendix number 1; Anticipation

**Fill at the beginning of a shift and at the end**

yes no other/more

Beginning of the shift

| | | | |
|---|---|---|---|
| 46. Car and equipment check was performed during the start of the shift. (If not, add why into else box and move ino a statement 48:) | | | |
| 47. Car and equipment check was performed, time: | | | |

| | | | |
|---|---|---|---|
| 48. Car and/or equipment malfunctions / breaking down was reported forward (if not, add why into else box.) | | | |
| 49. There is a CO-detector attached to the care backpack | | | |

**End of shift**

| | | | |
|---|---|---|---|
| 50. Calls were re-directed during the shift (If yes, add why into else box / tick also how many times this happened). | | | |
| once | multible times: how many times | | |

## Appendix number 2; Multi-authority mission

| | yes | no | other/more |
|---|---|---|---|

**Ennakoiva toiminta**

| | | | | | | |
|---|---|---|---|---|---|---|
| 51. Specific check list was used on call | | | | | | |
| 52. Work distribution was clear (e.g. situational leadership) | | | | | | |
| 53. Changing the radio channel was done as ordered | | | | | | |
| 54. Paramedics got clear instructions from the other authority (tick the right authority) | | | | | | |
| Police | Border guard | Emergency services | PSAP | other | | |
| 55. Other authority was a part of transporting the patient, where did the authority was located (A=ambulance): | | | | | | |
| Front seat (A) | At the back (A) | Own car | Paramedic in a different unit | other | | |

## Appendix number 2 – Observers statement for the working class

Saimaa University of Applied Sciences,
Skinnarilankatu 36
FI-53850 Lappeenranta

Saimaan ammattikorkeakoulu

### Observer´s statement about the research

I am a paramedic student from Saimaa University of Applied Sciences, Lappeenranta, Finland. I will be conducting my international research in cooperation with North West Ambulance Services. Theme for the study is safety of the paramedic staff.

**Info:**

- I will be working only as an observer.
- I will not participate in the treatment of the patient.
- I will not assist in any way or form with the equipment or the transfer of the patient during the observation.
- I will not be observing patient safety.
- I will not be observing specific individuals or crews
- I will not be observing the skills or the knowledge of the staff.

No individual names; call signs or incident details will be published.

Observer will collect data with a structured form.

All these rules are made for keeping the observation as objective as possible. Observer's involvement will decrease the quality of the sample thus giving tampered results.

Thank you for your cooperation!

*Kind Regards,*

*Observing team.*

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Regarding any questions about this research be advised to contact either of the following:

**Research group**

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**Supervisors**

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## Appendix number 3 – Declaration of the approval for the research plan

Saimaa University of Applied Sciences,
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Saimaan ammattikorkeakoulu

### Declaration of the research plan approval

Here by we declare that a research plan titled *Study of paramedic staff safety comparing Greater Manchester & Finland (2016)* made by *Teija Auvinen & Dimitri Lisitsyn* is approved by the Saimaa University of Applied Sciences research supervisors, *Niina Nurkka & Simo Saikko*.

Nurkka Niina, Principal Lecturer (PhD),
Saimaa University of Applied and Social Sciences

Simo Saikko, Principal Lecturer (RN, MNSc),
Saimaa University of Applied and Social Sciences

Saimaa University of Applied Sciences

Date: 18.12.2015

Place: Lappeenranta, Finland

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