

**BTCCE –**  
**Boundless Trauma Care Central Europe**  
Analysis of cross-border trauma care  
collaboration in Norway, Sweden and  
Denmark



Bachelor Thesis

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## **List of abbreviations and acronyms**

AA – Air Ambulance
BTCCE – Boundless Trauma Care Central Europe
CBD – Criteria Based Dispatch
DALY – Disability Adjusted Life Years
ED – Emergency Department
EHIC – European Health Insurance Card
EMCC – Emergency Medical Communication Centre
EMD – Emergency Medical Dispatch
EMS – Emergency Medical Services
EMRIC – Euregio Maas-Rijn in Crisis
ES – Emergency Services
EU – European Union
GP – General Practitioner
HiT – Health systems in Transition
ISS – Injury Severity Score
MECU – Mobile Emergency Care Unit
MS – Member States
NIS – National Insurance Scheme
PHI – Public Health Insurance
PHTLS – Pre-hospital Trauma Life Support
TRISS – Trauma and Injury Severity Score
RDIC – Resource Dependence Institutional Cooperation Model
RHA – Regional Health Authorities
RTS – Revised Trauma Score

VHI – Voluntary Health Insurance

YLL – Years of Life Lost

YLD – Years Lived with Disability

## **Abstract**

**Background:** Unintentional injuries and trauma are the leading cause of death amongst young people. Trauma care is therefore very important. The aim of trauma care is to provide the best and most appropriate care in the shortest amount of time possible, to increase survival chances. In line with this, it is possible that the most appropriate care could be found across the border. The Boundless Trauma Care Central Europe (BTCCE) project has been initiated to investigate the possibilities regarding cross-border trauma care

**Objective:** The objective of this study is to provide a thorough understanding of the health and trauma care systems in Sweden, Norway and Denmark. In addition, it aims to provide an understanding of the legal basis on which the trauma systems and cross-border collaboration is based. Lastly, it aims to provide an overview of the current state of cross-border pre-hospital trauma care collaboration in the three countries.

**Methods:** A mixed methods approach was used for this study. It was based on a combination of literature review, policy analysis and expert interviews. The literature was selected using several databases including PubMed and Maastricht University Library. The policy analysis focussed on national, Nordic and European policies regarding trauma care and cross-border collaboration. The interviews were semi-structured and were used to complement the data, and investigate the implementation of cross-border collaboration in their region.

**Results and conclusion:** The health and trauma care systems in Sweden, Norway and Denmark have several similarities, but there also differences. The differences are mostly regarding the responsibility and the reimbursement of trauma care, and the competences of the ambulance staff. In none of the countries, there is specific regulation that concerns trauma care, however, it is included in overall health law. European-wide laws on trauma care are lacking. Cross-border trauma care collaboration is present between Sweden and Norway, but there is no collaboration with Denmark. The collaboration mostly concerns exchange of air ambulances. There are several obstacles for the implementation of cross-border collaboration, including legislative issues, lack of a legal basis, communication and language problems and issues concerning reimbursement of costs.



## 1. Introduction

Trauma is the leading cause of death worldwide. There are several types of trauma that can occur, including burns, falling, and unintentional injuries with children. One of the most common causes of trauma are traffic accidents, which are the number one cause of death in the age group 15-29 worldwide (Sethi, Towner, Vincenten, Segui-Gomez, & Racioppi, 2008). Every year, over 1.2 million people lose their lives due to trauma obtained in traffic accidents, and another 50 million are non-fatally injured (World Health Organisation, 2015). Within Europe, unintentional injuries have resulted in over 223 000 fatalities in the time period 2008-2010, of which 16 per cent was due to traffic accidents (EuroSafe, 2013). In addition to traffic accidents, unintentional injuries are a large burden on the European health systems. In age group 5-19 years, unintentional injuries are the Europe's leading cause of death (Sethi, Towner, Vincenten, Segui-Gomez, & Racioppi, 2008), (Anell, 2008).

Trauma care aims to provide the best possible care for the victims of trauma. There has been a growing interest in the border regions as opportunities for a transnational trauma care system, because in some regions, more appropriate care can be found in other Member States (MS) (Jabakhanji, Krafft, Andruszkow, & Pape, 2015). Euregio Meuse-Rhine, which includes regions of Germany, the Netherlands and Belgium, is an example of the initiation of a cross-border trauma care network. The steering group of the Euregio Maas-Rijn in Crisis (EMRIC), has initiated and intensified the contact between the relevant stakeholders in the three countries, to create a transnational network of trauma care collaboration (EMRIC, 2012). In addition, the EMRIC group has created the Boundless Trauma Care Central Europe (BTCCE) network. The goal of this network is to expand the principle of cross-border trauma care and to see if this type of collaboration can also be implemented in other regions. In line with this, the common border regions Norway, Sweden and Denmark were chosen. The aim of this study is to investigate whether there is a need for cross-border trauma care collaboration in this region.

## **2. Background.**

The next section will provide a more detailed background description of the research topic. It will focus on the definition and burden trauma, the EMRIC organisation and the specification of the study area.

### **2.1 Trauma.**

Trauma can be defined as: “Tissue or organ injury, or both, sustained by the transfer of environmental energy.” (Trauma System Evaluation and Planning Committee, 2008). It concerns an injury that is not the result of an illness, but the result of an external source (PHTLS, 2008). The severity of the trauma is measured based on a scoring system. There are several types of trauma scoring systems, depending on the country and trauma care system. One of these scoring methods is the Trauma and Injury Severity Score (TRISS) (Singh, Gupta, Garg, & Gupta, 2011). TRISS is a combination between Injury Severity Score (ISS) and Revised Trauma Score (RTS), and based on age of the victim, it can be used to predict the chances of survival after the occurrence of trauma (Schulter, 2011). ISS can be used to assess patients with multiple injuries. There are six areas that are assessed for trauma, and the severity of trauma in these areas is expressed in a number. A score of fifteen points or more will be classified as major trauma (Baker, O’neill, Haddon , & Long, 1975).

Trauma care involves many different factors. The factors can be divided into three broad areas: human resources, physical resources and process (Mock, Lormand, Goosen, Joshipura, & Peden, 2004). Examples of human resources are education, skills and properly trained staff in hospitals and ambulances. Physical resources are, for example, medical equipment and supplies (Gosselin, et al., 2009). Process concerns the organisation and administration of the trauma care resources (Mock, Lormand, Goosen, Joshipura, & Peden, 2004). The trauma care chain can be divided roughly into two sections, the pre-hospital Emergency Medical Services (EMSs) and the Emergency Department (ED) (Berben, Meijs, Van Grunsven, Schoonhoven, & van Achterberg, 2012). In addition, the trauma care chain concerns rehabilitation (Sommer, 2014). The focus of this study is on the pre-hospital EMSs.

## **2.2 Burden of trauma**

The burden of trauma can be measured and expressed in various ways. One of these measures is the Disability Adjusted Life Years (DALY). DALYs are comprised of two other measures, namely Years of Life Lost (YLL) and Years Lived with Disability (YLD) (Salomon & Vos, 2012). YLL measures the years that a person would have lived, if they had not died prematurely (Polinder, Haagsma, Toet, Brugmans, & van Beeck, 2010). YLD refers to short-term or long-term loss of health, and measures the years lived with disability caused by the trauma (Salomon & Vos, 2012). In addition, the burden of trauma can be expressed in monetary units. Occurrence of trauma can lead to direct and indirect costs. Direct costs concern, for example, medical treatment, rehabilitation and hospital bills. Indirect costs are related to loss-of-productivity, e.g. when the victim cannot work (World Health Organisation, 2009).

One of the most common types of trauma to occur in Northern Europe are falls, often related to alcohol consumption (Tagliaferri, Compagnone, Korsic, Servadei, & Kraus, 2006). Around ten per cent of the Norwegian population is injured annually. The type of injury differs between small injuries, treated by the General Practitioner (GP), or major injuries that require specialist care (Uleberg, Vinjevoll, Kristiansen, & Kledstad, 2014). In Norway, falls and other unintentional injuries were responsible for 4.52% of the DALY's in 2013 (Institute for Health Metrics and Evaluation, 2016). In Denmark, traffic accidents have led to 191 fatalities in 2013 (World Health Organisation, 2015). Falls are responsible of 2.84% per cent of the DALY's in Denmark annually, and fire and burns amount for 0.2% of the DALY's (Institute for Health Metrics and Evaluation, 2013). In 2013, there were 187 reported fatalities due to traffic accidents in Sweden (World Health Organisation, 2015). In addition to these fatalities, traffic accidents were responsible for 1.16% of all DALY's in Sweden. (Institute for Health Metrics and Evaluation, 2013) One of the risk groups, children between the ages of 0-19, has an unintentional death rate of 2.73 per 100,000 people in Sweden in 2010 (European Child Safety Alliance, 2012).

## **2.3 EMRIC**

The study is part of, and done in name of EMRIC. EMRIC is a cross-border cooperation between public organisations responsible for public safety and acute care in the Euregio Meuse-Rhine (EMRIC, 2012). The directors of the responsible organisations form the

steering group EMRIC. It was initiated several years ago after the realisation that in the Meuse-Rhine region, emergency care could be found closer across the border than in the country of origin. EMRIC initiated and intensified the contact and communication between all responsible stakeholders in region (Ramakers, Jabakhanji, & Thonis, 2009). The main goal of the EMRIC organisation is to provide care in case of non-police related dangers and civilians in need of acute care (EMRIC, 2012). In addition, EMRIC is responsible for the creation of several projects and focus groups. Eumed, part of EMRIC, is a focus group with expertise in cross-border healthcare in the Euregio Meuse-Rhine. The focus group is specialised in the investigation of possible cross-border care in this region, consisting of three countries: Germany, the Netherlands and Belgium (Ramakers, Jabakhanji, & Thonis, 2009).

The BTCCE project focuses on the cross-border health care collaboration in the Dutch-German border region. In addition, the BTCCE project expanded to include the border regions between Germany and Luxembourg and the border regions between Germany and France (Ramakers, Jabakhanji, & Thonis, 2009). The BTCCE project is part of the focus group Eumed (EMRIC, 2012). The goal of the BTCCE project is to create a network of trauma care collaboration that will transcend national borders and could eventually include the entire European Union (EU) (Ramakers, Jabakhanji, & Thonis, 2009). In line with this goal, different areas, including the border region between Sweden, Norway and Denmark, are studied to determine whether cross-border trauma care collaboration is possible.

## **2.4 Area specification**

The study will focus on the following area: Denmark, Norway and Sweden. The population of Denmark are 5,650,252, as measured at the start of 2016 (Countrymeters, 2016). Denmark has a total area of approximately 43,000 square kilometres (CIA World Factbook, 2015). The total population of Norway was measured at 5,086,894 inhabitants in 2016 (Countrymeters, 2016), on a total area of 321,802 square kilometres (CIA World Factbook, 2015). The total area of Sweden was measured at approximately 540,000 square kilometres, carrying a population of measured at 9,583,167 (CIA World Factbook, 2015). Norway has a scattered population and a very low average population density (Uleberg, Vinjevoll, Kristiansen, & Kledstad, 2014).

### **3. Goals and research questions**

This section will outline the goals and the research questions of the study. In addition, it will elaborate on the relevance of the topic.

#### **3.1. Goals and relevance**

Cross-border healthcare holds a large relevance in a changing Europe, where internationalisation becomes more important (O'Dowd, 2001). National borders have become less significant due to the four fundamental freedoms of the EU: freedom of movement of goods, people, services and capital. Consequently, this has led to an increasing interest in cross-border collaboration (National Board of Trade, 2015). The overall purpose of cross-border trauma care is to attempt to ensure the “golden hour” principle. The golden hour principle states that patients have the highest chance of survival if treatment occurs within sixty minutes after the occurrence of the trauma (Lerner & Moscati, 2001). When this principle is applied to cross-border trauma care, it could mean that the golden hour principle is attained more often, by crossing borders to a hospital that is closer by.

The study will focus on the border region between Denmark, Sweden and Norway. To investigate the need and possibilities for cross-border healthcare in this area, there is a need for a thorough understanding of the health systems in the countries involved. In addition, an understanding of the legal basis regarding trauma care and cross-border collaboration is required. The goal of this study is to investigate the current state of trauma care in this region. In addition, the study will focus on regional needs and possibilities regarding cross-border trauma care collaboration.

#### **3.2 Research questions.**

The study will aim to answer the following questions:

1. How is pre-hospital trauma care organised in Norway, Sweden and Denmark?
2. What are the relevant legislations regarding emergency healthcare in this area, regarding both national and cross-border trauma care?
3. To what extent is cross-border collaboration present in this region?
  - a. If not present, is there a need for cross-border collaboration?
  - b. What are the barriers and facilitators for cross-border collaboration in this region?

## 4. Theoretical framework

The study will be based on two theoretical models. The next section will outline the theoretical basis and the conceptual model.

### 4.1 Theory

The study will base its theoretical framework on the studies of A. Sommer (2014) and T.M. Meijer (2013). Both studies are part of the EMRIC programme, and using a similar theoretical basis will increase comparability between the studies. The study will be largely based on the theoretical model by de Rijk, van Raak and van der Made (2007): The Resource Dependence Institutional Cooperation (RDIC) model. The model, shown in figure 1, provides an overview of a combination of sociological theories. The four theories that are used are: the Network theory, Organisational Behaviour Theory, Resource Dependence theory and the Institutional Theory (de Rijk, van Raak, & van der Made, 2007).

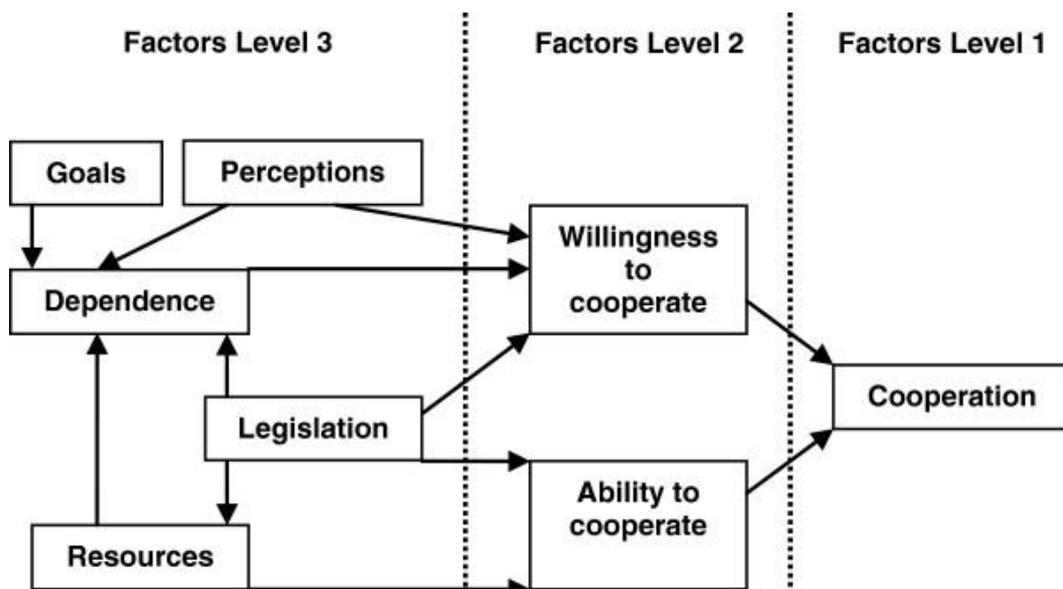
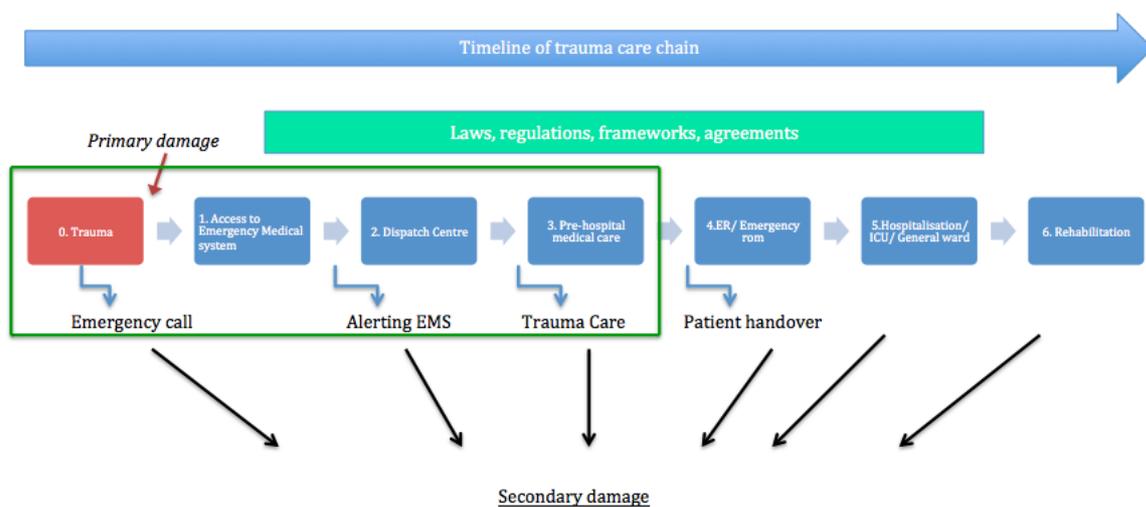


Figure 1: The resource Dependence Institutional Cooperation Model (de Rijk, van Raak & van der Made, 2007)

The RDIC model is divided into three levels, as shown in figure 1, where the interconnectedness between the levels is high. The third level, consisting of goals, perceptions, dependence, legislation and resources, influences the second level. The second level explains the ability and willingness to cooperate in a certain situation. The willingness and ability, in combination with the level three factors, determine the state of cooperation in level one (de Rijk, van Raak, & van der Made, 2007). This model will be applied in the analysis of cross-border pre-hospital trauma care in Norway, Sweden and Denmark, especially when looking at the possibilities for cross-border care. The level that is most

relevant in this study is the third level. The factors in the third level can all be separately analysed to determine the possibilities for cross-border trauma care collaboration, however, there will be a focus on the legislation and the dependence. The dependence will determine whether there is a need for cross-border trauma care. The legislation will show if there are legal possibilities or obstacles to enable or prevent cross-border trauma care collaboration. In addition, there will be a focus on the factors in level two, concerning the willingness and ability to cooperate in cross-border trauma care collaboration.

## 4.2 Conceptual model



**Figure 2: The Trauma Care Chain (A. Sommer, 2014)**

The conceptual model provides a graphic overview of the theories that will be used during data analysis. A. Sommer (2014) created the conceptual model, when researching a similar topic in the BTCCE project, however in a different region. The model shown in figure 2 includes all steps from the occurrence of the trauma until the rehabilitation. There is a distinction made between primary and secondary damage. Primary damage is the damage inflicted at the moment of trauma; secondary damage is all harm that can occur later in the trauma care chain (Sommer, 2014). Due to the time limit of the study, the focus will be on the pre-hospital trauma care; the first three steps in the trauma care chain, as shown in the green box in figure 2.

The cross-border aspect will come into play when looking at the trauma chain. The study will focus on the current state of trauma care, and how the pre-hospital section of the trauma care chain is organised in each of the countries. In addition, it will explore the opportunities regarding cross-border collaboration. It will focus on the access of the patient to the system, in case of unplanned care, and if there are possibilities, for example, to access a hospital that is closer to the patient, but in another country. The choice of hospital is not done by the patient, but by an expert. In addition, there will be a focus on the challenges of cross-border cooperation such as legalities, reimbursement etc.

## **5. Research methods.**

This study uses a mixed methods approach. This approach was used due to the diversity of the topic, and using one method would not provide sufficient information to fully cover the topic. Using multiple methods for this study can be seen as a form of method triangulation, which allows for a continuous checking of facts found in different types of sources. It is a combination between a literature review, a policy analysis and expert interviews. The literature review will elaborate on the health systems and the existing trauma care chain in the different countries. The literature review relates to the first research question. The policy analysis section focuses on the relevant policies that are in place regarding trauma care chain and cross-border collaboration, and relate to the second and third research question. The expert interviews are used to complement the information gathered in the literature review and policy analysis.

### **5.1 Literature study**

The literature study is based on a search in from different scientific databases. For this study, the databases Pubmed, Maastricht University Library and ScienceDirect were selected. Pubmed and ScienceDirect were selected due to the fact that the medical nature of the articles found complement the topic. In addition, Maastricht University Library was used to gain access to sources that would otherwise not be available. The search was based on several key words, including '*Scandinavia*', '*Sweden*', '*Norway*', '*Denmark*', '*Health System*', '*Trauma care*', '*Cross-border care*', '*cross-border collaboration*', '*Policy*', and '*Acute care*'. The search terms were combined using Boolean operators; terms referring to a country were combined with the Boolean operator AND to search terms relating to cross-border care OR

acute care OR trauma care. In addition, literature was found using the ancestral approach, meaning that within literature, other literature was found.

Literature was selected based on relevance containing one or more of the key words. Literature that concerned only one section of the pre-hospital trauma care was included as well. One of the exclusion criteria is literature published before 2006, in order to ensure that the most recent data was included in the study. However, for certain definitions, older literature was used. Other exclusion criteria include articles that do not concern pre-hospital trauma care, articles not concerning the relevant countries and articles in the native languages. In this study, only English sources have been included, due to lack of understanding of the native languages. The data obtained within the literature review was analysed and grouped per country. Subsequently, the data per country was compared to other countries.

## **5.2 Policy analysis**

The policy analysis section provides a different, more legal perspective regarding the topic. This section focuses on laws, regulations, policies and other relevant documents regarding trauma care and cross-border collaboration. To study the relevant policies, Google and Google Scholar were used as a database. National policies were extracted from the national and regional government websites of the countries of interest. In addition, the Health systems in Transition (HiT) reports were used. Due to the fact that Sweden and Denmark are both part of the EU, and Norway is closely associated, the role of EU law was included as well. . For the European policies, the Eur-lex database was used, in addition to the websites of the European Commission. The policies were selected based on containing information regarding trauma care or cross-border healthcare, and analysed to obtain the most suitable information

## **5.3 Qualitative interviews**

The use of interviews is a form of qualitative data analysis and provides a more in-depth approach to the data collection (Dicicco-Bloom & Crabtree, 2006). In addition, it provides insights beyond the literature, for example, by taking a more personal perspective. For this study, at least one study participant from each country was selected. The selection of study participants was done through purposive sampling. Purposive sampling can be defined as sampling where the researcher purposely selects study participants based on their benefit for the study (Polit & Beck, 2008), in this case, participants with expertise knowledge regarding the topic. Purposive sampling was selected to gain access to a cohort of experts, which would not have been available using random sampling methods. Experts have been partially

extracted from personal contacts of the thesis supervisor; other experts have been obtained through websites of national governments and other relevant organisations. The study participants have been selected based on their knowledge on this topic, and were contacted via email. In this email, a brief explanation was given about the topic and why the study participants could be relevant sources. Further explanation of the topic was given at the start of the interview.

<b>Country</b>	<b>Expert</b>	<b>Organisation</b>	<b>Type of interview</b>
Denmark	Mattias Giebner	Falck Denmark	Skype
Norway	Torben Wisborg	Norwegian Advisory Unit on Trauma Care	Skype
Norway	Nina Hesselberg	Norwegian Air Ambulance	Skype
Sweden	Lars Engelström	SOS Alarm	Skype

**Table 1: List of interview partners**

The type of interview conducted was a semi-structured interview. In this type of interview, a list of topics of questions is made available to the study participants, but the interview is not limited to these topics (Polit & Beck, 2008). The interview questions were based on the questions used in other BTCCE studies, but were adapted to fit this particular study setting. Ten questions were provided to the study participants, and each question contained several key words and phrases. The study participants have consented to allow recording and publication of the outcomes of the interviews. The interviews were conducted using Skype, and were recorded with two recording devices. Once, using a built-in Skype recording application, and once using a recording application on a smartphone. The interviews were transcribed and coded according to the key words and phrases. The coding method that was used is open coding, where the content relating to the key principles were selected. In addition, axial coding was used, where the relationship between core concepts was studied. As a final step, the codes were related to one of the key principles, using selective coding. Copies of the transcripts were made available to the study participants and a member check was performed.

## **6. Results**

The results section will focus on different aspects to provide a detailed overview of the situation in Sweden, Norway and Denmark. The first section will focus on the health systems and trauma care in each country respectively. The next section will outline the legal basis for the trauma care and cross-border collaboration. In addition, it will focus on European policy regarding cross-border healthcare. The last section will elaborate on the findings regarding the existing cross-border collaboration and the facilitators and barriers.

### **6.1 Existing trauma care systems**

To gain insight in the possible cross-border trauma care cooperation, a thorough insight of the healthcare trauma care system. The next section will provide a detailed description of this.

#### **6.1.1 Sweden**

The healthcare system in Sweden is divided into three different levels: national, regional and local level, and is based on The Health and Medical Services Act of 1982 (Anell, Glenngard, & Merkur, Sweden: Health system review, 2012). This act outlines that the responsibility and authority for healthcare lies on the regional level, with one of the twenty-one County Councils, whereas overall healthcare policy is made by the state. County Councils have a certain level of freedom regarding the organisation of their health services; however, they must meet certain national guidelines and standards (Ministry of Health and Social Affairs, Sweden, 1982). The Swedish health system is based on three basic principles: Human dignity, need and solidarity and cost-effectiveness. The insurance system is also based on these principles. In Sweden, there is universal coverage, for all legal residents in Sweden. Emergency healthcare is covered for every EU resident (The Commonwealth Fund, 2015). The Swedish health system is largely tax funded. Approximately seventeen per cent of all expenditure on healthcare is privately funded, mostly in user charges. Both primary and specialist healthcare require user charges. In most County Councils, inhabitants under twenty years old are exempted from user charges (Anell, Glenngard & Merkur, 2012). Emergency care is largely funded by the state, through taxes; however, it does require an out of pocket payment between SEK 200-300 (€21-32) per treatment (Anell, 2008).

Emergency medicine was specified as a speciality in Sweden in 2008 and concerns the trajectory a patient goes through from the first call to the Emergency Services (ES) and ending in hospital care (Resident & Student Association, 2007). The trauma care chain in

Sweden can be divided into several sections. The first section is the call to the ESservices. The emergency number in Sweden is 112, which is the standard in the EU (European Commission, 2016). The response time to an 112 call is not allowed to exceed eight seconds on average, as specified in the national guidelines (Lindstrom, Bohm, & Kurland, 2015). The emergency centre operator will assess the situation and refer the call to the appropriate emergency service, such as police or ambulances (SOS Alarm, 2013). In case of medical trauma, the call is forwarded to the Emergency Medical Communication Centre (EMCC) (Lindstrom, Bohm, & Kurland, 2015). There are twenty-one EMCCs located in Sweden, one in each county (Bjornstig, 2004). The EMCCs are responsible for a large part of the resource distribution and are the link between the ES and the Emergency Medical Dispatch (EMD) (Lindstrom V. , 2012).

After receiving the emergency call, the EMD dispatches ES (Lindstrom V. , 2012), including ground and air ambulances (AAs) (Bjornstig, 2004). The dispatching of ambulances is based on four different levels of priority, which have different response times. The first priority level concerns life-threatening conditions, where ambulance services are required to attend the scene of accident within ten minutes after the emergency call. The second level of priority concern urgent, but not life-threatening conditions. On this level of priority, ambulances are required to arrive within thirty minutes. The third priority level concerns non-urgent, non life-threatening situations, where the response time of the ambulance is adjusted for optimal use of the ambulances. The fourth and last level of priority mostly concerns non-urgent transportation of patients (Hjalte, Ssuserud, Herlitz, & Karlberg, 2007). In practice, ambulance response times vary from twelve to twenty-one minutes, dependent on the counties. There is a nationwide average of fourteen minutes (Swedish Association of Local Authorities and Regions, 2013).

Previously, ambulances were only used as a means of transportation, from the scene of the emergency to the hospital; however, this role has changed over time (Lindstrom, Bohm, & Kurland, 2015). Currently, national legislation requires that each emergency ambulance is staffed with at least one registered nurse, meaning that adequate medical care can now be provided in the ambulance (Suserud, 2005). The implementation of this legislation led to the creation of a specialist emergency nurse. Registered nurses, who wish to specialise in emergency care, are required to complete a one-year addition training in emergency care, to be promoted to become a pre-hospital emergency care nurse (Lindstrom, Bohm, & Kurland,

2015). The ambulance staff is trained in Pre-hospital Trauma Life Support training (PHTLS) (Blomberg, Svennblad, Michaelsson, Byberg, Johansson, & Gedeberg, 2013).

### **6.1.2 Norway**

The Norwegian healthcare system can be described as semi-decentralised (Ringard, Sagan, Saunus, & Lindahl, 2013). It is divided into three levels: state level, regional authorities and municipalities (Festoy & Aanes, 2015). The state level is guided by the Ministry of Health and Care Services, and is responsible for the overarching decision-making regarding healthcare. It sets policies and controls the budgets for healthcare expenditure (Ringard, Sagan, Saunus, & Lindahl, 2013). The second level of healthcare governance is based on the Regional Health Authorities (RHAs). There are four RHAs in Norway, each responsible for a different region: Northern Norway RHA, Central Norway RHA, Western Norway RHA, and South-Eastern Norway RHA (Ringard, Sagan, Saunus, & Lindahl, 2013). The RHAs were created as a result of the reform caused by the Health Authorities and Health Thrusts Act of 2001, and are under governmental control (OECD, 2014). The RHAs are responsible for the financing, planning and provision of specialised healthcare (Festoy & Aanes, 2015). In addition, the RHAs have control over the hospital trusts. Currently, there are 21 hospital trusts in Norway, each responsible for a different geographical area, which are responsible for the budgets and organisations of hospitals within their respective area (Ringard, Sagan, Saunus, & Lindahl, 2013). The last level of healthcare governance in Norway is the local or municipal level. The 428 municipalities are fully responsible for the primary care provision, including emergency care (OECD, 2014).

The majority of the Norwegian healthcare system is publically funded (Ringard, Sagan, Saunus, & Lindahl, 2013), including primary and specialist care. This is done primarily through taxes (Festoy & Aanes, 2015). All Norwegian inhabitants are insured through the National Insurance Scheme (NIS) (Festoy & Aanes, 2015). However, some healthcare facilities are privately funded, mostly through out-of-pocket payments. This amounts to around fifteen per cent of the total healthcare expenditure (Ringard, Sagan, Saunus, & Lindahl, 2013). Emergency care is covered by the NIS, and is fully reimbursed by the public insurances, and does not require any out-of-pocket payments (Ringard, Sagan, Saunus, & Lindahl, 2013).

The responsibility for pre-hospital emergency care in Norway is divided between the municipality and the hospital trusts (Ringard, Sagan, Saunus, & Lindahl, 2013). The municipalities are responsible for the GPs on call, and the hospital trusts are responsible for the ambulances. These two layers have to work together (T. Wisborg, personal communication, April 2016); where emergency care is provided by GPs and the ambulances are supplied by the hospital trusts (Ringard, Sagan, Saunus, & Lindahl, 2013). This is especially relevant in the less populated areas, where trauma victims may be very distant from the nearest hospital (Vaardal, Lossius, Staas, & Johnsen, 2004). There are fifty emergency hospitals in Norway (Hansen, Engestaeter, Eide, & Viste, 2005).

The trauma care chain in Norway starts with the call to the ES. The emergency phone number in Norway is 113. The ES assess the type of emergency, and in case of a medical emergency, the call is forwarded to the closest of nineteen EMCCs. (Ringard, Sagan, Saunus, & Lindahl, 2013). The EMCCs are staffed by nurses and other ambulance personnel. The nurses will provide medical expertise and assign a level of priority to the mission. The ambulance dispatchers are trained ambulance personnel, who work part-time in the EMCCs and part-time on the ambulances (T. Wisborg, personal communication, April 2016). The nurses assess the severity of the emergency using 'the Norwegian Index', where forty categories are presented and classified as 'acute', 'urgent', or 'not urgent' (Vaardal, Lossius, Staas, & Johnsen, 2004). Based on the severity and the geographical location of the emergency, ES are dispatched.

The ambulance services in Norway are closely connected to several partners, including hospitals, GPs, police departments, mental health institutions and fire brigades (Bos, Krol, Veenvliet, & Plass, 2015). The ambulance fleet in Norway consists of cars, boats, helicopters and planes (Ellensen, Hunskaar, Wisborg, & Zakariassen, 2014). Norway has twelve primary AAs (Zakariassen, Uleberg, & Roislien, 2015). The AAs are staffed by a pilot, paramedic or rescue worker, and an anaesthesiologist (Moek, Klepstad, Skandsen, Fredriksli, & Vik, 2008). Due to this high qualification of the staff, the AAs can provide adequate and advanced trauma care to the trauma victim (Ellensen, Hunskaar, Wisborg, & Zakariassen, 2014). Ground ambulances are staffed with paramedics who have completed a four-year education, during which they are taught and work practically (T. Wisborg, personal communication, April 2016). All ambulance staff is trained in PHTLS (Sundstrom, Asbjornsen, Habiba, Sunde, & Wester, 2015). The response time for ground ambulances is approximately twelve minutes in

urban areas, and twenty-five minutes in rural areas (Vaardal, Lossius, Staan, & Johnsen, 2004)

### **6.1.3 Denmark**

The healthcare system in Denmark can be classified as a decentralised national system, and its structure is similar to the healthcare systems in Norway and Sweden (Pedersen, Christiansen, & Bech, 2005). The healthcare system is governed on three different levels: state, regional and local (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012). On the state level, the main authority is the Ministry of Health. The ministry is responsible for legislation regarding all healthcare areas. In addition, it lays down the tasks of the regions and municipalities (OECD, 2013). The regions and municipalities of Denmark are responsible for the provision of primary and secondary healthcare (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012), including emergency care (OECD, 2013). After a health reform in 2007, Denmark's thirteen counties and municipalities were comprised to five regions, shifting the responsibilities to one of these regions. The larger size of the regions means that the regional governments can increase their performance, in comparison to the smaller governing units (OECD, 2013). The local level carries responsibility for disease prevention and health promotion (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012).

The healthcare system in Denmark, similar to other Scandinavian countries, is for the largest part publically funded (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012). The healthcare is funded through a 'health tax', which is paid by Danish inhabitants, and is based on eight per cent of the taxable income (The Commonwealth Fund, 2015). The taxes are levied by the state and then redistributed to the different municipalities. In addition, block grants are provided from the state to the municipalities. The 'health tax' and the block grants provide Public Health Insurance (PHI) for all Danish inhabitants. A small part of the healthcare expenditure is derived from Voluntary Health Insurance (VHI), which is available for the Danish inhabitants, and is an additional, private insurance (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012). Emergency healthcare is fully covered by the PHI, and does not require additional payments (Pedersen, Christiansen, & Bech, 2005).

Access to the emergency medical system is granted by the EU standardised phone number 112 (European Commission, 2016). This connects the caller to the police department where the situation is analysed. If the accident constitutes a medical emergency, the call is forwarded to one of the EMCC (M. Giebner, personal communication, April 2016). There are five regional EMCCs in Denmark, where the nurses assess the severity of the trauma, using a system called Criteria Based Dispatch (CBD). The severity of the trauma is assessed and classified using CBD into one of the following categories: 1) Potentially life threatening, (2) urgent, but not life threatening, (3) non-urgent ambulance or (4) non-urgent patient transport. Based on these ratings, different response times are implemented (Andersen, Johnsen, Sorensen, Jepsen, Hansen, & Christensen, 2013). The EMCC also dispatches the ambulances, based on the need of the trauma victim (M. Giebner, personal communication, April 2016).

The ambulance fleet of Denmark consists of various types of ambulance vehicles, including ground ambulances and Mobile Emergency Care Units (MECU's) (Fjaelstad, Kirk, Knudsen, Bjerring, & Christensen, 2013). The ground ambulances are on rapid response, arriving within eight minutes in fifty per cent of their missions (Kruger, Skogvoll, Castren, Kurola, & Lossius, 2010). Denmark has four AAs, of which three are located within the borders of Denmark, and one is located across the border in Germany, but operates in the south of Denmark (M. Giebner, personal communication, April 2016). The majority of the country is covered by one private ambulance provider: Falck. Falck covers around 85 per cent of the country, the remaining fifteen per cent are covered by four other, both private and public ambulance services (Clemmensen, et al., 2013).

The role of the ambulance in pre-hospital trauma care has changed over time. Whereas previously, its sole purpose was the transport from the scene of impact to the hospital, now it is now regarded as a critical part of treatment (Andersen, Carlsen, & Christensen, 2011).

There are three types of ambulance staff. The first competence level, the certified ambulance assistant is obtained after three years of education. After two years of work experience, a certified ambulance assistant can become a senior EMT, who is PHTLS trained and is allowed to give a limited level of medication. Senior EMTs need to gain three more years of experience in order to become certified paramedics (M. Giebner, personal communication, April 2016)

	<b>Responsibility</b>	<b>Reimbursement</b>	<b>Access</b>	<b>Dispatch</b>	<b>Pre-hospital emergency care provided by</b>
<b>Sweden</b>	Regional level (county councils)	Predominately tax funded, some out of pocket payment of 200-300 SEK	Call to 112, if classified as medical emergency → referral to EMCC,	Ground or air ambulances are dispatched by EMD	Specialised Emergency nurse
<b>Norway</b>	Local level (municipalities)	Fully covered under the NIS	Referral of GP or Emergency calls 113, classified as a medical emergency → EMCC,	Ground or air ambulances, dispatched by the EMD	Specialist trauma paramedic
<b>Denmark</b>	Regional level	Fully covered by the PHI	Emergency calls 112, in case of Medical emergency → EMCC	Ground and air ambulances, MECU's dispatched by EMD	Ambulance assistant, senior EMT or paramedic

**Table 2: Overview of trauma care systems**

## **6.2 National policy**

To understand the underlying mechanisms of the trauma care system, an understanding of the legal basis is required. The relevant policies regarding trauma care and cross-border collaboration are provided

### **6.2.1 Sweden**

There are several laws and regulations relevant for healthcare in Sweden. The Swedish healthcare system is based on the Health and Medical Service act of 1982. This act outlines the general points, which the healthcare system should comply with. One of the fundamental points that the act outlines is that all inhabitants of Sweden have the right to primary healthcare (The Health and Medical Service act of 1982, 2003). In addition, this act elaborates on several other topics, including required training for EMS staff, minimum standards of care and qualification and the organisation of response and dispatch system (World Health Organisation, 2008).

### **6.2.2 Norway**

The health system in Norway is based on the Norwegian Primary Health Services Act of 1982. In this document, the responsibility for the healthcare was distributed to the 430 local authorities, the municipalities. They are responsible for the treatment and healthcare of all those living in the municipality. This also includes emergency care (Oien & Nylenna, 2009). As of the first of January 2012, a new act has been implemented in Norway: the Public Health Act (act 2011-06-24 no.29). The public health act focuses on reducing social inequalities in health care, and promoting public health. In the Regulation relating to a Municipal Regular GP Scheme, it is laid down that General practitioners should take part in the answering of the emergency calls, and thus the first step in the trauma care chain (Ministry of Health and social affairs, 2000).

### **6.2.3 Denmark**

The Danish healthcare system is based the Health Act of 2007, which was implemented after a reform in the healthcare system (Olejaz, Nielsen, Rudkjobing, Birk, Krasnik, & Hernandez-Quevedo, 2012). In the first two articles, the Health Act outlines the objectives of the Danish healthcare system. The overall goal of the health system is to improve population health and prevent illness. In addition, it strives to create easy and equal access, high quality treatment and a transparent healthcare system (Pedersen, Christiansen, & Bech, 2005). Other topics that have been explained in the healthcare act regard the equipment, staffing and financing of trauma care in Denmark. The healthcare act lays down the rules and regulations regarding the training of the staff operating in the EMS (World Health Organisation, 2008).

## **6.3 Overall policies in the Nordics**

In addition to the national legislations and policies, there is one agreement in place that covers the entire European Nordics. The Nordic Public Health Preparedness Agreement was signed by Norway, Sweden, Finland, Iceland and Denmark in 2002. The agreement states that the Nordic countries should aim to cooperate in case of emergencies and disasters (Norden, 2008). In addition, the agreement aims to promote cooperation and remove barriers in national legislations (de Guttery, 2012). The goal of the agreement is to create a united front in which all countries support each other. This concerns multiple factors, including administrative and financial consequences that arise from the cooperation (Norden, 2008).

In addition to the Nordic Public Health Preparedness Agreement, the Stoltenberg Report entails the aims and goals for the Nordic region (Archer, 2010). The report was presented to

the relevant ministers of the countries involved. One of the proposals was to create a disaster response unit to deal with large-scale accidents and disasters in the Nordic region. This disaster response unit should complement the national trauma and emergency preparedness systems (Stoltenberg, 2009).

However, the Stoltenberg Report only contained proposals for cooperation. Using this report as a basis, a meeting was held to discuss the future of these proposals (Archer, 2010). The meeting is referred to as the Haga cooperation. The cooperation has been in place since 2009, and is a non-military security cooperation between the Nordic countries (Bailes & Sando, 2014). Haga aimed to create a coherent plan to include cooperation from all Nordic countries, and based on the thirteen points in the Stoltenberg report (Archer, 2010). In 2014, Haga II was implemented as a successor of Haga. The main goal was to expand on the plans in Haga I and create a “borderless” Nordic region, free of barriers, and a platform for exchange of experiences in disaster management (Bailes & Sando, 2014).

#### **6.4 European Policy**

Within the EU, there are no universal guidelines regarding the quality or coordination of trauma care. Due to the fact that there are different systems implemented in different countries, there is no set of standards that are applicable to the entire EU (Trunkey, 2015). Nevertheless, there are several regulations that enable and regulate cross-border collaboration within the EU.

One of these regulations is Directive 2011/24/EU on the application of patients’ rights in cross-border healthcare, henceforth known as the Patients’ right directive. The directive focuses on the importance of cross-border healthcare within the EU (EUROHEALTH, 2013). The directive is based on one of the four fundamental freedoms of the EU, namely the freedom of movement of people. (Jacque, 2011). The freedom of movement of people allows patients to travel to other countries to receive the necessary healthcare. In addition, the directive states that cross-border collaboration is possible due to the fact that there are overarching values in all European MS: universality, access to good quality care, equity and solidarity, and these values should also be applied to patients from other MS (The European Parliament and the Council of the European Union, 2011). The directive outlines the rules and regulations regarding reimbursement, quality and patient rights of healthcare in other countries than the patient’s native country (The European Parliament and the Council of the

European Union, 2011). In addition, the directive encourages MS to work together in cross-border healthcare, as laid down in article 10.3 (World Health Organisation, 2013).

There are several articles that relate to the reimbursement of cross-border healthcare. In the directive is stated that costs are only reimbursed up to the level that the procedure would have cost in the country of the patient, meaning that they cannot derive financial advantages by obtaining healthcare in another country (The European Parliament and the Council of the European Union, 2011). In addition, article 7 (7) states that the home country should take responsibility in the process of after-care, as if the procedure had taken place in said country (European Commission, 2015).

Another initiative relevant regarding the reimbursement of medical costs is the European Health Insurance Card (EHIC). The regulations regarding the EHIC are laid down in regulation (EC) No 883/2004. Even though this regulation was adopted in 2004, it only came into force in 2010. The EHIC allows for access to healthcare of people residing in other countries than their country of residence. In addition, it states that the care received should be of the same terms and costs as for people insured in that country. The reimbursement is done by the insurance in the country of origin (European Parliament & European Council , 2004).

## **6.5 Existing cross-border collaboration**

Currently, there is cross-border trauma care collaboration present in Norway, which takes place between Finland, Norway and Sweden (World Health Organisation, 2013). This collaboration is not translated into action on a national level, but operates on regional level. The focus of the collaboration is mostly on the AAs, which are exchanged between Norway and Sweden. There are specific regulations that enable the collaboration between Norway and Sweden regarding the AAs (N. Hesselberg, personal communication, June 2016). The Norwegian helicopters have permanent clearance to cross the borders (T. Wisborg, personal communication, April 2016).

In Denmark, cross-border collaboration is taking place within the border region with Germany, but not with the border region with Norway or Sweden (T. Wisborg, personal communication, April 2016). On the border with Germany, there are multiple types of cross-border collaboration. This includes the transnational use of helicopters, where one of the four Danish helicopters is already placed in Germany, but used in the south of Denmark. In

addition, it concerns the cross-border use of ground ambulances (M. Giebner, personal communication, April 2016).

## **6.6 Barriers in cross-border care**

There have been several barriers identified that obstruct the implementation of cross-border trauma care collaboration. The barriers have been identified and grouped, and will be elaborated in the next section

### **6.6.1. Necessity**

According to N. Hesselberg (personal communication, April 2016), there is no cross-border collaboration between Norway and Denmark, and is not necessary. This is due to the fact that Denmark only shares one land border with Sweden, other than the bridge between Malmö and Copenhagen; there are merely sea borders (M. Giebner, personal communication, April 2016). In addition, the one land border that they have in common, the Oresund Bridge, connects the two large cities, which each have their own trauma centre. This means that it would not be profitable to transport the patient to the other country (M. Giebner, personal communication, April 2016).

### **6.6.2 Emergency calls**

In the border region between Norway and Sweden, a different barrier has been found. Since Norway is not part of the EU, it is not obliged to have the same emergency phone number. Whereas in Sweden, similar to Denmark and the rest of the EU, the emergency phone number is 112, in Norway, the emergency phone number is 113. Even though the phone numbers are different, this is a barrier that can be overcome, by introducing an extra step into the trauma care chain, a measure of communication between the two emergency numbers (T. Wisborg, personal communication, April 2016). In addition, language can be seen as a barrier for cross-border care. Even though English is a commonly spoken language in these countries, not all first responders at the EMCCs have sufficient knowledge of the English language. This can result in communication problems between providers in different countries. In addition, the victims often do not have sufficient knowledge of the English language (L. Engelström, personal communication, June 2016).

### **6.6.3 Reimbursement**

Another barrier that became apparent in discussing cross-border trauma care collaboration is the reimbursement of the treatment. Due to the fact that Norway is not part of the EU, the EHIC system is not implemented in Norway. This means that the costs of the treatment

cannot be reimbursed through this system (N. Hesselberg, personal communication, June 2016). According to M. Giebner (personal communication, April 2016), the reimbursement should be regulated before cross-border trauma care can be fully implemented. According to L. Engelström (2016), there is no exact calculation for the reimbursement; however there are certain template regarding the reimbursement, where a standard amount is reimbursed, however, this is not always proportional to the actual costs.

#### **6.6.4. Education and training of staff**

In addition to the reimbursement issues, other barriers regarding legislation became apparent. All three countries use different education systems for the training of the ambulance staff, as laid down in the national laws. This means that the ambulance personnel in different countries have different competences and skills. This could result in staff from one country to perform more complex acts compared to ambulance staff of other countries (N. Hesselberg, personal communication, June 2016). Another barrier that arises regards the responsibility. If an ambulance were to cross the border, which country would carry responsibility, and is the staff allowed to perform according to their own competences or the country they are crossing to? (T. Wisborg, personal communication, April 2016).

#### **6.6.5. Priority and readiness**

Cross-border trauma care is present between Norway and Sweden, however there are several factors that should be taken into account. According to L. Engelström (2016), the ambulances would cross borders if necessary, but the patient would be taken to the country of the ambulance's origin. This is to maintain readiness of resources within the country of origin. In addition, N. Hesselberg (2016) states that in case of cross-border trauma care, patients of the country of origin would be prioritised.

## **7. Discussion**

The results will be related to the theoretical basis of this study. This will be done according to the two models used. In addition, the limitations of the study will be elaborated on.

### **7.1 Theoretical considerations**

Access to the emergency medical system is step one in the trauma care chain and is organised differently in Norway compared to Sweden and Denmark. In Sweden and Denmark, access to the emergency medical services is granted through the EU standard phone number 112 (M. Giebner, personal communication, April 2016). In Norway, access to the emergency medical

system is gained through referral from a GP or through the emergency phone number 113 (Ringard, Sagan, Saunus, & Lindahl, 2013). In all three countries, the emergency call will be forwarded to an EMCC in case of a medical emergency (Lindstrom, Bohm, & Kurland, 2015), (Ringard, Sagan, Saunus, & Lindahl, 2013), (M. Giebner, personal communication, April 2016). The dispatch is the next step in the trauma care chain (figure 2), which in all three countries is organised by referral from the EMCCs. The EMCCs classify the severity of the injury, and will coordinate the dispatch together with the EMDs. In all three countries, the ambulance fleet consists of at least ground and AAs. In Denmark, there are specialised MECU's, that are adapted for more severe trauma care in the ambulance (Fjaelstad, Kirk, Knudsen, Bjerring, & Christensen, 2013).

The following step in the trauma care chain is pre-hospital medical care. In this step, the competence level of the staff on board of the ambulance differs amongst the three countries. In Sweden, the ambulances are staffed by specialised emergency care nurses. The education required to become a specialist emergency care nurse is an additional one-year education in the emergency care field (Lindstrom, Bohm, & Kurland, 2015). In Norway, ground ambulances carry specialist paramedics, who have completed a two-year education and two years of working experience in emergency care (T. Wisborg, personal communication, April 2016). The Norwegian AAs are staffed by a pilot, paramedic or rescue worker, and anaesthesiologist (Moek, Klepstad, Skandsen, Fredriksli, & Vik, 2008). In Denmark there are three levels of ambulance staff that work in the care chain, namely the ambulance assistant, certified ambulance assistants and Senior EMTs (M. Giebner, personal communication, April 2016). In all three countries, the ambulance staff are PHTLS trained, thus they operate according to the same principles. However, the competences are not similar in all countries, e.g. with regards to the medication they are allowed to provide. In addition, the competence levels within countries can differ, depending on the level of education.

### **7.1.1 RDIC model**

The cross-border trauma care collaboration is analysed using the RDIC model. In the model, several factors influence the eventual cooperation, but are also interlinked on the different levels. According to the model, one of the factors that influence cooperation is resources. In the border region between Norway and Sweden, there is mutual use of resources. The main focus of this exchange of resources regards the AAs, which have permanent clearance to cross the borders. There is no exchange of resources between Norway, Sweden and Denmark. According to the RDIC model, the use of mutual resources influences the dependence

between countries. Therefore, the exchange of AAs between Norway and Sweden can be seen to have an impact on the dependence between the two countries. The dependence between Norway and Sweden is high. There are no cooperation initiatives in place between Norway, Sweden and Denmark (M. Giebner, personal communication, April 2016), thus the dependence can be interpreted as low.

Due to the high interconnectedness between Norway and Sweden on the levels of dependence and resources, the willingness to cooperate between these countries might be higher, which could result in cross-border collaboration. In addition, it could lead to an increased ability to cooperate. These two factors, ability and willingness to cooperate could have led to the collaboration between Norway and Sweden. There is a lack of dependence between Norway, Sweden and Denmark. Due to this, the willingness to cooperate can be assumed to be low. This is in line with the model. According to M. Giebner (personal communication, April 2016), cross-border trauma care collaboration would not be beneficial between Denmark and the other countries. This is due to the fact that Denmark only shares only one land border; the remaining borders are all on sea. The lack of dependence on Norway or Sweden results in decreased willingness to cooperate. In addition, Denmark does not share resources with Sweden or Norway. Similar to the dependence, this could influence the willingness to cooperate.

The barriers found through the expert interviews can be included in one of several factors shown in the model. One barrier that became apparent was the reimbursement of the trauma treatment for the patient. The rules regarding reimbursement are imbedded into national legislation, which could be incompatible with other countries. This barrier is especially relevant considering the reimbursement in Norway, since Norway is not part of the EU and does not fall under the EHIC system. In addition, the ambulance staff is trained differently in each of the countries. The competence level of the ambulance staff is based on national legislation. Placing this in the model, it can be seen that legislation affects the ability to cooperate. The willingness to cooperate is influenced due to the fact that countries will prioritise their own patients over cross-border collaboration.

The Nordic cooperation relates to several factors in the model. Firstly, the Nordic cooperation was created due to dependence between the Nordic countries. The dependence was caused by several factors, including low average population density and the limited number of resources,

especially in the Northern regions (Archer, 2010). Regarding the overall policies present in the Nordics, legislation is an enabler for cross-border collaboration. The legislation and dependence allow for a more “borderless” Nordic region. Even though the Nordic cooperation concerns large-scale emergencies and disasters, it does show that there is a basis for cross-border cooperation in this region. In addition, it could contain possibilities to enlarge the scope and create a network for small-scale accidents and trauma care.

## **7.2 Limitations of the study**

There are several limitations to this study that need to be taken into consideration. Firstly, due to lack of understanding of the native languages (Swedish, Danish and Norwegian), only literature in English could be used for the study. As a result, especially regarding the national policies on trauma care, there is little information included in the study, due to the lack of English materials. An attempt was made to compensate this by including information from the expert interviews, however, not all experts had enough expertise on the legal basis to completely satisfy the goal. In addition, the aim was to include six interviews, however, only four were included. This was due to the lack of appropriate contacts made in the countries, which occurred as a result of timely constraints and limited willingness to participate in the study. More extensive research is suggested, including the translation of non-English documents and involving more stakeholder opinions, to compensate for a potential loss of information that may have resulted from these limitations.

## **8. Conclusion and recommendations**

The healthcare and trauma care systems in Sweden, Norway and Denmark have similarities, but there are several differences. The trauma care in Sweden and Denmark is organised regionally, whereas in Norway, it is organised on local level. In all three countries, emergency care is reimbursed through the public insurances, however, in Sweden, it does require an out-of-pocket payment. The access to the emergency medical system can be granted in two ways, either through referral of the GP or by contacting the emergency phone number (112 in Sweden and Denmark, 113 in Norway). The ambulance fleet in all three countries consists of both air and ground ambulances, and in Denmark, there are specialised MECU's, which are adapted to more severe trauma.

There are no specific laws and regulations that focus solely on trauma care, however, several national regulations regarding the overall functioning of the health system have a focus on trauma care. The regulations outline several aspects, including the staffing and education of the ambulance personnel. The education levels and training of ambulance staff differs per country. International legislation regarding trauma care is not present, however there are several agreements within the Nordic region relating to collaboration in case large-scale trauma and natural disasters. These agreements could provide the opportunity to expand this cooperation to small-scale trauma and to create a borderless Nordic region, in terms of trauma care cooperation.

Cross-border pre-hospital trauma care cooperation is present in the border region between Norway and Sweden, and is organised on regional level. The trauma care collaboration between Norway and Sweden is mostly based on AAs, both air and ground ambulances have permanent clearance to cross borders. There is no collaboration between where all three countries are involved. The lack of collaboration between these countries is due to the fact that they do not share a land border, except for the Oresund Bridge between Malmö and Copenhagen. Both Malmö and Copenhagen have their own trauma centres; therefore collaboration would not be beneficial. There are several barriers that obstruct optimal implementation of cross-border trauma care, including legislative issues regarding both reimbursement as well as competences of the ambulance staff. This is due to the different education and training levels in each of the three countries. In addition, language and communication issues can be seen as a barrier.

There are several opportunities for the elaboration of the cross-border trauma care collaboration within the border region of Norway and Sweden. The Nordic agreement provides a legislative basis for a “borderless” Nordic region, and even though it only relates to large-scale trauma and natural disasters, there is the possibility to enlarge the scope to also include small-scale trauma and daily care. In addition, the presence of cross-border collaboration on regional level between Sweden and Norway shows that there is a possibility for a cross-border care network.

The topic requires further study. To increase understanding of the policy basis, the policy analysis should be elaborated by using the policies and laws in the native languages (Swedish, Norwegian and Danish). In addition, more interview partners should be involved to create a

more representative cohort. A more extensive cohort will provide perspectives from different stakeholders and will give a better insight of the need for a cross-border trauma care collaboration system.

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## Appendix I – Interview questions

### Opening Statement:

“Trauma patients shall get the best care, regardless of place and time. Additionally, the patients should be transported to the nearest hospital suitable to their needs, in which case borders should be irrelevant.”

- 0) To what extent do you agree with this statement?

### Overall functioning of the trauma care chain:

- 1) How is the pre-hospital (up and till the handoff at the Emergency Room) trauma care organised in your country?
- 2) What different professionals work within the trauma care chain?
  - a. Everything from phone call to dispatch
  - b. How are the ambulances staffed?
  - c. Do the ambulance staff have to have a specific trauma education?
- 3) In case of trauma, who decides to which hospital the trauma victim is taken?
- 4) On what laws and regulations is the trauma care chain in your country based?
  - a. Are there specific laws regarding the education/staffing of ambulances?

### Cross-border collaboration:

- 5) Are there currently collaborations regarding cross-border emergency care in your region?  
If yes:
  - a. What legal basis do these collaborations have?
  - b. How did the collaboration come into existence?
  - c. Which levels of trauma care are involved?
  - d. How is the cooperation funded?
- 6) Is cross-border trauma care collaboration necessary in your region?
- 7) Do you believe that cross-border collaboration could be beneficial if implemented well?
  - a. If yes: What are the advantages of cross-border collaboration?
  - b. If not: What are the disadvantages of cross-border collaboration?
- 8) Are there specific barriers that obstruct the implementation of cross-border collaboration?
- 9) Do you have any suggestions for literature, stimuli, and recommendations about this topic?
  - a. Did we overlook anything?
  - b. Any critique?